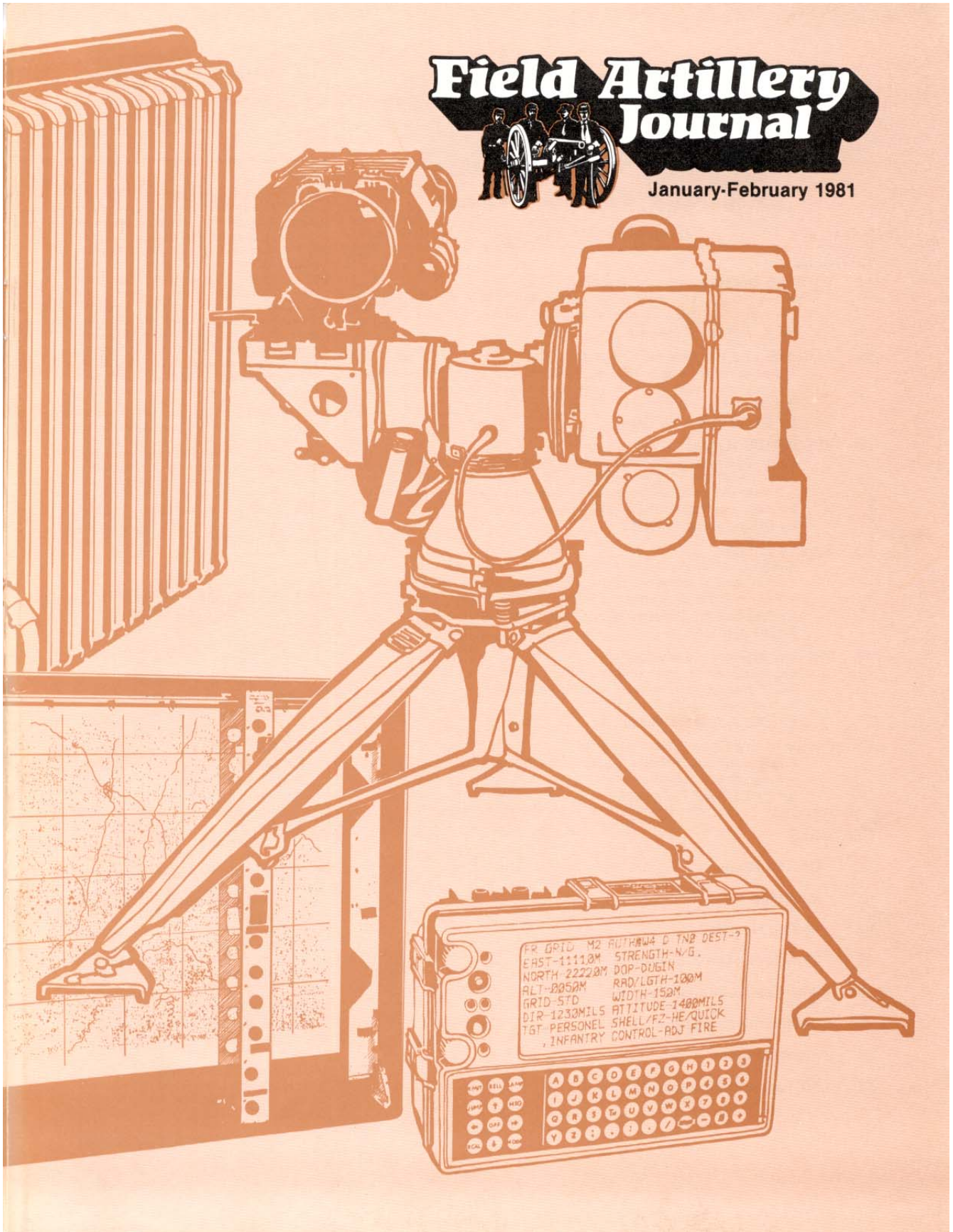


Field Artillery Journal



January-February 1981





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Field Artillery Journal

On the Move

by MG Edward A. Dinges

About a year ago my distinguished predecessor, MG Jack Merritt, offered in this space several examples of how the Army, in general, and the Field Artillery School, in particular, are redesigning our enlisted training strategy to meet the twin challenges of advancing technology and diminishing personnel assets. In this issue I want to talk about the other side of this planning coin, the redesign of our officer training strategy to conform to new policies regarding officer education and training.



Background

The genesis of these policies occurred in August 1977, when the Chief of Staff of the Army (CSA) directed a Department of the Army level study group to conduct a thorough "Review of the Education and Training of Officers" (RETO). Headed by MG Benjamin L. Harrison, the RETO task force sought to develop officer education and training requirements from a deliberate examination of both Army missions and individual career developmental needs projected through the 1990s. In particular, RETO was to serve as a vehicle for initiating training and education policies and programs combining self, unit, and institutional development in a phased schedule from precommissioning through career completion.

As one of four US Army Training and Doctrine Command (TRADOC) service schools selected to "pilot" the RETO effort, the US Army Field Artillery School developed a new approach to Job/Task Analysis which documents the criticality of each task required of an officer, based on surveys, questionnaires, and on-the-scene interviews of job incumbents. The findings of this "front-end analysis" were reviewed by boards of officers and then translated into a comprehensive training strategy which was submitted to TRADOC in November of last year. Since this strategy will affect all Field Artillery officers in one way or another, both its rationale and its implications deserve attention.

Training rationale

Central to our new training strategy is the conviction that the critical task of every field artillery officer is to manage fire support for the maneuver commander.

While providing an adequate grounding in the technical specialties which comprise the indirect fire business, the Field Artillery School must also insure that each officer develops a broad understanding both of the fire support system itself, and of its interface with the maneuver arms. Development of this broad tactical foundation begins during precommission schooling, is then extended and intensified in the basic and advanced courses, and culminates in combined arms schooling at Fort Leavenworth.

Basic and advanced courses

In the structuring of our Officer's Basic and Advanced Courses, close coordination of subject matter is important since a well trained lieutenant will require less "institutionalized" schooling at the advanced course level. As such, the Officer's Basic Course (OBC) must focus on critical high density positions that a lieutenant will occupy shortly after leaving the School, while on the other hand, non-critical, low density positions or functions should be programmed for on-job-training or self-study.

In accordance with guidance provided by TRADOC, the School's proposed training strategy has OBC as a TDY course of 19 weeks, 4 days (the maximum allowable length). This is in comparison to the current basic course of 10 weeks followed by one of four specialty tracks (cannon, Lance, Pershing, target acquisition) which vary in length from four to nine weeks. One should note, however, that it is our projection that FY84 and beyond will require an OBC of longer than maximum TDY length

because of integration of the TACFIRE family of computers and other sophisticated systems into the force. Here, certain trade-offs in course lengths will be required so that we provide the best possible training environment within expected resource limitations. One of these trade-offs has been the Field Artillery School's position to retain the Officer Advanced Course (OAC), which on 19 September 1980 was approved by the CSA.

Reshaping the OAC, however, will most likely be required since the original RETO proposal called for eliminating the course (as we know it) by teaching some skills in an expanded basic course and providing functional and specialty courses in conjunction with a battery level pre-command course (PCC). Integration of the Combined Arms and Service Staff School (CAS³) into the officer education system this April will also require a rethinking of how we should conduct mid-level training for Field Artillery officers.

Continued evaluation of OAC and the product—our officers—must include an assessment of job performance by commanders and planners in light of new tactics, doctrine, techniques, and modernization. As such, we should now ask ourselves in what direction are we headed?

Military Qualifications Standards

I believe the answer may well lie within the Military Qualification Standards (MQS) system. Designed as both a *system* and a *manual*, the concept is to provide:

- A means of qualifying officers in their specialty at a particular grade level.
- A framework which efficiently integrates the training and education efforts of the officer, his commander, and the Army School System.

Structured in three areas of MQS—Precommissioning (MQS I), Lieutenants (MQS II), and Captains (MQS III)—the system centers on programed, standardized, and evaluated training. Here, my concern is the manner and extent to which we decide to enforce this training system.

The "teeth" we want (or can afford) may well determine the difference between having a viable training tool or one shelved due to real and/or imagined priorities. It is here that our commanders' participation is needed, since personal involvement will determine how effective the overall MQS may become. Two examples of this participation are as follows:

- First, to assist in the officer's professional development, commanders at varying levels will be required to validate and certify unit officers as "competent" in specific job tasks/functions. Additionally, commanders will be required to become knowledgeable in four separate reading list

materials (classics, contemporary, ethics, and specialty).

- Secondly, since a distinct feature of MQS III will be attendance of the Combined Arms and Services Staff School (CAS³) at Fort Leavenworth, a pre-resident correspondence phase must be validated prior to attendance at the resident phase, which may well require the commanders personal involvement. As I see it, this participation by commanders is not a *detriment* but a *responsibility* to assist in their officers' professional growth.

Now I should point out that these rather significant educational changes are in accord with those currently taking place in tactics, doctrine, and modernization. These advances, spawned by the proliferation of new systems, equipment, and weapons, will be integrated during the early years of the strategy's educational cycle (FY82 through FY87). Teaching of the complex skills required for several new systems entering the FA inventory will require time far in excess of current course length/resource limitations. Here, with equipment and weapon systems sometimes overshadowing personnel requirements, we must not lose the perspective that *one is only as good as the other*. The dividends paid by well-trained officers will be realized in force multiplying, a critical element of our future combat power. This includes not only the Active Army but also the Marine Corps and Reserve Components.

Recap

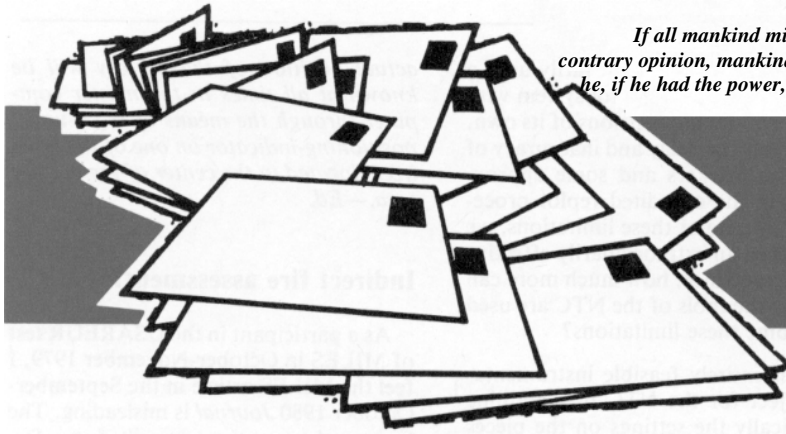
With our current efforts now focusing on the training strategy of the Officer Basic and Advanced Courses, the future impact of MQS, CAS³, and extensive technological modernization remains uncertain. As such, I urge our commanders and officers to evaluate and provide feedback on the impact of these developments—a communication which I believe is essential to the development of future training strategies.

Impact

The diverse changes initiated by RETO and force modernization will continue to be the driving force of change within the Field Artillery. While our mission of fire support to the maneuver arms provides a central foundation for the training of Field Artillery officers, I feel the common base of our proposed training strategy will go a long way to insure total branch qualification.

I again encourage all officers to support and evaluate the progressive changes of RETO by corresponding with the School's Director of Course Development and Training. Only with your help can we devise a balanced equation for better training of the Field Artillery officer.





If all mankind minus one, were of one opinion, and only one person were of the contrary opinion, mankind would be no more justified in silencing that one person, than he, if he had the power, would be justified in silencing mankind. "On Liberty"—John Stuart Mill

Incoming

letters to the editor

The mystery of the lost met equipment repairman

As technological advances increase our capabilities on the modern battlefield, so must we increase our capability to maintain sophisticated equipment. In this, a problem all commanders should recognize is that each meteorological (met) section is authorized only one met equipment repairer MOS 93F20H1.

The 93F20H1 MOS is given to an individual who is first trained as a Field Artillery Meteorological Crewmember and subsequently as a Meteorological Equipment Repairer (MOS 93F20 has no repair training). Personnel managers and units, however, normally address only the basic MOS without the "Additional Skill Identifier" (ASI) which is the underlying reason for assignment problems. Commanders therefore should check unit manning reports/requisitions to insure that they have a qualified met equipment repairer.

Currently there are four Active Army met sections with more than one repairer. Here it is safe to assume that the same type problem occurs in other MOSs with ASIs.

Previously the Meteorological Equipment Repairer was identified by the MOS 35D20. In 1975 when the Enlisted Personnel Management System (EPMS) eliminated all low density MOSs, the 35D20 MOS became the current ASI of H1 attached to the MOS 93F20. This ASI is annotated on a soldier's official military records and possibly under the special instructions on the orders but no where else. This presents a problem to the field due to the low visibility of the ASI H1. Additionally, when a soldier reaches the rank of staff sergeant, the ASI is deleted which results in the commander not knowing that the noncommissioned officer is a maintenance qualified supervisor who can guide the training of the 93F10 as well as the 93F20H1 within the met section.

The Field Artillery School is authorized, by Table of Distribution and Allowances (TDA) one E7 93F40 and three E6 93F30 for the Meteorological Equipment Repairmen Course and one E7 93F40 for the Meteorological Maintenance Branch. With the current system of displaying MOS codes, how can these unique slots be filled correctly without the knowledge of a soldier's qualifications?

Shortages always will occur under any situation, but one solution, which may alleviate this problem in 93F and other MOSs, is the adoption of a seven-digit MOS code by EPMS on all documentation pertaining to the assignment of an individual. As such, a seven-digit MOS code would provide clear, precise knowledge of a soldier's qualifications. For example, a 93F2HH1 is an E5 Field Artillery Met Crewmember, who is instructor and maintenance qualified. If this seven-digit MOS were shown on all documentation instead of the present five-digit MOS, numerous mal-assignment problems could be eliminated. The Army needs such a system to more accurately assign soldiers.

Richard Young
SFC, FA
Met Div, CFD, USAFAS
Fort Sill, OK

USAR change of command

I noted with interest CPT Eugene P. Moser's comments about the lack of Reserve Component commanders in the Journal's "Commanders Update" section and your comment that the major reason for not including them was the lack of timely and accurate information pertaining to the changing of commanders in the Reserve forces.

My Reserve battalion, the 3d Battalion, 92d Field Artillery (8-inch, SP), had a change of command this past month to: MAJ John H. Shoemaker, Field Artillery. This certainly is current and valid information from one of the Reserve

Field Artillery battalions. Let's see this fact in print which will hopefully cause other Reserve battalions to submit command changes to you. I can think of at least 20 other Reserve or National Guard 8-inch battalions that must occasionally change command.

George A. Fromholtz
MAJ, FA, USAR
Executive Officer
3d Bn, 92d FA
Akron, OH

Appreciate this information which has also been provided to the Reserve Components Division (RCD) of the School's Directorate of Course Development and Training. Should other Reserve Component Field Artillery units follow your proposal, the chief of RCD would certainly welcome an info copy of the update material.—Ed.

The battery scout

CPT Rick Hardie's article ("The Battery Scout," November-December 1980 *FA Journal*) represents the kind of original thinking so often absent in our doctrine. I absolutely concur that another "trained" and responsible person (the battery gunnery sergeant is an excellent choice) should have primary responsibility for the reconnaissance and selection of positions (RSOP), especially in a rapid-moving environment such as Captain Hardie described.

The battery commander is then free to be at the most critical place at the most critical time, which may well be with the advance party, supervising any aspect of the RSOP as he deems necessary. When I was a Pershing platoon commander, I often sent my officer assistant on the advance party for this very reason.

Robert F. Kemp
MAJ, FA
CGSC
Fort Leavenworth, KS

Engagement simulation

I very much enjoyed CPT Arthur A. Schrader's interesting article on the Army's National Training Center (NTC), particularly as I have been active in the development of engagement simulation (ES) for the last three years and am presently engaged in developing the learning methodology of the NTC. I am also a co-author of an article in the same issue (September-October 1980) on application of ES techniques to field artillery training. These experiences have led me to some thoughts on NTC training for the field artillery, as described by Captain Schrader, that I should like to share with the Field Artillery Community.

The central fact of ES methodology is that, at the end of an ES field training exercise (FTX), a real outcome exists. Some missions are accomplished and others are not; some people are casualties and others are not. This outcome is caused not by the decisions of umpires but by the actions of each and every man in the unit, exactly as he would have contributed to that outcome in battle. The challenge is to determine what each man contributed and see that he learns from the experience what he must do differently next time to improve the unit's performance and his own chance of survival. The NTC is by far the most effective training environment so far created for the application of this methodology; yet it appears to me that the proposed field artillery participation takes only very limited advantage of it.

Captain Schrader correctly extols the added realism which the NTC will bring to the indirect fire unit's application of essentially the same methodology as the artillery uses in non-ES exercises. I suggest, however, that this is not enough. To review the point that my colleagues and I tried to make about this non-ES methodology in our article, only the actions of the fire support team (FIST) and the communicators have much to do with the artillery's contribution to the outcome. If the fire direction center (FDC) makes a gunnery error or a piece is laid a few mils off, it will make no difference to the effect that will be assessed in the FTX. Only by being slow can the FDC or battery have an effect on the perceived quality of fire support—not by being imprecise. We demonstrated in our experiment (more completely reported in US Army Research Institute Research Report 1245) that when the ES principle is extended to the FDC and battery (i.e., the effect is assessed where the FDC and battery would have put it) both speed and precision improved. Working in the home station

environment, we necessarily used a somewhat laborious control system with a few delays and imprecisions of its own, most notably the delay and inaccuracy of soldier fire markers and some approximations in the expedited replot procedure. If, in spite of these limitations, we still achieved an extraordinarily effective training experience, how much more can be done if the tools of the NTC are used to overcome these limitations?

It is an entirely feasible instrumentation project for the NTC to determine automatically the settings on the pieces and to measure any errors in lay. Transmitting this information to the computer and determining exactly where the data would have placed the fire are also quite feasible in the NTC environment. The NTC system already has provisions for marking indirect fires and assessing casualties due to them. We therefore have the potential to incorporate the exact effect of the entire indirect fire loop into the FTX with no delay or additional personnel requirements and with relatively minor instrumentation.

The most valuable resource a commander preparing his unit for combat has is the training time of his troops. Now consider that by present planning, 11 of the combined arms team's 14 days of training time at the NTC will be spent in ES exercises (these two weeks will come only once in every 18 months). This is a unique opportunity for complete visibility and high impact feedback under the most realistic conditions this side of combat. To have the FDC and firing battery spend most of their time in drills, which could have been accomplished at home station, which have no effect on the exercise outcome, and which have little possibility of developing instructive feedback, seems less than an optimum use of this resource.

Francis King
COL (Ret), FA
McLean, VA

The School has submitted a request to the Combined Arms Center that all Field Artillery personnel and equipment at the National Training Center be armed with MILES devices for realism in defense against the opposing forces. Further, actual computed grids from the fire direction centers, modified by actual gun settings, will be input to the computer for casualty assessment. The School has also requested Hoffman Devices be placed on all howitzers for realistic audio-visual cue for cannoneers when "dry-firing." The

actual position of the battery will be known at all times in the master computer through the means of a "B-unit" positioning-indicator on one of the howitzers located in the center of the battery area.—Ed.

Indirect fire assessment?

As a participant in the USAREUR test of MILES in October-November 1979, I feel the MILES article in the September-October 1980 *Journal* is misleading. The fire marker system described by Dr. Stein, et al, although with merit, really has nothing to do with MILES; i.e., it can be used in conjunction with MILES equipment, but need not be.

The title of the article leaves the impression that MILES is realistic training for direct support artillery. It is not. It is realistic training (super is a better word) for maneuver elements in that the laser equipment allows an accurate assessment of the effects of direct fire weapons, but unfortunately it cannot be used for indirect fire assessment.

The engagement simulation technique described in the article is an improvement over the standard fire marker system. Several major exercises in Europe have avoided using fire markers since the overhead required to do it properly is outright prohibitive. Putting a controller in the firing battery to input data integrates the guns into the evaluation and keeps them "honest."

I urge the FA Community to continue research in engagement simulation techniques. Right now we are markedly behind maneuver elements in this area.

George Demetriou
MAJ, FA
S3, 1-2d FA
Baumholder, GE

The MILES article in the September-October 1980 FA Journal is just one clinical opinion to a solution of the indirect fire problem associated with engagement simulation exercises. The USAFAS neither indorses nor accepts this as the solution to the problem. It is recognized that the task of realistically integrating the Field Artillery into MILES is complex and as such there are several efforts ongoing to try to solve this problem. It is also recognized that only with several varied ideas, such as those of the MILES authors, that research and further studies will continue in this extremely important area of realistic training.—Ed.

Sound ranging

General Dinges' comments in the September-October 1980 *Journal* must have hit home with many artillerymen. Much progress is evident throughout the branch, but in research and development there has been more promise of what may be available in the 1990s and too little evidence of what is available to the troops here and now. With a drastically limited budget, the relative emphasis on the balance between long range research and short term development is always a tricky matter of crystal-ball gazing and judgment. But, while we must certainly keep up our research program for the more distant future, we cannot afford to wait for the "perfect" system to be developed, and we cannot count on the Russians or their surrogates to await our pleasure.

Sound decisions in such matters depend on guidance by men with knowledge of military requirements, reasonable familiarity with current state of technology in the applicable fields, and some "technical imagination."

One FA system that has received renewed emphasis lately, but which suffers particularly from imbalance in its research and development, is sound ranging. Because of the need for an effective means for locating enemy weapons, there has recently been renewed interest in our old sound ranging system. In spite of some limitations, its inherent advantages make it an essential tool of any modern army. When properly used, the existing basic system still gives good service, but design of equipment and training for the job have not kept up with technology.

No one has ever claimed that sound ranging is effective under every condition. (What system is?) In spite of its inherent advantages there are some specific areas that should receive further study and improvement. The chief of these problem areas include:

- *Mobility.* This involves detailed training and up-dating equipment.

- *Meteorological corrections to improve accuracy.* The method now used has been essentially the same for 60 years.

- *Saturation.* Like any locating system, sound ranging has a saturation level. With present equipment this level is quite low but, with equipment now technically available, it could be raised considerably. The PAWLS project, looking at the "worst case," aims to raise it much higher, but its solution is likely to be illusive and require a long term program.

- *Automation.* "Push-button operation" (as practically achieved with the AN/TPQ-37 radar) and proposed in the PAWLS project, would be most desirable;

however in my *opinion* it will be a long time in coming, simply because of the physics involved. I do not believe that the artillery can afford to wait for this development.

In the last 30 years considerable money and effort have been spent on research for sound ranging, so far with little improvement in performance. The catch in the research and development problem seems to be that we keep trying to invent the perfect wheel instead of greasing the one under our wagon. And, when transferring ideas from the laboratory or computer model to the field, the bright new ideas usually trip over the same old intransigences of sound travel and weather that have already been encountered. Again, while any promising basic changes of the system should be investigated, we should remember that even those that may prove feasible are likely to take a long time to develop for practical field operation. In the meantime, it is very questionable whether current performance can even match that of World War II. This evaluation is made in full knowledge of use of computers, new survey instruments, and the radio link (being fielded after 35 years of requests). All of these help, but are peripheral to the recording and meteorological equipment needed to obtain the raw input data for locations.

The currently issued sound ranging set, AN/TNS-10, is listed as a "product improvement." It is merely a version of the old GR-8 repackaged to conform to current manufacturing practice. Its 35-year old design was not very satisfactory when new and even experimental devices of that time are still included. Better and more versatile equipment is now available commercially or with very little engineering modification. Such equipment would not only improve performance for units now in the field, but could be used to try out new ideas. It would improve mobility of bases and flexibility in adaptation of sound ranging to tactical conditions and would be more effective in combat than the presently issued equipment.

The PAWLS program is set up from the view of data processing technology. To adapt this to the idiosyncrasies of artillery acoustics will likely take more time than we have. In the meantime we should provide for the difficult (not necessarily for the worst-case) conditions. Such updating is now feasible and would provide data for still more difficult conditions.

An example of the all-or-nothing attitude of research in this field is illustrated by the answer to a bidder's request for data from previous tests. An answer was

denied, for "Only in total ignorance would you be working on a totally new development." As in the bidder's question: re-invent the wheel. No wonder we don't make progress!

To put first things first, and coming back to General Dinges' idea, I believe that some of the money being spent to equip the new sound ranging units and to support the long range research programs should be used to provide up-to-date equipment for our field units, rather than issue obsolete and inadequate models.

As a final thought, it is high time to develop a few real experts with field experience and enough technical background to guide a balanced research and development program in this field.

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

You are right in that an automated sound ranging system will be 10 to 15 years in coming and only then if there is a change of attitude in the Army. Recently a DARCOM/TRADOC review determined that sound ranging was a low priority program and further funding for sound ranging programs was deferred. This action prevents any further development of a new sound ranging system and will cause the Field Artillery to continue to pursue the product improvement program (PIP) route for the AN/TNS-10. Currently under the PIP program we are adding a commercial, off-the-shelf computer to the system. This PIP will greatly simplify the training of sound ranging personnel and reduce the time required to process raw sound ranging data. Further PIPs are anticipated to upgrade the microphones and, as in the case of the computer, commercially available microphones may very well be utilized. Work will also continue to improve the sound ranging computer program by refinement or the inclusion of modified or new algorithms, if developed.

With respect to the PIP of the AN/TNS-10 Sound Recorder, the solid stating of the old GR-8 was the first of two PIPs for the TNS-10. The second PIP, which is currently being addressed by the Combat Surveillance and Target Acquisition Laboratory, will replace the old record head that was retained from the GR-8. Upon completion of the PIP, the TNS-10 will be a militarized sound recorder utilizing modern electronic technology throughout.

By the end of the second quarter FY82, the Radio Data Link, AN/GRA-114, and PADS will start arriving in the target acquisition batteries. This will allow sound ranging bases to be installed in approximately

one hour as compared to the current six to eight hours. The HP-9825 calculator will also be available to the sound/flash platoons by the end of FY81 and will virtually eliminate the need for training personnel in the processing of data.—Ed.

US Artillery—1980

I've read of the addition of the MLRS system to field artillery armament. This addition, in weight, caliber, mobility, and rate of fire, is intended for employment against missions in rear of the assault area. Thus, all the present armament is ideally suited for destructive fires in a NATO rear area. Three other missions exist:

- Close support of infantry, NATO, or elsewhere.
- Artillery support for rapid deployment forces.
- Secretary of Defense Brown's call for light armored equipment for the 9th Infantry Division.

What has the field artillery to offer? Nothing! Absolutely nothing! What's needed and necessary is a *modern field piece!*

The Soviet's 122-mm self-propelled howitzer is an example. A few vital capabilities follow:

- Direct and indirect fire.
- High rate of fire.
- Armor-effective ammunition (not necessarily armor-piercing).
- Lightly armored.
- Amphibious.
- Protected against CBR environment.
- Lightweight (15 tons).

Having failed to program and develop an excellent modern field piece, as the Soviets have done, we must now purchase helter-skelter to meet Secretary of Defense Brown's order.

We also lack a necessary doctrine for such missions and equipment. Listen to these quotes:

1) "Artillery units must if possible avoid attack by enemy mechanized forces."

2) "The operational concept includes 'shoot and scoot' tactics."

Field artillery today badly needs a modern field piece to enable it to stand and break the modern attack (armored) and closely follow and support infantry across streams and through CBR contaminated areas.

Field artillery today needs a doctrine of close infantry support—not "shoot and scoot"—just a reaffirmation of our age-old role as typified at Gettysburg when our hard-pressed infantry, in certain

areas, were forced back under the guns valiantly supporting them.

Failure to take such action will necessitate redesignating our artillery as US Heavy Artillery and Missile Branch.

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

You are correct, Sir, in that the US does not have a direct equivalent to the Soviet 122-mm SP howitzer currently under development. Light divisions, however, are currently getting "upgunned" to the 155-mm M198 in the direct support role, and heavy divisions are receiving the M109A2/3. US Army Materiel Development and Readiness Command (DARCOM) has an abundance of ongoing technology programs, particularly within the Large Caliber Weapons System Laboratory, US Army Armament Research and Development Command (ARRADCOM). These programs possess high payoff potential for improvement in responsiveness, effectiveness, availability, and survivability for self-propelled artillery. Technology demonstrations continue under the ARRADCOM Test Bed Program. Here, a major concept development and technology integration effort is ongoing for a 1990-2010 system which will replace the aging M109, taking full advantage of developmental technology under the title "Enhanced Self-Propelled Artillery Weapons System" (ESPAWS).

Against an adversary who will fire more than 500 rounds per counterbattery mission, significant changes are required for protecting our delivery systems. These are primarily wide dispersion (300 to 500 meters) between pieces and use of "shoot and scoot" tactics only when forced to do so. (See "Letters To An Artilleryman" (September-October 1980) and "Field Artillery Survivability" (May-June 1980).) Today's technology permits using both of these tactics. Each howitzer can be equipped with real-time self-locating and self-orienting instrumentation which frees the weapons of the requirement to bunch around a survey control point and implant external azimuth reference points. During periods of intense battle, this dispersed artillery can stand and fight since the enemy cannot effectively wage a counterfire battle against an apparent "24-battery" force within a brigade zone.

Winning the fire support battle is just as critical today as it was in the 1940s. With the introduction of MLRS to complement cannon fires, more of the opponent's fire support, command, service support, and record echelon maneuver

elements can be engaged, thus reducing their direct effectiveness against our forces.

*Close and continuous fire support for the maneuver forces remains the primary mission of field artillery. Today's **problem** is using today's artillery system in such a manner that it survives in battle to provide that support. Today's **challenge** is how to improve today's artillery system within very limited budget resources.—Ed.*

FA Association support

As of 20 October last year, all officers assigned to the 2d Battalion, 34th Field Artillery, Fort Sill, OK, joined the rolls as members of the Field Artillery Association. I believe this is probably a first for a unit at Fort Sill or anywhere else!

Terry Burns
MAJ, FA
2d Bn, 34th FA
Fort Sill, OK

Your unit's support of the Field Artillery Association should serve notice to other Redlegs that our revitalization is indeed making headway. Hopefully, the noncommissioned officers and soldiers of the 2-34th FA share equal interest.—Ed.

Reunions

76th Field Artillery—Members of Battery C from 1937 to 1940 stationed at Fort Warren, WY, who are interested in reestablishing contact and planning a reunion in Cheyenne, WY, should write CWO Daniel Renfro, USAF (Ret), 3922 Doris Drive, Amarillo, TX 79109.

510th Field Artillery Battalion—Members during 1949 to 1954 please furnish COL Alan Blankenship, USA (Ret), Apt 5A, 3803 Barrington, San Antonio, TX 78217, with current address and anecdotes. A roster and newsletter are being compiled for former members.

Field Artillery Training Center (Yunan; 1943-1945)—Members interested in a reunion should send inquiries to D. R. Frazier, Route 3, Box 187, Dover, TN 37058.

Battery L, 18th Field Artillery (Fort Sill, OK; 1941-43)—Contact A. G. "Tony" Ramirez, 3917 Surfside Dr., Modesto, CA 95355.

670th Field Artillery Battalion (World War II)—Members who are interested in a reunion should contact LTC (Ret) Joseph S. Howard, 405 Willow Oaks Blvd., Hampton, VA 23669; telephone (804) 851-4008.

New feature?

I would like to suggest a department be started in the *FA Journal* along the lines of "MSG Half-Mast" in *PS Magazine*. The various departments at USAFAS could contribute the answers to questions most asked from the field.

Another way could be to have your own MSG Half-Mast that people could write to. You could call him LT Lanyard Grease or SSG Muzzle Blast. The names are corny, but so is the name "MSG Half-Mast."

With this new feature, much needed current information could be disseminated to the field on technical, administrative, and other issues.

Norman Cagle
1LT, FA
CSC, 3d Bn, 68th Armor
APO NY

Your thoughts to improve the Journal are appreciated; however, the service you describe is currently provided by our "Incoming" and "View From The Blockhouse" features. Unit/individual questions may be addressed to the appropriate School department or the FA Journal—Ed.

From the past

The 102d Field Artillery Battalion landed at Cherbourg, France, 7 September 1944 and subsequently occupied an area near Videcosville during the first three weeks. Then the battalion moved to the vicinity of Cartaret. Twelve officers and 354 enlisted men were on duty with the 26th Infantry Division Truck Battalion (Provisional) during the first weeks of October. On 18 October, the battalion left the Cherbourg Peninsula and traveled east to the vicinity of Nancy, France. Positions were occupied and OPs established on 22 October at Arracourt. The first round was fired at 1105, 23 October by B Battery. One hour later SGT Harold I. Slings, Headquarters Battery, became the first battle casualty.

On 14 December 1944, the battalion was relieved of its mission and moved to Metz. Following the German breakthrough in the Ardennes, the 102d moved from Metz on December 20th to a concealed bivouac at Hobscheid, Luxembourg.

On 27 January 1945, having been relieved of its mission in the "Battle of the Bulge," the 102d moved to Bedersdorf, Germany. Positions were occupied the following day at Felsburg. The battalion continued on its mission at Saarlautern until 7 March 1945, when orders were received to move north to the vicinity of

Saarbourg. Positions were occupied March 9th at Irsh and the division attacked March 13th. There followed the dash across Germany. The Rhine was crossed during the early morning hours of March 25th. The advance continued to the East through Germany and into Central Europe. The Austrian border was crossed on May 1st and Czechoslovakia was entered on May 6th.

The final combat round was fired at approximately 1700 on May 6th by B Battery. On May 8th, the battalion was notified that all hostilities would cease as of 0001 May 9th, after 210 days spent in the line.

Ammo report

31 October 1944	553
23 November 1944	10,634
9 December 1944	16,713
31 December 1944	24,629
6 January 1945	29,927
31 January 1945	45,048
10 February 1945	48,964
28 February 1945	57,847
18 March 1945	66,505
31 March 1945	69,058
24 April 1945	71,811
30 April 1945	72,162
8 May 1945	72,213

Total rounds 586,064

Melvin S. Welsch
LTC, FA, 102d FA Bn
Commanding

The above report was written by a former commander of the 102d FA Battalion. (The present commander is LTC James Mangraviti, FA.) During World War II, the 102d FA Battalion advanced through more than 400 cities or towns through Central Europe and fired approximately 586,064 rounds.—Ed.

TACFIRE

On 25 September 1980, Congress approved the Army Reprogramming Plan which provides \$86 million to buy 43 additional TACFIRE sets, leaving us only 23 sets short of the total Active Army requirement. Hopefully, we will get the remainder with an FY81 supplemental appropriation.

After several years' work, debate, and speculation, the Field Artillery is, in fact, going to enter the world of automation, and units should start preparing for it.

The system is now fully operational in the 1st Cavalry Division and the 212th FA Brigade. Additionally:

- Repair parts are in the Army supply system and the maintenance system has been thoroughly tested. We found that

TACFIRE works well (providing greatly increased operational utility) and that the equipment is remarkably durable.

- The Soldier's Manual and Skill Qualification Tests for MOS 13C and the TACFIRE Army Training and Evaluation Program (ARTEP) will be out soon.

- The multimedia training package is ready, and we are now determining which portions to export.

- MOS 13C training has begun at Fort Sill, and we expect to have more than 300 TACFIRE trained soldiers in the "pipeline" by the end of the year.

TACFIRE is fielded to an entire division or an entire field artillery brigade. Approximately 12 months prior to the fielding date, units will be visited by representatives of the Field Artillery School and the Project Manager's office. This TACFIRE team will present detailed briefings to the commander and his staff, the division staff, and maneuver commanders. The commander will be informed as to the number of individuals requiring training at the Field Artillery School or the USAREUR School at Vilsek. (For a division artillery, approximately 100 personnel must receive from 4 to 11 weeks of institutional training.) On a case-by-case basis, MILPERCEN will stabilize key personnel for up to 18 months after they are trained. Additionally, a Communications and Electronics Readiness Command (CERCOM) team will begin training direct support personnel (MOS 31E) in proper alignment of radios since all radios must be in top condition prior to receipt of TACFIRE. Units can expect to receive new or rebuilt radios to replace some of the older ones, and commanders should aggressively support this important procedure since proper communication is essential for optimum performance of TACFIRE.

The TACFIRE equipment will be accompanied by a fielding team who will check the equipment and sign it over to the unit. A 14-man CERCOM New Equipment Training Team will assist the unit in three months of training which is culminated with a week-long field training or command post exercise to validate the unit's proficiency with TACFIRE.

I believe TACFIRE will greatly improve our combat effectiveness during the 1980s. It is not a simple system, and successful fielding is not an easy task. Units should be prepared because TACFIRE is on the way!

Hardy R. Stone
COL, FA
FATDS TRADOC
Systems Manager
Fort Sill, OK

*The Field Artillery continues its transition to TACFIRE both in the United States and Europe, but deployment will not be as rapid as originally forecast due to an unexpected funding cut announced in December 1979. Funds, however, were later restored by a reprogramming action in September 1980, and, as such, sufficient monies will be available to equip all Active Army division artillery and FA brigades with TACFIRE. Funds for corps FA equipment should be forthcoming in FY81. Current fielding of TACFIRE in the 1st Cavalry Division (Fort Hood, TX), the 1st Battalion, 17th Field Artillery (Fort Sill, OK), and the 212th FA Brigade (Fort Sill) has produced some new information and a need for restatement of ideas that have appeared in the **FA Journal** and elsewhere.—Ed.*

Deployment

Deployment of TACFIRE is controlled primarily by the schedule of training for the operators and maintainers of the equipment. Although the latest deployment

schedule is still being adjusted, the next units to receive TACFIRE will be the 1st Mechanized Infantry Division (Fort Riley, KS), in February 1981 and the 8th Mechanized Infantry Division (USAREUR) in June 1981. Complete transition to TACFIRE should be completed by 1986.

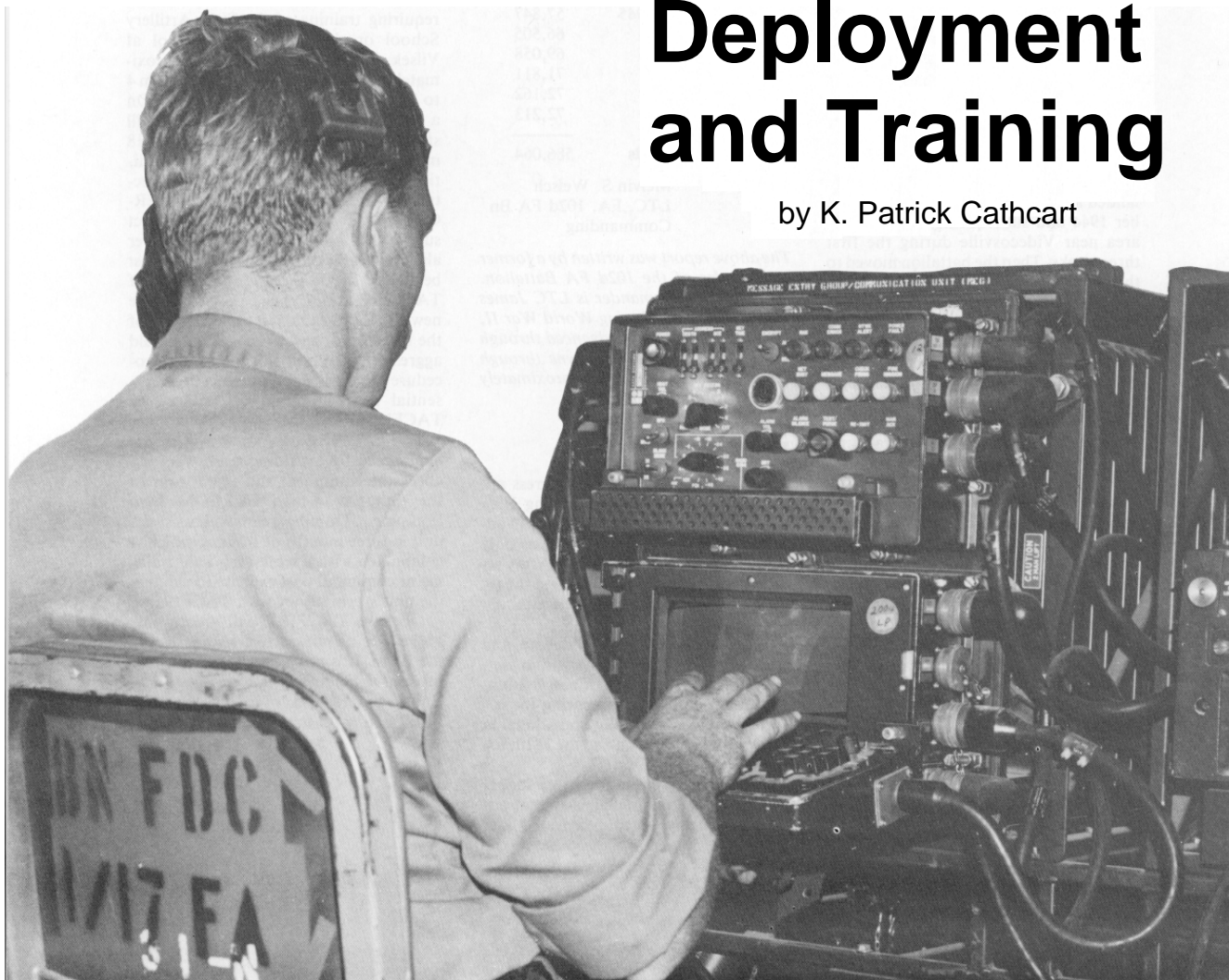
Training

Six separate TACFIRE courses are taught in residence at Fort Sill or the Seventh Army Combined Arms Training Center (CATC) at Grafenwoehr and five additional courses are offered at the unit by the Communications and Electronics Readiness Command's New Equipment Training Teams (NETTs) (figure 1).

TACFIRE

Deployment and Training

by K. Patrick Cathcart



Course	Description	Length	Taught by:		
			USAFAS	Seventh Army CATC	NETT (with unit)
TACFIRE Fire Support	Teaches division artillery and battalion level computer operators (MOS13C) and FA fire direction officers (captains and majors) the applicator of doctrine, tactics, operational concepts, and technical skills to operate and maintain TACFIRE.	11 weeks	X	X	
TACFIRE Command and Staff	Teaches commanders, operations officers/NCOs, and intelligence officers/NCOs the operational concepts and computer data generation capabilities for command and control. Staff workers find out what information is available, what applications the information contains, and the programming control options available to influence machine generated "recommended solutions." Essentially, this course explains what the computer operators can and cannot do for the commander and his staff.	1 week, 2 days	X	X	X
Fire Support Element/Liaison (FSE/LNO)	Fire support elements at maneuver battalion, brigade, and division headquarters receive data processing support from FA battalion and division artillery computers. This course teaches the fire support officers and fire support sergeants (MOS 13F) how to coordinate fire support operations with TACFIRE.	Self-paced, 6 weeks	X	X	
TACFIRE Tactical Operations Center (TTOC)	Trains MOS 13C10 and MOS 17C10/20/30 Variable Format Message Entry Device (VFMED) operators who work at FA battalion and division artillery operations centers. Current and future fire planning and counterfire operations are emphasized.	Self-paced, 6 weeks	X	X	
TACFIRE Operations Specialist	MOS 13C has two phases of initial entry training immediately following entry on active duty. Phase I is Basic Combat Training (BCT), and Phase II is Advanced Individual Training (AIT). The TACFIRE Operations Specialist Course is 13C AIT. The course trains the MOS 13C10 how to operate the VFMED and introduces the soldier to FA operations with TACFIRE.	5 weeks, 4 days	X		
TACFIRE Direct Support Maintenance	Direct support (DS) maintenance for TACFIRE is accomplished by MOS 34GY1 until October 1981, when MOS 34GY1 converts to MOS 34Y. The DS Maintenance Course trains the computer repairer to diagnose and repair TACFIRE mainframes and remote terminals. In the future, this course will be expanded to include repair of the digital message device, the Battery Computer System, Mortar Fire Control Computer, and the Meteorological Data System.		X		
TACFIRE Digital Message Device	Trains the FIST leader and FIST sergeant as well as the forward observer parties how to use the Digital Message Device (AN/PSG-2) to conduct fire missions, to submit fire planning targets, and input intelligence reports. The AN/PSG-2, as do all TACFIRE devices, operates over existing radio and wire communication systems.				X
Battery Display Unit (BDU)	The New Equipment Training Team instructors teach personnel in the unit to install, troubleshoot, and operate the Battery Display Unit which is mounted in an M577 at the battery fire direction center.				X
Variable Format Message Entry Device (VFMED)	Operators who have not attended the TTOC Course or the FSE/LNO Course are trained in the unit by the New Equipment Training Team to install, troubleshoot, and operate the VFMED and remote communication monitoring unit in the operations/intelligence section M577 command track.				X
TACFIRE Battalion and Division Artillery Command Post and Field Training Exercises (CPX/FTX)	The New Equipment Team introduces battalion and division artillery problems, and the command post and field training exercises emphasize practice in performing collective tasks that bring the elements of the unit together as a team.				X

Figure 1. TACFIRE courses.

The design of the TACFIRE training program remains the same as described in MAJ John Martin's article, "TACFIRE—Where Do We Go From Here?" (*FA Journal* January-February 1979). First, individual institutional instruction for key individuals is conducted at Fort Sill or the 7th Army Combined Arms Training Center. The unit is then met by the New Equipment Training Team (NETT) instructors who will initiate the structured on-the-job training (OJT) that will lead to unit proficiency strengthened by battalion and division artillery training exercises.

Replacements

Replacement skill level 1 personnel are provided through advanced individual training currently taught at Fort Sill while level 2 training of the TACFIRE equipment specialist is available through supervised OJT by the battalion computer operator and fire control noncommissioned officer. The skill level 3 soldier will be trained at the Basic Noncommissioned Officer Course (BNCOC) at either Fort Sill or the Seventh Army Combined Arms Training Center. There the program of instruction will closely parallel the current TACFIRE Fire Support Course. Additionally, TACFIRE BNCOC will train the skill level 3 soldier how to teach skill level 2 tasks. The Advanced Noncommissioned Officer Course (ANCOC) will be taught at Fort Sill to 13C soldiers selected by MILPERCEN. Those 13E soldiers who must convert to sergeants first class, MOS 13C, will receive mandatory 13C ANCOC training since there are no E7 positions at the battery level with TACFIRE.

The Field Artillery Officers Basic Course (FAOBC) will have an emphasis on FIST operations and battery level fire direction operations, whereas the Field Artillery Officer Advance Course (FAOAC) will concentrate on battery, battalion, and division artillery operations. The transition, however, from deployment training to replacement training will probably occur in the fall of 1983. (When appropriate, information will be provided in *View From The Blockhouse* when these programs of instruction are available.) Until that time, training for deployment and replacement training will be available as stated in figure 1.

Preparations for deployment are specifically linked to times for equipment delivery, institutional training, and training conducted by the New Equipment Training Team. Actions which should occur before a unit receives TACFIRE are shown in figure 2.

An understanding of TACFIRE is difficult without a description of what it is and what it does. Here the best description appears in FM 6-1, *TACFIRE Operations*, dated September 1979, which is available through normal publications channels. Additionally, if one wishes to see what the equipment looks like in the shelter and in

Actions Prior to Receiving TACFIRE	
N = Date Net Equipment Training Team starts unit training.	
<u>Date</u>	<u>Action</u>
N-18 months	<ul style="list-style-type: none"> • Command briefing by Project Manager, TRADOC System Manager, and Communications and Electronics Readiness Command (CERCOM) representatives • Unit begins planning for FM radio alignment program.
N-18 to N-12	<ul style="list-style-type: none"> • MACOM allocates resources to support fielding and includes in budget.
N-12	<ul style="list-style-type: none"> • MACOM publishes MTOE. • Key personnel in unit briefed by Project Manager, TRADOC System Manager, and CERCOM representative.
N-10	<ul style="list-style-type: none"> • Unit submits equipment requisitions.
N-9	<ul style="list-style-type: none"> • Unit submits personnel requisitions. • Unit starts identifying personnel to receive institutional training at Fort Sill or Seventh Army CATC (USAREUR units).
N-6	<ul style="list-style-type: none"> • Unit selects personnel to attend institutional training, notifies personnel, prepares TDY orders.
N-5 to N-2	<ul style="list-style-type: none"> • Unit receives, deprocesses, and stores TACFIRE equipment.
N-4	<ul style="list-style-type: none"> • Unit coordinates installation support for fielding.
N-3	<ul style="list-style-type: none"> • Institutional training for selected personnel begins (varies from 4 to 12 weeks).
N-2	<ul style="list-style-type: none"> • Material Preparation Team (4 personnel) arrives to assist unit in the issue and checkout of equipment. • Unit completes FM radio alignment program.
N-1/2	<ul style="list-style-type: none"> • New Equipment Training Team (14 personnel) arrives.
N	<ul style="list-style-type: none"> • Equipment training starts.
N+3	<ul style="list-style-type: none"> • TACFIRE validation complete. • FTX planned and conducted by unit.

Figure 2. Deployment checklist.

tactical configurations, the following television tapes are available from your training aids support office:

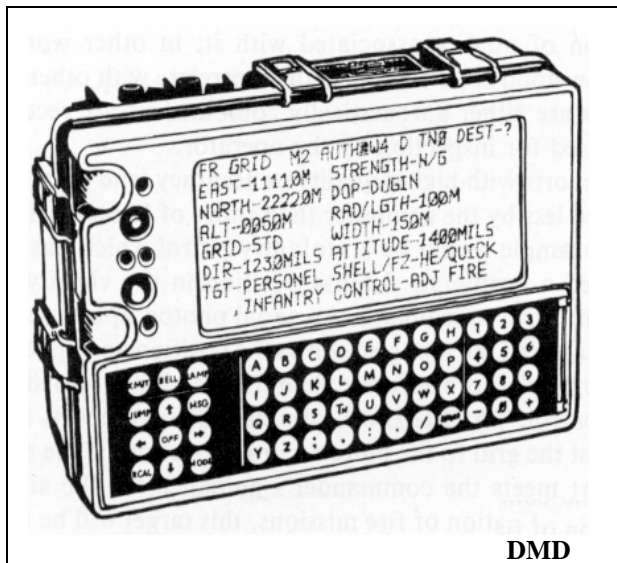
- TVT 6-106 TACFIRE
- TVT 6-107 TACFIRE: Improved Fire Support for the Combined Arms Team
- TVT 6-108 Digital Communications

TACFIRE processing of fire requests

FIST operations begin with forward observer teams who have a digital message device (DMD) to transmit fire requests, subsequent adjustments, or observer locations over any standard FM radio or wire communications means. At the beginning of a specific task the DMD offers a menu of messages for the operator. Some examples are:

M2 Active

A = FR QUICK	H = PREC REG	O = OBSR LOC
B = FR GRID	I = EOM & SURV	P = ATI GRID
C = FR SHIFT	J = HB/MPI	Q = ATI POLAR
D = FR POLAR	K = RDR REG	R = FIREPLAN
E = FR LASER	L = FO CMD	S = MTO
F = SUBQ ADJ	M = SHELREP	T = FREETEXT
G = SA LASER	N = FL TRACE	



The operator selects the message he requires for a particular job and the DMD then prompts the operator through the required entries to complete a message. When this action is accomplished, the message appears on the DMD screen for final review prior to transmission to the battalion TACFIRE computer. After the operator depresses the transmit (XMIT) button, the complete message is transmitted in approximately one second and is acknowledged by the battalion TACFIRE about one second later. (This is a good example of the kind of speed TACFIRE can achieve.)

Two seconds after the forward observer's fire request is transmitted, the digital plotter map in the TACFIRE battalion computer center moves to the grid location of the mission and plots the location where the observer wants the rounds to impact. Almost simultaneously, a copy of the mission is sent to the maneuver battalion's fire support element as a message of interest.

Eight seconds after the forward observer pushed the XMIT button, the fire commands are on the way to the batteries and the forward observer is getting his message on the DMD screen. The message will say which battery is firing in adjustment and how many rounds will be fired in effect.

At the battery fire direction centers, fire commands are printed on the battery display unit and are announced by voice to the guns. Once the batteries have begun to fire, the following voice transmissions between the battery fire direction center and the observer are made:

"TARGET TWO SIX, SHOT, OVER"

"SHOT, OUT"

"TARGET TWO SIX, ROUNDS COMPLETE, OVER"

"TWO SIX, ROUNDS COMPLETE, OUT"

The only voice traffic that is sent over the fire nets during a mission are the announcements that cannot be sent by the battery display unit. When the Battery Computer System is fielded in 1982, even this voice traffic will be eliminated.

When the mission has ended, the observer sends an end-of-mission and surveillance message. This message generates an end-of-mission message to be prepared for the batteries and a mission-fired report of how much ammunition was expended. The battalion computer operator reviews these messages and takes actions to notify the batteries that the mission has ended and to decrease the batteries' ammunition count by the amount expended. Operator action on the mission-fired report automatically sends target information and an ammunition decrease for the battalion to the division artillery computer.

All solutions to the engagement of every target are in accordance with the field artillery battalion commander's guidance for priority, volume of fire, fire unit and munition selection, plus all existing fire support coordination measures. The same kind of guidance can be applied for target intelligence information or fire plans.

The machines are tools of great power placed in the hands of the soldiers who need them for command and control of artillery operations. Whether today's soldiers can be trained to operate and maintain these tools is a fairly common concern expressed about TACFIRE. These same kinds of concerns have always been expressed throughout history for the "modern" weapon or procedure of the time—from catapult to cannon; or from horse drawn artillery to today's self-propelled howitzers. The US Artillery has been incorporating computer technology since 1946 and its presence in TACFIRE is an example of our continual endeavor to do a tough job better, faster, and easier. An examination of TACFIRE capabilities (figure 3) will give an idea of the kinds of operations TACFIRE is capable of performing.

FA battalion	Division artillery
<ol style="list-style-type: none"> 1) 100 fire units (batteries). 2) All calibers. 3) 99 known points. 4) 31 fire plans. 5) 300 target records. 6) 30 active fire missions at any one time. 7) 28 message of interest types and 12 individual message of interest functions operational at any one time. 8) 99 observer locations. 9) Simultaneous Operaiton over eight communications nets AM, FM, or Wire. 	<ol style="list-style-type: none"> 1) 100 fire units (batteries, naval gun sections, or TACAIR units). 2) Up to 30 fire units to a fire plan. 3) 31 fire plans, 2-hour maximum length, 4-phase maximum. 4) Target analysis for high explosive, chemical, and nuclear munitions for delivery by artillery and naval cannons, artillery rockets and missiles, and tactical aircraft. 5) 1,364 target records. 6) 3 standing requests for information (target). 7) Information for up to 20 subscribers.

Figure 3. TACFIRE capabilities.

Fire mission processing is an example of only one functional area that the machines have automated. There are seven general applications that TACFIRE performs:

- Fire support coordination measures.
- Ammunition and fire unit status.
- Meteorological data storage and retrieval.
- Fire mission processing.
- Target intelligence processing.
- Fire planning.
- Survey computations and storage.

There is also a program that allows the machines to perform self-tests to isolate equipment faults or failures.

Fire coordination measures may be entered to describe boundaries, coordinated fire line, forward edge of the battle area, fire coordination areas, and other tactical control measures as required. If a measure is violated, the operator receives a warning of what measure is violated and what unit established the control measure.

Ammunition and fire unit status keeps track of where the batteries are (or will be), the kind of unit it is, and the amount of ammunition available. The operator will be warned if ammunition is being consumed faster than it can be resupplied.

To get the best artillery accuracy available, meteorological information is stored and accessed each time a fire mission is processed. At division artillery, forecast conditions for radioactive fallout and chemical hazard meteorological conditions are also maintained which can then be used for nuclear and chemical target analysis.

The core of the most extensive and complex computer operations takes place during fire mission processing. Here there are an extensive number of options available to arrive at the kinds of fire mission solutions that the commander wants for a particular phase of the battle.

Requests for fire can be placed in priority depending on the source, location, or even the kind of target that is being attacked. All solutions reflect the best munitions and fire units that are available to defeat the target according to the commander's guidance. For example, if one battalion is insufficient, a request for additional fire is sent to a battalion with a mission of reinforcing or general support reinforcing. If both battalions still cannot defeat the target, additional fire will be requested from division artillery. If division artillery assets cannot defeat the target (or are not available) a TACAIR recommendation may be generated at the division fire support element. The options, on a mission by mission basis, are almost endless; yet each recommendation has the same high quality solution.

The ability to store targets is not a sophisticated function for a computer, but the routines in TACFIRE go far beyond just the storage of target information. The information that is reported from various agencies has an indication of quality associated with it; in other words, "How good is it?" Reports that correlate with other reports are either automatically combined or are recommended for inspection by the operator.

Reports with higher quality or accuracy tend to be adjusted less by the computer than those of lesser quality. An example would be an infantry patrol which has reported a hostile air defense position in the vicinity of specific grid coordinates. An aerial photographic reconnaissance of the area also shows the position and appears to be much more accurate than the location reported by the patrol. TACFIRE will combine the two reports and adjust the grid to the more accurate location. If the new report meets the commander's guidance for the automatic generation of fire missions, this target will be recommended to the computer operator for immediate attack. Target intelligence processing is the exclusive province of the division artillery computer. This information is available on a single or standing request by maneuver battalion and field artillery battalion headquarters elements and higher. Requests may be for such targets as:

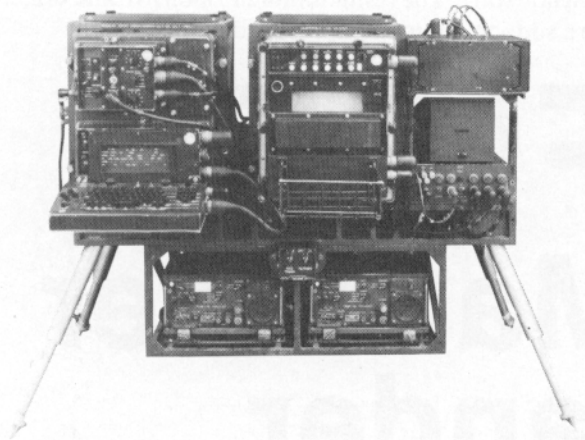
- In a zone.
- Older than or newer than a certain time.
- By type.
- By quality of reporting agency
- By size.

TACFIRE is of great assistance in computing a fire plan. To compute the appropriate volume of fire required to defeat 20-30 targets, select the correct shell and fuze combinations by fire unit, and assign and allocate fire unit assets on a minute by minute schedule is a tedious and error creating process. Once the schedule is set, ballistic calculations must be made for each battery for the targets to be attacked by that battery. For example, if a new meteorological message arrives, if a battery moves,

or if a target is added or deleted, new computations are required. TACFIRE automates all these activities to allow recomputations in 20 to 45 seconds.

Using electronic data processing support, staff officers and noncommissioned officers will have time to make better decisions. Individuals still have to interact, but they have better information about what they can and cannot do about a specific target array. And, just as with other applications addressed so far, the commander's guidance is applied to each target and every fire plan schedule that is generated by the computer.

TACFIRE can solve the same survey schemes normally solved by survey parties. The most useful application of the survey program will probably be in control point storage and retrieval. The control point file can be accessed by any subscriber with a Variable Format Message Entry Device (VFMED) or any computer center.




VFMED

Target analysis is also automated by TACFIRE. Targets can be attacked with high explosive, chemical and nuclear munitions delivered by artillery cannons, artillery missiles, artillery rockets, naval gunfire, and TACAIR. The division fire support element has primary control over these applications; however, the brigade fire support elements can access routines for analysis of a single target. These same routines are used for fallout prediction and to assess unit vulnerability to nuclear effects.

From fire missions to fire planning the artillery job has been defined in operational terms with TACFIRE. The only area that has not been explained is the maintenance and diagnostic ability of the computer. TACFIRE will not fix itself; however, it does tell the operator when it is working and when it is not. TACFIRE's maintenance software program is constantly checking all computer components and if a component fails a test the operator is warned of this condition. The operator is also given instructions to isolate problems to a specific card series to be tested by the Module Test Set. If a card fails in the

module test set, it is replaced by one in the Mission Essential Parts Kit. At organizational level, it is probably easier to fix a TACFIRE than it is the 5-ton truck that hauls the shelter and generator.

TACFIRE has survived challenges to its funding, design, operations, testing, ability to be used by soldiers, fielding, survivability, and acceptance by troops because of the tremendous improvement it provides in the timely and accurate processing of field artillery functions. Its value as a combat multiplier is clearly evident when weighed against manual, FADAC, or hand-held calculator procedures. Anyone who has seen a horseshoe-shaped 12- to 18-man battalion fire direction center versus a 3-man team in a computer shelter controlling the battalion's three 8-gun batteries while also giving computer support for other agencies has to agree that for all the things TACFIRE can do versus the things it cannot, it is the only way to solve the artillery problems of today's war. Unfortunately, TACFIRE is not a 30-dollar shoebox size computer with a console, display, keyboard, and map, containing 10 digital radio receiver transmitters, with a total weight of three pounds, that can be operated on two D-cell batteries for six months under water. A TACFIRE that will do that will probably be the subject of another *FA Journal* far into the future. 

K. Patrick Cathcart is a Field Artillery Operations Specialist – Automatic Data Processing – in the TACFIRE Division of Tactics, Combined Arms and Doctrine Department, US Army Field Artillery School.

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.

The 1st Brigade Commander issues guidance to his staff:

" . . . and we will conduct a supporting attack against Heimbach ridge east of Highway 12. S2, get a list of all reported enemy armor—I don't want any targets over two hours old. S3, plan on a 20-minute preparation—concentrate on ATGM and artillery targets. Division has given us only four close air support sorties. Do not use them in the preparation; we'll keep them on call. I want your draft operations order and fire support plans in 30 minutes. That's all."

Immediately, the brigade S2, S3, air liaison officer (ALO), and commander of the attached attack helicopter unit converge upon the brigade fire support officer (FSO).

"Can you get a list of known or suspected armor targets in our zone? I only want those reports which are less than two hours old."

"I'll need some good SEAD (suppression of enemy air defense) fires to keep my Cobras from getting clobbered."

"Can you get the preparation worked up in only 30 minutes?"

"I'll need an airspace coordination area to get my aircraft in and out safely."

"We'll need to modify the coordinated fire line (CFL) for this operation."

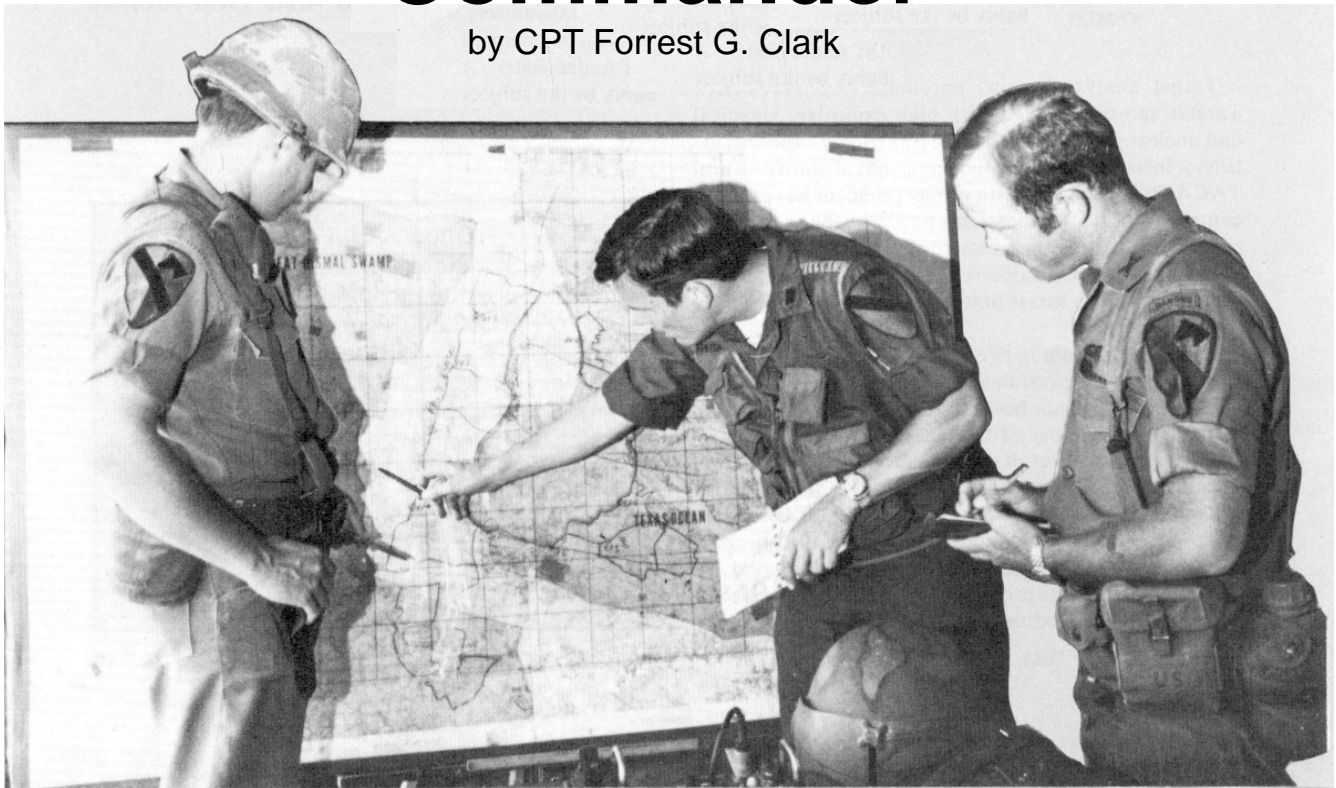
"What fire support do we have available to support our attack?"

For a unit equipped with TACFIRE this scene is a routine occurrence, since the brigade staff understands the capabilities and potential of tactical automated data processing. With his Variable Format Message Entry Device (VFMED), a remote computer terminal, the FSO can provide timely answers to the questions posed by the brigade staff. The result is more responsive and effective fire support planning and coordination.

TACFIRE

And The Maneuver Commander

by CPT Forrest G. Clark



Within the next several years, most of the Active Army will receive the TACFIRE system. Surprisingly, there is very little existing doctrine concerning how to best utilize TACFIRE's capabilities to support maneuver units. There are several reasons for this:

- Few maneuver personnel are knowledgeable of TACFIRE's capabilities, and even fewer are aware of how these capabilities can enhance maneuver operations.
- Artillerymen are equally unaware of TACFIRE's potential. This is partially due to the fact that currently only one division artillery and one FA brigade are equipped with TACFIRE.
- Virtually no published material exists which discusses tactical operations with TACFIRE. For example, with the exception of FM 6-1, since March 1978 only two articles on TACFIRE have appeared in the *Field Artillery Journal*, and neither of these addressed TACFIRE's contribution to the maneuver force.

In an attempt to initiate a dialogue on the maneuver commander's use of TACFIRE, this article will discuss several TACFIRE functions that will greatly increase an FSO's responsiveness to the maneuver commander and his staff. They include the following functions:

- Artillery target intelligence.
- Nonnuclear fire planning.
- Ammunition and fire units.

The Artillery Target Intelligence (ATI) program provides for the collection, processing, and dissemination of target information. Here, the TACFIRE computer at division artillery can store 1,364 targets or target indicators, including shell reports, which is far more than any brigade S2 could collect, sort, and analyze. As a result, the brigade commander now has available, through the FSO, a greater volume of information than has previously been available.

Artillery target intelligence

"Can you get a list of current known or suspected armor targets in our zone? I only want those reports which are less than two hours old."

The ATI files contain data from various target acquisition sources, some of which are shown in table 1. (Currently, the brigade S2 must rely on organic battalion S2s for spot reports.) These pieces of information are time-consuming to record, correlate, and update. This information is, however, available as input to TACFIRE by forward observers, FSOs, radars, aerial observers, the division fire support element (FSE), the division artillery counterfire section, and the division artillery operations and intelligence section. Additionally, data can be received from agencies such as the CEWI battalion, US Air Force, military intelligence units, and survey parties.

Retrieval of the ATI data from the TACFIRE system is faster than through non-automated means. The FSO can search the division artillery files for specific categories of

Table 1. Sources of information to TACFIRE.

1) Forward observers	11) Photo interpretation
2) Long range reconnaissance patrols	12) Tactical air reconnaissance
3) Aerial Observers	13) Communications intelligence
4) Field artillery survey observation posts	14) Electronic intelligence
5) Sound ranging	15) Non-artillery observers
6) Flash ranging	16) Prisoners of war
7) Counterbattery radar	17) Counterfire target production element
8) Countermortar radar	18) Division fire support element
9) Ground surveillance radar	
10) Side-looking airborne radar	

information in response to the requirements of the maneuver commander. Table 2 contains a list of criteria which may be used in searching the ATI files. Any combination of these criteria may be specified for a given search. Given the commander's guidance, the FSO can access, search, and receive from the division artillery

Table 2. Criteria used to search Artillery Target Intelligence (ATI) files.

1) Zone of responsibility of unit (within boundaries)
2) Circular area (grid and radius)
3) Rectangular area (length, width, and attitude)
4) Thrust area (line and distance on each side)
5) Size of target (within specified maximum and minimum limits)
6) Strength of target (within specified maximum and minimum limits)
7) Accuracy of report (fair, good, or excellent)
8) Recency of report (based upon time report entered in files)
9) Type of target (description)
10) Type of report (shell report, grid location report or combined from several reports)
11) Targets already fired on
12) Confirmed targets
13) Suspected targets (not confirmed)

computer, a printout containing data on each target on file which meets the specified criteria—normally within three to five minutes. Compared with manually sorting through a card file and hand copying the desired information for presentation to the commander, TACFIRE's rapid and accurate sorting of information is a significant aid and will soon become the S2's most reliable information source.

Nonnuclear fire planning

"I'll need some good SEAD fires to keep my Cobras from getting clobbered."

"Can you get the preparation worked up in only 30 minutes?"

The Nonnuclear Fire Planning (NNFP) function is used to develop fire plans and to schedule artillery fires and naval gunfire. The battalion computer can store data for 31 distinct fire plans for contingency operations. Each plan can include up to 150 targets and 15 separate

fire units (batteries or ships). The FSO, through his remote terminal, can develop fire plans to support planned operations without interfering with the current fire support activity.

Using the ATI function previously discussed, the FSO can select potential targets for inclusion in the plan. For counterfire programs, artillery and rocket targets would be specified, and for SEAD, air defense artillery targets would be selected. A variety of target types can be chosen for a preparation, depending on guidance received from the maneuver commander. The flexibility of search criteria under the ATI function allows for equal flexibility in fire planning. As such, the FSO can input any special instructions concerning engagement of specific targets and subsequently have the computer analyze the target list to determine the most effective tactical and technical fire control to successfully engage each target. The computer then produces a schedule of fires for the fire plan and, after the FSO makes any desired changes to the schedule of fires, it calculates and transmits fire commands to each affected fire unit. The entire sequence, from target selection to fire commands, can be completed in less than 30 minutes. Plans can also be stored and continually updated for use at any time.

With TACFIRE, quick response to short-notice requirements for fire plans is a reality. With the time saved, the FSO can spend more time analyzing and less time filling out worksheets. This is especially valuable in preparing such on-call programs as counterfire, counter-preparations, and SEAD.

Fire support coordination measures

"We'll need to modify the coordinated fire line for this operation."

"I'll need an airspace coordination area to get my aircraft in and out safely."

Updated battlefield geometry data provides the means to establish fire support coordination measures. The FSO uses the Variable Format Message Entry Device to input measures established by the maneuver commander. All fire support agencies within the division are provided this information for planning and coordinating fires. The computer then considers these measures during all computations and alerts the computer operator at the fire direction center should a violation occur. Establishing and disseminating fire support coordination measures usually takes less than a minute.

The capability to establish and rapidly disseminate fire support coordination measures to all other fire support agencies is extremely valuable in updating the tactical situation on a fast-moving battlefield. This is especially important when coordinating TACAIR and attack helicopter support, where airspace coordination areas must be established on short notice. TACFIRE is a great improvement over manual means of establishing and managing fire support coordination measures.

Ammunition and fire units

"What fire support do we have available to support our attack?"

The FSO must be continuously aware of the fire support means available, to include unit status and location and ammunition on hand. The ammunition and fire unit function in TACFIRE provides the means for continual update and dissemination of this information. The computer is instructed to automatically transmit any changes in unit locations, strength, ammunition levels, operational status, or mission to all FSOs. The FSO can also request specific information on any fire unit stored in the computer. TACFIRE's fire unit file includes all Field Artillery, Naval, and Air Force assets available to support the maneuver commander. Rapid access to this information will enable the FSO to provide complete, accurate, and timely advice to the maneuver commander.


Conclusion

Because of its recent arrival to the field, most artillerymen and maneuver personnel are unaware of TACFIRE's capabilities and potential; however, this situation will change during the next several years as additional field artillery units receive their TACFIRE equipment. Hopefully, it will also generate more thought on the tactical utilization of TACFIRE.

This article is not intended to be either a technical description of the TACFIRE system or an SOP for fire support officers and maneuver staffs. I have tried to emphasize the *REAL* importance of TACFIRE:

- To increase effectiveness in managing all fire support means available to support the maneuver force.
- To provide responsive, accurate information through the use of tactical automated data processing.

TACFIRE is much more than a super-FADAC which merely speeds up the ballistic computations in the fire direction center. TACFIRE is the first effort at automation of the command and control function of the fire support system. It provides accurate target information, rapid implementation of fire support coordination measures, and responsive fire planning. It aids in effective management of scarce fire support resources, resulting in improved support to the maneuver force.

Improved fire support to the maneuver commander is TACFIRE's greatest contribution to combined arms operations. Each field artilleryman must enhance his professionalism by educating himself on the TACFIRE system and then brief, teach, and preach TACFIRE to maneuver personnel. Only then will TACFIRE's true value be appreciated by all members of the combined arms team. 

CPT Forrest G. Clark is assigned to the Communication and Electronics Command New Equipment Training Team 2 as an instructor.

REDLEG

NEWSLETTER

Army basic training toughened

Plans for a tougher eight-week basic training (BT) program have recently been announced by the US Army Training and Doctrine Command (TRADOC). The plans call for more demanding physical conditioning, training in additional soldier skills, and the raising of course standards.

The new program will go into effect at some training installations in FY 81 and is planned to include all training installations by the end of FY82.

The revamped BT program centers on the belief that a physically fit Army begins with tough demanding standards established in BT and continues through all phases of a soldier's professional growth. Increased emphasis will be placed on basic soldier skills as well as new technical subject materials such as map reading and communications.

Individuals will be pushed to their physical capability and will receive increased training in the specific skills needed to become professional soldiers, such as weapons familiarization and qualification, individual tactical training, marches and bivouacs, and basic rifle marksmanship (BRM).

Plans also call for the combat arms oriented One Station Unit Training (OSUT) courses to be expanded by one week in FY82.

Rules changed for veterans preference

Effective 1 October last year, retired members of the armed forces (1) who are not disabled veterans and (2) who retired at or above the rank of major or lieutenant commander are no longer eligible for veterans preference in competitive examinations and appointments.

The change is contained in the Civil Service Reform Act of 1978.

However, disabled veterans and those who retired below the rank of major or lieutenant commander will continue to receive veterans preference.

The decision to discontinue veterans preference for high-ranking, nondisabled veterans is based on the grounds that they are fully equipped to compete for Federal jobs on an equal basis with the civilian population.

Officer Advanced Courses

To improve the understanding of combat arms techniques and to provide opportunity for exchange of ideas, a program exists to send combat arms officers to officer advanced courses (OAC) of combat arms branches. This "cross-fertilization" has for years enhanced the operation of the combined arms team. A small number of experienced Field Artillery officers who have not attended an advanced course are chosen to attend either the Infantry, Armor, or Air Defense Artillery OAC by submitting a DA Form 483 (Officer Preference Statement) to MILPERCEN, DAPC-OPE-F, or by contacting the FA Management Section, Autovon 221-0116/0118/7817/0187.

VA head testifies on Agent Orange

In testimony before a Congressional Subcommittee, VA Administrator Max Cleland assured the members that "no eligible veteran who is concerned about Agent Orange exposure will be denied Veterans Administration medical care."

Cleland was testifying before the Subcommittee on Oversight and Investigation of the House Interstate and Foreign Commerce Committee.

Not All Answers

He continued by stating that "unfortunately we cannot provide all the answers to the many questions being raised today, nor will we be able to do so in the near future." But he went on to describe a comprehensive government-wide effort to find answers to the many questions about Agent Orange exposure.

The herbicide Orange was widely used during the Vietnam conflict as a defoliant.

Free Pamphlet

The known scientific information and a summary of government efforts to deal with veterans' Agent Orange fears are summarized in a VA pamphlet, "Worried About Agent Orange," which is available at any Veterans Administration office.

Ideas from the field

Obtaining information concerning the Army's various commissioning and appointment programs is often difficult for enlisted soldiers. In an attempt to overcome this problem, the Military District of Washington (MDW) Personnel Actions Branch conducts an officer procurement seminar.

The seminar is designed to assist soldiers in applying for the Branch Immaterial Officer Candidate Course, warrant officer direct appointment, and the US Military Academy Preparatory School. Information is also made available for soldiers interested in the active duty ROTC scholarship program.

Application packets containing information letters, fact sheets, and blank forms are provided to each attendee.

For more information on establishing an officer procurement seminar, contact MDW Personnel Actions Branch by calling Autovon 223-0228 (commercial (202) 693-0228) or by writing to the following address:

Commander
US Army Military District of Washington
Attn: ANPE-AG-MPA (SFC Dennis)
Fort McNair
Washington, DC 20319

Added drills sought for cannoners

Lieutenant General LaVern E. Weber, Chief of the National Guard Bureau, recently asked Congress for the authority to provide four additional paid drills annually to Army Guard artillerymen to improve proficiency.

The extra drills, according to General Weber, are needed to improve the proficiency levels in 155-mm and 8-inch howitzer battalions in moving and guarding nuclear weapons. The extra drill periods would be authorized for 50 to 60 key personnel in each artillery battalion.

Presently, the artillerymen meet for 48 paid drills a year.

Discount car rental rates

New special car rental rates are now in effect for military personnel. Discounts offered by Avis, National, and Hertz are available to active and retired Department of Defense (DOD) and Coast Guard personnel, military or civilian, National Guardsmen, and reservists on official business or for personal use. Other company rates apply only to active duty personnel on official orders.

Government travel orders, DOD ID cards, or car rental company ID cards will be accepted as proof of eligibility for the special rates. Travel orders will be accepted in lieu of a cash deposit when official travel and cash payment is made, but a credit card will help if rental is arranged for personal reasons. Otherwise, a cash deposit and other identification may be required.

Rental discounts vary from company to company. For example, American International, Budget, Dollar, and National offer fixed cost per day or week with no charge for mileage. Avis and Hertz have discontinued all flat rate programs and now offer DOD travelers a 50 percent discount from time and mileage rates published for each rental location.

Avis and Hertz discounts are applicable to all size cars. However, even with a 50 percent discount, their rates will normally be higher than GSA Motor Pools, GSA contractors, and those companies offering flat rates on compact, standard, and full-size cars for official or personal use.

Cars are normally returned to the renting location. On one-way rentals, Avis and National offer a 50 percent discount while Hertz offers a 40 percent discount from regular time and mileage rates. With the exception of GSA motor pool cars, all rentals require the customer to pay for gasoline used.

Rental cars selected for official travel must permit satisfactory accomplishment of the mission at the lowest possible cost to the government. Problems or complaints should be brought to the attention of the manager of the renting location or the company representative.

For more specific information or to obtain company ID cards contact the following:

American International Rent-A-Car	Mr. Bill Salls 3957 Sapphire Drive Encino, CA 91436 TEL: 213-986-8960
Avis Rent-A-Car System, Inc.	Mr. Bob Weaver 6301 Ivy Lane Greenbelt, MD 20770 TEL: 301-441-3405
Budget Rent-A-Car Corporation	Mr. Thad Kilby 1465 Northside Dr NW Atlanta, GA 39318 TEL: 404-351-7555
Dollar Rent-A-Car System, Inc.	Mr. Gary Valetti 2805 Jefferson Davis Hwy Arlington, VA 22202 TEL: 703-836-7677
The Hertz Corporation	Mr. Richard Sullivan 700 N Fairfax Street Alexandria, VA 22202 TEL: 703-836-5333
National Car Rental	Mrs. Linda Enis 5205 Leesburg Pike Suite 211 Falls Church, VA 22041 TEL: 703-671-6400

Toll-free finance office calls

Although the toll-free finance office numbers for each service connect with as many as a dozen phones, all are usually over-taxed during the first and last 10 days of each month. As payday approaches, individuals call about problems, and after payday they call back to find out why errors were not corrected.

Finance officers indicate that the best time to use these toll-free numbers is during the early working hours on the 10th to the 20th of the month.

The finance office toll-free numbers are:

Army — 1-800-428-2290 (except Indiana residents who must call commercial 317-542-3911).

Navy — 1-800-321-1080 (except Ohio residents who must call commercial 216-522-5955).

Air Force — 1-800-525-0104 (except Colorado residents who must call commercial 303-370-7051).

Marine Corps — No toll-free number. Call commercial (816)926-5268.

Coast Guard — 1-800-638-0250 (except Maryland residents who must call commercial 301-436-7775).

Officer HAAP changes announced

Beginning 1 October last year, post commanders in CONUS and Hawaii have more say in homebasing assignment decisions on commissioned and warrant officers.

Under the Army's Homebase/Advanced Assignment Program (HAAP), soldiers are informed of their next assignment in CONUS before going on an overseas tour. This affects soldiers SGT/SP5 to lieutenant colonel stationed in CONUS and Hawaii who receive orders to dependent restricted overseas areas.

Post commanders have continually expressed an interest in being a part of the homebasing decisions on officers; particularly when returning members to the same installation. Because of that interest it was decided to include those commanders in the decision-making process.

The decision to include post commanders in the HAAP for commissioned and warrant officers does not reduce the assignment commitment to individual officers since MILPERCEN retains final authority in all decisions under HAAP.

To involve post commanders in the decision-making process, the following procedures are now being used:

- When alerting an officer for a dependent restricted overseas short tour, the assignment manager will inform the officer of his or her options under the HAAP.
- If the officer wishes to return to his or her current installation under the HAAP, he or she must apply through the post commander to MILPERCEN. The post commander's comments on the DA Form 4187 will be

considered in making homebase assignments. This, however, does not give the commander veto authority on officer HAAP assignments since MILPERCEN will continue to make the final decision.

- Requests for a HAAP assignment must be forwarded to MILPERCEN to arrive not later than 30 days after the initial alert. If the request is not received within 30 days, an advanced CONUS assignment will be determined by MILPERCEN.

The procedures for enlisted homebase assignments have not changed. In individual cases where the post commander does not agree with enlisted homebase assignments, the commander may address the action to the MILPERCEN Commander for decision.

Discharge review program

Some veterans with less than honorable discharges now have until 1 April 1981 to file for Department of Defense (DOD) review of their discharges.

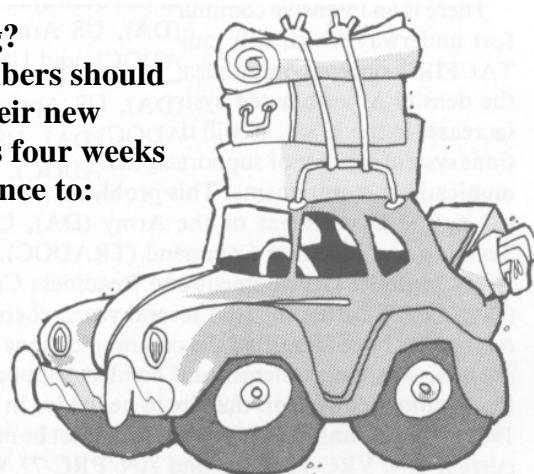
Eligible veterans (those discharged prior to 1 April 1966) include those who served in World War I and II, the Korean War, and Vietnam Conflict. The discharges will be reviewed for possible upgrading by the service discharge review board.

During the past two years, several veterans have had their discharges changed. The original deadline of 1 January 1980, was extended because of a large number of applications.

Former soldiers with less than honorable discharges can write for full information to: Discharge Review Board, P.O. Box 21, St. Louis, MO 63166.

The application for discharge review will be treated as confidential.

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



**Field Artillery Association
c/o Fort Sill Museum Fort
Sill, OK 73503**

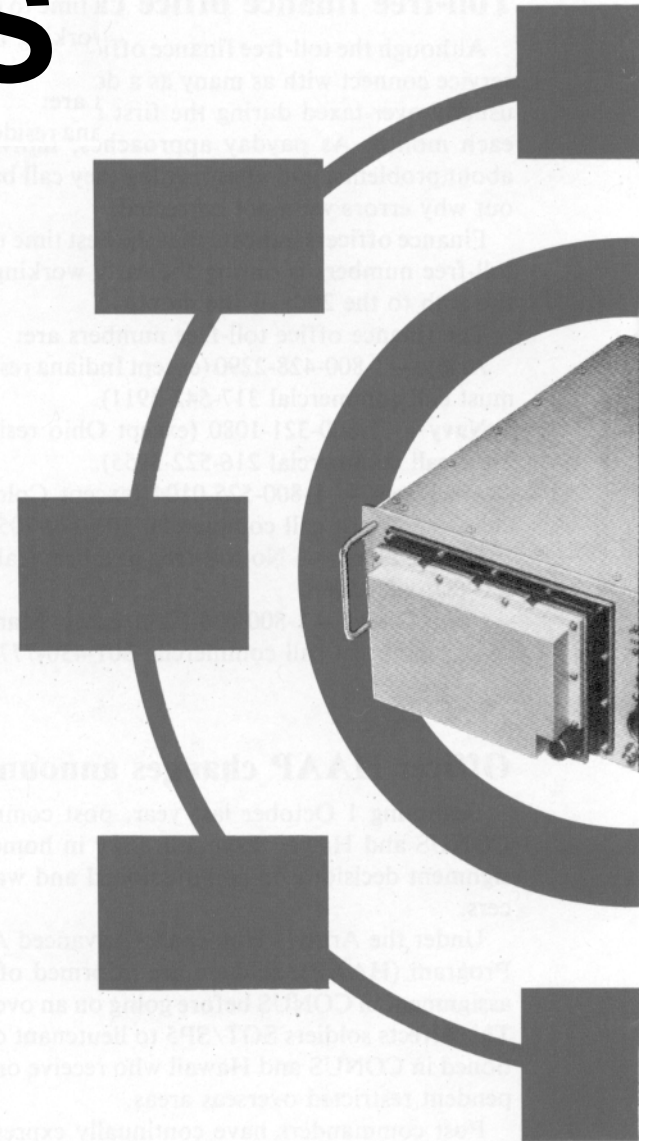
PLRS/JTIDS Hybrid

by MAJ James L. Ondo

A system that meets TACFIRE requirements for secure jam-resistant digital data communications

TACFIRE is designed to send and receive digital messages over all contemporary communications systems. Here multichannel circuits are used whenever available, since they provide the best quality communications. Too often, however, due to the mobility of the TACFIRE elements and the slow tear-down and setup time of the multichannel network, these circuits are unavailable, which in turn places more reliance on radio and wire. High frequency (HF) radios are rarely used for TACFIRE because of the relative unreliability of the current HF radios. Additionally, field wire uses are limited due to the survivability tactics of rapid movements and dispersion, thus placing the heaviest reliance on very high frequency (VHF) and frequency modulated (FM) radios.

There is an intensive communications development effort underway which will radically change the way the TACFIRE system communicates on the battlefield. As the density of automated systems fielded by the Army increases in the 1980s, so will the need for a communications system capable of supporting increased digital communications requirements. This problem has been studied by the Department of the Army (DA), US Army Training and Doctrine Command (TRADOC), and US Army Materiel Development and Readiness Command (DARCOM) during the past several years where numerous studies have identified the communications needs of sensors, weapons systems, and combat support battlefield automated systems that are to be fielded in the early 1980s. These communications needs cannot be met by the current AN/VRC-12 series and AN/PRC-77 VHF-FM radios due to their characteristic range limitations, vulnerability to jamming, and user delays. The studies point overwhelmingly to the need for a new digital data communications capability.



The Battlefield Automation Management Plan (BAMP) identified those systems which require data communications while the Automated Battlefield Interface Concept (ABIC) specified interface requirements. An update of the Communications Support Requirements (COMSR) data base described the specific communications links, or "needlines", between these systems, while the Signal School's Mission Area Analysis (MAA) examined several alternatives to satisfy the needs. It becomes increasingly clear that among all candidate digital communications schemes, the Position Location Reporting System (PLRS)/Joint Tactical Information Distribution System (JTIDS) Hybrid is the only alternative that can satisfy the bulk of the Army's data communication requirements and be fielded by the mid 1980s.



Effectiveness of these programmed battlefield systems depends on communications. The powerful advantage of their data processing and computational speed can never be achieved unless the information they generate is passed between the sensors, decision makers, and fire control systems in near real time (delays of seconds become critical). Experience with the TACFIRE system shows that current radio communications frequently inhibit fire support during intense operations.

The VHF-FM range is limited by radio line-of-sight. Retransmission of the net is required to extend range or to provide reliable communications in hilly terrain or urban areas.

The radios have no protection against jammers. Although TACFIRE can work through moderate jamming, strong jammer signals "capture" the FM receivers, thus preventing receipt of messages.

Analysis of heavy communications loads on TACFIRE FM digital fire nets during a one-hour surge period showed utilization from 71 to 100 percent. (The average waiting time for the net was 24 seconds.) Delays of this magnitude are intolerable by most of the TACFIRE system, especially where Firefinder or Copperhead are involved.

To be effective, TACFIRE requires near real time data communications. The adverse effects of delay were investigated by the US Army Material Systems Analysis Activity (AMSAA) and it was determined that elimination of message delays increased the effectiveness of the division artillery TACFIRE system as follows:

Number of battery missions	Up 67 percent
Number of targets engaged	Up 91 percent
Percent of acquisitions fired	Up 31 percent
Effect of fires	Up 30-50 percent

It is clear that effective communications determine the effectiveness of automated systems and, as the Army moves to greater sophistication, requirements for a specialized data communications system become urgent. Without real time data communications, resistance to jamming, and extension of range, the powerful systems fielded in the 1980s will not operate to full potential.

System description

The PLRS/JTIDS Hybrid (PJH) takes its name from two developmental systems:

Requirement

The coming automated systems demand specialized data communications. In addition to the functional area of fire support automated by TACFIRE, other automated functions that will require near real time data exchange include:

- Air Defense Artillery (ADA)—Man Portable Air Defense (MANPAD), Short Range Air Defense (SHORAD), and High to Medium Air Defense (HIMAD).
- Intelligence—All Source Analysis System (ASAS) and associated sensor systems.
- Sensor netting and target integration—the Netted Universal Radar System (NURADS).
- Command control information netting—the Command Control and Subordinate System.

- The Position Location Reporting System (PLRS—a joint Army/Marine development that, by itself, will be fielded in 1983.

- The Joint Tactical Information Distribution System (JTIDS)—a joint Army/Air Force/Navy development that is now in initial production.

The PLRS is designed to provide automatic position location, navigation, and user identification to manpack vehicular and airborne users in a division area. A small hand-held user readout device is used to enter requests for self-location or navigational information to a designated point. The user readout is connected to a 14-pound radio-like device known as the PLRS user unit (UU) and displays location in UTM coordinates and navigation data by direction and range. The UU contains the electronics to run the user readout and the radio and antenna to link the user to the PLRS. The heart of the PLRS is the PLRS master unit (MU), a sheltered computer center that controls the PLRS network for a division area. The computer calculates user positions by accurately triangulating the time of arrival (TOA) of messages received from various UUs and automatically tracks and updates positions simultaneously for up to 370 active users. The MU displays all PLRS users in the division, giving the commander accurate real time knowledge of friendly locations. The PLRS also allows limited free-text communications between users and the MU, wherein short OPCODE style messages can be sent.

The Joint Tactical Information Distribution System provides airborne and ground station users with secure, jam-resistant communications, position location, navigation, and identification information. The JTIDS Class I terminal, which is in low rate initial production, is being used on board the Air Force E-3A, Airborne Warning and Control System (AWACS) aircraft. The JTIDS Class II System, smaller and lighter in weight, will fit on board Army sheltered automated systems such as TACFIRE. JTIDS terminals are more capable than the PLRS UU, being able to transmit large volumes of data.

The Position Location Reporting System by itself cannot provide data communications for the TACFIRE System. On the other hand, JTIDS Class II radios are too large and require too much power for use in ¼-ton trucks or as a manpack system. But the combination of both systems, coupled with modifications to the MU and PLRS UU, can provide the communications support for the TACFIRE system as well as other automated systems in the division area. By integrating two mature developmental systems, the PLRS/JTIDS Hybrid can be fielded in 1986.

The modified PLRS UUs are called Enhanced PLRS UU (EPUUs) and have new internal circuits which allow user-to-user communications. The EPUU will be the same size and weight as the PLRS UU and, instead of the

PLRS user read-out, the EPUU will interface with the data terminal it supports. For example, the TACFIRE Digital Message Device (DMD) will transmit and receive messages through the EPUU.

In the PLRS/JTIDS Hybrid the modified PLRS MU becomes the PJH Net Control Unit (NCU). It has an EPUU and a JTIDS radio, plus an additional computer to monitor the communications between users. Instead of one MU per division, there will be five NCUs (one per brigade area and two in the rear).

Normally, each NCU manages approximately 200 EPUUs, including position location calculation and automatic tracking of the EPUU users. Also, within each area, the NCU manages communications by assigning time slots to EPUUs. The time slots allow high-speed exchange of data for all users in the community. The NCU is the master interface for the whole system. Operators monitor the status of system connectivity within the community and change link requirements as data exchange requirements dynamically evolve. The NCUs communicate over the JTIDS nets for continuity of operations (CONOPS) and with Army and other Service JTIDS users. In this way, survivability of the system is enhanced and the identification and position location information is rapidly netted across the battlefield.

Operational concept overview

Figure 1 shows the capabilities of the PLRS/JTIDS Hybrid. Shown in color are the NCUs, one supporting each brigade and two supporting the rear area. One NCU is designated the Net Control Master (NCM). NCUs and NCMs are identical, except that the NCM performs the additional role of overall division-wide management. The letter "P" refers to EPUU terminals while "J" refers to JTIDS.

Depicted in the lower brigade area is the automatic position location function which is performed by the original PLRS and its capability is totally retained in the PJH. The position of each EPUU is automatically updated by the NCU and stored in its memory. The update rate is selectable and depends on the mobility of the user.

The middle and top brigade areas show the user-to-user communication features. Requirements to transmit digital data between users are called needlines; during PJH system initialization, the predetermined needlines are entered into the NCU computer. The NCU then allocates time slots to the needlines such that transmissions between any two users are accomplished within their specified response time, regardless of the number of relays required. For example, transmissions from a forward observer (FO) to the Battery Computer System (BCS) form a needline with a response time of five seconds. This is defined as the time between pushing the "send" button by the FO to the time the message is received

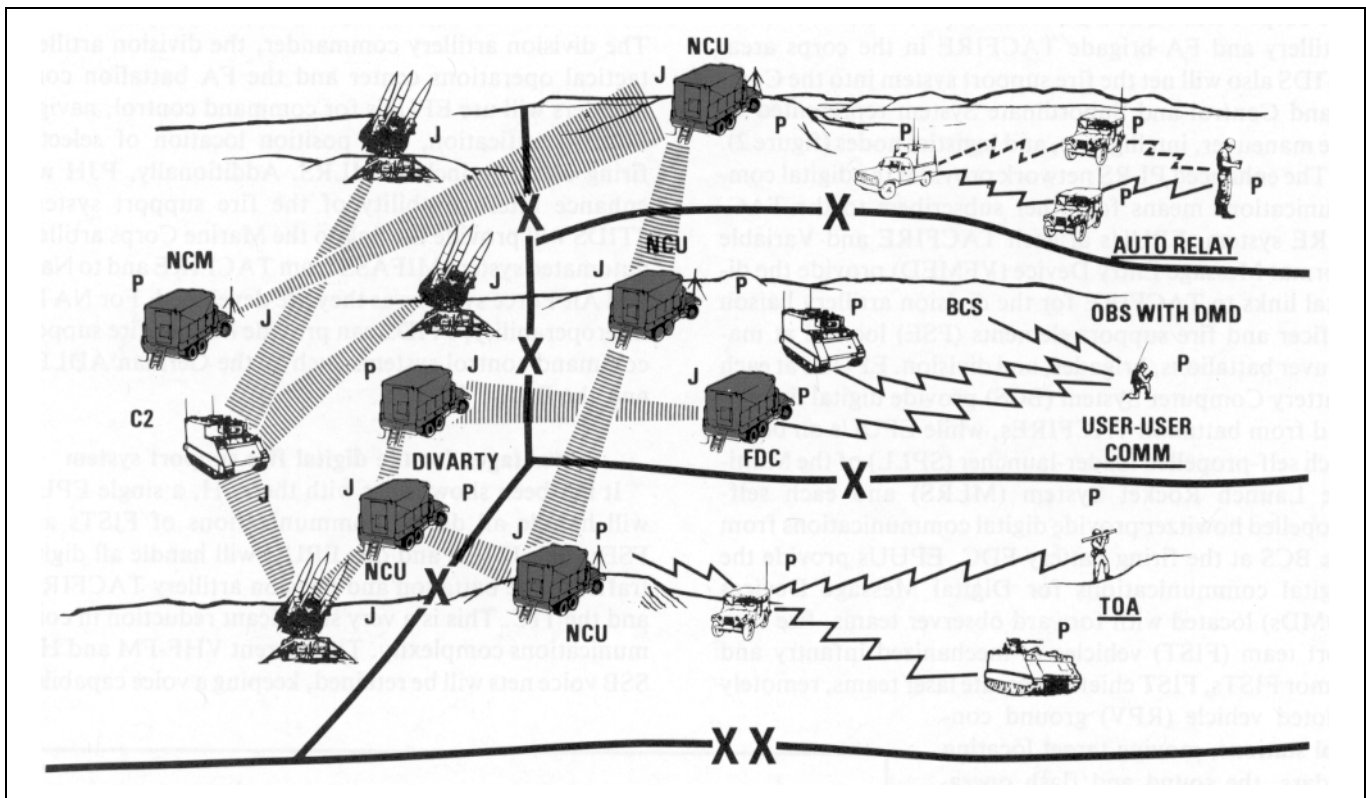


Figure 1. PJH concept overview.

at the BCS. Through the position-location function, the NCU computer continuously monitors the path over which communications transmission will pass. The path is dynamic; the computer selects the fewest number of relays (max of four) through which transmissions will occur. The guarantee of response time is achieved by the time slot allocation, which is equivalent to having a communications "window" opened every five seconds between the FO and the BCS. Regardless of how often the FO actually chooses to transmit, his "window" to the BCS is opened once every five seconds. Any user in the NCUs area may be selected to act as a relay for other user's needlines; however, from the viewpoint of the FO and BCS, the message transmission path is irrelevant. Other significant performance features of the PLRS/JTIDS Hybrid are:

- Jammer resistance based on spread spectrum modulation and frequency hopping. PLRS operates on eight frequencies pseudorandomly selected in the ultra high frequency (UHF) band, 420 to 450 megahertz; JTIDS operates on 51 frequencies in the band 965 to 1215 megahertz.

- Satisfactory capacity to carry the communications loads of the busiest hour of current European scenarios. Each NCU simultaneously controls up to eight interoperable digital nets. Analyses show that three nets are sufficient. A fourth net serves as the position location net

in the identical manner as the PLRS. Mutual interference is greatly reduced or totally eliminated because the nets are separated by both frequency and spread spectrum code.

Security is achieved by encrypting both the spread-spectrum sequence and the selection of the frequency hopping sequence. Encryption is inherent in the hardware of both PLRS and JTIDS.

Survivability is enhanced because of all PLRS or JTIDS users appear identical to the enemy from a signal intelligence standpoint. (Each one has the same signature.)

Field artillery employment

The data communications requirements of automated field artillery systems will be carried by the PLRS/JTIDS Hybrid. JTIDS will be the primary replacement for VHF-FM radio nets and multichannel circuits now providing the computer-to-computer links within the TACFIRE system. These links include those between TACFIREs within division artillery and field artillery brigade battalions at each echelon (thus forming the critical continuity of operations (CONOPS) links) and those between TACFIRE and the Target Integration Center (TIC) of the Netted Universal Radar System (NURADS). When the PJH is extended above the division level, JTIDS will form the primary links from the TACFIRE at

the corps Field Artillery Section (FAS) to each division artillery and FA brigade TACFIRE in the corps area. JTIDS also will net the fire support system into the Command Control and Subordinate System represented by the maneuver, intelligence, and logistics nodes (figure 2).

The enhanced PLRS network provides the digital communications means for other subscribers to the TACFIRE system. EPUUs at each TACFIRE and Variable Format Message Entry Device (VFMED) provide the digital links to TACFIRE for the division artillery liaison officer and fire support elements (FSE) located at maneuver battalions, brigades, and division. EPUUs at each Battery Computer System (BCS) provide digital links to and from battalion TACFIREs, while EPUUs on board each self-propelled loader-launcher (SPLL) of the Multiple Launch Rocket System (MLRS) and each self-propelled howitzer provide digital communications from the BCS at the firing battery FDC. EPUUs provide the digital communications for Digital Message Devices (DMDs) located with forward observer teams, fire support team (FIST) vehicles in mechanized infantry and armor FISTs, FIST chiefs, separate laser teams, remotely piloted vehicle (RPV) ground control stations, moving target locating radars, the sound and flash operations and control center, and the Target Integration Center. The Field Artillery Meteorological Acquisition System (FAMAS) and the Firefinder radars require the EPUU's digital communications.

The position/location function of the EPUUs will be used by field artillery cannon battery commanders and MLRS platoon leaders to locate firing positions. Here, the EPUUs will permit use of predicted fire techniques prior to the establishment of the battalion survey grid. Additionally, the EPUUs required for communications at the FIST vehicle and FO teams will provide position/location and navigation thus enhancing the location devices contained in the FIST. An EPUU will be required by each FA battalion S4 (service battery commander) for accurate location and navigation to and from ammunition transfer points and units requiring resupply and maintenance support

during day and night operations.

Command and control will be enhanced by the PJH. The division artillery commander, the division artillery tactical operations center and the FA battalion commanders will use EPUUs for command control, navigation, identification, and position location of selected firing units, to include MLRS. Additionally, PJH will enhance interoperability of the fire support system. JTIDS will provide the link to the Marine Corps artillery automated system MIFASS from TACFIRE and to Navy and Air Force systems as they are developed. For NATO interoperability, JTIDS can provide links to fire support command control systems such as the German ADLER and the British BATES.

Advantages for the digital fire support system

It has been shown that with the PJH, a single EPUU will handle all digital communications of FISTs and FSEs; one JTIDS and one EPUU will handle all digital traffic at the battalion and division artillery TACFIREs and the TIC. This is a very significant reduction in communications complexity. The current VHF-FM and HF-SSB voice nets will be retained, keeping a voice capability

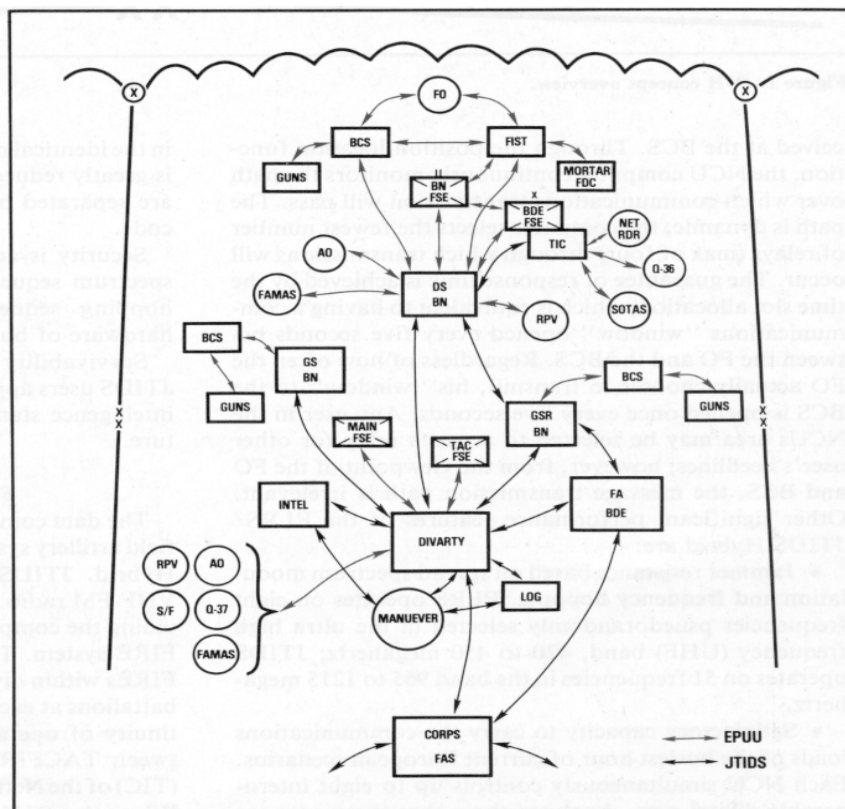


Figure 2. The PJH employment scheme in a type heavy division artillery.

throughout the FA System. Forward observers will carry the AN/PRC-68 small unit transceiver (SUT) radio for voice which, in combination with his EPUU and DMD, results in an overall seven-pound weight reduction over his current AN/PRC-77 radio and DMD.

Figure 3 summarizes the principle advantages that makes the PJH so attractive. The reduction in vulnerability to threat electronic countermeasures (ECM) is particularly important in light of the Warsaw Pact's known capability and intention to locate and neutralize NATO nuclear-capable artillery units.

Advantages for the Digital Fire Support System.	
1)	Improves fire support: <ul style="list-style-type: none"> • Reduces communications delays. • Increases speed of service • Automatically relays messages. • Eliminates voice/data contention • Provides position/location, navigation.
2)	Improves overall OPSEC posture: <ul style="list-style-type: none"> • Total data security. • Jammer resistance.

Figure 3. PLRS/JTIDS Hybrid.

Areas for further investigation

The PJH development program is intended to field the system as rapidly as possible in order to support the fielding of Army automated systems during the 1980s. The program is on track and should yield a workable tactical system in 1986. In order to insure communications supportability of TACFIRE, however, every effort is being made to design adequate digital communications plans using the current tactical system and improved systems through 1990. These include the Single Channel Ground and Airborne Radio System (SINCGARS), which will replace the current VHF-FM radios; a family of improved high frequency radios (IHFR) to replace the aging AN/GRC-106 HF-SSB radios; and single channel tactical satellite terminals to replace various critical radiotele-type (RATT) nets. Like TACFIRE, all Army automated systems being fielded in the 1980s can be supported with the current tactical communications means; however, their efficiency will be hampered by the relative lack of ECM protection, range limitations, and user delays for these communications systems. Specific areas in which work is ongoing include:

- Design of PJH vehicular installations for TACFIREs, FIST vehicles, and MLRS.
- Extension of the PJH into the corps area to accommodate corps TACFIREs.
- Direct use of PJH position/location information in the TACFIRE system.
- Methods to distribute the computer functions performed in the NCUs to improved system survivability.

Conclusions


Too often today, communications constrain TACFIRE due to delay, lack of range, or vulnerability to intense jamming. The lack of communications security device for DMD users today adds time and operational complexity to the processing of DMD messages. The PLRS/JTIDS Hybrid will enhance the effectiveness of the fire support system by solving some of these problems as summarized in figure 4.

The PLRS/JTIDS Hybrid will herald a new era of digital communications networks on the battlefield. It is a first step for the Army, but it is not without shortcomings. Some enhancements to the PJH are:

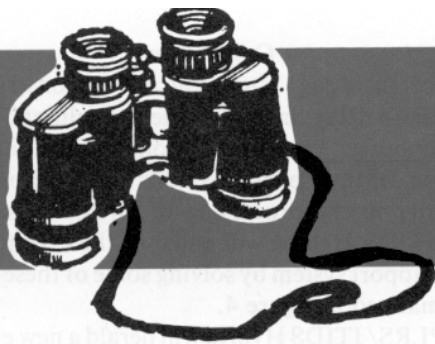
- Elimination of the critical nodes of the NCUs; distributing the computer processing throughout the network.
- Provision for digitized voice communications processed as though they were data messages.
- Miniaturization of the JTIDS radios to manpack size and weight.
- Internetting techniques to allow messages to pass automatically from PJH networks to satellite nets, optical communications nets, etc.

Problem	PJH Approach
ECM Vulnerability	Jam-resistance through spread spectrum and frequency hopping.
Range	Relays automatically selected by NCU for all needlines.
User Delays	Speed of service guaranteed by NCU allocation of time slots.
Security	Total integrated system security.

Figure 4. PJH approach to solving data communications problems.

As a communications network becomes more sophisticated, the processing capability of its terminals increases. Even with the PJH, EPUUs and JTIDS, radios will be much more "powerful" devices than many of the user terminals they support. The future may well see a synthesis of the automated system and communications computer. In the year 2010, for example, TACFIRE may no longer exist, and all of the automated fire support functions, as well as those now performed by other Army automated systems, may be infused, integrated, and distributed throughout the network of communications devices. 

MAJ James L. Ondo is the Communications-Electronics Officer in the Tactical Data Systems Division of the Directorate of Combat Developments Department, US Army Field Artillery School.



View From The Blockhouse

notes from the school

Journal on microfilm

Past issues of the *Field Artillery Journal*, *The Field Artilleryman*, *Tactical and Technical Trends in Artillery for Instruction*, and *Artillery Trends* are now commercially available on microfilm from University Microfilms International.

For those interested in this copy service, the following order information is provided:

- *Field Artillery Journal* (Order number: C556)

35-mm microfilm

	<u>Cost</u>
1. 1-6 (1911-1916)	\$62.40
2. 7-12 (1917-1922)	62.40
3. 13-17 (1923-1927)	62.40
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6. 19-31 (Jan 1939-Dec 1941)	36.60
7. 32-34 (Jan 1942-Dec 1944)	36.60
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Total price (1 through 8 above)	\$396.00
41-46 (Jul 1973-Jun 1979)	8.60 per year
47 (Jul 1979-Jun 1980)	6.30 per year
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Future issues	7.00 per year

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41-46 (Jul 1973-Jun 1979)	8.60 per year
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Note: Publication was suspended in June 1950 with volume 50. Publication was resumed in 1973 with volume 41. The micro-edition includes a "Reader's Guide to the *Field Artillery Journal*" and an "Index to the *Field Artillery Journal*."

- *Field Artilleryman* (Order number: C11858.02)

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1. 43-50 (Apr 1969-1972)	Inquire
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Note: The micro-edition includes an "Index to the *Field Artillery Journal*." Also available are "Tactical

and Technical Trends in Artillery for Instruction" numbers 1-5 (Jan 1957-Feb 1958) and "Artillery Trends" numbers 6-42 (Jun 1958-Dec 1968).

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Toll free 1-800-521-3044 (except in Alaska, Hawaii, and Michigan).

In Canada, call toll free 1-800-268-6090.

Field Artillery and Senior Commanders Conferences

During the period 21-23 October 1980, the first Field Artillery Conference was held in conjunction with the 1980 Senior Field Artillery Commanders Conference.

Changing from the "traditional" format of past commander's conferences, the first day and a half was open to worldwide attendance offering a program designed to provide an update on the Field Artillery with emphasis on the combined arms team. Presentations were made by several distinguished officers from the Active Army, United States Marine Corps, and Reserve Components.

Heading the list of attending dignitaries was General John W. Vessy Jr., Army Vice Chief of Staff. Others who addressed the conference included: Lieutenant General Donald R. Keith, a former commander of Fort Sill who is currently the Army Deputy Chief of Staff for Research and Development; Lieutenant General Willard W. Scott Jr., Commander of V Corps; Lieutenant General John R. McGiffert, Commander of Fifth Army; and Major General Maxwell R. Thurman, Commander of the US Army Recruiting Command.

Attending the Senior Commanders Conference were representatives from 4 corps artilleries, 25 FA brigades/groups, 19 division artilleries, the Marine Corps Field Artillery, and selected key military command and staff agencies.

Much of the conference focused on discussion of solutions to problems that now or will face our senior FA commanders in the field. Additionally, it provided an open forum for exchange of ideas on solutions to problems

currently facing the Field Artillery School. The agenda also included an update from the School in the areas of doctrine, training, combat developments, weapons, and fire support.

School Commandant, Major General Edward A. Dinges, hosted the three-day gathering which was a first of its kind for the Field Artillery Community.

Computerized Skill Qualification Testing

Scene: A Field Artillery officer briefing the Director of Training Developments sometime in 198? about the status of a Skill Qualification Test.

(SGT): "Two weeks ago we made the final decision to change scorable units 6 and 11 of the 17 total that we wanted to test. If we had to print, number, and distribute a new edition on time, it would have been impossible. We would have just thrown out responses for those two units. With computerized testing, the corrections were posted in the TACFIRE labs in Fort Sill's Knox Hall, the tapes were recorded and mailed to Division Test Control Officers Army-wide. Now the operators will take the correct test edition and all of the scorable units will count."

Our fictitious officer continues discussion on how, not only MOS 13C soldiers, but also three other MOSs can be tested by machine at computer terminal locations that have access to the field artillery's automated fire support system.

The Field Artillery School has requested and received assistance from the Army Research Institute (ARI) to determine if the above scenario is a real possibility worth pursuing. Beginning in 1975, ARI reported on computer adaptive instruction for field artillery applications. Essentially, the computer can be programmed to teach the operator how to operate it. The instruction can be used for self-paced training or as a form of skill practice for operations that have been learned in classroom instruction. The TACFIRE training conducted at Fort Sill and at Seventh Army Schools (Germany) uses some computerized lessons for TACFIRE deployment training and will later use the same kind of material for the 13C Basic Noncommissioned Officer Course and the Advance Noncommissioned Officer Course.

Once computerized training was demonstrated, the solution on how to run a "hands-on" component of an operator's Skill Qualification Test became apparent—have the machine give the test.

In June of 1979, ARI initiated the current 13C SQT study which will give Army decision makers the information needed to answer several important questions.

- Can a computerized SQT be fielded?
- How may it be validated?
- Does the Army need a computerized SQT?
- What does it cost in terms of dollars, time, and personnel compared to other forms of testing?

- Can computerized testing applications be used for the Battery Computer System that will provide fire control for cannons, Lance missile, and the Multiple Launch Rocket System?

- Are the test applications suitable for the computers in the Firefinder radars and the Remotely Piloted Vehicle? In June, 1980, ARI presented 32 scorable units to USAFAS. These units will be expanded for skill levels 3 and 4 soldiers for the 13C Skill Qualification Test to be administered in October of 1981.

The test begins with the soldier sitting at a TACFIRE console and entering his name, grade, and social security number into the computer. The computer then inserts the soldier's name in the first line of text at the beginning of the test so it reads "Welcome to Skill Qualification Test 4 for MOS 13C SSG Hyman. This is the hand-on component of SQT 4. It will test. . . ."

When the soldier has completed the test, the computer scores his results and tells him where he made an unacceptable error on a scoreable unit. The final SQT report is then printed for use by the test control officer to record the soldier's score.

The lessons learned from MOS 13C will be applied to the Battery Computer System (BCS). The Army has a contract to buy more than 600 BCS units for use by the Active Army as well as Reserve Components. Soldiers with MOS 13E have a good probability of performance testing and scoring on the machines they use on a day-to-day basis.

A TACFIRE console is used in the hands-on component of the Skill Qualification Test.



Quadripartite

During the period 10-14 November 1980, the United States hosted the 10th Meeting of the Quadripartite (ABCA) Working Group on Surface-to-Surface Artillery (QWG/S-S) at the US Army Field Artillery School. COL George Krausz, Director of Training Developments, USAFAS, headed the US delegation and was assisted by Mr. A1 Moss, US Army Armaments Research and Development Command; MAJ Howard Rubin, Combat Developments Department, USAFAS; Mr. Robert F. Farmer, Meteorology Specialist of Combat Developments, USAFAS; and Mr. B. M. Berkowick, US Point of Contact for QWG/S-S Artillery and NATO Artillery Working Party.

Delegations from the United Kingdom, Canada, and Australia, and an observer from New Zealand met with US members which included delegates and observers from the US Army Field Artillery School, the US Army Armament Research and Development Command, the US Army Concepts Analysis Agency, the US Army Ballistic Research Laboratory, and the Washington Standardization Representative of the ABCA.

Objectives of meeting were to:

- Standardize artillery procedures.
- Standardize artillery ammunition.
- Develop surface-to-surface artillery concepts for the period up to the year 2000.
- Develop future meteorological requirements.
- Resolve Automatic Data Processing System (ADPS) interface problems.
- Achieve standardization of artillery weapons post 1990.
- Standardize procedures for the tactical use of scatterable mines.

Achievements resulting from work accomplished since the 9th QWG/S-S Meeting (November 1979) were significant. Some of these include the finalization of a US-developed concept paper on command and control, finalization and agreement on draft QSTAGs (Quadripartite Standardization Agreements), and the initiation of a draft QSTAG on artillery ammunition interoperability, which is a major achievement in a high priority field.

Departments renamed

The Directorate of Evaluation (DOE), which is now responsible for standardization, has been retitled Directorate of Evaluation and Standardization (DOES). This is the second department in the School that has recently received added responsibilities. As mentioned in the November-December 1980 *Journal*, the Tactics and Combined Arms Department (TCAD), renamed Tactics, Combined Arms and Doctrine Department (TCADD), is now responsible for fire support doctrine.

Fire Support Conference

The 1980 Fire Support Conference was held 18-20 November, bringing together representatives from TRA-DOC and other service schools, ROTC, Readiness Regions, the Active and Reserve Components, and the Marine Corps. Concurrently, the School's Counterfire Department hosted a conference for target acquisition battery commanders of the Active Army, Reserve Components, and Marine Corps.

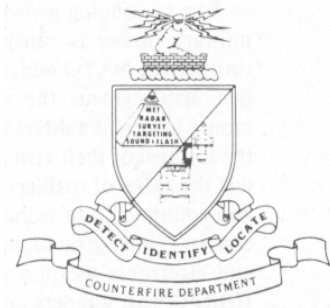
The Fire Support Conference provided an update on Field Artillery tactics, techniques, doctrine, materiel, and training. Presentations by the Field Artillery School provided a basis for open discussion by the attendees. Displays of new materiel systems and training devices were provided by DARCOM, civilian contractors, departments of the Field Artillery School, and the 212th Field Artillery Brigade.

TACFIRE and Reserve Components

There is no TACFIRE training for Reserve Component units since only enough equipment has been purchased to field Active Army units. The reason for this decision is twofold: scarce dollars for equipment and even more scarce training time for Reserve Component units. A battalion set runs approximately \$1.2 million without considering the required 5-ton truck and power plant. Even if the money were available, the training time is not. It takes an average of 16 hours per week for a battalion with a direct support mission to maintain proficiency. Generally speaking, the 11-week operator course and 24 weeks of on-the-job training (OJT) necessary for initial deployment training may be too demanding for Reserve Component scheduling availability (2 weeks of active duty for training and an average of 16 hours per month in Monthly Unit Training Assemblies).

The vital position of Reserve Component Field Artillery units is certainly recognized. In fact, some round-out battalions for high priority units may get the new Battery Computer System before many Active Army units. The Battery Computer System communicates digitally with the Digital Message Device of the forward observer parties and an Active Army TACFIRE equipped unit. TACFIRE's large mainframe support may be made available to a Reserve Component unit with Battery Computer Systems for new targets, fire plan scheduling, and tactical fire control recommendations. In this way, a Reserve Component unit can operate in the digital communications environment. The digital interface will allow Active Army and Reserve Component units to work together as a portion of the combined arms team.

The MOS 13E will remain in effect for sergeants first class in Reserve Component units while MOS 13C will designate E7s with TACFIRE training.



COUNTERFIRE SYSTEMS REVIEW

Radar Technicians Course

The Counterfire Department, USAFAS, will initiate a Field Artillery Radar Technicians Course on 15 January (this year) which is designed to provide newly appointed 211A warrant officers their basic entry level technical training. The 17-week course, which deals with operations and organizational preventive and corrective maintenance of the AN/MPQ-4A, AN/TPS-25, and AN/TPS-58 radar systems, will be presented prior to the new WO's first assignment. To support fielding of the Firefinder radar systems, the course will also include operations instruction on the AN/TPQ-36 and AN/TPQ-37 Firefinder radar systems. This training will insure that newly appointed 211A Warrant Officers (who have completed a course in basic electronics) are proficient in all operations and maintenance tasks associated with Field Artillery radar systems.

Field Artillery Target Acquisition Conference

The third Annual Target Acquisition Battery Commander's Conference was held at Fort Sill 18-20 November 1980. Representatives from 15 of the 17 Active Army and four National Guard target acquisition batteries (TAB) were in attendance along with two representatives from the United States Marine Corps. The conference provided a forum for the interchange of information between the TAB commanders and the Field Artillery School.

The primary focus of the three-day conference was the near-term growth of target acquisition and its potential as a viable career field for the field artilleryman. Of special interest were plans for expansion of the TABs to 22 target acquisition battalions by 1986 with the initial battalions being organized as early as 1983.

Another theme was "world-wide" target acquisition which included presentations from liaison officers from Great Britain, France, and West Germany, wherein they

explained their target acquisition equipment and capabilities. An added bonus arose when both Israeli and Egyptian officers, members of one of the resident Officers Advanced Courses, participated in a question and answer session.

The conference concluded with a round-table discussion which allowed attendees the opportunity to air their feelings and direct questions to School representatives. The TAB commanders expressed the feeling that this year's conference was very constructive and a positive step in the growth of target acquisition.

TI-59 forms revised

The Survey Division, Counterfire Department, has been using the new TI-59 forms for more than a year and, based on input from survey instructors and artillery surveyors in the field, a few changes are minor and, with the exception of FS Form 611-13, the October 1979 forms can be used until new ones are published by DA. (Corrections to the FS Form 611-13 were announced on page 21 of the November-December 1980 issue of the *Journal*.)

Department of the Army will not print new forms until the new FM 6-2 is published with the TI-59 chapter incorporated. FM 6-2 is scheduled for publication in draft form in October 1981 and in final form in February 1982.

Field units are reminded that even though the forms must be locally reproduced, field printing plants in Germany, Korea, and CONUS have the capability of using the current forms as masters for local reproduction until the DA forms are available. If required, the Counterfire Department will provide copies for reproduction purposes. Please write or call:

Commandant
US Army Field Artillery School
ATTN: ATSF-CF-SV (MAJ Rogers/CPT Piper)
Fort Sill, OK 73503
AUTOVON: 639-1415
Commercial: 1-405-351-1198

In order that field units may begin using the new (October 1980) TI-59 forms, target acquisition battery (TAB) commanders were issued several sets of each form during the TAB Conference held 18-20 November, last year. Additionally, the Survey Division, Counterfire Department, has forwarded copies of the forms to each corps artillery commander for distribution. Reference note AS**EZ, "Computer Set FA, General, with Program Kit, Computer Set for FA Survey," dated November 1979, is being revised to incorporate the updated forms. It will also contain a full-size blank copy of each form which can be used as a guide for either print plant reproduction or stenciling at the unit level. Copies of this reference note will be mailed to all artillery battalions.

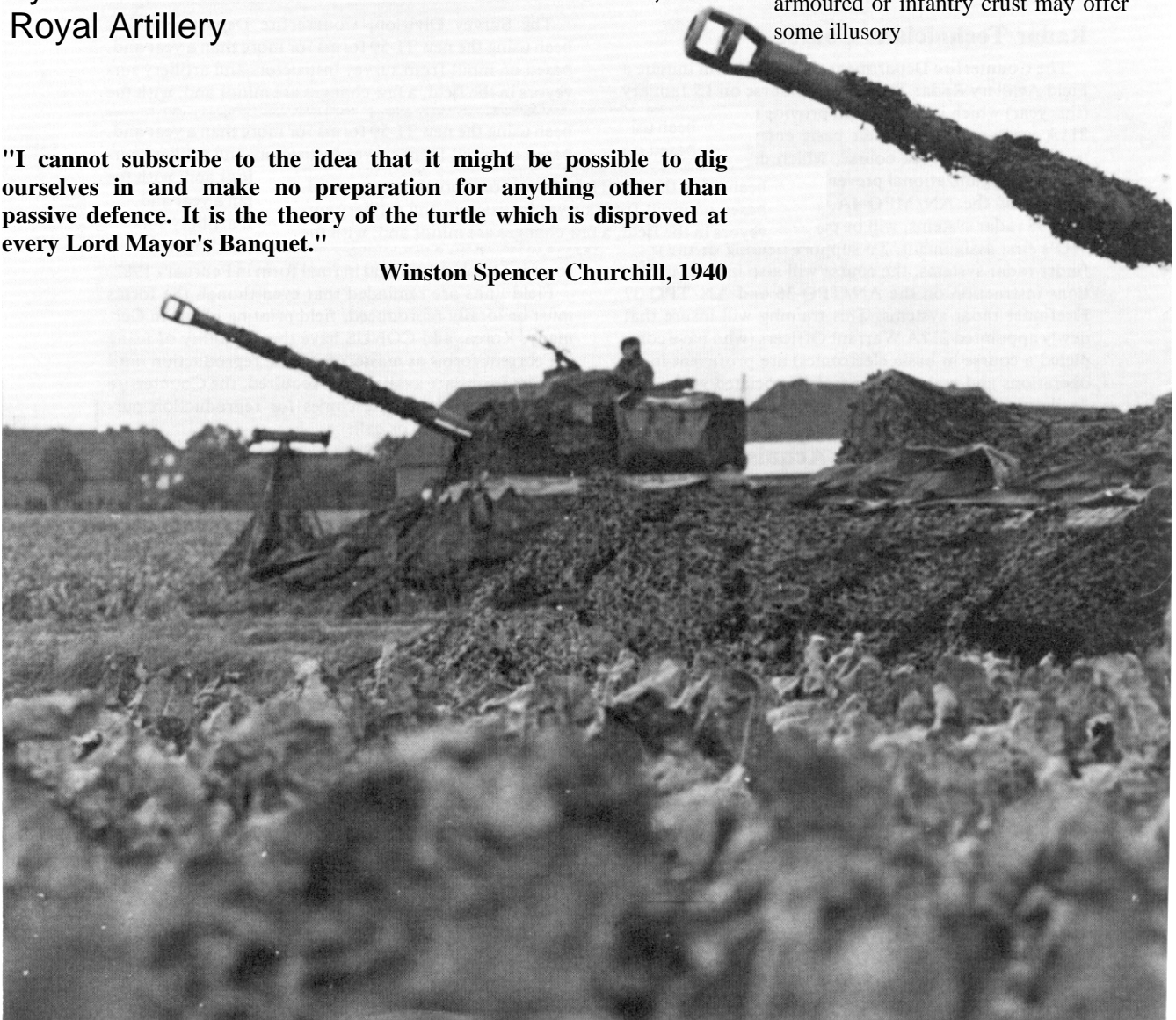
Survive to Fight

by Lieutenant-Colonel M. J. H. Hudson,
Royal Artillery

The continuing growth of Soviet military power is causing disquiet throughout NATO and, to many allied artillerymen, the massive armoury is seen as a direct challenge to the survival of their arm. In carrying out the tasks of artillery, both men and equipment are vulnerable to attack by enemy ground, artillery, air, and electronic weapon systems. In 1(BR) Corps, gunners are no longer "rear area" soldiers, they operate well forward in the combat zone; within that zone, "deployment in depth" behind an armoured or infantry crust may offer some illusory

"I cannot subscribe to the idea that it might be possible to dig ourselves in and make no preparation for anything other than passive defence. It is the theory of the turtle which is disproved at every Lord Mayor's Banquet."

Winston Spencer Churchill, 1940



comfort, but it affords no real protection. Guns by their corporate deployment are at particular risk. How we are to survive the multiple threat to our gun areas and still carry out our tasks is the subject of this article.

To focus on the gun area is not to denigrate the vulnerability of our gunners. Battery commanders, forward observation officers, and *Swingfire* and *Blowpipe* operators will face the same dangers as their supported arms; locating and air defence weapons will be subjected to electronic warfare, while nuclear delivery means are a high priority for

clandestine forces, as well as being the preeminent target for Soviet artillery and air. Survival clearly concerns every artillery unit, and much of the ensuing discussion about guns is equally applicable to all.

This article addresses the gun area and the artillery elements that immediately affect its security. The battlefield is contemporary and gunner organisations and equipment are those in being. Recommendations are similarly centered on what is possible now; where these have implications on men and money, they are included not in ignorance of present constraints, but rather an

awareness of the less palatable alternatives.

Tasks

A predominant task for field artillery is close support. When employed in mass, the effect of indirect fire can be devastating—in the Yom Kippur War, the Israelis used it on at least one occasion to halt a battalion tank attack. Once battle is joined, requests for close support will be almost constant and always urgent; quick, intense, and accurate concentrations of fire are needed throughout to support the manoeuvre arms.



Close support can be used either to attack targets with indirect fire or to set up and isolate the contact battle to allow direct fire weapons to be employed on the most favourable terms. Depth fire has parallel importance. Sophisticated Soviet air defence systems will seriously degrade the ability of our air forces to operate in the hostile air space of the attrition zone; artillery will have to play a large part, both in thinning out armour before it reaches the contact battle and in helping to suppress enemy air defences, thereby allowing our aircraft more freedom and diversity. The size of the artillery threat makes our counterbattery vital.

The twin tasks of close support and depth fire between them determine the requirements for field artillery in the corps battle: guns to support the Aggressive Delay Force from the onset of hostilities and to continue that support during the subsequent withdrawal of the force; additional fire from the FEBA (forward edge of the battle area) divisions to assist the Aggressive Delay Force in breaking clean; thereafter the maximum number of guns to be available for the FEBA battle and to engage targets in depth. Considerations of frontages, ranges, flexibility, concentration of fire, and command and control are all important. In deploying to meet these different requirements, the threats to the gun area become clear.

The threat

The Soviet threat has four facets—a tetrad comprising ground, artillery, air, and electronics. Each is closely integrated with the others and together they menace every aspect of the gun area. Ground troops, especially reconnaissance forces, may chance upon our guns at any time; the greatest danger from tanks will be in the Main Defensive Battle when the enemy is attempting to break through and destroy our main positions. Unless the advance is unacceptably disrupted or delayed, there is unlikely

to be an early Soviet release of nuclear or chemical weapons. Once employed, however, targets will include artillery. Indigenous agents, saboteurs, and long range reconnaissance units will harass gun areas in depth.

Our guns are second only to nuclear delivery means as a priority for enemy artillery, and there is a formidable array of target acquisition devices tasked to locate them. Nearly half the available artillery ammunition is devoted to counterbattery, and the Soviets supplement this in their fire plans with mortars, tanks, and armed helicopters. In the fire plans at the onset of hostilities, and for the attack on our FEBA, all our known and suspected gun areas will be attacked. The sheer preponderance of weapons makes artillery bombardment the most portentous threat.

If the Soviets achieve air supremacy and force "corridors" through our air defences, many aircraft will rerole for fighter/ground attack tasks. A major effort will then be made against selected ground targets, gun areas being of prime concern; air attack will be particularly heavy on the FEBA guns while they are deployed forward to support the Aggressive Delay Force. Aircraft will also be used for reconnaissance and electronic intelligence and, if required, to deliver nuclear and chemical weapons; vertical envelopment by airborne and heliborne assaults is possible. Any one of these may affect us. The advent of the new attack helicopters with their much improved stand-off capability are a particularly daunting prospect for any gun area.

A future war in Europe could be nuclear and would be electronic. Radio electronic combat support is an essential element of enemy intelligence and embraces all electronic warfare resources. Agencies will be directed to intercept artillery communications and neutralise target acquisition devices

and surveillance systems. Our signature is blatant. Fixed call signs, standard procedures, and repetition of messages will quickly identify gunner nets and the formations they support, while the detection of radios and radars will pinpoint locations. The enemy plans to disrupt artillery communications and electronic systems when it has the maximum impact on our operations and least on his own. Deception and jamming therefore will be intense during both the initial advance and the FEBA battle—when close support is most in demand by our own forces.

The first rule of survival is to avoid detection; ergo, the methods by which the Soviets detect our artillery are as important as the attacks themselves and they deserve specific attention. The primary means in order of precedence are radio and radar direction finding, sound and flash ranging, and visual identification. Direction finding may account for as much as 60 percent of all locations of our guns, the others about 20 percent each. Discipline defeats detection; thenceforth gun area survival will hinge on the measures by which they can escape engagement or weather an attack. As the ultimate danger, it is the last of these which principally concerns us. Against a multiple threat, to resolve one facet is often to enhance another—to counter the tetrad our *modus operandi* must be oriented to every aspect of survival. In doing so, it is as necessary to review principles, techniques, and priorities as to identify deficiencies. Sacred cows are never slaughtered but they have to die. Although technical, tactical, and administrative issues are looked at under seven different headings, they are closely interrelated and collectively essential to our tasks.

Deployment

Deployment of artillery in its widest sense includes reconnaissance, movement, deployment, and duties in action. As far as reconnaissance



British Abbots on the move.

and movement are concerned, our problems are those of any arm operating in an adverse air situation and harried by clandestine forces. Every daylight move, whether it be of reconnaissance parties, gun groups, or resupply convoys, will be telltale and in all probability hazardous. Movement therefore by day except during bad visibility should be minimised and tactical. Reconnaissance vehicles need to be armed, agile, and armoured; to operate in pairs; and to prove each area before occupation. Guns may have to travel across country by tactical bounds, perhaps on a trickle system. Evasion and concealment will be important and air defence imperative.

Besides the requirements of their indirect fire role (e.g., flash cover, staggered layout, etc), guns are at times sited with emphasis on their direct fire capability. In a field force, artillery may deploy to provide the final antitank stop line for the formation; within a division, they could be given a counter-penetration task. In both, guns will often be the commander's only uncommitted reserve. Field batteries are once again "fighting alongside" armour

and infantry and it is appropriate to regard gun areas as artillery combat teams in much of what follows.

There are many well established technical and tactical reasons why guns should not be deployed either in very close country or in wholly open terrain. In view of the threat from counterbattery, the forward edges of woods may be equally unsound. Broken ground affords some natural concealment and protection without being instantly identified as a gun area by the enemy on a cursory map reconnaissance. Shallow quarries, scrub, and gorse, etc., are the features most favoured; these are, however, uncommon in parts of the corps area and, not surprisingly, they command the attention of many units. When finally agreed, artillery reserved areas will seldom be ideal and we may have to deploy in featureless country and built-up areas.

The overriding threat to guns once they deploy is from artillery and that threat grows the longer they remain in action. The best defence against counterbattery, or indeed air attack, is a combination of protection, concealment,

movement, and dispersion. In a short warning scenario, the mobility inherent in the Aggressive Delaying Battle will make the preparation of diverse gun positions impossible and full protection probable only on first deployments. Assuming some concealment, survival thereafter will depend on short frequent moves, the optimum use of natural protection and on the dispersion of guns—tactical fire and movement. During the FEBA battle, when close support is the principal task, guns will be committed to a largely static deployment. This incurs a high risk of detection and attack by artillery and air; positions have in consequence to be thoroughly prepared and widely dispersed.

Other than for deployments in close country, dispersion must be the tenet for every second-in-command and battery captain/gun position officer. Gun areas at present solicit Soviet interest, and the 50 percent zone of the multi-rocket launcher battery, the foremost counterbattery unit, is disconcertingly similar to the traditional deployment pattern of a field battery. The footprint and intensity

of fire could endanger 60 percent of the guns in any gun area. Separate troop positions reduce the danger by as much as six to one; target acquisition devices are deceived and either probability zones offset or ammunition expenditure are increased with enemy guns having to engage two targets rather than one. Dispersion, however, occasions certain penalties, notably in control and manning—the wider the dispersion, the greater the penalties. Attractive as it is in some ways, therefore, single gun and section positions may be unacceptable apart from the transient deployment of pistol guns. For greater dispersion, commensurate with proper control, each troop must have its own troop centre and inaction command post, or fire control post. A third command/control post, with staff to man it, is needed for step-up.

When 155-mm eight-gun batteries are introduced, a troop will be a recognised fire unit and continuous support will be possible from a battery in a mobile mode. The troop options thereafter include predetermined main and alternative positions or a central hide from which a number of concealed and protected firing platforms can be occupied on a "shoot and scoot" basis. As field artillery in the British Army is never held in reserve, the hide option is open to question, even for general support batteries. A gun area with a central ammunition dump and several alternative troop positions about 500 metres apart has distinct tactical merit; with a "four square" layout, any one of six deployments is possible, these being changed in tandem or parallel to suit the situation. Reconnaissance and survey, response times, and fire order procedures are the technical implications. Short-range, low-power radios, perhaps pocket phones, with at least one gun net frequency would be required.

The proliferation of urban precincts in Western Europe has

renewed interest in built-up areas and villages as potential gun positions. While the clinical estates of suburbia have only qualified attractions, the older villages and hamlets offer obvious tactical and administrative benefits. Being of rural origin, they are usually based on a complex of large houses and farms, with spacious yards and abundant cellars, and linked by a network of roads and tracks. Considerations of control, especially at night, may well outweigh those of dispersion, and reconnaissance will be protracted if guns are to be dug in and alternative platforms marked. However, a village position should still be developed fully within 24 hours. By careful siting and judicious use of local materials and battlefield flotsam, the agricultural environs and solid buildings afford cover from optical air observation and infrared devices and protection from the blast and shrapnel of artillery and air-delivered weapons such as cluster bombs and rockets. With such good facilities to aid concealment, protection, and comfort, as well as easy access to ad hoc defence stores, we should be imprudent not to become "village minded" in certain areas.

Our deployment of mortar locating radars is at times suspect. All radars are vulnerable to detection, and the practice of regarding *Cymbeline* as the "seventh gun" is manifestly wrong—it endangers the guns while operating the radar at a disadvantage. Mortar locating radars should never be closer than 500 metres to any gun position, each being dug in with two crests between it and the enemy. Ideally in their primary role they operate as a troop—to attenuate detection they can either deploy as single radars or, where the frontage/range equation allows, a section deployment may be the best compromise.

Digging and Defence Stores

On deployment of 1(BR) Corps, the paramount engineer task is the

corps barrier plan and, until that is complete, only limited engineer plant will be available for other work, such as assisting with defensive positions. Based on the corps digging policy, each division determines its own precedence for the preparation of gun areas. Inevitably, with shortages of time and equipment, guns must depend for their protection to a large extent on self help. Even in the Main Defensive Area, therefore, many thoughts of deceptions plan and dummy positions, albeit highly desirable, may be stillborn. Consideration should be given both to introducing integral artillery plant and to fitting dozer blades to gunner APCs and perhaps self-propelled guns—self-entrenchment devices—on a scale of at least two per battery.

On a recent exercise, it took a surprisingly long time to dig in fully six *Abbots* and two command posts, including revetting and returving; the heavy digging was done by two engineer wheeled tractors, and guns first occupied the pits after 24 hours. In war, any timings in excess of 48 hours may be unacceptable. Temporary gun emplacements have also been trialled and results indicate that under best conditions—using engineer plant and defence stores and working in daylight—an M109A1 battery could be hull-down in less than 20 hours. Revetting and other work would continue thereafter. This is a more expedient aim.

There are anomalies too about defence stores. A completely prepared battery position can take up to 10 tonnes of stores, but only arms "in direct contact" with the enemy draw from the pool allotment and artillery is precluded. Defence stores redirected from the pool for gunner use have to be moved to the operational area on unit transport, and batteries have insufficient lift capacity for the task. As artillery combat teams, batteries should have protection comparable to that of the manoeuvre arms, including protective

minefields and defensive fire. The former is their responsibility; the latter requires planning with neighbouring batteries.

Artillery in field forces and the Territorial Army has two singular disadvantages: the lack of ballistic protection on towed guns and the limited time available to prepare defensive positions. Towed batteries move less frequently than their self-propelled counterparts, and more extensive use is made of pistol guns. Priorities of work must be laid down bearing in mind the time and resources available and, as guns have a restricted top traverse, the arcs to be covered. Splinter protection for the detachment will often be the first task. The size of some equipment such as the FH70 may make a scrape or even a *bund* more realistic. Clearly, towed gun batteries should be high in the pecking order for engineer plant and defence stores. Prefabricated hardened shelters would substantially reduce the effect of improved munitions such as bomblets.

Notwithstanding the availability of resources, digging is fundamental to protection. With the sparsity of plant and stores, much will depend on professional acumen and local improvisation—abandoned plant and constructional debris in particular must be utilised to advantage. Where digging is difficult because of the rocky ground or water table, *sangers* are the historical alternative; in Europe raw materials are found in rubble and ammunition boxes filled with spoil. Whatever the design, once any form of earthwork is begun in open country it is difficult, if not impossible, even with additional camouflage and an ingenious track plan, to conceal from ground and air reconnaissance.

Local Defence

By definition, dispersion of guns conflicts with the cohesion needed for strong local defence. For the latter, gun areas have to be chosen with concealment, depth, mutual support,

and obstacles in mind. In the "four square" layout, local defence will be based on the two troops and the echelon—our "platoon" positions—the degree of dispersion in this case being determined by GPMG range (600 to 800 metres). An outer perimeter of local defence posts must dominate the likely routes and approaches—some 200 metres from the main positions by day, but withdrawing closer perhaps at night providing this is tactically and geographically sound. The perimeter should contain both antitank and air defence weapons and be reinforced by fighting patrols from a battery quick-reaction force when required; the posts themselves must be linked by pocket phones and controlled from a local defence command post manned by the battery captain. Lines at the gun positions, even when buried, will be quickly destroyed by counterbattery. Protective minefields should be covered by observation and fire, possibly by the guns themselves, and the defensive fire plan coordinated for the battery area. Gun positions will be prepared to combat tanks and where appropriate "alert platforms" marked. Arrangements have also to be made to counter less tangible threats. If the enemy employs remotely delivered mines against our positions, guns

Shoulder fired surface-to-air missile. (Blowpipe).



may be unable to move until safe lanes have been cleared—a task for self-entrenchment devices? Some self-propelled guns do not have inbuilt NBC filters, so a chemical strike may force us to move whatever the battle situation; chemical agents will create secondary problems too by spreading contamination, either by gun movement or introducing contaminated ammunition into uncontaminated self-propelled guns. Well-trained sentries are a prerequisite for early warning of ground, air, and chemical attacks.

For local defence to be meaningful in a dispersed layout, either some redistribution of, or increases in, weapons and manpower are inescapable. Additional holdings of antitank and air defence weapons and GPMGs are required with soldiers to man them. Dispersion reinforces the role of the battery captain, not merely in local defence but overall; the gun position officer controls the gun position, and the battery captain commands the gun area.

Fire direction centres are fallible links in the gunner chain from both electronic and local defence standpoints. With communications their *raison d'être*, they home onto obvious and isolated sites. Neither combination with, nor collocation at, regimental tactical headquarters is

entirely satisfactory. Although perhaps not ideal for their usual communication catchment areas, fire direction centres deployed in close proximity (within 500 metres) to a gun position, probably in *loco parentis* to the echelon, would gain considerable protection, while being sufficiently removed from the guns to escape the effects of any artillery fire directed at them.

Air Defence

Air defence has two adjuncts: self-defence of individual weapons and the protection these afford other artillery units. The paucity of equipments and tight control of electromagnetic emissions means that for much of the Aggressive Delaying Battle there may be only partial area air defence. However, most gun positions behind the FEBA should be under the *Rapier* umbrella, and with more liberal control of emissions during the Main Defensive Battle the cover will be much augmented. Towed equipments are slow in and out of action and their replacement by self-propelled *Rapier* would enhance both mobility and protection, and thus flexibility and survival; additional self-propelled *Rapier* would enlarge the coverage to include all gun areas. Nonetheless, because guns at times will move frequently and, in the Aggressive Delaying Battle, to hastily prepared positions, they need some form of dedicated unit air defence—at least a half section of *Blowpipe*, preferably self-propelled, or similar weapon for each field battery. This could be met either by an increased establishment of *Blowpipe* or by regrouping existing assets. As a first step, our customary operational groupings and tasks should be examined—regular sections to armoured reconnaissance regiments? territorial troops to vital points and route defence?

All-arms air defence is at present the only certain way of providing close air defence of gun areas. As new smaller calibre small arms enter

service, this important complementary capability must not be negated. While active measures dominate our thoughts, passive air defence remains *sine qua non*.

Communications

Communications here is a generic term straying in places to encompass non-communications equipments. Much of the information on electronic warfare is classified, and as an arm we are not familiar with Soviet capabilities; as a result we underestimate radio-electronic combat support. Electronic counter-counter-measures are rarely practised, and our operating techniques and control of electro-magnetic emissions are less than perfect. Radio is the Judas of artillery; its deceit is unseen and insidious. Nevertheless, the success of artillery still depends on the quality of its communications—improvements in equipments, even BATES, will not totally offset our other deficiencies. Communications in an electronic warfare environment will be maintained by electronic camouflage, inter alia, a combination of better antennae designs and transmission methods, changing call signs and random frequency changes, and proper control of electromagnetic emissions. Multifarious alternatives must be explored; instead of radios—liaison officers and motorcycle dispatch riders (couriers), civil telephone systems and land line; in place of radars—passive sensors and optical tracking. Remoting radios and antennae is a technique deserving greater attention. If our communications are crippled at a critical point and anti-jamming drills are ineffective, preplanned/pretimed harassing or defensive fire may be an appropriate riposte. The value of short-range, low-power radios (pocket phones) bears repetition. Training for electronic warfare has to be realistic and comprehensive—we must have a thorough understanding of both the

dangers and preventive measures. Discipline like confidence comes with knowledge. At regimental level, an officer in a key appointment (the adjutant?) should be made responsible for communications.

Logistics

Medical arrangements, the recovery, repair and replacement systems, and ammunition resupply are the chief logistic considerations. Medical support and casualty evacuation must be reviewed. The movement, dispersion, and fluid nature of the Aggressive Delaying Battle in particular make the early introduction of a battery ambulance imperative. In the Aggressive Delaying Battle too, every effort will be made to recover unserviceable vehicles, weapons, and equipments, whether they are victims of mechanical failure or enemy action, and then to repair and return them to units as soon as possible. Spare parts and replacements have to be readily available. During the Main Defensive Battle, should the normal system be swamped, repair has either to be completed in forward locations or units must evacuate unserviceable vehicles, weapons, and equipments themselves. Early replacement of irreparable items could be vital.

Artillery ammunition scales are currently being examined and substantial increases are expected; as some unit mobile stocks cannot be wholly carried now by unit transport, any additions will exacerbate the shortfall. The vehicle lift has to be augmented, and in the Aggressive Delaying Battle a high mobility armoured ammunition carrier, on the lines of the United States forward resupply vehicle, would be a major asset. The rates of expenditure in the Main Defensive Battle will make mobile resupply on its own impracticable and ammunition for at least 48 hours should be dumped on each battery area and then dug in, or a silo built for protection. Before any dumping programme is undertaken,

however, the correct mix of munitions must be decided. Further resupply should be via the echelon area from vehicles protected by scrapes or bunds.

Manning

Manning is a cornerstone in this as in most military debates and demands specific attention. It is an erroneous belief that sophisticated equipments in themselves reduce manning levels; in certain instances the reverse may be true. The British Army is short of mass—both weapons, but more especially the men to operate them effectively for a protracted period. The mental as well as the physical stress of general war will be shattering and the value of proper training and junior leadership are self-evident. Nevertheless, once battle is joined, soldiers must be allowed some rest if excessive fatigue is to be avoided and units are to continue their operations for more than a very few days. Mental and physical resilience cannot be maintained nor confidence, determination, and aggression upheld by any arm unless the men themselves can be sustained. The manoeuvre arms attempt to retain a reserve; for artillery this is neither feasible nor desirable. Guns must continue to provide a 24-hour service—with manpower our bane, triple training of soldiers? On the gun area, there are a plethora of tasks, and the spectrum for the gun detachment alone stretches from technical skills in serving the guns to specialised tasks in local defence, and from the physical labour of ammunition handling to the mental alertness of sentry duties of every kind. Even with enhanced establishments, a combat day for a soldier might be as much as 12 hours on the guns and eight hours on the other tasks, leaving only four hours for personal needs—with our present austere manning the imbalance would be markedly worse. Movement and dispersion introduce additional pressures on the existing manpower—reconnaissance and

survey, command/control posts, local and air defence; with line-laying and larger ammunition stocks also to be considered, thoughts turn perchance to reservists on mobilisation.

Proper manning then is fundamental. Man is the final arbiter of war, and it is on mental and physical stamina as much as robust equipment that the outcome of the battle may depend. On their current establishments, field batteries do not have the capacity to sustain 24-hour operations as envisaged in the corps battle. Some increase in manning is required if we are to become, and then remain fit, to fight. It is of course always easy to present a parochial case for additional men, more difficult to justify when the overall constraints put that case in conflict with the needs of others. Be that as it may, the juxtaposition of manning to survival is irrefutable and cannot be ignored.

Allied and other views

Having now examined the survival of guns in the corps battle and before attempting to subsume the various proposals into one contemporary gun area, it is pertinent to look briefly at the views of some other countries. They vary considerably.

In Vietnam the United States employed a fire base concept in which two or more batteries and mortar platoons were deployed together in an area of operations about 1,000 metres in diameter. Guns were well dug in and protected in part by dedicated infantry. Such a convocation has positive advantages when the threat is from lightly armoured ground forces and there is no danger of either artillery or air attack; in Europe, as a target of major tactical importance, it would invite early neutralisation or destruction. The United States estimates that at least one-third of all Soviet artillery missions will be counterfire/counterbattery and in that setting a fire base would be untenable.

In the United States artillery, batteries are split into two four-gun platoons using terrain gun positioning; i.e., individual guns widely dispersed. Within this framework, survival measures embrace: gun-and-run tactical moves at least twice and survival moves perhaps 15 times each day; ballistic protection—protective covering for the gun detachments and ammunition vehicles; and hardening howitzers—armour protection. Gun pits, except for towed guns, are seldom dug; however, terrain gun positioning coupled with "gun-and-run" improves survivability by nearly 50 percent and when ballistic protection is added, up to 70 percent. Air defence weapons are attached to each battery. Tracked vehicles only remain on the gun area, and improved resupply methods include the introduction into service of an armoured ammunition vehicle.

The Germans believe regular movement and wide dispersion desirable and are conducting trials with guns as much as 300 metres apart; a derivative is "twinning guns" (sited "knee to knee" in pairs) as strong points to overcome the worst problems of local defence. Roving/pistol guns are the norm. Although gun pits are unusual, ammunition is always dug in. The French, with a military concept based on counterattack, go further and dig in neither guns nor ammunition. Philosophy is unequivocally "shoot and scoot" and guns are built for speed of movement and deployment. In both countries, air defence guns and motorcycle couriers are integral to each artillery battalion.

Doctrines in the Netherlands, Belgian, and Danish armies are much alike. All favour digging but have no dedicated plant and survival depends therefore on frequent moves, pistol guns, and hedgehog battery areas. Motorcycle couriers are used extensively.

In the Canadian artillery, the guiding principles of survival are dispersion,

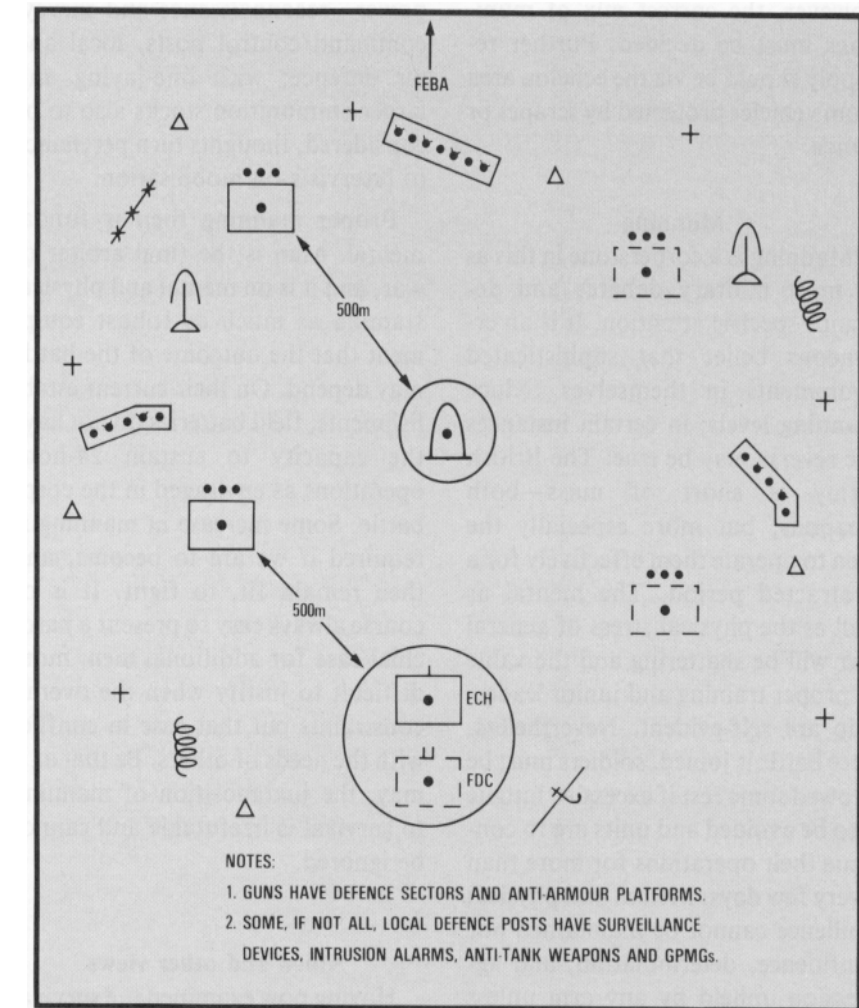
concealment, and security. There is an emphasis on hides, and guns are often concealed until a fire mission is ordered (held in reserve?). A gun alignment and control system then passes immediate orientation to all guns within line of sight. Non-essential vehicles are removed from the gun position. There is an APC dozer in each battery, and ballistic protection is under consideration for ammunition vehicles.

Clearly, artillery survival is a subject being seriously addressed by many of our allies. Where movement is the accepted answer, it is germane to note that guns might be out of action for half of every day—self-induced neutralisation—and not surprisingly the armies with the largest resources of guns and ammunition (United States, Germany, and France) are its chief proponents. Others who prefer digging as a solution (the Netherlands, Belgium, and Denmark) are without the means to achieve it. Canadian philosophy is unique. Several of these countries give greater emphasis than us to the electronic war, being doubtful of their ability to work through either spot or barrage jamming effectively—even with proper anti-jamming drills they believe radio nets alone would be less than 50 percent efficient.

Outside NATO the views of two countries with recent operational experience are significant; in the last decade both have been subjected to heavy concentrations of artillery fire from Soviet weapons employed in Soviet style. Pakistan strongly advocates digging as the watchword for artillery survival. Israel is less adamant and propounds a balance of digging and movement.

Gun Area 1980

We come then to a possible gun area for the 1980s—Gun Area 1980. While recognising the importance of ground, time, and resources, the obvious attractions of villages and the difficulties in implementing any of



Gun Area 1980 (GA80).

the earlier recommendations, let us look at the most salient points of the four-square layout as they apply in the Main Defensive Battle. In the Aggressive Delaying Battle, tactical fire and movement remains more apposite.

At the centre of the square is the battery ammunition dump, concealed and protected in a pit or silo and stocked with the appropriate munitions mix. The points of the square are the troop positions about 500 metres from each other and the same distance from the silo. Each troop has a fire control post, its layout is irregular, and there is approximately 50 metres between guns. The priority is to prepare two positions fully and for work to continue on the others as time allows. The troops occupy these prepared positions and

fight from them until forced out by tank attack, chemical strike, etc. Once deployed there is no question of a "shoot and scoot" policy; however, we should be foolhardy not to be ready to move in extremis—there is little merit in standing and fighting and dying if our tasks are not achieved by doing so. For the same reason other four-square positions are reconnoitred in depth and developed as the battle dictates, either to conform with a re-deployment of the corps or to provide fire support during subsequent operations. In a four-square layout alternative positions are very local, are dug at least in part, and the real estate is guaranteed; moreover time out of action for any one troop/fire unit is minimal and the battery can continue to operate with the other. Positions are

reoccupied as required. Concealment and track plans mitigate for deliberation rather than panache in most deployments. The technical implications have been discussed and the case for integral plant and self-entrenchment devices argued.

By deploying the echelon as an entity some 500 metres to the rear, the area is given depth. Essential vehicles only remain and these are camouflaged and protected to escape casual ground and air observation; if undetected they can expect to stay in their chosen sites throughout the battle. The regimental fire direction centre may be collocated with this or another battery echelon. Mutual support is achieved by the two troops and the echelon; if a major ground attack becomes imminent when one of these, due to current deployment, is unable to provide mutual support for its nearest neighbour, either a troop redeploys or support becomes reliant on the direct fire of the local defence posts and/or indirect defensive fire. The size of the complete gun area may be as much as one and a half grid squares, but bearing in mind the normal requirement for alternative positions this probably represents an overall reduction of artillery real estate and is certainly a lesser management problem.

The local defence posts are deployed around the perimeter of the gun area commanding the most likely avenues of approach—although adjustment may be necessary at night, this could invite their destruction and in principle they remain in situ. Some if not all the posts have surveillance devices, intrusion alarms, antitank weapons, and GPMGs. Pocket phones link the posts to a local defence command post (to be redesignated the battery command post when this in turn becomes a fire control post), sited in the echelon and manned by the battery captain. The ground defences are strengthened by protective minefields, wire and defensive fire; a half section of *Blowpipe* supplements the

all arms air defence weapons. Each gun is allocated a defensive sector, perhaps covering a minefield, and antiarmour platforms are prepared. Specialised sentries, the quick reaction force, and an ad hoc line party are the responsibility of the battery captain who also makes the ground surveillance and night visibility plans and coordinates the entire local defence of the gun area. Above all, it is he, as the gun area commander, who determines the immediate threat and orders a troop to move—providing the battery keeps one fire unit in action at all times he needs no further authority to redeploy within the square layout. It is a truism that Gun Area 80 gives the battery captain a very positive tactical command function in the survival of his battery—it is too great a responsibility for a subaltern.

The four-square layout is not a template for success in World War III; there are penalties as there are in any deployment, but it does counter the worst dangers of the threat, while still enabling us to carry out our tasks—we could survive and we would fight.

Postscript


This article has looked first at the tasks of artillery today and then at the multiple threat to our guns on the contemporary battlefield; it has suggested means by which survival might be improved and outlined the views of certain of our allies; finally, by considering a gun area for the 1980s, a sometimes philosophical debate has been given a practical interpretation. Several countries believe in the maxim "survival of the fastest"; others in "disperse and dig"—each by themselves both is a part answer. Counterbattery is the gravest danger and radio and radar direction finding the primary means

of detection. While there is no simple solution to either, survival remains a nice balance between digging and movement, a balance which reflects many factors, not least the different phases of the corps battle. With that caveat, movement should be related to the need for continuous fire support and the ability of the guns themselves to move, while digging as always depends on time and resources. The current Corps Concept assumes that it will be possible to prepare at least one position thoroughly; thereafter we must retain the flexibility and control to react to a quickly changing situation.

Artillery cannot be convincingly portrayed on exercises; nevertheless it undertakes essential battlefield tasks that no other arm can perform. In World War II, 60 percent of all casualties were caused by indirect fire. In 1(BR) Corps the place of artillery is assured and its importance is increasing. Indirect fire will be an indispensable element in the combined arms effort to defeat the Soviet juggernaut—survival of our guns is therefore no longer an esoteric matter.

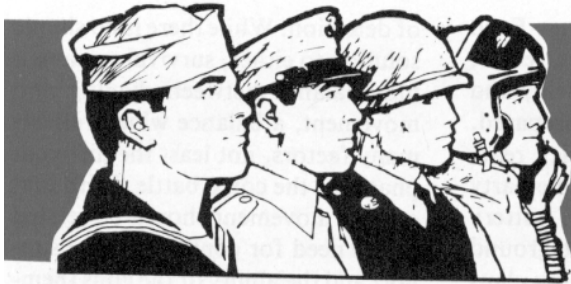
In conclusion, and notwithstanding the earlier discussion, we should be clear on one point. Although this article has indicated some ways in which the gun area might better survive the intensity of modern combat, the recommendations it makes have to be put firmly into the context of our role as gunners:

"To allow the direct fire weapons of the battle group to do their job of destroying the enemy with the minimum interference from enemy direct fire—weapons, guns or aircraft."

We survive to fight—survival must never be allowed to become an end in itself. 

(Reprinted from *The Journal of THE ROYAL ARTILLERY*)

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With Our Comrades In Arms

notes from other branches and services

Shortage of Guard training ammunition critical

Training ammunition is no longer an abundant item within the National Guard or the active forces, according to the Ammunition Management branch of the Organization/Training Division for the Army Directorate. A branch spokesman said, "Ammunition being a commodity, in the past, was viewed as a box of good and plenty during the war years and the Korea and Vietnam buildups. This is no longer the case. Previously, ammunition was made available upon demand to units to train. However, within the last five years, availability has become a problem."

To further complicate matters, the cost of ammunition has more than tripled since that era. The spokesman pointed out that even though the defense budget dollar is increasing, purchasing power is decreasing, causing a shortfall of millions of rounds of training ammunition for the National Guard. Working from the authorizations provided by the Army's Training Ammunition Authorization Committee (TAAC), the National Guard has received 65 percent of its FY80 ammunition requirements. For FY81, the National Guard Bureau requested \$125 million worth of training ammunition; TAAC authorized \$65 million. This is only 52 percent of the National Guard requirement.

In addition, to further highlight the critical situation, the official said that the National Guard is presently using a few weapons for which ammunition is no longer being produced. One such item is the Light Antitank Weapon (LAW). The LAW will soon be replaced by the VIPER, a similar antitank weapon with increased effectiveness. Also, pending redesign of that munition, the 2.75 rocket is another item used by the Army Guard which is no longer being manufactured.

He stated that the old ammunition stockpiles are no longer full. The Bureau spokesman added that the requirements placed on the active forces and the National Guard are draining the stockpile and the budget doesn't allow for the procurement of ammunition to refill it. "The supply just isn't there," he said. "The simple 5.56-mm round (used in the M16 rifle) hasn't been bought in several years. It (the stockpile) is being depleted. In the Vietnam

war days, this could be purchased at seven cents per round. The cost of that round is now estimated at 25 cents per round. This is an increase of over 350 percent since 1976. This just was not anticipated by anyone in the National Guard or the Active Army. By 1986, because of inflation, tank, armor, and mortar shell costs will be astronomical. The sheer costs are staggering, and force modernization impacts heavily on ammunition requirements for the National Guard. For example, division direct support artillery battalions are being converted from 105-mm to 155-mm howitzer units. This increases the demand for more costly 155-mm shells."

To improve this situation, the official said, "The National Guard must now establish guidelines and policies to make every round count. Management and conservation have to be applied right down to user level. It is not going to be a higher echelon management task. The company commander, platoon sergeant, section chief, and gunner will have to take the initiative and decide when they have reached that required level of efficiency in firing and then determine to save the last mortar round."

In order to begin immediately on ammunition conservation, the Ammunition Branch is recommending four guidelines to conserve the use of training ammunition. First, the use of subcaliber ammunition while training must be highlighted. A Guard Bureau official said the National Guard has been a front runner in subcaliber training compared to the other services, but it is not enough.

Second, the official said units should use incentives in the firing of some ammunition, as is the case for the TOW missile. Presently, the National Guard only receives 42 TOW missiles per year for more than 2,000 weapons systems. As a consequence, only the best TOW crews fire an actual TOW missile after training, which is designed to serve as an incentive for excellence in training. There is no subcaliber round for the TOW, only a "flash/bang" simulator. The official pointed out that less than one percent of today's TOW crews will ever fire an actual TOW round.

The National Guard must look to the field for new training devices and programs that promote conservation. The Bureau wants all units to submit ideas coming from the user level which will avoid the inefficient use of training ammunition.

The Ammunition Branch reported that out of 1,213 unit readiness reports submitted from FY79, only 152 showed shortages in ammunition, a factor of 13 percent. Even though this percentage appears small, the Ammunition Branch only sees the situation getting worse unless immediate action is taken at the unit level. (*National Guard* magazine)

IMAAWS contracts canceled

The Department of the Army recently terminated two contracts for the Infantry Manportable Anti-Armor Assault Weapon (IMAAWS) which was under development by the Army Missile Command at Redstone Arsenal, AL. The Army had planned to field IMAAWS in the mid-1980s as a replacement for the infantry's current antitank weapon, the Dragon.

Contracts for IMAAWS development were awarded in September 1980 to McDonnell Douglas Astronautics Company of Huntington Beach, CA, and to Honeywell, Inc., of Hopkins, MI. The contracts called for a competitive advanced development program leading to flight demonstrations by the two contractors in FY82. When completed, the Army would have selected one of the two for further development.

The decision to cancel IMAAWS allows a restudy of the balance between weapon performance characteristics (lethality and range) and physical characteristics (size and weight) to try to make it more suitable for the soldier.

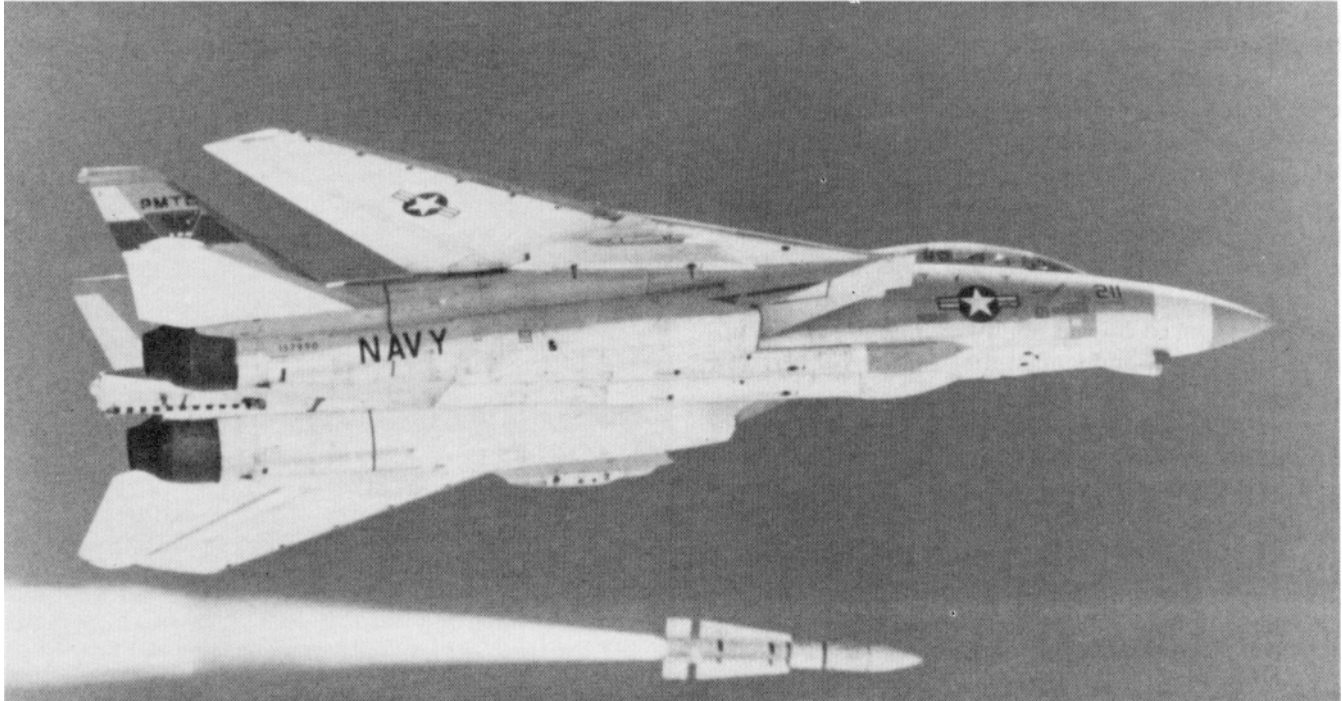
Phoenix tested

The performance of both the current and future models of the US Navy's Phoenix air-to-air missile during last year's test launches was most impressive.

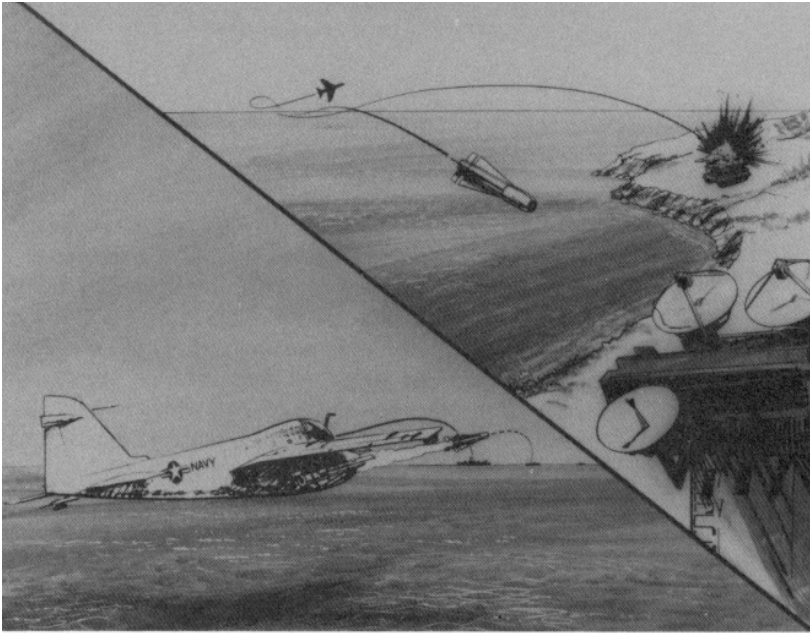
In its first three firings, an improved version of the radar-guided Phoenix missile, the AIM-54C, scored three successes, each time passing well within the lethal distance of a drone target. At the same time, the current version of the Phoenix, the AIM-54A which is in the fleet inventory, was successful in 10 out of 12 operational readiness exercise launches.

The high success rate experienced in 1980 is typical of the overall record the Phoenix has compiled. For example, of the 155 production models of the AIM-54A that have been launched, beginning in May 1972, 92 percent (not including aircraft weapon system failures) have guided successfully to the target, with either the warhead rendering the target uncontrollable or nonrecoverable or with an unarmed missile actually hitting the drone or passing within the lethal distance.

Operational with the Navy since 1974 as the principal long-range defense armament of the F-14 Tomcat fighter, the Phoenix is teamed on that aircraft with the AWG-9 radar fire control system, (both are products of Hughes Aircraft Company). The Phoenix with its 100-mile-plus range, multi-target capability and attack versatility, is regarded as one of the world's most technologically advanced tactical missiles.



An engineering development model of the improved AIM-54C Phoenix missile is fired from a Navy F-14 at the Pacific Missile Range. The missile, the third to be launched, set a perfect three-for-three score by continuing the string of successful firings in the test program, passing well within the lethal distance of the drone target. Hughes Aircraft Company is upgrading the long-range air-to-air defense missile under contract from the Naval Air Systems Command. (US Navy photo)



Navy Maverick—Two primary applications of a new version of the Maverick air-to-ground missile being developed for the US Navy are illustrated in these artist concepts. In the lower left, a Navy A-6 in a low level ocean attack at long range launches a second Maverick at an enemy ship while a missile fired just seconds earlier nears the first target. In the upper right, a Navy A-7 veers away after firing two of the launch-and-leave Mavericks at air defense installations. The AGM-65F Maverick, under development by Hughes Aircraft Company, provides selectable warhead fuzing to optimize its effectiveness against various sea and land targets.

New Maverick gives Navy added firepower

A new version of the combat-proven Maverick air-to-surface guided missile that will add sea and ground target attack capabilities to the US Navy air arm is now under development at Hughes Aircraft Company.

Designated the AGM-65F, the Navy Infrared (IR) Maverick will follow the Maverick family modular design by using the imaging infrared guidance of the US Air Force's AGM-65D model of the Maverick and the warhead and propulsion sections of the AGM-65E, the laser-guided version planned for the US Marine Corps.

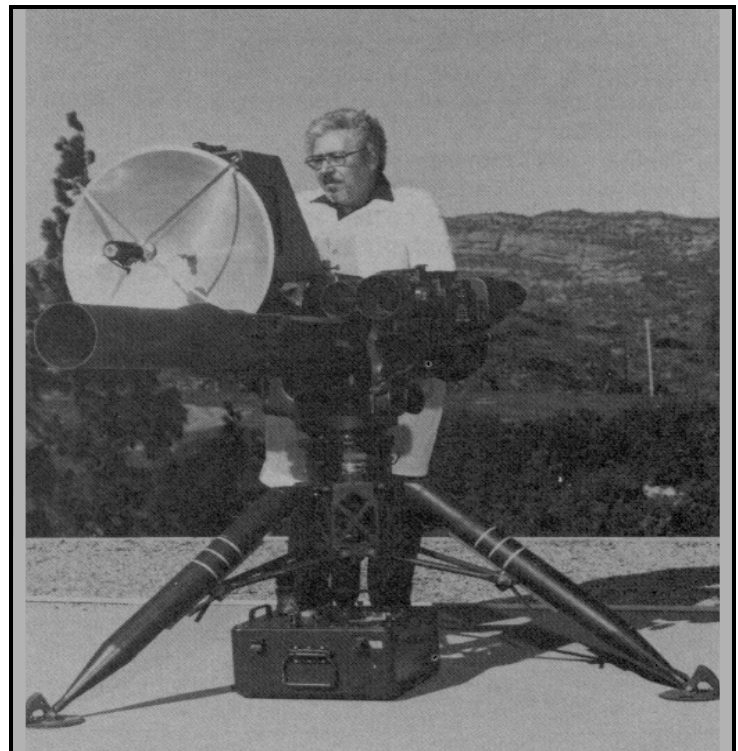
"The Navy IR Maverick will be a low-cost weapon that will be effective against all but the largest naval targets," said the manager of Antiship and Navy Attack Programs at Hughes Missile Systems Group. "The missile's range will allow launching beyond enemy air defense perimeters where flight crews can then immediately take evasive action or fire successive missiles at other targets."

The survivability of the attacking aircraft will be further enhanced by the ability of the aircrew to approach the target and launch the Maverick at very low altitudes.

The Navy IR Maverick can be launched day or night and in low visibility weather conditions. A heavy blast penetration warhead is in the final stages of development for the AGM-65E, and the Navy IR Maverick will utilize this new warhead with selectable fuzing for optimum effectiveness (penetration or point detonating).

Captive flight tests of the Navy IR Maverick are scheduled to begin in March this year while flight test launches of the missile will follow in mid-1981.

Delivery of the first of 7,000 Navy IR Mavericks is planned for mid-1984. The missile is expected to be operational initially on the Navy's A-7 attack aircraft, with integration on the A-6 and F/A-18 to follow.



A still largely unexploited form of radar has demonstrated its ability to track targets and guide missiles accurately through smoke and rain as part of a technology experiment program aimed at enhancing the US Army's ability to fight in adverse combat environments. Shown here is the millimeter wave radar used to guide TOW antitank missiles with pinpoint accuracy through battlefield smoke and aerosols in recent experimental firings at Redstone Arsenal, AL. The modified US Army TOW missile launcher, with a two-foot diameter radar antenna and (behind it) the radar transmitter and receiver, was used in the tests conducted by Hughes Aircraft Company.

Patriot money granted

The Army awarded approximately \$123.1 million to Raytheon Company for fiscal year 1980 production of Patriot, the Army's newest and most advanced air defense missile system.

The initial buy of the Huntsville-developed plane killer was five fire units and 155 missiles with the work to be performed at Raytheon's Andover, MA, facility; Martin Marietta Aerospace's plant at Orlando, FL; and Thiokol Company at Redstone Arsenal, AL.

Defense Department approval for limited production of Patriot was announced earlier in September but full-scale production will depend on test results with the first production hardware and other tests planned during the 1981-82 time frame.

The computer-assisted Patriot is so sophisticated that it can diagnose its own problems and tell how to solve them. Featuring a new guidance scheme, along with the digital computer, Patriot can simultaneously destroy a number of planes over a wide range of altitudes, maneuvers, and countermeasures and can operate under all weather conditions.

The highly mobile Patriot will replace both the Nike Hercules and Hawk weapon systems.

Improved graphite fibers

The Material Technology Laboratory of the US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, is participating in a developmental program to improve the capabilities of high toughness graphite fibers and evaluate their potential application in Army materiel.

Past efforts to improve the modulus strength, or stiffness, of graphite fibers, resulted in a loss of tensile strength. At the same time, efforts to improve the tensile strength resulted in a loss in fiber stiffness.

MERADCOM and their contractor, Fiber Materials, Inc., of Biddeford, ME, are developing a boron strengthened graphite fiber which, for the first time, promises to give both improved strength and stiffness characteristics.

The toughened graphite fibers are made from a commercially available organic precursor fiber which is drawn down to approximately five microns. It is then further reduced in size to approximately three microns during graphitization and is alloyed with boron at a temperature of 2300 degrees Celsius.

The high toughness graphite fibers can then be used in either a plastic or metal host material to form a matrix composite. These boron strengthened graphite fibers offer lightweight composites with increased strength and toughness.

These lightweight composites may be used in a variety of military equipment. MERADCOM's Marine and Bridge Laboratory is especially interested in the possible

application of the improved graphite fibers in future Army bridging equipment. Other possible applications include use in military vehicles and helicopters.

Boron strengthened graphite fibers have already been produced with a significantly improved modulus strength or stiffness and with almost twice the tensile strength of untreated fibers. Expectations are that fibers will be produced of 500,000 to 600,000 pounds-per-square-inch (psi) tensile strength with a 60 million psi modulus level.

Guard "cranes" fight forrest fire

CH-54 "Sky Crane" helicopters from the Alaska Army National Guard played a decisive role last summer in overcoming the largest forest fire in the state's history.

The CH-54s supported the efforts of personnel of the 172d Infantry Brigade whose transportation was hampered by beds of soft, soggy peat under the Arctic tundra. They airlifted bulldozers needed for clearing firebreaks, and rescued mired vehicles, including an M116 personnel carrier.

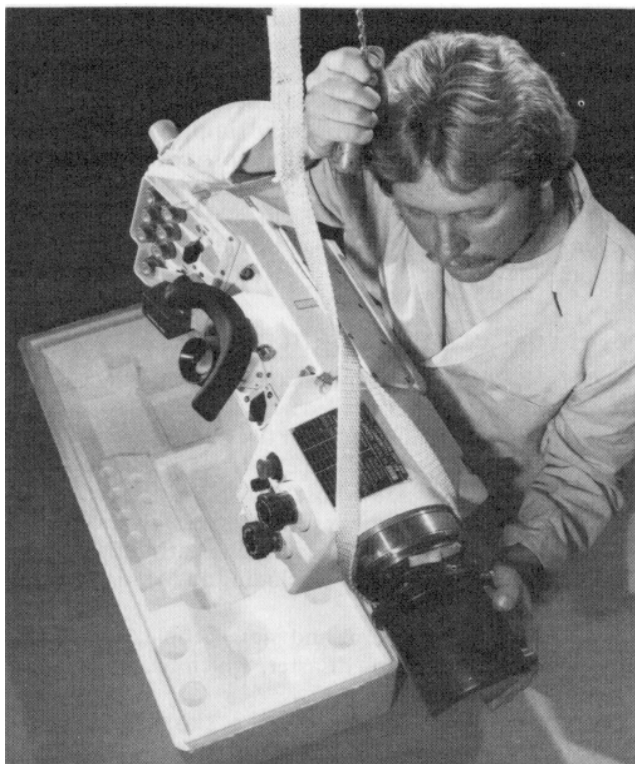
Regular Army, federal and state people, and equipment joined to fight the disaster, which broke out some 30 miles south of Fairbanks.

The Sky Cranes are well-known to Alaskans. Their primary mission was and still is to provide support to the active military establishment in the state.

An Alaska ARNG CH-54 is believed to hold the weight-lifting record for its type of aircraft—a gross weight of 59,000 pounds carried over a 60-mile distance against headwinds.

"Sky Crane" is ready to move out.





Tank laser—A tank commander's sight unit is prepared for shipment to complete the delivery of the 1,000th laser fire control system for the US Army's M60A3 main battle tank. Here, an employee of Hughes Aircraft Company's El Segundo, CA, manufacturing facility lowers the sight into a shipping container. The laser fire control system gives the tank a significantly improved first-round hit capability. The sight unit is equipped with a laser rangefinder that can provide accurate and almost instantaneous target range to the system's computer. The computer processes the range, along with wind, ammunition ballistics, and other necessary data, to send the correct azimuth and elevation firing commands to the tank turret and main gun. Under contract to the US Army Armament Research and Development Command, Hughes is producing these systems at a rate of 50 per month.

Demilitarizing chemical munitions

The Army's new \$67 million Chemical Agent Munitions Disposal System (CAMDS) at Tooele Army Depot, Tooele, Utah, recently began operation. Tooele Army Depot's south area was selected as the site for CAMDS due to its relatively remote location and access to an assortment of obsolete chemical munitions on the site.

The CAMDS is a prototype system designed and built to develop and demonstrate advanced procedures and equipment for large-scale demilitarization of obsolete or unserviceable chemical agents and munitions by means that insure the protection of workers and the environment.

The system represents an 11-year technology, development, construction, procurement, testing, and training effort by the

Army's Toxic and Hazardous Materials Agency located at Aberdeen Proving Ground. This agency has overall responsibility for all developmental and operational aspects related to the demilitarization of military toxic chemical agents and munitions.

Before initial operations, extensive pre-operational testing was conducted using simulated munitions which proved the effectiveness of the overall system design. The tests also proved that operating personnel and the surrounding population would not be subject to any safety or health hazards from CAMDS operation.

The system's capability will be tested and demonstrated during 12 different phases of demilitarization operations over the next six years. During this period, approximately 120,000 assorted rockets, artillery projectiles, bombs, mortars, spray tanks, and bulk containers filled with mustard or nerve agents are scheduled to be destroyed.

Processes used to demilitarize the munitions and chemical agents include thermal deactivation of explosives and propellants, chemical neutralization of nerve agents, incineration of mustard agents, and thermal decontamination of contaminated metal parts and solid wastes.

All equipment was designed for safety and total containment of hazardous materials. Only a single type of munition and one type of agent will be processed at any one time. The plant is designed so that it can adapt to a particular munitions process by rearranging special machinery between each phase of demilitarization. Explosives are processed by remote control in special reinforced containment structures. Chemical agents are also processed by remote control in areas maintained under negative pressure to assure containment of pollutants.

All functions involving chemical agents or explosives are performed by totally automatic remote-controlled machinery. Operating personnel will not be required to work in agent- or explosive-processing areas, except for maintenance. When performing maintenance in chemical-agent-processing areas, personnel will wear a self-contained protective suit designed especially for that purpose. All other individuals are required to wear varying types of protective clothing, depending on the maximum exposure conditions they may encounter.

Combustion gases from the furnaces are passed through sophisticated pollution-control systems to insure that emissions are safe and in compliance with applicable pollution-abatement standards. All ventilation air passes through a series of absorbers and filters to remove any trace of chemical agent gases before discharge into the atmosphere.

No contaminated waste liquids leave the CAMDS site. They are all reduced to dry salts after undergoing analysis to insure that they are agent-free. Metal parts from the destroyed munitions, contaminated filters, and other

solid wastes are heated to temperatures in excess of 1,000 degrees Fahrenheit and tested to insure that they are free of any residual agents. Safety and containment are further insured through stringent certifications and monitoring programs involving the use of a variety of alarms, detectors, and laboratory analyses.

During the first three months of CAMDS operations, all procedures and systems for disposing of agent-filled M55 rockets were checked. More than 2,000 rockets, each filled with 10.7 pounds of nerve agent GB and 22.5 pounds of explosives and propellants, were processed during the first prototype operation with live munitions.

The CAMDS has entered the second phase of operation, designed to demonstrate its capability to conduct full-scale demilitarization over an extended period. This 13-month phase calls for the destruction of about 16,000 unserviceable M55 rockets. (*ARMY LOGISTICIAN Magazine*)

Submarines withdrawn

Ten Polaris submarines, approximately one-fourth of the Navy's ballistic missile submarine force, are being withdrawn from missile-firing duties with no quick replacements available. Two of these submarines—the USS Theodore Roosevelt and Abraham Lincoln—are being dismantled to fulfill SALT I treaty requirements. The other eight are being stripped of missiles and modified to fill attack submarine roles.

The 10 Polaris submarines were part of the Navy's 31 sub-ballistic missile force. The other 31 are armed with the more powerful Poseidon missiles.

Airborne history researched

The Airborne Department, US Army Infantry School, Fort Benning, GA, is interested in obtaining historical information concerning active duty service members who participated in military combat parachute operations during World War II.

This information will be used to set up a historical tribute to our active duty service members who served in the airborne community during World War II.

Any service member who is still on active duty and participated in a military combat parachute jump or was assigned to an airborne unit during World War II is requested to contact the Airborne Department.

Information should be sent to: Director, Airborne Department; USAIS; ATTN: ATSH-A; Admin Officer; Fort Benning, GA 31905, or call commercial 404-545-1873 or AUTOVON 835-1873.

Infantry OCS Course Set for 1 April

An Infantry Officer Candidate Course for Reserve Components is slated for 1 April to 1 July 1981 at the Army Infantry School, Fort Benning, GA. Applications for the training must be submitted by 1 February.

Colonel Carl L. Acree, Chief, Army Organization and Training Division of the Bureau, said the individuals who apply must demonstrate an outstanding capacity for leadership and possess those qualifications desired in a commissioned officer.

Applicants must send NGB Form 64, accompanied by related documents listed in NGR 351-5 and NGR 600-100, to the Army National Guard Military Education Branch, ARNG Operating Activity Center, Edgewood Area, Aberdeen Proving Ground, MD 21010.

Joint Electronic Warfare Center established

The Department of Defense has a Joint Electronic Warfare Center at Kelly Air Force Base, TX, designed to coordinate future electronic warfare (EW) requirements among the services and rationalize the current inventory of equipment.

The center, which began operations in October last year, will evaluate offensive EW techniques and equipment and also assess the vulnerability of US forces and their methods of operation and equipment to enemy electronic warfare.

Commanders Update

COL Louis J. Delrosso
75th Field Artillery Group
LTC Robert D. Morig
1st Battalion, 2d Field Artillery
LTC Josue R. Robles
1st Battalion, 7th Field Artillery
LTC William E. Roberts
3d Battalion, 18th Field Artillery

LTC Gerald W. Thrash
2d Battalion, 27th Field Artillery
LTC Dennis D. McSweeney
1st Battalion, 30th Field Artillery
LTC James E. Metelko
2d Battalion, 31st Field Artillery
LTC Frank L. Miller
1st Battalion, 35th Field Artillery

LTC James Bachman
1st Battalion, 81st Field Artillery
LTC Joseph E. Nickens
2d Battalion, 92d Field Artillery
LTC Edward J. Cocoran
5th Composite Training Battalion
LTC Ronald J. Kopec
Special Training Battalion

In recent years many issues of the *Field Artillery Journal* have contained valuable features dealing in one way or another with survivability of the field artillery on the modern battlefield. Threat briefings covering the same subject provide the rationale for such concern about the capability of artillery to sustain itself long enough, in sufficient numbers and with adequate ammunition to fulfill its vital support mission.

The trend in doctrine and tactics has turned away from the fixed fortification, impenetrable fortress defense mentality. Failure of the French Maginot Line in the early stages of World War II provided a glaring illustration of the vulnerability of static positions when pitted against overwhelming firepower and highly mobile forces. Furthermore, forces employed in such a manner could not be converted quickly for offensive operations.

Several articles in the *Journal* have dealt with protection of the fire support system through various methods of increased mobility. Others have highlighted the fact that there is degradation of efficiency somewhat proportionate to the number of moves within a 24 hour period. Most of these articles have concentrated on the sustainability of delivery units, as well they should, since the firing elements are basically the only reason for the other segments of the artillery structure. Army doctrine has emphasized mobility and dispersal for entities up to and including battalion. The "trains" concept promulgated in FM 6-20-1 allows firing batteries and command centers to move rapidly and gives the more cumbersome supply and maintenance sections within the battalion the necessary time to accomplish their tasks without the threat of continuous displacements.

Suppose these "survival-through-mobility" concepts were extrapolated to cover the next higher echelon of artillery, the division artillery and the nondivisional artillery brigades

Division Artillery Survivability

by LTC Robert B. Adair

and groups? What could be done within current assets and present structures to increase the probability of survival of these control links? The purpose of this article is not to provide the ultimate solution, but to provide a description of what one National Guard division artillery is doing in an attempt to answer these questions.

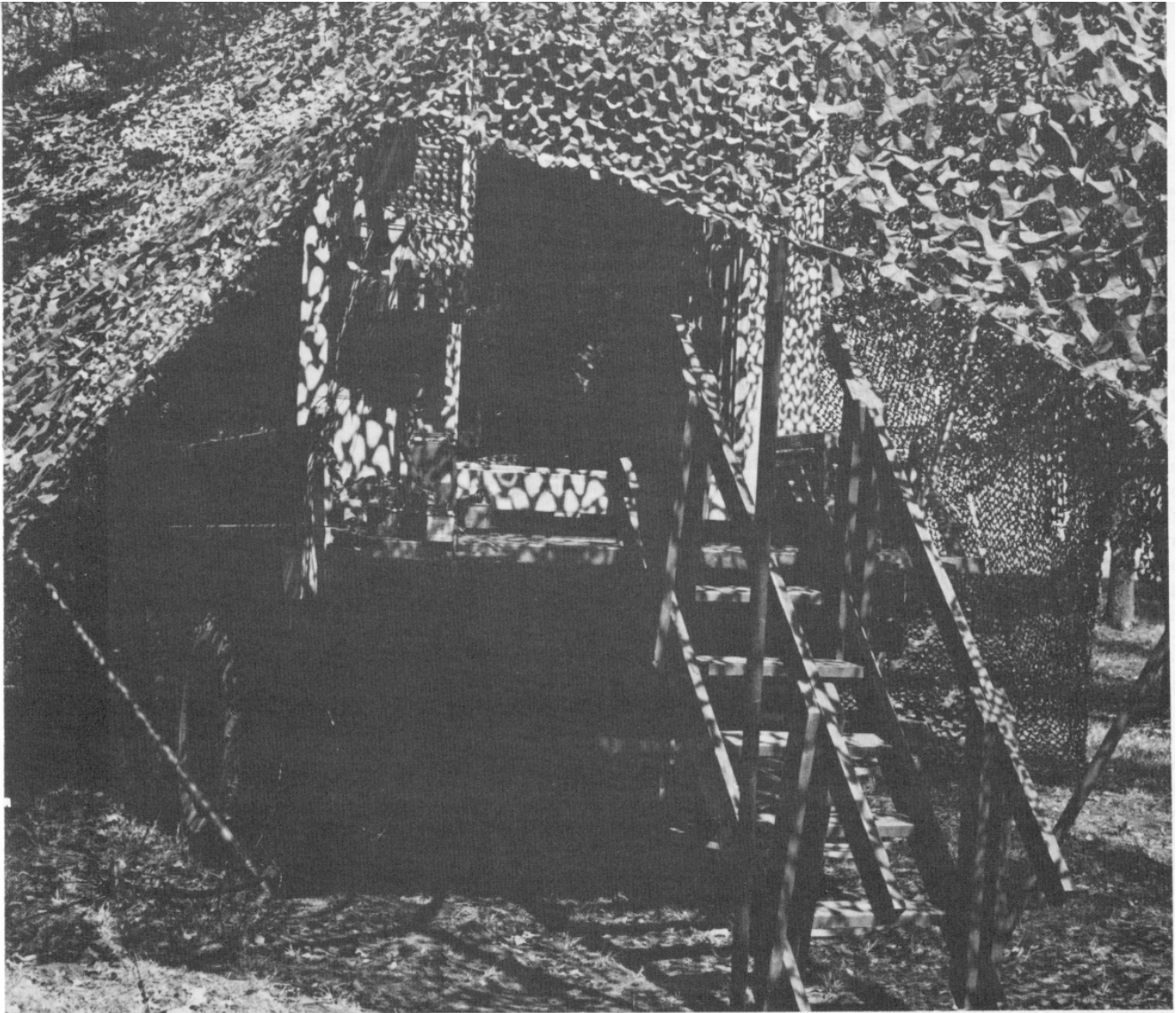
The 28th Infantry Division Artillery (Pennsylvania National Guard) launched a project in August 1979 to improve its tactical posture after a thorough analysis of div arty operations accomplished during that year's Annual Training (AT). The goals established for the project were:

- Displace the Tactical Operation Center (TOC) in 15 minutes; set up in 15 minutes.
- Move the TOC at least twice in a 24-hour period.
- Reduce or disguise the electronic signature of the TOC.

The typical field position for the division artillery contained the command group, headquarters battery, meteorological and the Target Acquisition Battery (TAB). The normal density was approximately 180 personnel and 50 vehicles. Depending on the time of day and availability of personnel in the various headquarters

sections, it took varying amounts of time to displace the elements. Two hours appeared to be above average. The physical location of the TOC, located in the center of the complex, consisted of a general-purpose medium tent, two M109 vans, radio teletypewriter (RATT) riggs, and other vehicles required to support the communication requirements of the TOC. One of the M109 vans was for the S3/plans officer and also doubled as the jump TOC. The other van was used primarily to transport all the equipment used in the tent and some of the TOC personnel. The entire TOC could displace in less than an hour; however, this was difficult to measure accurately because the time depended on whether the jump TOC was dispatched separately. In short, the division artillery, like other large headquarters, required a miracle of orchestration to displace quickly, and even then the time was far in excess of the desired goals.

A host of theories and ideas were explored by the project team. The system adopted and tested during the last AT period was not the result of any tremendous original thought, nor was it a radical departure from current doctrine and tactics. It was an amalgamation of methods and techniques employed by various



echelons of armor, mechanized, signal, and field artillery organizations gleaned from the pertinent manuals and training publications. For example, the displacement goals match those listed as the future displacements objectives under consideration by the Army and they appear in FM 24-1, "Combat Communications."

The singular, most important physical change required was the elimination of the tent. A five-ton expandable van was made available by the 28th Division and essentially the whole operation from the tent, less the TOC switchboard, was put on wheels. Next, rather than try to reduce

the organization piecemeal, the project team started at zero and began adding only those personnel, vehicles, and items of equipment considered critical to the TOC operation. One M109 van was added, primarily because it served in the dual role as the S3/plans officer's vehicle and as the jump TOC when required. It was equipped with two FM radios that remained in the "receive" mode when the van was part of the main TOC. One M880, equipped with four FM radios, a switchboard, and a radio-wire integration (RWI) capability, was included to serve as the communications center for the TOC. The M880 was to be positioned

approximately 600 meters from the M109 van so that radios could be remoted into the van or radio transmissions could be routed through the phone system using radio-wire integration. Antennas were placed a good distance from the vehicle and moved often to confuse any triangulation attempt. Two RATT rigs were added to the complex and were usually located about 200 meters from the van and linked by wire to the TOC. The M109 van with radio assigned to the S3 and an M880 wire team vehicle rounded out the rolling stock of the TOC. (There was one additional M880 used by the TOC but not considered an integral part of

the system.) In addition to the GP tent, all tents and personal gear were eliminated in the TOC. The M880 was used as an alternate to rotate TOC shifts of approximately 20 personnel.

It was obvious to the project team that all this accomplished little toward the stated goals if the TOC remained in the center of the division artillery headquarters area. Consequently, it was decided the TOC would operate forward of the division artillery location, with the actual separation distance determined by the tactical situation and availability of secure radio and wire communications. Ten kilometers appeared to be sufficient to obtain the desired results. Actually, the team simply modified the tactics and doctrine found in FM 6-20-1 and fit the "trains" concept to the needs of the division artillery.

All functions and sections not critical to the TOC were located in the division artillery trains area. This included the S1 and S4 staff sections, battery headquarters, maintenance, medical support, survey and meteorological elements, and the TAB. Space was also provided in the trains area for the off-duty TOC personnel and a briefing area for updating visitors.

The team completed the project in January 1980. The tactical field position of the division artillery consisted of three areas: the division artillery trains, division artillery communications center (equipment and personnel provided from the Division Signal Battalion's Operations Company) and the "roving TOC." The operations center was so named because essentially that is what it was. It was not the command post because the commander had the capability of running the operation from one of several locations.


The "roving TOC" was tested during last year's AT. The division artillery occupied field positions for eight days and seven nights, during which time the TOC displaced 16

times. After the first few attempts, it was capable of moving in 15 minutes; the best time of emplacement was 20 minutes. The trains and communications center remained in place due to severe constraints on available training area; however, this was tactically sound since the trains would be required to move only if the situation changed radically in either direction.

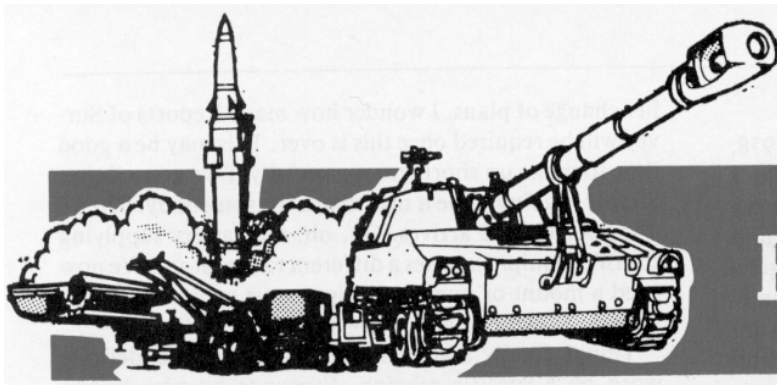
Several factors prevented the unit from achieving the desired "set-up" time during the first test period, communications being the greatest detractor. (More time was needed to lay wire lines than had been anticipated.) The present solution to this problem is to identify three or four successive positions along a given axis from the trains and communications center areas. The wire team then installs the wire to the farthest point and the TOC can tie into the lines as it displaces to the next site. The number of wire lines from the TOC switchboard had to be reduced to five; however, the resulting cable, even when reduced to five lines, was too bulky and cumbersome to be installed quickly. The team is now looking at the use of commercial telephone cable with 10 pairs of wire. Such wire takes up much less space and is easy to roll up, but it does not possess the strength of military wire.

Other attendant problems arose but were solved by additional practice or by a slight change in the method of operation. As examples: The expandable van had to be situated on a fairly level plane or it would bind when the sides were expanded; housing and feeding the off-duty shift in the trains area caused some hurried feeding and late replacement; and with the addition of another independent area, the age old problem of perimeter security was increased.

Considering the lack of some critical equipment such as secure radio gear and the short amount of training time available, the 28th Division Artillery made optimum use of resources to put their concept to the test. General Meloy, Commanding General of the 82d Airborne Division, in his role as chief evaluator for the 28th Infantry Division during 1980, reported: "Division artillery headquarters should be commended for their efforts to operate tactically during the entire AT period and for the enthusiastic way in which they forced and then corrected mistakes in the field. They worked extremely hard to refine their operational CP procedures, displaced twice a day for four consecutive days (during the first week), and through trial and error tried a variety of ways to man an around-the-clock staff, plus a variety of CP configurations. Their performance improved remarkably, and by the end of AT they were functioning in the field with an easy skill."

The 28th Division Artillery realizes that it is far from a complete, totally responsive, fully validated solution to the problem. They solicit any comments and suggestions that could assist in perfecting the system. Almost the entire division will train together this year, and the concept will be further tested which will add several imponderables to the equation not identified to date. Further, the team will consider the impact and possible aid that a nondivisional Artillery Brigade could have on the concept. All concerned with the project believe the thrust to be in the right direction. Survivability of the command and control facilities on the modern battlefield is so important that it may well be the lynchpin that thwarts any tactical or numerical superiority possessed by the enemy. 

LTC Robert B. Adair is the Senior Advisor to the 28th Infantry Division Artillery, Pennsylvania Army National Guard, Hershey, PA.



notes from the units

Right by Piece

REFORGER welcomes first Army National Guard battalion

LANCASTER, SC—The South Carolina Army National Guard not only has one of the highest combat readiness ratings in the National Guard, but it also has a record-breaking unit—the 3d Battalion (8-inch, Self-Propelled) of the 178th Field Artillery. This unit is the first battalion-sized Guard or Reserve unit to participate in REFORGER and the RAMDEP POMCUS programs.

More than 450 members of the 3-178th FA, headquartered in Lancaster, SC, spent their two weeks of last year's Annual Training in Braunschweig, West Germany, in an exercise called "Spearpoint 80." This was a part of the overall "REFORGER 80" (Return of Forces to Germany) exercise involving more than 63,000 American, British, and West German Active and Reserve Component soldiers.

What sets "Spearpoint 80" apart from other overseas deployment training exercises is the fact that the 3-178th relied entirely on drawn POMCUS (prepositioned) equipment for their training requirements, as opposed to bringing organic equipment from their home station. In the event of war, the first deploying units would be equipped in this manner which is an important concept of the RAMDEP (Rapid Deployment) program.

In early September (1980), an advance party of 159 soldiers from the 3-178th arrived at the Miesau Army Depot, Germany, to draw equipment for the exercise. Their task was to quickly inventory, fuel, and test equipment in preparation for immediate use in simulated combat situations. The amount of time usually necessary to draw equipment from the warehousing area and move it to the marshalling area is 4½ hours. The 3-178th completed their draw in 3 hours and 44 minutes, in spite of minor operational problems and bad weather.

During the simulated war exercise, American, British, and West German troops split into two opposing forces with the 3-178th sharing the role of the aggressor force. At the conclusion of the exercise, the 3-178th returned all 156 items of equipment and their components without loss or damage.

The record performance times and successful return of equipment are indications of the professionalism and dedication that exists within the 3-178th FA.

"Spearpoint 80" has proved some significant points about the National Guard. LTC Stan Baldwin, 3-178th Battalion Commander, says, "Spearpoint 80 confirmed that the National Guard is ready and capable in the combat arena. We can be proud of our accomplishments and our important role in the total Army as 60 percent of the Army artillery." (Donna Robey)

321st trains in Texas

FORT BRAGG, NC—In mid-October last year, elements of the 2d Battalion (Airborne), 321st Field Artillery, returned home from Fort Hood, after completing nearly 30 days of continuous field training in the Lone Star State.

For Battery B, the tactical redeployment to Fort Bragg consisted of a heavy drop of one of its howitzers, a personnel jump for 44 artillerymen, and a tactical air-land exercise for other men and equipment using two Air Force C-130 transports.

At Fort Hood, the battalion participated in a test, called "Firefinder," conducted by the 1st Cavalry Division. During testing the airborne artillerymen worked with a new generation of artillery (enemy) locating radar system.

In addition to the Firefinder test, the 2-321st FA conducted battery-level diagnostic gunnery tests. In firing 2,100 rounds during this portion of the training, evaluators noted a significant improvement in the battalion's ability to put "steel on the target."

The battalion also worked with the M110 and M107 howitzers and a TACFIRE computer system. Officers observed the technique of computing firing data from an observation post (OP) without the assistance of a fire direction control center.

The battalion invested 16 battery training days in improving individual marksmanship skills.

"It gave me a chance to see what the rest of the Army looks like," said SP4 Dwight J. Jordan, who made the trip to Texas with the 2-321st FA. "It was a new experience and I enjoyed it."

Despite the heat on the sunny days and the mud on the rainy ones, everything turned out well for SGT Foe Fualau Jr. "It was good training and I got a lot out of it," he said. "I wouldn't mind going back." (Dave Matthews)

A battery XO's recollection

FORT BRAGG, NC—The day is Tuesday, 16 May 1978, which starts as usual for an artillery battery in the 82d. I am in my office doing some paperwork, and my battery commander is in the field with the National Guard unit we habitually support in the summer. About 1430 I get a message to report to the battalion headquarters immediately because the battalion has been alerted—this is unusual! We seldom have any prior warning on callouts and we are in the midst of NG training!

The battalion headquarters is alive with excitement. People are in constant motion. The training teams in the field have been recalled. Until they return, we will function with what we have. No definite word about the mission has been received. Someone says "Zaire." Where is Zaire? What is in Zaire? That's what I get for not reading the newspaper or watching television newscasts for several days.

A briefing is held by the battalion commander. Zaire is the focal point, but few specifics are available. Looks like my battery may not go. We are to provide filler personnel and equipment for the other two batteries.

I go back to the battery area and issue what instructions I can. Hand receipts are prepared and required equipment lists received. Equipment is transferred. I feel like I am cutting off my arms when the FDC and communication equipment leaves. One part of my XO mentality wants to sign over the marginal pieces of equipment—save the good stuff. My good sense overcomes that. It would not be fair to send my friends off to war with less than the best available.

During these wild moments I jump from one emotional level to another. Excitement, fear, pride, nausea, disappointment, and relief all sweep over me in rapid succession. I want to go to Zaire; yet, I do not want to get shot. Getting left back here will be the pits. If I go, I may never see my family again. I'm too smart to get shot, though. Final decision—go if I get the chance (with reservations).

New change—my battery is alerted too. Looks like airlanding for us with another battery dropping and the other ready to go either way. New problem—I just hand receipted several critical pieces of equipment to those other two batteries and it is too late to get back those items. This is a *lovely* day!

The battery scheduled to move out first has a new battery commander as of that morning. What a way to break in. His driver is cranking his jeep to leave for the heavy drop rigging site and lo and behold, the vehicle refuses to move. Being the lowest priority battery of the three alerted and overall just swell guys, we give them our jeep (i.e., our battery commander did). What else could happen?

Equipment from another battalion begins arriving. I feel like a pauper since so much is needed due to the earlier

change of plans. I wonder how many Reports of Survey will be required once this is over. This may be a good time to make up shortages—especially if we go to Zaire. Supply is going to be a nightmare for somebody. The 1/4-ton for my BC arrives. Oh, oh, the battery supplying the filler equipment uses a different radio set-up. We now need a mount or must reconfigure our communications system. I love being an XO—God help me!

Things finally start calming down. Still no definite word on a specific mission. Everyone by now knows about the foreign nationals whose lives are in danger. Rumors fly. Word is to move later to the call-forward area close to Pope AFB and stand by.

I call Marilyn to bring in some extra clothing. Her voice betrays a certain degree of knowledge, but we do not discuss the matter on the telephone. She comes to the bowling center parking lot with the clothes and a few goodies to eat. Shannon, our two-year-old daughter, and our beloved mutt come, too. Wives and girlfriends are making many such visits. One good thing about being an artilleryman is having a vehicle to carry more equipment and clothing than the minimum required. War might as well be comfortable. Saying good-bye is tough but necessary.

Night has arrived. The time has come to move to the call-forward area. All the vehicles are placed in their respective lines. We wait. Last minute adjustments are made. Paperwork for the air movement is organized. I am lucky—my AXO is squared away on the paperwork. He stays there with a few guards. The remainder of the battery returns to the battery area to rest. Now the longest three days of my life begin. All of my sleeping equipment is loaded on my vehicle. I sleep about 30 minutes. A couple of chair cushions and a poncho liner help me pass what little is left of the night.

Daylight brings little change. We pick up plywood to protect the aircraft floors from our trailer stands. Concertina is issued. Nice to have but a little difficult to store in an M561 already loaded, but we make room. No ammunition is passed out. I guess the people that make the important decisions have not.

Maps are distributed by the S2. Several different scales are used on them—one even is a 1:200,000. Trails are hard to pick out on it. The FISTs and FDC get their heads together and decide to use a mark center of sector mission if we land where we do not have a map. Maybe that won't happen.

The days all blend together. Waiting is rough. Guards are rotated. Walter Cronkite and his associates provide constant updates. The emotional roller coaster continues. Pool, pinball, and foosball games relieve some of the boredom.

The troops amaze me. There have always been a few in the past who said they would never deploy because they were sole surviving sons. Some never tried to do their

jobs. Not so now. Everyone is fired up and ready to go. No one tried to get out of this alert! They make me proud to know them.

The French and Belgians drop. Looks like we will not go after all. Now rumors run rampant on how soon we will go home. A certain amount of relief sets in. However, I wonder what our allies think of our decision and whether we should have allowed another country to risk their troops' lives without us doing the same, but the 82d was ready to go. Certainly someone would have protested claiming a new Vietnam but the Army was prepared to make the sacrifice. I hope the stakes will not be higher the next time.

On Friday the long wait ends. The decision to only use US aircraft to support the rescue operation reduces the need for us. I go home around 1600. That bed sure feels good.

WHEW—that was close! (1LT John M. House)

Charlie Battery, 1-79th FA earns Gillmore prize

FORT ORD, CA—Charlie Battery, 1st Battalion, 79th Field Artillery, was recently named the best firing battery in the 7th Infantry Division Artillery.

The announcement came as a result of the 5th Annual Gillmore Artillery Competition held last October at Camp Roberts.

The battery, commanded by CPT Emilio DiGiorgio, showed their skills in all-around artillery proficiency as they blasted their way to victory.

Charlie Battery competed against Alfa Battery, 6th Battalion, 80th Field Artillery, and Bravo Battery, 2d Battalion, 8th Field Artillery, for the coveted trophy. The batteries finished so closely that it took numerous recomputations to finally decide the winner.

"We're the best by test," said CPL Reggie Taylor, a gunner for C Battery's 1st Section and that's just what the Gillmore award proves.

The batteries struggled neck and neck with each other through the stringent competition. They battled it out in tactical operations, fire direction, firing battery operations, and live fire exercises.

"While the competition was extremely close and is a credit to each of the units that participated, I'm particularly proud of the enthusiasm and will to win that was demonstrated by the individual soldiers of my battery," DiGiorgio said.

The three competing batteries were joined by the other parts of the division artillery team, Headquarters and Headquarters Battery, and B Battery, 333d Field Artillery (TAB), who provided a wide range of support expertise.

But at the end of it all, Charlie Battery edged out in front and took the esteemed title of Gillmore Battery.

The trophy, a mounted Soviet weapon captured from a North Korean soldier during the Korean War, was given to the 7th Infantry Division Artillery for the annual award by MG (Ret) William N. Gillmore, for whom the competition was named. Gillmore commanded the 7th Division Artillery during the start of the Korean War.

Ammunition "on time"

FORT HOOD, TEXAS—A howitzer without ammunition is like a car without gas; all it does is sit there!

Getting enough ammunition to the guns, at the right time, is a big responsibility, but, during the AN/TPQ-37 artillery locating radar operational test exercise held during September and October last year, the ammunition section from the 1st Battalion, 77th Field Artillery, 1st Cavalry Division, did a great job.

According to LTC Gary J. Walk, commander of the 1-77th FA, "They were set up in the field for almost two months and kept things running smoothly the whole time."

"We did a good job because we planned for all the problems we thought we might run into," said 2LT Richard Broach, executive and battalion ammo officer of 1-77th's Service Battery. "We really put a lot of effort into the maintenance of the vehicles. GOERs can be a real headache sometimes, but we took a mechanic with us and kept everything rolling."

Normally the weather in central Texas offers a few unpleasant surprises, and weather during the test exercise was no exception. Heavy rains turned most of the tank trails and dirt roads into quagmires which didn't make ammo resupply any easier.

"Some of the roads were really bad," Broach recounted, "but the drivers kept everything going."

Just finding the firing points was challenge enough and, as part of the test program, it was necessary for the battalion to locate its guns over a maximum number of firing points. At one time each of the battalion's 18 howitzers was at a different location. "The drivers got a lot of good training reading maps," grinned Broach, "but none of them ever got lost."

The key to the ammo section's success on the operation was organization. They set up an ammunition supply point (ASP) in a central location and picked up a massive load of ammunition each week and brought it to their ASP. There, the rounds and fuzes were sorted as to type and made into separate loads to meet the needs of each battery.

"Battery firing schedules for the entire problem were made up before we went to the field," said Broach, "but, like any exercise, there were several changes and we had to stay flexible."

A 155-mm artillery round weighs about a hundred pounds, plus the powder charge and the packing. Multiply

that by the more than 3,200 rounds that the members of 1-77th's ammo crew delivered to the guns and you get an idea of the size of the job. They had to move more than a ton per man.

PFC Douglas Tracey, ammo clerk in the section, looked back on what the section accomplished, "I wouldn't have believed that moving 3,200 rounds in a month was possible if I hadn't seen it. That's a lot of weight."

Getting the ammo to the guns wasn't the end of the work. The leftover packing materials, crates, nose caps, etc. had to be picked up and accounted for. Any shortcoming—a missing canister for example—will cause a "break" in the sections accountability. "We've gone 22 months without a "break" Tracey boasted. "I believe that's a division record."

"We went to the field a week before the rest of the battalion, to set up, and we came back in a week after they returned. That's a long time to be out in the field," Broach stated. "During the middle of the week, when the guns weren't firing we had to work preparing GOER loads. All that could have caused a morale problem, but these guys were really great."

"We made the most of the time we had and that helped," Broach commented. "When we had work to do, everyone worked hard. During the slack times I was able to get people back to the post for a little time off." Finally Broach concluded, "I think it's when you do a little bit of work and have a lot of time sitting on your hands that you have problems with morale. When you stay busy it isn't a problem."

Broach felt that his men did just about everything on the field problem that they would be called on to do in combat. It's with a bit of pride in his voice that he made the statement, "If we do have to go into combat, we know we're ready." (SGT David Kuhns)

Artillery soldier returns to Golden Lions

NEW ULM, GE—Many soldiers leave the Army out of dissatisfaction or curiosity—they want to take a look at what's out "there," and find out if the door of opportunity will open to them. They may spend several months looking for a job or going to school and, if unsuccessful, the Army and its benefits and security sometimes start looking better. Perhaps, the ex-soldier thinks it wasn't all that bad after all. The Army started looking good to SGT Henry Bacon (age 26) in September of last year.

The Army had been good to Bacon during the eight years he served in it. He volunteered in 1972, reenlisted in 1974, and sewed on sergeant stripes not long after. But his job in administration left him unchallenged, so he bid

farewell to the 2d Battalion, 33d Field Artillery, and the Army in early 1980.

He had his eye on attending an air conditioning refrigeration repairman school to learn a trade, but received a major setback when the school had already started.

A new semester would not begin for eight months, so Bacon went hunting. The Tampa Bay native covered most of Florida and Georgia in search of an occupation.

"I did construction work for awhile, road and bridge type stuff, but the foreman was a real hell raiser, and it was hard to stay in a job that I knew held no future and only paid minimum wage," Bacon said.

He left the construction job and undaunted, tried his luck at a few other locations. One firm's reply was "don't call us, we'll call you"—and never did. Another gave him a waiting time of at least four to five months before he would be considered. So he returned to a \$135 a week construction job, but he was feeling the bite—literally. Two pulled teeth dropped him \$60 and keeping the tank of his 1976 Electra full, at \$32 a shot, was next to impossible. A visit to a friend in the Army and "homesickness" for Germany, where he had spent five years, led him to enlist. As it happens, Bacon was still on his long terminal leave and had not officially reached his ETS date yet, when he rose his hand and was returned to the 2-33d Field Artillery for reenlistment processing.

As for the 2-33d, they welcomed Bacon back with open arms and during his brief stay in Neu Ulm, he talked to many "Golden Lions" who were "short."

"A lot of them had been living in the barracks for a few years and, although they didn't have many complaints, that alone can make a man want to get out, like I did, and see what he can do. Some others are staying in," Bacon said. "I know now that I've come in a second time I'll be in at least 20 years. I won't try to talk them into staying but I will tell them straight."

"A lot of professional people I talked to on the 'outside' (teachers, principals, city officials, etc.) recommended that a person in the Army, thinking of getting out, might as well stay in; if you're dissatisfied, you can switch jobs. But if you want you can always check the 'outside' for yourself."

Don't be surprised if after awhile in the "world" the Army starts looking good, and those "dissatisfactions" small. (The Traveler)

Clark was a Redleg

William Lewis of Lewis and Clark fame became a Second Lieutenant of Artillery prior to his trip.

Courtesy COL (Ret) Robert M. Stegmaier

The Many Sides of Saint Barbara

by Truman R. Strobridge



The Metropolitan Museum of Art, Gift of J. Pierpont Morgan, 1917.

The pages of this journal have often been graced by reproductions of various paintings of Saint Barbara. Not once, however, has a reproduction of a sculpture of the Patroness of Artillerists appeared.

To most people, "art" probably means painting, but it seems only fair that the readers of the *Field Artillery Journal* have an opportunity to be exposed to works of sculpture—a spatial art that occupies and displaces space, something the flat-surfaced painting can't do—of their most famous and beloved historical figure, Saint Barbara. After all, what other group of fighting men have their own personal Saint that stands guard over their welfare?

To remedy this oversight, the Metropolitan Museum of Art in New York City has granted the *FA Journal* permission to print photographic reproductions of two carved figures from their collection.

- One is a full-length stone sculpture of Saint Barbara, painted and gilded, of 15th Century French origin. Little else is known about it.

- The other, also from the 15th Century but of German (Swabian) origin, is a 14-inch tall reliquary bust of painted and gilded linden wood. Attributed to the school of Nicolai von Leyden, it came from the Church of Saints Peter and Paul at Weissenburg, Alsace. The combination of feminine delicacy and strong modeling in this bust is characteristic of late Gothic German sculpture. Note the three-dimensional, multifaceted, and all-round viewpoint of your favorite Saint.

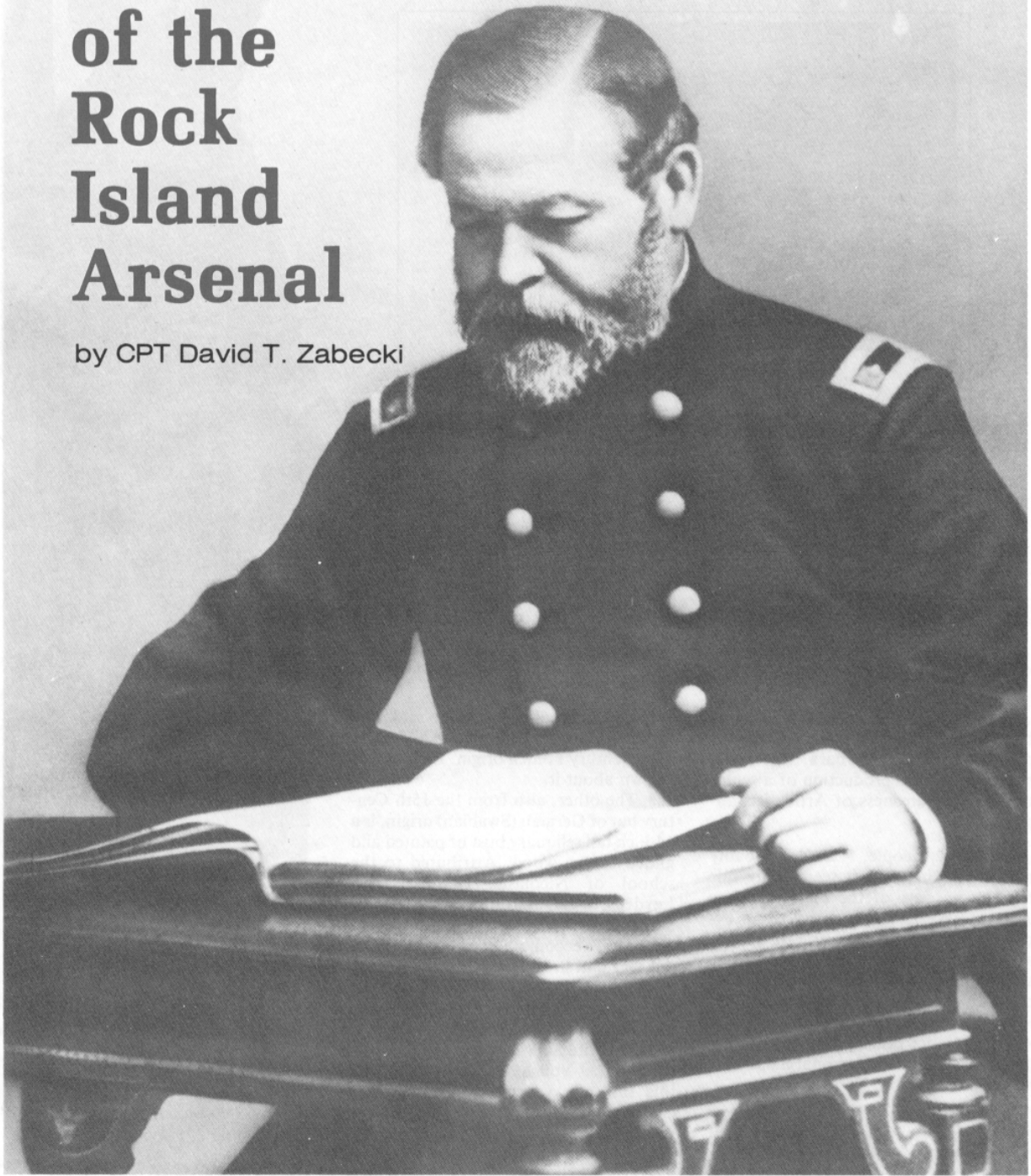
Now that you have been exposed to this fine art, you might even be encouraged to seek out and view during your travels the many other sculptures of Saint Barbara that are scattered throughout the world in churches, museums, and private collections.



The Metropolitan Museum of Art, The Cloisters Collection, Gift of Mrs. Solomon R. Guggenheim, 1950.

Father of the Rock Island Arsenal

by CPT David T. Zabecki



Brigadier General Thomas Jefferson Rodman (photo courtesy of Rock Island Arsenal Historical Office).

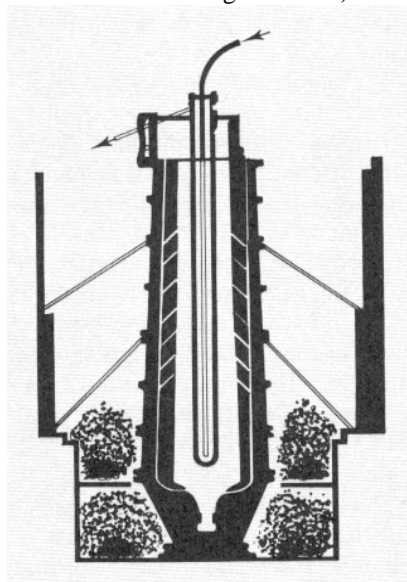
A landmark period in the evolution of artillery technological development occurred in the 40 years between 1830 and 1870 while the practical application of these developments was dramatically demonstrated during the Civil War. These advances were brought about by a scattered handful of civilian and military inventors and scientists who worked to improve virtually every facet of military ordnance. Foremost among this group was Brigadier General Thomas Jefferson Rodman who revolutionized cannon barrel design and developed the theory of propellant design that is still used today.

Rodman began his military career in 1841 when he graduated from West Point, seventh in a class of 52. He was commissioned in Ordnance and assigned to the Allegheny Arsenal in Pittsburgh. In 1844, he began working on the problems of cannon barrel design after a 12-inch gun exploded on-board the *USS Princeton*.

Gun barrels at that time were cast solid and then bored out. Here, Rodman observed that as the barrel cooled, the outside became solid first and, as the cooling process continued, so did the contraction of the inside material, often resulting in large cracks through the center. Although these cracks were removed when the center was bored out, Rodman reasoned that the metal on the outer diameter of the tube was in a state of compression while the inside metal surrounding the bore was in a state of tension. Further, when the explosion from a propellant ignition occurred inside the chamber, the added tension could easily rupture the tube.

He initially proposed to increase the compression on the tube metal by wrapping it with wire; however, the problems of maintaining a constant tension on the wire soon caused him to abandon that approach. Rodman then surmised that he could achieve the same effect by cooling the cast tube from the inside out. This could

be accomplished by casting the tube hollow and cooling the inside of the gun by circulating water through an iron pipe around a cored barrel. At the same time, the outside of the casting would be kept hot with coals which would be gradually removed as the cooling process progressed from the inside out. During this process, as the barrel cooled, each successive layer of metal would be shrunk one upon another, with each layer being compressed by the shrinking of the next outer layer. The resulting tube wall would be in a state of compression throughout its thickness. (Rodman compared this principle to the process of shrinking an iron tire on a wagon wheel.)



Hollow casting process.

At first, Rodman was unsuccessful in his attempts to convince the Ordnance Department to experiment with the process. The idea of circulating water through a molten casting was considered too risky because it was feared that the pressure of the resulting steam from water hitting a hot iron would result in an explosion. After three unsuccessful trips to Washington, Rodman received permission to patent and privately develop his process from Ordnance Chief General Talcott. In 1845, Rodman

entered into a contract with the Pittsburgh firm of Knap and Totten, who agreed to bear all the manufacturing and testing expenses for half interest in the patent.

Rodman conducted his tests between 1849 and 1858 using eight different pairs of 8- and 10-inch guns. One gun of each pair was cast by conventional methods and the other by the hollow casting process; however, the guns were identical in all other respects (e.g., size, weight, and metal composition). The first test was conducted in 1849 on a pair of 8-inch tubes. Using a 64-pound projectile and 10 pounds of powder, the solid cast gun burst on the 85th round but the hollow cast tube was still intact when the test was terminated after 251 rounds. In a follow-up test in 1851, the solid cast tube burst on the 73d round with the hollow cast gun surviving 1,500 rounds.

Rodman suspected that the hollow casting process produced an additional desirable effect, although he could not prove it at the time. Testifying before Congress in 1864, he described the bore of the hollow cast guns by saying:

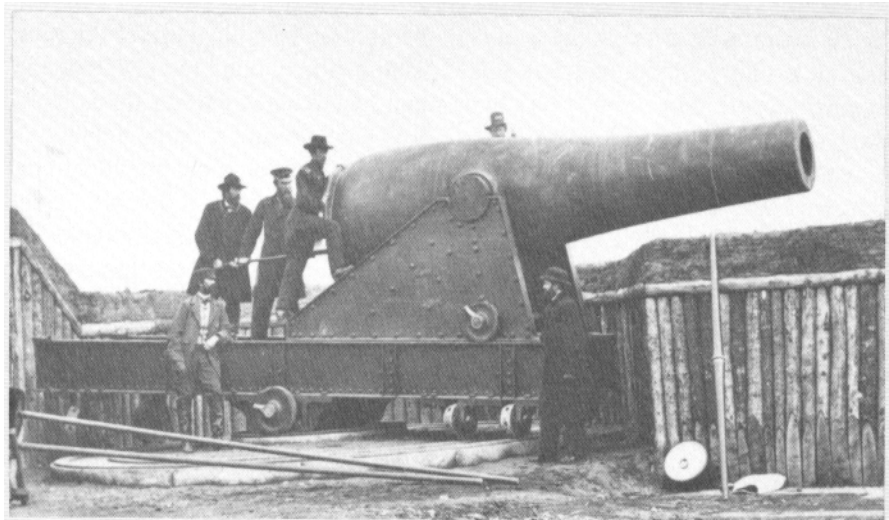
"The metal of the interior is harder and closer and will not be so readily abraded by the passage of shot along the grooves. In fact, the very rapid cooling, to which the metal closest to the bore is subjected, produces martensite, a hard and resilient crystalline form of steel. This material significantly increases the tube's resistance to gas erosion and projectile wear."

The Government finally accepted the hollow casting process in 1859 and requested that Rodman design and manufacture a 15-inch gun prototype using his process. The resulting 15-inch Rodman Gun had a total length of 190 inches, a weight of 49,099 pounds, and a maximum outside diameter of 48.1 inches. Test firing conducted in May 1860 at Fort Monroe, VA, was witnessed by a joint board of Engineer, Ordnance, and Artillery officers. (One of the

Artillery officers, Major Robert Anderson, would be in command of Fort Sumter at the outbreak of the Civil War, a scant 11 months in the future.)

The board witnessed a total of 49 firings using both 330- and 450-pound projectiles with 25 pound propellant charges. A complete firing cycle of sponging, loading, and running into battery took 1 minute and 52 seconds on the first round; however, by the sixth round, the gun crew had the time down to 1 minute, 3 seconds. The maximum range achieved during the tests was 5,730 yards. The board recommended acceptance of the design which was subsequently adopted as the standard heavy gun for Coast Artillery while lighter versions were adopted for fortress, siege, and shipboard use. Throughout the course of the Civil War, the Federal Government purchased over 1,500 Rodman guns in 8-, 10-, and 15-inch calibers. (Two experimental 20-inch Rodman guns were produced, but never fired.) More importantly, virtually all artillery tubes from that point on were manufactured by the hollow casting process.

Perhaps Rodman's greatest contribution to the evolution of artillery came in the area of the physical configuration of the propelling charge. Here, he was the first to propose that powder be specifically designed for the gun in which it was to be used. During test firings in the 1850s, he observed that the rate at which a propellant burned was directly proportional to its surface area. With the conventional grain powder of the time, the greatest surface area was at the moment of ignition. As the grain powder burned, its surface area decreased; hence the rate of burning slowed and subsequent generated pressure decreased. As the projectile moved down the bore, the volume in the chamber increased, which also affected a reduction in the pressure behind the projectile. Rodman concluded that the optimum propellant



Battery Rodgers, Alexandria, VA (Brady photo, circa Civil War, courtesy of the National Archives).

"would be that which burnt so as to evolve its gas proportionally as the space increased behind the projectile while in the bore."

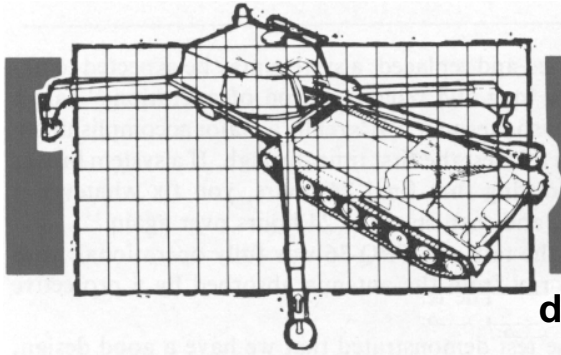
Rodman's solution was to press powder into cakes which were then perforated with longitudinal holes. This configuration would cause the individual cake to burn from the inside out as well as the outside in. As the propellant material around the holes burned, the holes would get larger, thus increasing the exposed surface area as well as the rate of burning. "Prismatic powder," as Rodman called it, did not really increase chamber pressure—it simply maintained it at a higher level as the projectile traveled down the bore. The logical result was an increase in the muzzle velocity of the projectile without a corresponding increase in strain on the tube. Progressive burning propellant, specifically designed for a particular tube-projectile combination, is a basic principle of artillery ammunition to this day.

In 1861, Rodman published the results of his studies in a book entitled *Report of Experiments on the Properties of Metals for Cannon and the Qualities of Cannon Powder*. During the Civil War he commanded the Watertown Arsenal which produced

ammunition, artillery carriages, and a wide range of other ordnance materiel. Throughout the War, Rodman worked seven days a week, often until one o'clock in the morning. At the end of the Civil War he was investigated by a Congressional committee on charges of mismanagement of the Arsenal and "disloyalty." He was cleared of these charges and in 1865 was transferred to the Rock Island Arsenal and promoted to brevet brigadier general.

Rodman assumed command of the former prisoner-of-war camp and immediately developed plans to expand it into a large, modern manufacturing facility. He drew up the plans for the installation's road system, the commandant's quarters, and 10 large, stone shop buildings, most of which are still in use. In his characteristic fashion, he worked day and night on the project, ignoring the warnings of his doctors. Eventually, the long hours took their toll and in 1871, the "Father of the Rock Island Arsenal" at the age of 56 died while still in command. He was buried at the east end of the Arsenal, which today, appropriately enough, is the home of the Armament Logistics Command. ✉

CPT David T. Zabecki is Commander of Battery C, 2d Battalion, 123d Field Artillery, Illinois Army National Guard, Galesburg, IL.



FA Test and Development

design • development • testing • evaluation

USAREUR firing batteries to get new intra-battery radios

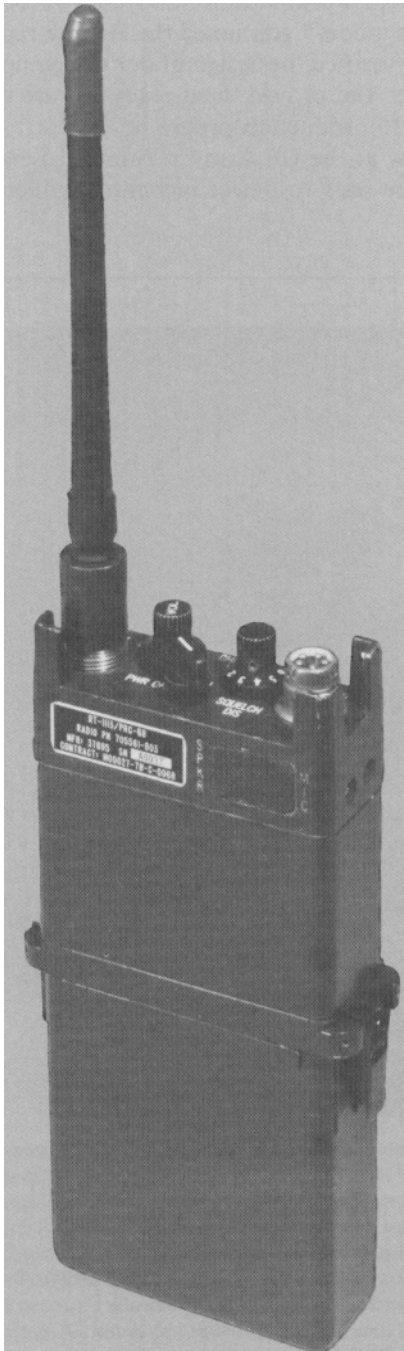
Department of the Army recently approved priority issue of the handheld AN/PRC-68 Small Unit Transceiver (SUT) to USAREUR M109 battalions scheduled to be reorganized under the 3x8 concept. The radio, now in production by Magnavox, should be fielded in Europe during the June-August 1981 time frame.

SUT, which was developed as an infantry squad radio, will offer firing batteries a marked improvement in communication. The radio is lightweight (35 ounces), compatible with the current FM radios (30-80 megahertz), and requires no crystals. The radio has a pre-set base frequency and nine other channels spaced at 200 kilohertz. Transmitter range is between three to five kilometers, with more than enough power (1 watt) to communicate between

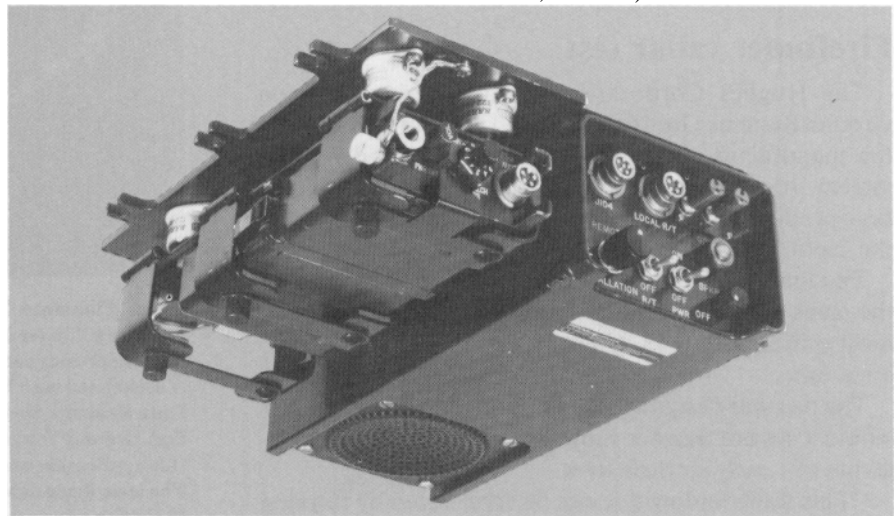
howitzer sections and fire direction centers, but limited enough to avoid detection and mutual interference.

Radios will be issued to each howitzer section, fire direction center, platoon leader, and battery commander. Its primary use is intended to supplement the battery's wire system and provide quicker response during occupations and hip-shoots and for convoy control.

In a follow-on action, the Field Artillery Board will test the SUT mounted with a power amplifier (OG-174 (VRC)) in February 1981. The SUT and power amplifier will be mounted in self-propelled howitzers and FDC vehicles. This will give the added capability of an external loudspeaker and interface with the VIC-1 intercom and the Battery Computer System. The SUT with power-amplifier system should appear in mid-1983. (Mr. Dick Brown, FATDS)



Small Unit Transceiver.



AN/PRC-68 Small Unit Transceiver with a power amplifier.

Chemical weapon modernization

Recent events, to include Congressional actions on construction of a binary munitions facility, have stimulated increased interest in US chemical warfare policies and posture. It is important that US chemical warfare policies be clearly understood; therefore, the following Department of Defense policy statement regarding chemical weapons modernization was recently released:

"The US policy continues to be to seek a complete and verifiable international ban of lethal chemical weapons, and we are continuing negotiations toward that goal. However, in the absence of an adequate verifiable international agreement banning such weapons, it is the US policy to maintain a retaliatory stockpile to deter others from using chemical weapons and to retaliate if deterrence fails. The US is formally committed to the policy of 'no first use' of lethal or incapacitating chemical agents by adherence to the Geneva Protocol of 1925. Any future modernization of the offensive chemical capability would only be for the purposes of deterring the use of chemical weapons by others and for retaliatory employment in the event others use it first. There is no desire to see the use of chemical warfare in any future conflicts, but US forces must be realistic and prepare for such an eventuality."

A decision is expected in the next few months whether or not to undertake a modernization program and in what form it should take. That decision must take into account such considerations as the need to modernize, attitudes of US allies, and negotiations to ban chemical weapons. The pending decision regarding modernization of our chemical warfare offensive capability does not affect our extensive on-going programs to upgrade defensive capabilities (e.g., detection equipment, protective gear, shelters, and training).

Firefinder radar test

The Hughes Corporation Manufacturing Division Ground Systems Group has reached a major milestone in the manufacture of the AN/TPQ-36 Firefinder radar system—the successful system and burn-in test of the first production TPQ-36 built and tested completely by the factory.

The Firefinder was subjected to seven days of round-the-clock operation and passed, failure free, the final, most critical 24 hours, when weak components tend to burn out.

The test was designed to find the parts and assemblies within a system that are subject to "infant" mortality—giving out early in their lives.

"This fault-finding test can be accelerated by running the system in a heated environment. With weak parts identified

and replaced, a system may be expected to undergo a long and reliable period of operation," said a Hughes spokesman. "It's really a major accomplishment to pass this test the first time through. If a system breaks down during that final 24 hours, you fix whatever is wrong, and then start the 24 hours over again."

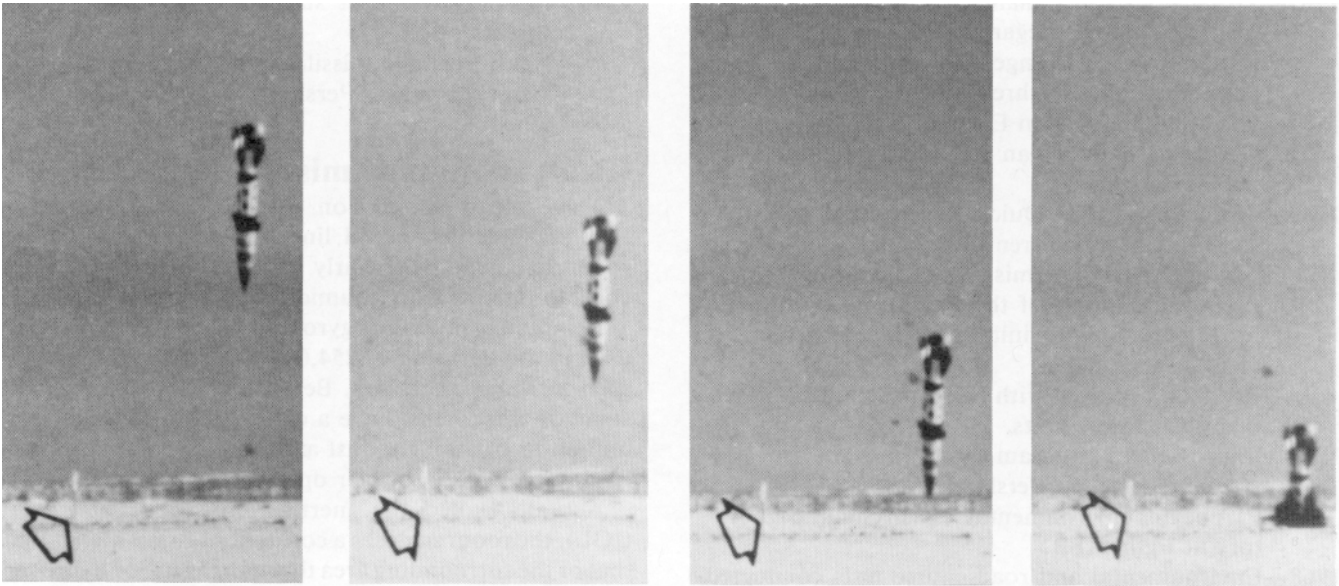
For the test, the TPQ-36 was fully operational, with the energy from the antenna absorbed by a protective blanket.

"The test demonstrated that we have a good design, good quality, excellent workmanship, and that we can operate in a fail-free mode," continued the Hughes representative. "It also verified the design of our test equipment and procedures and proved them ready for use in the sustained TPQ-36 production program."

The system is now at the US Army's Yuma Proving Grounds for live-fire tests to detect incoming artillery and mortar shells.



Laser Pinpoints Targets—US Army forward observer teams operating "under armor" will be able to pinpoint targets for laser-homing or conventional weapons by using a new laser designator. A technician with Hughes Aircraft Company's Electro-Optical and Data Systems Group adjusts the transceiver assembly on a modified Ground/Vehicular Laser Locator Designator, retrofitted for this application under contract to the US Army Missile Command. The laser designator and rangefinder device will be mounted on the M113 fire support team (FIST) armored vehicles. The system will also maintain its full tripod-mounted capability.



SIG-D flight just released—Composite photographs show results of US Army Missile Command Simplified Inertial Guidance Demonstration (SIG-D) program firing at White Sands Missile Range, NM, in March last year. Taken from high speed motion picture film at the target site, arrow indicates center of target stake. The missile is a T-22 solid propulsion Lance sized missile provided by Vought Corporation, aerospace subsidiary of the LTV Corporation.

400th Pershing missile launched

On 15 October last year, 21 years after the Army's largest weapon was first launched, the 400th Pershing missile roared into clear skies over the McGregor Range launch complex at White Sands, NM. The missile's inert re-entry vehicle landed on target minutes later at the White Sands Missile Range impact area approximately 100 miles away.

German Air Force troops of Missile Wing Two conducted the firing as part of an eight-round series of tests and training launches of the NATO missile system.

Each year a number of operational test firings are conducted under combat conditions to determine the proficiency of troops and the integrity of missiles assigned to the NATO defense role. Additionally, Artillery/Ordnance firings are conducted for training and to check out new concepts, modifications, or procedures.

The first Pershing missile was launched 25 February 1960, from Cape Canaveral, beginning a series of six successful firings during "maiden" testing. Since then, Pershing's record makes it a top contender for the most successful major weapon system to be developed by the United States.

In commenting on the milestone marked by the 400th firing, COL William J. Fiorentino, Pershing Project Manager, said that Pershing has established a commendable record in the three most critical aspects of military procurement—cost, schedule, and reliability—since the first contract was awarded to Martin Marietta Aerospace in 1958.

Since its beginning, the Pershing program has been one of continuing success and accomplishment. Starting with a solid basic system, Pershing has been continually improved in keeping with new roles and advancements in technology. Major modular improvements have been made to the launch, control, transport, and ground support systems to provide a quicker reaction capability and more flexibility for the field commander.

Currently, the system is undergoing the latest modular improvement through the Pershing II program, now in full-scale engineering development. Included in the modular improvements is a new radar correlator terminal guidance system that will provide pinpoint accuracy and thus allow the use of smaller yield nuclear warheads with greater military effectiveness and reduced collateral damage. Also, its increased range will permit a whole new spectrum of accessible targets for Pershing in its deterrent role in defense of the free world.

A chronology of Pershing highlights is as follows:

- 1958**—Army Missile Command awarded the Orlando Division of Martin Marietta first contract to design and develop the Pershing system.
- 1960**—First missile fired from Cape Canaveral (first-stage propulsion only) just 22 months after award of original contract.
- 1962**—First full flight (400 miles) at Cape Canaveral.
 - First Pershing battalion (2d-44th) activated, trained, formally organized.
 - Cold-weather tests in Alaska.

FA Test and Development

- 1963**—Tropical tests in Panama.
—Tactical findings began at White Sands Missile Range, with full-range (400 miles) firings over populated areas in three states.
- 1964**—Pershing deployed in Europe.
—German troops began Pershing training in the United States.
- 1965**—Pershing assigned Quick Reaction Alert (QRA) role as nuclear deterrent in support of NATO, in addition to its basic mission of providing massive firepower support of the field army. Major improvement program initiated to meet this requirement.
—Pershing deployed with Federal Republic of Germany Air Force units.
- 1967**—Improvement program completed and the new system designated Pershing IA.
—PIA begins environmental tests in climatic laboratory at Eglin AFB.
- 1968**—Environmental and road-course tests conducted at Orlando.
—Green River, Utah, service test firings into White Sands Missile Range.
—Beginning of "Operation SWAP" to equip US Army Pershing missile units with Pershing IA. This operation exchanged, item for item, new equipment for the old in a direct contractor-to-troop delivery system, bypassing the traditional Army supply system and without interruption of the units' combat readiness.
- 1970**—US phase of Operation SWAP completed.
- 1971**—German Air Force units equipped with PIA via SWAP.
- 1972**—Work begins on development of Automatic Reference System and Sequential Launch Adapter (ARS/SLA) ground equipment.
- 1973**—Pershing production line, closed since 1967, reopened for replenishment program.
- 1974**—Contract awarded for advanced development of new terminal guidance system for Pershing (Pershing II).
—First missiles fired with new ARS/SLA ground equipment.
- 1975**—Production contracts awarded for ARS/SLA for both US and German units.
- 1976**—ARS/SLA ground equipment delivered to PIA units in the field.
- 1977**—First Pershing II flight tests (five missiles) successfully conducted at White Sands Missile Range, demonstrating new terminal guidance system with analog correlator device.
- 1978**—Pershing program marks its 20th birthday.
—Contract awarded by Army for Engineering Development phase of Extended Range Pershing II.
- 1979**—Captive flight test conducted for Pershing II, using digital correlator.
- 1980**—Pershing II motor static firing tests conducted

- successfully.
—400th Pershing missile fired.
—After 22 years, Pershing program remains on schedule.

Clean room aids missile performance

The "clean room" on Pueblo Depot Activity's Pershing missile rebuild line is exactly that—a clean room designed to be nearly dustfree, as well as having constant temperature, humidity, and pressure.

Rebuilding precision gyroscopes and accelerometers used in the Pershing's \$254,000 guidance system makes such a facility necessary. Because the moving parts on some of these items have a clearance of only about 20 millionths of an inch, dust and other particles can have an adverse effect on their operation.

Actually called the Inertial Guidance Laboratory (IGL), the room encloses a constant pressure higher than that of the surrounding area through the use of hydrocarbon-free air compressors. According to IGL supervisor W. E. Greenarch, the air in the room completely changes every 90 seconds and the floor is totally grounded to prevent static electricity.

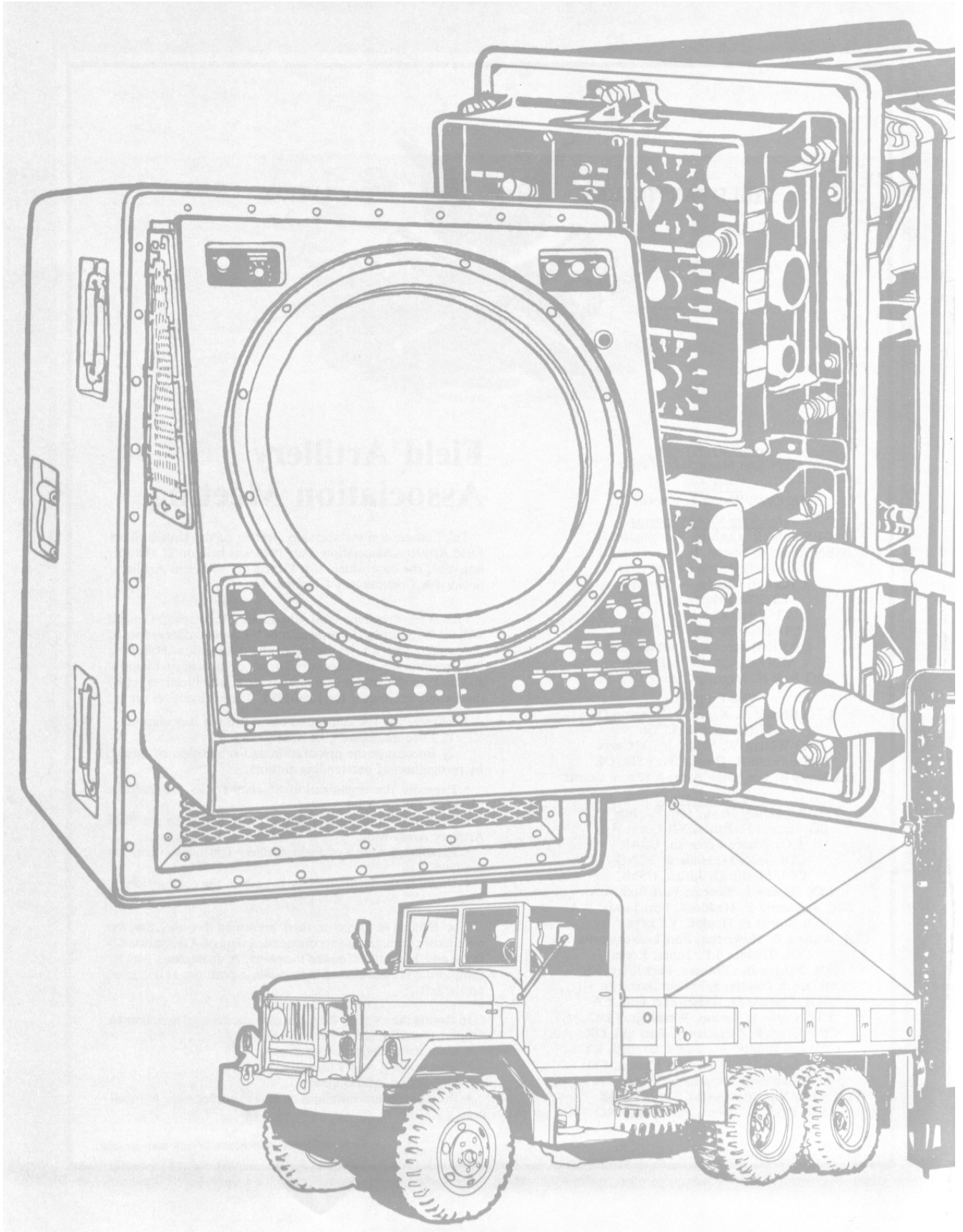
"These gyros are so sensitive that they can detect sunlight and are affected by it," says Greenarch.

Employees who enter the IGL must first don a surgical-room-type outfit. By necessity, they cannot wear beards, and are not permitted to enter if their skin is peeling for any reason.

In addition to this "clean room," there is also a "super clean room," in which the environment is even more controlled.

The Super Clean Room (environmentally controlled laboratory) was completed in March 1969 and greatly increased the depot's capability in performing overhaul of the Pershing stabilizing platform. Total cost was approximately \$571,000. Additionally, a special air control unit was erected on the roof of the building.





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Field Artillery Association Meeting

The first general membership meeting of the United States Field Artillery Association since 1949 was held on 21 October last year, the date which also kicked off the Field Artillery/Senior FA Commanders Conferences.

First Vice President (and Chairman), Lieutenant General Willard W. Scott Jr., Commander of V Corps Artillery, opened the meeting with a brief history of the Association. Following this presentation, the Executive Director reported on financial and membership status as well as association objectives set by the Executive Council for 1980-1981. Those objectives are to:

Recognize the FA Journal as central to the Association.

1) Encourage that it be widely read.

2) Encourage the preparation and submission of articles by recognition of outstanding authors.

- Promote the organization of chapters as professional forums within a social context.

- Recognize individual professional excellence in the Field Artillery Army-wide.

- Establish a source of Field Artillery-Distinctive items for the field.

- Promote the Field Artillery Branch in the commissioning base.

The Executive Director then presented for election the nominating committee's recommended slate of Association officers and Executive Council members. A unanimous vote by the quorum present elected individuals to positions as indicated on the left.

In closing the meeting the Chairman encouraged members to support the Association by:

- Continuing their membership.

- Encouraging others to join.

- Organizing local chapters.

- Provide recommendations on how to improve our Association.