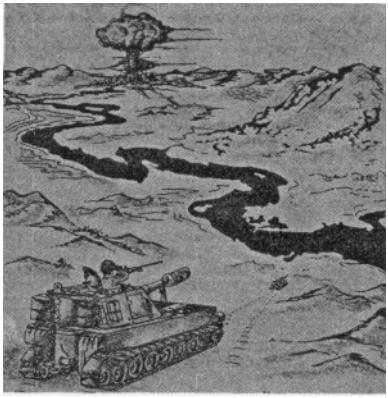
ARTILLERY TRENDS

NOVEMBER
1965

US ARMY
ARTILLERY AND
MISSILE SCHOOL

ARTILLERY TRENDS



NOVEMBER 1965

US ARMY ARTILLERY AND MISSILE SCHOOL

Instructional Aid Number 35

● COVER

A 155 SP battery is heading for a position across the river from which to support the infantry as it exploits the shock and destruction of a nuclear mission. This issue features an article on the problem of Nuclear Target Intelligence as tested by the 2d Armored Division Artillery. A second article, contributed by the Tactics/Combined Arms Department, USAAMS, deals with the much neglected subject, Retrograde Operations.

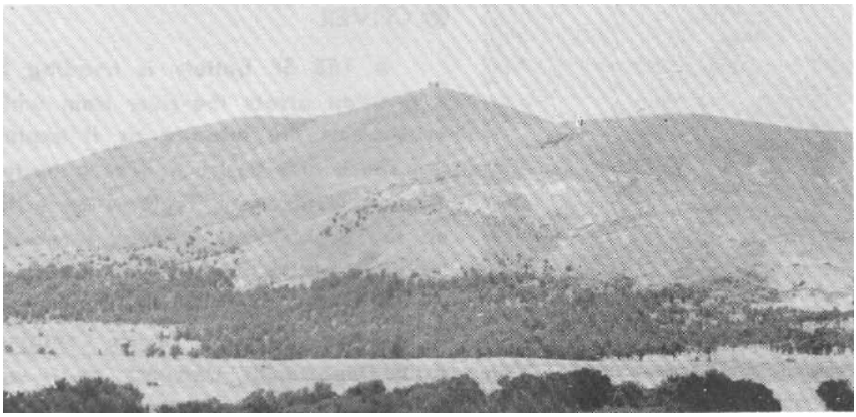
● INSTRUCTIONAL DEPARTMENT NOTES

● ARTICLES

● STATUS OF TRAINING LITERATURE AND FILMS

ARTILLERY TRENDS is an instructional aid of the United States Army Artillery and Missile School published only when sufficient material of instructional nature can be gathered.

Instructional Department Notes



Artillery Transport Department

TRACKED VEHICLE MECHANIC COURSE

Tracked vehicle mechanics are in demand. With the increasing number of tracked vehicles coming into the Army inventory and the constant emphasis on proper maintenance of all vehicles, a well-trained tracked vehicle mechanic has become an increasingly valuable asset to the commander. As newer and better tracked vehicles are developed and made available to units in the Army, personnel who know and can maintain these vehicles must also be available to the commanders of these units.

The main purpose of the Tracked Vehicle Mechanic Course taught by the Artillery Transport Department is to make these mechanics available. This course is designed to provide the units in the field with a mechanic capable of performing organizational maintenance and recovery functions on tracked vehicles in the field.

The student receives training and becomes well grounded and knowledgeable in all aspects pertaining to tracked vehicles. During his schooling, which lasts seven weeks, he is trained in the construction, operation and maintenance of vehicle engines and accessories. This includes training on diesel fuel systems, fuel injection, valve adjustment and starting systems and charging circuits, among others. Training on power trains and chassis, emphasizing transmissions and track and suspension systems, is conducted. The inportance of periodic services to good vehicle maintenance is realized in that 64 hours of the course is devoted to this subject. Recovery operations and troubleshooting are not neglected;

32 and 41 hours, respectively, are spent in training on these subjects, with safety a prime consideration. To insure that the student has a knowledge of the tracked vehicles common to the combat arms, 11 hours are spent on vehicle familiarization, to include equipment serviceability criteria.

In addition to the technical aspects, the student is trained in the important common subjects, such as maintenance administration, repair parts supply procedure and materiel readiness, without which no unit can have a good maintenance program.

A graduate of the Tracked Vehicle Mechanic Course emerges with the necessary knowledge and working experience (over 75 percent of the training is practical exercise) to fill the growing need of a capable and trained tracked vehicle mechanic for units in the field, a need that must be met if we are to continue being combat ready for any emergency.

Communication/Electronics Department

TRAINING FOR MOS 053.1 (05C20) RADIO TELETYPEWRITER OPERATOR

The Communication/Electronics Department has received requests from major echelon artillery units throughout CONUS to conduct training for MOS 053.1 (05C20) Radio Teletypewriter Operator. USAAMS is unable to conduct this type of course for several reasons—

a. Within CONUS the number of personnel in MOS 053.1 meet the requirements for that MOS.

b. MOS 053.1 is a Signal Corps monitored MOS.

c. The lack of sufficient personnel, equipment and facilities to conduct such a course at Fort Sill.

The Communication/Electronics Department recently contacted the U. S. Army Southeastern Signal School, which is the agency responsible for training MOS 053.1, in an effort to determine what steps are required to have an individual trained in that MOS and returned to his parent unit. The following information was received and may assist units in training Radio Teletypewriter Operators:

a. The MOS 053.1 is no longer taught in a school course. It is now an eleven week Advanced Individual Training course taught under Army Subject Schedule 11-053. The 053.1 course is taught at Fort Gordon, Georgia, with courses commencing every week throughout the year, except during the Christmas holidays. An individual graduating from the 051.1 (05B20) Radio Operator course on a Friday reports to Fort Gordon to start 053.1 the following Monday.

b. The prerequisites for the 053.1 training include—

(1) Qualification in MOS 051.1.

(2) Radio code (RC) aptitude area score of 100 or higher.

(3) Security clearance of SECRET.

c. MOS 051.1, also an Advanced Individual Training course, is of seven weeks duration. Details of course content are contained in Army Subject Schedule 11-051; training locations are Fort Knox, Kentucky; Fort Jackson, South Carolina; and Fort Dix, New Jersey.

d. Although both courses are Advanced Individual Training with the input normally provided from Basic Combat Training (BCT), units can obtain quotas for the courses from Headquarters, USCONARC, Fort Monroe, Virginia.

Guided Missile Department

SERGEANT MISSILE SYSTEM PREVENTIVE MAINTENANCE

The Programs of Instruction for the SERGEANT Officer Course and the SERGEANT Missile Battery Course have been revised to include instruction and practical application of the preventive maintenance procedures associated with SERGEANT peculiar equipment. Students now receive TM 9-1440-301-12, dated February 1965, as part of their text issue, thereby minimizing reliance on Instructional Notes. The "Troubleshooting" chapter and the Preventive Maintenance check list outlined in the new manual provide guidelines related to correct maintenance procedures.

Gunnery Department

CHANGE TO FM 6-40

Change 3 to FM 6-40 is presently being written by Gunnery Department personnel. The change is scheduled for submission in the first quarter, Fiscal Year 1966, and should reach the field by the third quarter, FY 66. The most significant changes are conversion of all sample problems to FT 155-AH-2 (M109 Howitzer) and a revision of precision fire techniques. The gunnery procedures for the massing of high angle fire have also been modified. No instructional material incorporating these changes will be available prior to publication of change 3.

Tactics/Combined Arms Department

TACTICS/COMBINED ARMS DEPARTMENT ALLOCATION AND ASSIGNMENT

CON/ARSTRIKE Reg 525-2, dated 5 May 1965, officially defines anew the terms allocation and assignment. These new definitions are applicable to nuclear operational matters during both combat and exercises.

An **Allocation** is the apportionment of specific numbers and types of nuclear weapons to a commander for a stated time period as a planning factor for use in the development of war plans (Additional authority is required for the actual dispersal of allocated weapons to locations desired by the commander to support his war plans. Expenditure of these weapons is not authorized until release by proper authority). An allocation permits the subordinate commander to develop plans based on the allocated weapons, but does not authorize the expenditure of any nuclear weapon. Prior to receipt of Presidential release only allocations of nuclear ammunition will be made. When Presidential approval is received the allocation commander may designate all or a portion of the allocation as an assignment.

An **Assignment** is a specified number of complete nuclear rounds authorized for expenditure by a commander. An assignment may be made for a specific period of time, for a phase of an operation, or to accomplish a particular mission. Assignments will not carry conditions such as the requirement that prior approval be given by higher headquarters before each round is fired. If this degree of control is required, an allocation should be made rather than an assignment. Whenever an allocation is changed to an assignment, a reduction in the number of weapons should be made only when absolutely necessary and with as much prior notification as possible. Restrictions on types of targets which may be attacked may be specified. These restrictions should appear in operations order or SOP. Any commander possessing an assignment may further subassign it to units under his control. Assignments automatically expire at the conclusion of the mission for which the assignment was made.

Target Acquisition Department

SURVEY INSTRUCTION FOR TARGET ACQUISITION OFFICERS

Each direct support battalion is authorized an 1154, Artillery Target Acquisition Officer, as the Target Acquisition Platoon Leader. His duties include those performed in other battalions by an 1183, Reconnaissance and Survey Officer. There is no 1183 in the direct support battalion. USAAMS has revised the survey instruction in the Artillery Target Acquisition Officer Course to place primary emphasis on battalion-level survey. This will insure that graduates of this course are prepared to perform the reconnaissance and survey functions required of the Target Acquisition Platoon Leader in each direct support battaion.

Nuclear Target Intelligence

whose responsibility

Lieutenant Colonel Samuel W. Murphey
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The purpose of this article is to recommend a more effective division of responsibilities for nuclear target acquisition between the G2 and the fire support coordination elements (FSCE) of a tactical operations center (TOC). Specifically, the ROAD division tactical operations center (DTOC) is the vehicle used for discussion, with the G2 section and FSCE organization taken from the E-series TOE.

The term "target acquisition" has been the subject of many discussions. The timely production of nuclear target intelligence has been a matter of concern since the advent of nuclear weapons, because an appropriate weapon placed on a critical target can influence the battle. Therefore, the subject has appeared in an endless number of articles and after-action reports. The conclusions are unanimous—target acquisition has not kept pace with weapons development.

Collectors and evaluators of target information must meet the requirement for more detailed knowledge of the target. The analyst needs to know more about the size and shape of the target as well as its distribution and its types of elements so that he can select the best weapon and delivery system. Also, the commander must have a basis for the decision to expend the weapon.

Materiel for the collection of target information has been improved, and there is promise of still more improvement. Yet the timely acquisition of nuclear targets remains a matter of concern, and gadgetry alone will not provide a solution.

We must continue to seek improvement in the target acquisition system and its associated material for the following reasons:

Nuclear firepower and maneuver are weighted equally in the determination of the appropriate combat power to be applied (FM 101-31-1, para 4.1d).

The tactical theory of maneuver in the nuclear environment (disperse-mass to execute - disperse) connotes transitory targets of great mobility.

New and improved delivery systems provide more mobility, greater range, and reduced reaction time from receipt of the fire mission to weapon delivery.

NOTE: "Nuclear Target Intelligence, Whose Responsibility?" does not represent the viewpoint of U. S. Army Artillery and Missile School... The opinions and conclusions stated therein are solely those of the author.

Simplified warhead design contributes to shorter reaction time and increased reliability.

Mobile tactical operations centers (which include representatives of all command components concerned with nuclear warfare) permit the commander to exercise closer personal control and to make timely decisions to fire.

It is important to remember the ultimate objective of target acquisition is accurate and timely location of targets to permit effective attack by the appropriate weapon **at the time** when destruction will gain for us the best advantage. "It's tough to fight an enemy you cannot find. It would be tragic to find an enemy we could not effectively attack." (T. N. Greene, "Targets: The Eternal Triangle," **Marine Corps Gazette**, Volume 44, Number 2, February, 1960, p. 55.)

IMPROVEMENT CONCEPTS

There have been many proposed solutions to the problem of target acquisition. Three published ideas deserve discussion because each attacks the same problem, each conclusion has merit, and each is different.

The first article was written in 1958. It was oriented toward improved sensory equipment which was then being tested and much of which is now in use. The concept envisioned rapid collection of information, assembly of intelligence in an intelligence/operations center (today's TOC), introduction of the intelligence into an automatic data processing system (ADPS), and feedback of intelligence upon demand. The ADPS was envisioned down to and including battle group (brigade) level. The conclusion was as follows: "Basically, the intelligence tasks are no different than in years past. The intelligence requirement for the future involves the integration of new means and methods, new devices and techniques to insure immediate responsiveness to the more mobile and fluid characteristics of the Army of 1962." (Royal Reynolds, Jr., "Combat Intelligence Finds The Target," **Army Information Digest**, Volume 13, Number 1, January, 1958, p. 44.)

The second solution, written in 1963, agrees that target acquisition is the key problem in nuclear weapons employment but disagrees that the solution lies with better materiel. The author referred to the large number of information-gathering devices available and recommended an enlarged G2 section in order to report, record, evaluate, and display a vast quantity of data. At that time the fault was too much information instead of too little. This study placed the responsibility for failure on staff organization and proposed an expanded G2-G3 complex organized as shown below:

(G2) Intelligence for fires Operations for fires (FSCE)	(G2) Intelligence for maneuver Operations for maneuver (G3 element)

The desirability of ADPS for recording and posting was included in the discussion. The conclusion was: "The fault in our system of target acquisition lies less with materiel than with our somewhat archaic staff organization. ADPS may be the long run solution to our problems of target acquisition, but ADPS is not here now. We must have a means to handle the problems today." (Laurence M. Jones, "G2, Key to Nuclear Target Acquisition," **Military Review**, Volume XLIII, Number 8, August, 1963, p. 66.)

The third discussion equated firepower, maneuver, and the information system as elements of combat power. Written in 1964, it pointed up the increase in the effectiveness of firepower and maneuver, noted a relative decrease in the capability of the information system, and used target acquisitioning as an example of its weakness.

This study stressed the need for more training for G2'S and their assistants. It offered education and basic research as a solution in the following conclusion: "The situation is not apt to change until the Army's educational institutions create in the future commanders and staff officers a climate of awareness and understanding of information systems, and institute, or cause to be instituted, the kind of basic research for military requirements of the type traditionally associated with civilian colleges and universities." (Charles B. Ablett, "Shoot What? Scoot Where?," **Military Review**, Volume XLIV, Number 2, February, 1964, p. 48.)

Three experienced officers, over a six year period, agreed that a better target acquisition capability is required for effective nuclear weapons employment. The varied solutions—sophisticated materiel, staff reorganization, basic research at service schools and colleges—were all valid. All three would contribute toward the attainment of the objective; materiel improvement has already done so. None of them will stand alone as a solution.

PRESENT DOCTRINE

Our currently published doctrine does not tell us **how** to make target acquisition a full partner instead of a weak sister, but guidance on **what** to do is complete and detailed. For example, pages 54 and 55 of FM 30-5 contain an excellent, concise, and complete discussion of the requirements for target acquisition planning, precision, timeliness, and dissemination. Likewise, paragraph 4.3 of FM 101-31-1 details the jobs to be done in acquiring surface targets.

USCONARC Training Text 101-2-1 specifies the functions of the elements within the division tactical operations center and assigns the responsibility for target intelligence to the G2 element. For the G2 element of TOC, the text lists 10 major functions in **addition to** the development of target intelligence. Included within these functions are 24 related procedures which require action. Some of the functions make a contribution to target intelligence, and some do not.

The fire support coordination element is assigned 7 functions with 18 related procedures. In contrast to the varied duties of the G2 element, all FSCE functions are directly related to positioning weapons and delivering fire.

One FSCE function is the recommendation of targets to be attacked with nuclear weapons. The description of this function begins with target intelligence being received from the G2. Other than coordinating the nuclear target recommendation with G2, this is the only point at which current doctrine ties the G2 and the FSCE together.

G2-FSCE PERSONNEL

There are six officers and nine enlisted men in the division G2 section. With these personnel assets, G2 mans the G2 element and G2 air element of the DTOC, provides a representative at the alternate CP and supervises all aspects of the intelligence effort of the division. The G2 element is usually limited to one officer, one intelligence sergeant and one intelligence specialist on each shift of 12 hours. The three-man shift must do the work required by the functions mentioned previously.

The FSCE (TOE 6-302E) is equal in size to the G2 section, with five officers and nine enlisted men. With these personnel assets, the fire support coordinator mans the fire support element at DTOC and provides a representative at the alternate CP Each shift may consist of two officers and three enlisted men.

FSCE TARGET ACQUISITION CAPABILITIES

The FSCE organization contains an artillery intelligence officer (MOS 59301) and an intelligence sergeant E8 (MOS 15280). By means of the artillery communications net, this team has direct access to information collected by the—

Forward observers.
Liaison officers.
AN/TPS-25 surveillance radar section.
Division artillery air section.
Visual airborne target locator section.
AN/MPQ-4 countermortar radar section (one in each direct support battalion).

The division artillery S2 passes information to G2 from all these sources. He also passes it to the FSCE, by direct radio and telephone circuits. On occasion, the FSCE is the means of passing the information to G2.

ROLE OF THE FIRE SUPPORT COORDINATOR

Normally, the division artillery commander performs the duties of fire support coordinator for the division. Given the latest and best nuclear

target intelligence and the division commander's priorities for striking targets, he can continuously maneuver the organic and attached delivery systems in response to the situation. The capability increases the probability of having the correct weapon within range of a target and in a high state of readiness at the time the division commander decides to strike the target.

The system loses responsiveness when the FSCE does not have available the latest and best target intelligence. Considering the multiplicity of G2 functions and the austerity of his work force, it is entirely possible that he cannot furnish updated and detailed target intelligence.

DIVISION OF RESPONSIBILITIES

I suggest one basic shift in the present G2-FSCE functions—that production of nuclear target intelligence be made a responsibility of the fire support coordinator. He now is responsible to the division commander for all aspects of nuclear weapons employment except for target intelligence. Even in the case of air-delivered weapons, the FSCE analyzes the target and participates in the decision to recommend to the commander the use of air versus ground delivery.

If the fire support coordinator were responsible for the production of nuclear target intelligence, he would become a single manager, responsible to the commander for the SASP-to-target sequence. His dual staff officer-commander status would provide him with the tools (FSCE and his own staff) to operate in this manner. The effect of this single shift in responsibility would streamline the system of making one agency, which is completely oriented on both weapons and targets, responsible for the entire job.

G2-FSCE RELATIONSHIP

The shift in responsibility for nuclear target intelligence to the FSCE would have no effect on the general staff responsibility of the G2. The FSCE, instead of the G2 element, would become the agency which evaluates information in the light of nuclear target feasibility.

The proposal is represented below in a manner similiar to that shown for the G2-G3 complex, except for one change:

(FSCE) Intelligence for fires	(G2) Intelligence for maneuver
Operations for fires (FSCE)	Operations for maneuver (G3 element)

Procedural changes would be as follows:

The fire support coordinator would recommend the EEI (essential elements of information) for nuclear target intelligence.

The G2, with the facilities of division-wide collection agencies, would respond to requests from the FSCE for needed target information.

The G2 would feed target information to the FSCE as the information becomes available, without waiting to evaluate it as nuclear target intelligence.

In spite of improved target detection materiel, procedures for the timely acquisition of nuclear targets have not kept pace with weapons development. The G2 section is currently responsible for the production of nuclear target intelligence as one facet of the overall division intelligence effort. It is undermanned for the job it is expected to do in combat.

The ROAD division organization affords the FSCE sufficient manpower to fulfill its fire support coordination duties and at the same time assume responsibility for the production of nuclear target intelligence.* The fire support coordinator, in his capacity as division artillery commander, controls organic and attached delivery means and has a **primary** interest in nuclear target acquisition. Given the responsibility, he can increase the responsiveness of the system to the will of the commander. Through his own artillery staff and the FSCE, he can exercise the maximum influence on the efficiency of all elements involved in the SASP-to-target sequence.

We need an employment system that gives the commander the best chance to attack targets critical to his success. The recommendation to shift target acquisition responsibility from G2 to FSCE is a logical one and should clarify a somewhat confusing staff relationship. It offers a chance for increased efficiency with little change in present procedures, and it uses the present divisional organization without augmentation.

***Both the Target Acquisition and Tactics/Combined Arms Department feel that the present Fire Support Coordination Element does not possess sufficient manpower to assume responsibility for the production of nuclear target intelligence.**

STATUS OF SINGLE SIDEBAND RADIOS

Production models of the new single sideband radio set AN/GRC-106 were received in mid-June 1965 by the U. S. Army Airborne, Electronics and Special Warfare Board at Fort Bragg, North Carolina for confirmatory tests. Initial results of these tests should become available in about two months. The radio set AN/GRC-106 is programmed to replace the present AM voice radio set AN/GRC-19 now on TOE for division artillery and target acquisition battalions. It also is the basic unit for the new radio teletypewriter equipment which soon will replace the present radio teletypewriter AN/GRC-46.

AIR ASSAULT ARTILLERY FINALE

Division Artillery Operations Center

Major Robert G. Custer
Division Artillery Headquarters

Does the 11th Air Assault Division Artillery operation center differ significantly from that of other division artilleries? Since my answer to this query is an unqualified "yes," I would like to point out some of the factors which influenced this conclusion.

When the first provisional MTEL (Manning Table and Equipment List) for division artillery was received, I was both alarmed and surprised. My

Note: These articles are the last in a three-publication series (April, July, November 1965 issues). Although the designation of the Air Assault Division has been changed to the 1st Cavalry Division (Airmobile) during this period (see new TOEs, page 27), the techniques mentioned in the articles also apply to airmobile artillery operations.

alarm was caused by the greatly reduced quantities and, in some instances, the complete absence of equipment I had come to regard as essential. It appeared to me that the people who developed this MTEL had, in their effort to produce a "lean and mean" organization, unwittingly reduced it to a point where it could not function properly.

There are, of course, numerous differences between the ROAD and air assault division artillery operation centers. The one to which I want to specifically direct your attention is the obvious lack of transportation, not transportation for tactical operations—the division aircraft provide tactical mobility—but transportation for limited ground movement of our equipment, personnel and supplies to and from the helicopter pickup or landing zones.

At first, it appeared impossible to transport an entire division artillery operation center with just two vehicles—one jeep and a 3/4-ton truck—plus a trailer for each vehicle). But it can be done and it is done, every time the air assault artillery rear operation center is displaced. This is not to imply that all the equipment normally found in a division artillery operation center or, for that matter, even all the equipment listed on that first MTEL is carried on our two vehicles. When compared with other operation centers, the air assault division artillery operation center is austere indeed. Even with the elimination of all but the most essential items, the available vehicular cargo space still remains insufficient. The problem of how to expand the usable cargo capacity without exceeding either weight or size restrictions was resolved when one of our officers fabricated a complete operation center which could be transported on one 1/4-ton trailer (fig 1).

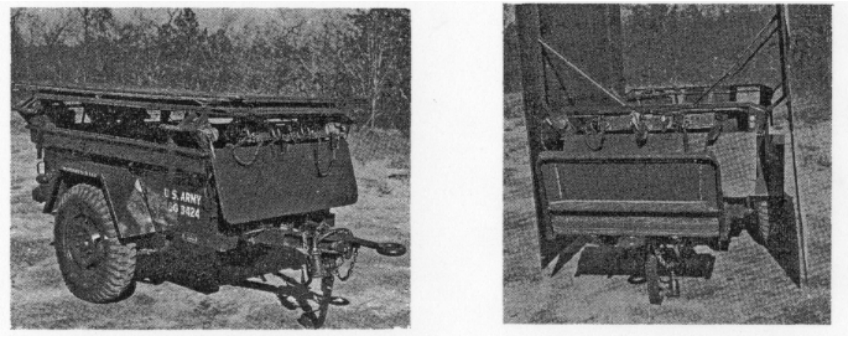


Figure 1. Operation center mounted on 1/4-ton trailer (left) AN/ASC-5 center (right).

It was the new equipment that surprised me, but one item stands above all the rest—the control central AN/ASC-5 (fig 1). The AN/ASC-5 is the most important single piece of equipment in the air assault artillery operation center. With it the operation center can insure unsurpassed artillery support for the "Sky Soldiers" while the rear operation center is displacing.

The operation center procedures and techniques used by the air assault artillery must be geared to the requirements of airmobile operations. It was anticipated that the greatly expanded area of employment made possible by the use of helicopters, the increased tempo of operations conducted by airmobile forces, and the requirement to be fully air-transportable in almost anything with wings or rotor blades would have a pronounced effect on operational procedures and techniques. Not anticipated was the effect of airmobile operations on the operation center itself.

The air assault division artillery has three operation centers—a rear, a forward and a "flying" operation center. Depending on the tactical situation, one, two or all three may be operational at the same time. The rear operation center (fig 2), which is housed in one tent, is divided into two functional areas. The larger of the two areas is for S2/S3 operations and the smaller area is for the FDC. The division artillery aviation section and the chemical officer also are located in the S2/S3 operations area; the target acquisition platoon representative has working space in the FDC area.

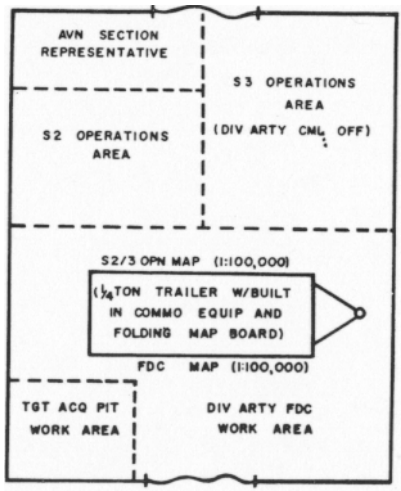


Figure 2. Rear operation center.

Nine operations/intelligence personnel, plus the chemical officer, aviation officer and target acquisition platoon representative, normally man the rear operation center. Each nine-man team consists of a duty team chief (usually a field grade officer), an S2 officer, a fire direction officer, the S2 and S3 operation sergeants, an S3 clerk, two S3 RTOs, and one S2 clerk/RTO. When possible, the personnel are organized into three shifts; each shift is on duty 8 hours and is off duty 16 hours. With this schedule, one well-rested crew is always available for immediate displacement. Morale is also given a boost, since the schedule is arranged so that no one is subjected to a continuous diet of the "graveyard" shift.

When the tactical situation requires that only part of division artillery be relocated, and the mission requires command and control of subordinate units in a forward area for a short period of time, the flying operation center is used.

The entire flying operation center (fig 3) consists of a single UH-1B helicopter equipped with the AN/ASC-5. In addition to the pilot, co-pilot and crew chief, the flying operation center is manned by the division artillery commander (unless he is accompanying the division commander or ADC), S3, S2 and fire direction officer. Utilizing the AN/ASC-5, the latter three officers are able to control and direct the fires of subordinate units, while maintaining contact with higher headquarters. Another unique advantage of the flying operation center is that displacement is almost instantaneous. As soon as the aircraft is airborne, communications are established and displacement is considered complete.

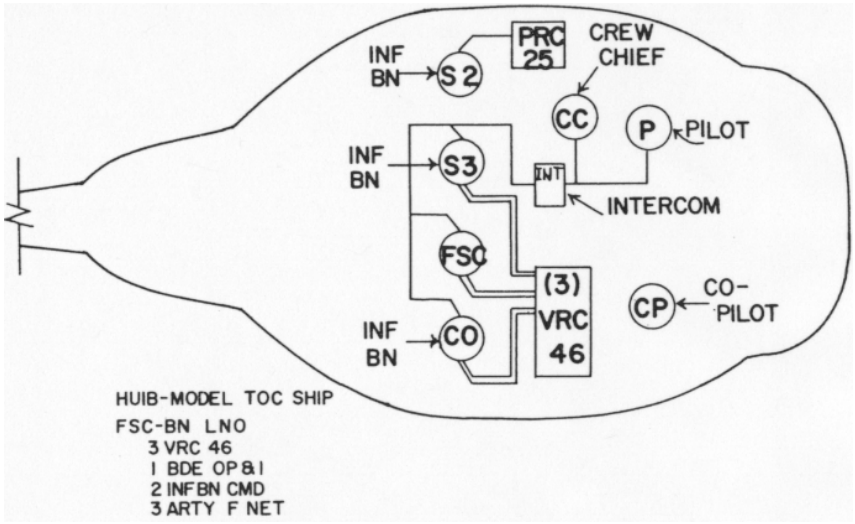


Figure 3. Flying operation center.

Figure 4 depicts the physical arrangement of the forward operation center. Even though the amount of working space is reduced considerably, the number of personnel involved is exactly equal the number used in the base. The map boards are smaller and the furnishings more austere, but everything necessary for operating is there. The forward operation center is used for situations in which the mission will probably require division artillery control of subordinate units in the forward area for a period in excess of 4 hours for situations that will require the eventual displacement of the entire rear headquarters.

Assuming that the tactical situation will require division artillery control forward for approximately 8 hours, movement of the operation center would be accomplished as follows: First, the flying operation center

becomes airborne and assumes control. The personnel and equipment necessary to establish the forward operation center then become airborne in a second "Huey." When the two aircraft arrive over the forward area, the S3 selects the new CP location, usually with one of the committed artillery battalions. As soon as the second "Huey" has landed and the personnel have established the forward operation center facility and are prepared to open communications, the flying operation center lands in the new area and control passes from the flying operation center to the ground-based forward. The personnel and equipment carried by the second "Huey" plus the personnel and equipment in the flying operation center are sufficient to organize, equip and operate a ground forward operation center on an emergency basis for an extended period. This "lean and mean" organizational concept and the phased displacement is employed, with minor modifications, by all artillery battalions and batteries as well as the air assault division artillery headquarters.

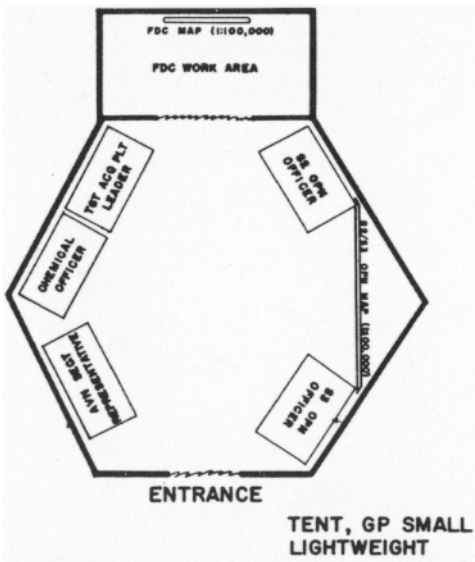


Figure 4. Forward operation center.

Assuming a tactical situation that requires displacement of the entire division artillery headquarters, the forward operation center is first established and assumes control and then the rear begins displacing. Normally, CH-47 helicopters are used to displace the rear, but it can be moved by a CV-2 aircraft. As soon as the aircraft for displacement arrive at the pickup point, the officer in charge notifies the S3 of the expected time of arrival at the forward position area. When the CH-47s or CV-2s carrying the remainder of division artillery headquarters arrive and off-load at the new location, displacement is complete.

These, then, are the factors which influenced my answer.

Air Assault Meteorology

CWO Charles A. Montano
Division Artillery Headquarters

When the air assault division was formed, ballistic meteorology sections were authorized for both division artillery and the Little John battalion. Each section was organized with approximately 15,000 pounds of standard meteorological equipment, plus the normal vehicles required by the section. The requirement for airmobility by helicopter later dictated deletion of ground vehicles and trailers from the TOEs.

The mission of these ballistic meteorology sections was to provide meteorology coverage for the entire division, since the division normally operates out of range of corps metro support. In addition to supplying units with ballistic metro messages, division artillery was to supply division with fallout and air weather data. Frequent displacement of the metro sections was envisioned to support the fast-moving air assault operations. Support was to be provided for a division front which often would be 100 kilometers in width and exceed that figure in depth. The equipment was distributed so that two teams could operate electronically while a third team operated visually.

MOBILITY PROVIDED

A need for limited ground mobility was recognized. To facilitate the loading and unloading of aircraft and to provide transport between the position areas and landing zones, four M274A1 Mechanical Mules were added to the division artillery metro section. The Mules were modified by adding pintles to provide a towing capability. By using four Mules and four carts, all of the section equipment plus a 15-day supply of expendables could be transported overland for short distances. Additionally, a "roll-on, roll-off" capability would be available when transport by helicopter was required. The loading of the section is shown in figure 5. The lightweight Mule (approximately 950 pounds) can carry a 1,000-pound payload over rough terrain. The carts used are capable of carrying an additional 2,000 pounds. This loading allowed all section equipment to be lifted internally by three CH-47 helicopters or be sling loaded to eight UH-1s. A reduced section capable of operating for 24 hours can be deployed by one CH-47 or four UH-1 helicopters (fig 6).

ELECTRONIC MESSAGES

Electronic metro messages are provided by both the division artillery section and the Little John battalion section working on a coordinated schedule. When one unit is moving or otherwise non-operational, the responsibility for broadcasting scheduled messages is assigned to the other. When both units are in position, flights and broadcasts are alternated

to eliminate duplication of effort and reduce the requirements for expendable supplies. When the units are beyond corps metro range, each section broadcasts on a six-flight-per-day schedule and provides support to the units in its area.

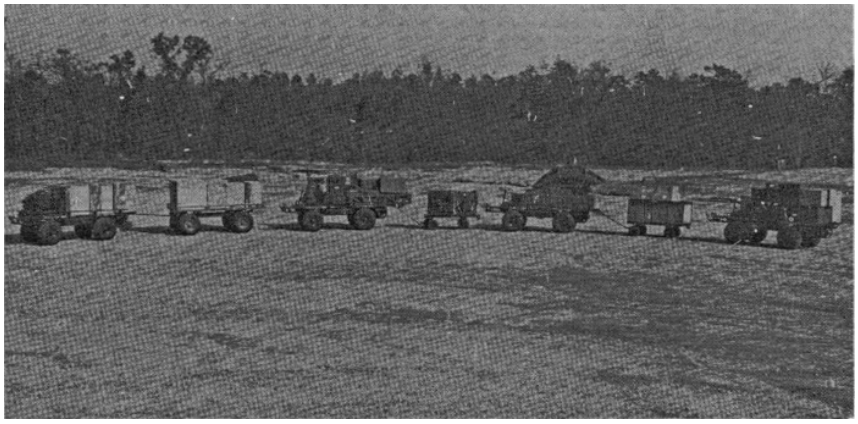


Figure 5. Loading of the mules.

Figure 6. Reduced met section prepared for airlift.

USE OF VISUAL TEAMS

Visual metro teams are employed with those units more than 20 miles from an operational electronic station. A visual team consisting of four men and approximately 300 pounds of equipment can be easily transported by one UH-1B helicopter. To insure a suitable reaction time to

unit displacements, division artillery maintains one visual team prepared to move on 30 minutes notice. Deployment of visual teams is an interim measure which can be applied to fill the metro void until such time as the electronic team can displace and become operational. Visual teams also can be used to provide low-level wind data at Little John launch sites.

BALLOON INFLATION

The need to keep the sections as light as possible has led to the use of calcium hydride for balloon inflation. One 54-pound box of 20 charges, when the charges are mixed with water, will inflate up to twice as many balloons as one 140-pound cylinder of helium or hydrogen. When helium is used, the empty cylinder must be retained by the section until it is replaced by a full one. When calcium hydride is used, the box is discarded and the useless weight, with the attendant transport requirements, is eliminated.

WATER SUPPLY AND EXPENDABLES

The use of calcium hydride for balloon inflation requires that water always be available at the metro site. Initially, the metro sections had to set up near natural water sources. Now, plastic 5-gallon containers ("Lug-a-jug") are available. Fifty "jugs" are transported empty and filled after occupation of position. Since an empty "jug" weighs only one-half pound, this allows a substantial saving (250 pounds) in weight when compared to 50 standard 5-gallon water cans. These plastic jugs are sturdy enough to take hard usage. When it is more convenient, water can be helicopter lifted (internally or sling loaded) to the metro site in 250-gallon collapsible drums.

ADDITIONAL WEIGHT REDUCTION

Reducing the basic load of expendable supplies from a 30-day to a 15-day level lightened the section by 3,542 pounds. An additional 1,168 pounds was saved by substituting lightweight 5-kw and 3-kw generators for the 10-kw and PE-75 generators normally supplied. As now equipped the air assault division metro section weighs only 7,210 pounds plus the weight of the vehicles and personnel.

Providing meteorological support to an air assault division requires flexibility and many departures from standard procedures. A dominant requirement is to lighten an inherently heavy section to make it helicopter transportable in the minimum number of loads. Providing metro coverage over extremely large areas necessitates integration and coordination of all available assets and minimum decentralization of operations. The techniques described herein, although nonstandard to some extent, have proved effective.

A Lean and Mean FDC

Captain Eugene O. Roverse
6th Battalion, 81st Artillery

One of the challenges which faced us in the air assault division was how "lean and mean" could our battery fire direction centers be? We needed an FDC that could be moved under or inside a helicopter, dropped by parachute or towed behind the firing battery 1/4-ton. On the other hand, we wanted an FDC large enough to control the fires of the battalion when necessary. Our design objectives were to develop an FDC small enough and light enough to meet all the movement criteria and which could, within 2 minutes, be completely functional in any weather at any time of day or night and could operate in at least two radio nets.

We started by putting aside all TOE fire direction center equipment that was not absolutely essential for controlling the fires of the battery. The next step was to house the remaining equipment in a compact, mobile package. Borrowing an idea from the camper-trailer, we constructed a similar foldout arrangement for the TOE 1/4-ton trailer being careful to retain the overall dimensions of the trailer, so that our standard helicopter load plans and parachute rigging requirements would remain unchanged. Another idea was to designate a place for each item of equipment and to keep each item in its place.

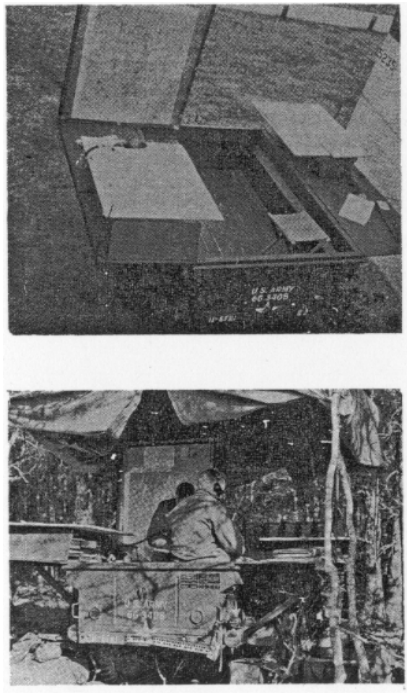


Figure 7. "Lean and Mean" FDC in operation (top). Open view of FDC (bottom).

In less than a week our mobile FDC (fig 7 and 8) was operational. Preparation and march order times were reduced to the desired 2 minutes. Even less time is required if the canvas top is not erected.

All communication equipment is mounted and connected to wire reels mounted on the outside of the trailer, using the time proven cords and plugs from the connecting and switching group MX/155. One of the reels contains the recorder's line; the other two the radio remote lines. The latter lines are connected through local units to the two AN/VRC-46 radios mounted in the FDC 1/4-ton. Additional remote and telephone lines are installed as required.

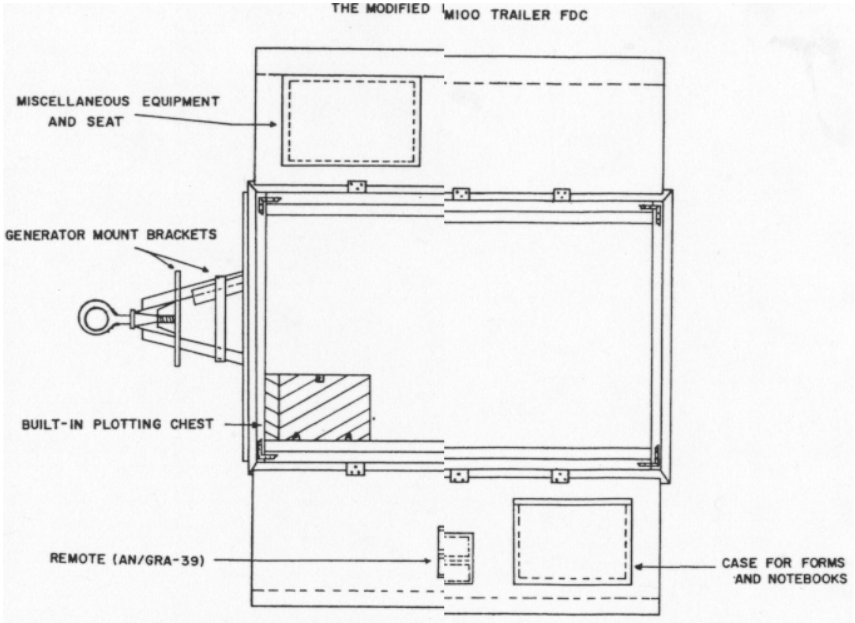


Figure 8. Diagram of "Lean and Mean" FDC.

The mounted 0.5 kw generator charges the vehicle batteries which power the radios and lighting system. During airborne operations or when the FDC is loaded separately from its 1/4-ton prime mover, the generator provides power for the lighting system. Radio sets AN/PRC-25 are used instead of AN/VRC-46s, and placing these portable radios high in trees before remoting them into the FDC provides satisfactory communication.

Sustained operations of the "lean and mean" FDC disclosed only one weak point—it was necessary to separate the radio remote units to determine which radio was calling.

RSOP–The Air Assault Way

Lieutenant Colonel Lloyd J. Picou
1st Battalion, 15th Artillery

"Well, let's see. Here's the battalion area on this map. I'll put headquarters in the center, Alpha, Bravo on the right and Charlie can go there. Yep, we can support the operation from these positions. S-3, have the battery commanders and recon parties meet me here in 2 hours. I want survey to get started now."

You will recognize these mental and physical gyrations as those of a direct support artillery battalion commander as he begins the initial steps of reconnaissance, selection and occupation of position. The battalion commander is given an area. He knows the mission and scheme of maneuver of the supported unit. What could be more simple? You just use the "school solution"—right out of the books.

As a 105-mm howitzer battalion commander in a ROAD division, this was how I pictured it. This was how it was done. However, with the same battalion in the air assault division, "it just ain't the same." In the air assault division, the direct support artillery commander finds himself not merely in another dimension of warfare; he finds himself in a new environment which is fast moving, physically demanding, ever changing, continuously challenging, and, most of all, exciting. No longer does the situation develop at a maximum of 20 miles per hour. Seldom is there an opportunity for deliberate occupation. The days of lengthy reconnaissance, preparation of position by advance parties and prior survey to battery centers are gone. Covered routes into positions are now a thing of the past. Howitzers are no longer meticulously jockeyed into precise patterns on the ground. Targets appear in all directions, and a tree-line position no longer allows a battery to accomplish its mission. Surprise is lost in the roar of engines and the clatter of helicopter blades. The situation now develops before our eyes at speeds in excess of 100 miles per hour, covering distances from 50 to 100 miles and more. Reconnaissance is virtually limited to maps, aerial photographs and a quick look from an aircraft. Selection of positions is often reduced to a split-second decision made by the battery commander as he sees a likely position area. The hasty occupation is now the "order of the day."

Air assault is not simply the employment of fixed and rotary-wing aircraft to carry troops into combat. Nor is it merely a mobility concept. Rather, I would like to suggest that it be pictured as a coupling of aerial transport with infantry, armor, airborne and guerrilla tactics and unlimited ingenuity. The object of an air assault movement is to position precisely an organized force which is immediately ready to perform its mission. Tactical mobility is the key to success. Only a few minutes of reflection are necessary to recognize the vast differences between the old and the new. Before we compare the techniques of RSOP employed by the ROAD and air assault divisions, I would like to point out that the TOE of the air assault 105-mm howitzer battalion provides no prime movers for howitzers; it provides only eighteen 1/4-ton trucks, two 3/4-ton trucks, and seven "Mules." Two additional important points to remember are: (1) the battalion has no assigned aircraft, and (2) division artillery has no organic heavy lift capable of carrying howitzers.

RECONNAISSANCE

The basic thought process of reconnaissance of positions remains unchanged. "What is the mission and scheme of maneuver of the supported unit?" "Time?" "Duration?" "Fire a preparation?" "Security?"

"Enemy Situations?" To the above questions must be added "Pick-up zones?" "Flight route?" "Landing zones?" "Lift available?" "Coordination with lift commander?" "Landing pattern for positioning of howitzers?" "Pathfinders?" "Resupply, to include LOLEX delivery area?" Although the thought process remains unchanged, in air assault some of the factors have new implications. Security, for instance, may be provided by a rifle platoon which will accompany the artillery battery in the aircraft lifting the artillery unit.

In most instances, the assault is conducted in the enemy rear area. This immediately imposes the question of whether a reconnaissance is desirable. The battalion commander normally has one OH-13 at his disposal, and if this is the only one available, the reconnaissance will be limited to that which can be accomplished by the battalion commander. At times, a UH-1 can be obtained. With this aircraft, the reconnaissance party can be enlarged to from five to seven persons. Of course, there also is the possibility of sending the battery commanders on reconnaissance in their OH-13s. In this case, the battery commanders are given general areas from which they select their own positions. The battalion commander may or may not have the opportunity to look at the positions prior to occupation. Finally, when reconnaissance is neither desirable nor feasible, the battalion commander gives the battery commanders a "goose egg and a good luck." The time available for reconnaissance in the air assault operation is greatly reduced. The speed of the aircraft and endurance over the objective area are limiting factors. Distances are great. Reconnaissance will be more hurried and more often decentralized to the battery commanders. Seldom will more than one person see the area prior to occupation. Battery commanders will receive minimum direction and control, and battalion commanders will develop more ulcers unless they learn to trust implicitly the decisions of the battery commanders.

SELECTION OF POSITION

In most instances in conventional warfare (ROAD) "We're here and the enemy is there." In the air assault concept, it is normally, "We're here and the enemy is everywhere." One can immediately see that a primary consideration is the ability to fire in any direction; thus, areas must be carefully evaluated for site to mask in all directions.

It goes without saying that the primary consideration in the selection of a position is the ability to accomplish the mission of furnishing fire support. A chilling thought which passes through the minds of commanders of air assault units is: **"There is no room for error."** The helicopters land, unload and are gone. It is to late to discover mistakes. We must make it difficult for the enemy to get at us; therefore, we try to stay as far away from roads and trails as possible. We must also consider alternate positions, which must be relatively close because we have only limited means to move overland. Other considerations peculiar

to air assault include the selection of landing areas for friendly infantry in the event they must come to our aid and a strip for low-level extraction (LOLEX) resupply by CV-2 (Caribou).

OCCUPATION

Occupation is really not too different from that described in the manuals. If the enemy is on the primary LZ, we move to the alternate position area or have the LZ taken under fire by aerial rocket artillery. Security elements of the battery must move out quickly to screen the area. Because of the noise, commands must be by radio, telephone or arm signals until the helicopters have departed. In addition to the noise, helicopters whip up winds of over 100 miles per hour, which play havoc with aiming circles and loose equipment. Even the aiming posts may be blown down. It takes 8 minutes or less from touchdown of the first aircraft until the entire battery is ready to fire (fig 9).

Figure 9. 105-mm howitzers and crews quickly go into action after being unloaded from aircraft.

An entire RSOP can be completed while you are reading this article. During this time the unit could be transported a distance of 10 to 20 miles.

Air assault truly opens new horizons for the artillery commander. The possibilities are limited only by his imagination and his means. In paying a compliment to the 7th Infantry Division Artillery, during the early phase of the Korean conflict, Major General David Barr said, "There is nothing the artillery won't or can't do. No place the artillery won't or can't go." I can think of no phrase which can better be applied to the artillery of the 11th Air Assault Division.

The Artillery FO Role

Lieutenant John F. Kramer
1st Battalion, 15th Artillery

The 16 helicopters are flying at 90 knots at treetop level, the pilots taking advantage of the cover afforded by the contour of the earth. Inside the lead helicopter, the company commander and the artillery forward observer have received by radio the final location of the landing zone and objective. At an earlier briefing, they had been given several projected landing zones and objectives, for which they had planned supporting fires. Based on the latest information concerning the enemy situation, the final objective is assigned to the company commander en route to the area of operations.

The company commander then briefs the forward observer on the landing zones (LZ), the objective, the route to the objective and the proposed positions the three platoons will occupy. Together, they make a quick check of the fire plan to insure that the preplanned concentrations will effectively support the new scheme of maneuver.

As the helicopters clear the top of a hill the FO gets a brief glimpse of smoke rising in the vicinity of the objective. This is the final phase of the preparation that is being fired in support of the assault; the smoke shells were fired to mask the approach of the lift helicopters.

The preparation was initiated with an airstrike on the objective by Air Force fighter bombers. Between aircraft passes, the artillery battalion fired two volleys to pin down the enemy. The howitzer fires were adjusted by a heliborne observer, through coordination with the LO (liaison officer). Both the tactical fighters and air observer spotted enemy locations during the preparation and transmitted the information to the LO The reconnaissance sergeant, with the assault lift, monitored the transmissions and passed the information to the FO and company commander.

At this point the flight is less than one minute out.

As the lift helicopters touch down and unload their troops, the UH-1B aerial rocket artillery ships provide suppressive fires for the infantry troops while they clear the landing zone and advance toward the objective. The FO, moving with the infantry, initially will have limited observation of enemy activity. The aircraft under the direction of the FO act as his "eyes"—spotting targets along the approach routes and in and around the objective area.

The point platoon has been pinned down by fire from a machinegun nest. The FO requests a fire mission from the aircraft, giving the coordinates, the nature of target and a vector, in degrees, to the target. The vector is the direction the pilot flies to insure that he is always firing over friendly positions toward the target. If the pilot cannot identify the target, the FO can adjust the rounds fired on each pass using normal procedure

(e. g. RIGHT 20, ADD 200....). The FO continues to adjust until the target is destroyed or the pilot identifies the target. The mission is ended and surveillance is given by whoever is in the better position to see the effects of the fire.

If the target is large enough or of such a nature that a greater amount of firepower is required, the FO or LO can request that tactical air support be provided. Instead of conducting the mission directly with the aircraft, the FO contacts the forward air controller (FAC), the Air Force representative, who directs the aircraft. The procedure, however, is the same—coordinates, nature of target and vector—and the rounds are adjusted in the same way. Any additional directions that will speed up the mission or improve the effectiveness of the fire can be incorporated in procedure.

The advantages of both aerial rocket artillery and TAC air are rapid reaction time, speed of adjustment and ability to attack moving targets and targets that the FO cannot observe. When not firing missions, the aircraft can be utilized for reconnaissance. The disadvantages are fuel limitations, weather, ammunition load and vulnerability to enemy ground fire and aircraft. If the target requires a heavy and continuous pounding, the FO should utilize the tube artillery elements at his disposal.

Close coordination is necessary between the aircraft, forward observer, liaison officer and FDC to insure that aircraft do not fly through friendly artillery fires.

Although no-fire lines, flight routes and schedules are established, the final responsibility for coordination lies with the forward observer and the liaison officer. In some cases, the FO serves as the forward air controller.

One of the FO's responsibilities is to maintain the best possible communications at all times. The FO party has two AN/PRC-25 radios, which allow the FO to communicate over substantial distances and with multiple agencies—infantry, armor, aircraft and artillery. Because of the weight and space limitations dictated by air assault aircraft, the members of the FO party must learn to operate with minimum gear. Besides the two radios (and extra batteries), the party carries binoculars, compasses, enough maps to cover extensive areas of operation, rations, rifles, a basic load of ammunition and smoke grenades to mark friendly positions. With this load, it is imperative that the artilleryman remain in the best possible physical condition.

Air assault units often find themselves with a large area to cover. This necessitates a relatively wide dispersion of elements. On the company level, this makes the FO's job of maintaining fire support difficult. One method that can be used is the assignment of a light observation helicopter to an FO who finds himself with poor visibility and widely disposed elements to support. He can become airborne quickly and maintain surveillance on a periodic or an on-call basis.

With the helicopter there are few positions, no matter how inaccessible to ground travel, that the FO cannot reach. Once an area of observation has been established, the heliborne FO party lands nearby

and proceeds on foot to establish an OP. If the terrain conditions are such that a landing is impossible, the FO party can rappel from the aircraft at tree-top level.

This has been a brief description of some of the activities and requirements of an FO during the initial assault phase of an airmobile operation. Intensive prior planning, with special attention to flexibility, is required in air assault operations. The FO must constantly be ready to cast out at a moment's notice the plans he spent all night in receiving, preparing and assimilating, at best adapting them to new situations. In the example discussed in this article, the company commander started the mission before the specific objective had been established. He and the FO were given, at an earlier briefing, several projected landing zones and objectives for which they planned supporting fires. Based on the latest information on the enemy situation, the infantry battalion commander selected the objective. The final objective was assigned to the company commander en route to the area of operations. This last minute change caused the FO to finalize his plans on the aircraft, adding new concentrations to his fire plan based on the latest enemy locations. Air assault moves fast, and the artillery FO must provide for fire support to be available more rapidly than ever before.

Air Assault to Airmobile

Although the 11th Air Assault Division has been renamed the 1st Cavalry Division (Airmobile), the ideas, operations and techniques presented by the Air Assault Division in the last three issues of ARTILLERY TRENDS also apply to the current airmobile concept.

With this redesignation and to provide you with the latest information available, ARTILLERY TRENDS has printed, in the following pages, the new airmobile division artillery TOEs under which the 1st Cavalry Division (Airmobile) Artillery is organized.

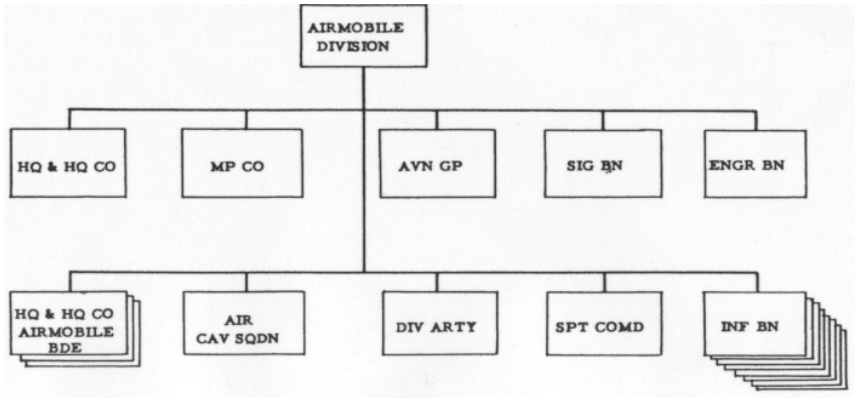


Figure 1. TOE 67T: Airmobile Division.

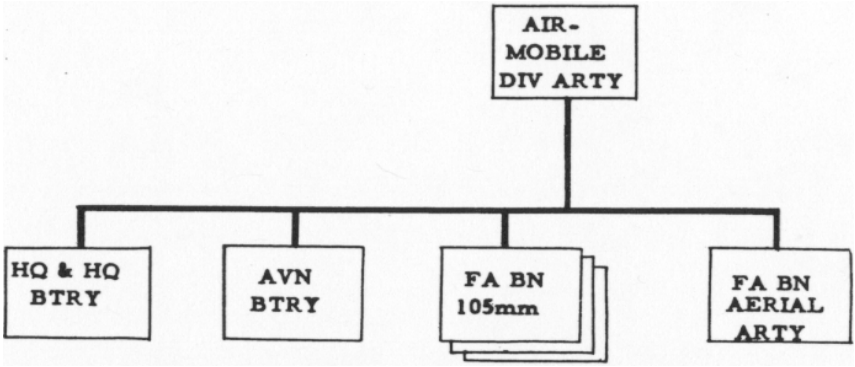


Figure 2. TOE 6-700T: Airmobile Division Artillery.

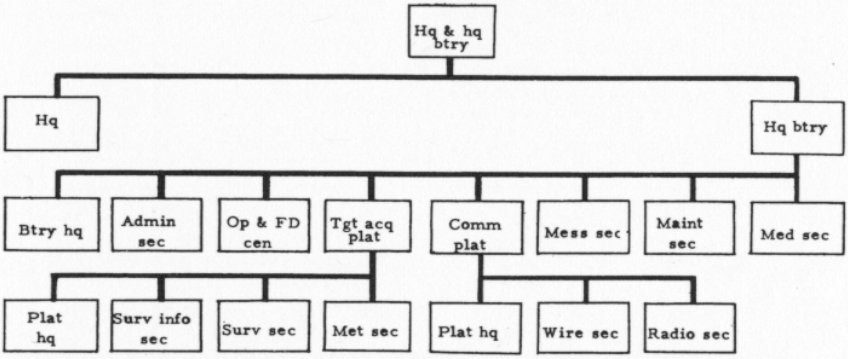


Figure 3. TOE 6-701T: Headquarters and Headquarters Battery, Airmobile Division Artillery.

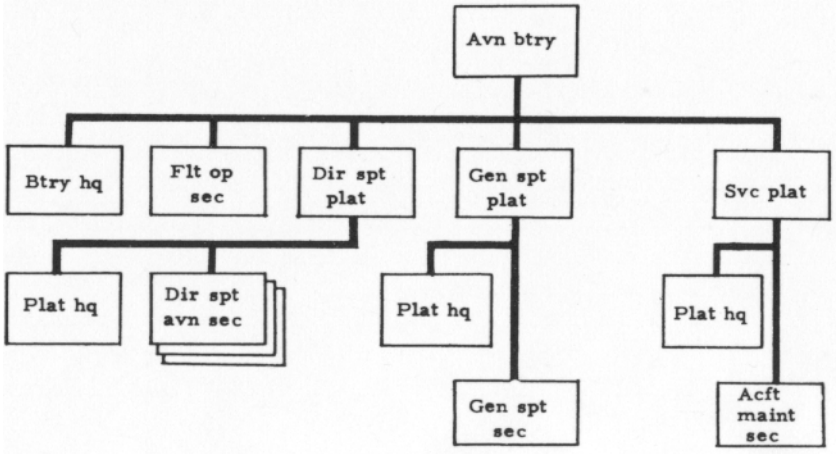


Figure 4. TOE 6-702T: Aviation Battery, Airmobile Division Artillery.

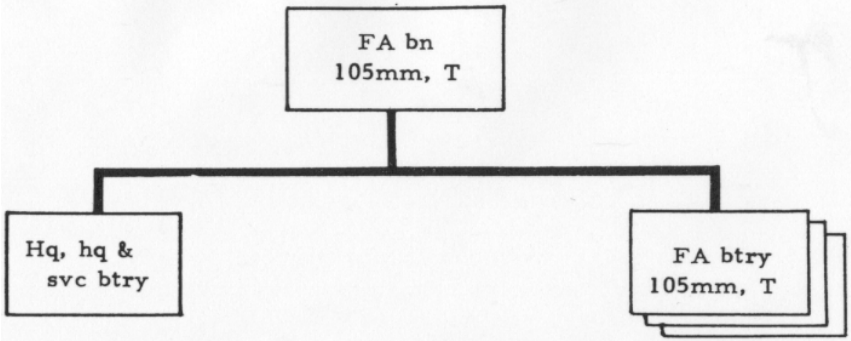


Figure 5. TOE 6-705T: Field Artillery Battalion, 105-mm, Towed, Airmobile Division Artillery.

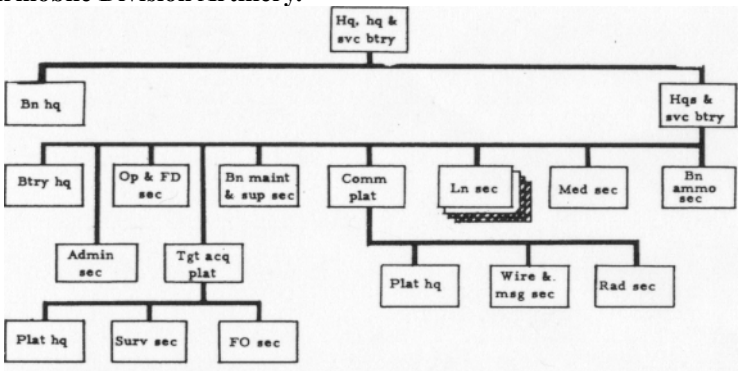


Figure 6. TOE 6-706T: Headquarters, Headquarters and Service Battery, Field Artillery Battalion, 105-mm, Towed, Airmobile Division Artillery.

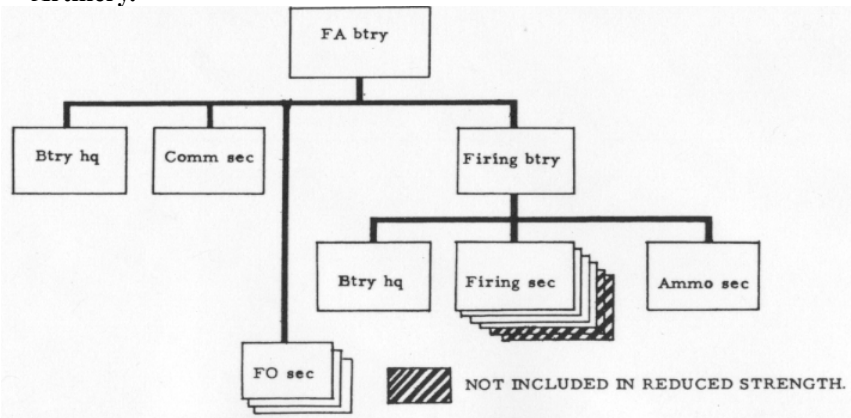


Figure 7. TOE 6-707T. Field Artillery Battery, 105-mm, Towed, Field Artillery Battalion, Airmobile Division Artillery.

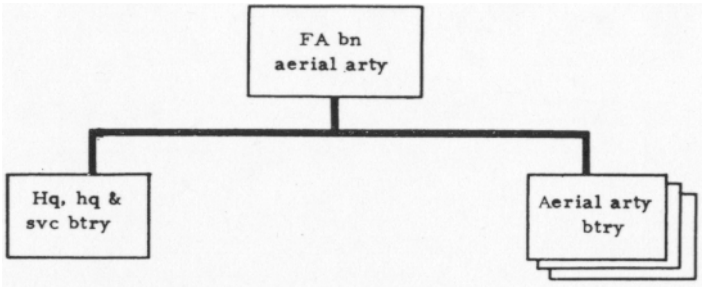


Figure 8. TOE 6-725T: Field Artillery Battalion, Aerial Artillery, Airmobile Division Artillery.

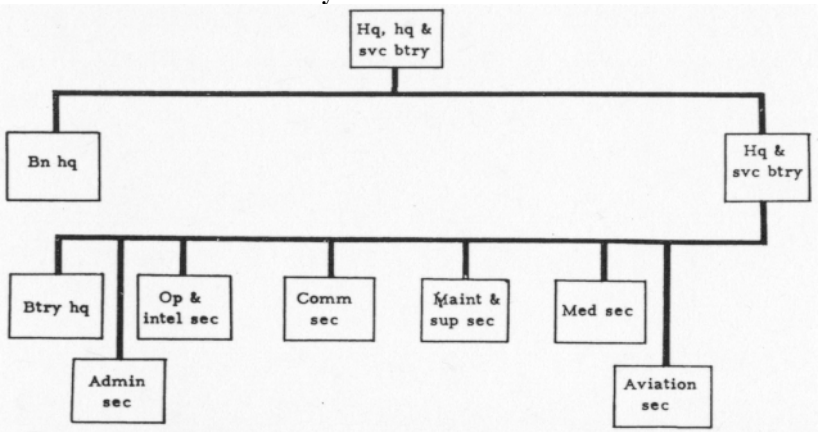


Figure 9. TOE 6-726T: Headquarters, Headquarters and Service Battery, Field Artillery Battalion, Aerial Artillery, Airmobile Division Artillery.

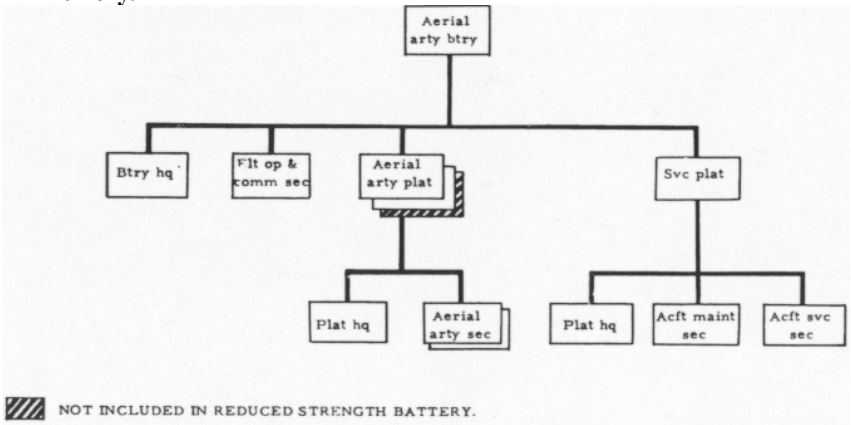


Figure 10. TOE 6-727T: Field Artillery Battery, Aerial Artillery, Field Artillery Battalion. Airmobile Division Artillery.

RETROGRADE

artillery in retrograde operations

Colonel Richard A. Crecelius and Major Arthur L. Kelly
Tactics/Combined Arms Department

Retrograde, says Webster, means, among other things, "directed backward, or having a backward direction, motion or tendency." American forces have fought countless retrograde actions, beginning with Lexington and ending—temporarily, at least—with the "yo-yo" campaigns of the Korean Conflict. It's no military secret that if our forces in Korea or in Western Europe are attacked, they will once more engage in retrograde operations until the strength of the enemy's blow spends itself and the initiative for the offensive passes to the friendly side.

Little has been written about artillery support or retrograde operations; the doctrinal treatment in the artillery field manuals is brief and general. This article is designed to fill this gap by presenting a resume of the instruction on the subject given to the Career Courses at the U. S. Army Artillery and Missile School.

Combat during a retrograde operation is characterized by mobile, fluid operations over a broad front, and is conducted through decentralized but coordinated small-unit actions. Success depends on the skillful application of maneuver and fires to delay the enemy advance and to inflict heavy casualties as payment for the terrain surrendered. Since a retrograding force is usually weaker than the opposing force, and since the maneuver elements must avoid becoming decisively engaged, artillery firepower can be expected to play a significant role. Artillery tactics and techniques are tailored to the plans and actions of the close combat elements, within the scheme of operations of the supported force. Strong leadership and effective control are imperative at all levels of command. Supply requirements, especially of ammunition and fuel, take on added significance. Detailed planning and close command attention to supply operations are necessary to assume adequate resupply of these items.

COMPOSITION OF ARTILLERY SUPPORTING A RETROGRADE ACTION

Artillery units supporting a retrograde action conducted by mechanized or armored forces should be self-propelled. Since a force engaged in a retrograde operation usually is numerically weaker than the enemy,

it should be augmented by additional artillery units, if available, to partially compensate for this imbalance. Frontages assigned to the covering force are usually abnormally wide; therefore, additional artillery is required just to provide minimum area coverage. The organic artillery of a division employed as a corps covering force normally is augmented by additional artillery units from the corps artillery. These corps artillery units are normally **attached** to the division in order to give the division commander maximum freedom of action in employing this major element of his combat power. In allotting artillery to the covering force, the higher artillery commander considers both the covering force's requirements and the requirements of the main force in preparing the main defense position.

ILLUSTRATIVE EXAMPLE

The following example illustrates the problem of allocating corps artillery units to a division operating as the corps covering force.

GENERAL SITUATION

U.S. forces have been advancing to the east. To halt the U.S. advance, Aggressor launched a large scale counteroffensive. The scale of the Aggressor counteroffensive forced U.S. forces to suspend offensive operations and commence a retrograde movement to the Grand River. 1st US Corps, a part of the First Army, located some 150 miles east of the Grand, received orders 050430 Aug to withdraw to the west bank of the Grand River and conduct a mobile defense in zone.

The corps commander ordered the 14th Armored Division, with the 901st Armored Cavalry Regiment attached, to cover the withdrawal of the 1st US Corps by delaying the enemy east of the general outpost (GOP) until 161800 Aug, and then revert to corps reserve. Figure 1 shows the corps zone of action from the initial delay position (IDP) to the FEBA along the Grand River and the general disposition of the divisions for the defense.

SPECIAL SITUATION

Immediately upon receipt of orders to withdraw to the the Grand, the corps artillery commander and his assistant fire support coordinator (FSCOORD) attended the corps commander's conference. Pertinent notes taken by the assistant FSCOORD are as follows:

NOTES ON CORPS COMMANDER'S GUIDANCE ISSUED AT 050500 AUG

"14th Armored Division will occupy an IDP along the Red River not later than 060500 Aug. 1st and 2d Infantry Divisions and 10th Mecchanized Division commence withdrawal during the night of 6-7 August. 14th Armored Division will provide adequate security force forward to the IDP to protect the withdrawal of these divisions.

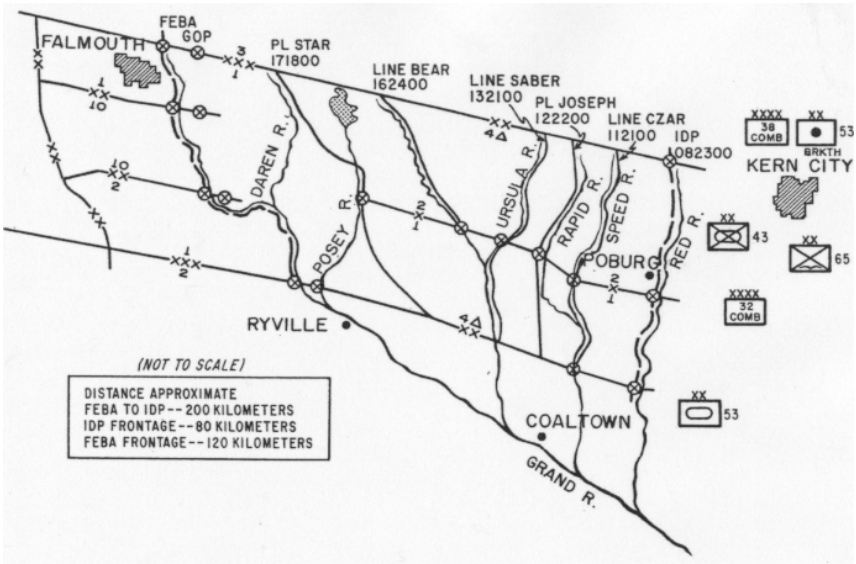


Figure 1. Corps Plan of Operations.

"Twelve days delay is desired between the IDP and the Grand River.

"In addition to the 901st Armored Cavalry Regiment I want the 4th Armored Division beefed up with sufficient artillery and engineers to meet the requirements imposed by the extremely wide front across which the 4th Armored Division will be deployed. Remember, however, that our decisive battle will be fought behind the Grand.

"Authority is granted to the 14th Armored Division commander to use persistent and nonpersistent chemicals in the execution of his mission.

"Priority of corps tactical air sorties to 14th Armored Division. Arrange for an Air Force DASC (direct air support center) and an adequate number of TACP's (tactical air control parties) to join the division on the IDP.

"Insure that adequate class III and V stocks are positioned on the 14th Armored Division's planned axes of withdrawal to permit rapid resupply during the delay.

"In the redisposition of forces, all movements of battalion and larger units must be made during darkness.

"I want to hear the staff estimates and recommendations at 1200 hours today."

When the conference ended, the corps artillery commander instructed his assistant FSCOORD to prepare specific recommendations concerning the allocation of corps artillery units to support the 14th Armored Division in its covering force mission. (The current missions and organization for combat of the corps artillery are shown in figure 2.)

CORPS ARTILLERY ORGANIZATION FOR COMBAT
(As of 4 Aug)

101st Arty Gp
- 1/41 Arty (105-mm, Towed)
- 1/50 Arty (155-mm, SP)
- 1/51 Arty (155-mm, Towed)
- 1/60 Arty (175-mm, SP)
- 1/70 Arty (8-inch, SP)
- 1/82 Arty (HJ)

Atched 1st Inf Div

102d Arty Gp
- 2/50 Arty (155-mm, SP)
- 2/51 Arty (155-mm, Towed)
- 2/60 Arty (175-mm, SP)
- 2/70 Arty (8-inch, SP)

GS-reinf 2d Inf Div

103d Arty Gp
- 3/50 Arty (155-mm, SP)
- 3/60 Arty (175-mm, SP)
- 3/70 Arty (8-inch, SP)
- 3/82 Arty (HJ)

GS-reinf 10th Mech Div

104th Arty Gp
- 4/50 Arty (155-mm, SP)
- 4/60 Arty (175-mm, SP)
- 4/70 Arty (8-inch, SP)
- 1/71 Arty (8-inch, Towed)
- 2/82 Arty (HJ)

GS (positioned in center of corps sector)

1/40 Arty (105-mm, SP): Atchd 10th Mech Div
1/42 Arty (105-mm, SP): Atchd 2d Inf Div
2/71 Arty (8-inch, Towed): Atchd 2d Inf Div
1/80 Arty (LJ): GS
1/92 Arty (Sgt): GS
1/39 Arty (Tgt Acq): GS
A/1/37 Arty (Slt): GS

Figure 2. Corps Artillery Organization for Combat.

FACTORS GOVERNING ALLOCATION OF ARTILLERY TO A COVERING FORCE DIVISION

In arriving at his recommendation, the assistant FSCOORD weighed the factors discussed below.

Mission of the Covering Force

The mission of the covering force is usually stated in terms of delaying the enemy forward of a specified line within a given zone for a stated period of time to allow the main body to prepare defenses to the rear. The width of the zone, the amount of delay required, and the ability of artillery firepower to contribute to this delay are prime factors in estimating the amount and calibers of artillery required.

Artillery Available

The artillery planner considers the requirements for artillery support for both the covering force and the corps defense position and allots artillery battalions and group headquarters accordingly. Since the covering

force division will be deployed across an entire corps front, one or more field artillery group headquarters should be attached to the division to provide additional control headquarters for the covering force artillery. The amount of assistance that can be provided to the covering force by the corps target acquisition battalion is also considered. As a final factor, the artillery planner must consider the mission to be assigned each artillery unit upon completion of the retrograde action; i.e., after the covering force has withdrawn through the corps' main defense position.

Enemy Capabilities

The fact that friendly forces are engaged in a retrograde action indicates that the enemy has a preponderance of combat power. This imbalance may be significantly redressed by the provision of additional artillery support to the covering force. The amount of artillery in support of the covering force may also be influenced by whether the enemy has air superiority. Artillery is vulnerable to air attack, and a concentration of artillery in the forward area may invite serious losses before the decisive battle is even joined. If the enemy force is strong in artillery support, the covering force will require sufficient artillery to permit neutralization of this enemy artillery. Without this neutralization ccapability, the success of the retrograde may be imperiled. The nuclear and chemical situation may influence the amount of artillery allocated to support the covering force. Artillery positions are prime targets for nuclear attack, and the presence of many artillery units forward may invite attack and premature destruction of these units before the main battle is joined.

Terrain and Weather

When organizing artillery for combat, the artillery planner must also consider the terrain and the effects of weather. Before providing additional artillery to the covering force, he must ascertain the availability of position areas to accommodate the additional artillery. Poor trafficability may limit the supporting artillery to light and medium weapons. The adequacy of bridges and road nets must be examined. If bridges have been destroyed or are inadequate, the amphibious capabilities and limitations of artillery weapons must be considered. Rain and snow can adversely affect the mobility of artillery and must be given careful consideration.

CORPS ARTILLERY ORGANIZATION FOR COMBAT

The assistant FSCOORD prepared his recommendation in a format suitable for use as the artillery subparagraph of the corps operation order. After some explanation and discussion, which are summarized below, the corps artillery commander accepted the recommendation as follows:

Corps Arty:

(1) 101st Arty Gp:
1/50 Arty (155-mm, SP)
1/60 Arty (175-mm, SP)
1/70 Arty (8-inch, SP)
1/82 Arty (HJ)
Detached 1st Inf Div and atchd 14th Armd Div effective 061800 Aug.
Detached upon withdrawal of the 14th Armd Div through corps GOP; then GS-reinf 1st Inf Div.

(2) 102d Arty Gp:
1/42 Arty (105-mm, SP)
2/50 Arty (155-mm, SP)
2/60 Arty (175-mm, SP)
2/70 Arty (8-inch, SP)
Atchd 14th Armd Div effective 061800 Aug.
Detached upon withdrawal of 14th Armd Div through corps GOP; then GS-reinf 2d Inf Div.

(3) 103d Arty Gp:
1/71 Arty (8-inch, Towed)
3/50 Arty (155-mm, SP)
3/60 Arty (175-mm, SP)
3/70 Arty (8-inch, SP)
3/82 Arty (HJ)
GS-reinf 10th Mech Div.

(4) 104th Arty Gp:
1/40 Arty (105-mm, SP)
4/50 Arty (155-mm, SP)
4/60 Arty (175-mm, SP)
4/70 Arty (8-inch, SP)
Atchd 14th Armd Div effective 051800 Aug. Detached upon withdrawal of 901st Armd Cav Regt through IDP; then GS in zone 1st Inf Div.

(5) 1/41 Arty (105-mm, Towed): Atchd 1st Inf Div effective 061800 Aug.
(6) 1/51 Arty (155-mm, Towed): Remains atchd 1st Inf Div.
(7) 2/51 Arty (155-mm, Towed): Atchd 2d Inf Div effective 061800 Aug.
(8) 2/82 Arty (HJ): GS, prep for atchmt to 104th Arty Gp west of the Grand R.
(9) 1 /80 Arty (LJ): GS.
(10) 2/71 Arty (8-inch, Towed): Remains atchd 2d Inf Div.
(11) 1/92 Arty (Sgt): GS.
(12) 1/39 Arty (Tgt Acq): GS.
(13) A/1/37 Arty (Slt): GS.

In developing his recommendations, the assistant FSCOORD considered the following factors:

The corps commander's guidance.

The mission of the 14th Armored Division, in terms of delay required; distance over which the delay would be conducted; width of zone; and composition of the division.

Requirements for artillery at the corps main defense position in order to strengthen the vulnerable areas and to prepare defensive plans and positions.

The need to conserve some artillery resources to assume their presence when the decisive battle is joined on the Grand River.

The adaptability of various types of artillery to employment in a mobile, fluid operation.

Quantitative requirements for performance of artillery tasks in a retrograde operation.

Strength, composition, and tactics of the enemy.

The towed cannon battalions and the Little John battalion were quickly eliminated from consideration for use by the 14th Armored Division, since an adequate quantity of self-propelled artillery was available. These battalions were, therefore, kept in general support or attached to one of the withdrawing divisions for movement to the main defense position. Two of the Honest John battalions were also retained under corps artillery control, since only limited scope for their employment in support of the 14th Armored Division's operation could be foreseen. Uncertainties concerning the nuclear threat also contributed to this choice. One Honest John battalion was attached to the division to give missile coverage of the extremely wide division zone.

Three artillery group headquarters, each with an appropriate mix of self-propelled battalions, were attached to the 14th Armored Divison. The 104th Artillery Group, formerly in general support, was attached early to permit its employment in support of the 901st Armored Cavalry Regiment, which was employed as the division covering force to protect the withdrawal of the infantry divisions. After performing this mission, the entire group would revert to corps control to organize the corps main defense position and to be available to add strength to the vulnerable area around Falmouth. The other two artillery groups were attached to the 14th Armored Division coincident with the start of the general withdrawal by the infantry divisions, scheduled for the night of 6-7 August. Upon attachment, these groups and attached battalions would displace to the IDP and assume the missions specified in the 14th Armored Division operation order.

In formulating the composition of the artillery groups to be attached to the 14th Armored Division, due consideration was given to their current composition and to the location of the battalions, in order to minimize the amount of lateral movement and to reduce control, coordination, and communication problems. To the same end, the towed cannon battalions detached from the groups were attached to the divisions in whose zone they were located for control of their movement to the rear. The movement of the units retained under corps control would be scheduled and coordinated by corps artillery.

CONDUCT OF RETROGRADE OPERATIONS

Once additional artillery has been allocated to the covering force, the artilleryman must know how to employ it for maximum effect. In order to achieve the maximum effect, the artilleryman must know and apply certain principles and considerations for employing artillery in support of the delaying action, the night withdrawal, and the retirement. These principles and considerations are discussed in the succeeding paragraphs.

Command and Control

Aggressive leadership and expert exercise of command are extremely important at all levels in a retrograde action. The enemy has the initiative in selecting the time and place of his attack, and the friendly force usually is overextended and his combat resources overtaxed. It is not uncommon to find both offensive and defensive actions occurring simultaneously. In such an environment, the intangibles of effective leadership loom large in the equation for success.

Local Security

The security of artillery positions and columns requires great emphasis during a retrograde operation. Each artillery unit must prepare a perimeter defense against the enemy threat. Unit SOP's should provide for effective utilization of the unit's organic defensive capabilities. Whenever possible, artillery defenses are tied into those of adjacent maneuver units. Some artillery units, due to a shortage of personnel or the nature of the position area, may require assistance from maneuver elements in the vicinity. Alternate positions are selected and prepared to the extent that the situation warrants. Passive measures are employed to the fullest to avoid disclosure of artillery positions to the enemy. Careful attention is paid to concealment and camouflage; light and noise discipline are strictly enforced. Civilians and other unauthorized persons are barred from artillery positions and command posts. When the tactical situation permits, displacements are made only at night or during other periods of reduced visibility.

Deceptive Measures

Dummy positions, alternate positions for conducting registrations, harassing and interdiction fires, and artillery simulators are used to confuse and deceive the enemy counterbattery effort.

ARTILLERY SUPPORT OF THE DELAYING ACTION

In executing a delaying action, minimum space is exchanged for maximum delay. Artillery supports the delay by delivering long-range fires from positions well forward to inflict damage and to delay the enemy. Fire planned must be rapid, flexible, and continuous. Fires are planned on avenues of approach into the delaying position to delay the enemy, and on and behind the position to support our disengagement and withdrawal.

FIRE SUPPORT TASKS

Artillery supporting a delaying action employs its fires to disrupt and delay the enemy advance, to neutralize enemy artillery, to assist supported forces to disengage, and to support limited counterattacks and tank sweeps. Fires are delivered on avenues of enemy approach, troop concentrations, and assembly areas. Priority targets are enemy forward elements, fire support means, and local reserves.

Fires on enemy forward elements. Artillery fires delivered on enemy forward elements are most remunerative in securing delay and disruption of the enemy advance. Fires are planned on avenues of enemy approach and likely assembly areas. Observation agencies are deployed and coordinated to provide long-range target acquisition and surveillance of important areas so that fires may be observed and adjusted for maximum effect. Artillery fire plans are coordinated and integrated with the plans of the supported force to insure maximum contribution to the overall mission.

Counterbattery fires. All available target acquisition means are aggressively employed to locate enemy artillery and mortars. Radars, sound and flash devices, air and ground observers, shell reports, and image interpretation agencies are exploited to the fullest. Knowledge of enemy artillery organizations, tactics, and weapons capabilities facilitates prediction of enemy artillery locations and focuses the target acquisition effort on likely position areas. An active counterbattery policy is pursued to destroy or suppress enemy fire support means in order to minimize friendly casualties and to disrupt the enemy's buildup and reduce his combat power. Enemy artillery, once located, is attacked immediately. Neutralization is maintained by repetitive attacks with reduced ammunition expenditures.

Fires on local reserves. Interdiction of likely assembly areas and routes of approach makes more difficult the movement and deployment of reserve elements. Fires on enemy local reserve positions and assembly areas serve to inflict casualties and disrupt enemy plans to commit the reserve, thus reducing his momentum and contributing to the delay.

Fires in support of disengagements. Detailed, coordinated fire plans to assist in the disengagement of friendly maneuver elements are vital. Massed artillery fires are employed on areas where enemy concentration and pressure are greatest in order to relieve the pressure on friendly elements and to discourage the enemy from pursuing.

FIRE PLANNING AND COORDINATION

Fire plans containing concentrations designed to reinforce obstacles and engineer barriers, interdict avenues of approach, and deny to the enemy terrain needed to mount attacks against the delay position are prepared. Concentrations are planned to the maximum range of all artillery weapons. Detailed fire plans to support counterattacks and withdrawals are developed concurrently with the counterattack and withdrawal

plans. Counterbattery programs and counterpreparation fires are planned if time and targets permit, and the plans of the supported force make them feasible.

RECONNAISSANCE AND SELECTION OF POSITIONS

Reconnaissance. Reconnaissance is coordinated by division artillery headquarters by the assignment of routes or axes to the rear along which battalion positions are to be selected. Coordination is effected with the maneuver elements to obtain route clearances. Artillery units conduct hasty route reconnaissance to insure the adequacy of routes and bridges. Reconnaissance parties select positions along the routes from which the artillery can support the delaying action and/or withdrawals. Selection of numerous positions provides flexibility for future occupations.

Positions. Artillery positions are selected well forward at each delay line to allow the early attack of targets, thereby assisting in delaying the enemy advance. Artillery coverage is provided to the flanks of the supported units, either as a primary task or through the use of supplementary positions or contingent zones of fire. Once positions are selected for the support of the IDP, reconnaissance parties select positions to the rear for future occupation. The distance between successive position areas should not exceed one-half the range capability of the weapon, terrain permitting. The closer together the positions, the more flexibility the artillery unit commander will enjoy in making a timely displacement. Positions should, as a minimum, provide defilade and concealment and have adequate routes into and out of the position. To provide flexibility in displacement, numerous positions should be selected and improved as time permits.

DISPLACEMENTS

Artillery is initially positioned well forward in order to exploit the range of its weapons. As the enemy closes upon the delaying force, the artillery is echeloned in depth to permit maximum continuous fire support of the close combat elements as they yield ground. Artillery battalions, even general support units, normally displace by echelon to insure that some fire units are always in position to respond to calls for fire. Displacement is begun when targets begin to appear at less than two-thirds of the range of the weapons. Every artillery unit commander, regardless of his tactical mission, must follow the battle situation closely and be prepared to make recommendations on position areas, routes, and times of displacement. Artillery displacement plans are closely coordinated with the plans and actions of the supported force to insure that adequate artillery support is always available when needed.

TACTICAL MISSIONS AND ORGANIZATION FOR COMBAT

The assignment of tactical missions to the artillery must provide effective support to the committed maneuver elements, yet retain at the force artillery level the capability to shift fires and units rapidly to meet unforeseen tactical contingencies. The five fundamentals of organizing for combat apply to retrograde operations; however, their relative weights vary in some detail in comparison to other forms of combat.

Adequate support for committed elements. Because of the abnormally wide frontages associated with the delaying action, additional close-support artillery is usually required in order to satisfy this fundamental. The zone, task organization, and scheme of maneuver of the committed force must be analyzed to determine how much artillery is needed to meet this requirement.

Maximum feasible centralized control. This fundamental is satisfied when the bulk of the artillery remains under the command of the force artillery commander. Although the wide deployment of the maneuver units and the decentralization of operations may suggest attachment of artillery to subordinate maneuver elements, the need for maximum flexibility and versatility to meet unforeseen tactical contingencies usually outweighs any advantages that may be thought to accrue through attachment.

Weight to the main attack or vulnerable area. In a delaying action it is desirable to have the capability of massing representative calibers across the entire sector, for two reasons. One reason is to aid in the deception effort in order to confuse the enemy as to the location of the FEBA. The other reason is to achieve maximum effect by the difference of lethality between weapons. Massing all calibers across the entire sector often will be impossible, due to the width of the sector. In the event all calibers cannot be massed across the entire sector, additional artillery, with appropriate tactical missions, must be positioned to weight the most vulnerable areas.

Facilitation of future operations. The overall scheme of maneuver, from the initial delay position back to the main defense line, provides the rationale for satisfying this fundamental. Since the enemy has the initiative, the use of appropriate tactical missions in order to permit rapid and orderly changes in artillery organization for combat is preferable to attaching artillery to maneuver elements.

Immediately available fire support with which the commander can influence the action. This fundamental is satisfied through the assignment of general support and general support-reinforcing missions to appropriate artillery units and by provisions for shifting artillery units to different zones to meet tactical contingencies that may arise due to enemy initiative.

EXTRACT FROM 14TH ARMORED DIVISION OPERATION ORDER

TASK ORGANIZATION

1st Bde
- 1/40 Mech
- 1/41 Mech
- 1/32 Armor
- 1/33 Armor
- ***
- Arty omitted
- ***
- A/4 Engr
- A/4 Med (Spt)
- A/4 Maint (Spt)
- 1/B/4 Sig (Spt)

2d Bde
- 1/42 Mech
- 1/43 Mech
- 1/44 Mech
- 1/34 Armor
- 1/35 Armor
- ***
- Arty omitted
- ***
- B/4 Engr
- B/4 Med (Spt)
- B/4 Maint (Spt)
- 2/B/4 Sig (Spt)

3d Bde
- 1/36 Armor
- 1/37 Armor
- ***
- Arty omitted
- ***
- C/4 Med (Spt)
- C/4 Maint (Sp)

Figure 3. 14th Armored Division Task Organization

ILLUSTRATIVE EXAMPLE CONTINUED

Let us return now to the situation, and illustrate how the 14th Armored Division Artillery could be organized for combat to support the division's mission as the corps covering force. Prior to receipt of the corps operation order, the 14th Armored Division commander issued to his staff his concept of operation based on oral information received during a hasty visit to the corps command post. The division artillery commander and his assistant FSCOORD were present. Pertinent portions of this concept are given below:

"The division will occupy the IDP night of 5-6 August with two brigades abreast—2d Brigade in the north, 1st Brigade in the south. 3rd Brigade, small and tank-heavy, will comprise the reserve. The 901st Armored Cavalry Regiment, reinforced with additional tanks, mechanized infantry, artillery and engineers, will act as the division covering force. Attachments to 901st Armored Cavalry Regiment will cease upon its withdrawal behind the IDP.

"I want maximum combat power—especially firepower—brought to bear on the Aggressor all the time. However, no brigade should allow itself to become decisively engaged.

"I want maximum use of barriers to delay and disorganize the enemy. Use persistent chemicals freely to contaminate routes of approach and likely assembly areas east of the IDP.

"Because of the wide zone we must cover, I want the artillery organized and disposed so that it is responsive to the task forces fighting the delay, yet flexible enough to be shifted rapidly to reinforce any threatened area or to support any sudden change in the division's plan of maneuver."

Artillery organic to the 14th Armored Division.
- 1/30 Arty (HJ)
- 1/32 Arty (155-mm, SP)
- 1/34 Arty (155-mm, SP)
- 1/36 (Arty (155-mm, SP)
- 1/38 Arty (155-mm/8-inch, SP)

Artillery attached from corps artillery.

101st Arty Gp
- 1/50 Arty (155-mm, SP)
- 1/60 Arty (175-mm, SP)
- 1/70 Arty (8-inch, SP)
- 1/82 Arty (HJ)

102d Arty Gp
- 1/42 Arty (105-mm, SP)
- 2/50 Arty (155-mm, SP)
- 2/60 Arty (175-mm, SP)
- 2/70 Arty (8-inch, SP)

104th Arty Gp
- 1/40 Arty (105-mm, SP)
- 4/50 Arty (155-mm, SP)
- 4/60 Arty (175-mm, SP)
- 4/70 Arty (8-inch, SP)

Note: The 104th Artillerey Group is detached from the division when the 901st Armored Cavalry Regiment withdraws behind the IDP.

Figure 4. Artillery available to 14th Armored Division

After this conference with the CG, the division G3 gave the division artillery commander an operation overlay and the tentative task organization of the division (less division artillery) (fig 3), and briefed

him on the general scheme of maneuver. The G3 requested that the division artillery commander prepare the artillery subparagraph of the division operation order that was being drafted by the G3 section planners. The artillery available to the 14th Armored Division is listed in figure 4.

After pondering the division CG's guidance, studying the map and the operation overlay, and performing some mental calculations concerning fire support tasks and fire capabilities, the division artillery commander developed the following artillery subparagraph for inclusion in the division operation order:

———Arty:

(1) 1/30 Arty (HJ): GS
(2) 1/36 Arty (155-mm, SP): GS; o/o DS 3d Bde
(3) 1/60 Arty (175-mm, SP): GS-reinf 101st Arty Gp
(4) 1/82 Arty (HJ): GS
(5) 2/60 Arty (175-mm, SP): GS-reinf 102d Arty Gp
(6) 101st Arty Gp
    1/32 Arty (155-mm, SP)
    1/38 Arty (155-mm/8-inch, SP)
    1/50 Arty (155-mm, SP)
    1/70 Arty (8-inch, SP)
    DS 1st Bde
(7) 102d Arty Gp
    1/34 Arty (155-mm, SP)
    1/42 Arty (105-mm, SP)
    2/50 Arty (155-mm, SP)
    2/70 Arty (8-inch, SP)
    DS 2d Bde
(8) 104th Arty Gp
    1/40 Arty (105-mm, SP)
    4/50 Arty (155-mm, SP)
    4/60 Arty (175-mm, SP)
    4/70 Arty (8-inch, SP)

Atchd 901st Armd Cav Regt effective 051800; detached upon withdrawal of 901st Armd Cav Regt through IDP and revert to corps arty control.

The division artillery commander's mental processes in arriving at the above organization for combat were quite similar to those followed by the corps artillery assistant FSCOORD in allocating artillery to the 14th Armored Division. However, the division artillery commander performed in a much more concrete tactical environment, and his decisions had to be quite specific and exact. The first question he had to settle was whether or not to attach artillery to the brigades. With one exception, to be discussed later, he decided in the negative, based on two considerations:

The division artillery headquarters and the attached group headquarters provided adequate command, tactical fire direction, and communication capabilities to control and maneuver the large number of artillery battalions over the distances involved.

The division commander's dual requirement—that the artillery must be responsive to the task forces yet flexible enough to be shifted rapidly to any threatened area—made retention of centralized control mandatory. By judicious use of the group headquarters, a considerable degree of centralized control was feasible, and at the same time adequate fire support was provided to the task forces.

The one exception to the ruling against attachment was in the case of the 104th Artillery Group, which was attached to the 901st Armored Cavalry Regiment. Since the group and the cavalry regiment had, in effect, been attached to the division at the same time for for the same initial purpose (to cover the withdrawal of the infantry divisions), and since the cavalry's operation during the brief time the group was to be attached promised to be something of a scramble, attachment to the cavalry regiment was the preferred action.

The next matter to be settled was the method of employing the group headquarters. With two brigades abreast of the IDP, each having a zone of action of from 40 to 50 kilometers, at least two artillery battalions were required just to provide area coverage of a brigade zone. To provide some capability for massing, three or more battalions per brigade were needed. A group, with an appropriate number and mix of battalions, employed in direct support of each brigade, provided adequate fire support to the frontline echelons while still retaining the flexibility of centralized control. To insure that each group possessed all the resources (FO's, LO's, etc.) essential to the performance of the assigned direct support mission, an organic division close-support battalion was attached to each group.

The two Honest John battalions and the two 175-mm gun battalions retained in general support provided the necessary means for delivery of chemical warheads, for rapid counterbattery operations, and for quick reaction to unexpected tactical contingencies at the division level. Retention of the 1/36 Arty directly under division artillery control insured rapid response to the close support requirements of the reserve brigade when committed.

Honest John and 175-mm gun coverage was provided throughout the division zone by positioning. The 1/36 Arty was positioned near the reserve brigade and given a zone of fire covering the vulnerable area of the 1st Brigade sector.

LIAISON

Since all the artillery units will initially be positioned well forward in support of IDP, and since concentrations will be planned to the maximum range of the artillery weapons, careful coordination must be effected between the artillery supporting the IDP and the artillery with the 901st Armored Cavalry Regiment. The division artillery would send a liaison officer to the 104th Artillery Group. The 101st Artillery Group and 102d Artillery Group would each send a liaison officer to the direct support artillery units with the cavalry squadrons to their front. These liaison

officers would keep their parent units informed as to the location of the units of the 901st Armored Cavalry Regiment, thus enabling the artillery supporting the IDP to engage targets at maximum range without endangering elements of the 901st Armored Cavalry Regiment. These liaison officers would also act as communication links to tie in with the target acquisition agencies of the 901st Armored Cavalry Regiment. Phase lines and check points would be used as coordination measures.

In order to see how the commander of the 101st Artillery Group (DS 1st Bde) would employ his artillery, let us now turn to the situation at the brigade level.

SITUATION CONTINUED

By 052100 Aug, the CA, 1st Brigade, had received the division operation order, made his reconnaissance, analyzed the situation, and selected a course of action. The CO, 101st Artillery Group, visited the brigade CP and was given the following general guidance by the brigade commander:

> "1st Brigade delays on successive positions with three battalion task forces abreast, TF 1/32 Armor, TF 1/40 Mech, and TF 1/41 Mech from north to south, with TF 1/33 Armor in reserve. Task forces will conduct continuous delay between positions. With such a broad front, we will have to rely heavily on artillery firepower to accomplish our delay mission and to keep the enemy off our backs. As the enemy closes on the IDP, I want to avoid decisive engagement but make him pay for every yard he advances. His leading elements and supporting weapons are the priority targets. I want all likely assembly areas and avenues of approach into our zone heavily interdicted, preferably with observed fires. Priority of artillery fires goes to the task force company teams during their disengagements. I depend on you as brigade FSCOORD to insure the integration of fires with our plans and orders and to provide continuous fire support for the battalion task forces and company teams. TF 1/32 Armor has the most vulnerable sector."

The CO, 101st Artillery Group (DS 1st Bde), must prepare plans for artillery support of the brigade at the IDP. Plans must be developed and decisions made concerning the following:

Execution of the direct support tactical mission by the group.
Planning and coordination of fires.
Observation.
Reconnaissance and positioning and displacement of units.

After carefully studying his notes from the brigade commander's concept of operation and the operations overlay (fig 2), the group commander organized his artillery for combat as follows:

101st ARTILLERY GROUP ORGANIZATION FOR COMBAT

1/32 Arty (155-mm, SP): DS TF 1/32 Armor; provide 1/50 Arty necessary FO's and LO's.
1/38 Arty (155-mm/8-in, SP): GS-reinf 1/32 Arty.

1/50 Arty (155-mm, SP): Support TF 1/40 Mech and TF 1/41 Mech. Displace when necessary and report new location; furnish forward observers and establish liaison as required; establish communication with TF 1/40 and 1/41; zone of fire is zone of action of TF 1/40 and 1/41; plan fires for supported units; answer calls for fire from supported TF's and from this headquarters.

1/70 Arty (8-in, SP): GS

The organization for combat of the 101st Artillery Group was tailored with due regard for the five doctrinal fundamentals of employment: centralized control, adequate fire support for the committed units, weight to the vulnerable areas, facilitation of future operations, and retention of fire support means with which the force (brigade) commander could influence the action. Tactical missions were assigned to subordinate units to promulgate this organization for combat in such a way as to maximize their fire support capabilities while minimizing their limitations.

Because of the extremely wide front assigned to the brigade (approximately 40 kilometers), two field artillery battalions—1/32 Arty and 1/50 Arty—had to be committed to the task of providing adequate fire support to the frontline task forces. The 1/50 Arty was given the mission of supporting **two** committed battalion task forces. To clarify the responsibilities, the CO, 101st Artillery Group, enumerated the specific fire support tasks the 1/50 Arty was to perform. Since one close-support artillery unit was assigned the task of supporting two maneuver units, the direct support mission was not considered suitable in this case and was not used; instead the battalion was directed to **support** TF 1/40 and TF 1/41, and the specific fire support responsibilities were spelled out. Inasmuch as TF 1/32 Armor is defending the most vulnerable sector, the 1/34 Arty was given the mission of direct support of the single task force.

Maximum feasible centralized control, facilitation of future operations, and provision of fire support means immediately available to the 1st Brigade commander through the 101st Artillery Group commander were accomplished by the assignment of a general support mission to the 1/70 Arty and a general support-reinforcing mission to the 1/38 Arty. Thus, the fires of the bulk of the group artillery were retained under the control of the group commander. Fire support planning to support the reserve on commitment was retained by the group headquarters, since plans to commit the reserve would be formulated by the brigade S3. A liaison officer and the necessary forward observers to perform the detailed fire planning for the reserve task force were provided from the group resources.

Because of the assailable flank and the wide front, the entire brigade zone is vulnerable to both penetration and envelopment. The group commander counteracted this vulnerability by assigning general support and general support-reinforcing missions to 1/70 Arty and 1/38 Arty and by a balanced disposition of his artillery across the brigade zone. This action will enable the group to respond to the fire support requirements of the brigade equally well anywhere in its zone of action.

COORDINATION MEASURES WITH THE 1ST AND 2D SQUADRONS, 901ST ARMORED CAVALRY REGIMENT

In a delaying action, field artillery takes the enemy under fire at extreme ranges. As the Aggressor approaches the initial delay position, fires are intensified. Since the 1st and 2d Armored Cavalry Squadrons are delaying the Aggressor to the immediate front, it is imperative that the brigade FSCOORD know where the armored cavalry elements are located at all times so that fires may be delivered in those areas that have been evacuated by the armored cavalry. He therefore establishes liaison with each squadron's FSCOORD. An air OP would be used for radio relay if necessary.

CONCENTRATIONS PLANNED FOR THE DELAYING ACTION

Fire support planning in a delaying action is similar to that in other defensive operations. Concentrations are selected by using target prediction based on map study, air and ground observation of the terrain, and the applied knowledge of Aggressor organization and tactics. Particular emphasis is placed on planning fires on defiles, minefields, destroyed bridges, and other obstacles. Fires are planned on roads, road junctions, key terrain features, and likely assembly areas to disrupt and delay the Aggressor's approach and to inflict as many casualties as possible.

OBSERVATION AND SURVEILLANCE PLAN

Continuous observation and surveillance of the selected concentrations are necessary in order to employ artillery fires with maximum effect. The massing of artillery fires on these concentrations at the moment the enemy arrives on the spot will disrupt and delay the enemy and cause considerable damage. Many of the concentrations selected will be within the observation or surveillance capability of the 1st and 2d Armored Cavalry Squadrons, 901st Armored Cavalry Regiment. Observation and surveillance for these concentrations would be accomplished as discussed below. As the 1st and 2d Armored Cavalry Squadrons withdraw, the requirements for surveillance of some concentrations will exceed the capability of most of the cavalry agencies mentioned. Therefore, preplanned tactical air reconnaissance missions should be scheduled through the S2 Air, 1st Brigade, to provide surveillance during this time. Arrangements could be made through the air liaison officer (ALO) at the 1st Brigade to have pilots returning from close air strike missions give spot reports as they fly over the concentrations.

Day surveillance. Arrangements would be made through the 101st Artillery Group liaison officer with the artillery supporting 1st and 2d Armored Cavalry Squadrons for the FO's to observe those concentrations they can see. These FO's would also utilize the "eyes" of personnel in the 1st and 2d Armored Cavalry Squadrons and the surveillance radars

organic to the squadrons. The group air OP would be used to back up the cavalry observers and to observe concentrations the 1st and 2d Armored Cavalry Squadrons could not see from the ground. The group S2 would incorporate the concentrations into his surveillance schedule to insure systematic coverage.

Night surveillance. Patrol reports of the 1st and 2d Armored Cavalry Squadrons would be monitored by the group liaison officer to obtain surveillance information. Arrangements would be made with division G2, through artillery intelligence channels, to obtain information from stay-behind forces (if any) and to utilize OV-1 Mohawk radar and infrared missions to check the concentrations. If necessary, arrangements would also be made for intermittent illumination of certain areas by artillery or flare aircraft so that air or ground OP's could check for enemy activity. The division artillery AN/TPS-25 surveillance radar would also be a source of reports on enemy movements in areas that the radar was capable of covering. Forward observers would be instructed to coordinate with the maneuver elements along the IDP in order to utilize organic surveillance radars to aid in covering certain concentrations.

DISPLACEMENT

Displacements during the delaying action would be coordinated and timed with the movements of the supported elements. The 1/34 Arty and 1/50 Arty would be displaced on their commander's own initiative. The 101st Artillery Group would control the displacement of the 1/38 Arty and 1/70 Arty. Although general support battalions displace only on order of higher artillery headquarters (the 101st Artillery Group in this case), the battalion commanders are responsible for a continuous study of the situation and for making timely recommendations to the higher artillery commander when displacement is deemed necessary. In this situation, all battalions would displace by echelon, timing their displacements so that the first battery, with a "jump" battalion FDC, would displace as targets begin to appear at less than two-thirds range, and the last battery would displace in time to avoid coming under direct fire of the Aggressor tanks. The batteries of the battalions would displace to positions that are echeloned in depth. The initial displacement would be based on the withdrawal of the 901st Armored Cavalry Regiment toward the IDP. Subsequent displacements would be based on the rearward movements of the 1st Brigade elements. Timely displacements will be critical throughout the delaying action. If displacements start too soon, many targets will appear that are out of range. On the other hand, if displacements start too late, some artillery elements may be cut off and overrun.

ARTILLERY SUPPORT OF THE NIGHT WITHDRAWAL

The night withdrawal is usually voluntary, and there is usually time to plan the action in some detail. Darkness lends a degree of security to the withdrawing force and enhances secrecy and deception. Artillery

supports the night withdrawal by providing continuous fire support to the detachments left in contact. The normal pattern of fires is maintained to enhance deception and to cover the noise of displacing vehicles. Detailed fire plans are prepared to counter enemy attempts to interfere, either by fires or by maneuver, with the withdrawal.

PLANNING AND EXECUTION OF DISPLACEMENTS

Artillery units of representative calibers, in strength proportionate to the strength of the detachments left in contact, remain in position to cover the withdrawal. The remainder of the artillery displaces with the main body to new positions to the rear. Artillery commanders normally move with the bulk of their artillery as it displaces. Designated representatives (usually the executive officers) are left forward to control the artillery supporting the detachments left in contact. The movement of the artillery is integrated into the movement plan of the supported force. The force artillery accompanying the main body displaces in two increments: general support and general support-reinforcing artillery units move out early, usually just behind the trains and the division reserve; direct support and reinforcing artillery units displace with the main bodies of the supported brigades or task forces. The artillery elements left to support the detachments in contact displace in coordination with the movement of those forces.

SUPPORT OF DETACHMENTS LEFT IN CONTACT

As stated earlier, artillery units of representative calibers, in strength proportionate to the strength of the detachments left in contact, remain in position to cover the withdrawal. All calibers of artillery present with the force should be represented. In order to maintain area coverage and the same pattern of fires, platoons or half-batteries may be employed. The unit fragments may retain their tactical integrity, or they may be consolidated to facilitate control, as the situation warrants. Skeleton CP's and FDC's are manned with minimum personnel. Sufficient liaison officers and forward observers remain with the detachments in contact to insure close coordination and responsive fire support. Fires are planned and delivered to maintain the normal volume of harassing and interdiction fires, to mask the commotion of the withdrawal, and to discourage enemy patrol and surveillance activity. Detailed fire plans, including counterbattery and countermortar programs, are prepared to counter any enemy attempts to interfere with the withdrawal.

DECEPTION OPERATIONS

Artillery supporting the detachments left in contact contributes to the deception effort by maintaining a volume of fires representative of the entire force artillery, using roving guns if necessary, and by maintaining the normal nighttime volume and pattern of artillery radio traffic. Artillery units displacing with the main body observe radio silence so that no inkling of the movement will reach enemy intercept stations.

ILLUSTRATIVE EXAMPLE OF NIGHT WITHDRAWAL

SITUATION CONTINUED

It is now 101700 Aug. Since 052100 Aug, the following events have occurred in the 1st and 2d Brigade sectors:

Night 5-6 Aug, all elements of 1st and 2d Brigades arrived on the IDP. Artillery units were in position to support the IDP. Liaison was established with the artillery supporting the 901st Armored Cavalry Regiment.

Night 6-7 Aug, the withdrawal of the 1st, 2d, and 10th Divisions was carried out without serious interference by Aggressor.

070600 Aug, 901st Armored Cavalry Regiment established contact with Aggressor reconnaissance elements.

070900 Aug, Aggressor was taken under fire at maximum range by artillery supporting the IDP.

Night 7-8 Aug, numerous Aggressor patrols were detected. 901st Armored Cavalry Regiment withdrew through the IDP.

Period 8 Aug to present, 14th Armored Division delayed the Aggressor between the IDP and delay line CZAR. The 14th Armored Division is presently occupying delay line CZAR.

The 14th Armored Division is under heavy pressure in the 1st Brigade sector.

At 1700 hours, the division commander, to avoid becoming decisively engaged, ordered a general withdrawal from line CZAR to line SABER to commence at 2130 hours. The 3d Brigade was ordered to cover the withdrawal of the 1st and 2d Brigades. Order of march: Division reserve with supporting artillery to covering positions, division trains, artillery (less artillery supporting security forces left in contact), main body.

ARTILLERY ORGANIZATION FOR COMBAT TO SUPPORT THE NIGHT WITHDRAWAL

To protect the withdrawal the following artillery units were left to support detachments left in contact:

Under division artillery control:
- Btry B, 1/60 Arty (175-mm, SP)
- Btry B, 2/60 Arty (175-mm, SP)

Under 101st Artillery Group control (1st Bde sector):
- Btry B, 1/32 Arty (155-mm, SP)
- Btry B, 1/50 Arty (155-mm, SP)
- Btry B, 1/70 Arty (8-in, SP)

Under 102d Artillery Group control (2d Bde sector):
- Btry B, 1/34 Arty (155-mm, SP)
- Btry B, 2/50 Arty (155-mm, SP)
- Btry B, 2/70 Arty (8-in, SP)

The following artillery units were provided to support 3d Brigade (division covering force) during the withdrawal:

1/36 (155-mm, SP): DS 3d Bde
1/42 Arty (105-mm, SP): Reinf 1/36 Arty
1/60 Arty (175-mm, SP) (minus Btry B): GS-reinf 1/36 Arty

ARTILLERY IN SUPPORT OF DAYLIGHT WITHDRAWAL

In the daylight withdrawal, the maneuver elements must fight to disengage. Artillery supports the daylight withdrawal by delivering fires to assist in the disengagement and to discourage the enemy from pursuing.

During the daylight withdrawal, artillery units displace to the rear by echelon in close coordination with the movement of the supported force. Timing is critical; units must displace rapidly enough to avoid being overrun, but must be in position to respond to calls for fire when needed. If enemy pressure is great, maneuver by the close combat elements may require several displacements before disengagement is achieved. Once the disengagement is completed, direct support artillery remains in position and continues firing until the last possible minute. It then displaces quickly to join the withdrawing columns. When the situation warrants, control of displacement is delegated to lower echelon artillery commanders to facilitate timing and coordination with the disengaging elements. Multiple routes of withdrawal are used whenever possible to speed the withdrawal and avoid excessive concentration of troops and vehicles.

SUPPORT OF LIMITED COUNTERATTACKS

If enemy pressure prevents a maneuver element from disengaging, a limited-objective counterattack or a tank sweep may be launched to relieve the pressure. Artillery supports the counterattack with all available fires, including smoke if needed to screen friendly movements. Careful and detailed coordination of fires within the counterattack area is necessary to assure troop safety, yet secure maximum effect.

The artillery headquarters supporting the commander ordering the counterattack is responsible for the overall coordination of fires delivered in the counterattack area. During the planning phase of the counterattack, the artillery commander in direct support of the counterattacking force establishes a no-fire line (NFL) near the outer periphery of the counterattack (tank sweep), thus providing for coordination of all artillery missions fired within this NFL. The commander ordering the counterattack may establish an additional coordination measure, such as a boundary or fire coordination line (FCL), to delineate the inner flank of the counterattack zone. This latter measure assists in expediting the clearance of fires in support of the frontline elements by designating the area **within the NFL** in which fires may be delivered without requiring clearance from the direct support artillery commander of the counterattack force.

EXAMPLE — CASE I

Counterattack by brigade reserve. Figure 5 depicts the fire coordination measures appropriate for a counterattack of tank sweep mounted by the brigade reserve. The NFL can be placed on grid lines for ease of transmission, since it is purely an artillery fire coordination and control measure.

An amount of artillery proportionate to the security forces left in contact, with all calibers represented, was left in position. The units remaining in position retained the tactical missions of their parent battalions. Since deception is one of the vital considerations affecting the success of the withdrawal, the artillery remaining in position continued the normal volume of harassing and interdiction fires representative of the entire force artillery. The group and battalion executive officers were placed in command of the artillery elements left behind. Skeleton command posts and FDC's, with necessary communications, were left to control the artillery action. Normal radio traffic was maintained to enhance the deception effort. Some liaison officers and forward observers remained with the detachments left in contact to provide the usual flow of information and fire planning. Close coordination between the artillery remaining and the security forces was maintained at all levels. Detailed fire plans were drawn up to counter, should it occur, any enemy attempt to interfere with the withdrawal.

MOVEMENT

The most critical aspect of a night withdrawal is completing the movement to the next delay position without being discovered. Often, in order to complete the move prior to daylight, a tight movement schedule will be necessary. This is particularly true in an area of limited road networks. This creates two problem areas for the artillery. Some artillery must be moved early in order to keep the road arteries filled to capacity, yet some artillery must also be available until the last moment prior to movement of the main body in order to provide support to the main body in the event the enemy reacts. For these reasons the sequence of moving the artillery is critical. Plans must be made to pull artillery units off the road to provide emergency fires to reinforce those of the artillery left in support of the relatively weak detachments left in contact. Although it may be very difficult, some artillery units may have to countermarch in order to occupy positions within range. Since position areas will have been selected and organized to support the delaying action, the problem of an emergency reaction will be somewhat eased because of this prior planning.

In this situation the 3d Brigade (the division covering force), with its supporting artillery, moved first, followed closely by the division trains and the general support and general support-reinforcing artillery. Just prior to the movement of the main body, the close support artillery moved. Finally, the only elements remaining were the security detachments left in contact and their supporting artillery. The artillery remaining with the security forces moves in conformance with the movement of the security forces left in contact. Since this artillery is critically exposed to enemy action, careful coordination with the security forces will be necessary. Battery B, 1/60 Arty, would rejoin its parent battalion (GS-reinf 1/36 Arty) when the security forces withdrew through the covering force.

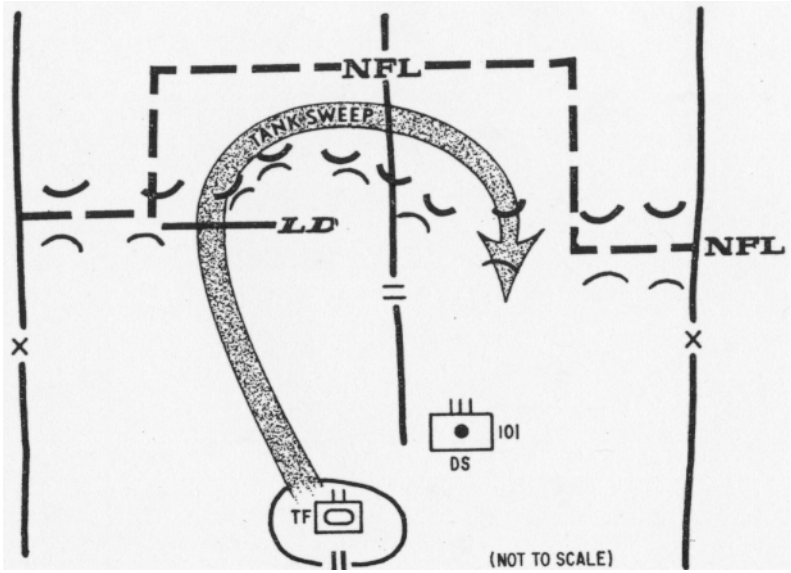


Figure 5. Fire Coordination Meaures for Counterattack by Brigade Reserve

In this case the fires within the NFL are easily controlled by the direct support artillery unit commander, and no additional coordination measures are needed.

EXAMPLE — CASE II

Counterattack by division reserve. Because larger forces and more real estate are involved, the coordination of fires incident to a counterattack mounted by the division reserve requires additional measures. Figure 5 depicts the fire coordination measures that may be appropriate in such action. The problem is complicated by the presence of at least **two** direct support artillery units with fire support responsibilities in the same area—the artillery in direct support of the division reserve and the artillery unit in direct support of the brigade in whose zone the counterattack is to be mounted. If the ground to be traversed by the counterattacking force lies in the zone of **two** brigades, then **three** direct support artillery units become involved. The fire coordination measures shown in figure 6 permit rapid clearance and delivery of fires with minimum interference with the freedom of action of the direct support artillery units concerned. The NFL was established by the 1/36 Arty, which is supporting the counterattacking force. The establishment of a fire coordination line (FCL) **within** the NFL permits the direct support artillery of the 1st and 2d Brigades to fire short of the FCL in support of their respective brigades without having to clear each mission with the 1/36 Arty. Depending on the real estate involved, the pressure on the 1st and 2d Brigades, and communication considerations, an FCL may or may not be needed. If employed, it is established by the division FSCOORD.

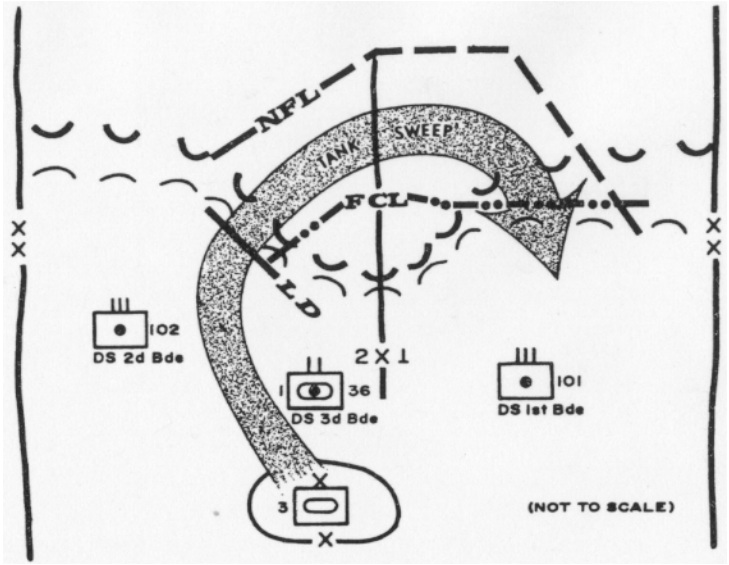


Figure 6. Fire Coordination Measures for Counterattack by Division Reserves

ARTILLERY SUPPORT OF A RETIREMENT

In a retirement, artillery units are integrated into the march columns of the main body. Adequate fire support is provided for the advance, flank, and rear guards, either by attachment of artillery or by assignment of appropriate tactical missions.

REARWARD PASSAGE OF LINES

Retrograde operations frequently terminate in a rearward passage of lines. Withdrawal through a defensive position requires considerable prearrangement and coordination with the forces manning the defensive positions, as to both movement and fire. Liaison is established between the artillery commanders of the withdrawing force and the force to be passed through. Fire plans are prepared and communication channels are established to permit the rear guard of the withdrawing force to receive artillery support from the force being passed through during that critical phase of the withdrawal. As the retrograding force passes through the general outpost (GOP) of the main defensive position, its rear guard comes under the "umbrella" of the artillery supporting the general outpost and the long-range weapons positioned behind the FEBA. The fires of these units are brought to bear on the enemy to compensate for the withdrawal from action of the general support and general support-reinforcing artillery of the covering force. These fires are provided

through mutual cooperation, rather than by the assignment of tactical missions as is the case in a passage of lines in an attack. Liaison and communications are established at each fire support echelon between the artillery with the withdrawing force and the appropriate artillery command posts supporting the main defensive position (including the general outpost artillery). These channels are used to exchange information and plans and to transmit requests for fires.

The movement of artillery columns through a rearward position is scheduled and coordinated by the supported force. Before the artillery supporting the rear guard occupies position areas located behind the general outpost, it must coordinate the use of such position areas with the artillery supporting the general outpost forces. The artillery unit passing through a maneuver element must send a representative to the maneuver element's contact point to clear the artillery column for passage.

The responsibility for fire support coordination within the zone remains with the artillery commander of the withdrawing force until the rear guard of the supported force has passed through the general outpost. As a rule, fire support coordination responsibility is transferred at the same time control of a given sector passes from the covering force commander to the commander of the defensive force occupying that sector.

EMPLOYMENT OF NUCLEAR WEAPONS

The development of nuclear weapons and the doctrine relative to their employment on the nuclear battlefield has not materially changed the concept for the conduct of a retrograde operation. The basic problems confronting the corps commander are first, to disengage his force while still preserving its tactical integrity, and second, to move to the next defensive position without offering the enemy the opportunity to pursue and destroy his corps.

There are two areas of differences in the conduct of a retrograde operation under conditions of nuclear versus nonnuclear warfare—they are closeness of engagement and time of withdrawal. The first of these concerns the use of the reserve. Prior to the advent of tactical nuclear weapons, the commander could ill afford to allow his forces to become too closely engaged with the enemy, for to do so might preclude their breaking contact. By the use of conventional artillery and air support or by a skillfully executed counterattack, contact with the enemy could be broken and the retirement or delay could begin. Tactical nuclear weapons have influenced withdrawal tactics to the extent that the commander, with this additional firepower available, can now accept closer engagement with the enemy without relying on a large ground reserve to assist his forward units in breaking contact. The destructive power of tactical nuclear weapons speeds up the disengagement and permits the employment of the command in close combat.

Employment of tactical nuclear weapons also affects the time of withdrawal of the forward units. Although a night withdrawal from contact has long been preferred to a daylight withdrawal, the accurate and timely employment of nuclear weapons enables a defender to execute a withdrawal during daylight, provided the conditions of air superiority do not unduly increase the risk.

The nuclear delivery capability of field artillery weapons reduces the requirement for massed artillery fire in nuclear combat. During operations, nuclear delivery means require protection against hostile action. This protection may be accomplished by their early withdrawal to rearward positions from which they can continue to deliver fire, by assigning specified combat units the mission of protecting the nuclear delivery means, or by locating uncommitted elements of the reserve sufficiently near the nuclear delivery means to afford them security without detracting from the ability of the reserve to perform its primary mission and without so concentrating forces as to present a lucrative target.

CONCLUSION

This article has highlighted the major doctrinal aspects of artillery support of modern retrograde operations. Artillery firepower, aggressively and efficiently employed, can contribute greatly to the objective—to trade space for time and to exact a heavy toll from the enemy for the terrain surrendered, while husbanding our own combat resources for the decisive battle to be fought at a time and place of our own choosing.

———●———

6,400-MIL FIRING CHART

Artillery must be prepared to deliver supporting fires in any direction, limited only by the range of the weapon. A relatively simple, one-chart method is presented which provides a 6,400-mil capability.

A firing chart is plotted in the normal manner with the batteries located near the bottom center and grid squares numbered along the left and bottom margins. The firing chart now has a 3,200-mil capability. The remaining 3,200 mils are obtained by turning the chart 180 degrees and numbering the grid lines appropriately. Batteries are plotted using a different color for the tick marks. Targets are plotted in this reverse direction using the same color tick marks as is used for the batteries. Plotting in this direction requires some care since the grid lines are read right-down instead of the normal right-up.

For longer range weapons where the 1:25000 scale firing chart does not provide sufficient range, the present grid sheet can be converted into a 1:50000 scale by the simple expedient of designating each square as 2,000 meters. Every other number is skipped (22, 24, 26, etc.) when the firing chart is marked. With this 1:50000 firing chart, a 1:50000 scale range - deflection protractor (Federal Stock Number 1290-580-4441) can be used or the 1:25000 RDP may be renumbered with each range division representing twice its present value.

Managing Your Maintenance

Major John F. Geraci
Artillery Transport Department

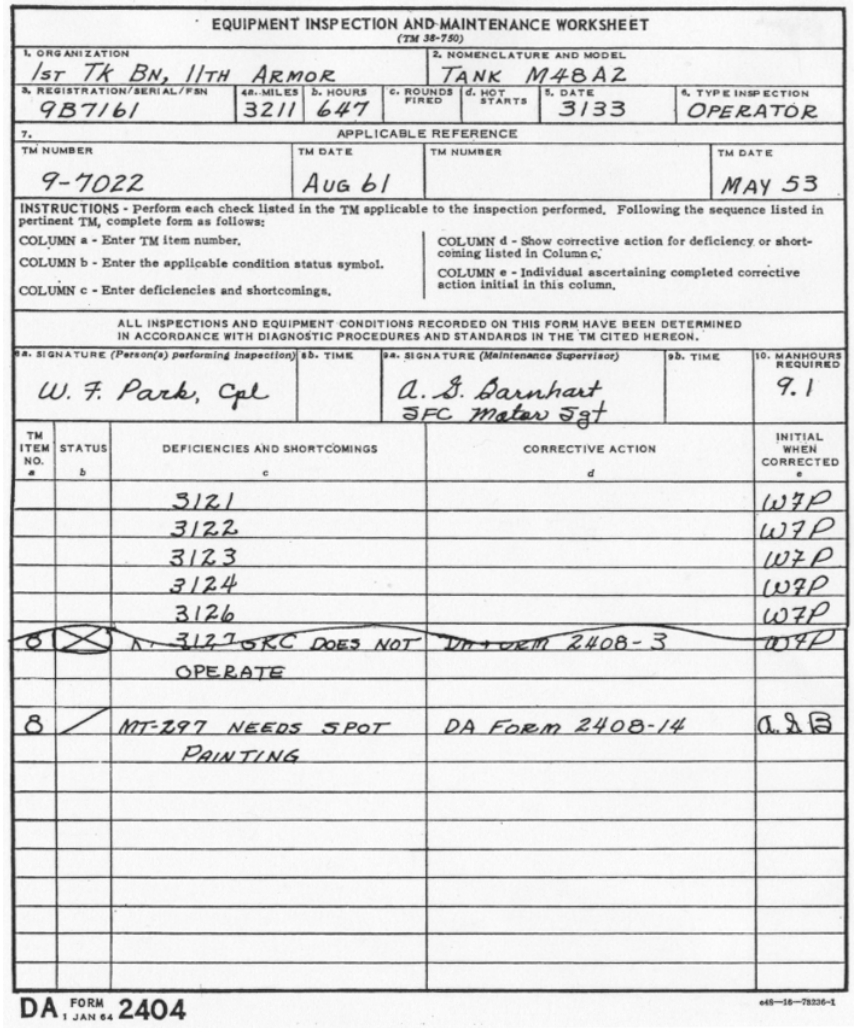
"Management Control" are the key words in this second presentation of MANAGING YOUR MAINTENANCE. In the first segment, published in the April 1965 issue, we talked about materiel readiness in conjunction with the Equipment Serviceability Criteria technical manual, as well as The Army Record Procedures (TAERP) which was followed by a brief discussion of management control. Continuing this discussion, ARTILLERY TRENDS and the Artillery Transport Department, in the following pages, are providing commanders more insight into management control with the use of TAERP; that is, the proper use of DA Forms 2404, Equipment Inspection and Maintenance Worksheet; 2408-1, Daily or Monthly Log; 2408-2, Equipment Lubrication Record; 2408-3, Equipment Maintenance Record; and 2408-14, Uncorrected Fault Record.

DA FORM 2404

One of the most basic of all maintenance management controls is a form which is not even properly a log insert. It is the DA Form 2404, Equipment Inspection and Maintenance Worksheet (fig 1). This form is completed (or an entry is made on the form) by anyone making an inspection of an item of equipment. This form is also required for recording the results of an equipment serviceability evaluation. Properly completed and used, this form gives the maintenance manager a good picture of the technical soundness and combat readiness of his equipment.

USED FOR INSPECTION AND SERVICING OF EQUIPMENT

Of direct concern to any commander are those worksheets prepared by his equipment operators to record daily inspections and services (before, during and after operation of equipment), for it is obvious that all maintenance management and control begins here—with the user. Instructions in TM 38-750 specify that, in recording inspections and services, the operator or crew will enter on the DA Form 2404 only those equipment faults which they are unable to correct or which they correct by the use of a part. Compliance with this very logical requirement prevents the DA Form 2404 from becoming a mass of insignificant information. Of what use, for example, is a record indicating that a little air was added to a tire, that a bumper was spot painted, or that a windshield was cleaned? The DA Form 2404 used for recording daily inspections



EQUIPMENT INSPECTION AND MAINTENANCE WORKSHEET
(TM 38-750)

1. ORGANIZATION						2. NOMENCLATURE AND MODEL	
1ST TK BN, 11TH ARMOR						TANK M48A2	
3. REGISTRATION/SERIAL/FSN	4a. MILES	b. HOURS	c. ROUNDS FIRED	d. HOT STARTS	5. DATE	6. TYPE INSPECTION	
9B7161	3211	647			3133	OPERATOR	

7. APPLICABLE REFERENCE

TM NUMBER	TM DATE	TM NUMBER	TM DATE
9-7022	AUG 61		MAY 53

INSTRUCTIONS - Perform each check listed in the TM applicable to the inspection performed. Following the sequence listed in pertinent TM, complete form as follows:

COLUMN a - Enter TM item number.

COLUMN b - Enter the applicable condition status symbol.

COLUMN c - Enter deficiencies and shortcomings.

COLUMN d - Show corrective action for deficiency or shortcoming listed in Column c.

COLUMN e - Individual ascertaining completed corrective action initial in this column.

ALL INSPECTIONS AND EQUIPMENT CONDITIONS RECORDED ON THIS FORM HAVE BEEN DETERMINED IN ACCORDANCE WITH DIAGNOSTIC PROCEDURES AND STANDARDS IN THE TM CITED HEREON.

8a. SIGNATURE (Person(s) performing inspection)	8b. TIME	9a. SIGNATURE (Maintenance Supervisor)	9b. TIME	10. MANHOURS REQUIRED
W. F. Park, Cpl		A. S. Barnhart SFC Motor Sgt		9.1

TM ITEM NO. a	STATUS b	DEFICIENCIES AND SHORTCOMINGS c	CORRECTIVE ACTION d	INITIAL WHEN CORRECTED e
		3121		WFP
		3122		WFP
		3123		WFP
		3124		WFP
		3126		WFP
6	X	R. 3127 SRC DOES NOT OPERATE	DA FORM 2408-3	WFP
8	/	MT-297 NEEDS SPOT PAINTING	DA FORM 2408-14	A.S.B

DA FORM 1 JAN 64 2404

e48—16—78236-1

Figure 1. DA Form 2404, Equipment Inspection and Maintenance Worksheet.

and services is destroyed when all corrected faults have been recorded on the appropriate form of the equipment log. Even when there are entries indicating faults beyond the ability of the user to correct, the DA Form 2404 is discarded after the fault has been corrected by a mechanic and recorded on the DA Form 2408-3 or DA Form 2409 or after the fault has been entered on the DA Form 2408-14 for future corrective action.

Perhaps the most important part of this form is column **a,** "TM Item No." The same 2404 is used to inspect all items of equipment. The TM for each item of equipment lists the specific operator and/or crew daily service checks, and each check is referenced to a check number, page number or picture number. The requirement for recording the information in column **a** literally forces the operator and/or crew to inspect and service equipment in accordance with the appropriate TM. The complexity of modern Army equipment makes the performance of any technical type of inspection or service without reference to a TM virtually impossible. Therefore, whenever a fault is noted on a DA Form 2404, you should check to see that an entry has been made in column **a.** Occasionally cross-check an entry with the referenced TM as a safeguard against "paper" maintenance.

If there are any uncorrected faults recorded on the DA Form 2404, after the equipment operator or crew completes an after-operation service, the form should be turned in to the person designated by the unit SOP—this might be the dispatcher, battery motor sergeant or chief of section. Each working day, the battery motor sergeant should examine these forms submitted by the operators and assign mechanics to correct the faults recorded in column **c.** If this is not possible, the motor sergeant should post shortcomings and suggested improvements to the DA Form 2408-14, Uncorrected Equipment Fault Record.

USED FOR EQUIPMENT SERVICEABILITY EVALUATION

It is extremely important that the motor sergeant "stay on top" of the DA Forms 2404 used to record an Equipment Serviceability Criteria (ESC) evaluation because of the possible effect of such an evaluation on materiel readiness reporting. Serviceability evaluation of equipment is based on the established ESC and, therefore, normally is not influenced by maintenance standards. There are, however, a few items of equipment which are evaluated based on maintenance standards. Although such items are few, the point values assigned to them could make a big difference in the outcome of the overall evaluation. For example, if an unserviceable tire is replaced immediately on a 1/4-ton truck M151, the vehicle could be classified as GREEN instead of AMBER or even RED as it might otherwise be rated. Similarly, the replacement of an inoperable oil or temperature gauge could result in the classification of a vehicle as at least AMBER and possibly GREEN; whereas, it would otherwise be placed in the RED category. These on-the-spot, immediate corrective actions should be made before a readiness report is submitted in order to present the best possible report and the most accurate picture to higher headquarters.

AS AN INDICATOR FOR THE COMMANDER

The key to the value of DA Form 2404 as a management control is whether or not the operator and crew are actually performing the prescribed daily services correctly, and if they are performing them, are they

recording those faults that they are unable to correct? Unless organizational maintenance personnel are made aware that faults exist, they cannot correct them—and since **all** repair information is initiated by DA Form 2404, an unrecognized fault is an uncorrected fault.

To determine whether operators are performing services and recording faults correctly, the busy commander should use the following "indicators" in checking the DA Forms 2404 prepared by his equipment operators:

- **Heading.** All blocks should be filled in. Special attention should be given to the TM number, date, and changes. The correct completion of these blocks indicates that the person who completed the form at least knew the correct TM to use. If these blocks are not completed or if the information recorded is incorrect or out of date, the person who used the DA Form 2404 may have performed the inspection or service without the appropriate reference.
- **Column a.** A TM item number, figure or page should be entered. It should be cross-checked with the actual TM from time to time. Often there is far too much left to memory by personnel performing a service or inspection. The absence of an entry is a good indication of incomplete or "paper" work, or it may indicate that work is not being properly supervised by a chief of section.
- **Column b.** There are only four authorized status symbols. The entry in this column of any unauthorized symbol indicates that the person who completed the form was evidently unaware of the significance of the fault he found. Authorized symbols and their meanings are as follows:
  1. "X" indicates a deficiency.
  2. "⊗" indicates shortcoming.
  3. "(/) indicates a suggested improvement.
  4. "(—)" Indicates that a required inspection, component replacement, maintenance operation check, or test flight is due but has not been accomplished.
- **Column c.** Only those faults which cannot be corrected by the operator or crew and those faults corrected by replacing a part will be shown in this column. An entry such as "water low," "tire pressure excessive (or low)," etc., in this column, indicates one of two conditions. If the operator's initials appear in column **e,** this indicates that he has already corrected the fault and is only wasting time by recording this information. If his initials do not appear in column **e,** this indicates that he has not done his job and apparently expects that someone else will do it for him. His section chief may not be exercising adequate supervision.
- **Column e.** The initials entered in this column should be those of the authorized person. If they are not, the commander should check to determine if someone is wasting the time of a trained mechanic by permitting him to perform unskilled operator maintenance. Conversely, are untrained operators being permitted to perform repairs which should be accomplished by a skilled mechanic? If such a situation exists, it indicates faulty supervision and grossly uneconomical use of personnel.

- **Information Recorded.** The commander should check the information recorded on the DA Forms 2404 to determine the following:

1. Are users reporting the same uncorrected faults day after day? If the faults are deficiencies, why hasn't corrective action been taken? If they are shortcomings or suggested improvements, have they been entered on the DA Form 2408-14? Such entries may indicate that effective supervision is lacking.
2. When an inspector or mechanic completed the DA Form 2404, did he find faults that the operator or crew should have corrected? If he did, this could indicate that the operators do not know how to identify faults, are ignoring them, or both. In any case, this is an indication that supervision is lacking.
3. Do the DA Forms 2404 rendered with an inspection report reflect faults which unit mechanics should have corrected? Existence of such faults may indicate either that equipment users are not reporting equipment faults for correction by the unit mechanics or that the mechanics are not making the repairs properly. Further investigation should be made to determine the cause of this condition and to take corrective action. If the mechanics are doing an effective job, it should be reflected by the entries on the DA Forms 2408-3 and 2408-14.

In checking the DA Form 2404 which has been used for an equipment serviceability evaluation, the following additional indicators will be useful to the commander:

The person performing the evaluation should be the equipment operator or crew as required by ESC technical manuals, although a mechanic may assist, especially on initial training of new operators. The chief of section may provide "technical" assistance (which isn't very complicated) while providing supervision. In any event, the evaluation should be that of the operator or crew, and inspectors will check on their ability.

In column **b** is entered the point value for each TM item number shown in column **a.** This point value varies from 0 to 10 as determined from the rating scale for the particular item number in the ESC manual. The entries in column **b** should be checked against the color category awarded the item of equipment. If a point value of 1 has been given for any item number, the equipment itself cannot be rated higher than AMBER. If a point value of 0 has been awarded any item, the equipment cannot be rated higher than RED. This is always true, regardless of the total point score of all items. This simple and rapid check can often save the commander from making an incorrect materiel readiness report.

Remember, no corrective action will ever be taken until a fault has been detected. Detection of faults depends on proper inspection and servicing of equipment. The DA Form 2404 is, therefore, the "first-line" of maintenance management control.

The management technique for insuring proper use of the DA Form 2404 (thereby insuring proper inspection and servicing of equipment) is to require adequate supervision of unit services and inspections.

DA FORM 2408-1 AS A DAILY LOG

The next management control is back in the log book. It is the DA form 2408-1, Equipment Daily or Monthly Log. It is numbered "1." But keep in mind that this insert itself depends, in turn, on that indispensable DA Form 2404. The DA Form 2408-1 is used both as a daily and monthly form, the sole difference being the square that is checked in block 5, "Type of Log." Figure 2 shows DA Form 2408-1. Consider this form as a daily log. On DA Form 2408-1, the equipment operator and/or crew enter **summarized** information, which they have obtained from DA Form 2404. The summarization is vital so that important control information is not lost in trivia nor time wasted in duplicating data which is available elsewhere. The value of DA Form 2408-1 as a management control is as follows:

- The form is maintained by the operator; therefore it is a report from the man who knows the item best and is most familiar with its operating characteristics.
- The form serves as an excellent cross-check for use with DA Forms 2408-3 and 2408-14.
- Specifically, the form indicates to the supervisor the daily operational status of the item, the amount of time lost due to repairs, and many other things that can be seen by the column headings.

The management technique to insure proper use of this control—

- Supervision of the operator's entries by the chief of section.
- Frequent inspection by commanders and staff and prompt, appropriate action wherever indicated.

1. NOMENCLATURE: TANK M48A2 — 2. REGISTRATION OR SERIAL NUMBER: 18220
3. NEXT PERIODIC SERVICE DUE (Date): 29 APR — 4. NEXT LUBRICATION DUE (Date): 17 APR — 5. TYPE OF LOG: [X] DAILY [ ] MONTHLY

DATE OF ENTRY	READING HOURS / MILES	TOTAL FUEL ADDED (Gal)	OIL ADDED (Qt): ENGINES	TRANS-MISSION	FINAL DRIVE	TURRET HYDRAULIC	WERE THERE ANY UNCORRECTED DEFICIENCIES OR SHORTCOMINGS IN COLUMN C, DA FORM 2404? (Check one): YES	NO	CHECK BELOW IF EQUIPMENT IS OPERATIONAL	SIGNATURE OF OPERATOR OR CREW CHIEF	INDICATE NUMBER OF DAYS NON-OPERATIONAL AND SIGN BELOW AFTER EQUIPMENT IS AGAIN OPERATIONAL: NO. DAYS ORG	NO. DAYS MPT	SIGNATURE
3060	1730	(BROUGHT FWD FROM FEB)					X		✓	R. B. Barnes			
3065	1775	42					X			R. B. Barnes		3.0	L.H. Quinn
3070	1801	17	2	1			X		✓	R. B. Barnes			
3070	2							✓	✓	A. L. Bell	0.5		A. L. Bell
3073	10						X			J. M. Little	2.0		A. L. Bell
3075	110	27	1					✓	✓	R. B. Barnes			
3078	130						/			R. B. Barnes	3.0		A. L. Bell
3088	131						—		✓	R. B. Barnes			A. L. Bell
3089	801	18							✓	R. B. Barnes			

DA FORM 2408-1, 1 JAN 64 — EQUIPMENT DAILY OR MONTHLY LOG (TM 38-750)

Figure 2. DA Form 2408-1, used as a daily log.

What are some indicators of problems?

- **Blocks 1 through 5 in the heading not filled out.** If the operator and chief of section are not aware of when the next PPMS and lubrication are due, how will they be able to plan the use and maintenance of this item efficiently? Perhaps the maintenance section has failed to schedule the item for a PPMS or lubrication? This is the type of information that the chief of section must be aware of.
- **Column a, "Date of Entry."** The Julian date only must be used. Information in this column provides some good cross-checks. Check to determine whether an entry on DA Form 2404 was completed for every day shown in column **a.** Then check to see whether there is an entry in column **a** of DA Form 2404 completed on the item. The lack of entries on DA Form 2404 for dates on which there are entries on the DA Form 2408-1 probably indicates that the chief of section is not taking his responsibility for the log book very seriously and is not insuring that **all** entries are made at the proper time.
- **Column b, "Reading Hours/miles."** The number of hours/miles recorded should increase from the top to the bottom of the form. Often they do not. If the readings do not increase, the operator is not paying much attention to his job, and the chief of section is paying even less attention to his.
- **Column c, "Total Fuel Added (Gal)."** A good check here is the quantity of fuel added on any date. If the amount of fuel added appears to be excessive, what became of the fuel? Consider a 1/4-ton truck. On 4364 the vehicle was operated for 60 miles and 20 gallons of fuel were added. Not even a bone-dry tank of a jeep would hold 20 gallons. Either this vehicle is using a preposterous quantity of fuel and should be checked immediately or expensive fuel is being diverted for unauthorized (and probably illegal) use. The technical manual for each fuel burning item gives a reasonable approximation of fuel consumption. Compare this to the daily entries.
- **Column d, "Oil Added (Qt)."** Information in column **d** is very much like that in column **c.** Again, something is very seriously wrong with the item or the lubricant is being diverted for unauthorized use.
- **Column e.** If the "Yes" column is checked, why? Examine the DA Form 2404 for the date in question. What faults were not corrected? Why weren't they corrected? Were they posted to the DA Form 2408-14? Why? What is being done to correct the faults? How long has it been since the uncorrected fault was reported? Has the equipment been operated with deadlining deficiencies? Why? Who is to blame? If the "No" column is always checked, be skeptical. Even in the best managed maintenance program not all faults will be corrected immediately. Apparently, the chief of section is letting the operator get by with "paper" maintenance. Examine the DA Forms 2404 on file, using the indicators covered previously for this form.
- **Column f.** Remember that this entry reflects the judgment or opinion of the equipment operator. Is his judgment valid? Check any DA Forms 2404 on file to determine if it is. No item of equipment can

possibly be operational 100 percent of the time. If the operator cannot validly determine whether the item is operational, what supervision has the chief of section exercised? Talk with the operator and section chief. Perhaps some intermediate commander has exerted pressure to show all items operational in an effort to make his materiel readiness report look good. False and inaccurate reporting is always a danger sign.

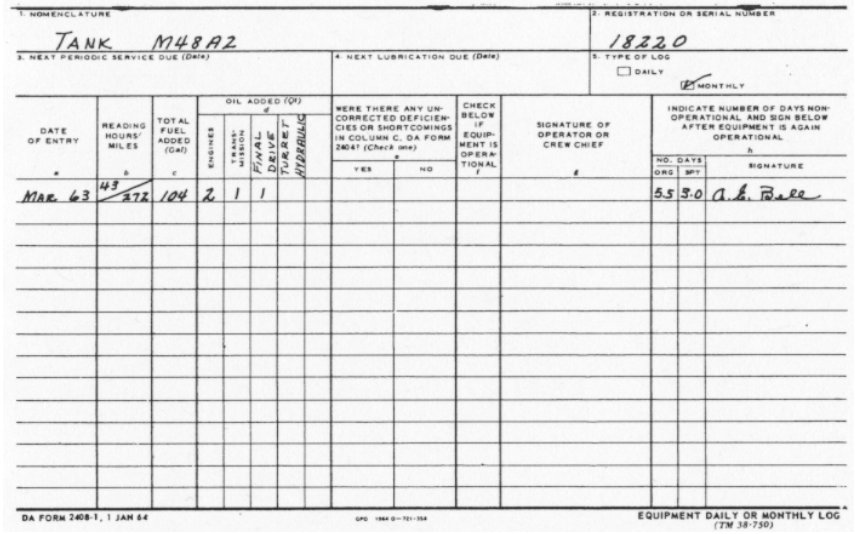
- **Column g.** Who is signing in this column, the chief of section or the operator or both? If it is the operator, is it the same operator each day? Within reason, it should be. The use of different operators for an item is one way to insure poor maintenance. If many different operators are shown, why? Perhaps the chief of section has a shortage of personnel or is overly committed with details. Some command assistance might be indicated. Is the chief of sections signature never shown or only very seldom? Why? It could be that he is not exercising much supervision.
- **Column h.** This is a crucial managerial control. The heading of column **h** is self explanatory. Look for an excessive number of days nonoperational and whether the item was in organizational or support shops. What took so long? The chief of section should know—ask him. If he doesn't know, he doesn't have much interest in his equipment. If column **f** shows days wherein the equipment was non-operational, there should be entries in column **h.** If the fault that made the equipment non-operational could have been corrected right away, it should have been shown operational. Why were no entries made in column **h** then? Probably because the chief of section failed to follow through, find out this data, and record it. Check the signature column. Who is signifying that the item is again operational? Is he in a position to know? Does he know what repairs were accomplished? If he doesn't know what repairs were accomplished, how does he know the item is really operational? Is he merely accepting somebody's word for it or does he know with certainty?

DA FORM 2408-1 AS A MONTHLY LOG

The DA Form 2408-1 is also used as a monthly log. It is differentiated as such by checking "monthly" in block 5. When used as a monthly log, 2408-1 merely displays a summary of data from one month of 2408-1's used as daily logs. This is no idle duplication of effort, because by summarizing large quantities of data, an entirely different picture can often be presented. Secondly, since the monthly is retained in the log book permanently (compared to 90 days for the daily), a useful maintenance history is developed.

Because the monthly 2408-1 is a **summary,** the column entries differ slightly. Columns **e, f,** and **g** are left blank. This information cannot be summarized.

Column **a** lists only the month, and obviously the Julian date cannot be used. Column **b** reflects the total miles or hours that the equipment was operated during the month.



1. NOMENCLATURE: TANK M48A2
2. REGISTRATION OR SERIAL NUMBER: 18220
3. NEXT PERIODIC SERVICE DUE (Date)
4. NEXT LUBRICATION DUE (Date)
5. TYPE OF LOG: ☐ DAILY ☑ MONTHLY

DATE OF ENTRY a	READING HOURS/ MILES b	TOTAL FUEL ADDED (Gal) c	OIL ADDED (Qt) d: ENGINES	TRANSMISSION	FINAL DRIVE	TURRET HYDRAULIC	WERE THERE ANY UNCORRECTED DEFICIENCIES OR SHORTCOMINGS IN COLUMN C, DA FORM 2404? (Check one) g: YES	NO	CHECK BELOW IF EQUIPMENT IS OPERATIONAL f	SIGNATURE OF OPERATOR OR CREW CHIEF e	INDICATE NUMBER OF DAYS NON-OPERATIONAL AND SIGN BELOW AFTER EQUIPMENT IS AGAIN OPERATIONAL h: NO. DAYS ORG	MPT	SIGNATURE
MAR 63	43 272	104	2	1	1						5.5	3.0	A. B. Bell

DA FORM 2408-1, 1 JAN 64 — EQUIPMENT DAILY OR MONTHLY LOG (TM 38-750)

Figure 3. DA FORM 2408-1, used as monthly log.

Column **c** shows the total fuel added during the month, and column **d** the total oil added. Column **h** should show the total days in the month that the equipment was non-operational, and further break it down into days in organizational and support maintenance. The signature should be that of the equipment operator or chief of section.

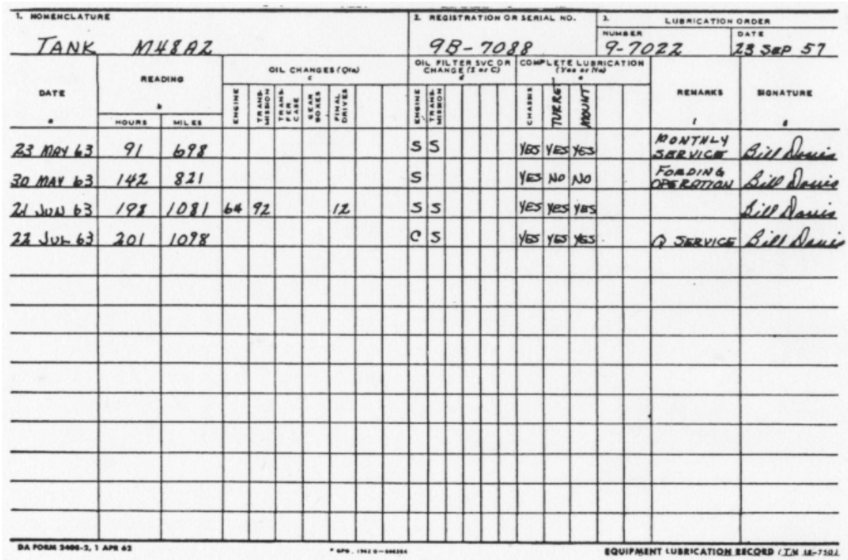
The supervisor's inspection indicators are essentially the same as those presented previously for the 2408-1 as a daily log, and will not be repeated here.

DA FORM 2408-2

Another form which reflects data from the immediate user is DA Form 2408-2, Equipment Lubrication Record (fig 4). The battery mechanic should supervise lubrication services and usually performs the service himself; however, the equipment operator or crew may perform the lubrication service if properly supervised. The fact that a mechanic provides technical supervision and assistance does not relieve the section chief of his supervisory responsibility in the chain of command. The piece of equipment is still assigned to the section chief.

As a management control, this form provides some excellent data. First, it serves as a means for determining whether required lubrication is being performed and whether it is being performed often enough or too often, which would waste valuable time and supplies. Depending on climatic conditions, the use of the equipment, terrain, etc., the commander may detect the need for more frequent lubrication (he cannot call for less frequent lubrication than specified by the lubrication order under any circumstances). Second, the supervisor can determine from this form if the lubrication is being performed. Third, the supervisor can

determine whether the right personnel are performing the lubrication, whether antifreeze has been added, where appropriate, etc.



1. NOMENCLATURE: TANK M48A2
2. REGISTRATION OR SERIAL NO.: 9B-7088
3. LUBRICATION ORDER — NUMBER: 9-7022 — DATE: 23 SEP 57

DATE a	READING b HOURS	READING b MILES	OIL CHANGES (Qts) c ENGINE	TRANSMISSION	TRANSFER CASE	GEAR BOXES	FINAL DRIVES	OIL FILTER SVC OR CHANGE (S or C) d ENGINE	TRANSMISSION	COMPLETE LUBRICATION (Yes or No) e CHASSIS	TURRET	MOUNT	REMARKS f	SIGNATURE g
23 MAY 63	91	698						S	S	YES	YES	YES	MONTHLY SERVICE	Bill Davis
30 MAY 63	142	821						S		YES	NO	NO	FORDING OPERATION	Bill Davis
21 JUN 63	198	1081	64	92			12	S	S	YES	YES	YES		Bill Davis
22 JUL 63	201	1098						C	S	YES	YES	YES	Q SERVICE	Bill Davis

DA FORM 2408-2, 1 APR 62 — EQUIPMENT LUBRICATION RECORD (TM 38-750)

Figure 4. DA Form 2408-2, Equipment Lubrication Record.

The suggested management technique for insuring proper lubrication is as follows:

The battalion motor officer should prepare a current listing of lubrication orders for each type of equipment in the organization. Lubrication orders change, but not often. The source for determining current lubrication orders is DA Pamphlet 310-4. Normally, this document is published semiannually, with changes between publishings. Since lubrication orders change infrequently, the motor officer can review his current listing as changes are published. Again, the current listings and the changes should be furnished each section chief for each item in his section that requires lubrication. Incidentally, the types of equipment requiring lubrication orders are truly incredible. Nevertheless, the proper use of the correct lubrication order is the heart of the problem.

The battalion SOP should specify that the lubrication of items requiring relatively complex lubrication, such as aircraft, vehicles, artillery pieces, certain missile equipment, and large generators, be performed by, or, at least, be **closely** supervised by a competent mechanic. Lubrication can be tricky business, and the operator who is not completely familiar with each component and fitting will seldom do a complete job. Of course, an aircraft pilot is an exception, but no one has to tell **him** to supervise maintenance of, his aircraft, even if he doesn't physically perform the maintenance. Items of a less complex nature, such as typewriters, and small arms, do not normally require such technical supervision.

Chain of command supervision, exercised by the chief of section, is a **must.** Mechanics are human, too, and may be inclined to take the "easy way out" unless someone is there to insist that a letter-perfect job be done. Furthermore, the section chief should coordinate with the battery motor sergeant as to when each item of section equipment is scheduled for a lubrication service to insure that the equipment is available when scheduled and to insure that the service is actually performed when scheduled or that the item is scheduled for a later date.

Platoon leaders should frequently spot check the supervision of the lubrication service (as well as its performance) and inspect the DA Forms 2408-2 at least monthly.

Battery and battalion commanders and staff officers should occasionally spot check the supervision and performance of lubrication services and spot check the DA Forms 2408-2 as often as time permits. Here are some indicators of trouble that a supervisor may find from the DA Form 2408-2:

Block 3, **"Lubrication Order, Number and Date."** Compare block 3 with block 1, "Nomenclature," to insure that the correct and current lubrication order is shown. If the lubrication order listed is the wrong one or is not current, your personnel **may** be lubricating by chance, not by order.

Columns a and b. The dates and miles/hours listed should agree with the intervals specified in the lubrication order for performance of the service. If services are being performed too soon (unless unusual circumstances, such as fording operations, intervene), time is being wasted. If services are being performed too late (excessively so, not just a few days or a few miles), the equipment is being improperly serviced.

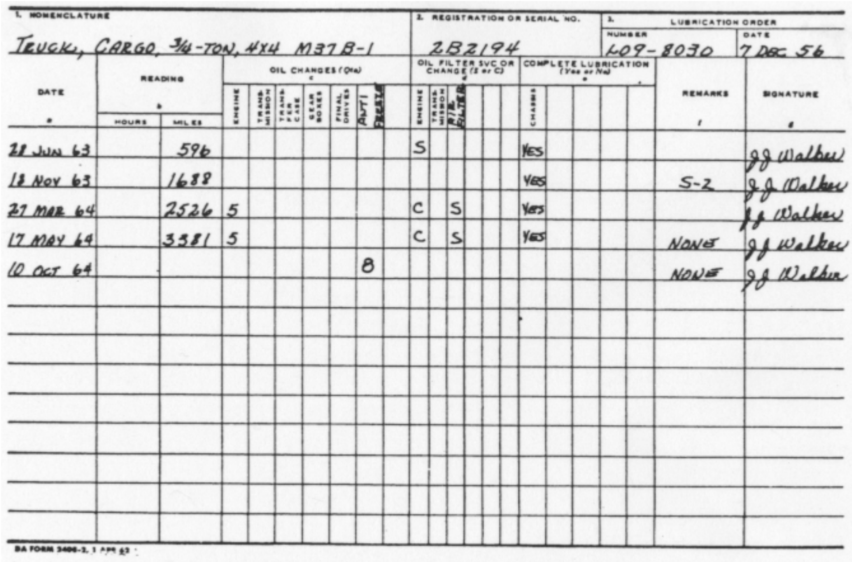
Column c.

1. Look for antifreeze entries. These entries are written on either of the two blank subcolumns provided. Antifreeze should be added on or before the prescribed date.
2. Check the number of quarts of oil changed, especially in the engine. If the amount shown fails to agree with the crankcase capacity shown in the TM, lubrication is not being performed correctly (or perhaps not at all).

Column d. Watch for too many "change" entries. Normally, filters will be serviced only.

Column f. Look for an explanation of any deviations from the lubrication order. Such remarks as "fording" could satisfactorily explain what would appear to be too frequent performance of a lubrication service.

Column g. Check the signature; it should be that of the person who physically performed the service. Normally, the mechanic should sign here as a control. A chief of section's signature once in a while may be a good indication. If the only signatures are those of the operator, it may mean trouble. There is no guarantee that a mechanic did the work or even supervised it.



1. NOMENCLATURE	2. REGISTRATION OR SERIAL NO.	3. LUBRICATION ORDER NUMBER	DATE
TRUCK, CARGO, 3/4-TON, 4X4 M37B-1	2B2194	LO9-8030	7 DEC 56

DATE a	READING b HOURS	READING b MILES	OIL CHANGES (Qts) c ENGINE	TRANSMISSION	TRANSFER CASE	GEAR BOXES	FINAL DRIVES	ANTI FREEZE	OIL FILTER SVC OR CHANGE (S or C) d ENGINE	TRANSMISSION	AIR FILTER	COMPLETE LUBRICATION (Yes or No) e CHASSIS	REMARKS f	SIGNATURE g
28 JUN 63		596							S			YES		J J Walker
18 NOV 63		1688										YES	S-2	J J Walker
27 MAR 64		2526	5						C		S	YES		J J Walker
17 MAY 64		3381	5						C		S	YES	NONE	J J Walker
10 OCT 64								8					NONE	J J Walker

DA FORM 2408-2, 1 APR 63

Figure 5. DA Form 2408-2 with errors.

Figure 5 is a reproduction of an actual DA Form 2408-2 from the log book of a vehicle in a tactical unit. What can you find wrong with it?

REPRESENTATIVE ERRORS

Heading. The lubrication order shown is dated 1956. On the surface, it appears pretty old. It bears looking into. As a matter of fact, LO 9-2320-212-12 dated 7 December 1962 is the current lubrication order for this vehicle. Research could not locate the lubrication order listed in the heading.

Column c. Notice the 1963 entries. Apparently no antifreeze was used that winter.

Column d. The engine oil filter is shown as "changed" on 27 March 1964. This is reasonable. It is again shown as "changed" on 17 May 1964, less than two months later. In the absence of any remark to explain this, this appears to be very poor supply utilization. If the filter installed 27 March was defective, this should be explained under remarks, column f.

Column f.

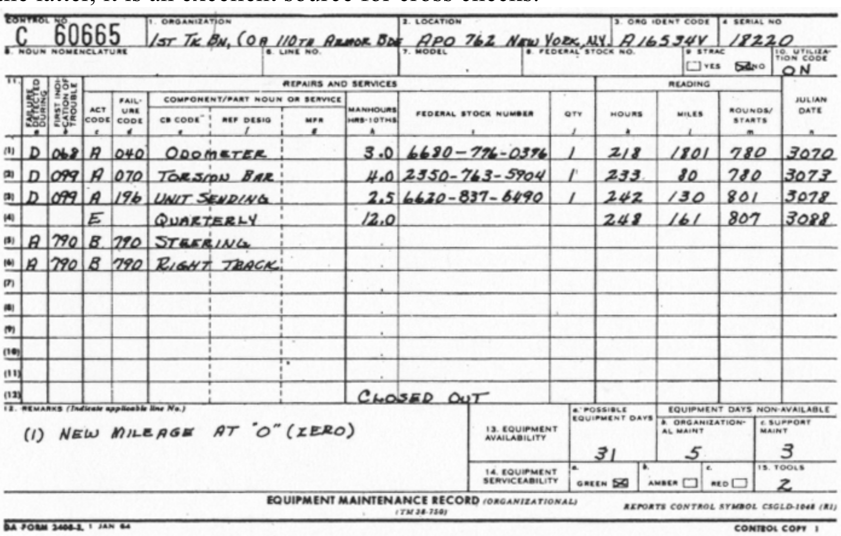
a. See column **d** above.

b. The remark on line 2 is strange. What does the entry "S2" explain? The DA Form 2408-2 is a semi-permanent insert, and the data is displays must be meaningful to unit personnel. As a good rule of thumb, a "remark" must be intelligible to a stranger (or inspector) or it is worthless. Apparently, the person who made this entry understood what he meant, but the remark was made in November 1963. In all probability he has left the unit.

Column g. All signatures are those of the operator. In view of the erroneous lubrication order shown in the heading, there is good reason to doubt whether the lubrication service was supervised or even performed.

DA FORM 2408-3

DA Form 2408-3, Equipment Maintenance Record (Organizational), gets to the heart of the battery and battalion maintenance controls. This is used to record data of maintenance significance (including supply) from the standpoint of organizational mechanics not to record anything involving direct support or higher categories; the DA Form 2408-6, Equipment Maintenance Record (Support Echelons), is used for that purpose. Figure 6 is a blank DA Form 2408-3. As a management control tool or control device, this is one of the more critical forms. Not only is the work of organizational mechanics laid bare to the commander's scrutiny, but this form is forwarded quarterly to the National Maintenance Point for its records and use. In addition, it reports the readiness color category of each item of equipment every quarter. Especially in view of the latter, it is an excellent source for cross checks.



CONTROL NO. C 60665 | 1. ORGANIZATION: 1ST TK BN, (OA 110TH ARMOR BDE | 2. LOCATION: APO 762 NEW YORK, N.Y. | 3. ORG IDENT CODE: A16534V | 4. SERIAL NO: 18220

5. NOUN NOMENCLATURE | 6. LINE NO. | 7. MODEL | 8. FEDERAL STOCK NO. | 9. STRAC: YES [ ] NO [X] | 10. UTILIZATION CODE: ON

11. REPAIRS AND SERVICES / READING

Line	Failure detected during (a)	First indication of trouble (b)	Act code (c)	Failure code (d)	Component/part noun or service: CB code (e) / Ref desig (f) / MFR (g)	Manhours hrs-10ths (h)	Federal stock number (i)	Qty (j)	Hours (k)	Miles (l)	Rounds/Starts (m)	Julian date (n)
(1)	D	068	A	040	ODOMETER	3.0	6680-776-0376	1	218	1801	780	3070
(2)	D	099	A	070	TORSION BAR	4.0	2350-763-5904	1	233	80	780	3073
(3)	D	099	A	196	UNIT SENDING	2.5	6620-837-6490	1	242	130	801	3078
(4)			E		QUARTERLY	12.0			248	161	807	3088
(5)	A	790	B	790	STEERING							
(6)	A	790	B	790	RIGHT TRACK							
(7)												
(8)												
(9)												
(10)												
(11)												
(12)						CLOSED OUT						

12. REMARKS (Indicate applicable line No.)
(1) NEW MILEAGE AT "O" (ZERO)

13. EQUIPMENT AVAILABILITY: a. POSSIBLE EQUIPMENT DAYS 31 | EQUIPMENT DAYS NON-AVAILABLE: b. ORGANIZATIONAL MAINT 5 | c. SUPPORT MAINT 3

14. EQUIPMENT SERVICEABILITY: a. GREEN [X] | b. AMBER [ ] | c. RED [ ] | 15. TOOLS 2

EQUIPMENT MAINTENANCE RECORD (ORGANIZATIONAL) (TM 38-750) — REPORTS CONTROL SYMBOL CSGLD-1048 (R1)

DA FORM 2408-3, 1 JAN 64 — CONTROL COPY 1

Figure 6. DA Form 2408-3, Equipment Maintenance Record.

From the standpoint of management technique, there are two basic considerations involved in the use of this form—first, the physical entries, the facts and figures **actually** recorded, and second, the control that insures entries **are** being made when required.

In the first instance, entries should be made by the organizational mechanic concerned, although the motor sergeant might make them. Notice that there is no place on this form for either signatures or initials.

Even though the mechanic makes the entries, the assistance of the equipment operator can be vital. Operator assistance may be verbal or, it is hoped, formalized on DA Form 2404. Operator assistance is recorded in columns **a** and **b.** Note that the actual entry here is a code which must be taken from the reverse side of this form. The normal source of detected failure codes A, B, D, and F is the equipment operator or chief of section. In every instance this failure should have been reported on a DA Form 2404. This is especially true of the first indication trouble codes 068, 360, 387, 432, 258, and 007. As a rule, the physical entries themselves usually do not present too much of a management problem, since only a mechanic would normally be qualified to make them.

The second aspect, that of insuring that the entries are made, is the one that can present difficulties. The motor officer, motor sergeant, and section chief must all exercise close supervision. Good management practice dictates that any time a mechanic makes a repair or performs a service, the motor officer or motor sergeant should inspect the work before the "product" is pronounced finished. Along with the inspection of work performed should be an inspection of the DA Form 2408-3. Nevertheless, there is, as usual, plenty of margin for human error here. This is why supervision by the chief of section is so vital. The equipment is **his** immediate responsibility; therefore, when it is returned, he too should examine the DA Form 2408-3 to insure that the entries which have been made agree with the facts. He need not be a mechanic to do this in every instance. For example, he should be able to tell whether a tire, or any other major item, was replaced or merely repaired.

Neither must the busy commander be a mechanic to be able to check this form and use it as a control tool. His "indicators" are—

- **Column a.** Check the codes used. Where the code D (failed during normal operation) is conspicuously absent, it probably indicates that the operator and chief of section are lax in reporting faults on the DA Form 2404.

- **Column c.** Check the codes used. If A (replaced) appears too frequently, be suspicious of improper supervision or training of your mechanics. It can indicate that the issued test and diagnostic equipment is not being used and that as a matter of routine expensive parts are being replaced instead of repaired after proper troubleshooting procedures.

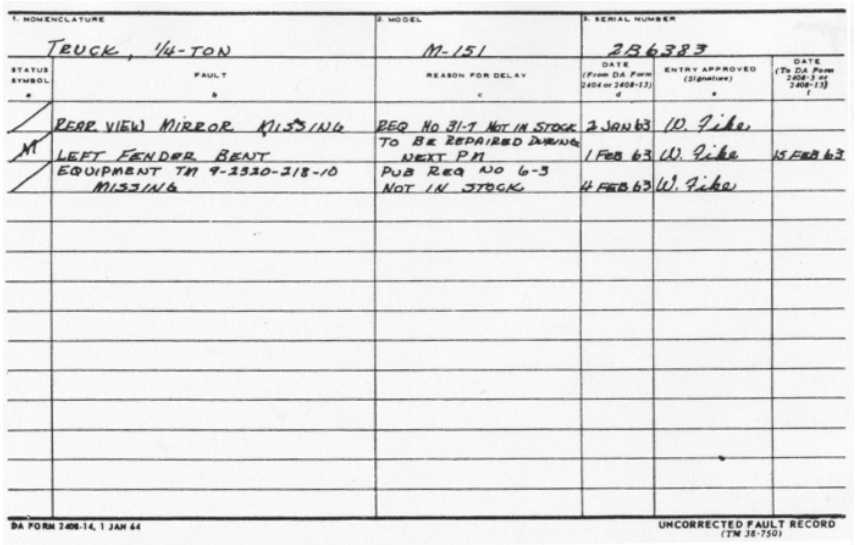
- **Column d.** Be sure that the correct codes are used. Examine the failure code portion of figure 6. Note that it is fairly easy to read the wrong column.

- **Columns e through g.** Examine the parts used. Be wary of too frequent replacement of a part or certain parts. This indicates vehicle abuse or poor practices by the mechanics.

- **Column h.** The time spent to complete a job should be realistic. For example, a PPMS is performed on a M109 self-propelled howitzer. Three man-hours are shown. This should raise an immediate question in the supervisor's mind. Conversely, if 5 hours is shown for replacement of two tires on a 1/4-ton truck, it would be obviously excessive.
- **Columns i through n.** These are for technical data, and while this data should be checked, it requires "digging" and research, such as referencing Federal stock numbers. A battalion commander can seldom spare the time for such complete inspection; he should periodically have the battalion S4 make a spot check in this area.
- **Block 13, a, b, and c.** On the DA Form 2408-3, block **a** reflects the number of days in the quarter. The nonavailable days shown in **b** and **c** should be cross checked with the DA Form 2408-1.
- **Block 14.** The color category reported here should be correct (as of the last day of the quarter). Cross check this entry with the DA Form 2408-5 for nonapplied MWO's and the DA Form 2408-1 for operational status. If the form 2404 for the last ESC evaluation is available, check the color status reported with this document. If an item is reported RED, the reason should be indicated, especially if the category is no fault of the unit; i.e., accumulation of low point values due to pure overage, a support maintenance unit not applying an urgent MWO, etc. This, then, provides excellent feeder information for the remarks portion of the quarterly materiel readiness report. The point is that if a piece of equipment is RED, someone should care enough about the situation to know "why." No illustration is provided of an actual form with entries because the type of data differs too radically from type unit to type unit and from item to item.

DA FORM 2408-14

One of the log book inserts most useful as a tool for management control is the Uncorrected Fault Record, DA Form 2408-14 (fig 7). Its usefulness is twofold—first, it facilitates more effective scheduling of certain repairs, thereby balancing the workload and making the best possible use of time and of maintenance personnel; second, because of the variety of management aspects it normally encompasses, it can provide the commander with an unusual variety of control information. When a shortcoming is discovered, it usually should be corrected as soon as possible. Yet this normal procedure often may be impractical; for example, the unit maintenance section may have more critical equipment faults to correct at the time, the date for periodic preventive maintenance services (PPMS) may be approaching, repair parts may be unavailable, etc. The uncorrected fault record permits the unit to record shortcomings (never deficiencies), keep track of them, and correct them when it is practical to do so. Usually the shortcomings would be corrected during the next scheduled PPMS.



1. NOMENCLATURE: TRUCK, 1/4-TON | 2. MODEL: M-151 | 3. SERIAL NUMBER: 286383

STATUS SYMBOL a	FAULT b	REASON FOR DELAY c	DATE (From DA Form 2404 or 2408-13) d	ENTRY APPROVED (Signature) e	DATE (To DA Form 2408-3 or 2408-13) f
	REAR VIEW MIRROR MISSING	REQ NO 31-7 NOT IN STOCK	2 JAN 63	W. Pike	
M	LEFT FENDER BENT	TO BE REPAIRED DURING NEXT PM	1 FEB 63	W. Pike	15 FEB 63
	EQUIPMENT TM 9-2320-218-10 MISSING	PUB REQ NO 6-3 NOT IN STOCK	4 FEB 63	W. Pike	

DA FORM 2408-14, 1 JAN 64 — UNCORRECTED FAULT RECORD (TM 38-750)

Figure 7. DA Form 2408-14, Uncorrected Fault Record.

CAUTIONS IN USING DA FORM 2408-14

This is a logical, practical, and desirable system. Unfortunately, it is to often used as a crutch for poor maintenance by permitting needed repairs to be put off unnecessarily and for excessively long periods of time. To illustrate, on 7 January, a vehicle operator notes that his windshield wiper blades need to be replaced. The next PPMS is due on 10 June. Since these blades are a part of the prescribed unit load, they should be on hand and readily available. The operator himself can install the replacement blades so none of the battery mechanic's valuable time is required. Under the circumstances it would be poor management to list this fault on DA Form 2408-14 and let it go uncorrected until 10 June. To do so could also create a safety hazard. About the only justifiable excuse for not replacing the blades immediately would be their nonavailability, and this would certainly indicate something seriously amiss in the unit repair parts system. Another flaw in the "wait until the PPMS" approach is that the correction of many shortcomings and the implementation of suggested improvements can thus be postponed for each item. The battalion maintenance section has a full-time job performing the required PPMSs, and the simultaneous addition of many of these "delayed" repairs could result in a workload beyond the capability of the maintenance section. As a general rule, sound maintenance management suggests correction of all shortcomings as soon as they are detected, provided parts are available—and parts should be available unless someone is failing to do his job! Suggested improvements, such as repairing dented fenders, and certain shortcomings, such as welding work, are handled more efficiently during a PPMS.

CORRECTION OF FAULTS

What management techniques can be used to keep the correction of equipment faults up to date and yet insure the most effective use of time and personnel? The following procedures are suggested:

Each time a DA Form 2404, (Equipment Inspection and Maintenance Worksheet), is filled out on an item of equipment, the chief of section should supervise whatever corrective action can be taken on the spot by the operator or crew.

For repairs beyond the capability of the section (as defined by the maintenance allocation chart), the chief of section should coordinate with the battery motor sergeant. Considering the nature of the shortcoming or suggested improvement (correction of deficiencies cannot be postponed by entering deficiencies on the DA Form 2408-14) and the time, parts, and personnel available, the motor sergeant may direct that some or all faults be entered on the DA Form 2408-14 for correction at the most appropriate time. On this point, the advice of the chief of section is vital because the most suitable time for the maintenance section may not be the most suitable time for the other section concerned.

The chief of section, who has the immediate supervisory responsibility for the equipment, should take followup action on all faults entered on DA Form 2408-14. If a repair is scheduled for a certain date he should insure that his equipment is made available for repair on that date. If parts are on requisition and are not available after a reasonable time, he should coordinate with the battalion repair parts clerk through the battery motor sergeant to initiate followup action- on the requisition. If the chief of section is not satisfied with the progress of the corrective action, he should inform his battery commander through the chain of command. The section chief should never attempt to foist this responsibility, which is his, on the motor sergeant!

Officers and NCOs at platoon level and higher frequently examine the DA Forms 2408-14 of each item for which they are responsible. Unsatisfactory conditions should be called to the attention of the immediate supervisor responsible for the item, and whatever command assistance may be indicated should be rendered. Bottlenecks should be reported immediately to the battery commander for his personal attention.

Any problems concerning the need for corrective action beyond the capability of the battery are immediately referred to the appropriate battalion staff officer or to the battalion commander for further action.

The battalion commander should periodically spot check the DA Forms 2408-14 for possible errors. Some of the more common indicators of trouble or problem areas which may be detected by such checks are—

1. The symbol X in column **a.** This indicates a deficiency, and a deficiency should never be entered on the uncorrected fault record. Some supervisor is allowing the operation of an item of equipment which should be deadlined.

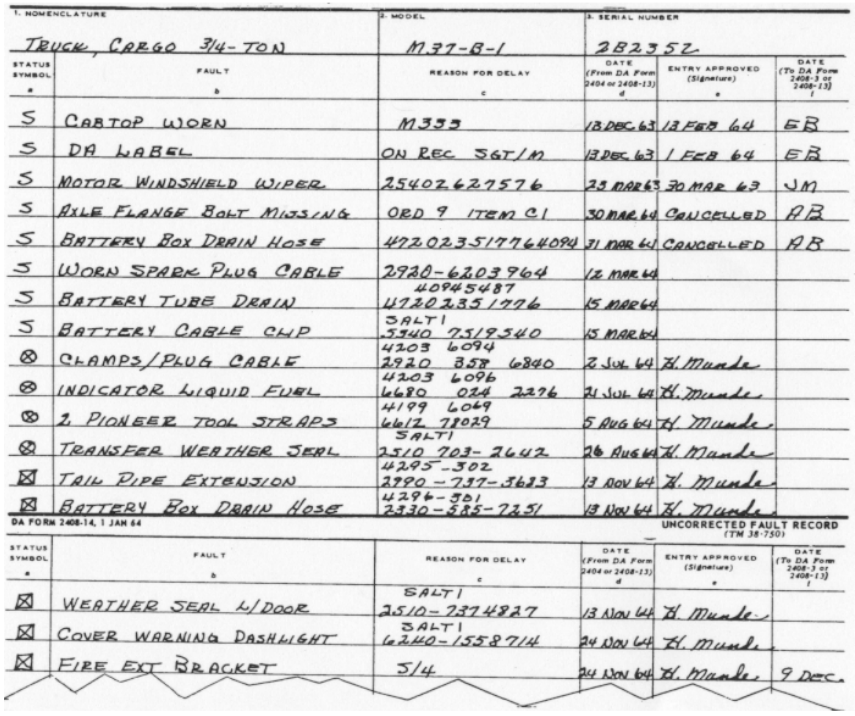
2. An excessive number of faults listed in column **b.** This indicates that needed repairs are being "put off." It could also indicate

that an item of equipment is deteriorating. Some supervisor is neglecting his maintenance responsibilities.

3. Entries in column **c** indicating that the reason for delay is that the part is not in stock. This could mean that there is something wrong with the unit supply procedure.

4. An excessive lapse of time between the dates in columns **d** and **f.** The time between the detection and the correction of a fault should not be excessive.

5. An unauthorized signature in column **e.** The signature in this column should be that of a responsible individual, such as the battery motor sergeant; the equipment operator is not authorized to initial this column. Entries approved by an authorized individual are indicative of either active or passive abrogation of supervisory responsibility, a condition which deserved prompt command attention.



1. NOMENCLATURE: TRUCK, CARGO 3/4-TON | 2. MODEL: M37-B-1 | 3. SERIAL NUMBER: 282352

STATUS SYMBOL a	FAULT b	REASON FOR DELAY c	DATE (From DA Form 2404 or 2408-13) d	ENTRY APPROVED (Signature) e	DATE (To DA Form 2408-3 or 2408-13) f
S	CABTOP WORN	M333	13 DEC 63	13 FEB 64	EB
S	DA LABEL	ON REC 56T/M	13 DEC 63	1 FEB 64	EB
S	MOTOR WINDSHIELD WIPER	25402627576	23 MAR 63	30 MAR 63	JM
S	AXLE FLANGE BOLT MISSING	ORD 9 ITEM C1	30 MAR 64	CANCELLED	AB
S	BATTERY BOX DRAIN HOSE	4720235177640940	31 MAR 64	CANCELLED	AB
S	WORN SPARK PLUG CABLE	2920-6203964	12 MAR 64		
S	BATTERY TUBE DRAIN	40945487 4720235/7776	15 MAR 64		
S	BATTERY CABLE CLIP	SALT I 5340 751/9340	15 MAR 64		
⊗	CLAMPS/PLUG CABLE	4203 6094 2920 858 6840	2 JUL 64	H. Munde	
⊗	INDICATOR LIQUID FUEL	4203 6096 6680 024 2276	21 JUL 64	H. Munde	
⊗	2 PIONEER TOOL STRAPS	4199 6049 6612 78029	5 AUG 64	H. Munde	
⊗	TRANSFER WEATHER SEAL	SALT I 2510 703-2642	26 AUG 64	H. Munde	
☒	TAIL PIPE EXTENSION	4295-302 2990-737-3633	13 NOV 64	H. Munde	
☒	BATTERY BOX DRAIN HOSE	4296-901 2330-385-7251	13 NOV 64	H. Munde	

DA FORM 2408-14, 1 JAN 64 — UNCORRECTED FAULT RECORD (TM 38-750)

STATUS SYMBOL a	FAULT b	REASON FOR DELAY c	DATE (From DA Form 2404 or 2408-13) d	ENTRY APPROVED (Signature) e	DATE (To DA Form 2408-3 or 2408-13) f
☒	WEATHER SEAL L/DOOR	SALT I 2510-7374827	13 NOV 64	H. Munde	
☒	COVER WARNING DASHLIGHT	SALT I 6240-1558714	24 NOV 64	H. Munde	
☒	FIRE EXT BRACKET	5/4	24 NOV 64	H. Munde	9 DEC.

Figure 8. DA Form 2408-14 with errors. Front (top). Rear (bottom).

Figure 8 is an exact reproduction of an actual DA Form 2408-14 from a vehicle in a tactical unit. Only the unit designation has been concealed to avoid embarrassment. What can you find wrong with it?

REPRESENTATIVE ERRORS

Under column **a, Status Symbol—**

The entry "S" is made eight times. This symbol is for "service" and is used to indicate flying missions for purposes other than training

or combat, such as administrative or courier service. It is a symbol used ONLY in maintenance records of Army aircraft to indicate a type of FLYING mission and is definitely inappropriate on this form.

The symbol ☒ is used in five instances. This is not an authorized symbol.

The symbol ⊗, meaning "shortcoming," is correctly used in four instances between the incorrect entries described in 1 and 2 above. It appears that supervisory personnel have not properly trained the persons making the entries. At one time someone knew the correct status symbol entries.

Under column **b, Fault—**

In line 4 on the front side of figure 5, the fault is shown as "axle flange bolts missing." This condition is a deficiency and deficiencies should never be shown on this form. Such an entry indicates that mechanics have not been trained in the proper use of the form.

The last entry is "Fire ext bracket." Assuming that this vehicle is required to have a fire extinguisher, then this fault is actually a deficiency and therefore should never have been entered on this form. Again, it is evident that the mechanics have not been trained in the use of the form.

The entry "Battery box drain hose" is made on lines 5 and 14 on the front side of the DA Form 2408-14. The item was requisitioned on 31 March and was cancelled. No further action was taken until 13 November, 6 1/2 months later. As of 23 December, (the date the vehicle was inspected and log book data extracted), after a period of almost 9 months, there still is no entry to indicate that the item was ever obtained. This indicates a lack of coordination between the maintenance section and the S4 in initiating followup action on outstanding requisitions.

On line 6, the entry indicates a "Worn spark plug cable. If this cable had been worn badly enough to require replacement, it would have been a deficiency. Note that it was discovered on 12 March. This is a direct exchange item; yet, as of 23 December, it had not been procured. Since the vehicle was operational all that time, it is apparent that the cable did not need replacement. This entry indicates that mechanics are not following the IROAN technique.

Under column **c, Reason for Delay—**

On line 4, the entry is "ORD 9 item, CI." Battalions cannot requisition ORD 9 items; it is no wonder that this request was cancelled. However, notice that here is a **deficiency** which apparently has remained uncorrected since 30 March, a period of nine months! No further action to correct this deficiency is shown on the form. Battalion supply is obviously making serious blunders if they are requisitioning unauthorized items. Furthermore, the battery motor officer is either ignorant of supply and maintenance procedures or negligent in inspecting log books. He should have seen this ORD 9 item on requisition and should have submitted a job order for this repair to his direct support unit, which is authorized to requisition ORD 9 items.

There are errors on lines 5 and 7. On line 5 the requisition number is improperly written; the numbers should not be run together. From the requisition numbers on lines 5 and 7, it is apparent that the entries shown under column **b** on line 5 (Battery box drain hose) and line 7 (Battery tube drain) refer to the same item. Now note the last entry on the front of the form; the same item was requisitioned again! Why? On line 7 there is no indication that the item was received; neither is there any reason given to indicate that it was not received. These entries indicate that the mechanics either are not trained in the use of this form or are attempting to "snow" someone.

The last entry, "S/4," on the reverse side of the form is completely meaningless. If the item **is** on requisition or work order, there is a document number and that number should be shown for control purposes. Again, it is apparent that personnel are untrained in the use of this form.

Under column **e. Entry Approved (Signature)—**

A signature is required, for each entry, as clearly indicated by the self-explanatory column heading. The first three entries under this column are dates (of what?), the next two entries are remarks, and the next three lines are blank. Beginning with the entry on line 9, dated July 1964, correct entries have been made under column **e.** Note that correct entries under column **a** also begin with the entry dated 2 July. This seems to indicate that personnel were eventually given some training in the use of this form.

Lines 5, 6, 7, were not approved for entry. The supervision of log books and training of maintenance personnel in their use resulted in some improvement in the entries made on this form subsequent to 2 July 1964. Additional improvement is needed.

Under column **f, Date—**

The entries in lines 1 through 5 are initials, not dates as required. This is a very obvious error. In lines 6 through 16 there are no entries under column **f.** This indicates that none of the faults listed on these lines were ever corrected. On line 17 there is a date shown under column **f,** indicating correction of the last fault; however, when a fault is corrected, the date should be shown in column **f and** the initials of the person correcting the fault should be shown in column **a.** Therefore, it is doubtful that this last fault was corrected. It is possible that all the faults listed on this DA Form 2408-14 have been corrected, but management would be unable to determine that from the information reflected on this control form.

It is apparent from the entries made on this form that supervisory personnel either are untrained in the use of the log book or are failing to take appropriate followup action to insure that faults are corrected and the proper entries are made on the DA Form 2408-14. In any case, responsible maintenance personnel definitely are inadequately trained in the use of the log book.

FORK REGISTRATION
A New Method for Precision Fire

Major E. R. Alford and Captain E. H. Weiler
Gunnery Department

Incorporating the best features of the present delivery systems for initial Fuze Quick registrations, subsequent lot registrations and time registrations, the Gunnery Department, USAAMS, has devised a "Fork Method" for precision fire. The Fork Method will be incorporated in Change 3 to FM 6-40 as a revised Chapter 18, Conduct of Registrations.

Using this method, it is necessary to learn only one set of rules which are applicable to all types of precision fire; it solves the problems introduced by the advent of new weapons with their small probable errors; it eliminates the possibility of a "6 and 0" registration, thus saving ammunition; and this method also increases the chances for a "4 and 2" or "3 and 3" registration, thus increasing the accuracy of computational procedures. This method also is applicable to destruction missions.

The adjustment phase of precision fire is conducted in the present accepted manner.

FIRE FOR EFFECT PHASE

Fire for effect is begun after the adjustment phase ends (when the forward observer requests fire for effect). As soon as a positive FDC range sensing is obtained (a positive FDC sensing is an OVER or a SHORT), the QE is changed one even fork in the appropriate direction. If the value of the fork is an odd number, it is increased to the next higher even value to facilitate splitting. This procedure is continued until a 1-fork bracket is established. The 1-fork bracket is split and positive FDC range sensings are obtained from three rounds. After the preponderance has been determined, the QE is changed 1/2 fork in the direction opposite the preponderance. Fire for effect is continued until positive FDC range sensings are obtained from two more rounds, for a total of six. The adjusted elevation is computed.

SITUATIONS GOVERNING TARGET HITS

Target hits may be classified into 2 cases:

- **CASE I** (fig 1). When a target hit occurs during the adjustment phase, it becomes the first round in fire for effect. In this case, or if a target hit is obtained at one end of the fork bracket, positive FDC range sensings from two additional rounds are obtained at the same QE. If a preponderance exists, move 1/2 fork opposite the preponderance and obtain positive FDC sensings from three rounds. If a preponderance does not exist, obtain positive FDC range sensings from three rounds at the same QE.

FORK -- 7 (USE 8)

QE	FDC RANGE SENSING
348	+
340	T (+, –)
340	+
340	+ (Preponderance is +)
336	–
336	–
336	+

QE	FDC RANGE SENSING
348	+
340	T (+, –)
340	+
340	– (No Preponderance)
340	T (+, –)
340	+
340	–

QE	FDC RANGE SENSING
348	+
340	–
344	+
344	+
344	T (+, –)
	(Preponderance is +)
340	–
340	–

QE	FDC RANGE SENSING
348	+
340	–
344	+
344	–
344	T (+, –)
	(No Preponderance)
344	+
344	–
344	+

Figure 1. Examples of Case I. **Figure 2. Examples of Case II.**

- **CASE II** (fig 2). When a target hit occurs, after the fork bracket has been established, firing is continued at the same QE until positive FDC range sensings are obtained from three rounds (including the target hit). If a preponderance exists, move 1/2 fork opposite the preponderance and obtain sensings from two rounds. If a preponderance does not exist, obtain positive FDC range sensings from three more rounds at the same quadrant elevation. The adjusted QE is computed in the normal manner

RULES FOR INITIAL REGISTRATION (IMPACT FUZE)

1. The first round in FFE is fired after the adjustment phase ends (when forward observer requests fire for effect).
2. A bracket is established by moving one full even fork in the oppropriate direction until an FDC sensing for range in the opposite sense is obtained.
3. Split the bracket and obtain positive FDC range sensings from three rounds.
4. If a preponderance exists, move 1/2 fork away and obtain FDC range sensings from two more rounds.
5. Compute the adjusted QE using the formulas:

$$\text{Adj QE} = \text{Mean QE fired} \pm \text{E1 change}$$

$$\text{E1 change} = \frac{\text{Preponderance} \times \text{Fork}}{2 \times \text{Number of rounds considered}}$$

RULES FOR TIME REGISTRATION

1. The first round is fired at the adjusted quadrant elevation with a time corresponding to the adjusted elevation (plus any known fuze correction).
2. Establish a bracket by moving 0.4 in the appropriate direction until a burst in the opposite sense is obtained (Add if air; subtract if graze).
3. Move 0.2 to center of the bracket and obtain 3 sensings.
4. Move 0.2 away from the preponderance and obtain 2 more sensings (add if preponderance is air; subtract if graze)—compute the adjusted time.

RULES FOR REGISTRATION WITH SECOND OR SUBSEQUENT LOT

1. The first round is fired at the adjusted QE of the first lot.
2. Follow rules 2, 3, 4, and 5 for initial registrations.

STATUS OF TRAINING LITERATURE & FILMS

1. The following training literature is under preparation or revision by the U.S. Army Artillery and Missile School or the U.S. Army Combat Developments Command Artillery Agency:

A. FIELD MANUALS (FM):

FM 6-3-2	Operations of Gun Direction Computer M18 (FADAC), Free Rocket Application.
FM 6-160	Radar Set, AN/MPQ-10A.

B. ARMY SUBJECT SCHEDULES (ASUBJSCD):

ASubjScd 613A	MOS Technical Training and Refresher Training of MOS 13A10, Field Artillery Basic.
ASubjScd 6-15E10	MOS Technical Training and Refresher Training of Field Artillery Missile Crewman, Pershing, MOS 15E10.

C. ARMY TRAINING TESTS (ATT):

ATT 6-358	Field Artillery Battery, Gun or Howitzer, Heavy, Towed or Self Propelled.
ATT 6-615	Field Artillery Battalion, Pershing.

2. Training literature submitted for publication:

FM 6-2	Artillery Survey.
FM 6-3-2A(S)	Gun Direction Computer, M18 Cannon Application with Nuclear Ammunition.
FM 6-15	Field Artillery Meteorology.
FM 6-20-1	Field Artillery Tactics.
FM 6-39	Field Artillery Battalion, Pershing.
FM 6-60	Field Artillery Rocket, Honest John with Launcher M289.
FM 6-115	Field Artillery Searchlight Battery.
FM 6-141-2	Doctrine for Effective Use of Nonnuclear Artillery Weapons, Part II.
FM 6-161	Radar Set, AN/MPQ-4A.
ASubjScd 6-13A1N	MOS Technical Training and Refresher Training of MOS 13A1N Nuclear Weapons Assemblies.
ATP 6-302	Field Artillery Missile Units, Honest John and Little John Rocket.
ATP 6-555	Field Artillery Battalion, Sergeant.
ATP 6-615	Field Artillery Battalion, Pershing.

3. The following training films are currently under production and scheduled for release during calendar year 1966:

Communication Systems of the Direct Support Artillery Battalion.
Pershing Missile Assembly—Mounted.
Fire Support Coordination for the Infantry Division.
Operation of the Gun Direction Computer, M18.
Radiotelephone Procedure for Conduct of Artillery Fire.
Field Artillery Ammunition and Fuzes.
On-Carriage Fire Control Equipment.

L 1136 ARMY-FT, SILL, OKLA