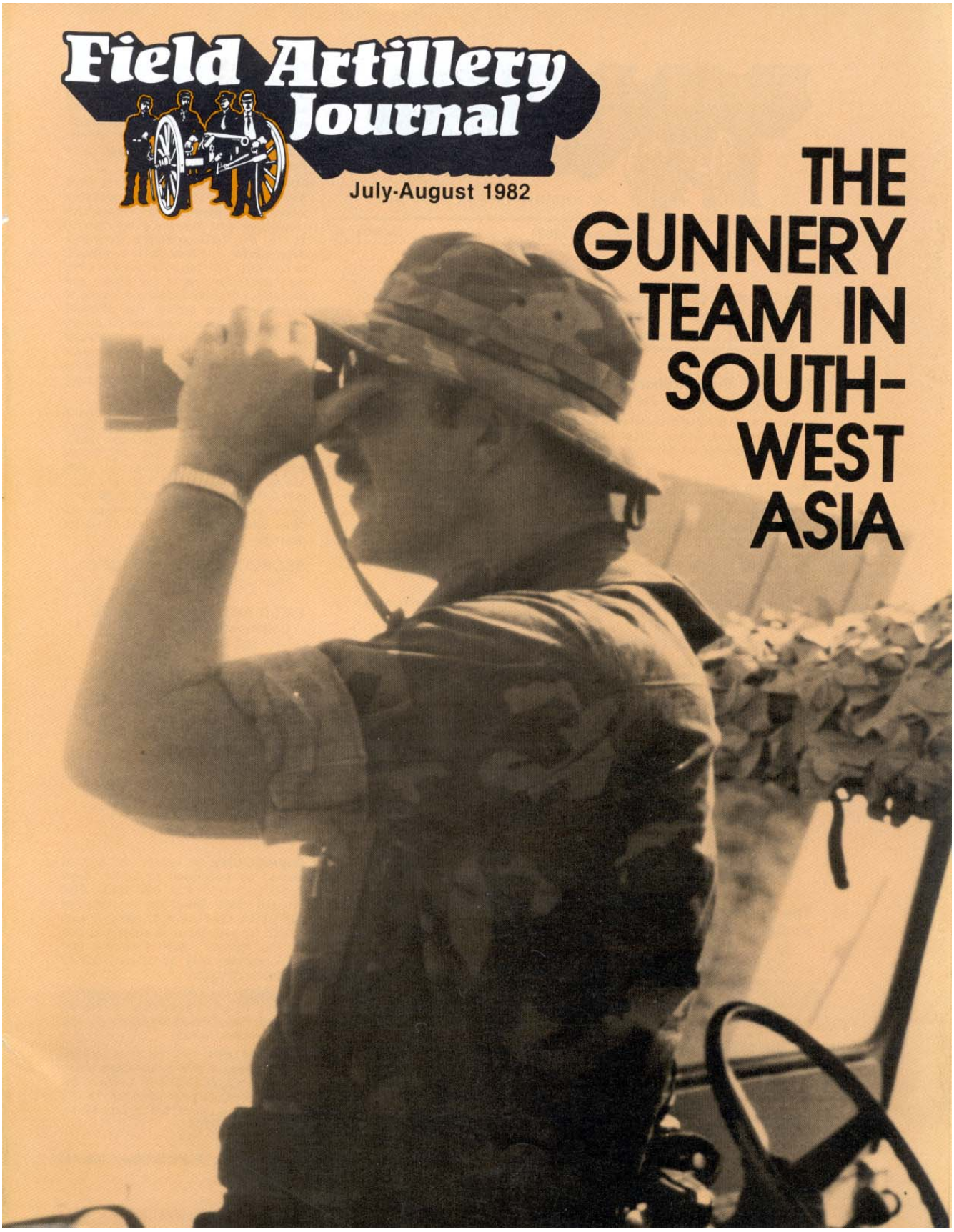
Field Artillery Journal

July-August 1982

THE GUNNERY TEAM IN SOUTH-WEST ASIA



Field Artillery Journal

THE JOURNAL OF FIRE SUPPORT

Volume 50 **July-August 1982** **Number 4**

ARTICLES

FEATURES

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

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On the Move

MG EDWARD A. DINGES

Having spent nearly two years as Commandant, I feel it appropriate now to take time to reflect on the state of the Field Artillery, for during this dynamic period we have made tremendous strides toward a Field Artillery system that will meet the challenges of the future.

After two years of intensive effort, the now completed Fire Support Mission Area Analysis provides a basis for the Fire Support Development Plan which in turn lays the foundation for the Field Artillery of the future. This, coupled with a June 1981 System Program Review, chaired by the Vice Chief of Staff of the Army, provides us a baseline for field artillery developments.

Frankly, I'm proud and excited to be a field artilleryman in the 1980s and, although we are quick to point out areas needing improvement, we must not overlook the forest for the trees. The real measure of effectiveness for the field artilleryman is how well we support the maneuver commander, and I am extremely confident in our ability to do just that.

Weapons and equipment

From an equipment standpoint, the past two years have probably been the most exciting in the history of the Field Artillery. The systems and related firepower hitting the field today would stagger the imagination of the Redleg of the past.

For example, the M198 howitzer provides the light infantry a long range punch while the Multiple Launch Rocket System (MLRS) gives us, without a doubt, the most significant advance in pure firepower since Atomic Annie fired that first nuclear round downrange at Frenchman's Flat. A ripple from just one MLRS launcher delivers the firepower of massed battalions. But, there is more than just the weapons — we are also fielding munitions with improved accuracy and lethality. The long-awaited Copperhead rolls out this year and, with it, for the first time in history, the mighty tank and other elusive point targets will fall prey to the King of Battle. And, for the future, we've convened a special study group to examine alternatives for the next direct support weapon system. Additionally, a Department of the Army Special Task Force has been tasked to examine alternatives for a Corps Support Weapons System (CSWS) to give the corps commander the ability to execute deep attack in the AirLand Battle.

In addition, we have seen advancements in other equipment during the past two years. We began fielding the Firefinder radars this year and, with them, we are making a quantum jump in our ability to acquire the enemy's weapons. Further, the Position and Azimuth Determining System (PADS) represents an incredible breakthrough in survey since we can now determine with the punch of a button our exact location to accuracies sufficient to deliver fire where the infantry and armor need it most.

Command and control

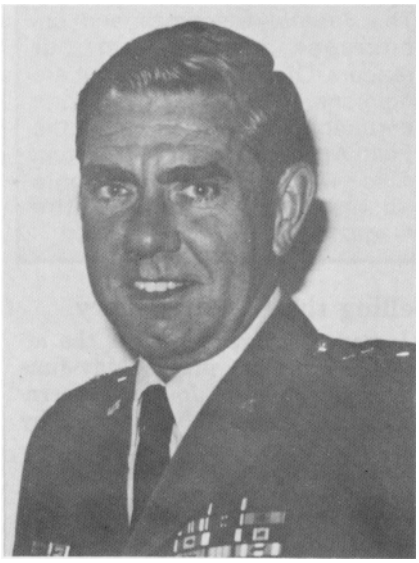
In the area of command and control, TACFIRE is now a reality and is proving itself beyond any shadow of doubt. Testing of the Battery Computer System (BCS) has been completed, with fielding scheduled later this year. The BCS significantly enhances battery survivability and poses new challenges for the battery executive officer who can no longer walk the "line of metal." Future efforts on improving command and control are also underway and are keyed to modular improvements of TACFIRE.

Doctrine

In the doctrinal arena, we are implementing the AirLand Battle Concept in all aspects of fire support. Here, of particular note is the Target Value Analysis (TVA) — a revolutionary approach to target development. And, we continue to progress toward the future with concepts such as Fire Support 2000.

Personnel

All of the new technology is exciting, but I believe the real key to an effective system still lies in the quality of our soldiers. The significant increase in the quality of those now enlisting (80 percent with high school diplomas), together with the increase of one week in initial entry training, means that the field is now receiving a better trained field artilleryman. Additionally, the Officers Basic Course has been expanded, with increased emphasis on FIST and the total fire support picture, and the Officer Advanced Course now better



prepares our captains to implement the AirLand Battle.

With 1981 also came the formal establishment of Fort Sill as the proponent for Field Artillery. Thus, we now have a greater voice in the development of personnel policies and the management of the field artilleryman's career. The ball has just begun to roll in this area and, as we look to the future, we see Fort Sill's role becoming one of ever-increasing importance.

Summary

I have concentrated on the Field Artillery of today because you in the field are now absorbing all the innovations in doctrine, changes in organization, and fielding of new equipment. I am confident that we are better prepared today than at any time in our history to fight if called upon and, with future systems now on the drawing board, we have the promise of a future Field Artillery with even greater capabilities.

In reflecting on these two years, I return to three bench marks:

•Our purpose is to support the maneuver commander, and I have never been more proud of our ability as field artillerymen to do just that.

•The close comradeship and dialogue between the field and the School account for the esteem in which our profession is held.

•The quality of our people at Fort Sill and in the field — civilian and military (Active and Reserve) — is unequaled.

I salute you!

Incoming

LETTERS TO THE EDITOR

Speak Out

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

Selling the Field Artillery

I read with great interest the articles and letters in the May-June 1982 *Field Artillery Journal* concerning the "selling" of fire support by field artillerymen. Of particular interest was Major General Dinges' comments on this subject in his "On the Move" feature which dealt with FIST duties.

The "selling" of fire support is, of course, not a new problem for field artillerymen. We are always faced with it during periods when we are at peace. Selling fire support is, however, not a problem during hostilities, but providing correct fire support is. The key point is that any bad habits developed during periods of peace can result in major problems and unnecessary loss of life when we are committed to action. We simply must know how to fight as combined arms teams at all levels of command to be successful on any future battlefield.

During the past 20-plus years, I have come to believe the problem of selling fire support during periods of peace is caused for the most part by the lack of good combined arms training. This type training is extremely difficult because of peacetime safety restrictions and the lack of adequate training areas. (The new National Training Center is a major step in the right direction!) There are of course other factors which contribute to the selling problem:

•Not placing our best-trained people in key fire support coordination positions (e.g., fire support officer) during training.

•Not selling ourselves to our maneuver commanders as the professionals who should be doing the fire support coordination job for them.

•Maneuver commanders who for whatever reason want to do it all by themselves (can't be done in combat).

There are other causes, but the point is: We can't win in combat if we don't train to fight as combined arms teams. Since safety restrictions probably won't be relaxed very much without a greater hostile threat to the United States and we won't all have the ability to visit the National Training Center each year, we are left with the difficult job of "selling" fire support and making every effort to train as we plan to fight. This is a difficult and sometimes thankless task, but it is one we field artillerymen must accept. It is simply our duty. We must do it well!

John S. Nettles Jr.
COL, FA
ODCSRDA
Washington, DC

How Important is the FIST chief?

A central precept of modern warfare is for a force to possess the capability to deny access to, and control over, key terrain by its opponents. Often this capacity is determined by the technical limitations of the force's weaponry; i.e., its direct and indirect fire assets. More important, however, may be the personnel controlling these assets, their training, expertise, and professionalism; in other words, the fire support team (FIST) which at the "grass-roots" level is under the control of a Field Artillery second lieutenant.

I believe the role and importance of the FIST chief has been degraded by the practice of assigning newly-commissioned second lieutenants as FIST chiefs. This practice results in inconsistent performances by FIST personnel on maneuver exercises and Army Training and Evaluation Programs (ARTEPs), a lack of cohesive training and leadership of respective FISTs, and the development of a "temporary" attitude by FIST chiefs toward their jobs.

Maneuver company commanders rely upon the FIST chief for professional advice in integrating indirect fire support into the scheme of maneuver. Here, it is necessary that a relationship of mutual respect for each other's capabilities be established between the maneuver company commander and the FIST chief. Yet, it is very hard to establish this type of relationship with the personnel changes inherent in the present system of FIST chief assignment. The guidance required by noncommissioned officers (NCOs) and enlisted personnel is missing when it becomes hard to predict or identify what officers will be FIST chiefs, fire support officers (FSOs), or fire direction officers (FDOs) on a monthly basis. Consistency in training, leadership, and standards is not maintained. Lastly, and probably the worst by-product of this practice, is the inherent lack of "professionalism" of the FIST chief.

The majority of time and emphasis in both the Field Artillery Officer Basic and Cannon Basic Courses is on gunnery and those "skills" necessary to become a proficient field artilleryman. Tactics, pertaining to FIST, is important, but is never given the necessary credence by the School's faculty or the students to enhance the FIST development from a professional point of view. Further, the job of FIST chief is viewed as an interim position, one that is necessary to go through until an opening occurs in a firing battery. This has detrimental effects on the FIST chief's perception of his role, his own value, and the morale of his subordinates. Therefore, I believe that one should not become a FIST chief before he completes a tour of duty as a fire direction officer and/or battery executive officer (XO). The most basic and obvious strength of this recommendation is individual experience and maturity. The simple fact that the FIST chief has functioned as an FDO and/or XO gives that officer greater "respectability" when dealing with technical and tactical application of indirect fire assets. Also, he possesses the knowledge and flexibility to provide the expertise lacking by most company commanders in developing integrated, combined-arms tactics.

The most glaring weakness of this recommendation is the removal of trained, experienced battery officers from the mainstream of command opportunity since the present career progression is FDO, XO, and then battery commander. Any change in this sytem would require a reordering of attitudes, both on the part of the individual officer and the Field Artillery Branch. It may not be possible to eliminate the attitude that being a FIST chief is not as important as being in a firing battery.

There are more second lieutenants than there are fire direction officer positions. So, what is to be done with

those not assigned? The only answer available is better management. The establishment of a system controlling the length of tour as FDO/XO would alleviate this problem in the long run. It would provide a means of controlling allocation of school slots and manning requirements. However, the initial change would result in a number of second lieutenants either being delayed the chance for a firing battery position or missing it totally.

If it is impossible to fill present FIST positions with second lieutenants, how will it become easier to man them with first lieutenants? The key is retention beyond the minimum three to five year commitment, something the present career development program has not been able to accomplish. Obviously, the present inadequacies will affect any recommended changes, but one should not be afraid to consider changes that may result in improved fire support.

Acceptance of his FIST chief's competence by the maneuver commander will not be automatic by virtue of his age or experience. It will again be based on performance. It will be up to the individual officer to develop the necessary relationship — one of respect for his abilities — to meet maneuver requirements.

One must always keep in mind that the number of rounds fired is not nearly as important as their accuracy. So long as the United States cannot match the Soviets on a weapon-to-weapon basis, it is necessary to out-shoot them. Doesn't this dictate the utilization of more experienced and professional officers to direct their accuracy?

Walter M. Biersack
1LT, FA
HHB, 1st Bn, 11th FA
Fort Lewis, WA

Sight extension for M110 howitzer

Anyone who has worked with the M110-series howitzers knows their outstanding capabilities; one problem, however, is that these weapons cannot be laid from every direction.

Since the panoramic telescope is located on the left side below the tube, the howitzer can only be laid from the left front or left rear. As such, with other than ideal terrain, it is increasingly difficult to lay all six howitzers with only one aiming circle (AC). Many times, obstacles make it necessary to utilize two aiming circles, slowing the laying procedure down considerably.

A possible solution to this problem would be to develop a "sight extension" to work much like the panoramic telescope currently used on the M109-series howitzers (figure 1). This sight extension would be an attachment, rather than a completely new sight, and would be used only when the weapon is being laid and verified safe; the sight extension would then be removed to allow the current panoramic telescope to be used in its normal configuration to set off deflections with the collimator and aiming posts. Depending on the terrain and location of the aiming circle in the battery area, the sight extension may be needed for only one or two howitzers (figure 2). (If necessary, reciprocal laying could also be accomplished.) With the ballistic shelter currently being considered as a possible modification to the M110-series howitzers, this sight extension could also be considered in this improvement.

Time to develop and test the sight extension would certainly be necessary to insure accuracy and reliability, but the advantages of such a device are numerous. Its utilization would definitely increase the combat effectiveness of the M110-series howitzers.

Daniel G. Hostetter
CPT, FA
USA ROTC Instructor Group
Tennessee Technological University
Cookeville, TN

Trent Frederickson
CPT, FA
2d Inf Div
APO SF

Your thoughts certainly have merit, but the engineering of an extension such as you describe would require the development of almost a completely new sight system because of the requirement for mirrors, erection prisms, etc.

Interesting to note, however, is that the product improvement of the M110A2 8-inch howitzer is programmed to incorporate the current M109 series panoramic telescope in a "through-the-roof" configuration.—Ed.

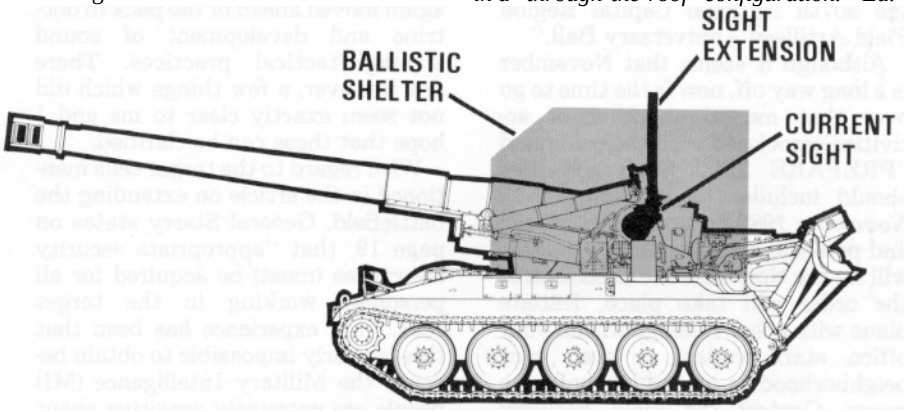
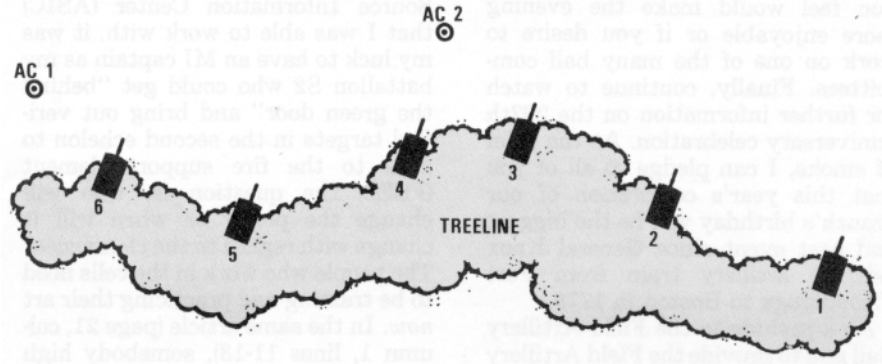


Figure 1. The sight extension with proposed ballistic shield.



Using AC1's location, howitzer 1 and 2 cannot see AC. Repositioning AC1 to AC2's location, howitzers 5 and 6 use the sight extension and all howitzers can be laid using the same AC.

Figure 2. Sample use of sight extension.

Assistance requested

Members of our readership who have back copies of the *Journal*, years 1940-1946, and who would be willing to donate them for research are encouraged to contact:

Doctor R. Livolla
Army Materiel Systems Analysis Agency
York Hall
Aberdeen Proving Ground, MD 21005

"Prepare to"

To a field artilleryman, the command, "PREPARE TO," takes on a special sense of urgency and anticipation that is not normally found among other soldiers. Upon hearing "PREPARE TO," every artilleryman initiates a mental as well as a physical checklist to insure that he is as ready as possible for the next event.

Therefore, acting as the chief of smoke for all of the loyal artillerymen in the national capital region, I have been informed by our battery commander, MG Edward A. Dinges, that we must all "PREPARE TO" attend the 207th National Capital Region Field Artillery Anniversary Ball."

Although it seems that November is a long way off, now is the time to go over that mental checklist of activities associated with the command "PREPARE TO." Such activities should include the marking of *19 November 1982* on both your official and personal social calendars, as this will be the time that the execution of the order will take place. Initiate plans with other Redlegs within your office, staff section, or even your neighborhood to attend the ball as a group. Contact the Field Artillery Branch, MILPERCEN (325-0016/0118), if you have any ideas which you feel would make the evening more enjoyable or if you desire to work on one of the many ball committees. Finally, continue to watch for further information on the 207th anniversary celebration. As the chief of smoke, I can pledge to all of you that this year's celebration of our branch's birthday will be the biggest and best event since General Knox led the artillery train from Fort Ticonderoga to Boston in 1775.

As a prelude to the Field Artillery Ball and to provide the Field Artillery Community in Washington DC a forum by which to share professional viewpoints in an informal atmosphere, a Field Artillery luncheon is being planned for 17 September 1982 at the Fort Myer Officers Club. The commanding general at Fort Sill is making plans to join us for the occasion and will bring us up to speed on the major actions affecting the branch. Fliers covering the exact details will be available through all of the agencies in the national capital area in early August.

So, mark 17 September and 19 November 1982 on your calendars and plan to meet with your fellow Redlegs at Fort Myer for the luncheon and later this fall at the Bolling Officers Club for the ball. I look forward to seeing each and every one of you at each occasion.

LTC Curtis L. Lamm
Chief, FA Branch
OPMD
Alexandria, VA

Security clearances

The September-October 1981 issue of the *Field Artillery Journal* was, as usual, a superior magazine. It was extremely informative with the contribution by GEN Donn A. Starry and the article on pages 20-27 concerning the implementation of the AirLand Battle. The Field Artillery has once again moved ahead of the pack in doctrine and development of sound strategic/tactical practices. There are, however, a few things which did not seem exactly clear to me and I hope that these can be clarified.

With regard to the target cells mentioned in the article on extending the battlefield, General Starry states on page 19, that "appropriate security clearances (must) be acquired for all personnel working in the target cells." My experience has been that this is nearly impossible to obtain because the Military Intelligence (MI) people are extremely sensitive about who knows where and how their information is acquired. In the All-Source Information Center (ASIC) that I was able to work with, it was my luck to have an MI captain as my battalion S2 who could get "behind the green door" and bring out verified targets in the second echelon to pass to the fire support element (FSE). The question is, who will change the policy or when will it change with regard to the clearances? The people who work in the cells need to be training and practicing their art *now*. In the same article (page 21, column 1, lines 11-13), somebody high up the chain of command needs to consider the phrase "attack the enemy with nuclear weapons when he is well within his own territory." If that means to fire across the international border, then who gives the clearance to fire? That's not a *military* decision. We can get ourselves into big trouble.

Finally, I just wanted to add a compliment on a fine article "Field Artillery Survivability — The Soviet Perspective." The article could not have been better timed than to be in the same issue with the new concepts of the AirLand Battle. The idea that the Soviets are rigid and unthinking or unresponsive to their perceived threats must be dispelled and banished. The Soviets *are* innovative and have flexibility and they seek solutions which will improve their chances for success on the battlefield. We've made a big step in getting away from the stereotyped idea that they are automations.

It was a great issue! Thanks for keeping those of us, who are not directly involved with the guns, up-to-date.

John D. Spengler
MAJ, FA
Military Science Department
Indiana State University
Terre Haute, IN

Your comments are well taken. To alleviate the problem of access to information within the targeting cell, the intelligence officers assigned to the targeting cell will already possess the required clearance and access to reach "behind the green door." Other than this, no special security clearance requirements will be placed on personnel manning the targeting cell. The information brought out of the All Source Information Center by the targeting cell's intelligence officers will contain a reliability code to allow the use of this information without the constraints associated in identifying sources used in collecting it.

Insofar as your questions on nuclear employment, there are obviously many strict controls on the use of nuclear weapons. The authority to use nuclear weapons will be conveyed from the National Command Authority (NCA). Because of the risks of escalation and the potential destructiveness of nuclear weapons, the decision will pose both political and military implications. The use of the nuclear option deep in the enemy rear will limit damage to friendly territory and minimize safety considerations for friendly troops. However, it may be difficult to convince political authorities of the need for nuclear weapons early in the battle. Although nuclear weapon system employment planning can proceed, actual use, again, is dependent on authorization from the NCA.—Ed.

"What do you want us to shoot?"

In response to MAJ John D. Spengler's article, "What Do You Want Us to Shoot?" in the March-April 1982 *Journal*, I have the following comments:

Shoot all that is needed to comply with the maneuver commander's guidance. Use the joint munitions effects tables for target analysis and keep the number of weapons in mind at all times. Destroy those targets you are told to destroy, neutralize the targets you were told to neutralize, and suppress others. Keep the enemy off the bayonets, keep indirect fire off the maneuver forces, and prevent or delay the second echelon from joining the fight — today.

This multiple tasking is difficult, but is no different than those tasks experienced in the past. The lesson must be learned now since there is no time for study on the battlefield.

John I. Gerzel
LTC, FA
TCADD, USAFAS
Fort Sill, OK

Hail to "The Second of the Second!"

The "Salute" article, authored by personnel of Bravo Battery, 2d Battalion, 2d Field Artillery, in the March-April 1982 *Journal*, brought back many fond memories. It is interesting to note that the authors can only trace the assignment of this famous outfit as the Salute Battery for Fort Sill for one decade. Beginning in the early 1960s, this unit fired all the salutes for visiting dignitaries at the post for several years. Perhaps the many memorabilia, artifacts, and other paraphernalia which had been kept in the trophy room of the battalion got lost in the shuffle during the Vietnam War.

I took command of the 2d Howitzer Battalion (105-mm), 2d Artillery, commonly referred to as "The Second of the Second," in April 1960. At that time we were quartered at the top of the hill just off Randolph Road. The barracks just to our south housed the 2d Howitzer Battalion, 13th Artillery, then commanded by LTC Hugh Martin. Both battalions were assigned as School troops.

As I remember, when I took command of the 2-2d, it was the policy at Fort Sill to rotate the task of firing ceremonial salutes among the assigned cannon artillery battalions. Due to circumstances which have escaped my memory, shortly after my assumption of command, this policy changed and we fired all salutes on the post. I assigned this mission as well as the requirement to develop a standing operating procedure for this activity to Bravo Battery.

But, the salute battery was not all that Bravo Battery could take credit for because, at that time, they had the only 280-mm gun (atomic cannon) in the Continental United States. In addition, the battalion maintained several "twin forty" antiaircraft, self-propelled weapons, "quad fifty" self-propelled machineguns, all of which were used in support of the Artillery School's firepower demonstration held periodically on the west range. To add to our already almost insurmountable maintenance problems we also had a number of 75-mm pack howitzers which were used for service practice for the School.

As with the current 2-2d, our primary mission was to support the School. I have no account of the number of rounds expended in carrying out this mission, but the amount must have been considerable for it was a rare day when we did not have some commitment for the Gunnery Department.

Despite our heavy commitments for the School and ceremonial salutes, we managed to carry out the order details necessary to be a first-rate artillery unit. At the annual command/maintenance inspection held during my tenure, we were second out of the 17 cannon artillery battalions then assigned to the post. We also participated in the many reviews frequently held during that period.

Of all recollections of my military service, nothing stands out as meaningfully as my tour as commander of "The Second of the Second."

Howard F. Brown
COL (Ret), AUS
East Greenwich, RI

Soviet markings

While reading the September-October 1981 issue of *Infantry*, I came across a nugget of information that might prove valuable to FIST personnel. It was contained in the article "Vehicle Markings" by 1LT Noyes B. Livingston III of Company A, 1-141st Inf (M), Texas Army National Guard. The large three-digit number on the Soviet armored fighting vehicle (AFV) turret is designed to tell other Soviet AFVs what company, platoon, and vehicle number and role in the organization the vehicle occupies; e.g., 312 would be the 3d company, 1st platoon, platoon sergeant's tank or second tank. With this information, a FIST member could attack the leadership vehicles in a formation with terminally guided munitions and get the maximum effect on an organization's command structure. It might be a good idea to publish a guide that explains the system in an intelligence training circular. The data from this numbering system could give information as to the units involved during a battle. The effects from using this idea are two-fold: loss of enemy leadership elements and combat intelligence data for order-of-battle specialists at higher levels. If this is coupled with the basic knowledge of enemy formations, a high percentage of enemy command elements could be targeted for destruction with terminally guided munitions and direct fire antitank weapons of the supported units.

Larry A. Altersitz
CPT, FA (PAARNG)
S2, 1-107th FA
Pittsburgh, PA

The School Threat Team confirms that vehicle markings, particularly turret numbers, are a valid identification feature for Soviet armored fighting vehicles. Telephonic coordination with the Combined Arms Development Activity and Infantry School Threat Teams corroborate this position. US Army Europe and the Defense Intelligence Agency have compiled classified studies on turret numbering systems which fully explain the intricacies of this identification method. This data does not lend itself to dissemination in an unclassified training circular.—Ed.

Reunions

4th Field Artillery Association (Mountain Pack, 1907-1958)—11 September 1982 at the Bordeaux Motor Inn Convention Center in Fayetteville, NC. Contact MSG (Ret) Dallas M. Kirby, 1536 Paisley Avenue, Fayetteville, NC 28304.

7th Field Artillery Association—Fifteenth annual reunion on 17-18 September 1982 at the Ramada Inn, 1117 Williston Road, South Burlington, VT 05401. Former members associated with any unit of the 7th Field Artillery Regiment and their wives and friends are cordially invited. For further information write to Mr. Carl Bessette, President, 78 Sherman Street, Burlington, VT 05401 or to Mr. Ernest Oakes, Secretary/Treasurer, 1 Pearl Lane, Wilbraham, MA 01095.

Hot Off the Hotline

QUESTIONS AND ANSWERS

Your "Redleg Hotline" is waiting around the clock to answer your questions or provide advice on problems. Call AUTOVON 639-4020 or commercial (405) 351-4020. Calls will be electronically recorded 24 hours a day and queries referred to the appropriate department for a quick response. Be sure to give name, rank, unit address, and telephone number.

Please do not use this system to order publications. Consult your FA Catalog of Instructional Material for this purpose.

Question: Is there a valid reference which illustrates a 155-mm perimeter defense?

Answer: *There is no doctrinal publication that prescribes the exact physical dimensions of a firing battery perimeter. Obviously, the perimeter size will depend on the terrain and tactical situation. Chapter 7, FM 6-50 (Field Artillery Cannon Battery) with Change 1 does, however, provide considerations relevant to the establishment and defense of a battery perimeter. Survivability considerations expressed in both the draft FM 6-50 and draft FM 6-20-1 (Field Artillery Cannon Battalion) suggest that artillery must disperse. Current Terrain Gun Position Corrections (TGPCs) limit battery dispersion to a 400-meter front. This, then, is the frontage that a firing battery should attempt to achieve.*

Question: When firing the beehive round, what is the minimum safe distance and time to insure safety? Also is there a publication that specifies how far out targets can be placed or the minimum safe time to set on the mechanical time fuze?

Answer: *The beehive round comes fuzed with the M563 fuze which is set on muzzle action (MA). If local range regulations do not state otherwise, that is the minimum fuze setting. This will cause the fuze to detonate three meters in front of the weapon (AR 385-63 w/Change 1, figure 11-4 and table 11-6). Technical data can be found in TM 43-0001-28 with Change 10 pages 3-55 and 7-17.*

Question: On page 43 of the March-April 1982 *Field Artillery Journal*, a short article stated that, for Reserve Component officers, the CAS^3 Course is not equivalent to CGSOC. I am told, however, that there will still be limited educational credits given for promotion through the rank of lieutenant colonel for completion of CAS^3. This article implies to me that this will no longer be the case.

Answer: *The article mentioned was from an OCAR (Officer of Chief, Army Reserve) Press Release No. 81-83, dated 23 December 1981. Since that date, however, representatives from OCAR, the National Guard Bureau, and the US Army Training and Doctrine Command met at Fort Leavenworth in February 1982 and decided to leave the current policy in effect through FY83; i.e., a Reserve Component officer who completes CAS^3 will be educationally qualified for promotion to the grade of colonel.*

Question: How do you compute firing data for the M198? Also, can the 109A1 sticks be used or do you have to add on a correction?

Answer: *For manual firing data computations for the M198 weapon system, firing table FT 155-AM-1 or AM-1 GFTs are used. The battery should register the weapons and the resultant GFT setting will incorporate the muzzle velocity difference between the M109A1 and the M198. When computing firing data with FADAC, the standard M198 muzzle velocities should be entered prior to firing data computation. A firing table for the M198 (FT 155-AM-2) is currently being published by the Ballistic Research Laboratories.*

Question: Are there any restrictions on the use of the M577 fuze with the 155-mm illumination projectile?

Answer: *There are no special restrictions on the use of the M577 fuze with 155-mm M485 illumination round. The M577 fuze, however, cannot be used with the older 155-mm M118 illumination round since it will not fit the fuze well.*

Question: What is the correct method for numbering nuclear targets?

Answer: *Targets are assigned a target number by fire planning agencies as they are received (FM 6-20). There are no specific blocks of numbers to designate nuclear targets. If a decision is made to attack a target, the most appropriate, available means will be used to achieve target defeat.*

Question: Is there a program text for the TI-59 hand-held calculator describing the procedure to be used for the M198? Also, is there an M198 module available for the TI-59?

Answer: *The program text of instruction for the TI-59 is RNGDO5HC. Currently, there is no M198 module for the TI-59; therefore, the M109A1 module should be used in conjunction with registering the weapon.*

The Redleg Hotline item in the March-April 1982 *FA Journal* concerning the calibration of the M198 was in error. The correct response should have been: With the issuance of the M90 radar chronograph, all new tubes should be calibrated immediately upon receipt (paragraph 7-2b, Change 1 to FM 6-40).

Moving?
Subscribers should send their new address four weeks in advance to:

Field Artillery Association
P.O. Box 33027
Fort Sill, OK

THE GUNNERY TEAM IN SOUTHWEST ASIA

by MAJ Heinz A. Schiemann

For the past several years, world attention has focused on the geographic, political, and economic influences of the countries of southwest Asia. We have also wondered how well our equipment, soldiers, tactics, and gunnery procedures would fare in the often inhospitable climate and terrain of that area.

Stemming from a request of one southwest Asian nation to demonstrate the capabilities of the M198 155-mm towed howitzer, an opportunity presented itself to answer these and other questions. In May 1981, the 1st Battalion, 73d Field Artillery, located at Fort Bragg, NC, was directed to form a team for deployment to southwest Asia with all the elements necessary to demonstrate to the host country three aspects of operations with the M198 howitzer:

•Capability of the weapon to fire 30 kilometers.

•Maintainability of the weapon during sustained firing operations.

•Ability of the howitzer and its M813 (5-ton) prime mover to traverse sandy terrain and negotiate steep slopes.

Additionally, the following "other" objectives were developed for observation during the demonstration:

•Accuracy of fires at representative ranges.

•Endurance of the crew in extreme conditions of temperature and altitude.

•Survey operations using the Position and Azimuth Determining System (PADS).

•Meteorological observations and corrections, using current rawin equipment.

In addition to the requirements specified in the invitation, certain other factors influenced the composition of the team and its initial training. For example, it was known that we would be required to operate in two distinct types of terrain characteristic of the entire region. The first was a rocky plateau desert area, at an altitude of approximately 7,000 feet, while the second was a sandy or dune type desert. In both areas the temperature could be expected to rise well above 100 degrees Fahrenheit. Administrative and logistical support would be provided by the host country, to include all communication support and all vehicles except the prime mover for the howitzer. It was learned early in the planning process that survey control in the area was extremely limited and that meteorological (met) data was not routinely available for use in firing. Finally, because of certain restrictions placed by our hosts upon the number of personnel to be allowed in the area, the team had to be as small as possible and still be able to accomplish the mission. Consequently, team organization was developed as follows:

Personnel	Purpose	Equipment
Headquarters (3)	Command, control, and forward observation.	Communication gear and vehicles (provided by host nation).
Fire direction (4)	Provide primary and alternate manual computation of firing data.	Manual equipment.
Gun section (11 plus 1 alternate cannoneer)	Emplace, fire, and march order weapon.	M198 howitzer and M813A1 5-ton truck.
Survey (5)	Provide position area, connecting, and target area survey up to 30 kilometers in length from gun to target.	Position and Azimuth Determining System (2) and DM60 (1).
Meteorological (6)	Provide ballistic met messages.	Rawin set plus expendables.
Maintenance (4)	Fire control, artillery weapon, and prime mover repair.	Tool kits and spare parts (heavy on preformed packings, wheel bearings, and tires.)

Training

Training was initially conducted at the section level, followed by intensified collective training by the entire team. Training highlights were as follows:

•*Fire direction center (FDC)* — Observed fire (OF) chart procedures were practiced. This was considered vital if accurate survey could not be obtained. Map coverage of the region was sketchy, and available maps, regardless of scale, looked like brown paper with contour lines drawn on them. Few, if any, topographical features could be identified, and survey control points were nonexistent.

The desert environment proved more of a test for the gun crew than for the gun. Although high sustained rates of five were maintained, the gun crew definitely grew more fatigued in this environment.

A shack shoot was conducted to practice time plot (site known) to include the executive officer's high burst procedures.

•*Gun section* — Since the gun section personnel were drawn from all organic firing batteries, crew drill was conducted for both the full 11-man section and the reduced 7-man section, to include sustained rate of firing practice. The crew also fired the M549 rocket assisted projectile (RAP) with M119A2 and M203 propellants. The weapon was also calibrated with the M90 chronograph with these propellants as well as with the M4A2 propellant.

•*Survey Section* — PADS was obtained only two weeks prior to actual deployment. Nevertheless, with the outstanding support of a two-man mobile training team from the Counterfire Department, USAFAS, only two days were required to completely train our survey section in the operation, maintenance, and installation of PADS in an M151A2 jeep.

•*Met section* — Personnel were trained to provide meteorological support without its shop van.

•*Maintenance* — Since US Army Armament Materiel Readiness Command representatives accompanying the team included experts in both the weapon and its fire control equipment, no special maintenance training was considered necessary.

•*Physical training* — This was conducted at Fort Bragg during the hottest time of the day (temperatures ranging from 90 to 108 degrees Fahrenheit with humidity in excess of 80 percent).

First demonstration site

The team was first employed in a rocky plateau desert terrain, characterized by nearly flat areas

covered with sparse vegetation. The flat areas had little relief, with the exception of rocky hills of granite and sandstone boulders which rose 100 meters above the plateau. These hills, when linked, formed an effective barrier to any vehicular movement. However, a trail network did exist throughout the area that could be navigated by tactical vehicles.

While the team was there, the climate was mild with temperatures ranging from 80 to 100 degrees Fahrenheit during the day to 60 to 70 degrees at night. Winds were generally from the southwest. On occasion, winds were extremely gusty and dust devils could be seen, but visibility remained fair. In the late afternoons, there would usually be enough rainfall somewhere in the area to settle the dust. Overall, as deserts go, high plateau deserts are garden spots and appear generally pleasant.

To demonstrate the capabilities of the M198 howitzer and the gunnery team, the following scenario was used and observations were recorded as they occurred:

•***11 August*** — An initial reconnaissance was conducted of the gun position, observation post (OP), and target area. Both PADS were installed by survey team members into M151 A2 jeeps furnished by the host nation.

•***12 August*** — The met section set up operations in a general-purpose small tent and flew the first met to check out its equipment. Both the gun and FDC sections set up and reviewed the fire mission scenario for the following day. Ammunition was prepared and sheltered by ammunition tarps. Survey with PADS was a simple operation for the first demonstration site, since the host nation used it as an artillery training site and a survey control point was available. Our survey team drove to the point, initialized its PADS, and then one PADS went to the gun position area while the other went to the observation post. At the gun position area, a battery center, orienting station, and orienting line were established in a matter of minutes with the first PADS and then it returned to the initialization point to close out the survey and re-adjust the grid. This was a survey of approximately five kilometers with the only delay resulting from scheduled stops every 10 minutes for a zero velocity update of the gyroscopes before the vehicle could continue to drive on at 30 miles per hour (mph) on relatively level terrain. The vehicle then proceeded to the met station to provide an accurate grid and altitude; from there it went to the OP to verify the grid already surveyed by the previously dispatched second PADS. This second PADS not only surveyed the first OP, but also surveyed alternate OPs and the target area of five targets. After each team verified the other's data, both PADS returned to the initial survey control point to close out their data. As the crow flies, the survey from initialization point to the first test target was 15 kilometers one way; yet this was done in one afternoon. Actual distance covered was approximately 50 kilometers, with an accuracy of 1:30,000. This was quite an impressive distance for our survey team which was used to the "pull, stick, stuck" method. Only one PADS would have been sufficient for this operation, but we chose to use two to verify the data and instruments.

•***13 August*** — Demonstration firing was divided into three phases.

1) Phase I was a demonstration of the capabilities of the M198 howitzer at the gun position to include adjust fire (AF), fire for effect (FFE), and high angle (HA) missions.

2) Phase II consisted of moving to the OP and firing one adjust fire mission, one fire for effect mission, a series of five targets, one high-angle mission, and two danger close adjust fire missions.

3) Phase III consisted of firing an illumination mission and a coordinated illumination mission. Only charge 7 M4A2 propellant with M107 high explosive (HE) or M485 illumination rounds could be fired because of the limited size of the training area. A total of 90 high explosive and 10 illumination rounds were fired.

Observations

There was not a single malfunction of the M198 howitzer, and the accuracy of weapon was outstanding. Although the firing was basically three 30-minute bursts and 10 FFE missions, the thermal warning device never moved past the yellow region. Dispersion was minimal — never more than 20 meters from the target, even though high rates of fire were achieved (10 rounds in two minutes).

The gun crew adjusted well to the high altitude. They did become fatigued during the latter missions but this did not prevent them from obtaining high rates of fire when required. It must be noted, however, that this phase of the operation was a formal demonstration and little sustained heavy activity was required.

To obtain accurate firing data, muzzle velocity and ballistic met messages were absolutely essential. Huge corrections were routinely experienced because of the high altitude. Air density averaged 75 percent, which caused range corrections of minus 1,000 meters at firing ranges of 12,000 meters. Cold stick data would be disastrous for friendly troops under these circumstances since these fires would be ineffective on enemy targets.

For illustrative purposes, the following actual data is provided from the 13 August firings. To obtain first-round data prior to registration, the following information was used:

•Latitude: 18.

•Gun location, known grid: Range 11,850.

•Azimuth of fire: 1793.

•Projectile weight: 5 square.

•Powder temperature: 83°F.

•Velocity error (VE) from calibration (different lot from the one previously calibrated): +13.5 M/S.

•Air density: 75 percent (Met had not been obtained at the time of firing of initial registration; therefore, only the current density could be used.)

•Entry range: 11,960.

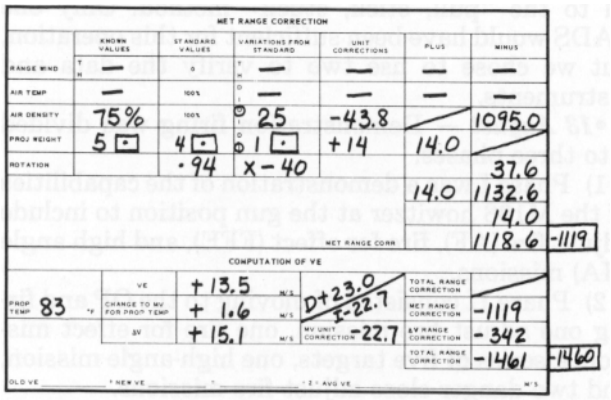


Figure 1. Computation of range.

Computation of range using FT 155-AM-1 (also used for M198) is shown in figure 1. The computed GFT setting for the base piece was as follows:

10,390
−1460
Charge 7, Lot XY, RG 11,850, EL 339.

Deflection correction computation is not shown here since nothing out of the ordinary occurred. Drift was the major correction. This GFT setting represented the best available data and proved to be accurate within 200 meters in gun target range and three mils in deflection when compared with the initial registration.

The GFT setting for the base piece actually obtained from registration was:

10,570
−2180
Charge 7, Lot XY, RG 11,850, EL 349.

A concurrent met message was solved as shown in figure 2.

The powder temperature was known to be 72 degrees Fahrenheit; thus solving the met data correction sheet with this information and the previous known data provided a velocity error of +8.5. This constant in conjunction with accurate met messages was used for all subsequent met solutions and provided first-round did-hit data or all subsequent firings during the three demonstration phases

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	K	Q							
METB	3	8	184	430	13	040	0	199	789

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	00	00	026	769
200	01	47	01	030	767
500	02	04	03	033	765
1000	03	00	00	034	765
1500	04	43	01	033	766
2000	05	25	05	031	768

Figure 2. Met message.

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	K	Q							
METB	3	8	184	430	13	062	0	199	790

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	46	01	037	762
200	01	42	03	038	762
500	02	42	04	037	763
1000	03	42	06	036	764
1500	04	43	06	034	766
2000	05	33	04	032	768
3000	06	23	06	028	771
4000	07	16	07	023	776
5000	08	14	11	021	778
6000	09	18	09	024	778
8000	10	15	08	024	781

Figure 3. Subsequent met message.

throughout the day. The first subsequent met message is shown in figure 3.

The computed GFT setting for the base piece was:

10,490
−1,360
Charge 7, Lot XY, RG 11,850, EL 345.

A third GFT setting with the second subsequent met also resulted in a minus 1370 meter range correction. From this an obvious point is made: Met data is absolutely essential to achieve accurate fires. As a matter of fact, if this team had had the opportunity to fire the M549A1 RAP with the M203 propellant, the following staggering correction at the 28-km range would have been obtained from the FT-A0-0, using the listed density for line number 10 of the previous published met message only. (Range correction equals variation from standard times unit correction (21.9 x –191.3) equals –4,189 meters.)

Further, when we consider that the M198 we used was a long shooter with a calibration velocity error of plus 12.5 for the M203 charge, an additional correction of minus 514 meters (+ 12.5 x –41.1) would have to be added. At this point we have reached a minus 4,700-meter range correction big enough to miss any target if not considered. However, this negative range correction could also be used to our advantage to deliver fires accurately up to 35 kilometers since now the maximum quadrant of the weapon would allow us to achieve a range of approximately 35 kilometers. Temperature, wind, etc., would also have to be corrected for, making the corrections even larger.

•***14 August*** — Cross-country mobility of the M813A1 truck towing the M198 howitzer was tested in this terrain, and the prime mover proved sufficient. The test course was over an extremely rocky trail with moderate grades with some deeply cut wadis (gullies) and sharp curves. The truck and howitzer negotiated all terrain without any difficulty. One mishap occurred when the right spade

jumped out of its holding clamp from the trail and cut one howitzer tire during the negotiating of a deep wadi. This could have been prevented by tying the spades onto the trails.

Second demonstration site

The second site was the typical sandy or dune type desert terrain. It was characterized by extensive flat areas covered in spots with gravel (volcanic rock or shale) and drifting sand. There were few hills with any elevation, but there were some escarpments several hundred feet above the desert floor. Overall the area presented a picture of complete desolation because there were few recognizable landmarks and very little vegetation. While the team was there, the temperature ranged from 115 to 118 degrees Fahrenheit during the day to 70 to 80 degrees at night. Winds were generally from the west-northwest. There was a sand storm, but it caused no problem, other than the sand jamming the keyboard of the met section's OL-192 computer, forcing manual computation of data. Again, there were three phases to the demonstration:

•Phase I was comprised of firing the M549A1 RAP with the M203 propellant and moving to gun position two.

•Phase II consisted of firing the M549A1 RAP with the M119A2 propellant.

•Phase III consisted of firing the M106 with the M4A2 propellant from a third gun position.

Mobility testing was accomplished by moving cross-country from one gun position to the next. Observations for this scenario are discussed only if they differ from those in the previous scenario or provide more information.

•***19 August*** — Since no survey control point was availble, the best available data was a map with a scale of 1:100,000. We established our own survey control point by map spotting the grid of a corner of an airfield fence. PADS accepted this map spot data for initialization. The tolerance for initial data appears to be approximately plus or minus 4,000 meters from the true location. Thereafter the position area survey, connecting survey, and target area survey were routine. From the first gun position to the farthest target, the range was 30,100 meters. Again the survey was accomplished in a little over a day. PADS was absolutely indispensable in determining accurate position area. Map spotting one's position in an open flat area would be a guess at best and surely in error by several grid squares. With no marked terrain features, triangulation would also prove futile. Accuracy was 1:32,000 with PADS.

•***20 August*** — During Phase I, a total of 125 M549A1 RAP rounds with M203 were fired. Again the firing was accomplished over a short period to see if the howitzer could operate under high ambient temperatures (118 degrees Fahrenheit that day) and maintain high sustained rates of fire. Base piece 10-round missions were fired at a rate of one round every 20 to 25 seconds; yet the operating temperature never indicated more than yellow on the thermal warning device. Sixty-five rounds were fired in a 2½-hour span in the morning, and an additional 60 rounds were fired during a 1½-hour time span in the afternoon.

The M198 howitzer had no malfunctions. Equilibrator adjustments or nitrogen pressure changes were not required despite an increase in maximum ambient temperatures of 20 degrees Fahrenheit and nearly 5,000 feet less elevation from the initial firing area. The howitzer was accurate and dispersion, even at a maximum range, was plus or minus 60 meters. At lesser ranges (26,000 to 28,000 meters) dispersion was no more than plus or minus 30 meters. This is considerably less than might be expected of the listed range probable error (PE_R) of 80 meters at 28,000 meters. The only exception to this dispersion pattern was when a round and propellant were left in a warm tube for about one minute prior to firing, causing that round to range 100 meters farther than rounds left in the powder chamber not more than 10 seconds.

Three delays were experienced during firing. Two delays occurred from firing the high charge which caused a displacement in excess of 90 mils and the gun had to be relaid. The third delay occurred when the camouflage net collapsed and had to be cleared from the gun. The tent stakes were just not long enough to hold the net down in the soft sand.

The desert environment proved more of a test for the gun crew than for the gun. Although high sustained rates of fire were maintained, the gun crew definitely grew more fatigued in this environment than at the first demonstration site. Even though a reduced crew was used much of the time so that some personnel could rest, a total of 125 M203 charges were prepared and fired in one day from one gun. The combination of noise and heat definitely tested the crew, but they continued to do their job. They drank sufficient water to prevent dehydration and worked with their gloves on (standard Army issued leather gloves) to prevent burn injuries from the metal. Overall, the American gunner performed admirably in this environment and proved equal to the challenge.

Initial firing data was computed based on a current met message (figure 4) and a velocity error obtained from calibration.

•Latitude: 18.

•Gun location, known grid: Range 25,580.

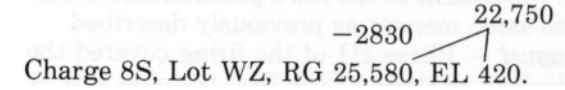
•Azimuth of fire: 3150.

•Projectile weight: 4 square.

•Powder temperature: 189°F.

•Velocity error: +12.5.

Working the met data correction sheet, the following GFT for the base piece was obtained:



A subsequent registration proved this data to be correct with a zero-meter range change and only one-mil deflection change. Obviously a minus 2,830-meter range correction is a huge correction

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	K	Q							
METB	3	8	173	471	20	031	0	077	907

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	37	02	039	873
200	01	47	10	058	858
500	02	47	18	072	850
1000	03	50	08	074	849
1500	04	56	09	073	851
2000	05	59	10	071	853
3000	06	61	11	063	860
4000	07	61	12	053	867
5000	08	60	13	050	874
6000	09	57	12	049	878
8000	10	58	07	049	882
10000	11	59	04	049	890

Figure 4. Current met message.

that cannot be ignored. The cost ($1,000) of the complete round by itself prohibits expenditure of a single round without obtaining the best available data. A second GFT setting was obtained later in the day, and the range correction proved to be a minus 3,210 meters. (These huge GFT settings cannot be placed on our cursors without either drawing in another hairline to take advantage of the full width of the cursor or by arbitrarily subtracting 2,000 or 3,000 of the announced range and then constructing the elevation gage line accordingly at the remaining range correction, remembering of course that this was done.)

The terrain to be navigated was flat with some slight elevation. The soil was sand covered in part with volcanic rock which appeared to follow contours. The sand and rock combination formed a fragile crust which provided enough support for the truck and howitzer when they were in motion. The driver had to maintain a vehicle speed of 20 to 25 miles per hour until the ground was firm enough (bedrock covered with sand was prevalent in places) to allow the vehicle to start moving again. Contour driving following the volcanic rock was essential. Truck tire pressure was also decreased to 25 pounds to increase traction. These techniques allowed us to move about without getting bogged down or stuck in the sand.

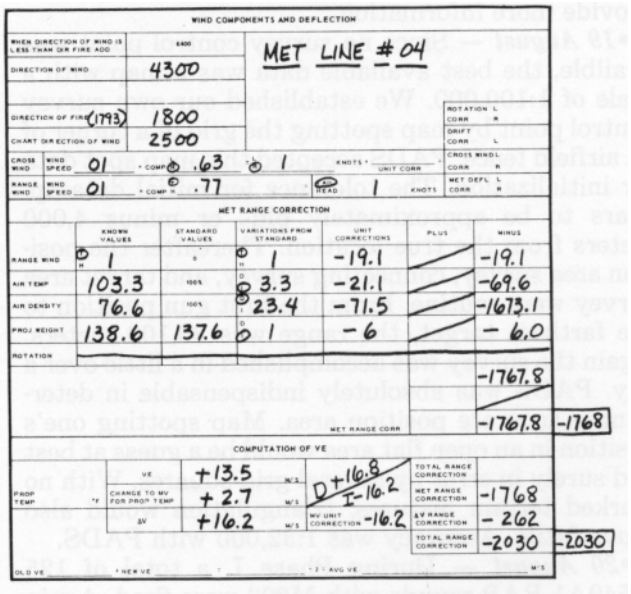
•***21 August*** — Phase II consisted of firing 25 rounds of 549A1 RAP with M119A2 propellant. Firing was routine, if one can consider a minus 2,160 meter range correction to be routine. No malfunctions occurred, and firing was complete within 40 minutes. Movement to the third position area occurred in the same manner as previously described.

•***22 August*** — Phase III of the firing covered the same missions as those at the first training site. A total of 105 M107 HE rounds and 10 M485A1 illumination rounds with M4A2 powder were fired. There were no malfunctions of the gun or delays in firing.

Conclusion

The team demonstrated first-round hit data with the M198 howitzer at ranges up to 30 kilometers. Accurate and rapid fires and massing of fires could only be accomplished with accurate survey as provided by PADS and accurate met messages. The M198 is easily maintained during sustained firing operations (no maintenance problems were encountered while firing 365 rounds). Cross-country mobility of the M813A1 truck towing the M198 howitzer in a high desert plateau and dune type desert is possible when the route is sufficiently scouted and the driver is trained in some basic desert driving techniques. Overall, the American artillery can do the job with the present equipment to deliver accurate and rapid fires.

The meteorological effects on the ballistic solution in southwest Asia for the M198 155-mm howitzer strongly suggests the need for a ballistic meteorology system that can provide timely and frequent met data to firing elements. To illustrate the impact to the Total Force, the same met data was applied to the M198 firing Copperhead, the M110 8-inch howitzer, and the M102 105-mm howitzer with the results shown in figures 5, 6, and 7. Met range corrections of —1,768, —1,156, and —960 meters respectively will have a significant impact on operations. Firing on an azimuth of 1,800 mils with these meteorological conditions may cause the observer to lose his initial rounds and necessitate bold shifts. On the other hand, a direction of fire of 5,000 mils would have a plus met range correction and possibly result in short rounds.

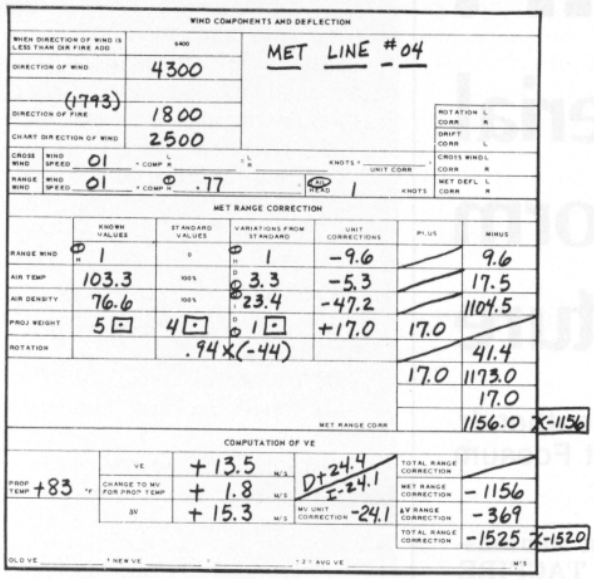


Pertinent information:

1. **MDP altitude was assumed to be the same as the battery altitude.**
2. **A similar VE was assumed for the M712 projectile.**
3. **Copperhead is not corrected for rotational or drift effects.**

Figure 5. M198 howitzer with Copperhead.

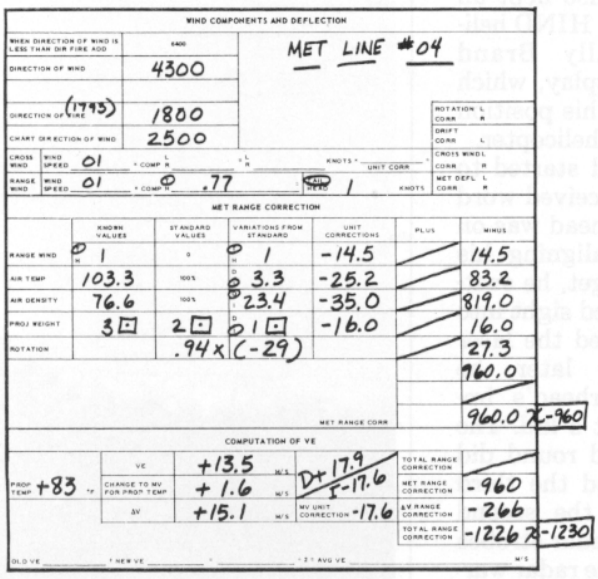
Why are such large met range corrections necessary for southwest Asia? Because the fire control information (FCI) used to produce the TFTs, GFTs, and computer tapes is based upon an arbitrary



Pertinent information:

1. **MDP altitude was assumed to be the same as the battery.**
2. **A similar VE was assumed (+13.5) for the HE projectile.**
3. **Met was computed for charge 7W at a range of 11,860 meters to insure line 04 was utilized.**
4. **Latitude used was 18° N.**

Figure 6. M110 8-inch howitzer.



Pertinent information:

1. **MDP altitude was assumed to be the same as the battery attitude.**
2. **A similar VE was assumed (+13.5) for the HE projectile.**
3. **Met was computed for charge 7 at a range of 10,200 meters to insure line 04 was utilized.**
4. **Latitude used was 18° N.**

Figure 7. M102 105-mm howitzer.

set of standard conditions. The meteorological standard conditions are biased toward sea level in the temperature zone. Therefore, when the US Field Artillery operates in areas of the world where weather conditions are quite different from those upon which cannon FCI were determined, the precise measurement of these variations from standard conditions and the proper calculation of their effects is essential for accurate predicted fire.

The hot, arid, high altitude desert plains where the team from the 1st Bn, 73d FA, demonstrated the M198 last summer is an example of an area of the world with meteorological conditions much different from the set of FA standard conditions. An examination of table F of any TFT indicates that an increase in temperature and a decrease in air density will necessitate a negative range correction. Translated, this means the field artillery must aim short in order to hit the target.

The Copperhead projectile is even more greatly affected by these deviations from standard conditions. To illustrate this fact, the met and total range corrections for Copperhead were computed using the concurrent met message for the 13 August M198 demonstration. A 2,030-meter total range correction resulted when firing with charge 8, 20-degree glide mode from the M198 howitzer at a range of 11,850 meters.

The relatively larger corrections for nonstandard conditions for the Copperhead projectile resulted in the decision to field the M712 Copperhead GFTs with the longer GMET curser and no manufacturer's hairline. Computer-derived GFT settings, essential for accurate fire, are then placed on the M712 GFTs appropriately based upon the cumulative effects of the nonstandard conditions. A similar consideration should be given to refit all cannon GFTs with this larger curser when contingency plans call for employment of FA units in areas where large variations from standard meteorological conditions are the rule rather than the exception.

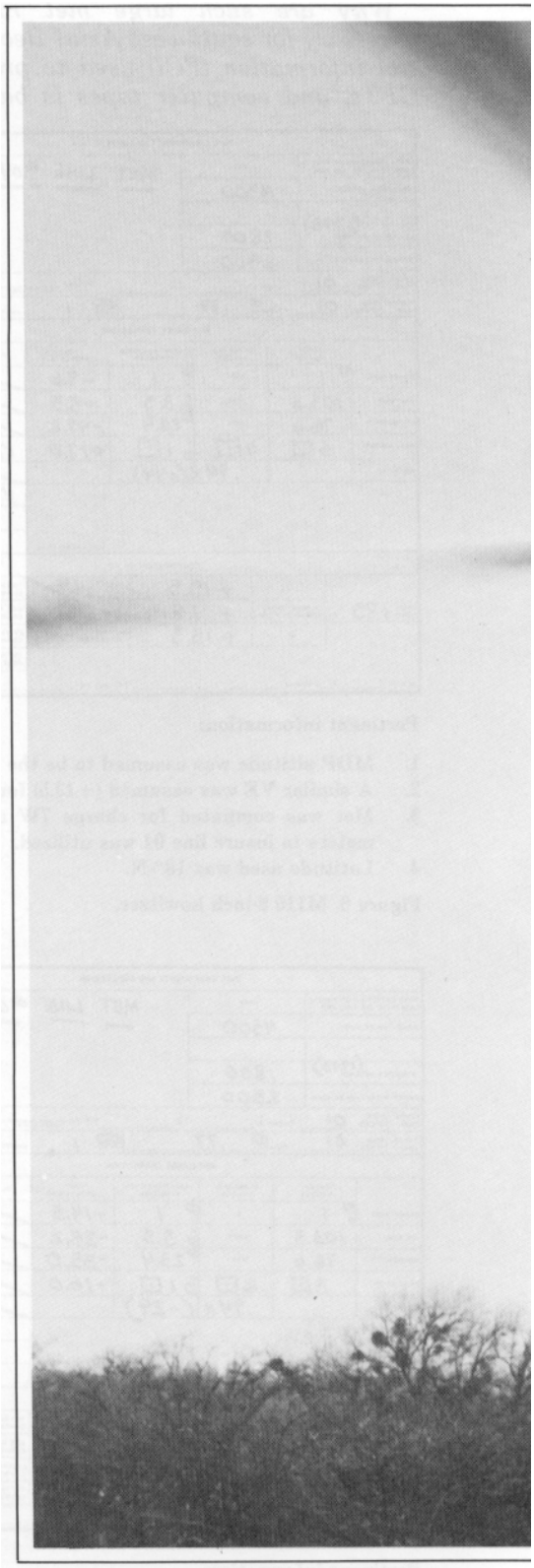
Good met data plus the Position and Azimuth Determining System (PADS) provided the 1st Bn, 73d FA, the timely support to achieve first-round accuracy. PADS, as the technological provider of survey data, allowed the firing position, observation posts, and target area to be placed on a common grid. If PADS had not been available, conventional survey at a rate of 1.5-km per hour would not have had sufficient time to provide accurate survey data to complete the mission.

The demonstration clearly indicated that the gunnery team not only includes the guns and a fire direction center but a couple of "horseshoe nails" as well. The "horseshoe nails" being met and survey. Without them, the gunnery system is seriously degraded.—Ed.

MAJ Heinz A. Schiemann is the Executive Officer of the 1st Battalion, 73d Field Artillery, 18th Airborne Brigade, Fort Bragg, NC.

The AHIP: Field Artillery Aerial Observer Platform of the Future

by COL Robert S. Fairweather Jr. and MAJ Grant Fossum



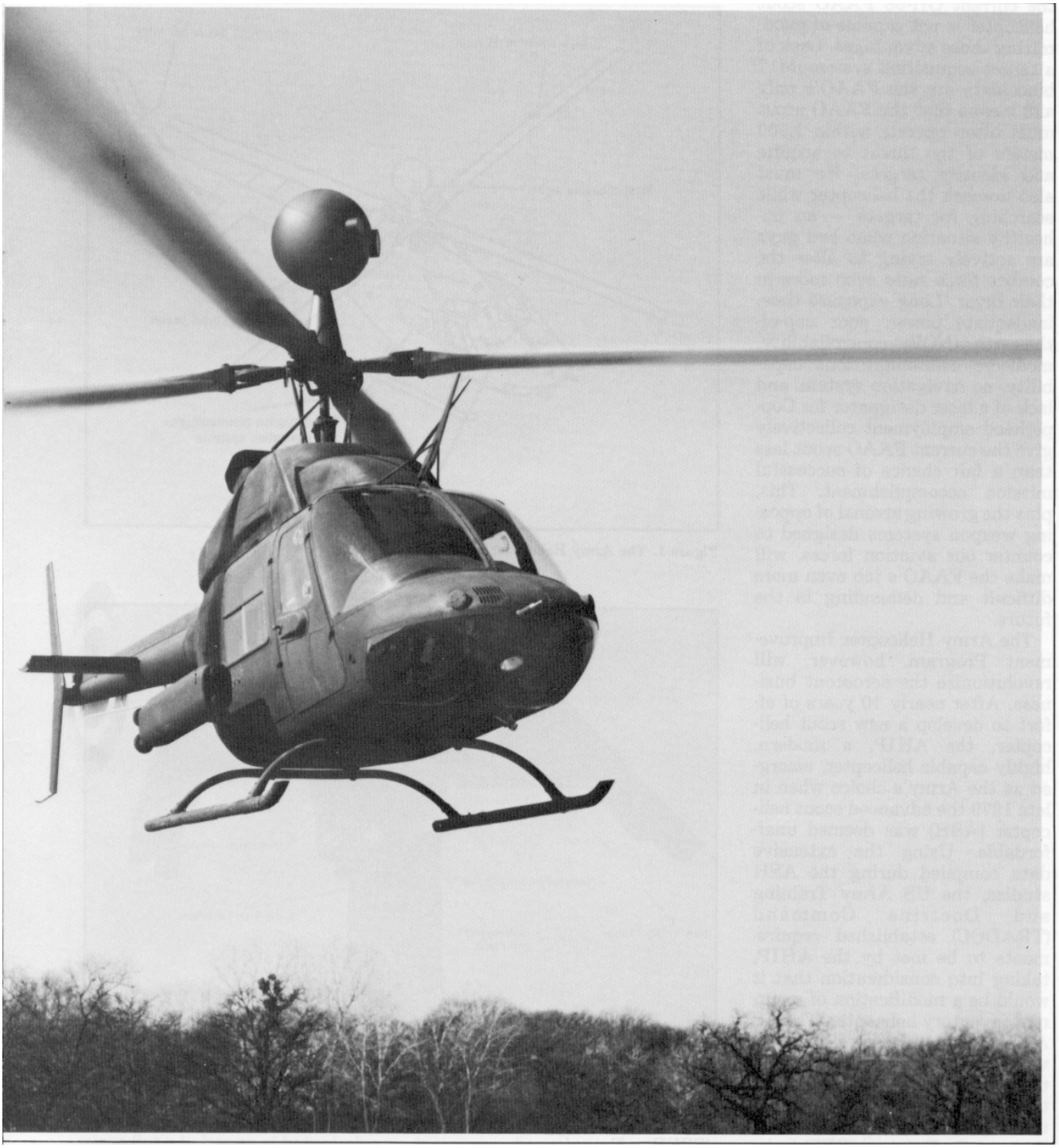
The bright ball of fire vividly contrasted with the simultaneous spray of debris, and Lieutenant MacDonald felt satisfaction as he surveyed the battlefield. Seconds before, he had laser guided a Copperhead onto the last T-72 tank in the platoon. Now he could relax for a moment while Warrant Officer Brand cautiously maneuvered the helicopter into a new observation position. (The lieutenant was always amazed at how expertly Brand used the terrain to keep the helicopter masked from the enemy.)

MacDonald's reverie was suddenly interrupted by a radio call from the fire direction center (FDC). More targets! Suspected tanks reported by the maneuver unit! Grabbing for the switches on his cyclic grip, he quickly slewed the mast-mounted sight toward a likely treeline. With the TV at low magnification, he scanned in the direction of what looked like movement. No luck, too much smoke in the area, he decided. With little hesitation, he switched to the Forward Looking Infrared Radar (FLIR) and found his prey — a T-72. And, another. Almost unconsciously, he ranged the distant target with the laser, released the range and azimuth to the computer and, with several strokes on the data entry keyboard, completed the automatic target handoff message and sent it by digital data burst transmission to the FDC's TACFIRE computer. As Lieutenant MacDonald waited for a reply that Copperhead projectiles were on the way, Warrant Officer Brand maintained the helicopter's rotor below the trees, exposing only the mast-mounted sight. Both monitored the radar warning receiver and Brand also kept an eye out for any Soviet HIND helicopters. Occasionally Brand checked his video display, which kept him updated on his position and the status of his helicopter.

Just as MacDonald started to query the FDC, he received word that the first Copperhead was on the way. Precisely aligning his crosshairs on the target, he switched the mast-mounted sight into autotrack and punched the laser designator. Seconds later, he observed the Copperhead's impact — a hit, but not a kill. The closely spaced second round did the job, however, and the third blew the turret off the second tank. The ZSU-23-4 radar strobes started painting on the radar warning receiver, and Brand swiftly lowered the helicopter into defilade.

Does the above scenario read like a pipedream? Perhaps, but in a few years it will be more truth than fantasy. In fact, the Army Helicopter Improvement Program (AHIP) aeroscout will do everything described in the scenario and more.

Field artillery is appropriately called the "King of Battle" because its awesome firepower can be precisely concentrated to devastate any foe. The precision



artillery, however, depends on the skill of an observer located some distance from the guns. The observer is the vital link that differentiates success from failure.

In addition to the fire support teams (FISTs), each division also has an artillery support section in the division aviation company containing ten OH-58 observation helicopters. These are used to provide highly mobile platforms for field artillery aerial observers (FAAO) assigned to division artillery headquarters. The advantages of the FAAO over the ground-based forward observer are numerous — greater mobility, a better view of the battlefield, immediate responsiveness, and flexible communications — yet

the current OH-58 FAAO scout helicopter is not capable of maximizing those advantages. Lack of a target acquisition system (M17 binoculars are the FAAO's only aid) means that the FAAO scout must often operate within 1,500 meters of the threat to acquire and identify targets. He must also unmask the helicopter while searching for targets — an unhealthy situation when bad guys are actively trying to alter the combat force ratio even more in their favor. Long exposure time, inadequate power, poor nap-of-the-earth (NOE) controllability, mediocre communications capability, no navigation system, and lack of a laser designator for Copperhead employment collectively give the current FAAO scout less than a fair chance of successful mission accomplishment. This, plus the growing arsenal of opposing weapon systems designed to counter our aviation forces, will make the FAAO's job even more difficult and demanding in the future.

The Army Helicopter Improvement Program, however, will revolutionize the aeroscout business. After nearly 10 years of effort to develop a new scout helicopter, the AHIP, a modern, highly capable helicopter, emerged as the Army's choice when in late 1979 the advanced scout helicopter (ASH) was deemed unaffordable. Using the extensive data compiled during the ASH studies, the US Army Training and Doctrine Command (TRADOC) established requirements to be met by the AHIP, taking into consideration that it would be a modification of a current inventory helicopter. The US Army Aviation Research and Development Command translated the requirements into specifications and, after coordination with the user community, released a Request for Proposal (RFP) to industry. Proposals were received from Bell Helicopter Textron (BHT) for a modified OH-58A and from Hughes Helicopters International (HHI) for a modified version of the OH-6A.

The proposals were intensively reviewed by the AHIP Source Selection Evaluation Board (SSEB). Experienced aeroscout aviators, FAAO technicians, and experts in related fields provided by US Army Forces Command (FORSCOM), TRADOC, US Army Development and Readiness Command (DARCOM), and other agencies comprised the SSEB and reviewed the two proposals for five months. This effort culminated in award of a full-scale engineering development (FSED) contract to BHT in September 1981. Figure 1 is a picture of the proposed Bell OH-58D aeroscout illustrating the major areas of improvement over the OH-58A and OH-58C.

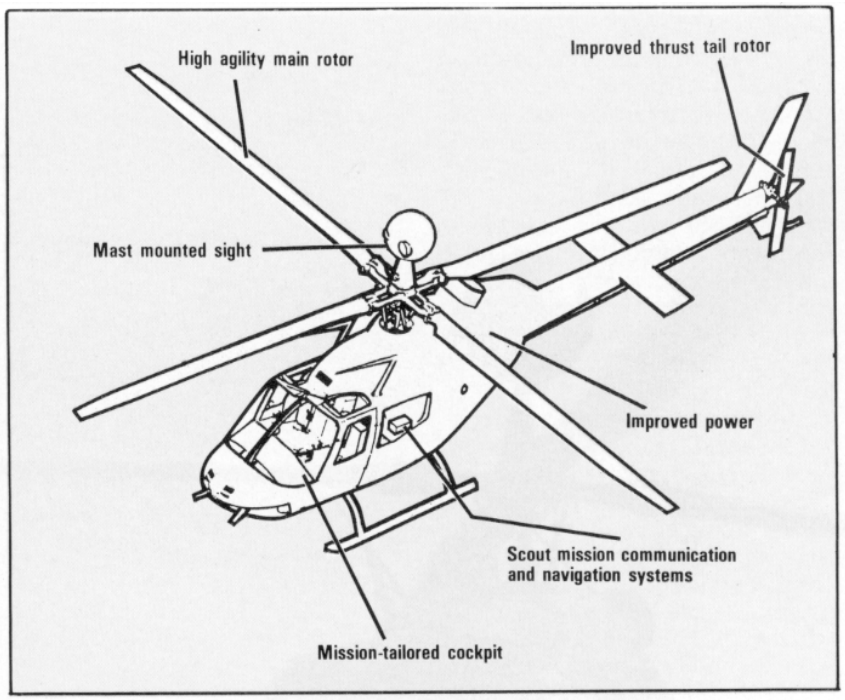


Figure 1. The Army Helicopter Improvement Program aeroscout.

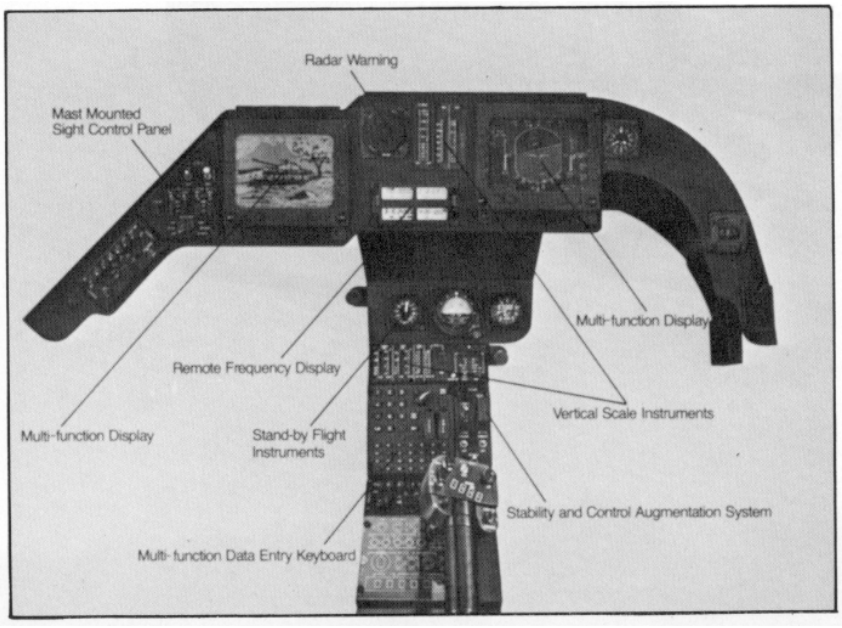


Figure 2. Instrument controls in the cockpit.

The AHIP will possess an impressive

array of modern equipment to provide the capability to perform reconnaissance, standoff target acquisition, and target designation missions for attack helicopter, air cavalry, and field artillery units. With initial fielding programmed for mid-1986, the OH-58D will be capable of operating around-the-clock and in adverse weather or other conditions of reduced visibility. Pilots will be impressed with the increased capability of the OH-58D afforded by the 650 shaft horsepower engine, new transmission, four-bladed main rotor system, and larger, improved tail rotor. The aircraft will be capable of maintaining a steady hover out of ground effect with a 35-knot wind from any direction. The cockpit (figure 2) has been engineered to eliminate the profusion of instruments and allow the pilot to operate all radios and select visual displays without removing his hands from the aircraft controls.

Target Acquisition System
- —Mast mounted sight (TV, FLIR, Laser Rangefinder and Designator)
- —Automatic target hand off

Armament
- —Space, weight, power for ATAS

Survivability
- —Radar warning receiver
- —IR suppression and paint

Commo
- —IFM, IFM/VHF, UHF, and HF/SSB

Navigation
- —Doppler and LR-80
- —Visual navigation display

Figure 3. Mission equipment package.

Though the airframe improvements are substantial, the key enhancement to mission performance is contained in the mission equipment package (MEP) (figure 3). The mast-mounted sight, with its TV day sight, FLIR night sight, and laser rangefinder/designator, provides the capability to acquire, identify, and designate targets at standoff ranges while masked behind concealing terrain features. Communications will be enhanced with an improved NOE radio package, and messages can

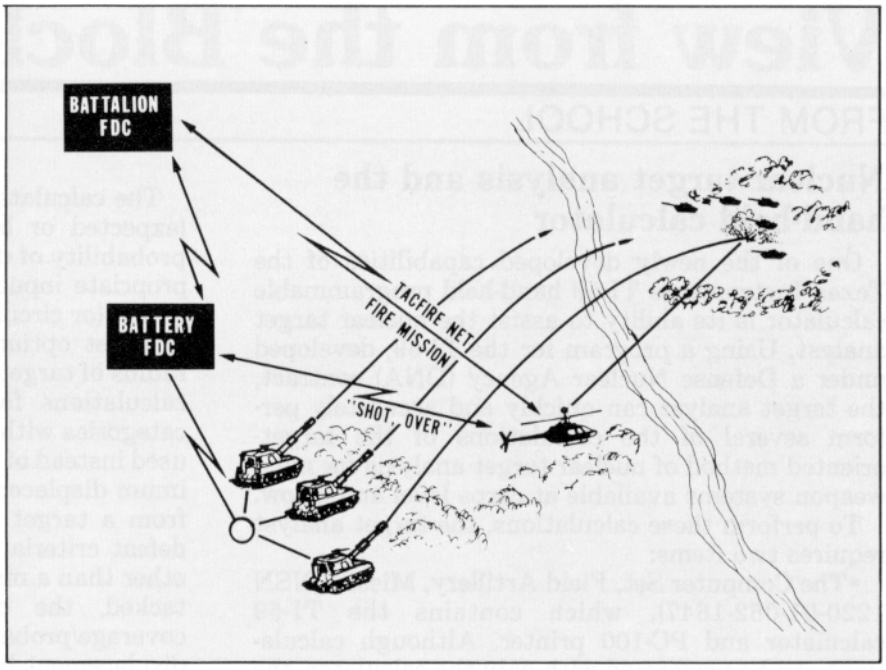


Figure 4. Field artillery aerial observer employment.

be transmitted digitally by data burst with the automatic target handoff system, which interfaces with TACFIRE. (Figure 4 depicts typical FAAO fire mission communications.) A visual navigation system, comprised of a navigational doppler, LR-80 heading reference system, and tie-in to the laser rangefinder, provides accurate aircraft and target location information and additionally will display checkpoints and heading/distance information on the multifunction displays (MFD). Though not yet part of the MEP, the AHIP does have space, weight, and power provisions for an air-to-air missile system.

The introductory scenario to this article presents a realistic picture of how the AHIP FAAO scout can be employed. The AHIP and Copperhead make a lethal team, primarily because AHIP can rapidly reposition to attain line-of-sight to the target with its laser designator. War games conducted to validate the AHIP demonstrated that even on a "dirty" battlefield, AHIP attained a significant number of Copperhead kills while the less mobile Ground Laser Locator Designator's performance deteriorated rapidly as smoke and aerosols obstructed the line-of-sight to potential targets.

AHIPs will also be issued to attack helicopter companies and air cavalry troops, where the compatibility of the AHIP with the AH-64 will result in a quantum increase in attack team lethality and survivability. The features that make the AHIP a great FAAO scout also make it an ideal partner in the attack team and an unsurpassed scout in air cavalry.

We are on the threshold of a new era of battlefield integration and weapon system effectiveness. The AHIP scout fills the void existing in current aeroscout capability and will enhahce the combined arms team capability to see farther and shoot straighter; thus, rapidly generating decisive combat power to insure success in battle.

COL Robert S. Fairweather Jr. is the TRADOC System Manager-Scout Helicopters at Fort Rucker, AL, and MAJ Grant Fossum is the Assistant TRADOC System Manager-Scout Helicopters (Personnel and Training).

View from the Blockhouse

FROM THE SCHOOL

Nuclear target analysis and the hand-held calculator

One of the newly developed capabilities of the Texas Instruments TI-59 hand-held programmable calculator is its ability to assist the nuclear target analyst. Using a program for the TI-59, developed under a Defense Nuclear Agency (DNA) contract, the target analyst can quickly and accurately perform several of the calculations of the target-oriented method of nuclear target analysis for most weapon systems available at corps level and below.

To perform these calculations, the target analyst requires two items:

•The Computer Set, Field Artillery, Missile (NSN 1220-01-082-1647), which contains the TI-59 calculator and PC-100 printer. Although calculations can be performed with only the calculator, the PC-100 printer allows the output to be expanded and provides a hard copy of both input and output.

•The DNA/FM 101-31 Continuous Read Only Memory (CROM) Module F2 with accompanying magnetic cards and user's guide. The basic issue to the field will be two per FA brigade, group, division artillery, and corps FA section. Division artillery will receive an additional set for each supported maneuver brigade. Additionally, 10 sets will be distributed to the Chemical and Field Artillery Schools for familiarization training on the TI-59 in the Nuclear and Chemical Target Analyst Course (NCTAC). Other special users will be considered on an individual basis. In addition, 60 sets are being provided to NATO activities for use in joint headquarters and at the NATO School in Oberammergau, Germany. Total production will be 500 sets: 350, US Confidential, and 150, NATO Confidential. The Defense Nuclear Agency will hold approximately 150 sets for future demands. If your unit performs nuclear target analysis and did not receive the F2 CROM, contact:

Defense Nuclear Agency
ATTN; NATD (Cdr Allen Hughes)
Washington, DC 20305
AUTOVON: 221-7403

There are nine magnetic cards that are used in conjunction with the CROM. Five of these cards are classified and contain the necessary data to perform calculations based on targeting data found in the "Staff Officer's Field Manual — Nuclear Weapons Employment Effects Data," FM 101-32-1 (SRD). The other four cards are unclassified and perform calculations based on FM 101-31-3 (U). The magnetic cards are used to program the calculator to perform calculations for different weapon systems. The F2 CROM also comes with a user's guide which explains the operating procedure and contains sample problems.

The calculator will determine fractional coverage (expected or high assurance) for area targets or probability of damage for point targets based on appropriate input of weapon system, yield, range to target (or circular error probable for bombs), height of burst option, displacement from target center, radius of target, and target category. It will perform calculations for all major or comparable target categories with one exception: personnel in APCs is used instead of personnel in open foxholes. The maximum displacement of a desired ground zero (DGZ) from a target which still meets the commander's defeat criteria can also be determined. If a target other than a major or comparable target is to be attacked, the computer can calculate fractional coverage/probability of damage and maximum displacement based on input of a radius of damage extracted from chapter 13 of FM 101-31-2 (SRD) or FM 101-31-3 (U).

The calculator will also display the minimum safe distance (MSD), least separation distance (LSD), and collateral damage distance (CDD) based on appropriate input. The CDD only provides distances for the categories of personnel in urban, rural, and open environments and is calculated for any desired level of assurance (but only for two-thirds maximum range).

The US Army Nuclear and Chemical Agency has tested the F2 CROM for accuracy, and data produced by the CROM are acceptable for target planning. In some special situations, however, accuracy is degraded because of the limited data space in the CROM and the magnetic cards; the user's manual fully explains this problem. If any users discover inaccuracies they consider excessive, they should contact:

US Army Nuclear and Chemical Agency
ATTN: MONA-OPS (LTC Lindsay)
7500 Backlick Road
Springfield, VA 22150

The F2 CROM for the TI-59 was designed to be used in corps, division, and even brigade fire support elements (FSEs) as a quick means to perform most of the calculations required in nuclear target analysis. The speed with which the calculator performs allows the analyst to spend more time on other tasks. Tasks which must still be performed manually include DGZ selection based on limiting requirements and attack of multiple targets, selection of units to fire, and scheduling nuclear weapons to account for preinitiation. The hard copy output of the calculator can be checked quickly for errors in input and accuracy.

In TACFIRE units, the TI-59 with the F2 CROM has an increased utility as it will enhance and supplement TACFIRE capabilities and will improve

TACFIRE responsiveness prior to nuclear employment. This then permits TACFIRE resources to focus on the conventional close support, interdiction, counterfire, and air defense suppression missions.

The target analysis routines available to the fire support element share the computer time of the TACFIRE division artillery computer. The most complex of these routines concern the evaluation of specific fire units with specific weapons to be employed against specific targets. If only general statements are made concerning an array of weapons, fire units, and targets, the computer processing time is lengthy since the computer is busy with other jobs in addition to the analysis request. If, however, an aimpoint and a specific weapons and fire unit are specified, the time for analysis is quite short. Getting preliminary solutions "off line" from TACFIRE and then setting up finalized planning measures in TACFIRE gives greater speed to not only the target analyst but also other operations such as counterfire. The analyst gets a much more rapid response from the TI-59 "off line" because of the dedication of that equipment to a specific use; however, to get full integrated fire planning "through put" for tactical and technical fire control (i.e., a fire order for a specific unit for a specific weapon with ballistic solutions and firing data) the analysis needs to be on file with TACFIRE. TACFTRE's payoff is high for target analysis and integrated fire planning; it is even higher with the TI-59.

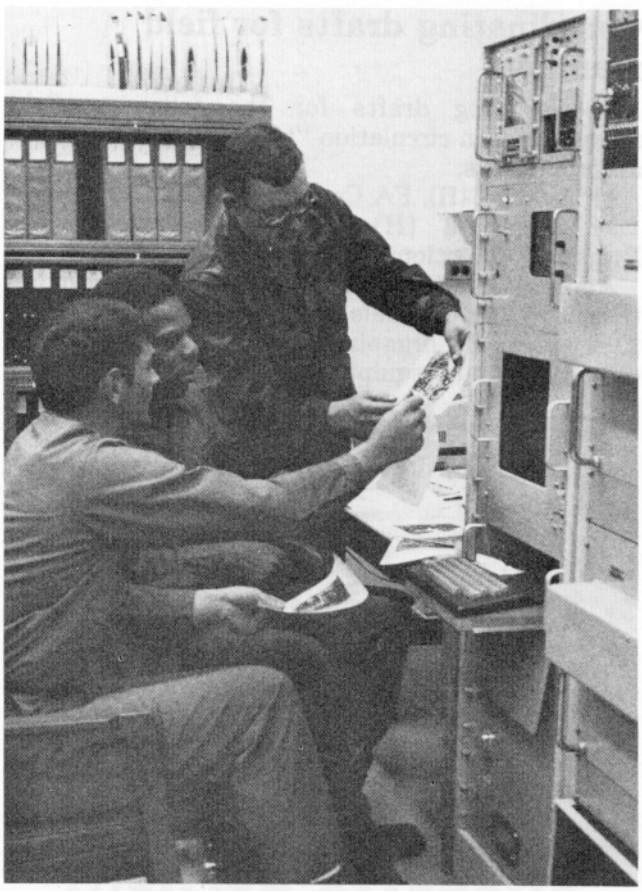
Additional CROMs under development or proposed by DNA include one which will select an optimum DGZ for attack of multiple targets and another for the entire fallout prediction cycle as well as residual radiation calculations. The United States Army Nuclear Chemical Agency, US Army Training and Doctrine Command, and Defense Nuclear Agency are cooperating in a testing effort to insure that hand-held calculators and CROMs are sufficiently hardened to nuclear weapons effects and normal field handling to be fully usable on the integrated battlefield.

The addition of the TI-59 to the equipment available to the target analyst will add greatly to his ability to perform target analysis. When integrated with TACFIRE, the target analyst, at all levels of control, can be assured of timely and accurate data which is necessary to insure the success of a nuclear mission. (CPT William H. Whitlock, TCADD)

PII training exercise

Four soldiers from the US Army Field Artillery School recently made sophisticated reference scenes (machine readable maps) for the Pershing II (PII) missile system in a test to determine whether reference scenes could, in fact, be made in the field.

A Reference Scene Generation Facility (RSGF), developed by the US Army Engineer Topographic Laboratories (ETL) under contract to Goodyear Aerospace Corporation, was used by the soldiers for an on-the-job training exercise.



Reference scenes for the Pershing II missile system are made by staff sergeants Paul G. Reynolds, David P. Dixon, and Steven R. Savage (left to right).

The week-long training session was designed to bring the user and the developer together; none of the soldiers had worked with digital data bases nor were they familiar with the RSGF.

Since reference scenes are a critical part of the PII system, the RSGF will be placed in the field to crank out relevant targets on an as-needed basis. Scenes made during the training exercise will be used later this year for captive flight tests (a simulation of missile flight). In such a test, the reference scene is in the terminal guidance system that is held "captive" in the airplane. The airplane is then flown over specified targets to test the accuracy of the scene data.

J-series revision of field manuals

Initial revision actions are underway for the production of FMs 6-20, 6-20-1, and 6-20-2 for field artillery elements to be organized under the Division 86, J-series tables of organization and equipment (TOEs).

Any suggestions or recommendations concerning the content of these manuals will be greatly appreciated.

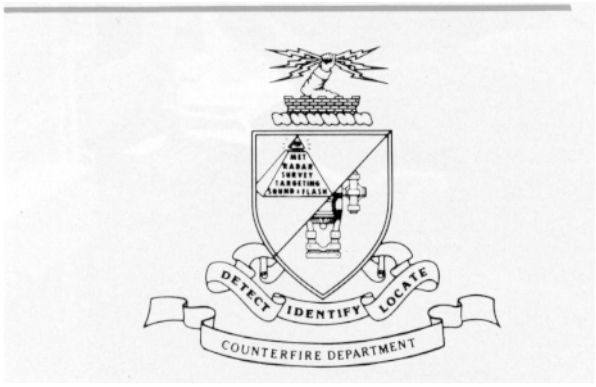
Coordinating drafts for field manuals

Coordinating drafts for the following field manuals are in circulation "to the field" for review and comments:

•FM 6-20-1 (H), FA Cannon Battalion.

•FM 6-20-2 (H), Division Artillery/FA Brigade/FA Section (Corps).

Addressees are encouraged to help in improving these two field manuals which will serve all field artillery elements organized under H-series tables of organization and equipment (TOEs).



COUNTERFIRE SYSTEMS REVIEW

Counterfire operations under study

Based on the results of the Firefinder Force Development Test and Experimentation held in December 1981 at Fort Hood, TX, several new requirements were generated for updating doctrinal publications and procedures for counterfire operations using automated equipment. As such, a study group has been formed at Fort Sill to review automated artillery operations for counterfire and other requirements in the 1980s. The group's preliminary findings will be a topic of the TACFIRE user's conference to be held 10-11 August 1982.

1982 TAB Conference

The 1982 Target Acquisition Battery (TAB) Commander's Conference, to be held at Fort Sill during 18-22 October 1982, will have as a theme "Command and Control of TAB Assets" and will treat both current and projected problems. Special emphasis will be given to information transfer in an automated (TACFIRE) environment.

Other intended topics are Warsaw Pact Target Acquisition, Remotely Piloted Vehicle update, and a review of the Firefinder Force Development Test and Experimentation (FDTE) at Fort Hood, TX.

Division artilleries are encouraged to have their respective TAB commanders submit outlines for presentations regarding command and control situations unique to their operations. Individuals having suggestions for discussion or presentation topics are encouraged to submit them to the Counterfire Department (CPT Holthus, AUTOVON 639-3312/6179).

PADS

The Position and Azimuth Determining System (PADS) is now being fielded with the 82d Airborne Division, 18th Field Artillery Brigade, 9th Infantry Division, and 24th Infantry Division operational.

The PADS is a self-contained inertial surveying system, capable of rapidly determining accurate position, elevation, and azimuth when utilized in either a ground or airborne configuration.

During recent operational performances at Fort Sill, Fort Chaffee, the National Training Center, and Saudi Arabia, PADS achieved outstanding accuracies. The most recent demonstration was in Europe where the system was used to reestablish survey points for training areas. The PADS was also used to establish survey control for infantry, armor, and aviation units where a total of 1,327 miles were surveyed to establish 735 survey points. The total time for this survey was 141.5 hours over a period of 15 days. An estimated 12 to 14 months were saved by using PADS. This outstanding performance is just one example of the giant step the field artillery has taken with the fielding of PADS. Surveys that normally take a conventional eight-man survey party several days can now be accomplished in just hours by a two-man PADS survey party.

Designated units which are scheduled to receive the PADS in the near future must make MTOE recommendations to complement PADS fielding. Due to numerous questions from the field, a personnel and equipment authorization for survey parties is shown below and can be used as a planning source

Table 1. Personnel and equipment authorization for survey parties.

PERSONNEL

JOB TITLE	TYPE PARTY		
	CONV 5TH ORDER	PADS	DME 4TH ORDER
1. Chief of Survey, E6, 82C30	1		1
2. Chief of PADS Party, E5, 82C20		1	
3. Survey Cmpt, E5, 82C20	1		1
4. Survey Cmpt/Recd, E4, 82C10	1		3
5. Instrument Operator, E4 82C10	1		3
6. Rodman/Tapeman, E3, 82C10	1		
7. PADS Vehicle Dvr, E3, 82C10		1	
TOTALS	5	2	8

Table 1 — *Continued.*

EQUIPMENT									
		QUANTITY					QUANTITY		
LIN	NOMENCLATURE	CONV 5TH ORDE	PADS	DME 4TH ORDE	LIN	NOMENCLATURE	CONV 5TH ORDE	PADS	DME 4TH ORDE
A22496 A	Aiming Circle	1			M75714 A	Mount Tripod			
B67766 B	Binocular: Modular Construction Mil Scale (Reticle) 7x50MM W/E	2	1	2		Machine Gun: 7.62 Millimeter	1		1
C62375 A	Case Battery: 2-AIJ/TSEC	2		3	N82364 B	Periscope Battery Command	1		
C89145 B	Camouflage Screen System: Woodland	2	1	4	P21220 A	Position Azimuth Determining System AN/USQ-70		1	
C89213 B	Camouflage Screen Support System: Woodland/Desert Plastic Poles	2	1	4	Q34308 A	Radio Set: AN/GRC-160	2		3
					Q53001 A	Radio Set: AN/VRC-46		1	
					S01373 A	Speech Security Equipment: TSEC/KY-57	2	1	3
E63728 B	Compass Magnetic Unmounted: MIL Graduations	2	1	2	S68559 A	Surveying Set Supplementary Equipment: Position and Azimuth Determining System		1	
K87243 A	Installation Kit: MK-1234/G F/AN/ VRC-46 53 64GRC 160 in M151	1	1	2	V26745 A	Target Set Surveying (Apr 82)			3
					U69083 A	Surveying Instrument: Azimuth Gyro Lightweight (SIAGL)	1		1
K87254 A	Installation Kit: MK-1246/GRC F/AN/VRC-46 53 64 AN/GRC-125 160 in M561	1		1	U69174 A	Surveying Set DME Infrared	1		
					U69357 B	Surveying Instrument Dist Measure Electron Micrwve Minatzd Purp			3
K87536 A	Installation Kit: MK-1838 VRC F/KY-57 W/AN/VRC-46 in M151A1		1		U69631 A	Surveying Set Artillery Fire Control: 4th Order	1		1
L44595 B	Launcher, Grenade, 40-Millimeter: Single Shot Rifle MTD DTCHBLE W/E	1	1	1	V98788 A	Vehicular Power Supply VPS: HYP-57/TSEC	2	1	3
K87540 A	Installation Kit: MK-1842 VRC F/KY-57 W/AN GRC-160 in M151A1	1		2	W07701 A	Theodolite Survey: Direct 0.002 Mil 30 Porm 5 Pwr Detch Tribrch			3
K87541 A	Installation Kit: MK-1843 VRC F/KY-57 W/AN GRC-160 in M561	1		1	W07838 A	Theodolite Survey: Direct 0.2 Mil Tripod and Carrying Case	1	1	
L64679 B	Light Signal Surveying: 2 in Dia Reflector			1	W95400 B	Trailer Cargo: ¼ ton, 2 Wheel W/E		1	
L92386 A	Machine Gun 7.62 Millimeter: Light Flexible	1		1	W95537 B	Trailer Cargo: ¾ ton, 2 Wheel W/E			1
					X39940 A	Truck Cargo: 1¼ ton, 6x6 W/E	1		1
					X60833 A	Truck Utility: ¼ ton, 4x4 W/E	1	1	2

to make specific MTOE recommendations. Proper and correct MTOE recommendations will insure a fully operational PADS party and deter equipment problems when PADS is fielded.

There are some exceptions to the equipment authorizations as shown in table 1 under the PADS survey party; for example:

•The standard theodolite, under the basic DA approved TOE is the Theodolite Survey: Direct 0.2 mil.

•Those units receiving PADS which have a fourth order directional requirement (i.e., target acquisition batteries, division artilleries, and Lance units) must insure that the Theodolite Survey: Direct 0.002 mil is retained in the MTOE.

•The second exception is the Surveying Set Supplementary Equipment: Position and Azimuth Determining System (LIN 568559). There is a distinct possibility that the fielding of the set to PADS units might be delayed. The Supplementary Survey Set is a container designed to fit in the PADS vehicle with the items listed in table 2 as part of the set.

These items will be pulled from the Surveying Set

Artillery Fire Control (LIN U69631) and used to complement the supplementary survey set. Since this set (LIN 568559) may be delayed in fielding, it is recommended that the Surveying Set (LIN U69631) be retained until such time that the PADS Supplementary Set is available.

Table 2.—Components list (6675-97-CL-E64), Survey Set, Supplementary Equipment.

NATIONAL STOCK NUMBER	DESCRIPTION	U/I	QTY
6675-01-073-3832	SURVEYING SET, SUPPLEMENTARY	SE	
	Consisting of the following components:		
5110-00-720-0711	AX, SINGLE BIT	EA	1
6675-00-566-8907	CASE, COMPUTER	EA	1
6675-01-NNIIN	CASE, SURVEYING SET, SUPPLE—MENTARY	EA	1
7520-00-281-5918	CLIPBOARD, FILE	EA	1
4020-00-270-1659	CORD, FIBROUSE	EA	1
7510-00-161-5675	CRAYON, MARKING	DZ	1
6675-01-NNIIN	DISPENSER, FLAGGING, SURVEYOR'S	EA	1
6230-00-264-8261	FLASHLIGHT	EA	1
6675-00-612-1187	LIGHT, SURVEYING	EA	2
5110-00-813-1286	MACHETE, RIGID HANDLE	EA	1
7530-00-285-3083	PAD, WRITING PAPER	DZ	1
6640-00-597-6745	PAPER, LENS	BK	1
	PENCIL:		
7510-00-281-5235	NO. 3	DZ	2
7510-00-240-1526	BLACK	DZ	1
7510-00-436-5210	BLUE	DZ	1
7510-00-174-3205	RED	DZ	1
5210-00-268-9621	PLUMB BOB	EA	2
6675-00-514-5575	POLE, RANGE	EA	2
6675-00-556-0118	PROTRACTOR, SEMICIRCULAR	EA	1
9905-00-542-4504	RIBBON, FLAGGING, SURVEYOR'S	RO	1
6675-00-283-0018	SCALE, PLOTTING	EA	1
7520-00-227-1451	SHARPENER, PENCIL	EA	2
8465-00-926-4932	SHEATH, MACHETE	EA	1
5210-00-273-1958	SHEATH, PLUMB BOB	EA	2
5315-00-161-9815	TACK	HD	3
8135-00-292-2345	TAG, SHIPPING	MX	1
7510-00-551-9824	TAPE, PRESSURE SENSITIVE ADHESIVE	RO	1
6675-00-240-1881	TRIPOD, SURVEYING	EA	2

Note: **This set shall be packaged in accordance with Packaging Data Sheet NSN 6675-00-C73-3832, Surveying Set, Supplementary Equipment. Batteries are not packed, stored, or shipped in equipment because of their limited shelf life. Requisition separately from (80063) US Army Communications and Electronics Materiel Readiness Command, Logistics Engineering Directorate. See SB 11-6 for allowances.**

Radar Technicians Course

The Counterfire Department has recently graduated its third class of warrant officers from the basic Target Acquisition Radar Technicians Course (4C-211A). Newly appointed warrant officers attend the 2-week Warrant Officer Orientation Course at Fort Rucker, AL, prior to reporting to Fort Sill for in-depth training in their specialty as target acquisition radar technicians. While here, they receive 17 weeks of hands-on instruction on the operation and organizational repair of the AN/MPQ-4A, AN/TPS-25A, and the AN/TPS-58B radar sets and the operation of the AN/TPQ-36 and AN/TPQ-37 Firefinder radar systems.

Previously, the course was open to only Active Army warrant officers (211A), but now it is accessible to Reserve Component warrant officers. Interested National Guard or Army Reserve MOS 211As should contact their servicing Military Personnel Center or their State Adjutant General. (POC: CW3 Barrett, AV 639-5014).

FORT BENNING, GA—Sergeant First Class Charles W. Vaughn, a member of the Artillery Team at the US Army Infantry School, was recently named the Noncommissioned Officer Instructor of the Year at the "Home of the Infantry." In recognition of his outstanding service, Post Commander Major General R. L. Wetzel presented Sergeant Vaughn the Army Commendation Medal, a $100 savings bond, and a Certificate of Appreciation.

The TI-59 As A Tool In Fire Support Coordination

by SSG David M. Johnson

Fire support coordination is an important mission which usually involves the processing of target lists. In this, the following situations must be identified:

•Targets which cannot be ranged by the FA battalion. This will be of immediate concern to higher headquarters.

•Targets which can be ranged by some but not all batteries. This situation will place restrictions on scheduling.

This analysis can become complicated since the battalion is not normally static. As such, there are situations which can dramatically affect the coordination process. For example:

•**Movement of a battery:** Here, we must insure that assigned targets can be covered during the displacement. In addition, reassignment may be necessary after the battery occupies its new position.

•**Ammunition status:** The process of consumption and resupply will create situations where the charges available (in required amounts) will change. This will expand or lessen the capability of the battery.

•**Battlefield losses:** Losses are unavoidable and will impact on fire support assignments.

Thus, the coordination effort must be a continuous process and will require substantial work from the chart operator and subsequent use of chart equipment. These same resources will, however, also be required for current operations which can create conflicts difficult to manage.

The TI-59 computer presently available can provide assistance in this area since it can be programed to analyze target lists. In addition, it has adequate memory to hold the list.

We have therefore developed a program for this task and believe it can provide an alternative that will both expedite target list analysis and leave other assets free to monitor current operations. Briefly, the program will take a single battery location and review the target list against this location. Up to 20 targets may be processed at the same time. Each target range is determined and compared with a stored maximum range. When the target range exceeds the maximum range, the program stops and displays the target number. The operator may then restart the review and continue analysis until the current list is exhausted. Since the target list can be recorded to magnetic cards, the program can process an unlimited number of lists.

During program development, it was noticed that the target list problem, stated in reverse, was identical to the massing problem. We, therefore, made provision for the review of a single target against a list of up to eight batteries. In this case, when the target range exceeded maximum range, the program stopped and the battery number was displayed. The program (table 1) is given in LOCATION, CODE, and KEY sequence. The program is entered by using the sequence given in the KEY column. The LOCATION and CODE columns are provided for edit purposes. Operating instructions are as follows:

Enter program

Initially, the program must be keyed into the TI-59 computer, using the sequence shown in table 1. Once entered, the program may

Table 1.

LOC.	CODE	KEY	LOC.	CODE	KEY	LOC.	CODE	KEY
		LRN						
000	76	2nd Lbl	067	05	5	134	08	O 8
001	11	A	068	42	STO	135	91	R/S
002	72	STO 2nd Ind	069	04	O 4	136	76	2nd Lbl
003	04	O 4	070	25	CLR	137	18	2nd C
004	25	CLR	071	61	GTO	138	43	RCL
005	69	2nd Op	072	00	O	139	12	1 2
006	24	2 4	073	16	1 6	140	42	STO
007	43	RCL	074	76	2nd Lbl	141	01	O 1
008	04	O 4	075	14	D	142	25	CLR
009	91	R/S	076	05	5	143	43	RCL
010	76	2nd Lbl	077	42	STO	144	13	1 3
011	12	B	078	04	O 4	145	42	STO
012	03	3	079	91	R/S	146	02	O 2
013	00	O	080	76	2nd Lbl	147	25	CLR
014	42	STO	081	15	E	148	43	RCL
015	04	O 4	082	03	3	149	11	1 1
016	73	RCL 2nd Ind	083	00	O	150	91	R/S
017	04	O 4	084	42	STO	151	76	2nd Lbl
018	42	STO	085	04	O 4	152	19	2nd D
019	03	O 3	086	91	R/S	153	43	RCL
020	69	2nd Op	087	76	2nd Lbl	154	15	1 5
021	24	2 4	088	10	2nd E	155	42	STO
022	73	RCL 2nd Ind	089	03	3	156	01	O 1
023	04	O 4	090	00	O	157	25	CLR
024	67	2nd x=t	091	42	STO	158	43	RCL
025	00	O	092	04	O 4	159	16	1 6
026	61	6 1	093	73	RCL 2nd Ind	160	42	STO
027	75	−	094	04	O 4	161	02	O 2
028	43	RCL	095	67	2nd x=t	162	25	CLR
029	01	O 1	096	01	1	163	43	RCL
030	95	=	097	03	O 3	164	14	1 4
031	32	x⇆t	098	69	2nd Op	165	91	R/S
032	69	2nd Op	099	24	2 4	166	76	2nd Lbl
033	24	2 4	100	61	GTO	167	25	CLR
034	73	RCL 2nd Ind	101	00	O	168	09	9
035	04	O 4	102	93	9 3	169	69	2nd Op
036	75	−	103	43	RCL	170	17	1 7
037	43	RCL	104	04	O 4	171	91	R/S
038	02	O 2	105	91	R/S	172	76	2nd Lbl
039	95	=	106	76	2nd Lbl	173	52	EE
040	22	INV	107	16	2nd A	174	09	9
041	37	2nd P➡R	108	43	RCL	175	08	8
042	25	CLR	109	06	O 6	176	00	O
043	32	x⇆t	110	42	STO	177	00	O
044	75	−	111	01	O 1	178	42	STO
045	43	RCL	112	25	CLR	179	00	O O
046	00	O O	113	43	RCL	180	91	R/S
047	95	=	114	07	O 7	181	76	2nd Lbl
048	22	INV	115	42	STO	182	53	(
049	77	2nd x≥t	116	02	O 2	183	01	1
050	00	O	117	25	CLR	184	04	4
051	55	5 5	118	43	RCL	185	08	8
052	43	RCL	119	05	O 5	186	00	O
053	03	O 3	120	91	R/S	187	00	O
054	91	R/S	121	76	2nd Lbl	188	42	STO
055	25	CLR	122	17	2nd B	189	00	O O
056	69	2nd Op	123	43	RCL	190	91	R/S
057	24	2 4	124	09	O 9	191	76	2nd Lbl
058	61	GTO	125	42	STO	192	54	)
059	00	O	126	01	O 1	193	01	1
060	16	1 6	127	25	CLR	194	08	8
061	09	9	128	43	RCL	195	01	1
062	94	+/−	129	10	1 O	196	00	O
063	34	$\sqrt{x}$	130	42	STO	197	00	O
064	91	R/S	131	02	O 2	198	42	STO
065	76	2nd Lbl	132	25	CLR	199	00	O O
066	13	C	133	43	RCL	200	91	R/S
								LRN

be recorded to a magnetic card using the instruction: 1 2nd Write. Subsequent program entries can be recorded on this card via the instruction: 1 INV 2nd Write.

If difficulty is encountered while executing the program, the RST key is pressed, followed by the LRN key. This will place the unit in the learn mode. By use of the SST key and the BST key, the program may be reviewed and compared with the LOCATION and CODE sequence given. Errors in the program may be corrected by pressing the CORRECT key while the unit displays the desired location. (See the "Personal Programming" manual for additional details. Exit the learn mode by pressing the LRN key.)

Set partitions

Keys SBR and CLR are pressed to set partitions and the following display will be shown: 239.89. This indicates that the unit is set to provide 90 memory registers and has allocated space for 239 program steps. The TI-59 has four memory partitions. Three of these partitions are dedicated to data storage. Partitions two and three are used for target storage. Partition four contains battery data.

00 Maximum range.

01 Battery or target easting (for location to be analyzed).

02 Battery or target northing (for location to be analyzed).

03 Battery or target number currently under review.

04 Control register.

05-29 Battery data. Three registers are used for each battery (ID, easting, and northing); thus, eight batteries may be stored. The program has provision for the automatic loading (to registers 01 and 02) of the first four battery locations.

30-89 Target data. Three registers are used for each target (number, easting, and northing); thus, 20 targets may be stored.

Store initial data

The program provides three storage methods; selection of method must be made before entering desired data.

•**Press D, Display=5:** This indicates that the program is set for the storage of battery data.

•**Press E, Display=30:** This indicates that the program is set for the storage of target data.

•**Press 2nd, E:** This feature is provided for use when previous entry of target data has been interrupted or when additions to the present target list are desired. The program will scan the target registers and stop when it finds an empty register. The display will indicate the location of this register.

The A key is used for data entry process. The program will store the data and advance to the next data register. The number of this register will be displayed. All data must be entered in the following format:

•Identification, A; easting, A; northing, A.

•Battery ID: A Btry = 1; B Btry = 2; C Btry = 3; D Btry = 4; etc.

•Target identification: Target number.

If the data is to be used for any length of time, it should be recorded on magnetic cards. Two cards will be required to record all three registers.

Load battery or target to be analyzed

If a battery is to be analyzed, the "2nd" key is pressed and then the letter key associated with that battery (A, B, C, or D). The program will transfer that battery to register 01 and 02 and display the battery number.

If a target is to be analyzed, the target easting is entered and then "STO, 01" is pressed. The target northing is entered and "STO, 02" is pressed.

Select maximum range

The program has the maximum ranges stored for 155-mm 109A1 HE charges 8, 7W, and 5G. When these options are selected, the program will display the range it selected.

•Charge 5G: press SBR, EE.

•Charge 7W: press SBR, (.

•Charge 8: press SBR,).

Note: *To store other ranges, enter range and press STO 00.*

Select analysis method

Two alternative methods are provided:

•If a battery has been loaded to registers 01 and 02, "B" is pressed. The program will review the target list and stop when it comes to a target that the battery cannot range. The target number will be displayed (this number should be written down). The R/S key is pressed, and analysis will continue until the target list has been exhausted. The program will display a flashing "3" when the analysis is complete.

•If a target has been stored in registers 01 and 02, "C" is pressed. The program will review the battery list and stop when it comes to a battery that is out of range. The battery number will be displayed. The R/S key is pressed to continue the analysis. When all of the batteries have been reviewed, the program will display a flashing "3."

Note: *To remove a flashing display, press CLR.*

Conclusion

Hopefully, the program offered here will be of assistance to fire support personnel as well as those in operations and higher headquarters.

SSG David M. Johnson is assigned to Headquarters and Headquarters Battery, 1st Battalion, 147th Field Artillery Brigade, South Dakota Army National Guard, Sioux Falls, South Dakota.

The M198

New Howitzer For Light Divisions

by MAJ Walter B. Brown II

Members of 1st Battalion, 73d Field Artillery, Ft. Bragg, NC, prepare an M198 howitzer for airlift.

Does the Army need a new more effective howitzer to serve as the light division's direct support weapon — a weapon that would provide a dramatic increase in range, fire all standard and developmental projectiles, be air transportable by CH-47C/D, have strategic mobility using the C-130 aircraft, and be easy to maintain and very reliable? Do we have the engineering expertise to produce such a weapons system? The answer to each question is YES! The Army does have such a need and, yes, it is possible to build such a weapon for it exists today — the M198, 155-mm towed howitzer.

Development of the M198, the Field Artillery's newest howitzer, began as a firing fixture in 1968 and achieved initial operational capability (IOC) at Fort Bragg in 1979. This weapon was originally designed to replace the World War II vintage M114 towed 155-mm howitzer but, in May 1980, the Army Chief of Staff approved

its fielding as the direct support weapon for light infantry divisions (not including the 82d Airborne or the 101st Air Assault Divisions). His decision was based on studies and analyses as well as a Force Development Testing and Experimentation (FDTE) demonstration conducted at Fort Bragg to determine the feasibility of using the M198 in a direct support battalion. The significant factors considered included:

•The light division's mission/threat.

•Comparative capabilities of the 105-mm and 155-mm towed howitzers.

•Relative effectiveness of munitions.

•Deployability of the systems.

•Cost of equipping/reequipping the light division artillery.

Although more expensive and less mobile than the 105-mm howitzer, the M198 was selected as the direct support weapon because it offers a significant increase in lethality (munitions and range) when weighed against the worldwide contingencies of the light division. (Figure 1 compares some of the critical capabilities of the M102 (105-mm), M114A2 (155-mm), and M198 (155-mm) towed howitzers.)

	M102	**M114A2**	**M198**
Maximum rate of fire (1 min)	10	4	4
Sustained rate of fire (1 min)	3	1	Two rounds or as determined by thermal warning device.
Range (km)	11.5	14.6/19.3 (RAP)	22.5/30 (RAP)
Emplacement time (min)	2	4	4
Crew size	9	11	11
Weight (lb)	3,338	12,700	15,795
Tube life	5,000	7,500	1,750 (M203)
Projectile weight (lb)	33	95-103	95-103
HE	yes	yes	yes
RAP	no	yes	yes
ICM	yes	yes	yes
DPICM	no	yes	yes
Illumination	yes	yes	yes
Copperhead	no	TBD	yes
FASCAM	no	yes	yes
Nuclear	no	yes	yes

The M198 is neither the dream direct support howitzer for the light division nor is it an absolute nightmare. Like all new systems, it has experienced growing pains such as early production problems, initial design changes, and misunderstandings. Rumors have given the howitzer some undeserved and some richly deserved "bad press." Most detractors criticize the M198 because of its mobility characteristics (ground, helicopter, and Air Force aircraft) and because of the blast overpressure associated with its maximum charge, the M203 zone 8 super; however, critics and advocates agree that it is an excellent firing platform.

Mobility

Mobility problems of the M198 (ground, helicopter, and Air Force aircraft) are caused by its size. The Air Force provides strategic air mobility for the M198; however, the howitzer is approximately five inches too wide to fit between the Low Altitude Parachute Extraction System (LAPES) rails in the C-130 aircraft. In order to compensate for this shortcoming, wooden ramps are constructed to raise the howitzer above the rails. Thus, a battalion must store, transport, and maintain over 10,000 linear feet of 2- by 12-inch rough cut lumber to build these ramps. This situation is obviously unacceptable from an operational standpoint; therefore, action is being taken to eliminate the requirement for much of the lumber.

The leading concept is to issue one set of narrow tires and wheels per howitzer which, when installed, will effectively reduce the width of the M198. In July 1981, this loading technique was tested at Fort Bragg and it successfully demonstrated that less lumber and time were required using this method for loading the howitzer on board the C-130. Additional testing and low level procurement is expected in the near future. Unresolved elements concerning this concept include:

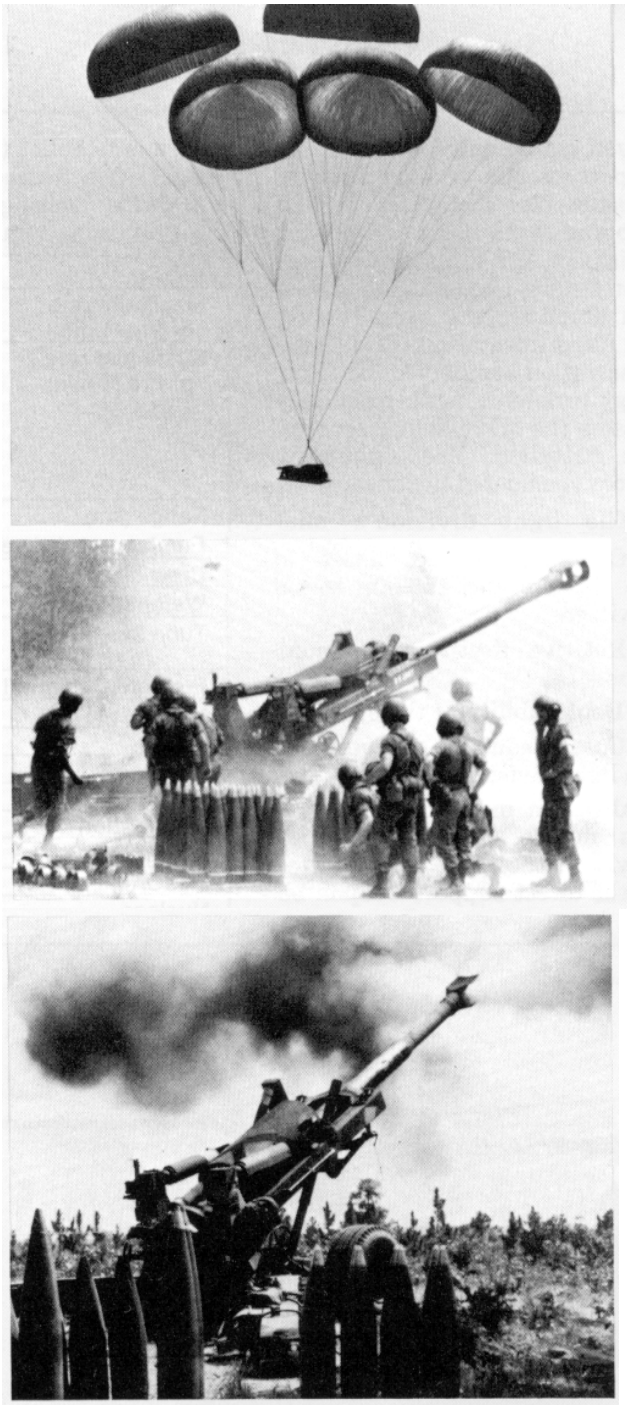
•Defining howitzer towing restrictions when narrow wheels and tires are installed.

•Determining stowage location for narrow wheels and tires when not in use.

•Formalizing installation and removal procedures.

In addition to its strategic air mobility, the M198 must also have a tactical air mobility. The Army CH-47C/D medium lift helicopter provides this capability under many conditions. However, the helicopter's operational characteristics vary, based on many factors including altitude, weather, weight of the load, and amount of fuel. (Although there is little hope of significant weight reduction for the M198, it is by far the lightest howitzer of its class in the world today.)

During airmobile operations, careful consideration must be given to not only moving the crew and howitzer but also in sustaining them in position until ground support is available. Since the howitzer's prime mover — the M813 5-ton truck — is not air transportable by CH-47D and the weight of 155-mm



An M198 howitzer is air dropped (top) to a new firing site, where members of the 1st Battalion, 73d Field Artillery demonstrate the weapon's capabilities (center and bottom).

ammunition will quickly consume the helicopter's lift capacity, sustainment operations can rapidly require an inordinate number of helicopters. Although this appears to be a critical problem, it is not as serious as one might think. Airmobile operations may account for a vanishingly small number of combat contingencies because of increasingly lethal enemy air defenses and difficult sustainment operations. Also, air mobility limitations of the M198

become less critical considering that the M198 has a range of 22.5 kilometers and a rocket assisted range of 30 kilometers. This additional range, coupled with well thought-out positioning, can provide continuous artillery support without taxing critically short aviation assets.

The M813 5-ton prime mover is a reliable vehicle which provides adequate mobility most of the time but, like most wheeled vehicles, it can bog down in soft soils (e.g., mud, sand, etc.). The M813 truck's rated cross-country towing capacity is listed as 15,000 pounds, although the M198 weighs approximately 15,800 pounds. Consequently, when it is fully loaded and is connected to the howitzer, the M813 is taxed to its limits as a prime mover.

Recently, the 1-73d FA Battalion, 18th FA Brigade (Airborne), deployed an M198 section to Saudi Arabia to demonstrate the capabilities of the weapon. One of the issues addressed during this demonstration was the ability of the howitzer and its prime mover to negotiate sandy terrain and steep slopes. The prime mover towed the howitzer successfully, proving cross-country mobility in bad soil conditions; but, as with operations, results are enhanced by prior planning, advance party input, and individual training.

Firing

One of the most publicized problems of the M198 is the blast overpressure associated with the maximum charge (M203), but the Surgeon General has determined that it is safe to fire the weapon. Until recently, double hearing protection and a 25-foot lanyard were required to fire the weapon using the M203, zone 8 super charge. The Medical Research and Development Command at Fort Detrick, MD, conducted a human volunteer walk-up study to determine the effects of blast overpressure on cannoneers. The results of the study allowed the Surgeon General to issue the following guidance:

> "Properly worn foam earplugs (Plug, Ear, Hearing Protection, Universal Size, Yellow/White, 400S, NSN 6515-00-137-6345) provides adequate protection for crews of the M198, 155-mm, towed howitzer at all quadrant elevations and all existing propellant charges, including M203, for all normal crew operating positions when not exceeding 12 rounds per 24-hour period. If conditions dictate firing more than 12 rounds per day with the M203 propellant charge, the crew should use the 25-foot lanyard in addition to the foam earplugs. Please note — the use of the DH178 helmet as double ear protection is not required."

Reliability

The M198 is proving itself to be a reliable, accurate weapon system with innovations which have improved its operational characteristics. The howitzer's M199 cannon features a thermal warning device which takes the guesswork out of determining hot tube status as well as affecting maximum rates of fire. During the Saudi Arabia demonstration in August 1981, the M198 fired 10-round missions in less than two minutes. In spite of the high ambient temperatures during firing days (as high as 118°F), the cannon never became excessively hot.

Another major feature is that the M199 cannon does not "fatigue out" as do other cannons in our inventory — it wears out. Its tube life is based on measured wear factors as opposed to estimated fatigue factors. Its tube life of 1,750 rounds appears deceptively low when compared with other systems; however, the 1,750 is based on the M203 maximum charge. When other charges are fired, tube wear decreases and in turn tube life increases. For example, the tube life increases to 5,250 rounds when firing M119 zone 8, to 17,500 rounds for M4A1 (white bag), and to an incredible 35,000 rounds when firing only M3A1 charge 5 (green bag).

Finally, the firing platform is very stable. Reports from the field indicate that M198 crews have engaged targets in excess of 30 kilometers, had a first-round miss distance of less than 100 meters, and round-to-round dispersion smaller than the range probable errors published in the tabular firing tables.

Currently, the M198 has been issued to: 1-73d FA Battalion of the 18th FA Brigade, Fort Bragg; 2-17th FA Battalion and 1-38th FA Battalion, direct support battalions of the infantry brigades of the 2d Infantry Division, Korea; and 2-31st FA Battalion at Fort Campbell. Plans for future issue to the Active Components include the remainder of the 18th FA Brigade, Fort Bragg; the 9th Infantry Division Artillery, Fort Lewis; and both the 7th and 25th Infantry Division Artillerys (including their Reserve Component roundout battalions). Subsequent issues of the M198 will reequip 105-mm direct support battalions of the Reserve Components. Simultaneously, the US Marine Corps has also adopted the M198 howitzer with initial receipt in February this year.

Operationally, the M198 is maturing through gained experience, and we find that the advantages of technological and operational improvements offset the disadvantages associated with the M198 howitzer's size. Since mobility is recognized as the most serious problem of the M198, various US Army material developmental agencies are actively exploring methods of improving mobility. These fixes combined with the traditional "can-do" attitude of the Field Artillery will insure close, continuous, effective artillery support to all maneuver units supported by units equipped with this howitzer.

MAJ Walter B. Brown II is the assistant TRADOC Systems Manager for cannon at Fort Sill.

Right by Piece

NOTES FROM UNITS

Artillery training with PEGASUS

BAUMHOLDER, WEST GERMANY—"Hey, FIST, get me artillery fire on those BMPs!" "Roger, sir, it will be there on the next game turn." These types of interchanges were heard frequently during the 8th Infantry Division's Compass Point command post exercises (CPXs) in January and February this year.

The PEGASUS Battle Simulation was used to drive the CPXs in lieu of a master incident list. Two of the division's brigades and their corresponding "slices" participated during each iteration of the CPX. The gameboard was located inside a helicopter hanger while the tactical operations centers (TOCs) were tactically deployed in the surrounding area. The purpose of the exercise was to train and evaluate the battalion and brigade TOCs, to include their artillery support. The main goal of the players on the gameboard was to portray a realistic scenario to the maneuver and artillery TOCs.

These exercises provided some very worthwhile training to the division's command elements. However, the PEGASUS Battle Simulation was not designed to be conducted on a division (—) level nor was the artillery intended to be played with the same degree of refinement as the maneuver forces. Consequently, the 8th Infantry Division Artillery had to develop a system to incorporate realistic artillery training into the PEGASUS framework. This system was designed to closely resemble the actual communication channels used by the artillery to provide the maneuver forces with fire support. Incorporated into the game play were procedures for requesting and receiving both observed and unobserved fires, processing counterfire missions, and exercising fire support coordination. In addition, an opposing force (OPFOR) artillery cell was organized to realistically control the enemy's cannons and rockets.

The fire support system was exercised extensively. Fire support teams and fire support officers (FSOs) integrated the use of the 81-mm and 4.2-inch mortars into the tactical situation. Scheduled fires were planned and initiated in support of the maneuver forces while fire support coordination measures were established and firing across boundaries was coordinated as required.

The counterfire system also played an important role during the exercises. Counterfire controllers passed active OPFOR locations to the target acquisition battery's processing section (C-333 FA) which determined whether the radars were cued at the time of firing and, if they were cued, whether the enemy's rounds would have passed through the sectors of scan. Acquired OPFOR artillery units were passed to the division artillery operations section which made target engagement decisions. Since artillery assets were limited and sometimes there were more targets acquired than could be engaged, some realistic decisions concerning the allocation of field artillery had to be made. A model was also designed to make friendly artillery units subject to enemy counterfire.

The command post exercises presented an excellent opportunity for the division artillery to further its proficiency with TACFIRE. Since the CPX environment offered the luxury of good communications, the trainers were able to focus on other training goals which may not have been possible in a field environment. The major training objectives of the division artillery were accomplished by developing procedures and supplemental rules to the PEGASUS Battle Simulation. The basic concept for this system will be forwarded to Fort Sill for evaluation. It is hoped that this model will help expand the PEGASUS rules to include the entire artillery system. Units interested in receiving information on artillery additions to the PEGASUS Battle Simulation should write to: Commander, 8th Infantry Division Artillery, ATTN: FSE, APO New York 09034.

Lance goes urban

GERMANY—In March this year A Battery, 1st Battalion, 32d Field Artillery, conducted a unique field training exercise using local villages rather than normal training areas for dispersal locations.

The battery was spread throughout three villages where soldiers were housed and fed in local gasthauses. This operational concept, used each year by the German Army during REFORGER, proved particularly effective for the Lance unit.

Because of the distinctive signature of the Lance, a town is more feasible for dispersion of this type unit.

French partnership training

GERMANY—As the sun began to rise above the craggy peaks, the firing battery's executive officer gave the command "*Tirez*" for the base piece to fire. The pull of the 155-mm self-propelled howitzer's lanyard dispatched the projectile downrange, beginning another day of live-fire exercises for the French 11th Artillery Regiment at the French major training area (MTA) in Canjuers, France.

The 2d Battalion, 33d Field Artillery, recently sent a delegation to observe its French partnership unit in the field at Canjuers MTA, located approximately 120 kilometers northeast of Marseille.

The Americans first visited the French Artillery School "*l'Ecole d'Application de L'Artillerie*" in Draguignan where they were briefed on the mission of the School and then guided on a tour of its modern facilities. The tour also included accompanying the 11th Regiment to the field for a day of fire and maneuver. All stages of battery operations were observed, to include initial reconnaissance and occupation, calls for fire, execution of fire missions, and deployment to other battery positions.

Although French equipment presently in the field is, for the most part, not as advanced as its American counterpart, the French field artillery system itself is practically parallel to the American system. Such a similarity presents many possibilities for interoperability of French and American units in the event of war in terms of fire support for maneuver elements. A minimum of training, primarily in language, would allow a French artilleryman to work in an American artillery unit, and his American counterpart to operate effectively in a French battery. Mutual ammunition resupply would not be a major problem in that French howitzers utilize American projectiles and propellants.

The visit by the 2d Battalion, 33d Field Artillery, with the 11th Regiment at Canjuers revealed that French-American interbattery operations—should the need arise—could be conducted in time of war without major difficulty.

"Cope Strike"

CAMP CASEY, KOREA—Soldiers of the 2d Infantry Division Artillery recently participated in a ROK-US Combined Live Fire Field Training Exercise called "Cope Strike" on Nightmare Range in Pochon County.

The purpose of this exercise was to demonstrate the 2d Div Arty's ability to simultaneously engage targets with surface-to-surface and surface-to-air fire. In addition to howitzers, Cobras, OV-10 "Broncos," and F16s were successful in their assigned missions during the demonstration.

The scenario called for enemy forces to attack the defensive position of the 1st Battalion, 35th ROK Regiment, while the 2d Div Arty was tasked to use several weapons against the aggressors. Using

Camouflaged howitzers were used to disorient the enemy until air fire support could be coordinated.

155-mm and 8-inch high explosive and white phosphorous munitions, Div Arty's mission was to confuse and disorient the enemy until air fire support could be coordinated. This they did with a high degree of accuracy, landing their rounds on target.

AH-1S Cobras then arrived and attacked both from the front and the flank of the enemy with 20-mm rounds from turret cannons and 2.75-inch rockets from their wing stations. OV-10 "Broncos" then joined in the assault to defeat the enemy, using 2.75-inch rockets.

Division artillery units that participated in the exercise included 1st Battalion, 15th Field Artillery; 2d Battalion, 17th Field Artillery; 1st Battalion, 38th Field Artillery; 6th Battalion, 37th Field Artillery; and 2d Battalion, 61st Air Defense Artillery. The US Air Force aircraft were from the 314th Air Division at Osan Air Base.

"Cope Strike" exercises are a regular feature of training in the ROK-US Combined Field Army. (Story and photos by SP5 Timothy Boivin)

An AH-1S Cobra zeroes in on the target.

Modernizing the M114 Howitzer

Even in NATO not many armies have, or can afford, sufficient numbers of modern artillery weapons to successfully counter the massive preparatory bombardments planned and exercised by the ground forces of the Soviet Union, its Warsaw Pact allies, and its clients. The few armies which do have respectable numbers of tubes for their strategic situations are often at a severe tactical disadvantage in range versus the Soviet-made weapons facing them. In most of these cases, the bulk of their artillery inventories are made up of aging ordnance which, even when still serviceable, cannot fire the modern ammunition which could provide them with the extended range, accuracy, and lethality necessary to outgun, or at least match, the opposition on today's battlefields.

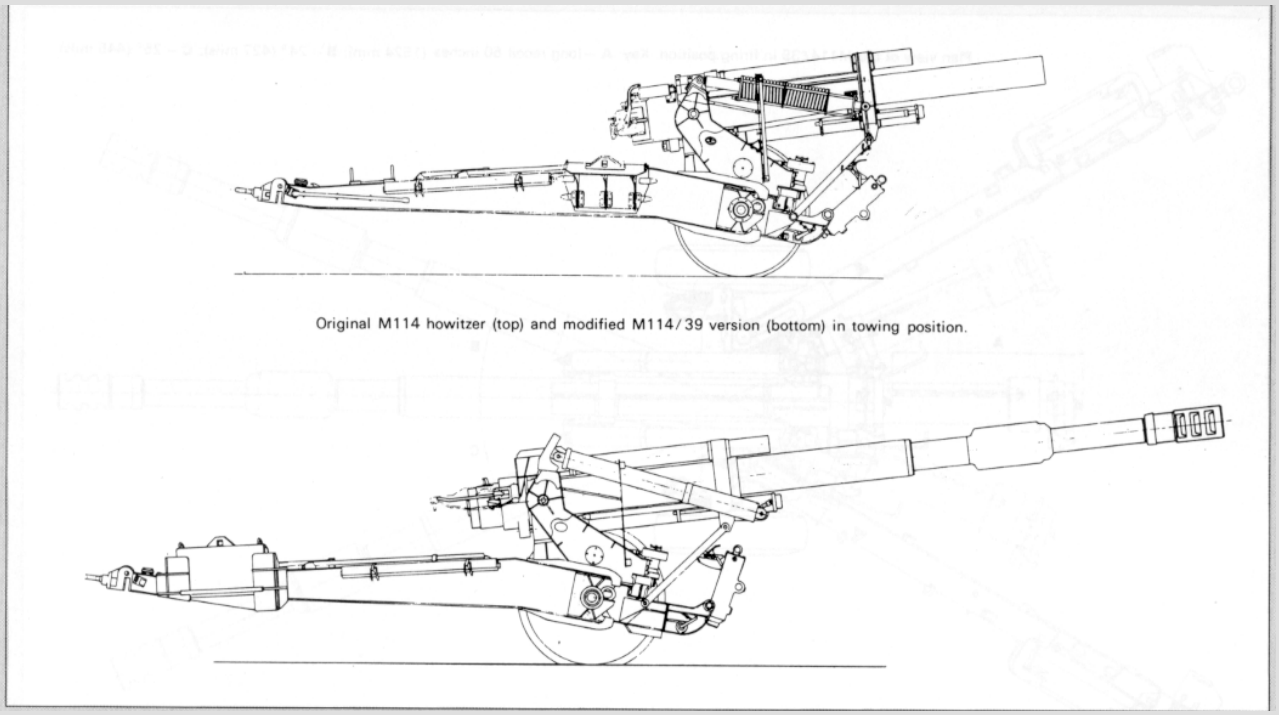
Faced with this situation, many western armies are product-improving their existing artillery weapons as an "interim" measure, while they hope for increased budgets, more affordable new developments, or both. This approach is being adopted particularly in those armies equipped with self-propelled artillery, with the 155-mm M109 having its service life extended in several countries, pending introduction in the late 1980s and 1990s of successors (e.g., the much-delayed SP version of the Anglo-German-Italian FH70 and the American ESPAWS).

A number of new artillery rocket and towed 155-mm weapons have made their debuts in recent years. These include the FH70, the Swedish FH77, the US M198 and MLRS, the French 155 TR, and the Israeli/Finnish (Soltam/Tampella) howitzers, to name a few. The quantities in which they are being produced so far are not large, however, and are still insufficient to effectively counter the artillery firepower of the Soviet Union and its clients. For the moment, the budgetary priorities of most defense ministries are elsewhere and Artillery remains the "poor relation" of other army branches such as Armor, not to mention other services.

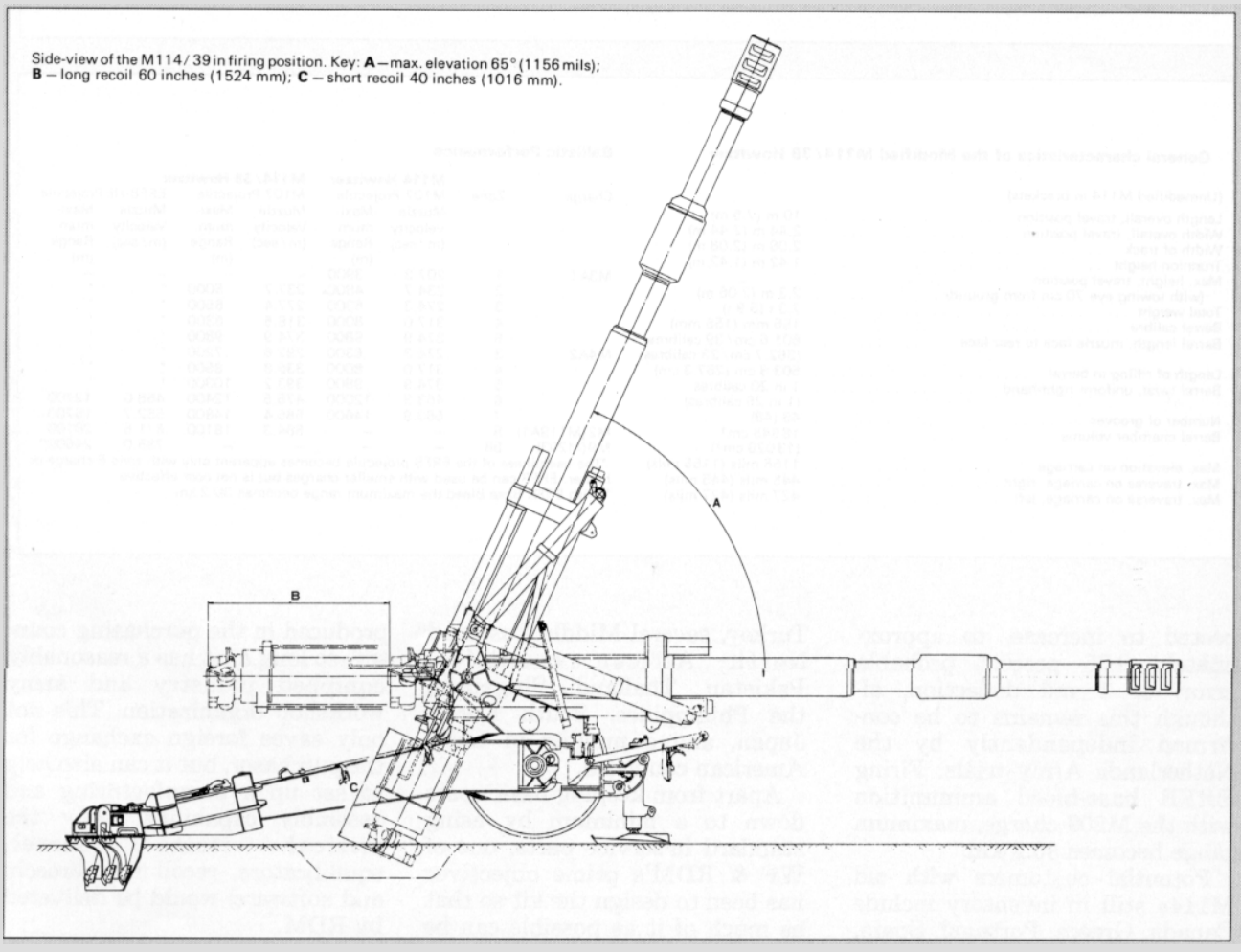
Given current budgetary limitations, how can this problem be solved in the short term? The answer appears so obvious that it is surprising it has not been provided before: modernize the large numbers of old-generation towed 155-mm howitzers which have survived — despite their years — in dusty store houses, reserve units, and even as operational frontline weapons in some less affluent armies, all over the world.

Almost certainly the most numerous of these weapons is the venerable American M114, first deployed just after World War II. By one recent estimate, there are some 10,000 M114s still in existence, about 6,000 of them being in a condition to merit modernization at limited cost.

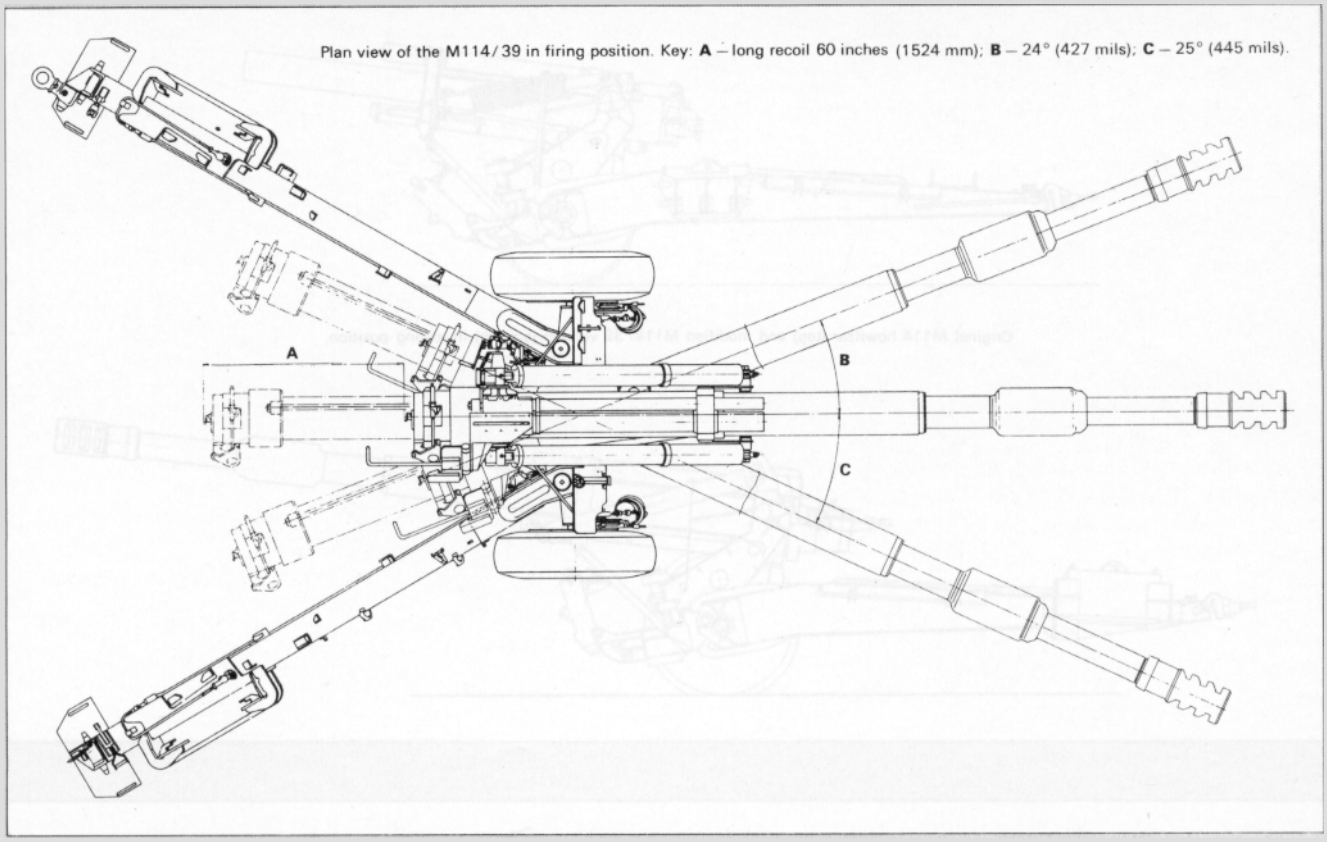
An M114 modernization kit is on the point of completing development as we go to press. Developed by the WF&RDM Engineering Works of the Dutch RSV Group, with inputs from North America, an M114 modernized with the kit is undergoing final firing trials with the Royal Netherlands Army this month (September). The kit renders the M114 ballistically interoperable with all the latest 155-mm weapons; allows firing of new-generation ammunition types (including M483-series Improved Conventional Munitions, extended-range base-bleed and laser-homing Copperhead); and should give it a barrel life at least as long as that of a new M109A2 SP howitzer, or approximately 2,000 M203 effective full charges (EFCs) fired under NATO standard conditions. Firing new Extended Range Full-Bore (ERFB) ammunition currently being manufactured by Belgian firm PRB, accuracy is confidently expected



Original M114 howitzer (top) and modified M114/39 version (bottom) in towing position.



Side-view of the M114/39 in firing position. Key: **A** – max. elevation 65° (1156 mils); **B** – long recoil 60 inches (1524 mm); **C** – short recoil 40 inches (1016 mm).



Plan view of the M114/39 in firing position. Key: **A** – long recoil 60 inches (1524 mm); **B** – 24° (427 mils); **C** – 25° (445 mils).

General characteristics of the Modified M114/39 Howitzer

(Unmodified M114 in brackets)

Length overall, travel position	10 m (7.5 m)
Width overall, travel position	2.44 m (2.44 m)
Width of track	2.08 m (2.08 m)
Trunnion height	1.42 m (1.42 m)
Max. height, travel position (with towing eye 70 cm from ground)	2.3 m (2.06 m)
Total weight	7.3 t (5.9 t)
Barrel calibre	155 mm (155 mm)
Barrel length, muzzle face to rear face	601.6 cm/39 calibres (362.7 cm/23 calibres)
Length of rifling in barrel	503.5 cm (287.3 cm)
Barrel twist, uniform right-hand	1 in 20 calibres (1 in 25 calibres)
Number of grooves	48 (48)
Barrel chamber volume	18845 cm^3 (13028 cm^3)
Max. elevation on carriage	1156 mils (1156 mils)
Max. traverse on carriage, right	445 mils (445 mils)
Max. traverse on carriage, left	427 mils (427 mils)

Ballistic Performance

		M114 Howitzer		**M114/39 Howitzer**			
Charge	Zone	M107 Projectile		M107 Projectile		ERFB-HE Projectile'	
		Muzzle Velocity (m/sec)	Maxi-mum Range (m)	Muzzle Velocity (m/sec)	Maxi-mum Range (m)	Muzzle Velocity (m/sec)	Maximum Range (m)
M3A1	1	207.3	3900	–	–	–	–
	2	234.7	4800	237.7	5000	*	*
	3	274.3	6300	277.4	6500	*	*
	4	317.0	8000	318.5	8300	*	*
	5	374.9	9800	374.9	9800	*	*
M4A2	3	274.3	6300	292.6	7200	*	*
	4	317.0	8000	336.8	8500	*	*
	5	374.9	9800	393.2	10300	*	*
	6	463.3	12000	475.5	12400	465.0	12700
	7	563.9	14600	565.4	14800	552.7	15700
M2(M119A1)	8	–	–	684.3	18100	671.5	20100
M9(M203)	8B	–	–	–	–	785.0	24600**

*The usefulness of the ERFB projectile becomes apparent only with zone 6 charge or higher. ERFB can be used with smaller charges but is not cost effective.

**With ERFB Base Bleed the maximum range becomes 30.2 km.

to increase, to approximately 0.35 percent probable error, or 1 mil deflection, although this remains to be confirmed independently by the Netherlands Army trials. Firing ERFB base-bleed ammunition with the M203 charge, maximum range becomes 30.2 km.

Potential customers with old M114s still in inventory include Canada, Greece, Portugal, Spain, Turkey, several Middle East and North African countries, Pakistan, Thailand, Singapore, the Phillippines, South Korea, Japan, and a number of Latin American countries.

Apart from keeping basic costs down to a minimum by using standard in-service parts, one of WF & RDM's prime objectives has been to design the kit so that as much of it as possible can be produced in the purchasing country, so long as it has a reasonably equipped industry and army workshop organization. This not only saves foreign exchange for the purchaser, but it can also help to set up a manufacturing and assembly capability. Only the critical items (barrel, equilibrators, recoil rod, breech, and software) would be delivered by RDM.

One example of a country interested in such an arrangement is Greece, where the 100 percent Government-owned Hellenic Arms Industry would like to set up production facilities. (Interestingly, the Greek Army is likely to become the first European customer for the 155-mm laser homing Copperhead, which could be fired from the modernized M114).

M114 modifications

The modifications to the M114, in order to provide the improved performance outlined above, are accomplished by using a maximum of existing parts and fitting new components only where necessary. The first step involves a magnetic particle inspection of the complete carriage, with particular emphasis on those areas subjected to high stresses, in order to ascertain whether or not that particular weapon is worth modifying. Assuming the carriage passes this inspection, the major change to the old M114 is the replacement of the complete cannon assembly. The increased size and weight of the new cannon assembly, which is similar to that of the M109A2 SP howitzer, require corresponding changes to the position of the spades on the trails, new equilibrators, a new hydraulic fluid metering rod in the recoil system, and modification of the gear trains in the elevating and traversing mechanisms.

•**Cannon assembly.** The new 39-calibre barrel has a continuous rifling of one twist in 20 calibres, with 48 lands and grooves. It provides for a shot travel of 200 inches (506 cm) with a chamber volume of 18845 cm^3. It is autofrettaged to provide maximum structural capacity and fatigue life. A screw block breech mechanism, with conventional-type obturator pad and split-ring seal obturator, is fitted. A high-efficiency, three-port muzzle brake is threaded to the tube in order to reduce the recoil loads on the basic gun structure. A bore evacuator is fitted as standard, to help eliminate noxious fumes from the crew area. In order to mate the new 39 calibre tube to the existing cradle, a barrel sleeve and new breech band assembly are necessary.

As an option, an existing breech auto-opening mechanism can be fitted. This consists of a bolt-on cam plate, which actuates the breech opening mechanism as the cannon moves into battery. For the future, the design of a fully automated loading and ramming system is being finalized.

•**Recoil mechanism and equilibrators.** Modification of the existing recoil mechanism is necessary due to the increase in muzzle momentum resulting from the use of a 39-calibre tube and new ammunition. The increased muzzle momentum is absorbed partly by the muzzle brake and partly by the recoil assembly.

The original hydraulic liquid metering rod, within the recoil cylinder assembly, is replaced by one which is optimized with respect to the increased muzzle momentum, heavier cannon assembly, and prescribed recoil distances. At low elevations, recoil distance is a maximum 60 inches (152.4 cm). For higher elevations (maximum 1156 mils, or 65 °), the automatic short recoil mode limits recoil distance to 40 inches (101.6 cm). This variable recoil, automatic device turns the metering rod at high elevations to provide an appropriate hydraulic fluid flow in the recoil cylinder assembly.

In addition, the original seals are replaced with modern components in order to seal off the larger fluid pressure generated during recoil. The net result is a trunnion force that is sufficiently low to allow weapon firing under all conditions without adversely affecting its structure. Projectiles can thus be fired at full charge, for example, with the ordnance at its maximum traverse angle. Maximum recoil force at maximum elevation is 80,000 pounds (36,287 kg) in operational conditions.

The original coil equilibrators were unable to compensate for the increased moment, due mainly to the heavier cannon assembly. They are therefore replaced by higher capacity pneumatic equilibrators. These required new top attachment points which are provided on a new front yoke (also required in order to provide the necessary forward support of the new cannon assembly). The original equilibrator bracket was replaced with a new one to allow compensation for temperature changes which affect the pneumatic equilibrators.

•**Other changes.** To cope with the increased weight of the elevating mass, the gear trains in the elevating and traversing mechanisms have been slightly modified to improve their mechanical efficiency. As a result, hand-wheel loads are kept within acceptable limits.

In order to compensate for the shift in the center of gravity of the weapon (due to the longer, heavier barrel), the jack and float assembly has been moved forward. This has been done by fitting a spacer between the jack and the bottom carriage on which it is mounted. The newly positioned jack is claimed to give stability to the weapon in all firing conditions.

Another modification to compensate for the shift in the center of gravity is to the trails, on which the travelling position of the spades has been moved to the rear. This allows the crew to easily maneuver the weapon when it is standing on its wheels.

All other original components, including sight and sight mount, are retained in order to simplify training and logistic support, as well as keeping modification costs down. Industry sources have told IDR that the average cost of modifying an M114 howitzer to the M114/39 configuration described above will be "roughly half the cost of a new American M198 howitzer."

*(Reprinted with permission from **International Defense Review,** Volume 14, No. 9/1981.)*

FA Test and Development

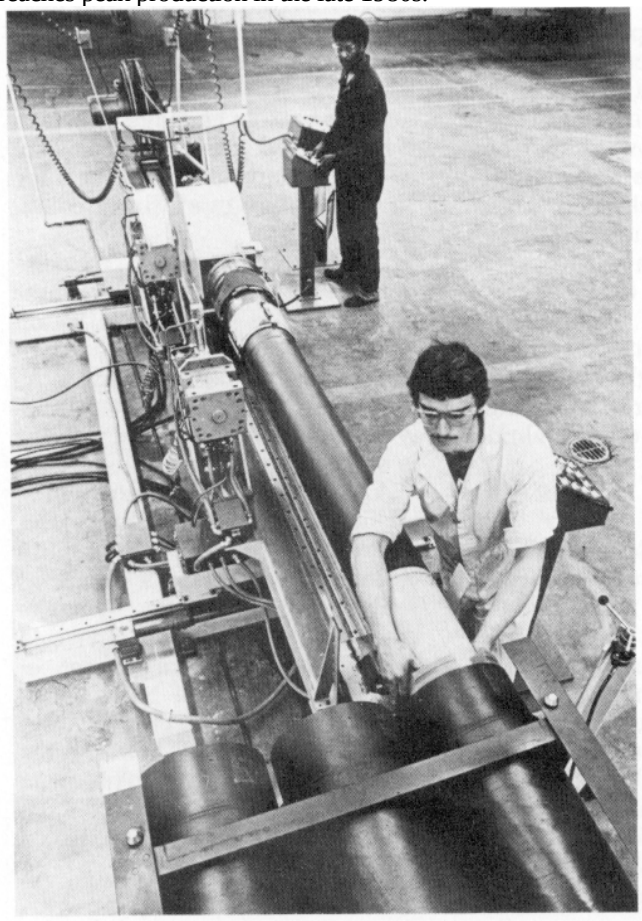
DESIGN • DEVELOPMENT • TESTING • EVALUATION

MLRS rockets delivered

Vought Corporation, aerospace/defense subsidiary of the LTV Corporation, recently delivered the first of approximately 400,000 rockets the Army expects to buy as part of the $4 billion Multiple Launch Rocket System program.

The rockets, each measuring approximately 13 feet in length and nine inches in diameter and weighing more than 600 pounds, are packed in sealed launch pod containers of six rounds each. They are designed to be fired from the MLRS launch vehicle at ranges exceeding 18 miles (30 kilometers) and will be used by the US Army, and ultimately NATO allies, for defense against a massed enemy ground attack.

The rockets are produced at the Vought MLRS manufacturing facility in East Camden, AR. With an automatic conveyor system for parts transfer and automated operations conducted largely by remote-control, the plant will turn out one rocket every three and one-half minutes when it reaches peak production in the late 1980s.



Vought Corporation technicians at the Arkansas MLRS plant load rockets into the first Multiple Launch Rocket System launch pod container for delivery to the US Army.

MLRS testing continues

The LTV Corporation recently announced that its aerospace subsidiary, Vought Corporation, had successfully completed the final series of validation flight tests of the AT-2 mine-dispensing warhead, one of three types planned for the Multiple Launch Rocket System. The test-firing consisted of three rockets fired seconds apart at MLRS' maximum range of more than 18 miles. This test together with those conducted in mid-1981 bring the total to 24 AT-2 rockets that have been fired.

The AT-2 mine warhead was developed by the West German government as part of an agreement with the United States to make MLRS a standard NATO weapon. Prime contractor is RTG of Munich, West Germany. Other MLRS partners are France and Great Britain.

Vought, as prime contractor for MLRS, is responsible for integrating the AT-2 into the basic system. The AT-2, which scatters its mines over a wide area when dispensed above the target, gives MLRS the capability to defeat heavily armored tanks. The MLRS system's basic M77 warhead dispenses grenade-like munitions to defeat enemy personnel, indirect-fire weapons, air defense systems, and light materiel.

The initial flight tests of the AT-2 verified its basic design features and demonstrated that MLRS rockets equipped with either the AT-2 or M77 warhead are operationally interchangeable. The final AT-2 series further validated its compatibility.

A third type of MLRS rocket warhead, with terminally guided submunitions, is now in the early stages of development.

FAASV tested

Since January, the US Army Field Artillery Board at Fort Sill has been testing the Field Artillery Ammunition Support Vehicle (FAASV), a new piece of artillery equipment mounted on an M109 self-propelled howitzer chassis.

The operational test of the FAASV ended with a live-fire exercise, culminating the 10-week test to assess the typical artillery soldier's ability to operate the vehicle under simulated wartime conditions while servicing both the M110 (8-inch) and M109 (155-mm) self-propelled howitzers. The FAASV is designed to have mobility equal to that of either self-propelled howitzer and provides ballistic protection for the crew and vehicle.

It can carry 90 complete 155-mm rounds or 48 eight-inch rounds. Ammunition can be transferred from the ground or from supply trucks directly into the ammunition support vehicle using the 1,500 pound capacity crane mounted on the front of the FAASV. The crane, along with a hydraulic stacker

and a conveyor system, allow the crew to handle ammunition efficiently. These features save manual effort and should allow the crew to do its work much faster over a sustained period of time.

In addition to the increased ammunition handling capability, the FAASV offers an auxiliary power unit and a built-in nuclear, chemical and biological (NBC) collective protection system.

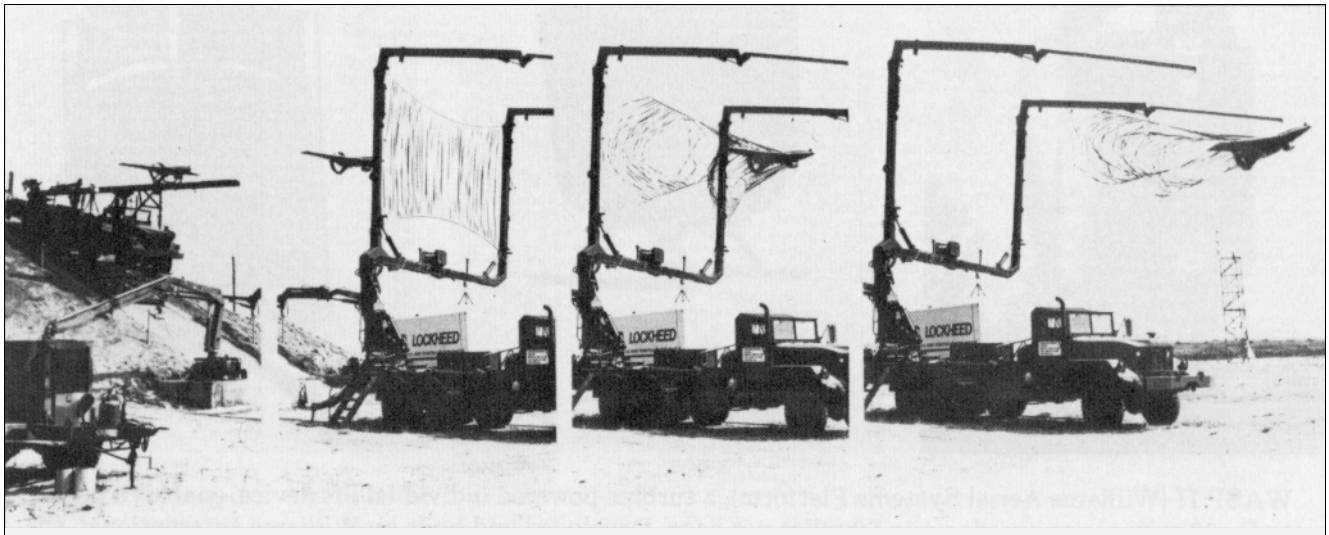
The field test simulated the rigors of war, and the ammunition support vehicle was used to move tons of ammunition from the ammunition transfer point to the howitzer. Both live and dry fire missions were conducted, during which the howitzer crew was required to transfer ammunition to the gun at either the maximum or sustained rate of fire for the weapon.

The Directorate of Combat Developments at the Field Artillery School will analyze and evaluate the field test data. Once analyzed, the data will be used to determine whether the FAASV system meets field artillery requirements.

After the field artillery position on the new system is determined, a position paper will be forwarded to the US Army Training and Doctrine Command (TRADOC) and then to the Department of the Army for the final decision on the vehicle.

Should the Army decide to field the ammunition support vehicle, it will replace the M548 ammunition carrier on a one-to-one basis.

A pair of artillerymen from B Battery, 4th Battalion, 4th Field Artillery, learn the basics of using the 1,500-pound capacity crane of the FAASV to load 8-inch rounds into the ammunition support vehicle before heading to the field for the operational tests.



SNARED IN THE AIR—This sequence shows a test launching of Aquila, the Army's remotely piloted vehicle (RPV) built by Lockheed Missiles and Space Company. At this stage, the RPV is inert (unpowered) although the first powered flights are set for Fort Huachucha, AZ, this year.

•Scene 1: The RPV starts down the launch rail.

•Scene 2: The RPV flies at 72 mph toward the net 30 feet away.

•Scene 3: The RPV is snared and slowed by the dacron net.

•Scene 4: The RPV extends the hydraulically operated cables. After that, the RPV swings in the net just above the ground.

All components—launcher, recovery subsystems (with net), ground control station (command van) and maintenance shelter—are mounted on a standard 5-ton Army truck. Aquila is designed to fly for three hours beyond enemy dispositions, infrared intelligence, and laser-designating targets for artillery fire and guided weapons. Then Aquila returns and, electronically guided, flies into the net. Aquila can be refueled and launched again in one-half hour.

M110A2 8-inch howitzer loader/rammer modifications

As a result of the "Blue Ribbon Panel's" investigation on the projectile fallback problems encountered with the long tube conversion of the M110 to the M110A2 configuration, modifications are being made to the loader/rammer. These modifications are currently being applied to M110A2 8-inch howitzers in Active, National Guard, and Army Reserve units at major unit locations and should be completed within 18 months. Those modifications of particular interest to crew members are:

•**Self-timing rammer** — A timing cam has been applied to the rammer mechanism that automatically retimes it after each cycle. Procedures for rammer timing have been deleted from the manual (Advanced Copy, Change 2, TM 9-2350-304-10).

•**Automatic ramming cycle** — A change has been incorporated in the rammer controls that provides an automatic ramming/retract cycle. Once the rammer handle has been cycled to the RAM position and the headlink enters the gun tube, the ramming cycle becomes automatic. The rammer chain will remain extended until the required ramming pressure has been applied, and then it will automatically retract. (DO NOT cycle the rammer without a projectile in the loading trough.) To allow units to conduct realistic training, an 8-inch dummy projectile is being provided that allows ramming, with unloading being accomplished with either the bell rammer or the H4277 extraction tool. The basis of issue for this dummy round is one per howitzer and must be ordered by the unit as follows:

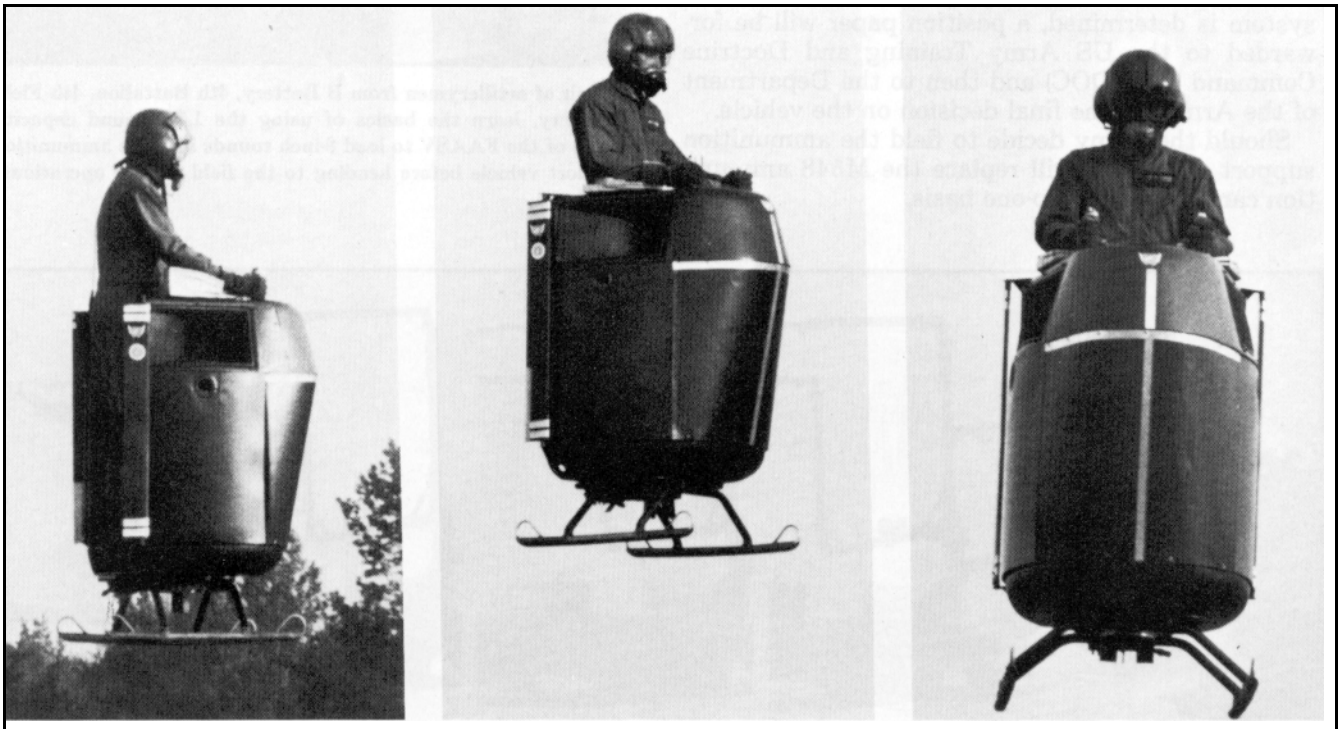
Item: M845 8-inch dummy projectile.

Publication: TB 9-2350-304-10; Operation and Maintenance of Projectile, 8-inch Dummy M845.

NSN: 1320-01-099-8515.

DODAC: 1320-D648.

Authority: Change 2, TM 9-2350-304-10; Howitzer, Heavy, Self-Propelled, 8-inch, M110A2.



WASP II (Williams Aerial Systems Platform), a turbine-powered individual lift device, enables a person to fly 30 minutes at speeds up to 60 miles per hour. Developed and built by Williams International, the lift device was successfully flown by a Williams operator and by three Army infantry soldiers under a contract to the US Army Tank Automotive Command (TACOM) for an individual lift device.

The compact WASP II, which is designed to take off vertically, has no wings or exposed rotors, allowing the operator to fly between and under trees, close to buildings and cliffs, and reach areas that helicopters and other transport devices cannot reach. It can land on a four square foot area. The small turbofan engine, producing a thrust in the 600-pound class, is mounted in front of the operator and is completely enclosed. The operator walks up to the free standing vehicle, steps on a small platform, takes the hand control, starts the engine, and flies. During flight, the operator controls the vehicle by leaning in the desired direction, experiencing a natural sense of balance. The device will accelerate rapidly, move forward, backward, sideways, hover, and rotate on its axis.

The Field Artillery Liaison Officer

by MAJ William S. Armstrong

Since the majority of US Field Artillery units perform a tactical mission other than that of direct support, liaison operations are one of the most critical components of successful support. Yet, in spite of this criticality, current field artillery doctrine is void of information on *what* the liaison officer (LNO) is supposed to do and *how* he is supposed to do it. The information is either passed down by word of mouth or discovered by trial-and-error. It is therefore hoped that this article will have two results:

•First, it will motivate others to write, revealing *their* secrets to good liaison.

•Second, that it will stimulate the creative talents of our current doctrine writers, spurring them into developing some detailed guidance on artillery liaison. (For brevity, this discussion is restricted to liaison duties to another artillery battalion; that is, liaison from a reinforcing (R) battalion to a direct support (DS) battalion. TACFIRE has not been considered.)

Liaison Officer duties

Generally, the LNO is the link between his reinforcing battalion and the reinforced battalion (in this case, a DS unit). He is in the enviable (?) position of serving two bosses: his reinforcing battalion and the reinforced battalion commanders.

•When serving the reinforced (DS) battalion, the LNO's duties are to:

1) *Provide communications.* The liaison section provides the equipment and personnel necessary for the DS unit to communicate with the R unit.

2) *Provide technical information.* The LNO must be an expert on the weapons system of his battalion. He must be able to brief the DS S3 on ranges, available ammunition, traverse limits, march-order and preparation-for-action times, communications capabilities, etc. Additionally, he must keep current information on the ammunition status and number of missions fired by his battalion.

3) *Provide unit capabilities information.* The LNO should be honest with the DS S3 regarding the R unit's capabilities and limitations. If limitations exist because of lack of equipment or training, the DS S3 should know about it and anything else that will impact upon the execution of the support mission.

4) *Provide unit status information.* The LNO keeps the DS S3 and fire direction officer (FDO) informed on missions fired and when units are march ordered, arrive at checkpoints, are ready to fire, etc.

•In serving his own battalion, the LNO's duties are to:

1) *Transmit fire missions.* Normally, the DS FDO will give mission data to the LNO who will then transmit that mission to his battalion.

2) *Transmit movement information.* When the DS S3 wants to move elements of the R battalion, he normally gives that information to the LNO who then transmits it to his battalion.

3) *Collect and transmit other data.* The LNO is the primary collection source for his battalion on enemy and friendly situations, fire coordination measures, anticipated activities, and damage assessment. The LNO must be able to listen to all

that is going on in the DS tactical operations center (TOC) and pass on that which is important.

Liaison personnel

The table of organization and equipment (TOE) provides for three personnel in the liaison section: a lieutenant, an E6 liaison sergeant, and an E4 radiotelephone operator (RTO). (This is the minimum number of personnel required for sustained operations.)

Equipment

The LNO section is equipped with one radio (AN/VRC-46), a secure set, an OE-254 antenna, a remote set, telephones, wire, and a 1/4-ton truck with trailer. In addition to TOE equipment, a number of other items are absolutely essential to good operations; for example:

- •Field table and chair.
- •Overlay paper.
- •Acetate.
- •Map.
- •Pencils and paper.
- •Plenty of spare batteries.
- •Spare gas.
- •Tent.
- •Plenty of OE-254 antenna cable.
- •Communications-Electronics Operation Instructions (CEOI).

Some of the special forms needed to record and maintain the data can be locally produced to facilitate the LNO's job. Figure 1 shows a form used to record all fire missions sent through the LNO to the reinforcing unit. Blocks 1 through 7 are for fire mission data, blocks 8 through 10 are used to record data given to the DS battalion FDO to keep him informed on the status of the mission, block 11 is used to record ammunition expended, and block 12 can be used to provide feedback to the reinforcing unit on the effectiveness of their fires.

The Artillery Data Sheet (figure 2) can be used to record all pertinent information on the reinforcing unit and as such should be covered with acetate to facilitate data update. As can be seen from the form, the LNO can maintain information on current and proposed locations, data on each unit's status during moves, ammunition status, and current targets sent to the battalion.

The LNO must be sure that he has all the necessary equipment to do his job and that it is operational.

Operations

Liaison operations depend on the equipment available and what the DS battalion needs. However, a few general points should be considered by the LNO:

- •Two of the three liaison personnel are needed for section operations. One remains in the DS battalion TOC, one remains with the vehicle and radio, and one camouflages, erects antennas, lays wire, and sleeps when possible.
- •In most cases, the LNO remotes the vehicle radio into the TOC. Using this configuration, the person stationed inside the TOC performs all critical tasks relating to liaison. This method forces the remoting of the secure equipment, leaving a potential problem with security.
- •Another method is to use only a telephone to relay information from the TOC to the radio vehicle. The individual at the vehicle then transmits the data via radio to the reinforcing unit. Advantages of this method are:

1) It makes the DS TOC quieter.

2) It divides the duties in the section more equitably (the man inside the TOC does not have the added burden of monitoring the radio).

3) It solves the security problem created in remoting the secure equipment.

- •The LNO should position himself in the DS TOC where he can easily communicate with and observe the S3 and the FDO.

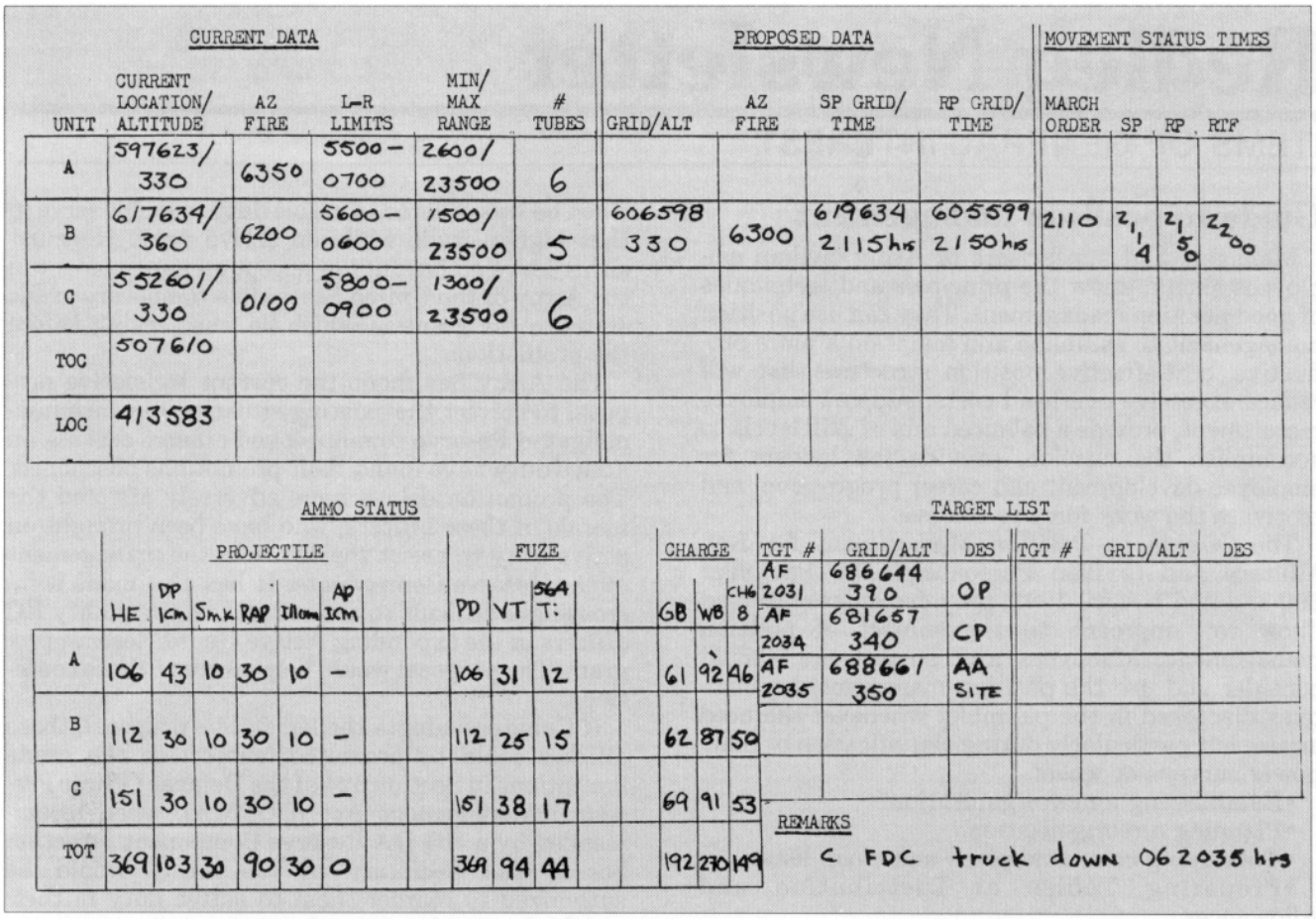
Tips for the LNO

The following is a list of recommendations for the LNO on how to do the best job possible and, just as important, how to get along with the DS unit.

- •Report as early as possible to the DS unit. Call the DS battalion before arrival to verify its location and give your expected arrival time.
- •When you arrive at the DS battalion, quickly find the NCOIC and ask him where you are to park to avoid loss of valuable time repositioning vehicles and antennas.
- •Report immediately to the S3 and give him a completed Artillery Data Sheet (figure 2) with

① DTG	② TYPE MSN	③ UNIT TO FIRE	④ GRID	⑤ DESCRIPTION	⑥ #/TYPE AMMO TO BE FIRED	⑦ METHOD OF CONTROL	⑧ MTO	⑨ TIME FIRED	⑩ RDS COM	⑪ #/TYPE AMMO FIRED	⑫ BDA
061400	FFE	BN	616623	122 HOW BTRY	③ DP ICM	AMC	BN ③	1404	1407	18 DP ICM	2 HOW dos, Btry moving

Figure 1. Fire mission log.



CURRENT DATA

UNIT	CURRENT LOCATION/ ALTITUDE	AZ FIRE	L-R LIMITS	MIN/ MAX RANGE	# TUBES
A	597623/ 330	6350	5500 – 0700	2600/ 23500	6
B	617634/ 360	6200	5600 – 0600	1500/ 23500	5
C	552601/ 330	0100	5800 – 0900	1300/ 23500	6
TOC	507610				
LOC	413583				

PROPOSED DATA

GRID/ALT	AZ FIRE	SP GRID/ TIME	RP GRID/ TIME
606598 330	6300	619634 2115hrs	605599 2150hrs

MOVEMENT STATUS TIMES

MARCH ORDER	SP	RP	RTF
2110	2114	2150	2200

AMMO STATUS

	PROJECTILE HE	DP ICM	Smk	RAP	Illum	AP ICM	FUZE PD	VT	564 T:	CHARGE GB	WB	CH6 8
A	106	43	10	30	10	–	106	31	12	61	92	46
B	112	30	10	30	10	–	112	25	15	62	87	50
C	151	30	10	30	10	–	151	38	17	69	91	53
TOT	369	103	30	90	30	0	369	94	44	192	270	149

TARGET LIST

TGT #	GRID/ALT	DES	TGT #	GRID/ALT	DES
AF 2031	686644 390	OP			
AF 2034	681657 340	CP			
AF 2035	688661 350	AA SITE			

REMARKS

C FDC truck down 062035 hrs

weapon ranges and limitations noted in the remarks section. He will then have 90 percent of his initial questions answered in writing.

•Establish radio contact with your unit immediately so that you will have communications established before meeting with the DS S3.

•Camouflage your vehicle quickly and erect the OE-254 (it will then be ready if you need it).

•Find out what the TOC rules are regarding smoking, eating, drinking, entry control, etc., and follow them.

•Bring a security roster from your battalion with you to verify the security clearances of your personnel.

•Have your liaison sergeant find the NCOIC and discuss with him questions concerning meals, sleeping quarters, uniform, fuel, equipment, repair, etc.

•When in the TOC, attempt to gather the information you need regarding friendly and enemy situations, plans, battle outcomes, etc., by listening rather than asking questions or hanging around the situation map. The DS S3 is busy; try not to bother him any more than necessary. Tell him upon your arrival what information you will need so he can get it for you as soon as possible.

•Keep the DS unit informed on the status of all missions and moves. Use the forms in figures 1 and 2 to remind you of what must be passed on.

•Find out how the DS TOC will move and make arrangements with the S3 regarding support from your unit during this critical period. (Too many DS battalions do not give enough consideration to the LNO when planning a move.)

The liaison section is as important to the divisional 8-inch battalion or the corps artillery battalion as the FIST and FSO sections are to the direct support battalion. Clear guidelines for the liaison section regarding what to do and how to do it need to be developed and practiced.

This article correctly points out that the Field Artillery Community has, for some time, been deficient in properly defining what the liaison officer should do and how he is supposed to do it. There is, however, relief in sight. A rewrite (now in draft) of FM 6-20-1, Field Artillery Cannon Battalion, contains specific information for the LNO. Additionally, the Field Artillery School now provides instruction on "how to" liaison, while Fort Leavenworth's RB 101-999(1) further amplifies the importance of LNO duties.—Ed.

MAJ William S. Armstrong is an advisor to the 1st Battalion, 180th Field Artillery.

Redleg Newsletter

ITEMS OF GENERAL INTEREST

Guide to position management

Managers and supervisors of Army civilian employees should know the principles and techniques of good position management. They can use position management to establish and maintain a more productive, cost-effective position structure that will reduce excessive overhead costs, support employee recruitment, provide a balanced mix of skill levels to accomplish the mission, provide job ladders for employee development and career progression, and motivate the work force to achieve.

The "Guide to Position Management for Key Military and Civilian Personnel," DA Pamphlet 690-8, dated 1 April 1982, provides an easy-to-read "how to" approach to the subject of position management. Managers and supervisors should consider and use the position management techniques discussed in the pamphlet whenever the need arises, but particularly during classification or manpower surveys or when:

- •Establishing a new organization.
- •Planning a reorganization.
- •Developing command plans and troop lists.
- •Preparing Tables of Distribution and Allowances.
- •Developing budget estimates and requirements for permanent positions.
- •Introducing new technology, equipment, and systems.

Supervisors and managers who improve their position and grade structures can be recognized and rewarded for their accomplishments. Performance appraisal regulations (Merit Pay and GPAS) provide for evaluation of supervisors and managers on their position management efforts.

Promotion of Reserve officers on active duty

The Department of the Army has recently proposed legislation which would allow the promotion of certain Reserve commissioned officers while serving on active duty in Active Guard/Reserve (AGR) assignments.

Currently most Reserve officers are considered at mandatory intervals for promotion to the next Reserve grade by HQ DA Reserve Component Selection boards. The approximately 3,000 Reserve officers now serving voluntarily in AGR assignments are considered by these Reserve selection boards.

Under the existing interpretation of the law, a Reserve Component (RC) commissioned Army officer on active duty (other than for training) who is promoted to a Reserve Grade higher than that held when he was ordered to active duty may not serve in that higher grade while on active duty. He must either leave active duty or accept an appointment in the Army of the United States in a temporary grade equal to the grade in which he was serving before the promotion.

The Army has made the current legislative proposal to correct the existing situation in which non-obligated Reserve commissioned officers serving on active duty have found their promotions postponed. The promotion delays have adversely affected the morale of these officers, who have been brought on active duty to assist the Army in the management of the Reserve Components. It has also made it increasingly difficult to attract and retain quality RC officers in the expanding Active Guard/Reserve program. The proposal would help alleviate these conditions.

If Congress adopts the legislative proposal, these officers could be promoted, subject to the grade limitations in Section 524 of the Defense Officer Personnel Management Act (DOPMA), when recommended by a HQ DA Reserve Component Selection board. The Secretary of the Army would be authorized to reorder them to active duty in their new higher grade.

Because the DOPMA grade tables limit the number of AGR tour officers on active duty with the Army to not more than 821 majors, 503 lieutenant colonels, and 163 colonels, the promotions would still be constrained by the number of vacancies in each grade. These current grade limits may be increased as the AGR program expands. These strength limits are also separate from the active duty list DOPMA grade tables and thus the legislative proposal would have no impact upon career active duty officers.

Under the proposal, a Reserve officer on active duty selected for promotion would thus be eligible to be reordered to active duty in the higher grade provided that there was a vacancy in that grade available under the DOPMA grade table limit for AGR officers. If no vacancy exists, the officer would continue to serve in the lower grade until a vacancy occurred or until he completed his tour and was released from active duty. At either of those times, he would be promoted to the higher grade, and his date of rank would be retroactive to the date on which he was eligible to be promoted.

The suggested change is contained in DOD Legislative Proposal 97-44, which contains draft legislation "to amend Title 10, United States Code, to authorize ordering Reserve commissioned officers of the Army on active duty (other than for training) to serve on active duty in a grade to which promoted."

Information about Europe

An informative new series of Training Extension Course (TEC) lessons on "European Orientation," has been produced specifically for soldiers and families assigned to US Army Europe (USAREUR).

Fielded earlier this year, the first lesson explains housing and travel while the second concerns shipping household goods and luggage. Other titles include "Your POV in Europe," "Medical and Dental Care and Facilities," "PX, Commissary, Banking, ACS, and Other Services," "Personal Affairs," and six other lessons about "Driving in Europe." All are recommended for Active Army personnel and National Guard and Reserve units with roundout missions in Europe.

These TEC tapes are identified by consecutive numbers from 920-791-0001-F through 920-791-0012-F. Viewing time ranges from 15 minutes to 45 minutes per tape. It takes about 7½ hours to complete all 12 lessons. TEC tapes are available at learning centers and libraries equipped with Beseler Cue/See sound film projectors for use by individuals or small groups.

TEC account holders who have not received these lessons should contact:

Commander
US Army Training Support Center
ATTN: ATIC-AET-TP
Fort Eustis, VA 23604
AUTOVON: 927-2141/3728
Commercial: (804)/878-2141/3728

The numbers and titles of TEC tapes are as follows:

920-791-0001-F: Housing and Concurrent Travel

—Types of housing
—Money required to live on German economy
—Differences between concurrent, deferred, and disapproved concurrent travel
—Housing assistance

920-791-0002-F: Shipping household Goods and Unaccompanied Baggage

—Household goods allowance
—Unaccompanied baggage allowance and related items

920-791-0003-F: Your POV in Europe

—Amount and type of insurance coverage needed in Germany
—Mechanical and safety requirements that must be met in Germany
—How to get a USAREUR driver's license

920-791-0004-F: Medical and Dental Care and Facilities

—Types of medical and dental care found in USAREUR
—Steps required to get special medical and dental care
—Special care for children

920-791-0005-F: PX, Commissary, Banking, ACS and Other Services

—Services provided by banks and credit unions in USAREUR
—How the Army Community Service Center can help
—Types of services in USAREUR military community

920-791-0006-F: Personal Affairs

—Critical personal affairs to settle before going to USAREUR and where to get help
—Types of schools in USAREUR
—Procedures for dependent employment in USAREUR

920-791-0007-F: Driving Tips for the Driver

—Major causes of traffic accidents
—Dangerous driving situations
—Know the miles under different road conditions
—Recognize special privileged vehicles
—Vehicle safety

920-791-0008-F: Driving in USAREUR—Laws and Regulatory Procedures

—Traffic laws and regulations
—Users of the road
—Rules of traffic and fines

920-791-0009-F: Driving in USAREUR—Rules and Regulations

—Signs and signals
—Posted and unposted speed limits
—Regulations for use of the roadway
—Right of way

920-791-0010-F: Driving in USAREUR—License and Registration Procedure

—Registration of your POV in Germany
—Obtaining a USAREUR learner's permit
—Violations that will cause you to lose your license

920-791-0011-F: Driving in USAREUR—International Road Signs —Part 1
920-791-0012-F: —Part 2

—Recognize, understand, and react to international road signs

Changes in separation policy

Effective 1 April 1982, Department of the Army changed its separation policies to expedite the separation of "marginal performers." Commanders now are able to discharge "marginal performers" under the Expeditious Discharge Program (chapter 5, AR 635-200) without the soldier's consent. Unsuitability enables commanders to discharge soldiers with less than six years' service involuntarily and without offering them a board of officers to consider the matter (chapter 13, AR 635-200). These changes implement Department of Defense policies which permit the identification and separation of individuals who have not adapted to military service. Soldiers separated under the revised policies will receive either an Honorable or General Discharge.

This change was implemented by Immediate Action Change 4 to AR 635-200.

Shortage of ASI 5Hs

In recent years the Army has undertaken a major effort to improve its capability to fight and win the AirLand battle. As the underlying doctrine for this concept is refined, attention is focused on ways to incorporate the AirLand battle concept into unit plans and training (see "Implementing the AirLand Battle", *Field Artillery Journal*, September-October 1981).

A key aspect of the emerging concept has been a much needed emphasis on integrating the nuclear, chemical, conventional, and electronic battle, which has caused concerns for commanders and staff at all levels of command. One major concern is a significant shortage of trained nuclear and chemical target analysis — i.e., officers qualified to hold the Additional Skill Identifier (ASI) 5H.

Visits to units in the field reveal worldwide shortages, both in the number of ASI 5H positions that exist and in the number of qualified analysts available to fill them. (Worldwide positions for Field Artillery officers are shown in figure 1.) Additionally, SC13 officers fill many other ASI 5H positions that have other initial Specialty Codes such as 52 (nuclear weapons) or 54 (operations and force development).

	LT	CPT	MAJ	LTC	COL	TOTAL
USAREUR	22	264	96	66	11	459
FORSCOM	2	292	136	66	16	512
KOREA	11	37	16	8	1	73
HAWAII/JAPAN	0	28	8	5	1	42
TRADOC	0	11	19	7	1	38
OTHER*	0	5	4	5	1	15
TOTAL	35	637	279	157	31	1139

***DOD agencies, Army agencies, DA staff, and unified/specified/NATO staffs, for example.*

Figure 1. Authorized positions for SC13/ASI 5H.

If one looks at the number of designated 5H positions and the number of officers holding the ASI 5H, the validity of concerns expressed in the field about shortages are readily apparent. Assignment officers at MILPERCEN try to maintain a ratio of 1.5 to 3.0 qualified officers of a given Specialty Code and/or ASI trained for each position. Within this bracket, they strive for 2.4 officers per position. Overall, the Field Artillery currently has 1.8 trained officers for each 5H slot. The statistics for the Field Artillery and the active Army as a whole are shown in figure 2. Since 66 percent of all 5H slots belong to the Field Artillery, it is not too surprising that the status of the active Army tracks that of the field Artillery.

For grades 04 and above, the personnel system and local commanders have a reasonable chance of getting a qualified individual into a 5H slot. However, the company grade situation is quite another matter; 37 percent of all identified 5H slots

ASI 5H, FIELD ARTILLERY							
	LT	CPT	MAJ	LTC	COL	GEN	TOTAL
Officers (trained)	5	284	833	686	300	3	2111
Positions (identified)	35	637	279	157	31	0	1139
Ratio (off per position)	0.1	0.4	3.0	4.4	10.0	-	1.8
ASI 5H, ACTIVE ARMY							
	LT	CPT	MAJ	LTC	COL	GEN	TOTAL
Officers (trained)	16	496	1645	1772	874	81	4884
Positions (identified)	64	884	443	277	50	5	1723
Ratio (off per position)	0.2	0.6	3.7	6.4	17.5	16.2	2.8

Figure 2. Nuclear and chemical target analyst (ASI 5H).

are for Field Artillery captains (Army-wide, 51.3 percent of the 5H slots are for grade 03). The questions then arise "What is the Army doing about the situation?" and, "What can the individual officer or artillery unit do?" The situation is critical but not hopeless. There are a number of things happening at the higher levels, and while actions are ongoing at places like the Field Artillery School, TRADOC, MILPERCEN, and DA, there are still a number of things individuals and units can do to help themselves.

First, check your TOE/MTOE/TDA. Do you have the correct type and number of positions designated ASI 5H? If not, submit a modification request. In the mid-1970s, at a time when integrated battlefield concepts were largely dying, there was a severe scrub of 5H positions. Some imbalances were created in that environment, and now is the time to reassess.

Second, check with your personnel center to see if they are actually forwarding the ASI 5H requirements to MILPERCEN. Every requisition allows for nine characters to describe the position being filled. Three characters for the Initial Specialty, two for an Additional Specialty, and two characters each for two ASIs; for example, 13E545H5P. However, assignment officers at MILPERCEN see a large number of requisitions where the position to be filled is described as 13E000000. Additionally, when the assignment officer checks his data base for available officers to fill the requisition, the computer presently only checks the first two characters. Efforts are underway at MILPERCEN to correct this and upgrade the system's capability; in fact, testing started 1 March 1982. However, for the time being, to get the assignment officer's attention, indicate in the remarks column or "trailer data" of the requisition that the "Individual must be 5H qualified."

Third, if you're in the gaining unit and have some lead time, contact the assignee directly. If he is going

to be filling a target analyst position, you can work together on planning and coordinating his training. If previously trained, he can start the nonresident refresher, for example. If not, perhaps resident entry schooling could be arranged TDY en route.

Finally, if you're an officer coming up for reassignment and have not had entry or refresher training within three years, especially if you are an 04 or below, enroll in the nonresident Nuclear and Chemical Target Analyst Course (NCTAC) or Nuclear and Chemical Target Analyst Refresher Course. All it takes is a DA Form 145 through your commander/supervisor to: Commander, US Army Training Support Center, ATTN: IPD, Newport News, VA 24628.

A nuclear and chemical fire planning capability is an ARTEP task in all artillery battalions, even if the unit itself is not nuclear capable. Thus, you owe it to yourself and the Army to have target analysis training and to be ready to fill a target analyst position.

While these actions are happening in the field, rest assured that the wheels are turning elsewhere. The Inspector General is making the nuclear and chemical target analyst situation an item of interest during nuclear management evaluations conducted by his office. TRADOC published a Nuclear and Chemical Action Plan in February this year that includes actions to insure that the Army has sufficient nuclear and chemical target analysts to meet its needs. The US Army Nuclear and Chemical Agency is working with MILPERCEN on techniques to better manage the limited supply of ASI 5H officers. One action already initiated is a change to AR 611-101 that will require all SC52 (nuclear weapons) officers to carry ASI 5H. This is of interest to FA officers since they comprise 16.6 percent of the SC52 population. (Prepared by LTC Larry A. Lindsay, Operations Division (MONA-OPS), US Army Nuclear and Chemical Agency, Fort Belvoir, VA 22060, AUTOVON 354-6287).

Commanders Update

COL Roger K. Bean
3d Infantry Division Artillery

COL David J. Lynch
25th Infantry Division Artillery

LTC Floyd V. Churchill
1st Battalion, 6th Field Artillery

LTC Craig H. Mandeville
1st Battalion, 12th Field Artillery

LTC George L. Youngblood
1st Battalion, 17th Field Artillery

LTC Robert H. Scales
2d Battalion, 17th Field Artillery

LTC Leo R. Kennedy
1st Battalion, 20th Field Artillery

LTC Stuart B. Travis
2d Battalion, 20th Field Artillery

LTC Anthony N. Kuykendall
1st Battalion, 29th Field Artillery

LTC Arturo Rodriguez
1st Battalion, 73d Field Artillery

LTC James L. Popp
2d Battalion, 81st Field Artillery

LTC Joseph Defrancisco
1st Battalion, 84th Field Artillery

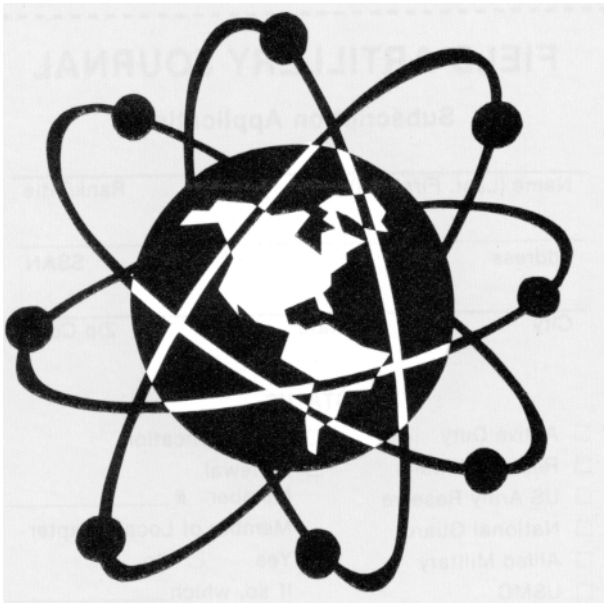
LTC James S. Loftus
3d Battalion, 84th Field Artillery

LTC Beverly W. Motal
1st Battalion, 92d Field Artillery

LTC John E. Bowers
1st Battalion, 94th Field Artillery

LTC Russell Simonetta
1st Battalion, 321st Field Artillery

LTC James C. Buchan
557th Group



Defensive Use Of Tactical Nuclear Weapons

by CPT Joseph R. Cerami

To date most discussions of enhanced radiation (ER) warheads have focused on the deterrent effects of these weapons. Their potential uses for defensive purposes, however, should also be examined. As quoted by Glen H. Snyder in his book *Deterrence and Defense*:

> *Defense means reducing our own prospective costs and risks in the event that deterrence fails. Deterrence works on the enemy's intentions . . . Defense reduces the enemy capabilities to damage or deprive us . . . .*

For the Army of the 1980s to be an effective fighting force, a systematic evaluation of the utility of ER warheads and tactical nuclear warfare is required.

S.T. Cohen, the "father of the neutron bomb," argues that the ER warhead indeed has defensive utility on the battlefield. He writes that, by detonating the weapon at an appropriate height of burst, blast effects can be minimized. In effect, the warhead can function as would the legendary "death ray" weapon. The reduced blast effect makes the warhead very useful in cases where target acquisition is difficult and where Warsaw Pact forces are dispersed. In Cohen's view, these situations would require large-yield weapons and, because it limits collateral damage, the ER warhead becomes an "attractive" choice.

Other policymakers and scientists disagree. Herbert Scoville, former official of the CIA and the Defense Department, and George Kistiakowsky of the Military Institute of Technology and former Eisenhower science adviser, dispute Cohen's arguments as to the increased effectiveness of ER warheads. In their opinions, the weapons would have less utility because some soldiers exposed to smaller doses of radiation "could continue to fight effectively for about half an hour and only die a day or so later." Additionally, Scoville has argued that the reduced blast effects of ER weapons will hinder the ground commander: "Only when the tank is visibly damaged by the blast from an atomic weapon can the commander be confident of having repulsed a tank attack."

Scoville ignores the possibility that, by deploying ER warheads, it may be possible to limit the attacker's ability to use massed tank-infantry formations. The threat of the use of ER weapons could thus affect the enemy's perception of the utility of a penetration, thereby forcing attacking units to disperse. This would in turn give an advantage to the defender and make conventional, antitank weapons more effective on the battlefield.

All parties agree that using ER warheads would minimize collateral damage and that some irradiated soldiers would be able to continue to fight for short periods of time. Nevertheless, it is questionable as to just how effective such soldiers would be after having been subjected to the shock of nuclear bombardment.

The need for increased blast effects to destroy tanks is also questionable. For example, in a European

scenario, with NATO forces in a defensive posture, simply stopping a massed armored advance might provide sufficient evidence that Western forces have the will as well as the capability to counter the Warsaw Pact's primary advantage. Thus, the question of the utility of ER warheads and the possibility for successfully fighting with tactical nuclear weapons deserves further examination.

Despite the potential defensive utility of ER warheads, even proponents of the development of tactical nuclear weapons and those who call for the integration of conventional and nuclear warfare agree that the Army lacks a sound doctrine for utilizing its limited nuclear options. The Army's capstone, "How-to-Fight" operations manual (FM 100-5) devotes a rather brief chapter to the employment of tactical nuclear weapons wherein it describes the procedures for planning a "package" and the timed planning sequence for firing on several targets simultaneously to halt an enemy breakthrough. If the Army truly intends to fight with nuclear weapons, then our doctrine and training must be altered accordingly.

Cohen writes that ER warheads will contribute little, overall, to the problem of redressing the NATO-Warsaw Pact military balance:

> *The basic problem facing NATO in recent years has been a refusal to modernize its strategic doctrine so that it can meet the real Soviet-Pact Threat — a threat that has emerged in a strongly nuclear-oriented form . . . . In contrast to the Soviet-Pact doctrine and strategy, NATO has yet to develop a sound military doctrine for employing its tactical nuclear weapons. Rather, these weapons are regarded essentially as adjuncts in a conventional war, to be used only if conventional defense fails and with the exception that NATO will have first nuclear use.*

After an extensive study of the evolution of US Army nuclear doctrine, John P. Rose comes to similar conclusions:

> *Technology has developed flexible and even discriminate tactical nuclear weapons — better delivery, lower nuclear yields, and weapons (the neutron bomb), suppressed radiation weapons, and induced radiation weapons. These developments, due to their nature and the limitation of collateral effects, promote rational use of nuclear weapons in land combat operations. However, the Army does not have a doctrine that will enable its tacticians to conduct military operations in line with the military effectiveness that tactical nuclear weapons can provide. The Army does not have a tactical nuclear war fighting doctrine in which soldiers are trained, instructed, and mentally and physically prepared to fight, survive, and win on the nuclear battlefield.*

Rose places the blame for the Army's lack of tactical nuclear war fighting doctrine on the fact that doctrinal developments "have been responsive more to political preferences held by national authorities than to the real nature of the threat and the rigors of the nuclear battlefield."

Defense analyst Jeffrey Record blames the Army for the current predicament. Citing the Pentagon's managerial bureaucracy as the culprit, he writes:

> *The reality is that since Vietnam the US Army has sustained little interest in anything other than the acquisition of fancy hardware and preferred end strength. It has devoted virtually no attention to the systematic study of war or to the character and style of warfare of potential adversaries.*

Rose's solution to this problem suggests a new tactical doctrine developed around the enhanced radiation weapon and modern nuclear munitions. Record finds Rose's "rehash of the discredited 'mini-nuc' strategy" as politically unacceptable and militarily inflexible.

Regardless of who deserves the appropriate measure of blame, it appears that the Army is allowing technology to dictate its doctrine. In the development of a war fighting doctrine, one would expect that an evaluation of the perceived threats would be made first; then a doctrine would be proposed to counter those threats. Weapons that have possible use in accomplishing the various missions would then be tested, troops would be trained in their use, and the overall effectiveness of the proposed nuclear-conventional mix would be evaluated. Thus, doctrinal developments, such as the tactical nuclear package, appear to be stopgap measures designed to use nuclear technology without a thorough evaluation of the consequences and overall impact of nuclear warfare on the battlefield.

A far-reaching evaluation of Army doctrine is necessary. If tactical nuclear weapons have a practical application on the battlefield, then an extensive war fighting doctrine is needed. And, given the current state of the world, as long as Warsaw Pact units possess a tactical nuclear capability, Western forces must be trained to survive, fight, and win on a nuclear battlefield. Further, the issues of ER warheads, limited nuclear options, and tactical nuclear warfare require additional study. If defensive employment is feasible, then an improved doctrine for their use must be proposed, debated, and developed, and unit testing under simulated combat conditions would also be required. To wait for the possibility of a failed deterrence strategy would be extremely costly, if not fatal for NATO and the defense of Europe.

CPT Joseph R. Cerami is an assistant professor in the Department of Social Sciences, US Military Academy, West Point, NY.

Doctrinal Option:
The Potential of the Enhanced Radiation Warhead in Europe

by LT Geoffrey C. Davis

The enhanced radiation warhead (ERW) has the potential to render much of the current Soviet military doctrine bankrupt, since it was designed to defeat massed forces quite similar to the typical Soviet offensive formations. In view of the current posture of NATO troops in Western Europe, the neutron bomb could be the keystone to a sweeping revision of defensive concepts.

Although considerable Soviet protests have erupted since President Reagan's declaration in August 1981 to develop the ERW, one might ask why the Warsaw Pact forces have conducted such vigorous protests against a weapon which is clearly designed for use against military targets while reducing collateral damages? The answer lies in the heart of Soviet conventional doctrine. Here the Russians depend on the breakthrough and deep penetration, with considerable emphasis on mass and firepower for the framework of their offensive operations. This precedent was established while fighting the Germans during World War II and has been carried over into their modern doctrine.

During the Russo-German campaigns of World War II, the Wehrmacht learned that one means of repelling the massive Russian assaults was the employment of a highly flexible "mobile defense" which essentially traded space for time so that counterattacking mobile units could thwart our every penetration. The "mobile defense" should not be confused with the "active/dynamic defense" of current US Army doctrine. Before discussing the concepts of the mobile defense, it might be helpful to provide a brief analysis of the active defense. Despite its name, the active defense seems to rely on firepower and attrition, while the German mobile defense was based more on tactical and operational maneuver. In the active defense, the ERW may serve the same basic function as the tube launched, optically tracked, wire guided (TOW) antitank guided missle. The present employment of the TOW is designed to erode a Soviet advance progressively by maximum range engagements. The Russians themselves realize from their experiences in World War II that such weapons in most situations will not be effective at stand-off ranges. Both sides reasonably expect most vehicle combat to take place at engagement ranges between 800 and 1,300 meters. Thus, weapons will have to be maneuvered extensively. The TOW, having a slow rate of fire, bulky ammunition, and being extremely vulnerable to tank fire in those ranges loses much of its effectiveness in that environment.

Moreover, the active defense, through an obvious political implication to defend forward, has violated its own defensive integrity. That is, because forces are positioned forward, they are prevented from obtaining

needed maneuver space to quickly and flexibly concentrate forces for a counterattack. Essentially, the active defense is an interlocking withdrawal by ranks in which the defense is keyed to each position withdrawing in a prescribed pattern. Should a breakthrough occur at some point, then the line would essentially collapse, because no counterattack could be conducted with the speed necessary. The West must also keep in mind the assured presence of Soviet troops in the NATO rear to disrupt movement and block communications.

One German army commander, General Brandenburger, who saw considerable combat against the Soviets, provided some sage advice on the German defense experiences in Russia. He stated,

> "*The defender, when fighting on a normal defensive front . . . must count on the attacker succeeding in his breakthrough attempts at the focus of his main effort. This realization calls for an organization of the defense where the defensive strength will increase in depth instead of decreasing, as is usually the case. Under no circumstances can the defender forego strategic reserves*."

Brandenburger's sentiments appear to suggest that the defense needed against the Soviets is quite the antithesis of the active defense. However, Europe does not have nearly the maneuver space which the Wehrmacht enjoyed during its tactical defense successes in Russia. The defensive network suggests an effort to stop all breakthroughs at all points, neglecting the capability to provide a forceful, decisive counterattack. The only way the active defense can work is if the Warsaw Pact forces do precisely what the NATO forces wish them to do. Unfortunately, such predictions are haphazard at best, and the risk entailed in such a rigid defense may place Western Europe in unnecessary danger if a Warsaw Pact combat offensive becomes imminent.

One other assertion made by the German General Staff was most clearly sounded by von Moltke. He said, "No plan of operations can with any assurance look beyond the first meeting with the main enemy forces." The active defense violates the maxim also. In light of the incredible tactical victories won by the Germans in Russia, even though they were on the strategic defensive, it may prove wise to heed some of their general suggestions. This does not imply using a new "formula" for defense. The German formula was that there were no formulas. Rather, *Truppenfuhrung*, the Wehrmacht's operational manual stated:

> "*There is no way of summing up the lessons of warfare in a comprehensive fashion in manuals. The principles contained in these manuals must be applied in accordance with the actual situation. Simple methods logically carried into effect are the surest way of gaining one's ends . . . . The situations arising in a war are of infinite variety. They undergo frequent and sudden changes which can only seldom be predicted. Incalculable factors often exercise a decisive influence. To one's own will is opposed the independent will of the enemy. Friction and errors are everyday occurrences*."

Does the present active defense take such variables into consideration? In view of current NATO and Warsaw Pact defensive postures, NATO might be well advised to reevaluate current doctrine and consider adopting a mobile defense, integrated with tactical nuclear weapons.

The factors previously discussed call for more flexible defensive doctrine. In the active defense, the ERW would enhance the firepower capability of the forces in various battle positions, but would still ignore the active defense's conceptual problems, as well as the great offensive potential which lies in this "defensive" weapon.

The defensive techniques of the Wehrmacht were inherently offensive. The ultimate end of a defense was to deny the enemy his intent and counterattack decisively. Essentially, the mobile defense allowed for breakthroughs into the defensive sector which were counterattacked by mobile "fire brigade" units. As mentioned earlier, the Germans had considerable space to conduct their defensive operations. However, the neutron bomb could increase the relative space with which to maneuver by providing a concentrated nuclear firepower force in the forward areas. The volume and mass of Soviet battlegroups makes them exceptionally vulnerable to such a warhead; moreover, the Soviets could no longer hope to penetrate in mass at weak points if such weaponry in sufficient quantity is awaiting them. The losses sustained in such an attempted breakthrough would most likely be too high to continue a major offensive.

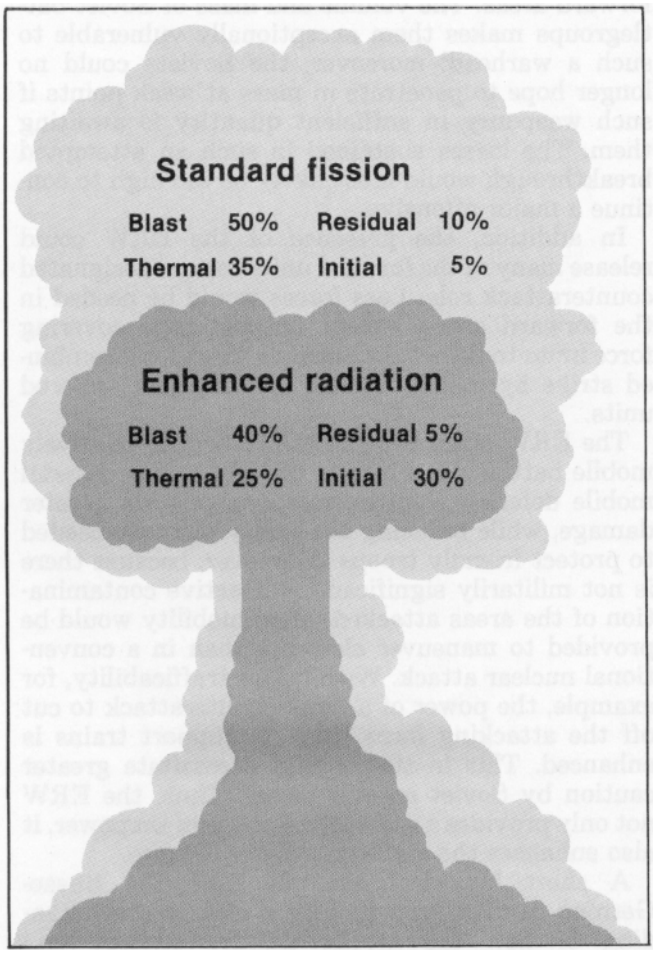
In addition, the presence of the ERW could release many of the forward units to a predesignated counterattack role. Less forces would be needed in the forward areas, except outpost type covering force units to detect the enemy's focus for a combined strike by mobile nuclear artillery and armored units.

The ERW could provide NATO with a relatively mobile battlefield, which is the key to a successful mobile defense. Neutron weapons provide greater damage, while reducing the safety distance needed to protect friendly troops. Moreover, because there is not militarily significant radioactive contamination of the areas attacked, more mobility would be provided to maneuver elements than in a conventional nuclear attack. With better trafficability, for example, the power of a flank counterattack to cut off the attacking force from its support trains is enhanced. This in turn would necessitate greater caution by Soviet assault forces. Thus, the ERW not only provides a more efficient use of firepower, it also enhances the maneuver of the defense.

A short historical example from the Russo-German conflict may provide a clearer understanding of how the mobile defense concept was

employed. The counterattacks by General Hermann Balck's 11th Panzer Division against the 5th Soviet Tank Army near the Chir River illustrated an application of the mobile defense. During the breakthrough of the 5th Tank Army, Balck's corps commander ordered him to conduct counterattacks to disrupt the Soviet assaults. By sliding through a gap into the Soviet rear, Balck was able to decisively defeat the Soviet forces in the sector and preserve the continuity of the XLVIII Panzer Corps defensive sector. The Germans often defeated forces which were vastly superior in numbers of men and materiel. The key to their successful defense was that one force drew the Soviets into a pocket while the "fire brigade" panzers counterattacked the weak point, which in this case was the Soviet flank.

Maneuver is necessary in the mobile defense to wrest the offensive initiative from the enemy and then counterattack. To compensate for the lack of maneuver space in Europe, the ERW would force a greater dispersal of the sizeable formations of Soviet armor, so that frontline NATO tank and tank destroyer units could engage more cautiously organized intitial armor attacks. By forcing the Warsaw Pact forces to disperse from the start, the ERW would allow density of smaller NATO frontline units and, hence, allow greater numbers to be dedicated to the fire brigade role for flexible counterattacks.



Covering force troops would form an operational outpost line which would enable the fire brigade elements to sit well to the rear. In such a scenario, it would be quite possible to keep the counterattack elements dispersed to prevent a target for Soviet weapons. However, the alarm units could detect the Soviet focus in order that the fire brigade forces in that sector might rush to the scene. Also, the ERW could be positioned forward to contain any secondary Soviet assault while the main effort was being detected.

With restored freedom to maneuver, the NATO armored forces might present a serious counterattack force. But, what might the Soviet response to be such an offensive-defensive concept? Basil H. Liddell Hart commented that the Soviet army employed a strategy using an "alternating series of strokes at different parts (of the German Main Line of Resistance), each temporarily suspended when its impetus waned in the face of stiffening resistance, each so aimed as to pave the way for one another." Basically, Liddell Hart meant that the Russians understood the German strength in moving a counterattack reserve to a key point and consequently conducted their attacks in an "alternating series" in order to force the Wehrmacht to hold their reserve *too long* while trying to determine the enemy focus, thus presenting a decisive breakthrough as somewhat of a *fait accompli.* It is not unlikely that the Soviets might try a similar strategy against a mobile defense if it were employed in Western Europe. Yet, the important point is that the ERW could return maneuver to the battlefield and help contain the alternating assaults, despite the relatively inferior numbers of NATO troops which are concentrated in far forward areas.

The most important aspect of the mobile defense concept is training. The German soldiers were especially adept at their individual tasks, leaving the commander in a position to orchestrate his units in combat and not have to be concerned with the most minor technical aspects of mechanized warfare. In the end, the Wehrmacht commanders viewed their mobile defense in terms of a thought process which envisioned tactics as "a feeling in the tips of the fingers." That is, no combat checklist or tactical formula gave them their answer.

Their success was based on the fact that each situation had to be analyzed independently in terms of the force, space, and time available. Simple solutions were their keystone.

The bottom line in modern times is that a mobile defense requires a high degree of training, command initiative and thoughtfulness, and the utmost audacity. Combining the mobile defense concept with an enhanced radiation warhead weapon system could provide improved maneuver capabilities and enhance the stability of NATO's defenses against a potential Soviet attack.

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With Our Comrades in Arms

NEWS OF OTHER BRANCHES AND SERVICES

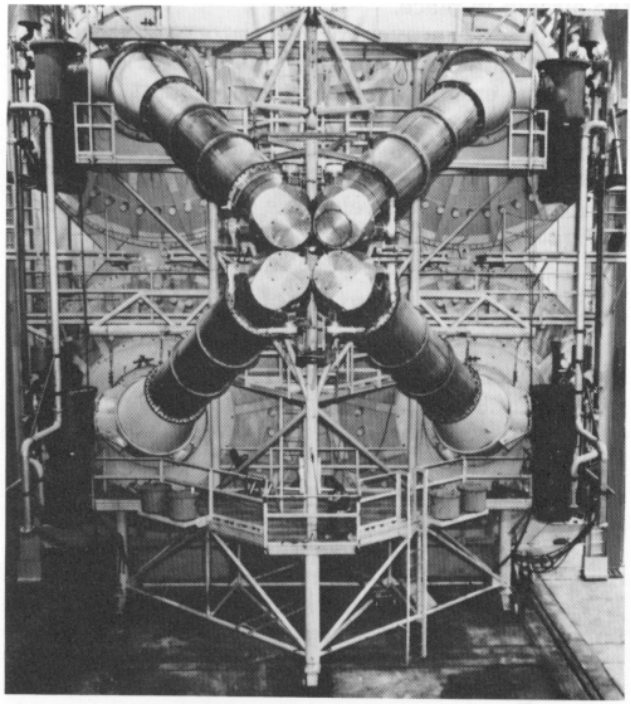
AURORA — mighty flash X-ray

Called AURORA, it is the world's largest known flash X-ray generator. Its barn-size bank of capacitors is insulated in 1.5 million gallons of transformer oil, a third as much as is produced in the US in a year. Fully charged, the bank releases an 18-million-megawatt pulse of electrical power that, for its brief duration, represents more than the entire US power grid produces at any time.

But these "gee whiz" figures, so large they defy comprehension, hardly convey the awesome, surrealistic impact of the flash X-ray machine. Gazing up at the four, giant, mandrel-shaped transmission lines that are the business end of this "gun," one is reminded of the appendages of a colossal, mechanical hand.

AURORA is a nuclear weapons effects simulator, designed to safely simulate certain elements of the nuclear environment. In a nuclear explosion, there is an immediate, high-energy emanation of gamma radiation called a prompt gamma pulse. Similar to X-rays, this pulse affects all electronic devices.

Today's weapons systems are designed to survive these transient radiation effects in electronics (TREE), but they must be tested, as a final step, to determine if the protective measures are effective. Before AURORA was built, there was no simulator large or powerful enough to perform these tests on major systems. Instead, they had to be tested with an actual underground nuclear detonation, an expensive procedure that permits only a one-shot opportunity to acquire all needed test data.



AURORA, in a rare, rolled back view, displays the business end of its hardware. (US Army photo)

AURORA, by contrast, permits repeated test shots. In 10 years, 111 users have logged over 3,750 firings, an average of 33 each, safely and without the latent radioactivity that results from underground testing. Since AURORA became operational, no underground tests dedicated to TREE testing have been required.

The secret of AURORA's tremendous power is its Marx generator, a bank of 1,600 capacitors in 100 stages that slowly builds and stores energy, releasing it simultaneously. Named for its inventor, Erwin Marx, the generator works on the principle of an ordinary photographic flash gun. A relatively small power source charges the capacitor stages separately, in a parallel circuit, to their 120,000-volt capacity. The capacitors are then switched to a series circuit for firing, combining their power to produce 12 million volts.

The Defense Nuclear Agency owns AURORA, but all testing is sponsored by the Department of Defense. Many tests subjects are Army systems, to include missiles, fuzes, satellites, and communications devices. There have been requests to test larger equipment, such as the Abrams tank, but the massive concrete doors that shield the test chamber are not wide enough to admit objects that large.

AURORA marked its tenth year of operation on 1 April this year — that same day it performed its first test on a subsystem of the Army's Spartan antiballistic missile system.

Cold weather diesel fuel

The Fuels and Lubricants Division of the US Army Mobility Equipment Research and Development Command's (MERADCOM) Energy and Water Resources Laboratory at Fort Belvoir, VA, is currently developing new specifications for cold weather diesel fuel.

Diesel fuel contains quantities of paraffinic hydrocarbons which, at low temperatures, forms into wax-like crystals that can plug fuel filters and restrict fuel flow. This makes vehicle starting difficult and causes stalling in cold weather.

The most important factor in cold weather operations is the cloud point of the fuel which is the temperature at which a cloud or haze of wax crystals appears. A vehicle can operate as long as the cloud point of its fuel is at or below the ambient temperature. Diesel fuel is selected based on the tenth percentile minimum temperature, the lowest temperature to occur 90 percent of the time. During a survey of 30 locations in Germany, it was found that the tenth percentile minimum for that area was —10°C and the fifth percentile minimum was

–17°C. The average cloud point of F-54 diesel fuel supplied to the area was –20°C (–17°C to –24°C). This meant that vehicles were at times operating with fuel at its cloud point. To solve this problem, the laboratory recommended blending kerosene-based JP-5 aviation fuel with the diesel fuel to lower its cloud point so that the fuel could be used at lower temperatures. Other kerosene-based fuels and solvents could be substituted if JP-5 was not available.

More long range solutions are currently being considered. For example, the Project Manager for the M1 Abrams tank initiated a program to develop a cold-weather kit which would use "ribbon heaters" or flat bonds containing heating elements that could be wrapped around fuel lines and filter surfaces.

Another factor which contributes to cold weather problems is the presence of water in the fuel, causing fuel lines and filters to freeze. New requirements will be established for using filter separators to remove water when fueling vehicles.

The progress of the work to lower the cloud point requirement of diesel fuel will be discussed at a meeting of the NATO Fuels and Lubricants Working Party later this year.

Navy HI-SPOT

Imagine a 500-foot "lighter than air" vehicle that could hover in one location at a 70,000-foot altitude for as long as 100 days.

Lockheed Missiles & Space Company has just completed a conceptual design of such a system under a $260,000 contract from the Naval Air Development Center (NADC), Warminster, PA.

Called HI-SPOT (High Altitude Surveillance Platform for Over-the-Horizon Targeting), the airship would provide the platform for payloads that perform such functions as air/sea surveillance, communications relay, sensor readout, and other military tasks.

A project leader for HI-SPOT says early Navy cost studies indicate the system can be developed and operated for about one-tenth the cost of a synchronous satellite system. The vehicle is reusable and could operate worldwide in all seasons.

As envisioned by Lockheed, HI-SPOT would have a volume of five million cubic feet — making it about three times the size of the largest blimp operated by the Navy. It would be 54 meters (500 feet) long, 46 meters (150 feet) in diameter, and could carry a payload of 250 kilograms (550 pounds).

The system would be remotely piloted and would be lifted to specific altitudes by a helium-filled gas envelope constructed of high-strength Kevlar/Tedlar fabric. The gas envelope could house additional payloads or large antennas.

In a typical scenario, the deflated bag will be mated to the system's suspended tail section and then partially inflated with helium gas. The airship would then be released from its holddown straps and would gradually lift noseup to a specific altitude. At operational altitude, the ground systems would pilot the airship to a particular mission location.

HI-SPOT depicted in this artist's concept, would accommodate payloads that perform such functions as air/sea surveillance, communications relay, sensor readout, and other military tasks.

The airship can remain stationary at altitudes of 50,000 to 70,000 feet. When the airship encounters wind, hydrogen fueled engines drive the system's propellers and provide enough horsepower to keep the airship in place.

Lockheed, the system integrator for HI-SPOT, will develop the airship's tail section truss assembly, engine assembly, drive shaft and propeller assembly, internal antenna support structure, cryogenic fuel storage tanks, and the gondola that will carry payloads and supporting electronics. The company will also develop the communications and navigation systems.

Life-support system for DSRV

Lockheed Missiles and Space Company has been awarded a US Navy contract to design and build a self-contained, low pressure life-support system for one of the two Deep Submergence Rescue Vehicles (DSRV).

The potassium superoxide (KO_2) life support system is designed to absorb carbon dioxide exhaled by the DSRV's 28 occupants and automatically release oxygen into the submersible's atmosphere. The KO_2 system will replace the complex, high-pressure pure oxygen system presently carried on board in tanks.

A single canister about half the size of an office wastebasket contains enough potassium superoxide to supply oxygen and control carbon dioxide for

about 15 man-hours. The DSRV's three pressure spheres normally will carry 32 canisters, giving an endurance of 480 man-hours.

There will be two KO_2 systems when the DSRV installation is complete:

•The regular system which will release oxygen directly into the DSRV atomosphere.

•An emergency system which will provide oxygen to each occupant through face masks in case the disabled submarine interior is contaminated. Each emergency system canister will supply five crew members for about three hours.

The standard canister will be interchangeable between the regular and emergency systems.

Lockheed designed, built, and delivered the two San Diego-based DSRVs to the Navy in 1970 and 1971. Designed to dive to 5,000 feet, they can rescue up to 24 trapped crewmen per trip from fleet submarines stranded on the ocean floor. Each is operated by a crew of four.

Hellfire contract awarded

In April this year, the US Army Missile Command (MICOM) awarded approximately $13.6 million to Rockwell International of Columbus, OH, for the first production buy of Hellfire launchers and missiles.

Rockwell's Missile Systems Division will produce Hellfire launchers and missiles at the company's new Atlanta, GA, facility. Thiokol Chemical Company will load rocket motors at Redstone Arsenal, AL, with final assembly and delivery of the complete Hellfire missile taking place by Rockwell at Anniston, AL, Army Depot. Martin Marietta at Orlando, FL, is the contractor for the Hellfire laser seeker.

The Army will field Hellfire (the new tank killer) in the mid-1980s. It will be the primary armament of the Army's new advanced/attack helicopter (AH-64 Apache) which will carry 16 missiles. Missiles are based on a modular design eventually accommodating a variety of terminal homing seekers, but the first missiles will be equipped with laser guided seekers.

In addition to the Apache helicopter, the Army is considering other deployment applications for Hellfire including ground launch modes and possible use on other service aircraft.

In March 1982, MICOM awarded approximately $11.5 million to Martin Marietta for laser seekers and engineering services supporting seeker production and $1.7 million to Rockwell for engineering services supporting missile and launcher production.

The External Stores Support System (ESSS) being developed for the UH-60A Black Hawk helicopter will provide a self-deployment for the aircraft when equipped with two 450-gallon tanks and two 230-gallon tanks.

Black Hawk testing

Testing is currently underway at West Palm Beach, FL, on the Army's new External Stores Support System (ESSS) for the UH-60A Black Hawk helicopter. The ESSS consists of wings mounted on each side of the aircraft which can carry four auxiliary fuel tanks or a variety of other externally mounted tactical equipment.

Under the current development program, the Army will qualify the ESSS and the external fuel system which consists of two 450-gallon tanks located on the inboard wing stations and two 230-gallon tanks outboard.

Using all four tanks results, the Black Hawk has a significant extended range capability and, with a crew of three, is self-deployable. With only the two 230-gallon tanks, an 11-man combat-equipped squad can be carried on extended-range assault missions.

Future testings will also include a demonstration of the Hellfire missile and M56 mine dispenser weapon systems.

The Army plans to modify all Black Hawk helicopters to accept the ESSS which will be provided in kit form on an as-needed basis. Current planning calls for receipt of initial ESSS kits late in 1984.

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The M198–
New Howitzer For
Light Divisions
See Page 26