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Training Effectiveness Analysis: Status of Institutional and Unit Mortar Training

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Unit mortar training

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Institutional and Unit Mortar training programs existing in 1982-1983 were observed to identify problems and deficiencies and to provide recommended improvements. An extensive analysis of Institutional Program of Instructions, Unit training programs, Army Training and Evaluation programs, and live-fire exercise was performed. Major problems identified were: (1) no selection criteria for soldiers who are being trained as 11C mortarmen, (2) no institutional training for Skill Level 2. FDC computer tasks, (3) no training or extensive use of the hand-held fire direction calculator, (Continued)

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(4) duplication of fire control plotting and computational procedures, (5) inadequate training for Mean Point of Impact (MPI) registration mission, (6) benefits of using meteorological (MET) messages and data not supported by resource expense, (7) units conduct less than one day of productive mortar training per week, and (8) lack of integrated training between Artillery Fire Support Teams (FIST) and the supported Infantry mortar units. Keywords include:

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Education and Training

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Throughout its history the mortar has been a critical support weapon for the infantry. Its use has enabled heavier fire to be placed upon enemy targets than that which would be afforded solely by the traditional small-arms of the infantryman. Design improvements have been made frequently to meet specific mission needs for mortars in battle; however, mortar training in the U.S. Army, like that for other weapon systems, presently suffers from resource restrictions making it critical to identify the most efficient and effective training procedures possible. In support of the U.S. Army Infantry School (USAIS), the U.S. Army Research Institute (ARI) has initiated a training effectiveness analysis for this weapon system. One of the purposes of the ARI research is to identify both short and long range possible improvements in current mortar training.

EDGAR M. JOHNSON
Technical Director

TRAINING EFFECTIVENESS ANALYSIS:
STATUS OF INSTITUTIONAL AND UNIT MORTAR TRAINING

EXECUTIVE SUMMARY

Requirement:

U.S. Army Training and Doctrine Command (TRADOC) studies indicate that for many Army weapons systems, training does not optimize total system effectiveness. Accordingly, the U.S. Army Infantry School (USAIS) has initiated research to improve the training effectiveness of mortar courses, procedures, and training materials. In support of the USAIS, the U.S. Army Research Institute (ARI) has initiated a training effectiveness analysis for this weapon system. One of the purposes of the ARI research is to identify both short and long range possible improvements in current mortar training. This research involves the assessment of problem areas, identification of needed improvements, and the development of cost effective alternatives for related mortar training.

Procedure:

A necessary prerequisite for accomplishing this research was the documentation and analysis of the current institutional and unit training for mortars which involved:

- Reviewing mortar training literature and literature on related mortar and indirect fire problems.
- Performing a descriptive analysis of current U.S. Army mortar curriculum.
- Assessing soldier proficiency following USAIS One Station Unit Training (OSUT) and unit sustainment training.
- Providing recommendations for new or altered institutional and unit mortar training programs.
- Identifying policy and procedural problems which counter effective training.

Findings:

Current U.S. Army mortar systems training (81mm and 107mm commonly called a 4.2 inch mortar) was observed and compared to historic U.S. Army training, to current U.S. Marine Corps training, and selected Allied training programs in order to determine its comparable adequacy.

A review was conducted of available literature to include current training tasks outlined in the Soldiers Manuals for Indirect Fire Crewmen (FM 7-11C 1/2/3/4, 1981) and published programs (FMs 23-90 81mm Mortar, Feb 1972; 23-91 Mortar Gunnery, Dec 1971; 23-92 4.2 Inch Mortar, Jun 1970) which serve as resource materials to institutional trainers and to units training in the field. Performance standards derived from this analysis were then compared to those used to evaluate mortar proficiency during unit Army Training and Evaluation Programs (ARTEP).

A series of observations of mortar training presented at the USAIS, One Station Unit Training (OSUT), and the Non-Commissioned Officers School of Infantry (NCOSI) were conducted. Documentation and analysis of these Programs of Instruction (POI) were accomplished in the following manner. First, the POI and the lesson plans were examined to derive program training objectives and organization. Next, specific instruction and practice exercise requirements were identified from a study of the program lesson plans. Later, quality control procedures were identified from cadre interviews and field observations of training. Finally, the results of the analysis were assessed and suggestions for improvements in current institutional mortar training were derived.

On-site visits were made to a Mechanized Infantry Division, an Infantry Division (Light), and a Divisional Mortar School. During these visits unit preparatory training and the conduct of live fire mortar ARTEPS were observed and documented. Also, unit leaders and mortarmen from these units were surveyed concerning unit training and proficiency.

Finally, additional data concerning unit training and proficiency were obtained from the Mortar Training Weapons Crew Training Test (WCTT) conducted by Headquarters TRADOC Combined Arms Test Activity (TCATA) at Fort Hood, Texas and Fort Ord, California. This data consisted of training observations and results of quarterly ARTEPS currently being administered to 31 Forces Command (FORSCOM) mortar platoons located at Fort Hood (18) and Fort Ord (13), over a one year test period. Data analysis and statistical comparisons were accomplished and, where available and appropriate, are incorporated into this report.

Utilization of Findings:

To improve institutional, unit, and individual mortar training, and to enhance overall unit proficiency while maximizing effectiveness of limited training time and resources, the following findings are submitted.

- o It may be appropriate to identify and validate more specific selection criteria for personnel to be trained as 11C Mortarmen.

- o FDC computer tasks could be effectively trained to skill level two proficiency as a follow-on course at OSUT. This may be considered for better students based on resource availability. An alternative would be to create an additional skill identifier (ASI) with appropriate schooling for FDC personnel, or design and develop an exportable training course which will insure that the necessary skill level FDC expertise can be developed and implemented at the unit level. This area, in terms of exportable FDC training, is planned for continuing research efforts.

- Examine training at the institution and in units to use a hand-held mortar fire direction calculator as a primary means of computing mortar firing data. Research into the effectiveness of the varied plotting and computational procedures needs to be conducted to ultimately reduce duplicate procedures.

- Determine, through testing, the effectiveness of training the M16 plotting board only as the back-up system for both the 81mm and 107mm Mortars. This assumes that the hand-held calculator can be the most effective primary system.

- Eliminate MPI Registration missions and evaluations for mortars or train properly for the mission.

- Eliminate the use of meteorological (MET) messages and data for mortars since very little benefit is available with continued use. The resource expense does not warrant continued use.

- Investigate the concept of FIST Team Forward Observer duty positions organic to maneuver unit TOE's, or a policy to insure continuity of FIST representation at the maneuver unit. The concept of the FIST appears excellent, but the effectiveness of its application should be examined.

TRAINING EFFECTIVENESS ANALYSIS:
STATUS OF INSTITUTIONAL AND UNIT MORTAR TRAINING

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INTRODUCTION

Background

The light weight and versatile infantry mortar is essentially a product of the trench warfare of 1914-1918. In the post war years, the mortar was developed further and became a standard infantry weapon. Throughout its history the mortar has been a critical support weapon for the infantry. Its use has enabled heavier fire to be placed upon enemy targets than that which would be afforded solely by the traditional small-arms of the infantryman. Design improvements have been made frequently to meet specific mission needs for mortars in battle, however, mortar training in the U.S. Army, like that for other weapon systems, presently suffers from resource restrictions making it critical to identify the most efficient and effective training procedures possible.

Purpose

U.S. Army Training and Doctrine Command (TRADOC) studies indicate that for many Army weapons systems, training does not optimize total system effectiveness.[1] Accordingly, the U.S. Army Infantry School (USAIS) has initiated research to improve the training effectiveness of mortar courses, procedures, and training materials. In support of the USAIS, the U.S. Army Research Institute (ARI) has initiated a training effectiveness analysis for this weapon system. One of the purposes of the ARI research is to identify both short and long range possible improvements in current mortar training.

The Mellonics Systems Development Division of Litton Systems, Inc., under contract to the ARI, is conducting the research presently being supported by the Fort Benning ARI Field Unit. This research involves the assessment of problem areas, identification of needed improvements, and the development of cost effective alternatives for related mortar training. A necessary prerequisite for accomplishing these tasks is the documentation and analysis of the current institutional and unit training for mortars. This report presents these research findings and discusses their implications for improving mortar training.

Objectives

The objectives of this research include:

- The review of mortar training literature and literature on related mortar and indirect fire problems.

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[1] Department of the Army. Analyzing Training Effectiveness (TRADOC Pam 71-8). Washington, D.C., December 1975.

- Performing a descriptive analysis of current U.S. Army mortar curriculum.

- Assessment of soldier proficiency following USAIS One Station Unit Training (OSUT) and unit sustainment training.

- Providing recommendations for new or altered institutional and unit mortar training programs.

- Identifying policy and procedural problems which counter effective training.

Method

Current U.S. Army mortar systems training (81mm and 107mm commonly called a 4.2 inch mortar) was observed and compared to historic U.S. Army training, to current U.S. Marine Corps training, and selected Allied training programs in order to determine its comparable adequacy.

A review was conducted of available literature to include current training tasks outlined in the Soldiers Manuals for Indirect Fire Crewmen (FM 7-11C 1/2/3/4, 1981) and published programs (FMs 23-90 81mm Mortar, Feb 1972; 23-91 Mortar Gunnery, Dec 1971; 23-92 4.2 Inch Mortar, Jun 1970) which serve as resource materials to institutional trainers and to units training in the field. Performance standards derived from this analysis were then compared to those used to evaluate mortar proficiency during unit Army Training and Evaluation Programs (ARTEP).

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Finally, additional data concerning unit training and proficiency were obtained from the Mortar Training Weapons Crew Training Test (WCTT) conducted

by Headquarters TRADOC Combined Arms Test Activity (TCATA) at Fort Hood, Texas and Fort Ord, California. This data consisted of training observations and results of quarterly ARTEPS currently being administered to 31 Forces Command (FORSCOM) mortar platoons located at Fort Hood (18) and Fort Ord (13), over a one year test period. Data analysis and statistical comparisons were accomplished and, where available and appropriate, are incorporated into this report.

Report Organization

This document is presented in six major sections, or parts.

- The introduction describes the purpose, objectives, collection methodology, and organization of the report.

- Part 2 presents an overview of literature and mortar employment. Mortar tactical doctrine, characteristics of mortar training, training aids, and mortar training literature review and analysis are discussed.

- Part 3 presents a descriptive analysis of current institutional training. Training programs of allied countries, and U.S. Marine Corps are evaluated and compared in this section.

- Part 4 is an assessment of unit training and mortar training proficiency. Individual skills, unit proficiency and ARTEP evaluations are discussed.

- Part 5 presents conclusions and recommendations which summarize major points of consideration discussed previously in the text. The recommendations include a list of suggested improvements and areas for additional inquiry.

- Part 6 includes references, an annotated bibliography, and appropriate supporting appendices.

LITERATURE AND DOCTRINE REVIEW

A review of mortar training literature and literature on mortar-related indirect fire problems was conducted. To obtain a broad perspective, a review of historical training literature was accomplished first. This was followed by a review of all relevant publications, doctrinal materials, Programs of Instruction (POI), and performance evaluations used by the USAIS. Next, as a basis of comparison, a review was made of training literature used by the U.S. Marine Corps and selected allied countries. Later, all exportable training materials published by USAIS were analyzed for accuracy and scope of material covered. Finally, the review addressed the proposed TOE changes being tested and considered under the Division 86 concept and how these may impact on mortar training.

A major emphasis was placed on a review of published research reports pertinent to mortar training. This included those already completed by USAIS, U.S. Army Infantry Board, Army Research Institute and other agencies, as well as research projects and tests currently being conducted. In line with this effort, a computerized bibliography search was accomplished through the Defense Technical Information Center (DTIC). Although a majority of these research reports are concerned primarily with weapon testing and employment, several were identified that address mortar training and proficiency. An annotated bibliography of these training reports is included as part of this research effort (Appendix A).

The historical review concentrated on documents (Field Manuals, Training Circulars, training notes, etc.) to determine the evolution of mortar training and to identify and compare number of hours of instruction, subject areas and skills emphasized, mortar gunner qualification procedures, and unit training responsibilities. The available literature dated back to the 1938-1940 time frame and was progressive up to current doctrine. This review indicates steady and consistent reductions in the number of hours of instruction, especially in the areas of crew/team drills and live fire exercies (FM 23-90, Jan 1940; FM 23-90, May 1942; FM 23-90, Dec 1958; FM 23-90, Feb 1972). During this evolutionary period, however, a number of weapon modifications, sighting devices, fire control procedures, and forward observation techniques were introduced, all of which required corresponding additions and deletions to programs of instruction (FM 28-85, Nov 1950; FM 23-92, Oct 1951; FM 23-92, Jan 1956; FM 23-92, Feb 1961; FM 23-92, Jun 1970).

The review of literature applicable to current institutional instruction included the current individual training tasks outlined in the Soldiers Manual (FM 7-11C 1/2/3/4, 1981) and published programs contained in Field Manuals 23-90 (Feb 1972), 23-91 (Dec 1971), and 23-92 (Jun 1970). Tasks and performance standards derived from this review were then compared to the tasks taught in Infantry School Programs of Instruction and to those used to evaluate collective task proficiency during unit Army Training Evaluation Programs (ARTEPS 71-2, June 1979; 7-15, Nov 1981). This analysis revealed that there are four Infantry School courses whose program of instruction

include a substantial amount of mortar instruction: One Station Unit Training (OSUT) 11C Track (Oct 1981); Basic Non-Commissioned Officers Course (BNOC) 11C Track (Jan 1983); Advanced Non-Commissioned Officers Course (ANOC) (Jun 1982); and Infantry Mortar Platoon Course (IMPC) (Dec 1981). A descriptive analysis of each of these programs of instruction and other POI's containing mortar instruction is presented in the current training section of this report and is listed in Table 1.

A major training deficiency noted is that there is no institutional training established specifically to train fire direction computers prior to attendance at BNCOC, which is normally available only to soldiers in grades E-5 and above. The TOE authorized grades for mortar fire direction center (FDC) computers are E-5 and below. The present solution to the FDC computer training void is on-the-job training at unit level. This approach assumes that FDC knowledge will be gained from experienced unit members, however, it does not provide any assurance that mortar units will have the necessary base of expertise to provide adequate standardized training for FDC personnel.

The results of analysis directed at differences found between time standards for individual tasks taught in the institutional environment and those actually tested during unit evaluations (to be discussed later) indicate that in several instances unit testing (ARTEP) requires a higher standard than that required for successful completion of initial MOS training.

A review of the available preliminary Weapons Crew Training Test[2] results has not indicated that lack of full caliber firing is a training constraint. In fact, several other studies indicate that there is little or no correlation between full caliber firing and gunner/crew proficiency (Powers et al., Determination of the Contribution of Live Firing to Weapons Proficiency, 1975). In this study, two field tests were conducted to identify the contribution of live firing to weapons proficiency for two large-caliber weapons systems, the M60A1 tank and the 105mm howitzer. Experimental training methods were used that varied the amounts of live firing and training simulation. In both tests, there were no statistically significant differences between training methods when proficiency level was measured by a live fire interior test. Attitude surveys showed some differences in the way in which trainees tended to view the various training methods, indicating a preference for live fire.

The Army Training Study - Battalion Training Survey, Volumes I and II (1977) discusses the impact of training detractors. The three significant detractors identified were: personnel not present for training, change in duty positions, and trainer grade substitution. In both the Army Training Study, Battalion Training Survey, Volumes I and II, and the Litton Mellonics Report, Sustaining Team Performance: A Systems Model, (July 1979) the quality of the soldier has been studied as it affects training. Basically, the lower

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[2]TRADOC Combined Arms Test Activity (TCATA) (Mortar Training Weapons Crew Training Test), Mar 1982 - Ongoing.

Table 1

USAIS Programs of Instruction
Mortar Training

Hours	Title	Location	Live Fire
ONE STATION UNIT TRAINING (OSUT) 11C TRACK			
48	Mortar Gunnery Qualification	Field	
8	Practice 81mm Gunners Test	Field	
8	81mm Gunners Test	Field	
12	Crew Tactical Training 81mm Mortar (ground mount)	Field	
16	Operator Maintenance on Mortar Carrier	Classroom and Field	
10	Crew Tactical Training 81mm Mortar (carrier mounted)	Field	
8	Fundamentals of Fire Direction	Classroom	
10	Engage Targets with 81mm Mortar	Field	L/F
10	Perform as Member of 107mm (4.2 inch) Mortar Crew	Field	
8	Perform as Member of Carrier Mounted 107mm (4.2 inch) Mortar Crew	Field	
138			
BASIC NON-COMMISSIONED OFFICERS COURSE (BNCOC) 11C TRACK			
55	Fire Direction Procedures 81mm Mortars	Classroom	
15	Fire Direction Procedures 107mm (4.2 inch) Mortar	Classroom	
32	Mortar Field Training Exercise	Field	L/F
4	Comprehensive End of Course Examination	Classroom	
106			
ADVANCED NON-COMMISSIONED OFFICERS COURSE (ANCOC) 11C TRACK			
2	Mechanical Training Examination	Range	
3	Intro to Mortars & Safety Procedures	Range	
5	Operation of the M2 Aiming Circle	Range	
5	Training Techniques and Devices	Range	L/F
4	Forward Observer Examination	Classroom	
8	Forward Observer Procedures	Classroom	
10	Forward Observer Service Practice	Range	L/F
4	Fire Direction Center Examination I	Classroom	
4	Fire Direction Center Examination II	Classroom	
4	Fire Direction Center Examination III	Classroom	
4	Fire Direction Center Examination IV	Classroom	
16	Advanced FDC Procedures 81mm	Classroom	
32	Fire Direction Center Procedures 107's	Classroom	
16	Advanced FDC Procedures for 107mm	Classroom	
1	Math Diagnostic Examination	Classroom	
123			

Table 1 (Continued)

Hours	Title	Location	Live Fire
INFANTRY MORTAR PLATOON COURSE (IMPC)			
4	Mechanical Training Examination	Range	
1	Introduction to Mortar Platoon Course	Classroom	
8	Mechanical Training with Mortars I	Range	
10	Mechanical Training with Mortars II	Range	
8	Mechanical Training with Mortars III	Range	
8	Mechanical Training with Mortars IV	Range	
10	Field Firing Exercise	Range	L/F
10	Field Firing Exercise	Range	L/F
2	Forward Observer Examination	Classroom	
4	Fire without an FDC	Range	L/F
8	Forward Observer Procedures	Classroom	
10	Forward Observer Service Practice	Range	L/F
4	Fire Direction Center Examination I (81mm)	Classroom	
4	Fire Direction Center Examination II (81mm)	Classroom	
4	Fire Direction Center Examination III (107mm)	Classroom	
4	Fire Direction Center Examination IV (107mm)	Classroom	
30	Fire Direction Center Procedures 81's	Classroom	
16	Advanced FDC Procedures for 81's	Classroom	
32	Fire Direction Center Procedures 107's	Classroom	
16	Advanced FDC Procedures for 107's	Classroom	
193			
INFANTRY OFFICERS BASIC COURSE (IOBC)			
4	Mechanical Training with Mortars	Range	
INFANTRY OFFICERS BASIC COURSE/RESERVE COMPONENTS (IOBC/RC)			
4	FO/Mechanical Training with Mortars	Range	
OFFICERS CANDIDATE/RESERVE COMPONENTS (OCS/RC)			
5	FO/Mechanical Training with 81 Mortars	Classroom/Range	
INFANTRY OFFICERS ADVANCED COURSE (IOAC)			
4	Infantry Mortars	Classroom	
INFANTRY OFFICERS ADVANCED COURSE/RESERVE COMPONENTS (IOAC/RC)			
4	Infantry Mortars	Classroom	
INFANTRY PRE-COMMAND COURSE (IPCC)			
6	Infantry Command Course Branch Update	Range	L/F (Demo)

mental category soldiers take longer to train, require more repetitions, do not achieve as great a proficiency, and experience a higher learning decay rate than higher category soldiers. The amount and time/frequency spent training was often mentioned as a determinant of team proficiency.

A Mortar System Evaluation by the Director of Evaluation, USAIS (Dev Report Number 4, 1977) had as objectives: measurement of individual mortar proficiency in tactical units; determination of the amount of mortar training being conducted in tactical units; identification of the relationships between soldier, training, and performance; and determination of the mortarman's attitudes about himself, his MOS, institutional training and his unit's mortar training. Five hundred and thirty-one soldiers from 25 mortar platoons, representing six divisions and two separate brigades, were surveyed. Some of the results reported were:

- o many mortarmen think they are expected to be able to perform mortar-related skills that they have not been trained to do,
- o school training is generally perceived to be more effective than unit mortar training,
- o mortarmen train less than one day per week on mortar skills,
- o most units live fire once per quarter,
- o 60 percent of authorized mortar platoon personnel are actually available for daily training,
- o AIT and IOBC (without IMPC) graduates felt their courses were ineffective in preparing them for 11C assignments,
- o individual mortar proficiency was measured by written examinations and found to be generally less than adequate.

An independent study conducted by the Human Engineering Laboratory (Human Engineering Laboratory Mortar System Test - HELMST-1, April 1977) during actual field firings was designed to measure the base line performance of 81mm mortar indirect fire teams and provide information from which to determine possible improvement in effectiveness through the introduction of new hardware and procedures. Results concerning individual mortar proficiency during a field evaluation were similar to those of the Department of Evaluation study (1977) test environment. HELMST-1 researchers found that the largest reduction in mortar cycle time could be made by reducing the fire direction center computation time. Comparison of the two studies seem to indicate that knowledge precedes performance and that poor performance in a test situation is an indicator of probable poor performance subsequently in the field.

Division 86

A review of proposed Table of Organization and Equipment (TOE) changes being tested under the Division 86 concept was conducted to determine how it may impact on mortar training. Essentially, this concept calls for consolidating mortars at battalion level and perhaps changing the type of mortar employed.

A consideration of elimination of company mortars and retention of only one echelon of mortars at battalion level would cause changes in employment concepts and traditional thinking because, under this concept, the one mortar platoon would be the sole organic mortar support of the battalion.[3] When compared to current training practices, TOE changes under this concept would require modifications in training to accommodate new doctrine and employment techniques. Also, if new equipment were to be introduced, such as the British developed 81mm mortar, training of its technical aspects would be required. Traditional institutional training should be affected only to the extent necessary to incorporate doctrine, employment techniques and equipment changes. Training of mortar indirect fire teams in the unit setting is generally the same whether they are located at battalion or company level. Therefore, new procedures for unit training, integrated tactical training, ARTEP evaluations, and live fire exercises would be only slightly affected by TOE changes. When viewed from a command and control perspective, however, centralizing the mortar system at battalion level would probably facilitate rather than detract from training. Table 2 is a summary of mortar platoon echeloning and type of mortar tested under the Division 86 concept. This review does not address the impact of these possible changes on firing effectiveness and density in tactical employment.

Overview of Doctrinal Concepts

The tactical doctrine applicable to a particular military unit prescribes how the unit is to be employed in combat, the techniques used, and the standards that unit must meet to perform its assigned mission. Generally, doctrine for a particular unit is determined by its mission, organization, firepower and mobility when compared with opposing threat force capabilities and maneuver tactics. Logically, individual and unit training is designed to encompass all of the technical and tactical aspects prescribed by applicable doctrine.

Mortar employment doctrine demands the timely and accurate delivery of indirect fire to meet the needs of supported units. Specifically, mortar sections/platoons are to provide close-in, immediate, indirect fire to kill or suppress the enemy and to obscure or illuminate the battlefield. For mortar fire to be effective, it must have adequate density and must hit the target at the right time with the correct projectile and fuze. These requirements have dictated the makeup of mortar organizations. (See Figure 1, Mortar Section/ Platoon Organization).

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[3] United States Army Infantry School. High Technology Test Bed Operations Manual for Mortar Platoon. Draft (Test) Fort Benning, Georgia. Mar 1981.

Table 2

Mortar Deployment (Proposed) - Division 86*

TOE	ECHELON	MORTAR
Mechanized Infantry Battalion MTOE 07-2545 600 (10 Sep 82)	Battalion Headquarters	6 - 4.2 inch mortars
Airborne Infantry Battalion MTOE 07-0355 200 (No approval date for testing)	Battalion Headquarters	4 - 4.2 inch mortars
	Company Headquarters	2 - I-81mm mortars
Airmobile Battalion MOTE 07-0555 200 (No approval date for testing)	Battalion Headquarters	4 - 4.2 inch mortars
	Company Headquarters	2 - I-81mm mortars
Motorized Battalion MTOE 07-0250 200 (24 Sep 82)	Battalion Headquarters	6 - 4.2 inch mortars
Light Attack Battalion MTOE 07-0650 200 (24 Sep 82)	Battalion Headquarters	6 - 4.2 inch mortars
Assault Gun Battalion MTOE 07-0750 200 (24 Sep 82)	Battalion Headquarters	6 - 4.2 inch mortars

*This is one of several proposals for mortar deployment. To date, none have been determined to clearly represent the TOE accepted for Division 86.

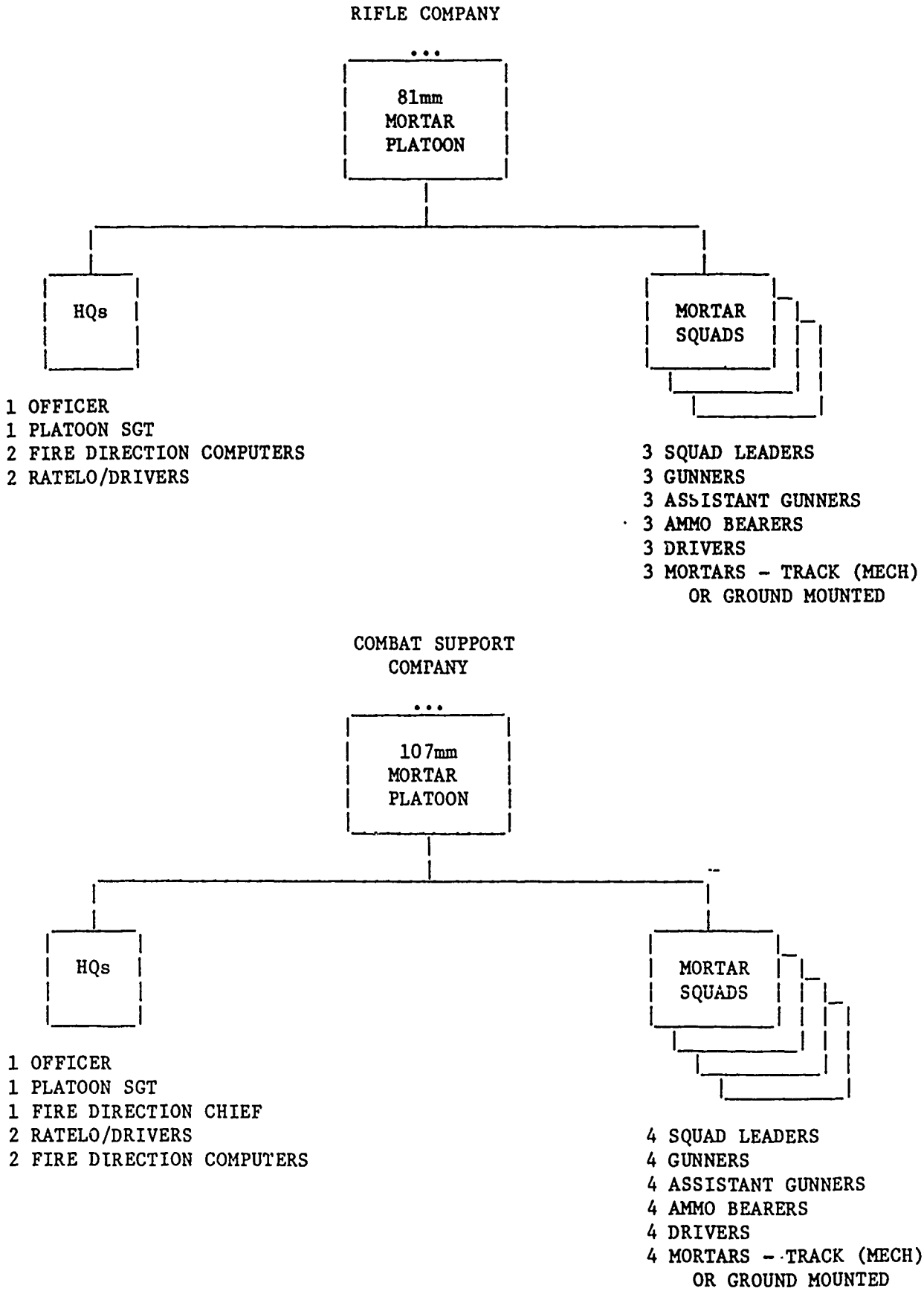

Figure 1. Typical Mortar Organization

Good observation for fire direction is necessary for effective mortar fire. Limited or untrained observation results in a greater expenditure of ammunition and less effective fire. Some type of observation is desirable for every target engagement to insure that fire is effectively placed on the target. Observation of close-in battle areas is usually visual. When targets are hidden by terrain features or when great distance or limited visibility is involved, observation, in a broader sense, may be based on radar sensing or sound. Mortars should be employed from defilade positions to protect them from enemy direct fire and observation to maximize the security of the unit's indirect fire support. Although this precludes sighting the weapons directly at the target (direct lay), it is necessary for survivability. Because mortars are indirect fire weapons, relatively complex firing procedures are required to insure that weapon and ammunition settings, when properly applied, will cause the projectile to burst on, or at a proper height above, the target. A coordinated team effort between the observer, fire direction center, and gun sections is required to insure the timely and accurate engagement of targets. The information and sequenced steps required for a mortar section to engage a target from a defilade position using indirect fire are:

a. Known location of targets and mortar positions.

b. Determination of what is called chart data (direction, range, and vertical interval from mortars to targets).

c. Conversion of chart data to firing data computation.

d. Application of firing data to the mortar and to the ammunition.

To accomplish these tasks and thereby control the mortar fires, an indirect fire team is employed. This team consists of a Forward Observation (FO) Team, Fire Direction Center (FDC), and a firing mortar section/platoon (Figure 1-1).

Forward Observation (FO) Teams detect and locate targets, initiate a call for fire, and adjust the impact of subsequent fires as necessary. The FDC evaluates the calls for fire received from the observers, determines through computation firing data, and issues those data in the form of a fire command to the mortar section/platoon. Finally the mortar section/platoon crews apply the firing data to the mortars, prepare ammunition for firing, and fire the mortars.

Mortars are area fire weapons which is to say that they are generally expected to provide simultaneous fire across relatively large areas of terrain. However, they may also be employed to neutralize or destroy small area or point targets, to screen large areas with smoke for sustained periods, provide illumination, or to attack targets with chemical fires (4.2 inch mortars only).

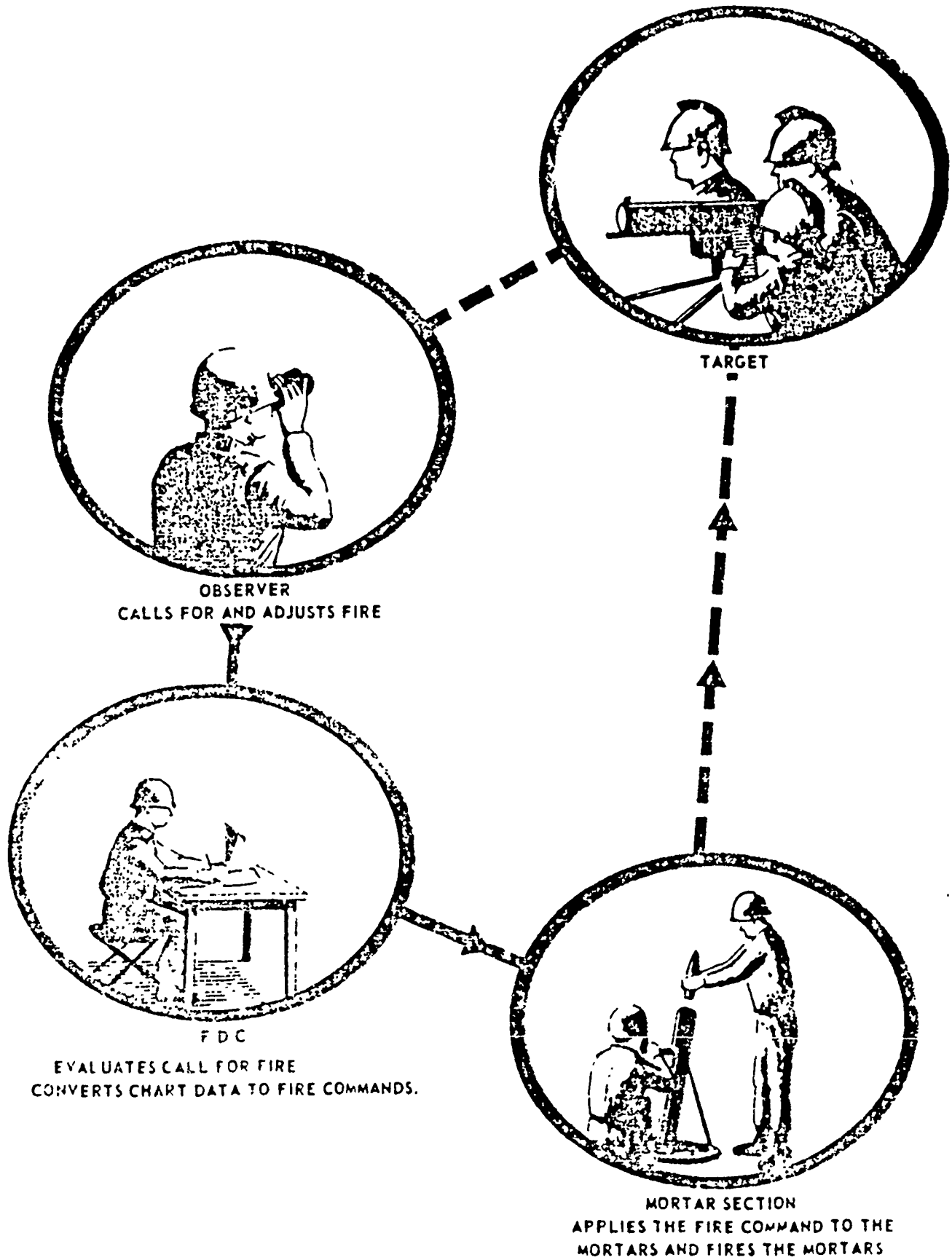

Figure 1-1. Indirect Fire Team.

The immediate doctrinal objective, however, is to deliver a large volume of accurate and timely fire to inflict as many casualties as possible on the enemy. The number of casualties inflicted in a target area can usually be increased by surprise fire. If surprise massed fires cannot be achieved, the time required to bring effective fires on the target should be kept to a minimum.

In the armor and mechanized infantry battalion, mortars are normally fired from mortar carriers which are as mobile as their parent unit; they have ground-mount capability, however, and infrequently are fired ground-mounted. Firing from the mortar carrier permits rapid displacement and quick reaction to the tactical situation.

Mortar doctrine calls for a unit to displace to provide continuous support and to evade suppression. The section usually displaces by echelon, moving one or two squads at a time to a new position. The first echelon to move takes enough men and equipment to set up a new FDC. When it is ready to accept calls for fire, it notifies the second echelon which has remained in its firing position in order to provide its unit with fire support. The second echelon then displaces to join the first echelon which is now ready to fire, or to leapfrog past it to occupy another position. When displacing, mortars must be ready to halt and fire at any time. If they get a call for fire while moving, they move to the nearest place with mask (forward cover and concealment) and overhead clearance, and compute the necessary firing data based on their location, and fire. Unless ordered otherwise, each squad fires as soon as it can. The volume of fire increases as additional mortars come into action.

During offensive operations such as a movement to contact, the mortar section is usually in general support of its parent unit (battalion or company) with priority of fire being given to the lead platoon. The section normally displaces one squad at a time so that at least one other squad is always in position and ready to fire. The section's displacement is based on the battalion or company's movement. The weapons platoon leader keeps the commander informed of the location and status of his weapons and ammunition. In an attack, initial firing positions are prepared and ammunition may be stockpiled. Positions are occupied at the last moment before the attack. The section must remain ready throughout the attack to respond to calls for fire and to displace, if necessary.

In the defense, mortars are positioned farther to the rear of the unit than in the offense. The commander plans his mortar section's Final Protective Fire (FPF) on a dangerous, dismounted enemy avenue of approach. Extra ammunition is stockpiled to fire the FPF. The mortars have some security provided by forward troops, but the crews must still prepare positions to provide local defense of their location. The mortar FPF is integrated into the larger artillery fire plan.

To avoid being suppressed or destroyed by threat artillery fire and/or counter battery mortar fire, a number of mortar positions are designated, prepared (if feasible), and occupied (if necessary) during any battle. This is a critical planning step in Europe where threat artillery is in abundance.

In a withdrawal not under enemy pressure, doctrine calls for one or more mortars to be left in position to support the security force at the discretion of the commander.

Historical Perspective

In his article, The Infantryman and His Mortars (Infantry Mar-Apr, 1980), Lieutenant General David E. Grange states that: "Mortars have proved themselves in our past wars and it is my opinion that they will be even more valuable in any future hostilities in which the U.S. infantryman is committed." He continues on to say that few soldiers today have personally experienced the stark terror of a massive artillery attack. The destruction, confusion, fear, and feeling of total helplessness are virtually impossible to describe. The Korean War produced battles in which the intensity of the enemy's artillery fire exceeded that of any previous war in which U.S. Army units have participated.

In the early stages of the Korean War, the North Korean People's Army (NKPA) massed its limited artillery means at every opportunity and placed great emphasis on its use to support most of its ground actions. With the entry of the Chinese Communist Forces (CCF) into the war late in 1950, Soviet-made artillery was introduced in large varieties and quantities. The artillery fires laid down in Korea during the latter period of war normally, day after day, far exceeded anything fired in either of the two World Wars. The average fire that fell on the United Nations' lines was 24,000 rounds per day.

In the battle to recapture Old Baldy on 16 September 1952, the CCF fired an estimated 1,000 rounds of artillery in a period of eight minutes on a small hill occupied by U.S. Forces. There were months when as many as 104 enemy attacks from company to division strength smashed against the UN outpost line, and days when as many as 131,800 rounds of Communist artillery fell on it within a 24-hour period. To counter this massive use of artillery by the CCF, all of the available indirect fire weapons in the U.S. Army's inventory had to work in concert to make the most of their unique advantages.

In contrast to the total demand placed on artillery and indirect fire weapons found in both of the World Wars and in Korea, U.S. Army commanders in South Vietnam seldom had to place priorities on their support fires. The abundance of fire support enjoyed in South Vietnam has lulled many officers and NCOs into a false sense of security. The fact is that artillery will be hard-pressed to satisfy the total indirect fire needs of the combined arms team on a European battlefield of the 1980s. This can be offset, though, by a proper balance of artillery and mortars, with each system adding its unique capabilities to the overall integrated fire support plan.

The forces of Western Europe and the NATO alliance are, and will continue to be, numerically outgunned by Warsaw Pact forces in conventional artillery, rocket, and close air support systems. Based upon these facts, there has never been a clearer requirement for a more varied and responsive fire support

system to aid the ground commander. The additional interest in rapid deployment forces has served to reinforce the need for light, effective, and nimble weapons systems (Grange, 1980).

The greatest portion of the close fire support requirement in the 1980s and 1990s will be met by current and follow-on field artillery, rocket, and mortar systems. A task force commander will require that his organic and supporting fire support systems perform - successfully and continuously - numerous tasks that are all critical to his ability to fight outnumbered and win.

The most demanding mission for an infantry task force commander will be to conduct a successful defense in the first stage of hostility in the central region of Europe. He will be outnumbered and outgunned. At times, he will find himself operating on task force frontages as much as 15 kilometers wide with a corresponding degradation of fire support and communication systems. He will be required to take on up to 250 enemy's first echelon forces, then quickly reorganize and reposition his task force elements to meet the enemy's second echelon forces.

Technology will not displace the dismounted rifleman from the potential battlefields of the world in the foreseeable future, and as long as the soldier is required to engage in close combat, the need for efficient, responsive, killing, indirect fire will remain. Readily-available, close-in, indirect fire must be available to infantry commanders at task force or team echelons.

A maneuver commander will continue to depend on his organic mortars and the field artillery to provide the close fire support, counterfire, suppression, smoke, and illumination that he requires. Mortars have provided the most responsive sources of indirect fire support available at the company and battalion level, and will probably continue to do so (Grange, 1980). Their maneuverability, rate of fire, low minimum-range restrictions, lethality, and proximity to the commander give him the versatility, reliability, and responsiveness required in a fast-moving combat situation. Because of the demands placed on artillery assets by counterfire, suppression and interdiction, and by the employment of special munitions in non-traditional artillery roles, particularly on the mid- to high-intensity battlefield, infantry leaders must train well today to make mortars as effective as possible tomorrow.

Characteristics of Mortar Units

One of the most difficult problems encountered by commanders of mortar units is finding a way to incorporate their mortar indirect fire team into the tactical play of company and battalion Field Training Exercises (FTX). Quite often the problem is solved by making the indirect fire team a training unit. While this solution provides realistic aggressor support for the units maneuver elements, it does little toward preparing the mortar indirect fire team to accomplish the mission of providing close and continuous indirect fire support to the infantry soldier.

There are several methods of training a mortar indirect fire team to accomplish its mission. Live fire, dry fire, training device employment or simulation are some of the methods. Usually, the mortar indirect fire team conducts live fire by itself while the infantry maneuver elements conduct separate tactical training. Due to terrain and safety limitations, it is rare that live fire is incorporated into tactical exercises. Other training methods include various dry fire exercises, such as crew drill and subcaliber firing. These methods usually become repetitive and boring for platoon members after a short time. Like live fire exercises, the dry fire and subcaliber training methods are difficult to realistically incorporate into tactical field training exercises.

Another problem the commander must solve when training his mortar indirect fire team is integrating the training of the Fire Support Team (FIST). The FIST is an artillery function and is the element of the mortar indirect fire team which conducts forward observation (FO) for the team and must be able to find targets, and call for and adjust fire on the target. However, the personnel who make up the FIST are from an artillery support unit and are not assigned to the commander of the mortar unit. Consequently, he does not control their availability, training, or proficiency.

Under the FIST concept, the Fire Support Team at company level is designed to:

- Optimize employment of available Fire Support Resources.
- Improve combined arms training and operations.
- Facilitate fire support coordination under the supervision of the company commander.

However, observations of mortar units during live fire exercises and informal interviews conducted at various posts indicate that the FIST teams at company level are rarely up to strength and are poorly trained in mortar specific aspects of forward observer procedures and in direct fire support. Compounding this problem is the fact that there does not seem to be any set procedure to insure that the supported unit will receive the same FIST team on a regular basis. These conditions allow little opportunity for the FIST and the Fire Direction Center (FDC) to develop the necessary rapport and coordination needed to minimize the response time of mortar indirect fire support.

Finally, an institutional training void exists in the area of the Fire Directon Center. Currently, there is no formal training of Skill Level 2 Fire Direction Computer tasks from the time the mortarman leaves OSUT until he attends BNCOC (see Appendix D). The only Fire Direction Center training he receives is OJT in the unit. If a mortar platoon is fortunate enough to have a highly-qualified IMPC or ANCOC trained platoon leader or platoon sergeant and the platoon receives sufficient training time, then adequate expertise and training may be available to transfer these skills. However, the high attrition rate in 11C BNCOC and the fact that this course must place a concentrated effort on teaching Skill Level 2 tasks indicates that little or no FDC training is taking place in the unit.

In the past there have been various proposals aimed at correcting this problem, such as the establishment of a follow-up program to OSUT to identify and train a limited number of Fire Direction Computers and the awarding of an Additional Skill Identifier (ASI) to qualified individuals. To date, these proposals have not been implemented.

The third element of the indirect fire team, the firing section is probably the least difficult to train. This is due to the ease with which the training can be conducted, i.e., easy access to the needed equipment, the limited resource requirements for conducting mechanical training and the requirement to conduct the gunners exam. Ease of training, however, will not ensure that enough mechanical training is conducted in the units or that there are no problems associated with mechanical training. Although the mechanics of mortar gunnery once learned are durable skills, speed and accuracy needed by expert gunners to adjust and deliver accurate and timely indirect fire support are more perishable and require frequent and repetitious training.

In general, unit mortar training throughout the Army is lacking in both quality and quantity. In the 1977 Directorate of Evaluation Report #4 conducted on Infantry Mortar Systems it was determined that:

- While most mortarmen indicated that unit training is necessary and that live firing exercises and training devices are effective means of training, most mortarmen indicated that their units do not train, live fire, or use training devices enough.

- Generally, institutional mortar training is perceived to be more effective than unit mortar training.

- Most platoon leaders indicated that their mortarmen train less than one day per week on mortar skills - gun crews 5.3 hours, FDC personnel 4.3 hours.

Using a similar questionnaire, surveys conducted by ARI/Litton of TOE units, IMPC and ANCOC courses indicate that little change has taken place in unit mortar training since the 1977 Directorate of Evaluation Report #4. (Assessment of Training, p. 51)

CURRENT TRAINING PROCEDURES

An analysis of present institutional training program (OSUT and USAIS) can be augmented most effectively by including comparisons with other mortar programs. Our allies, potential opposing forces, and sister services each have a philosophy of training and employment for their mortars. The approach taken by all other forces and services differs, in part, from that of the U.S. Army.

Allied Training

British/Canadian. The British and Canadian armies do not train mortarmen in their Basic/AIT Training Programs. Personnel are selected for mortar training after they have been in their TOE units for approximately 2 years. These personnel are selected based upon the evaluation and recommendations of the unit officers and NCO's.

Officers and NCO's who are selected to train the unit mortarmen are sent to an Infantry Training School and are given a mortar instruction equivalent to the U.S. Army's Infantry Mortar Platoon Course. Upon returning to their units they become responsible for the training of their unit mortarmen.

Probably, most noteworthy is the fact that the Fire Direction Center personnel once selected and trained are rarely, if at all, reassigned to different jobs within the unit.

The British manual for Infantry Heavy Weapons (Mortar) Volume V consists of two parts. Part I contains the information and instructional data which an instructor will need to train the soldier. It is written in lesson plan form and grouped in chapters, each of which deals with a certain aspect of training. It also contains in the annexes, additional subjects that are of interest to instructors, officers, and NCOs only.

Part II of the manual pertains to tactical employment of the mortars, to include sample operations orders and standing operating procedures for all types of operations.

The mortar division of the support weapons wing, School of Infantry teaches a 7-1/2 week course to platoon commanders/platoon second in command and the CPO/MFC (FDC/FO). In addition, there is also a 1-1/2 week mechanized course which runs consecutively with the 7-1/2 week course for those personnel serving in mechanized battalions (see Table 3).

Table 3

PL COMD/PL 2IC AND CPO/MFC COURSE

SUBJECT	INFANTRY								MECHANIZED	
	PL COMD/PL 2IC				CPO/MFC					
	IP*	TP*	PP*	NIGHT	IP*	TP*	PP*	NIGHT	IP*	PP*
Mortar Characteristics & ORBAT	2				2					
Weapon Handling	28		1		31	6	3		10	1
Technical Subjects	5				5	3				
Fire Control (MFC)	15	6	34		14	2	35			
Plotting Procedures	18		2		20	2	2		2	
Fire Planning	2		3		1		1			
Map Reading					3		2			
Rangework	14	2	2		8		2			
Signals	3				5		2		2	
Battle Procedure & Tactical Handling	14		25		11		12		2	
Exercises and Ranges			60	12			78	12		24
Examinations/Tests			20				15			3
Miscellaneous and Admin.	18		3		12				5	
TOTAL HOURS	119	8	150	12	112	13	152	12	21	28

*IP = Instructional Period, TP = Teaching Period (Students), PP = Practice Period.

A one week course is also conducted for majors and captains which teaches selected company commanders, support group commanders and company seconds-in-command to supervise unit mortar and anti-tank support weapons training (see Table 4).

Table 4

SUPPORT WEAPONS (MAJOR AND CAPTAIN)

SUBJECT	PERIODS Support Weapons IP*	PP*	DEMO	NIGHT
Mortar Characteristics & ORBAT	1.5			
Weapon Handling	2	2	1	
Technical Subjects	2	1		
Fire Control (MFC)	4.5	3		
Plotting Procedures	2			
Fire Planning				
Rangework	3			
Signals				
Battle Procedure	2			
Exercises and Ranges		7	1	4
Examinations/Tests				
Miscellaneous and Admin.	4		2	
TOTAL HOURS	21	13	3	4

*IP = Instructional Period, PP = Practice Period.

German. The German Army conducts approximately 180 hours of mortar training in their Basic/AIT Program.

The program is presented in two parts - the first is a 41 hour block of instruction on the mechanics of mortar gunnery and the second, 139 hours of field training. The trainee must also take and pass a gunners exam prior to being awarded the mortar MOS.

The German Army also has professional development courses that are equivalent to the U.S. Army's BNCOC and ANCOC courses. In addition, they also conduct a two-week course of instruction for their Forward Observers - Fire Direction Computers and Survey Teams. Like the British and Canadian Armies, the German Army does not reassign personnel to different jobs within the unit once they have been selected and trained for these specialized jobs.

The mortar platoons live fire on an average of twice a year and when not live firing employ training devices such as the Sabot, puff-boards, and Bryant Device.

United States Marine Corps (Institutional)

ARI/Litton Mellonics visited the USMC Infantry Training School, Camp Lejeune, North Carolina to observe and take part in 81mm and 60mm mortar training.

The Marine Corps Infantry Training School (ITS) conducts an 81mm/60mm mortar course to produce a mortarman/gunner with the designated Military Operational Speciality (MOS) of 0341. The course duration is four weeks, with 18 training days, and 212 hours of actual instruction. This course is designed for a Private or a Private First Class who has completed Marine Corps recruit training. The Marine at the ITS is enroute to a division and is taking the equivalent of the Army Advanced Individual Training (AIT).

The course devotes a total of 78.25 hours to mortar specific instruction. The program of instruction (POI) includes classroom instruction, mechanical training/crew drill, live-fire exercises, written examinations and a "hands on" gunners' proficiency examination. Reference material for all periods of instruction to include examinations, are Department of the Army Field Manuals 23-90, 23-91, and 23-85.

In the Marine Corps, the 81mm mortar platoon is located in the Weapons Company of the Infantry Battalion. The mortar platoon is organized into a platoon headquarters and four mortar sections, with each section having two squads with one 81mm mortar per squad.

The platoon headquarters consists of two officers and six enlisted men who are responsible for the operation of the platoon, control of firing positions, operation and training of the fire direction center, ammunition resupply and communications. Each section has six enlisted men who are responsible for training and employment of the section, supervision of firing, ammunition resupply, and communications. The mortar squad is the basic unit of the mortar platoon and is responsible for operation and maintenance of the mortar and equipment assigned to the squad. The mortar squad consists of: the squad leader who supervises the emplacement, laying and firing of the mortar; the gunner who places the firing data on the sight, lays the mortar for deflection and elevation, and conducts firing and safety checks; the assistant gunner who assists the gunner in laying the mortar and loads and fires the mortar on order; and four ammunition men who carry the ammunition, prepare the ammunition for firing and provide local security for the mortar.

The Marine Rifle Company is composed of three rifle platoons and one weapons platoon. The weapons platoon contains an assault section, an M60 machinegun section, and the 60mm mortar section. The mortar section (two 60mm mortars) has a section leader and two squads. Each squad has a squad leader and a three man mortar team. The weapons platoon of the Marine Rifle Company does not provide for a fire direction center and the concept of employment for the 60mm mortar requires use of direct lay and direct alignment methods of fire support. The unit compositional differences and employment doctrines are reflected in the differences found between U.S. Army and USMC training.

The typical class size for the 0341 mortarman course is usually between 25 and 50 (23 was the class size observed); therefore, a large amount of individual attention/coaching is provided to each Marine by the instructors who maintain a 1:4 instructor-to-trainee ratio.

The instructors are all graduates of the mortar course; some are graduates of the Infantry Mortar Platoon Course at the USAIS; and they are all qualified mortarmen before they are permitted to teach. Reportedly, assistant instructors serve as assistants several months before becoming primary instructors themselves in order to build confidence and proficiency as instructors. This is similar to other USMC instructor preparation observed by ARI in the past.

A gunner's exam is given after the first 34 hours of instruction on the 81mm mortar. This exam is equipment related and is administered as outlined in FM 23-90 (Feb 1972). A Marine trainee must successfully complete this examination before he is allowed to proceed to advanced mortar training and the live fire exercises. Unlike the gunner's exam administered at the U.S. Army Training Center, One Station Unit Training (OSUT), the Marine Corps makes no provision for awarding of the mortarmen MOS without meeting the minimum standards of at least a second class gunner. In addition, written examinations are administered to measure Marine trainee proficiency on other mortar subjects, and includes organization of the weapons platoon, mechanical training, operation of the mortar, malfunctions and corrective actions, care and cleaning, ammunition and fuze settings, and sighting devices and their use with the mortar. Proficiency and knowledge must be demonstrated clearly before the first round is fired.

Mortar training for Marines commences with classroom instruction covering the fundamentals of mortar platoon organization, weapon characteristics, and mortar crew procedures. This is followed by alternating periods of instruction covering specific mortar gunner tasks and techniques. After each period of classroom instruction, the trainee's understanding is reinforced with closely supervised periods of hands-on crew drill. Each task is learned, practiced and reviewed before proceeding to a new task. As a method of maintaining interest and attention, and at the same time providing necessary tactical training, instructional periods covering tactical employment, methods of fire support, ammunition and fuzes, and types of targets and methods of attack are presented.

Each mortar class is provided a unit leader. The unit leader is a qualified mortar instructor who accompanies the class through the entire course of instruction. His primary function is to provide expertise and to conduct reinforcement training following formal instruction. Unit leaders work closely with the school staff and instructor personnel to achieve maximum training benefit for all Marines and provide invaluable additional training for marginal students.

At the completion of all periods of instruction and crew drill training, a practice gunner examination is administered. This period is designed to prepare the Marine for the standards and conditions he will encounter during the actual examination for qualification. Each Marine is required to perform each task without instruction or coaching. Instructors supervise each student closely and at the completion of each event provide detailed critiques of the strengths and weaknesses demonstrated. At the completion of the practice gunners exam, when required, reinforcement instruction and crew training is provided. Practice exam proficiency records are maintained and used as a basis for comparison against actual exams performance. This provides valuable feedback to the student as well as instructor personnel for possible course and instructional improvement.

The practice exam is closely followed by the actual gunner's exam, usually administered the next day. The conditions, time standards and qualification prerequisites outlined in FM 23-90 are used for this exam. Each Marine student is graded on his individual performance and must attain the minimum qualifying score. Those failing to achieve minimum qualification are immediately retested on all events. Failure of a retest can result either in recycling through the complete program of instruction or reclassification to another military occupation specialty. Marine performances on this qualification test appear better than U.S. Army OSUT performances. These differences will be discussed later.

Sixteen hours are devoted to additional instruction and live fire exercises. Each Marine performs the duties of mortar gunner and fires approximately 40 rounds using direct and indirect lay techniques. When not performing gunner duties, each student functions either as assistant gunner or ammunition bearer. Instructor personnel closely supervise all aspects of the live firing to include student performance and range safety. However, instructor interference with firing exercises is kept to a minimum so as to maximize student training and learning experience. Table 5 presents, in summary, the distribution of both hours and rounds of ammunition for training USMC mortarmen. Table 6 is a comparison of USMC and OSUT programs of instruction.

The Marines produce their mortarmen by the use of traditional methods of mortar instruction, coupled with ample training time, and highly-qualified instructors. No startling innovations were noticed, nor were any high-technology training aids or devices used. The Marine Corps approach to mortar training is basically no different than that prescribed in the current U.S. Army FM 23-90, 81mm Mortar, of Feb 1972. The Marine Corps is developing a training program monitoring structure, similar to the Army Training and Evaluation Program (ARTEP) and Skill Qualification Testing (SQT) programs and uses a list of common training tasks. In fact, the tasks the U.S. Army currently lists for 81mm mortar training as part of the requirements for 11C skill levels 1 and 2 are being examined for acceptance by the U.S. Marine Corps Infantry Training School.

In summary, the high quality of the U.S. Marine Corps instruction is clearly based on the following factors:

Table 5

USMC Infantry Training School
81mm and 60mm Mortar Subjects

Subject Title	Hours	Live Fire
Introduction to 0341 MOS	2.0	
Introduction to M-53 Mortar Sight	2.0	
Care/Cleaning 81mm Mortar	1.0	
Crew Drill - 81mm Mortar	3.75	
Direct Lay/Crew Drill 81mm Mortar	3.5	
Ammunition and Fuzes	1.5	
Safety and Misfires	1.0	
Fire Commands	1.0	
Indirect Lay/Crew Drill	3.5	
Refer and Realign Aiming Stakes	3.0	
Type of Targets and Methods of Attack	3.0	
Crew Drill - 81mm Mortar	1.5	
Review of Indirect Lay	1.0	
Reciprocal Lay	3.0	
Review/Crew Drill - 81mm Mortar	3.5	
	34.25	
Pre-Qualification Gunner's Exam	4.0	
Review	3.5	
	7.5	
Qualification Gunner's Exam	5.0	
Retest	4.5	
	9.5	
Introduction to M-60 Mortar	1.5	
Ammunition and Safety	1.0	
M-64 Mortar Sight	1.0	
Boresighting	0.5	
Crew Drill - M-60 Mortar	1.5	
	5.5	
Field Firing - 81mm Mortar	8.5	20 Rds
Field Firing - 60mm Mortar	8.0	20 Rds
	16.5	
Examinations (written)		
1. Targets and Methods of Attack	1.0	
2. Crew Drill and Direct Lay	1.5	
3. Ammunition	1.0	
4. Mortar Comprehensive	2.0	
	5.5	
TOTAL MORTAR SPECIFIC	78.25	40 Rds

Table 6

Initial Entry Level Mortar Training

POI		OSUT	USMC
Total Hours		138	78.25
Crew Drill:	81mm	48	18
	4.2 inch	10	0
	60mm	10 (proposed)	1.5
Qualification: (81mm only)			
Pre-Qualification Exam		8	7.5
Gunner's Exam		8	9.5
Live Fire:	81mm	10 (4 Rds)	8.5 (20 Rds)
	60mm	0	8.0 (20 Rds)
FDC Procedures		8	0
Other Mortar-Related Subjects		46	25.25

- Highly skilled instructors.
- Sufficient training resources - ammunition, time, and instructors (low student-to-instructor ratios).
- Proven training procedures and practice.
- Training for a specific MOS.

United States Army Training (Institutional)

United States Army Infantry School (USAIS). This section addresses U.S. Army mortar training and is based on observations of institutional training conducted at USAIS and One Station Unit Training (OSUT). The analysis and review of these courses is presented sequentially by POI and in the order they are normally encountered by a soldier as he progresses through the various skill levels of mortar training. Currently, there are ten courses at USAIS and OSUT that include mortar training in their POIs. An overview of these training programs reveals that the Infantry Mortar Platoon Course (IMPC), Advanced Non-Commissioned Officers Course/11C Track (ANCOC), Basic Non-Commissioned Officers Course (BNCOC) and OSUT clearly present the most comprehensive instruction relating to mortar training (Table 7). The other course POI's range from 4 to 6 hours of instruction and serve only to present introductory and familiarization training.

All course POI's were reviewed for content and through a series of on-site observations and/or participation, each period of instruction was evaluated. Since nearly all institutional mortar training at the USAIS and OSUT is contained within four specific courses (OSUT, BNCOC, ANCOC and IMPC), they are the focus of this analysis. In addition, the mortar specific instruction presented in the 11C track of ANCOC is nearly identical to that of IMPC and both will be presented in a combined description.

Table 7

Distribution of Mortar Tasks
Across USAIS Programs of Instruction

Skill Level	OSUT	BNCOC	ANCOC	IMPC	RC OCS	IOBC	RC IOBC	IOAC	RC IOAC	IPCC
1	X		X	X						
2		X	X	X						
3		X	X	X						
4			X	X						
Other					X*	X*	X*	X**	X**	X**

* Introduction/Familiarization
** Review/Update

Appendix C presents all Soldier's Manual mortar tasks, POI of initial qualification, and other POI's/locations where tasks are trained or reinforced.

U.S. Army One Station Unit Training (Institutional). The purpose of mortar gunnery qualification (11C) at the U.S. Army Infantry School and Center One Station Unit Training (OSUT) is to make soldiers proficient at Skill Level One on the 81mm mortar gunner test and to familiarize them with the missions and organization of the mortar section, the characteristics of the 81mm and 4.2 inch mortars, and duties of the squad members.

To accomplish this, the course of instruction, as it is presented currently, is organized as follows:

Period		Hours
1	Conduct mortar gunner qualification	48
2	Conduct practice 81mm mortar gunner's test	8
3	Conduct 81mm mortar gunner's test	8
4	Perform crew tactical training (day and night) with a ground-mounted 81mm mortar	12
5	Perform basic operator maintenance on a mortar carrier	16
6	Perform crew tactical training (day and night) with a carrier-mounted 81mm mortar	10
7	Perform Fire Direction Center fundamentals	8
8	Engage targets with the 81mm mortar (live fire)	10
9	Perform as a member of a 107mm (4.2 inch) mortar crew	10
10	Perform as a member of a carrier-mounted 107mm (4.2 inch) mortar crew	8
		138

All training periods were observed a number of times, during which academic instruction, hands-on performance of the mortar tasks and live firing were conducted. It was determined by examination results that the instruction was meeting its objectives (Table 8, Results of Gunner's Exam).

A detailed look at the training disclosed that the established fundamentals of mortar gunnery were being taught as stipulated by the POI. The live firing was limited and served only to familiarize and introduce fundamental techniques. Crew drill, tactical training and mortar carrier operations provided valuable reinforcement and conceptual introductions. FDC instruction was introductory only (informational) and did not address detailed performance requirements.

At the present time, there are no specific guidelines or prerequisites for the selection of personnel attending mortar training in OSUT. Units are given a quota of 11Cs to train per cycle and the selection process is determined by the unit. Criteria most often considered, but not necessarily a determinant, are GT score, motor skills, aptitude, commander's subjective evaluation of trainee and course capacity.[4] During one period, 26 soldiers from a typical training company were observed, 15 of which were Regular Army (RA) and 11 National Guard. The training of this unit during the first week was consolidated with two other companies. Soldiers from this company had been identified and selected for mortar training one week prior to the 11C training start date.

The program of instruction for OSUT is intended only to produce a skill level one ammunition bearer. This is evidenced by the modified grading procedures (discussed later) and standards for award of 11C MOS. Although most students achieve minimum standards (73.8% of those observed), these procedures provide for a potential training burden at the unit level.

Period One consists of .5 hours of conference-type instruction, 1 hour of demonstrations, and 46.5 hours of practice exercises. This instruction is designed to teach the following gunner's examination tasks.

1. Place a ground-mounted 81mm mortar into action.
2. Lay mortar for large and small deflection and elevation.
3. Manipulate mortar for traversing fire.
4. Reciprocally lay mortar using M-2 aiming circle.
5. Refer sight and realign aiming posts.
6. Familiarization with the characteristics of the mortar and mortar squad (information only subject).

All the instruction is presented over a five-day period. Previous instruction is reviewed briefly each day and walk/talk-through demonstrations are presented for each required task. Practical exercises and crew drill are conducted under "timed" conditions and, where appropriate, a facilitating competitive atmosphere between students is employed. During this period of instruction, weapons are made available to the unit after duty hours to conduct reinforcement training of daily instruction and preparatory instruction for the next day's training. Tasks tested on the gunner's exam are certainly emphasized. In some units extra training is also scheduled for Saturdays and Sundays when possible.

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[4]Department of the Army, 1st Infantry Training Brigade Circular 350-23, Fort Benning, GA, 1 Aug 82.

Period Two instruction is devoted to the conduct of a practice 81mm mortar gunner's exam. Each student participates in a practice 81mm mortar gunner's exam. The practice exam is identical to the qualification gunner's exam which is presented the following day. This practice exam takes an average of 4 hours to conduct (varies depending on the number of students). The remaining 4 hours of training are devoted to reinforcement training at the stations (tasks) where the students were noted earlier to be most deficient. This additional instruction includes a critique of the practice exam and a review of all mortar procedures and practical work.

Period Three requires the students to qualify as gunners with the 81mm mortar. In order to qualify, the student will meet one of the following three standards:

Qualification	Score	Percent
Expert Gunner	180	90
1st Class Gunner	160	80
2nd Class Gunner	140	70
(Unqualified) Less Than	140	70

The examination is divided into six stations or testing steps, as described below. Each step is performed twice. Each student carries his scorecard (DA Form 2187-R) from station to station for recording performances. The examiner at each station makes appropriate entries in ink or indelible pencil on the student's scorecards as they complete the requirement(s) for the station.

Station 1 - Mounting the Mortar; scoring as follows:

(a) No credit is given when the:

1. Time exceeds 90 seconds.

2. Sight is not set correctly for deflection (3200)- and elevation (1100).

3. Mortar is not correctly laid for elevation (the elevation bubble is not centered).

4. Mortar is not cross-leveled.

5. Vertical line of the sight is more than 2 mils off the left edge of the direction stake.

6. Traversing mechanism is more than two turns to the left or right of the center position.

7. Barrel is not locked to the baseplate.

8. Baseplate is not positioned correctly in relation to the baseplate stake.

(b) When the mortar is laid correctly within the prescribed limits, credit is given as follows:

Time in Seconds	65 or Less	66-70	71-75	76-80	81-85	86-90
Credits (points)	20	18	16	14	12	10

Total possible score (two trials) = 40

Station 2 - Small Deflection and Elevation Change; scoring as follows:

(a) No credit is given when the:

1. Time exceeds 35 seconds.
2. Sight is not set correctly for deflection or elevation.
3. Mortar is not correctly laid for elevation.
4. Mortar is not cross-leveled.
5. Vertical line of the sight is more than 2 mils off the left edge of the aiming posts.

(b) When the mortar is laid correctly within the prescribed limits, credit is given as follows:

Time in Seconds	20 or Less	21-23	24-26	27-29	30-32	33-35
Credits (points)	15	13	11	9	7	5

Total possible score (two trials) = 30

Station 3 - Referring the Sight and Realigning Aiming Posts; scoring as follows:

(a) No credit is given when the:

1. Time exceeds 75 seconds.
2. Traversing handwheel is turned before the aiming posts are realigned.
3. Sight is not set correctly for deflection or elevation.

4. Vertical line of the sight is more than 2 mils off the left edge of the aiming posts.

5. Traversing mechanism is more than two turns to the left or right of the center position.

6. Mortar is not correctly laid for elevation.

7. Mortar is not cross-leveled.

(b) When the mortar is laid correctly within the prescribed limits, credit is given as follows:

Time in Seconds	60 or Less	61-63	64-66	67-69	70-72	73-75
Credits (points)	15	13	11	10	7	5

Total possible score (two trials) = 30

Station 4 - Large Deflection and Elevation Change; scoring as follows:

(a) No credit is given when the:

1. Time exceeds 60 seconds.

2. Sight is not set correctly for deflection or elevation.

3. Mortar is not correctly laid for elevation.

4. Mortar is not cross-leveled.

5. Vertical line is more than 2 mils off the compensated sight picture.

6. Traversing mechanism is more than two turns to the left or right of the center position.

(b) When the mortar is laid correctly within the prescribed limits, credit is given as follows:

Time in Seconds	35 or Less	36-40	41-45	46-50	51-85	56-60
Credits (points)	20	18	16	14	12	10

Total possible score (two trials) = 40

Station 5 - Reciprocal Laying; scoring as follows:

(a) No credit is given when the:

1. Time taken exceeds 1 minute 55 seconds.

2. Sight is not set correctly for deflection.

3. Elevation bubble is not centered.

4. Cross-level assembly bubble is not centered.

5. Vertical line of sight is more than 1 mil off the center of the head of the aiming circle.

(b) When the mortar is laid correctly within the prescribed limits, credit is given as follows:

Time in Seconds	65 or Less	66-70	71-75	76-80	81-85	86-90	91-95	95-100	101-105	106-110	111-115
Credits (points)	15	14	13	12	11	10	9	8	7	6	5

Total possible score (two trials) = 30

Station 6 - Manipulation for Traversing Fire; scoring as follows:

(a) No credit is given when the:

1. Time exceeds 80 seconds.

2. Student fails to command FIRE for each round.

3. Sight is not set correctly for elevation.

4. Student does not cross-level before firing each round.

5. Mortar is not cross-leveled after firing last round.

6. Mortar is laid in error more than 20 mils. The error magnitude is checked by the testing officer by traversing back and cross-leveling. The command given the students is 3 turns (and four rounds). The total number of turns taken by the student should be 9. Therefore, the mortar is traversed back 9 turns, cross-leveled, and checked to determine the number of mils the vertical line is off the left edge of the aiming posts.

(b) When the misson has been fired correctly within the prescribed limits, credit is given as follows:

Error in Mils	0-4	5-8	9-12	13-16	17-20
Credits (points)	15	13	11	10	7

Time in Seconds	55 or Less	51-60	61-70	71-80
Points cut according to time used for requirements	0	2	4	6

The score is computed by giving credit according to magnitude of mil error and then cutting points appropriate to the time a student uses for the requirement (Example: a 7-mil error in 60 seconds equals 13 points credit minus 2 points cut for time; or, 11 points in that trial). Total possible score (two trials) = 30.

Procedures for scoring the gunner's exam and subsequent award of the 11C mortarmen MOS are modified by the OSUT Program of Instruction. These modifications make it possible for a student to score as low as 36 points out of 200 and still be awarded the 11C MOS. Essentially all that is required is that the student must perform each event correctly to score within the maximum time allowed on at least one trial for each event on the exam.

Students failing to qualify are authorized to take an immediate retest (same day) on a maximum of two events. Those soldiers failing the retest may be retrained by the unit, or may be recycled based on the commander's evaluation. Individuals failing subsequent retests will be considered for reclassification or elimination. Once the soldier has qualified on the gunner's exam he moves on to advanced mortar training.

The purpose of this advanced mortar training is to teach the soldier selected gunnery techniques with infantry mortars, while reinforcing previously learned skills and to familiarize the soldier with the composition and functioning of the indirect fire team, basic FDC procedures, organization and employment of mortar units, as well as use of the M1 Sabot training device.

During Period Four, day and night crew tactical training with a ground-mounted 81mm mortar is presented. Students learn to move as members of a dismounted mortar squad, maintain an 81mm mortar and associated fire control equipment, boresight the 81mm mortar, perform crew duties, perform safety checks on a 81mm mortar, remove a misfire from the 81mm mortar, construct a mortar position, camouflage a mortar firing position, and prepare 81mm mortar ammunition for firing. Next, the students are familiarized with the organization of the mortar platoon (section) and methods of displacement. Finally, duties of the platoon advance party are presented.

During Period Five, students learn to perform basic operator maintenance on a mortar carrier. This period of instruction is currently being changed to common subjects and will no longer be taught as part of the 11C course.

Period Six instruction is devoted to performance of crew tactical training (day and night) with a carrier-mounted 81mm mortar. Students learn to place a carrier-mounted 81mm mortar into action, remove a misfire from the 81mm mortar (carrier-mounted), and to perform crew duties.

During Period Seven, students learn and perform fundamental fire direction center procedures. Specifically, they learn to prepare an M16 plotting board for operation on an observed chart and determine initial firing data for mortars (pivot point). Next, procedures for processing subsequent FO corrections using an M16 plotting board (pivot point) are presented. Finally, students are familiarized with the organization and duties of the Fire Direction Center (information subject).

Period Eight is a range exercise for the live-fire engagement of targets with the 81mm mortar. Students are divided into three groups and they are then rotated through stations to perform crew duties during live firing, engage targets using fire without an FDC (direct lay), operate as members of a Fire Direction Center, and to perform basic FO procedures. During this exercise, students are familiarized with the duties of an FO and his radio operator, the elements of a call for fire, method of target location, radiotelephone procedures used by the FO/FDC team, and use of the bracketing method of adjustment. Finally, students participate in an End of Block Test measuring their ability to prepare 81mm mortar ammunition and perform safety checks on an 81mm mortar (ground-mounted).

During Period Nine, students perform as members of 107-mm (4.2 inch) mortar crew. During this period, they learn how to ground mount a 4.2 inch mortar, refer sight and realign aiming posts, reciprocally lay a 4.2-inch mortar using an M-2 aiming circle and place out aiming posts, manipulate a 4.2-inch mortar for traversing fire (ground-mounted), perform safety checks, lay a 4.2-inch mortar for deflection and elevation (ground), prepare 4.2-inch mortar ammunition for firing, and remove a misfire from a 4.2-inch mortar (ground-mounted).

In the final period, students perform as members of a carrier-mounted 107mm 4.2-inch mortar crew. During this period, students learn procedures necessary to place a carrier-mounted 4.2-inch mortar into action, remove a misfire, boresight a carrier-mounted 4.2-inch mortar, perform operator maintenance, and perform crew duties. Finally, students participate in an End of Block Test measuring their ability to prepare 4.2-inch mortar ammunition for firing, place a carrier-mounted 4.2-inch mortar into action, and lay a 4.2-inch mortar for deflection and elevation.

The course of this research has included as part of the observations of the USAIS OSUT mortar training and the USMC Infantry Training School mortar training the opportunity to compare performances which have not been possible in past related training effectiveness analyses. Observations of U.S. Army

and U.S. Marine Corps training programs for rifle and M60 machinegun have shown that they differed in sufficient respects to make direct comparisons very difficult. However, mortar training for the initial entry soldier, or Marine, is much the same. This is at least true in terms of 81mm preparation for the gunner's qualification examination. The USAIS program and that of the USMC differ in other portions of training but a comparison of the results of 81mm qualification testing is reasonable and provides some meaningful comparison of program effectiveness for the initial entry mortarman. Table 8 shows the mean scores for both the preliminary, or practice gunner's qualification testing and final qualification for five classes of USAIS OSUT 11C students (N=126) and six classes of USMC 0341 students (N=191). The scores do not reflect retesting performances since the manner in which this is accomplished differs between service schools.

Table 8

Mean Performance of OSUT and USMC
Gunner's Qualification (81mm Mortar)

Class	N	Pretest $\bar{X}$ Score	Qualification $\bar{X}$ Score	Score $\bar{X}$ Increase	Number Retested	Passed Retest
OSUT A	31	127.84	148.00	20.16	10	9
OSUT B	25	132.04	134.68	2.64	6	5
OSUT C	24	145.42	150.75	5.33	7	7
OSUT D	20	128.55	170.00	41.45	1	1
OSUT E	26	177.85	180.69	2.84	2	2
	126	142.45	156.12			
USMC A	33	99.42	133.55	34.13	20	17
USMC B	30	141.47	171.97	30.50	-	-
USMC C	36	133.11	172.08	38.97	-	-
USMC D	36	120.22	170.28	50.06	3	3
USMC E	35	104.22	151.49	46.75	-	-
USMC F	21	115.05	153.29	38.24	4	4
	191	118.99	159.23			

As Table 8 shows, there is typically a greater margin of improvement in the mean performance scores for the Marine students than there is for the OSUT

students. This is accounted for in part by the structure of the USMC Infantry Training School. The instructors have fewer students each, and they stay with one class at a time. While class sizes appear to be similar, the OSUT Center may have numerous classes in training at one time while only one is in session at a time at Camp Lejeune, NC. The additional practice hours available before testing at OSUT appear to account in large part for the initial comparatively high scores on the practice qualification test. The USMC instructors make up for this differential practice performance deficit on the part of their students by focusing individual attention on those with poor performances. This attention at this point is apparently effective and is represented by the increase shown in the class mean on the qualification examination.

There are very few differences in the testing procedures used by the two service schools to qualify gunners. At least in terms of 81mm mortar preparation for the gunner's examination that is. Both follow the same training objectives and use the same time limits during the administration of the qualification examination. Observation of testing at both schools revealed minor differences which might contribute to better performance scores on the USMC tests, though not significantly. The USMC scorers do not start timing the examinees who must set-up the mortar at exactly the same point in the process as do the OSUT scorers. This is a very minor point since it is a matter of having to undo a chain around the stowed mortar bipod for the U.S. Army test and having the chain already free in the U.S. Marine Corps test. Much greater differences have been observed during U.S. Army ARTEP testing of different units on the same post.

It has been mentioned that retest scores were not included in the qualification means. The OSUT students may retest and qualify (score more than 140 points) or simply perform each task correctly and not qualify because of exceeded time limits, but complete the course. The objective of the course is to produce a trained ammunition bearer. The USMC students must score 140 points in order to not only qualify but to receive the 0341 MOS. If they do not, they are either retested, recycled, or given a different MOS. The objective of this program is to produce qualified gunners, not ammunition bearers. Retesting for OSUT produces either a score of 140 or better qualification, or a GO/NO GO course pass. The USMC result is a score of exactly 140, or a NO GO (MOS change, or recycle).

Additional information, primarily through observation and discussion with instructors, was available on two of the classes from OSUT (N=56) and on two from the USMC Infantry Training School (N=63) which allowed a statistical comparison to be made of their performances (see Table 9). A t-test for differences between two independent means yielded no significant differences between the groups tested ($\underline{t} = 1.73$, $\underline{df} = 117$, $p < .10$). In terms of the measured performances relative to 81mm mortar training the two schools are producing similar graduates. The remaining training and the associated objectives do differ as reported in other sections of this report.

TABLE 9

t-Test and Mean Results for
OSUT and USMC Gunner Qualification Testing

	N	Pretest Performance	Qualification Performance
OSUT	56	$\bar{X}$ = 129.71 SD = 28.42	$\bar{X}$ = 142.05 SD = 27.22
USMC	63	$\bar{X}$ = 119.44 SD = 38.87	$\bar{X}$ = 151.84 SD = 33.78

$t = 1.73$, $df = 117$, $p < .10$ (NSD)

BNCOC (USAIS). The Basic NCO Course/Combat (BNCOC) Arms 11C Track was observed by ARI/Litton Mellonics at Fort Benning, Georgia during the period 10 February 1983 through 4 March 1983. The purpose of this course is to develop a section leader who is a weapons system/equipment expert competent in 11C Skill Level 3 critical tasks who can lead, supervise, and train subordinates to maintain, operate and employ their weapon/equipment. Additionally, the course seeks to develop a skilled non-commissioned officer who can train and lead his subordinates in the proper application of cover, concealment, suppression, and teamwork; give and supervise the execution of the necessary orders/instructions so that the squad/section/crew can perform effectively its collective (ARTEP) missions.

The core POI is divided into three overlapping phases. Phase I of the course is devoted to diagnostic testing, Battalion Training Management System (BTMS), Trainers Workshop (TW), Leadership, and Methods of Instruction (MOI). Phase II consists of 11C critical tasks, and Phase III is devoted to collective tactical training and end-of-course comprehensive testing.

The first portion of Phase II is a 55-hour block of instruction on 81mm mortar FDC operations. This block of instruction is taught in a classroom environment and teaches the student how to use the M16 plotting board to produce firing data for Level 1 ARTEP missions. During each period of instruction, the student is given extensive practical exercises and is evaluated at the end of each period.

During the first period, the students are introduced to the M16 plotting board and are talked through setting up and observed firing charts using the pivot point method. This includes practical exercises emphasizing reading the board's vernier scale and measuring ranges. The students then progress to the modified observed firing chart with emphasis on building speed and accuracy. The surveyed firing chart and the registration mission are taught next. Practical exercises are conducted on the individual phases of the mission as well as on the complete process.

Next, the firing data sheet and the conduct of the re-registration is covered with emphasis on determining and applying re-registration firing corrections. Following this period, the students are introduced to meteorological (MET) messages, and are talked through recording MET messages as well as computing MET corrections.

During the next period of instruction, the final protective fire (FPF) mission and battlefield illumination are covered.

Finally, during the last eight hours, the coordinated illumination-high explosive mission, the quick smoke mission, and the suppressive fire missions are covered.

The last two hours of this block of instruction consist of a review of 81mm mortar FDC Procedures with a modest emphasis on those tasks that are to be evaluated during the end of course comprehensive test.

The second portion of Phase II is a 15-hour block of instruction on 107mm mortar FDC operations. During the first day, the students are introduced to the fire direction equipment for a 107mm mortar and talked through a registration, re-registration, and MET message. The second day, the students are talked through FPF, illumination, coordinated illumination, and quick smoke missions.

Phase II of the course is completed with a 32-hour mortar Field Training Exercise (FTX). This FTX teaches the students the leadership skills necessary for the smooth operation of a mortar section in the field. Additionally, previously learned skills are practiced in a simulated tactical environment. During the first two hours, the students are talked through troop leading procedures, supervision of occupation of mortar position, laying the mortar for direction with both the M2 compass and M2 aiming circle, as well as mounted navigation. The remainder of the time is devoted to issuing operations orders and fragmentary orders (FRAGOS) requiring the students to quickly move to new positions, occupy and prepare to fire simulated ARTEP missions. Throughout the day, leadership positions are rotated to give each student a chance to develop his leadership skills. During the last hour of the FTX, a final critique of the exercise is conducted.

Finally, a four-hour end-of-course comprehensive test is given. This test is an SQT-style hands-on evaluation of the student's ability to perform critical FDC tasks for both the 81mm and 107mm mortars.

The first two hours, the student is given a situation which will call for him to set up an M16 plotting board, produce and record firing data for a registration mission as well as record a meteorological (MET) message. During the last two hours, the student is given a situation which requires him to set up a firing chart as well as to produce record firing data for a registration mission.

This POI became effective for the 6 Jan 1983 11C course at Fort Benning. Currently, a new 11C POI is being staffed for approval (May 1983). The major changes in the new POI are the deletion of some Skill Level 2 Land Navigation tasks, the meteorological messages for both the 81mm and 107mm mortars, re-registration mission, and determining data for the 4.2-inch mortar using the M16 plotting board and graphical firing scale. In addition to adding Skill Level 3 tasks, one Skill Level 2 task was also added which was "compute data for FPF using a firing chart." The field training exercise was also reduced to 24 hours from 32 hours. Because of the high attrition rate for the 11C BNCOC track (35% Army-wide in 1981 to almost 39% in 1982, Table 11), the prerequisite to take and pass the Test of Adult Basic Education (TABE) Level D at the ninth-grade level has been implemented.

Although the purpose of the BNCOC course 11C track is to develop a section leader who is competent in Skill Level 3 critical tasks, the apparent lack of training in the units has required placement of heavy emphasis on Skill Level 2 tasks. In a recent interview with the proponent department at USAIS, it was learned that because of the lack of qualified 11C students capable of performing Skill Level 2 FDC tasks, USAIS has received verbal permission from TRADOC to retain Skill Level 2 FDC tasks in the 11C POI.

The BNCOC course observed at Fort Benning started with five students. One student was eliminated at the start of the program for administrative reasons. Another, a bonus extension and retraining (BEAR) trainee, was eliminated for academic reasons.

End-Of-Course Comprehensive Test (EOCCT). Critical tasks which will be used to make up a performance-oriented EOCCT for each BNCOC/CA 11C class are shown at Table 10. The intent is that each NCOA will select as a minimum 15 of the 33 tasks each cycle for testing. Since these tasks were previously trained, the student must, as a minimum, attain a GO on 70 percent in order to be declared a graduate. The end-of-block test will continue as a measure to determine whether an individual remains in the course. Any soldier not passing the EOCCT will be declared a non-graduate and will be processed as an academic failure IAW AR 351-1. DA Form 1059 will be completed IAW AR 623-1 and the commander furnished a list of tasks completed. Add-on subjects will not be tested on the end-of-course comprehensive test.

Table 10

End-Of-Course Comprehensive Test Subjects

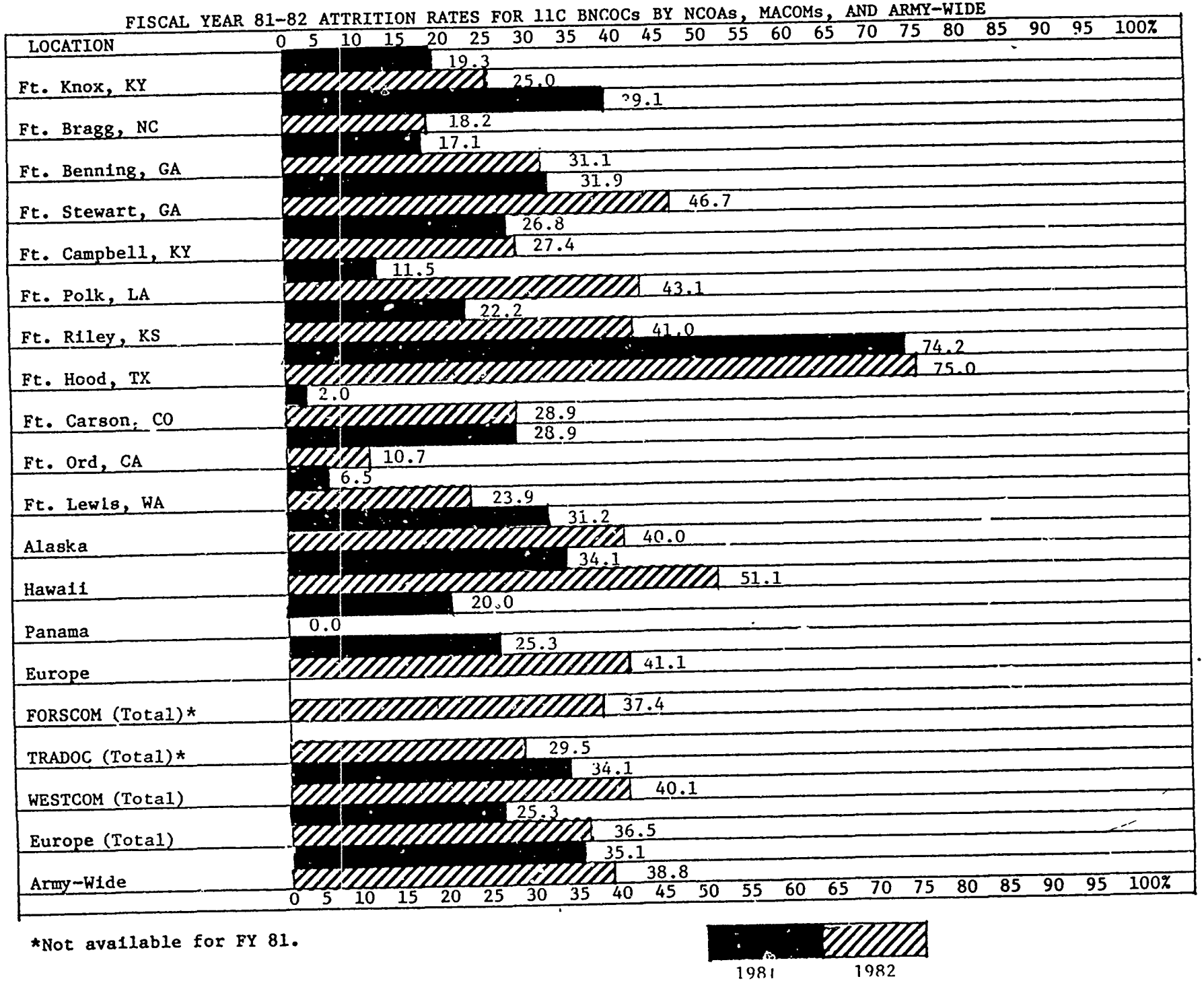
Task	Skill Level
Locate an unknown point on a map or on the ground by intersection	3
Locate an unknown point on a map or on the ground by resection	3
Declinate M2 aiming circle	3
Assist unit commander in the preparation of the indirect fire support plan	3
Prepare target lists, fire plans, and overlays	3
Prepare an FDC order (81mm mortar)	3
Prepare an FDC order (4.2-inch mortar)	3
Conduct troop-leading procedures for an operation	3
Prepare M16 plotting board for operation as an observed chart and determine initial firing data for mortars (pivot point)	2
Process subsequent forward observer (FO) corrections using M16 plotting board	2
Prepare M16 plotting board for operation as an observed chart and modified observed chart	2
Process subsequent FO corrections using M16 plotting board as a modified observed chart	2
Determine data for sheaf adjustments for M16	2
Determine data from re-registration and application of corrections for 81mm mortar	2
Record information on firing data sheet (81mm mortar)	2
Determine firing corrections	2
Record meteorological (MET) data using MET data sheet (81mm mortar)	2
Determine and apply MET firing corrections (81mm mortar)	2
Compute data for final protective fire using M16 plotting board	2
Compute data for coordinated illumination mission using an M16 plotting board	2

Table 10 (Continued)

End-Of-Course Comprehensive Test Subjects

Task	Skill Level
Prepare a firing chart for operation and determine initial firing data	2
Process subsequent FO corrections using the firing chart	2
Determine data for sheaf adjustments (107mm)	2
Determine data from re-registration and application of corrections to FDC equipment	2
Record information on firing data sheet (4.2-inch mortar)	2
Apply registration corrections to the fire control equipment for 4.2-inch mortar	2
Determine data for a 4.2-inch mortar using the M16 plotting board and graphical firing scale	2
Record meteorological (MET) data using MET data sheet (4.2-inch mortar)	2
Determine and apply MET firing corrections	2
Compute data for final protective fire using a firing chart	2
Compute data for illumination mission using a firing chart	2
Compute data for coordinated illumination mission using a firing chart	2

FISCAL YEAR 81-82 ATTRITION RATES FOR 11C BNCOCs BY NCOAs, MACOMs, AND ARMY-WIDE



*Not available for FY 81.

Table 11 - BNCOC Attrition

Infantry Mortar Platoon Course (USAIS). The Infantry Mortar Platoon course is approximately six weeks in duration and is designed to train mortar platoon leaders and platoon sergeants in all technical aspects of mortar gunnery and mortar indirect fire team operations. In addition, the course prepares the student to perform leadership and supervisory duties while conducting unit training, fire support planning, and tactical combat operations and fire support missions. To accomplish these objectives, the course is organized to present the following major segments of instruction:

Table 12

Infantry Mortar Platoon Course Subjects

Title	Hours
Mechanical Training	38
Forward Observation Procedures	22
Fire Direction Center Procedures (81mm)	54
Field Firing Exercise (81mm)	10
Fire Direction Center Procedures (107mm)	56
Field Firing Exercise (107mm)	10
Training Devices and Mortar Fire Without Fire Direction Center	4
Tactical Employment	5
Tactical Exercise Without Troops (TEWT)	10
Fire Support Planning	2
Fire Support Coordination	1
Firepower and Maneuver	1
Communications	1
	214

The mechanical training is divided into four distinct periods of instruction and is designed to teach 34 individual tasks. Each major segment is presented in conference-type instruction followed by demonstrations and practical exercises. An instructor-student ratio of 1:9 is maintained.

In Period One (8 hours), the student is taught to identify the nomenclature and characteristics of the 81mm and 107mm (4.2-inch) mortars. Next, mounting the mortars and supervision of mounting is presented in conjunction with placing the ground-mounted mortar into action and getting them ready for firing. This is followed by instruction on the performance of safety checks on both mortars and how each mortar is correctly boresighted. The final task taught includes the proper procedures for removing misfires from each mortar.

In training Period Two (14 hours), procedures for mounting and leveling the M2 aiming circle, declinating the M2 aiming circle, and calibrating the M53 mortar sight for deflection using the M2 aiming circle are presented. Next, students learn the procedures required to reciprocally lay the mortar section with the M2 aiming circle and how to properly place out aiming posts. Instruction is concluded with procedures to reciprocally lay a mortar section using the M53 mortar sight and techniques and procedures for properly employing night lighting devices with mortars.

Period Three (8 hours) consists of procedures for reciprocally laying mortars using the End of Orienting Line (EOL) methods, declination of the M2 compass, calibrating the mortar sight for elevation and laying the mortars for direction using the M2 compass. This is followed by training to make small and large deflection and elevation changes. Next, the student is taught to refer the sight to a designated setting and to realign aiming pasts. Finally, manipulation of the mortar for traversing fire and searching fire missions is presented.

The final period of mechanical training (8 hours) is dedicated primarily to carrier-mounted mortars. Instruction is presented on procedures to reciprocally lay carrier-mounted mortars, perform safety checks, remove misfires, lay the mortars for deflection and elevation, and lay the mortars for direction using the M2 compass. Next, the student is taught the breakdown and positioning of ammunition for vertical and horizontal ammunition racks and compartments for the M106 (81mm) and M125 (107mm) mortar carriers. The remainder of this period is designed to familiarize each student with ammunition, fuze combinations, and charge preparations. Students are also given an orientation for Soviet mortars and the counter fire battery and counter mortar radar-threat. Finally, instruction is presented on the characteristics, nomenclature, implementation and organization for the M224 60mm lightweight company mortar.

At the completion of mechanical training, students are administered a 10-station, 10-event mechanical training/gunner's examination. The examination is a hands-on performance-type examination covering all tasks and procedures taught. Students are graded on their ability to perform the tasks and procedures within a specified allotment of time. Students must attain an overall rating of 70% to successfully pass the examination. Those failing to attain a satisfactory score are provided after-duty instruction and are re-tested at a later date.

The next major segment of instruction is Forward Observation (FO) procedures and a live fire practical exercise. The purpose of this training is to provide the student with a basic knowledge of forward observer procedures. Eighteen hours are devoted to teach 12 individual tasks.

During the classroom portions of this instruction, students first learn to identify the six elements of a call for indirect fire. Next, instruction is presented on procedures for locating a target using the grid coordinates method, shifting from a known point and the polar coordinates method. This is followed by forward observation procedures necessary to conduct a registration mission, adjustment of final protective fires (FPF), quick and immediate smoke, and battlefield illumination. The live fire portion of the FO instruction requires students to rotate between a gunner station and an observer station. While at the observer station, the student will use the procedures and techniques learned in the classroom. Specifically, each student must call for and adjust indirect fire on targets determined using grid coordinates, shift from a known point and polar plot methods. Finally, the student is required to call for and adjust quick and immediate smoke, final protective fires, and battlefield illumination missions.

The final period of forward observation procedures is a two hour written multiple-choice type examination. The examination is designed to test the student's ability to call for and adjust indirect fire for the various missions, using the proper techniques and procedures. A minimum score of 70% is required to successfully pass the examination. Those failing to attain minimum standards receive additional after-duty instruction and a retest.

Tactical employment of mortars is the basis for the next segment of training. This is followed by a tactical exercise without troops (TEWT) and classroom instruction on artillery operations, fire support coordination, and firepower and maneuver. Twenty-two hours are allotted to teach, practice, and examine 10 individual tasks.

Tactical employment of mortars is presented to provide the student with a general knowledge of the fundamentals of mortar platoon employment. This instruction consists of planning missions for a mortar platoon/section, selection of positions (primary, alternate, and supplementary), selection of movement routes and displacement of a mortar platoon. Students work situational exercises using tactical maps and terrain models. Following the classroom instruction, the students conduct a tactical exercise to apply the principles and techniques learned. During the exercise, students physically move over the terrain and with the use of maps and actual reconnaissance identify missions, select positions and routes, issue oral operations orders, direct displacement of mortar elements, and supervise establishment of security.

Artillery operations are presented to provide the student with a basic understanding of artillery missions and the integration of mortar fire into the overall fire support plan. Emphasis is placed on the planning of offensive fires and planned fires in the defense. Fire support coordination and maneuver instruction has the objective of teaching the necessary coordination required to insure the most expeditious delivery of fire support, while at the same time protecting friendly troops and maximizing effects on the enemy.

The next training segment is presented to teach the student procedures and techniques of firing mortars without the assistance of fire direction center (FDC). The student also receives instruction on mortar fire simulation training devices. Four hours is devoted to teach five (5) individual tasks.

Instruction is presented at a range location and students engage targets using the 81mm mortar in the direct alignment/direct lay method without using an FDC. Students also engage targets with the 60mm M224 mortars, using the weapon in the handheld mode. Next, the students receive instruction and employ the Bryant, 60mm subcaliber, pneumatic, and Sabot training devices to engage targets and gain a better understanding of mortar training devices, techniques of employment, and integration of the devices into unit training programs.

The final four weeks of this course are devoted, almost exclusively, to instruction covering the tasks performed by the computer personnel in the fire direction center. This major segment is divided equally between procedures for the 81mm and 107mm mortars. Two live fire exercises are conducted to reinforce the classroom instruction. Approximately 130 hours of instruction are allocated to teach 34 individual tasks. A total of four examinations are administered to measure student learning, and are scheduled to coincide with increase in the degree of difficulty of the instruction. The examinations are situationally oriented and require the student to demonstrate his ability to perform all computer tasks for all missions on both mortars. A minimum score of 70% is required to successfully pass each examination. For those failing to achieve minimum standards, additional after-duty instruction and re-testing is provided.

Fire Direction Center Procedures I and II concentrate on the 81mm mortar. During Procedures I, instruction is presented on the use of the M16 plotting board as an observed, modified observed, and surveyed firing chart. Students also learn to record ballistic meteorological (MET) messages, determine and apply MET and registration corrections and develop appropriate range safety data. Instruction is presented situationally and students are required to manipulate the plotting board and use associated equipment. Training periods are reinforced with team drills. These drills require the student to perform techniques and procedures taught previously. During team drill exercises, students are allowed to work together and instructor personnel are available to provide needed assistance. Following this period, a performance exam is administered.

Procedure II is a continuation of instruction on fire direction center procedures for the 81mm mortars. During this period, instruction is presented on computation of firing data for area targets, illumination missions, split section operations, final protective fires and smoke missions. Instructional format is the same as Procedure I with students conducting step-by-step plotting board manipulation under the direction of instructor personnel. Reinforcement instruction is accomplished through the use of team drills. After this period of instruction, a live-fire exercise is conducted and it is followed by a performance examination.

Fire Direction Procedures III and IV concentrate on the 107mm mortar. During Procedure III, instruction is presented on use of the Graphical Firing Fan (GFF) and the construction and use of the observed, modified observed, and surveyed firing chart. Students also learn to record MET messages, determine and apply MET and registration corrections, and develop appropriate range safety data. Instructional format, student participation and team drill exercises are the same as for Procedures I and II. Following this period, a performance exam is administered.

Procedure IV is a continuation of Procedure III. During this period, students learn to use the M16 plotting board and the GFF in computing firing data for the 107mm mortar. Students are taught to compute firing data for illumination, smoke and final protective fire missions. Instruction is also presented on how to conduct split section operations and attitude missions. A live fire exercise is conducted after this period and is followed by a written performance examination.

The IMPC Course has consistently met its training objectives by producing a high percentage of graduates (96.2%, average) per class. The skills taught are complex and highly perishable; however, class averages for all instruction indicate effective training (Table 13). At the present time, however, there is no mechanism to assure that graduates of this course will be used in positions for which they have been trained. Surveys have indicated that as many as 23% of IMPC graduates were not assigned to mortar-related positions.

All of the instruction presented during this course reflected a high professional standard. The officer and enlisted instructors were all graduates of the IMPC course and many had several years experience as instructors and as members of mortar units.

The mechanical training portions assumed a certain level of experience and as such were presented at a quick pace. Any detriment that this may have caused to less experienced students was offset by the quality of instruction and ample opportunity for individual practical work.

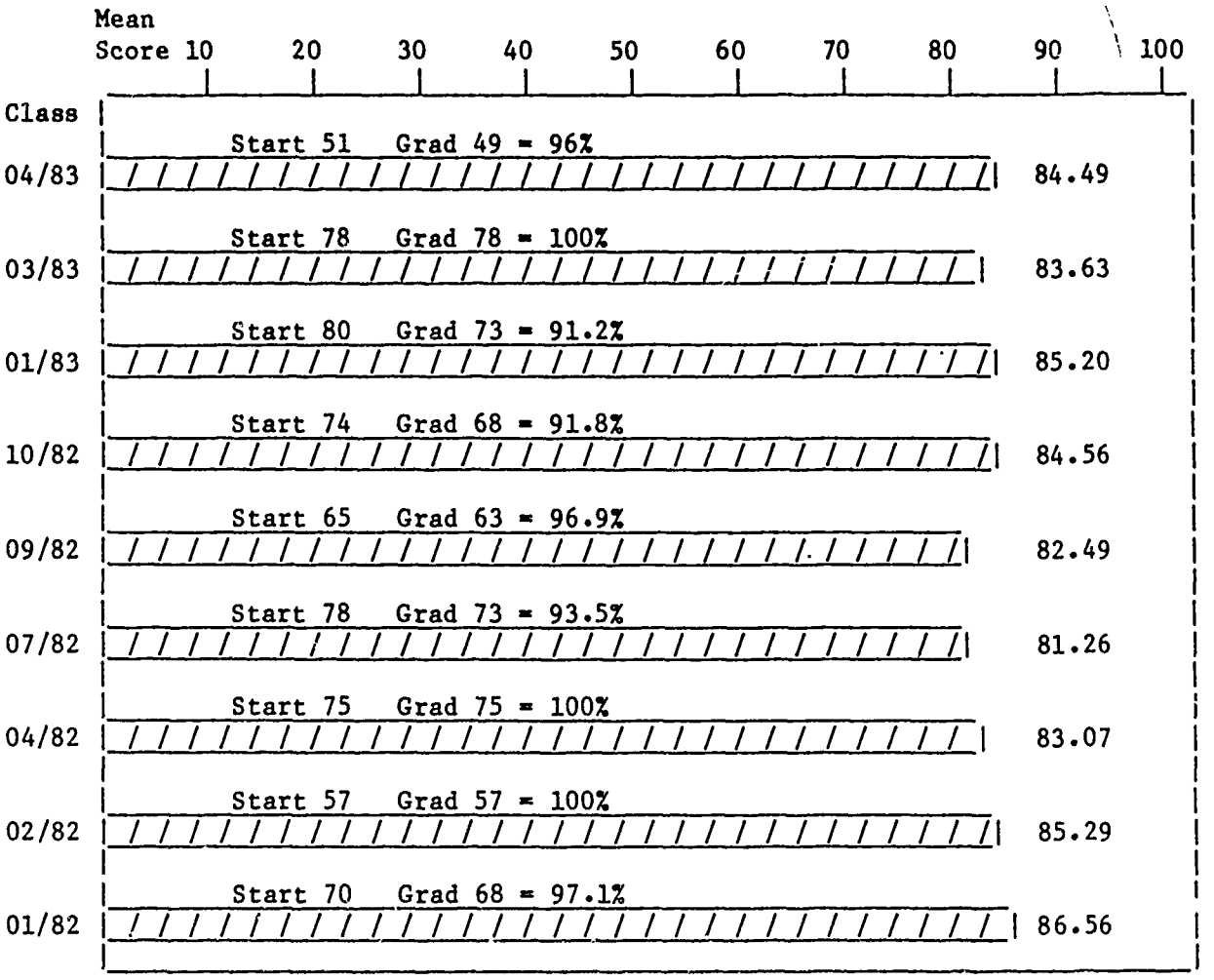
Although the call for and adjustment of mortar fire is the responsibility of the artillery FIST team, there is a requirement for mortar team members to understand call and adjustment procedures. The forward observation procedures portion of this course provided comprehensive instruction and appropriate practical work.

The tactical employment portion of this course is designed only to teach fundamental principles and techniques. When viewed from that perspective, it was effective.

The FDC portion of this course is very comprehensive and presents detailed instruction on all FDC computer tasks. One task not taught in this course, or any other institutional course, is Mean Point of Impact (MPI) registration. This is noteworthy in that MPI registration is a graded, ARTEP task.

Table 13

Mean Performances of Nine IMPC Classes



Two different systems for computing firing data are taught in this course, the M16 plotting board and the Graphical Firing Fan (GFF). The course instruction demonstrates that either one could be used for both mortars. Adoption of a single procedure could eliminate a sizeable training burden for both the students and the instructional staff.

No instruction was offered pertaining to mortar fire control calculators. This is noteworthy in view of the finding by Weapons Crew Training Test that although most units have the TI-59 Mortar Fire Calculator, it was rarely used due primarily to inadequate training of operators and their hesitancy to experiment with it on their own.

Infantry Officer Basic Course (IOBC), IOBC Reserve Component and Officer Candidate (OCS)/Reserve Component (USAIS). The goal of these courses is to teach the students the fundamental aspects of mechanical training for infantry mortars. A total of four hours is allotted for this instruction. The intent is to train students to have a working knowledge of placing mortars into action and to conduct necessary safety checks and misfire procedures.

Examination of this instruction is incorporated into a general section for all infantry weapons.

Infantry Officers Advanced Course (IOAC) and IOAC Reserve Components (USAIS). The intent of this instructional block for the IOAC course is to provide students with a working knowledge of mortar maintenance requirements and paperwork, safety checks, misfire procedures, safety diagram and safety card. Additionally, students must be able to verify the lay of a mortar section and know what size targets can be engaged with mortars and the type and characteristics of ammunition that are available to engage those targets. Prior to receiving classroom instruction, students are required to complete programmed texts ST 23-90-7 and ST 23-90-8 which are used to teach safety checks, misfire procedures, target engagement, training devices, ammunition, organic elements of mortar units and levels of training for 11C soldiers. Four hours are allotted for this instruction.

Infantry Pre-Command Course (IPCC, USAIS). During IPCC, four hours are devoted to general mortar subjects. The purpose of this block of instruction is to present an overview and update of mortar subjects and the characteristics of U.S. and threat offensive and defensive considerations. The material presented emphasizes doctrine and tactics at the battalion level.

Institutional training at the USAIS is extensive in its scope and its targeted student population. As noted, improvements can be made in those areas which currently require duplicate methods of data plotting (IMPC, ANCOC) and where training is missing, i.e., FDC Skill Level 2 training. The requirement for Mean Point of Impact mission ARTEP testing is not supported by training. This may not be a viable mission in a high intensity conflict. This consideration of practical task completion must be applied to meteorological data use as well.

The proof of institutional training effectiveness can be found, in part, in the methods used by units in the field to use this training to perform missions. The following section addresses field observations made during 1982 and 1983.

Unit Training Survey

An extensive survey was conducted with non-commissioned officers attending USAIS Infantry Mortar Platoon Courses (IMPC) 4/83 and 5/83, and Advanced Non-Commissioned Officer Course 3/83 to determine the state of mortar training in field units.

Sample

Of the NCOs sampled, a large majority (77.59%) were in the grade of E-6. Most had 11C Mortarman (92.24%) as their primary Military Occupation Speciality (MOS). The sample averaged a total of 10.13 years of experience with mortars (see Table 14). The NCOs who were not trained in 11C MOS or who did not reflect current field mortar experiences were not included in the final sample. Seven NCOs with other MOS training were included, however, because of current mortar experience. The NCOs in the three classes surveyed were representative of a wide variety of units in the force structure (see Appendix B, questions 5 & 6). A majority who responded (71.08%) expected to be with their assigned unit at least one year after their present training. A total of 37.35 percent expected to remain two years or more.

Table 14

Profile of the Typical ANCOC/IMPC
Non-Commissioned Officer(s) Surveyed in 1983

Questionnaire Item Appendix B	Predominant Responses (Number) and Percentage of the Total NCOs in the Survey (116)	
3. Rank:	E-6 (90) 77.59%, E-7 (19) 16.38%	
8. Important 11C Assignments:	81mm	4.2 inch
Platoon Leader	(20, $\bar{X}$ = 11 months) 17.24%	(10, $\bar{X}$ = 6 months) 8.62%
Platoon Sergeant	(71, $\bar{X}$ = 18 months) 61.21%	(38, $\bar{X}$ = 11 months) 32.76%
Section Leader	(59, $\bar{X}$ = 15 months) 50.86%	(26, $\bar{X}$ = 12 months) 22.41%
FDC Chief	(31, $\bar{X}$ = 11 months) 26.72%	(35, $\bar{X}$ = 13 months) 30.17%
FDC Computer	(32, $\bar{X}$ = 14 months) 27.59%	(25, $\bar{X}$ = 9 months) 21.55%
Gunner	(49, $\bar{X}$ = 11 months) 42.24%	(22, $\bar{X}$ = 7 months) 18.97%
12. Education Level:	12 years, or high school completion (86) 74.14% 1 to 3 years of college (28) 24.14%	

*Percentages and subsamples may not equal the total in all cases. NCOs could fall into multiple categories.

Of those sampled, 109 (93.97%) held an 11C primary MOS. Of the 99 who responded that they were assigned presently or most recently to a mortar unit, 56 served with 81mm mortars and 43 served with 4.2 inch, or 107mm mortars. A total of 43 of the 79 who responded to question 10 (54.43%) reflected a considerable range of experience over the course of their service careers with both types of mortars. Seven reported (Item 8) that their assignments immediately prior to ANCOC or IMPC, were as platoon leaders, and 54 were serving as mortar platoon sergeants. Appendix B, question 10, presents the mean number of months experience reported for specific critical duty positions in mortar sections and platoons and indicates the number responding to each item.

While many respondents had more than 18 months experience as platoon sergeants in either 81mm or 4.2 inch mortar units (30 in 81mm, 18 in 4.2 inch), fewer had such lengthy experience as Fire Direction Center Chiefs (10 in 81mm, 12 in 4.2 inch) and as FDC computers (5 in 81mm, 6 in 4.2 inch). This, for the most part, can be attributed to promotions which moved NCOs out of the grades commensurate with the computer duties; but of the sample, only 32 indicated any FDC computer experience with 81mm units and 25 with 4.2 inch units, few of whom had experience with both FDC procedures (see Appendix B). Of those who responded to the question addressing the most critical or important area of training (N=95), 89.47% identified FDC procedures as such. While FDC work is primarily computational and procedurally exacting, it is interesting to note that of the 114 respondents to questions regarding related math skills, 57.02% had taken high school algebra, 29.73% had taken geometry and only 10.28% had taken trigonometry. A total of 98.28% completed 12 years of education (high school) and 24.14% had between one and three years of college education.

The required computational procedures for use in the FDC are taught during IMPC and ANCOC, however these courses are presented to NCOs at points in their careers when they are no longer expected to use them regularly in the FDC. Of the 82 ANCOC sergeants in the sample, 21 indicated completion of IMPC which means that the other 61 (74.4%) probably have not received previous institutional FDC training. Nine responses from the total survey indicated specific FDC training at a variety of division and post established schools. One of these schools was visited as part of this research effort (see Unit Training, p. 51).

Survey Form

The instrument was designed initially for units in the field. Portions of the original form were not applicable to our purposes. Specific items which were not appropriate for this survey have been noted in Appendix B and will not be addressed in this section. While Appendix B presents the number of responses to each item, the percentage of responses to each possible answer, and the mean response, only selected issues will be presented in detail. A USAIS form used by the Directorate of Evaluation to compile data for its 1977 report on mortar systems (DEV Report No. 4, 1977) was adapted for use in the present research. The only real addition made was that of a comments section to collect specific impressions based on the NCOs experiences. A total of 116 survey forms was useable data collected from members assigned to these courses. The form along with summary response data is in Appendix B.

Results

The subjects sampled agreed somewhat ($\bar{x}$ = 3.90) that the mortar material presented in their courses required work and was not necessarily hard to understand ($\bar{x}$ = 2.52) (Appendix B, item 17). They were in strong agreement that the instructors knew their subjects ($\bar{x}$ = 4.61) and that the material was presented well ($\bar{x}$ = 4.59) with little waste of time ($\bar{x}$ = 3.95) (items 19-21). In general, institutional mortar training received favorable responses for the NCOs.

The subjects sampled agreed that platoon level training and live fire exercises are important ($\bar{x}$ = 4.61), though they disagree ($\bar{x}$ = 2.39) with statements that they get to fire and train enough (Appendix B, items 24-26). A number of additional comments were made later in the survey which specifically addressed these shortcomings. Units, for the most part are not training or getting enough live-fire experience to maintain proficiency. They felt that live fire was very important. The subjects were undecided or disagreed ($\bar{x}$ = 2.95) with the statement that they got enough mortar training weekly (item 34). When asked to identify approximately the percentage of people assigned who would normally be available for training (item 58), the mean response was 72%. The modal response was closer to 75%. Comments addressed problems with mortarmen being commonly considered as "detail men" or always available for administrative rather than training duty.

The subjects agreed that their men performed to the best of their ability (item 31) ($\bar{x}$ = 4.07) and that they, as individuals, were performing tasks that were appropriate to higher grades and that their efforts helped the platoon. They felt agreement ($\bar{x}$ = 3.78) with statements predicting good ARTEP and SQT results if such tests were to be given to them (items 35-37). The Weapons Crew Training Test measured performances do not support this particular area of optimism. Of those who responded (n=80), the majority (53.75%) responded that less than eight hours each week were devoted to mortar gun crew training. FIST or FIST-related subjects received less than four hours training and in many cases none at all (n=79, 86.08%). FDC related training was conducted less than four hours weekly in 44.3 percent of the responses and less than eight hours in a total of 58.22 percent of the responses. In response to a question asking which duty position in the subject's platoon/section was most critically short, 15.79 percent of the responses (some subjects responded to more than one item) were FDC computer. This does not mean that platoons did not have any trained computers, however, the responses did not preclude this possibility.

Responses indicated that mortar units, on the average, were conducting live fire exercises or training every four or five months. The modal responses of quarterly training in the cases of live fire (51.77%), illumination (49.98%) and smoke (42.68%) were offset by those identified as never firing or only once annually (live fire, 8.23%; illumination 9.64%; smoke 12.20%). In general, the weight of the subjects' written comments identified the lack of time and opportunities for training as the major problem faced by mortar sections and platoons. Reported mean unit strengths for both 81mm (80.15%) and 4.2 inch (77.20%) mortars presented readiness problems for units which were only exacerbated by the relatively low priority reportedly placed on unit training.

Weapons Crew Training Test - Mortar Training

The Weapons Crew Training Test conducted by TRADOC Combined Arms Test Activity (TCATA) is designed to compare the gunnery proficiency of weapons crews trained under selected training strategies. This is one of a series of actions being taken to attempt to quantify the relationship of live rounds fired in training and total crew proficiency. The mortar portion of the test started in March 1982, and will continue through September 1983.

The test has involved all 81mm mortar sections/platoons of nine infantry battalions. The test design includes three gunnery training strategies: one based on a doctrinal allocation of full-caliber ammunition, the second based on approximately two-thirds of the doctrinal allocation, and the third based on approximately one-third of the doctrinal allocation. The number of sub-caliber (22mm Sabot) rounds in each strategy increases in proportion to the decrease in full-caliber rounds. Mortar sections entered the Weapons Crew Training Test immediately after they participated in a live fire ARTEP exercise. Each section has then been in training for one year according to its assigned training strategy prior to conducting another live fire ARTEP. Fire mission results are converted to a numerical score to provide the basis for statistical comparison. By TCATA scoring procedures, only 2 of the initial 22 platoons met minimum ARTEP standards at the time of entry into the test.

As a measure of unit training proficiency and to evaluate test strategies, full caliber firing of ARTEP missions have been conducted quarterly. For the entry and exit external ARTEPs, all tasks have been fired at full level. This is to say, a complete ARTEP has been conducted. In the remaining quarters, only a portion of the tasks have been fired. Since units entered the test at different times, testing data for all units is not complete. Table 15 presents available performance summaries of sampled units at the different testing phases. Generally, the performance of the test platoons has been below established minimum standards. Some units have demonstrated continued improvement as they have proceeded through the test while others have decreased in measured proficiency.

The principal problem observed so far, and briefed by test officers, is that under the current TOE, the priority given to regularly conducted formal mortar training is generally very low. On the average, sections are reported by conducting less than seven hours of productive mortar training per week; in some cases, there has been no mortar training in over a two-month period. The effect of this lack of training is that such fundamentals as position occupation drills, communication procedures, crew drills, and ammunition handling are not being practiced, let alone FDC skills.

Another important observation concerns the lack of integrated training conducted by Artillery FISTs with the mortar sections. In some cases, the FISTs appear not to have been permanently affiliated with maneuver elements. Consequently, mortar sections have tended to train without the support of a forward observer and then during the ARTEP evaluation have tended to have little faith in the assigned FIST. The problem is illustrated by the fact that the mortar live fire ARTEP is perceived as an evaluation of only the

infantry elements of the indirect fire team. Infantry battalions assume no responsibility for assisting in the training of forward observers. In some cases, ARTEP evaluators have ignored FIST times altogether when comparing mission performance times to the ARTEP standards. Artillery battalions often allocate only one FIST to support all three 81mm mortar secion ARTEPs per battalion instead of using the opportunity to evaluate the proficiency of, and provide training for, the three FISTs usually affiliated with the battalion. There appears to be a distinct 'we/they' syndrome which inhibits teamwork to the extent that in some cases there is no coordination between the platoon leader, FDC, and the FIST prior to a live fire exercise.

Table 15

Weapons Crew Training Test (WCTT) Mortar Test
Quarterly ARTEP Test Results

Unit	Entry	Qtr 2	Qtr 3	Exit
2	39.5	63.3	58.5	70.1
3	71.0	58.8	55.1	70.9
10	59.7	62.3	56.1	
11	53.9	46.3	56.7	49.5
12	70.3	70.2	52.8	51.6
15	80.0	77.6	69.7	58.2
21	60.3	60.2	63.0	
22	72.3	53.0	65.7	
23	69.7	64.5		
24	61.2	65.5	61.2	
30	55.7	57.3	63.6	
31	59.8	61.2	68.5	
Mean Performance	(12)63.7	(12)62.5	(12)60.9	(6)61.6

Percent of total possible rating of overall mortar ARTEP performance.

Other observations include:

(a) Weapons platoon leaders and mortar section leaders have been reluctant to use the SABOT training device as intended. In a number of cases, SABOT training has been conducted without a map and without the support of an observer, thus forcing the use of direct lay techniques only. This has prevented the section from achieving the training benefit which can be obtained from proper use of the SABOT round.

(b) Observations of mortar ARTEPs have indicated that they have not been conducted according to a planned tactical scenario. Consequently, platoon leaders and forward observers have not exercised fire planning techniques or prepared or issued operation orders. In addition, soldiers have not been required to simultaneously conduct live fire missions and provide their own local security.

(c) In many of the mortar section platoon ARTEPs conducted so far, absent key personnel have been replaced by more senior personnel rather than by a designated or trained assistant. In particular, absent FDC computer personnel have been replaced by platoon sergeants or in some cases by platoon leaders rather than by an assistant computer or a cross-trained gunner. When this is allowed to occur, the ARTEP results do not give a true representation of the proficiency of the platoon nor does it give an indication of the amount of cross training which has been conducted with the section. FDC related skills are the most difficult mortar elements to train and sustain. Personnel turbulence in this area degrades proficiency immediately and significantly.

(d) Except in a couple of isolated cases, the TI-59 hand-held calculator has not been used even though it has often been available. This is apparently due to either a lack of trained personnel, or apprehension related to experimenting with the calculator.

(e) Doctrinal sustainment training programs do not appear systematically in the field. This lack of a common program results in decentralized training at company/platoon level where frequency of live fire, number of rounds fired, use of training devices, emphasis, and time spent on mortar training varies greatly. A need exists for a mortar training guide to assist platoon leaders and company commanders to formulate their training programs. USAIS, Fort Benning has prepared such a guide (TC 23-90, Feb 81), however, units are not aware of this guide.

Infantry Division Post

The conduct of mortar ARTEP live-fire missions for three ground-mounted 81mm mortar platoons was observed at an Infantry Division Post. The units observed were conducting quarterly ARTEPs as participating units in the Weapons Crew Training Test (WCTT). The scenario for the test required the units to move on to the firing range under simulated tactical conditions, locate and establish their position, and report to their company commander (WCTT test officer); they were prepared for fire missions. The test controller then tested the unit's proficiency by relaying through the FIST element the various calls for fire and fire missions associated with the ARTEP. Each element (FIST, FDC, mortar crews) had a test data recorder assigned to record time consumed in the performance of typical duties and to evaluate performance.

The test required units to be in position and ready for firing by 0900. Of the units observed, only one achieved this established objective. One unit reported ready for firing at 1030 and the third not until 1300 hours. Reportedly, poor communication, late arrival of ammunition at the range, and lack of personnel were the reasons for delay. All units selected defilade positions, but employed only minimum measures for cover, concealment and camouflage. One unit made no attempt to conceal itself at all. NBC operations and reaction to enemy direct or indirect fire were not practiced. The overall perception of the observers was that the units were behaving as if they were conducting an administrative exercise rather than a tactical training test.

None of the units observed had an officer/platoon leader assigned. Two units were lead by a Sergeant First Class (E-7) and one by a Staff Sergeant (E-6). Although these individuals subsequently proved to be very competent in

the control of the firing missions, the absence of the officer leadership and influence was obvious. A survey of ANCOC class 3/83 supports this observation as not being uncommon (see Appendix B).

Additionally, many of the platoon members were 11B infantrymen and not trained as mortarmen. This was necessary due to reported shortages of OSUT trained 11C mortarmen.

The FIST team consisted of one artillery officer (2LT) and four artillery enlisted observers, MOS 13F (Fire Support Specialist). Only one of these individuals had prior experience with any of the mortar units. Although the exercise required evaluation of the mortar platoon's proficiency, the FIST team treated it as a routine training session by alternating experienced and inexperienced observers when conducting the fire missions. Lengthy discussions on proper procedures, corrections, types of ammunition/fuze, etc. were observed for nearly every mission.

Once the initial fire mission had been completed, additional missions were given to the unit at a moderate rate and the test progressed routinely until all daylight fire missions had been completed. Depending upon the completion time of the unit's daylight missions, the test was administratively halted anywhere from 1 to 4 hours to await nightfall so that the remaining two illumination missions could be fired. During these periods, units did not relocate, improve positions or conduct any type of additional training. Of the 13 Infantry Division test platoons participating in the test, conduct of the firing missions are not accomplished within any of the allotted time standards. Of the three units observed by our researchers, one received a rating of 23%, the second 30%, and the third 7% (see Table 16 - Results of Firing Missions).

In addition to the timed fire missions, test controllers routinely evaluated each unit performance against a set of established subjective criteria (Table 17). Performance of the unit is recorded to indicate whether the unit always performed the task, performed it sometimes, or never accomplished it at all (Table 17). This evaluation is not a standard part of the normal unit ARTEP. Results of this evaluation indicate that 77% of the 13 units never used a unit standing operating procedure (SOP); 77% never coordinated with the FIST prior to registration; 85% never computed range or deflection corrections (surveyed data); and 92% never used the TI-59 Mortar Fire Calculator in the FDC during the course of the evaluation, 46% of unit leaders were not aware of ARTEP standards; only 23% checked equipment (serviceability and accountability); 100% of units did use an assembly area some of the time; 31% did declinate the aiming circle each time, 100% did boresight the mortars some of the time; 62% did lay the section with an aiming circle; 31% did announce angle T to the FIST; 23% applied registration refinement data; 54% completed computer records and data sheets. Units usually would locate/plot (77%) the mortar position on the M16 plotting board.

Table 16

Results of Firing Missions For
Weapons Crew Training Test Sample (3 Platoons)

MSN	OBSERVED UNIT		FIST TIME	FDC TIME	GUN TIME	TOTAL TIME	TOTAL TIME ALLOWED BY ARTEP 71-2
Emergency Fire	1		206	153	132	491	420 (With
	2		076	093	098	267	FDC)
	3		162	258	275	695	
		$\bar{X}$ =	148	168	168	484	
Registration &	1		547	1140	622	2309	480 (Reg)
Sheaf Adj.	2		403	1148	699	2250	480 (Sheaf
	3		521	663	240	1424	Adj)
		$\bar{X}$ =	490	984	520	1994	960
Adjust Fire	1		103	236	119	458	300
	2		238	362	212	812	
	3		074	297	209	580	
		$\bar{X}$ =	138	298	180	617	
Fire for Effect	1		370	063	033	466	120
	2		188	063	186	437	
	3		058	112	038	208	
		$\bar{X}$ =	205	079	086	370	
Adjust FPF	1		490	683	250	1423	720
	2		580	250	133	943	
	3		375	452	260	1087	
		$\bar{X}$ =	482	462	214	1151	
Fire FPF	1		010	008	014	032	030
	2		040	009	009	058	
	3		034	003	051	088	
		$\bar{X}$ =	028	007	025	060	
Engage	1		131	076	093	300	060
Priority	2		033	036	085	154	
Target	3		020	039	050	109	
		$\bar{X}$ =	061	050	076	188	
Time on Target	1		000	000	000	000	+ or - 5
	2		000	000	000	000	of specified
	3		000	000	000	000	time
		$\bar{X}$ =	000	000	000	000	

These data are part of a preliminary data base which will be reported more fully as part of the TCATC WCTT.

Note: All times in seconds.

Table 16 (Continued)

Results of Firing Missions For
Weapons Crew Training Test Sample (3 Platoons)

MSN	OBSERVED UNIT		FIST TIME	FDC TIME	GUN TIME	TOTAL TIME	TOTAL TIME ALLOWED BY ARTEP 71-2
Immediate Suppression/Smoke	1		046	087	057	190	180
	2		100	060	078	238	
	3		146	132	161	439	
		$\bar{X}$ =	097	093	099	289	
Establish Smoke Screen	1		135	171	067	373	360
	2		120	061	030	211	
	3		163	1855	375	2393	
		$\bar{X}$ =	139	696	157	992	
Illumination	1		365	607	176	1148	300
	2		225	242	240	757	
	3		195	637	224	1056	
		$\bar{X}$ =	278	495	213	987	
Coordinated Illumination	1		135	217	350	702	720
	2		161	300	221	682	
	3		190	479	232	901	
		$\bar{X}$ =	162	332	268	762	
Simultaneous Adjustment	1		120	467	195	782	420
	2		631	564	375	1570	
	3		516	502	586	1607	
		$\bar{X}$ =	422	511	386	1320	

Note: All times in seconds.

Table 17

Weapons Crew Training Test (WCTT) - Infantry Division Unit Evaluation

	UNIT												
QUESTION *	1	2	3	4	5	6	7	8	9	10	11	12	13
1	S	A	A	A	A	S	N	A	S	A	N	N	N
2	S	S	A	S	S	S	S	A	S	A	S	S	S
3	N	N	A	N	N	N	N	A	N	A	N	N	N
4	S	S	S	S	S	S	S	S	S	S	S	S	S
5	S	S	S	S	S	A	S	A	S	S	S	A	A
6	S	S	S	S	S	S	S	S	S	S	S	S	S
7	S	A	A	A	A	S	S	A	A	A		A	A
8	S	A	A	S	A	A	A	A	S	A	S	S	A
9	N	N	S	N	N	N	N	S	N	S	N	N	N
10	S	A	A	S	S	S	S	A	S	S	A	S	S
11	S	S	S	A	A	S	S	A	S	S	S	S	S
12	S	A	A	A	A	A	S	S	S	A	S	A	S
13	N	N	N	N	S	N	N	S	N	N	N	N	N
14	S	S	S	S	S	S	S	S	S	S	S	S	S
15	A	A	S	A	A	S	S	A	S	A	S	S	A
16	N	N	S	N	S	N	N	S	N	S	N	N	N
17	N	N	N	N	N	N	N	S	N	N	N	N	N

1. Are leaders aware of ARTEP standards?
2. Do units check equipment (servicability, accountability)?
3. Do units have and use a platoon SOP?
4. Do units use an assembly area?
5. Do units declinate the aiming circle?
6. Do units boresight all mortars for deflection and elevation?
7. Do FDCs locate mortars on M16 plotting board (8-digit grid)?
8. Do units lay section with aiming circle?
9. Do FDCs coordinate with FO prior to registration?
10. Do FDCs announce Angle T to FIST (if over 500)?
11. Do FDCs apply registration refinement information to data?
12. Do units refer/realine aiming posts?
13. Do FDCs compute/use VI and range correction?
14. Do FDCs compute/use data sheet (DA 2188-R)?
15. Do FDCs complete/use computer's record (DA 2399)?
16. Do FDCs complete/use deflection correction (surveyed chart)?
17. Do units use TI59 calculator in the FDC?

* Item content is presented in Table 16.
A = Always/Yes; S= Sometimes; N= Never/No

Mechanized Division Post

The mortar ARTEP evaluations for three carrier-mounted 81mm mortar platoons and one carrier-mounted 4.2-inch (107mm) mortar platoon were observed in the Spring of 1983 at a Mechanized Division Post. The evaluations were conducted internally under control of a senior evaluator and trained subordinate teams which evaluated the FDC, FIST, and gun crew activities for each unit and mission. Although ARTEP standards are commonly based on the aggregate time, performance times were recorded separately for each element of the indirect fire team to assist in identifying specific weaknesses. Elements of a direct support artillery battalion within the division provided FIST support for each firing platoon. The FIST Initiated calls for fire and then determined accuracy by the use of two battery commander (BC) scopes. The scopes are tripod-mounted binoculars with sophisticated grid reticles used for artillery spotting. An A/N TPQ4 radar set was also provided by the artillery to assist in evaluating the accuracy of mission, however, the radar was not called upon to be in operational suppport during a significant number of missions. Units were evaluated under day, night, and NBC conditions. Mission times for scoring were initiated when the FDC received the target location and ended when the Fire for Effect (FFE) portion of the mission was completed. Time of flight for the mortar rounds and safety times were subtracted from the total time to determine mission performance times.

The units observed were all from the same mechanized infantry battalion, and the ARTEP evaluations were conducted in conjunction with a full battalion field training exercise (FTX). A written operations order (OPORD) was issued to initiate the ARTEP and all missions and actions were performed following a planned tactical scenario. Tactical employment and battle drills conducted by the units indicated a high level of tactical training and proficiency. Maximum attention to the employment of tactical measures for cover, concealment, camouflage, position security, and communications security was maintained throughout the exercise.

Particularly impressive to the observers was leadership within the battalion. Of the platoon-sized units observed, three were lead by junior officers (2LTs) and one by a Staff Sergeant (SSG) E6. The SSG lead the battalion 4.2 inch mortar platoon and, in fact, was the most experienced platoon leader in the battalion. These leaders proved to be extremely effective in the command and control of their platoons as well as proving highly competent in the conduct of the ARTEP missions, although some had limited experience with mortars. Although the battalion was generally short of 11C mortarmen, the performance of the ARTEP missions was not limited by these shortages. Since division replacements were first going to units scheduled to train at the National Training Center, firing sections were borrowed between companies to complete the ARTEP.

In general, the mortar ARTEP missions were completed with few problems. All units received an overall rating of satisfactory, with three units achieving scores of 93% and one achieving 80% (Table 18). Coordination between the FIST team and the infantry mortars was the only major area which could easily be improved with additional training. (The FIST battalion with which they normally worked was at the National Training Center.) Other areas indicating minor weaknesses were emergency missions and FDC procedures.

Table 18

Results of Firing Missions (ARTEP 71-2)
Mechanized Division Post (4 Platoons)

MSN	OBSERVED UNIT		FDC TIME	GUN TIME	TOTAL TIME	TOTAL TIME ALLOWED BY ARTEP 71-2
			(400 mil error in gun lay)			
Emergency Fire	1		-	-	1405	420
	2		045	180	225	
	3		049	240	289	
	4		025	350	375	
		$\bar{X}$ =			573	
Registration & Sheaf Adj.	1		380	440	820	480 (Reg)
	2		390	424	814	480 (Sheaf Adj)
	3		110	084	194	
	4		075	119	194	960
		$\bar{X}$ =	239	267	506	
Adjust Fire	1		092	180	272	300
	2		035	190	225	
	3		090	155	245	
	4		029	064	93	
		$\bar{X}$ =	062	147	209	
Polar	1		160	211	371	420
	2		120	270	390	
	3		065	140	205	
	4		075	183	258	
		$\bar{X}$ =	105	201	306	
Adjust FPF	1		269	250	519	720
	2		250	133	383	
	3		452	260	712	
	4		245	158	403	
		$\bar{X}$ =	304	200	504	
Fire FPF	1		012	008	018	030
	2		012	003	015	
	3		009	007	016	
	4		025	009	034	
		$\bar{X}$ =	015	007	022	
Deliver Scheduled Fires	1		000	005	005	+ or - 5 sec
	2		000	004	004	
	3		000	005	005	
	4		000	003	003	
		$\bar{X}$ =	000	004	004	
Time on Target	1		000	003	003	+ or - 5 sec
	2		000	003	003	
	3		000	003	003	
	4		000	003	003	
		$\bar{X}$ =	000	003	003	

Note: All times in seconds. FIST times were recorded as GO/NO GO only.

TABLE 18 Continued

Results of Firing Missions (ARTEP 71-2)
Mechanized Division Post (4 Platoons)

MSN	OBSERVED UNIT		FDC TIME	GUN TIME	TOTAL TIME	TOTAL TIME ALLOWED BY ARTEP 71-2
Immediate Suppression/ Smoke	1		025	135	160	180
	2		055	145	195	
	3		070	155	225	
	4		030	055	085	
		$\bar{X}$ =	045	122	167	
Establish Smoke Screen	1		141	077	218	360
	2		135	120	255	
	3		163	087	250	
	4		058	032	090	
		$\bar{X}$ =	124	079	203	
Illumination	1		060	190	250	300
	2		065	125	190	
	3		072	255	327	
	4		040	170	210	
		$\bar{X}$ =	059	185	244	
Coordinated Illumination	1		420	221	641	720
	2		270	232	502	
	3		610	350	960	
	4		356	218	574	
		$\bar{X}$ =	414	255	669	
Direct Lay	1		005	140	145	240
	2		007	135	142	
	3		007	139	146	
	4		005	165	170	
		$\bar{X}$ =	006	144	150	
Fire for Effect (NBC)	1		000	018	018	120
	2		000	018	018	
	3		000	010	010	
	4		000	030	030	
		$\bar{X}$ =	000	019	019	
Re-Registration	1		165	080	245	480
	2		235	103	338	
	3		161	082	242	
	4		105	075	180	
		$\bar{X}$ =	166	085	251	

Note: All times in seconds. FIST times were recorded as GO/NO GO only.

Generally, these deficiencies were the result of incorrect application of procedures or the consumption of excessive time.

Formalized unit training of these mortar units averaged approximately 7 to 8 hours per week which is not much different from the survey results of IMPC and ANCOC NCOs (see Appendix B). This seemingly limited time is devoted primarily to gun crew drill and FDC procedures. Reportedly, little or no time at all is allotted to coordinated FIST training or FIST-related subjects. The senior evaluator did report that the FIST normally with the battalion trained with the mortars more frequently. Informal interviews of battalion personnel revealed that the mortar units of this battalion participated in an operational test of an experimental 81mm (I-81) mortar. Although the test followed a different scenario than that of a normal ARTEP, the units did receive invaluable intensive experience and training over an extended time period. During the test, mortar units fired in excess of 4,000 rounds of ammunition under controlled and field conditions. This testing exercise occurred approximately six months prior to the observed ARTEP and the retention of experienced personnel from this exercise undoubtedly accounts, in part, for their increased proficiency.

According to observations and interviews, the level of proficiency and the morale of the battalion is the result of the application of caring leadership. The officers are concerned and act on behalf of their men to insure that the limited training time which is available is used most effectively. Training detractors are minimized to allow attention to mission performance without distraction (for example, soldier's pay and personal problems are handled immediately). These intangibles contribute greatly to the esprit and, therefore, the performance of the battalion's training mission. Training time is used very effectively, even when it is scarce. Range time between missions during the ARTEP was used to cross-train crew members.

It would be reasonable to assume that the units evaluated within this battalion are different than those taking part in the WCTT. Short-handed, they performed effectively as a result of recent intensive experiences (I-81mm Test) and effective unit training and leadership.

Division School (11C)

In March 1983, ARI/Litton Mellonics visited an Infantry Division's G-3 School for mortar training.

The course duration is 3 weeks with 113 hours of actual mortar instruction and 7 hours devoted to administrative time (Table 19).

This course was started in 1975, and since then has averaged 13 classes per year with an average of 16 students per class. The average NO-GO post-training testing rate since the start of the course has been approximately 10%. There are no prerequisites for attending this course, and the student quotas are allocated to the units by Division G-3 Schools.

The first 37 hours of the course covers the mechanical aspects of mortar gunnery. This period also includes preparing the M2 aiming circle for operation and how to declinate the aiming circle. The period is concluded with a 4 hour section drill on all material taught.

The students are then taught how to prepare an M16 plotting board for operation as an observed chart and modified observed chart. Numerous practice exercises are conducted during this period. In addition to preparing the M16 plotting board for operation and computing firing data, the students also learn how to prepare an FDC order, maintain a firing data sheet, and prepare target lists, fire plans, and overlays. Also included in this period is a 4-hour block of instruction on map reading.

Due to insufficent numbers of M16 plotting boards, approximately 50% of the students must use the plotting board--M16 device 17E5 (Figure 2). Interviews with the instructor and students indicate that there were no significant difference in firing data processed with this device and the firing data of students using the actual M16 plotting board. This device, purchased commercially, is reported to be very inexpensive ($5.00).

The final block of instruction is devoted to preparation and storage of ammunition, fire without an FDC, and performing maintenance of the mortar and fire control equipment. Also included in this period of instruction are 7 hours of mortar platoon tactics.

Table 19

Mortar Program of Instruction
Division Training School

SUBJECT TITLE	HOURS
11C Mechanical Training	
Introduction to mortar gunnery, 60mm, 81mm, 4.2 in. (107mm) mortar	4.0
Boresight 60mm, 81mm, and 4.2 in. (107mm) mortar	3.0
Prepare an M-2 aiming circle for operation	1.0
Reciprocally lay mortar using M-2 aiming circle and place out aiming posts	4.5
Place a ground-mounted 60mm, 81mm, 4.2 in. (107mm) mortar into action	3.5
Lay mortar for deflection and elevation D&E (ground/carrier mounted)	3.0
Use of the black slip scale on the M-53 sight unit	2.0
Remove a misfire from the 60mm, 81mm, 4.2 in. (107mm) mortar (ground mounted)	1.0
Refer sight and realign aiming posts	2.0
Orient M-2 aiming circle and lay mortar for direction	1.0
Declinate M-2 aiming circle	4.0
Determine an azimuth using an M-2 compass	1.0
Lay mortar for direction using M-2 compass (ground mounted)	5.0
Boresight mortar for deflection using the M-2 aiming circle	.5
Boresight mortar for elevation using the M-2 compass	.5
Manipulate mortar for traversing and searching fires	1.0
Section drill all previous material	4.0
TOTAL	41.0

Table 19 (Continued)

Mortar Program of Instruction
Division Training School

SUBJECT TITLE	HOURS
FDC Procedures	
Compute data for open, converged, or special sheaf using an M-16 plotting board	4.0
Determine data for sheaf adjustments using an M-16 plotting board	2.0
M-16 plotting board	1.0
Prepare an M-16 plotting board for operation as an observed chart and determine initial firing data for mortars (pivot point)	4.0
Process subsequent FO corrections using an M-16 plotting board (pivot point)	3.0
Prepare an M-16 plotting board for operation as an observed chart (below pivot point) and modified observed chart	3.0
Process subsequent FO corrections using an M-16 plotting board as a modified observed chart	7.5
Use mortar firing tables (60mm, 81mm, 4.2 in.)	1.0
Determine angle T when using an M-16 plotting board	.5
Record information on firing data sheet (81mm mortar)	.5
Prepare an FDC order (60mm, 81mm, and 4.2 in. mortar)	1.0
Determine data for a 4.2 in. mortar using an M-16 plotting board and GFS	1.0
Locate a target by shift from a known point	1.0
Compute data for polar mission using an M-16 plotting board	2.0
Split section firing using an M-16 plotting board	2.0
Compute data for coordinated illumination mission using an M-16 plotting board	.5
Compute data for illumination mission using an M-16 plotting board	.5
Determine firing corrections using an M-16 plotting board	1.0
Determine data from re-registration and application of corrections (81mm mortar)	.5
Compute data for final protective fire using an M-16 plotting board	1.0
Compute data for traversing or searching fire using an M-16 plotting board	1.0
Prepare target lists, fire plans, and overlays	.5
Danger close mission	.5
Determine the grid coordinates of a point on a military map using the military grid reference system	1.5
Identify terrain features (natural and man-made) on the map	.5
Determine azimuths using a coordinate scale and protractor	1.0
Measure distance on a map	.5
Convert azimuths (magnetic or grid)	.5
Call for/adjust indirect fire	1.0
TOTAL	44.0

Table 19 (Continued)

Mortar Program of Instruction
Division Training School

SUBJECT TITLE	HOURS
Other Mortar-Related Subjects	
Prepare 60mm, 81mm, 4.2 in. (107mm) mortar ammunition for firing	1.0
Store mortar ammunition (60mm, 81mm, 4.2 in.)	1.0
Provide for mortar platoon/section defense (conventional)	1.0
Provide for mortar platoon/section defense (unconventional)	2.0
Assist in planning/identifying missions for mortar platoon/section	.5
Select/organize mortar platoon/section positions	.5
Select movement routes for mortar platoon/section	.5
Conduct displacement of mortars	.5
Supervise squad during the occupation of the firing position	7.0
Adjust fire, without an FDC using direct alignment	.5
Engage a target using fire without an FDC	.5
Perform operator maintenance on 60mm, 81mm, 4.2 in. mortar and associated fire control equipment	6.0
TOTAL	21.0

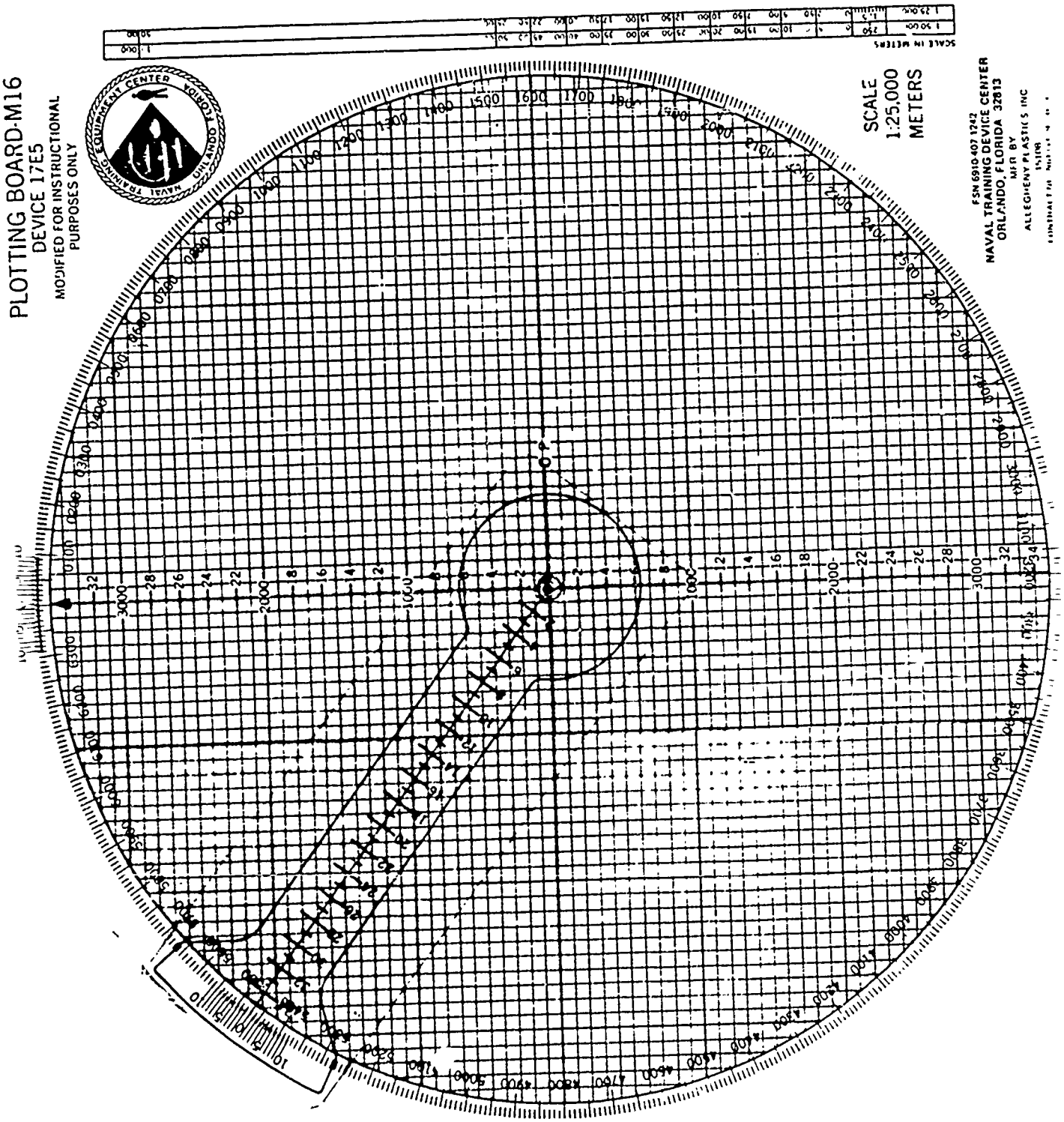
Table 19 (Continued)

Mortar Program of Instruction
Division Training School

Review		1.0
Examinations		5.0
Critique of final exam		1.0
	TOTAL	7.0
Graduation		3.0
Commanders time		2.0
Receive/turn-in weapons and equipment		2.0
	TOTAL	7.0

Summary:

11C Mech Training	41.0
FDC Procedures	44.0
Other Subjects	21.0
Review Exam/Crit.	7.0
Admin.	7.0
TOTAL	120.0 Hours



37% Reduction

Figure 2. Plotting Board - M16
Device 17E5

Asymptotic Training Performance

The issue of identifying optimum performance in either an institutional or unit setting is difficult to address. Asymptotic or peak performance, either demonstrated or potential, is most difficult to assess by measured mortar performance evaluation. In the case of either the U.S. Army OSUT or the U.S. Marine Corps initial entry training, the common performance measure is the examination for 81mm Mortar Gunnery Qualification. This test is given as part of the training block and certainly before the tested subjects have a clear mastery of the skills. Performance measured at this point, though achieving the established standards, could not be considered either optimum or comprehensive. Both Army and Marine service schools achieve similar results from training at this point (see Table 9, page 38). Divergence in training to meet service specific mortar tactical employment objectives makes subsequent interservice comparisons difficult at best.

From the standpoint of U.S. Army training, the objective is to train a fully functional mortar section or platoon to operate effectively. Performance in the platoon is measured by the ARTEP (71-2). Preliminary results from the Weapons Crew Training Test indicate that significant numbers of mortar platoons (20 of 22 tested failed first ARTEP) may have difficulty meeting these minimum standards for adequacy, let alone be able to achieve higher measured levels of performance. The ARTEP in its present form makes identification of the achievement of more stringent standards difficult as well since one time limit is imposed for each mission which does not allow for evaluation of the separate FIST, FDC, and gun crew sections. Recommendations have come from early results of the WCTT to correct this identified problem. Of the mortar platoons observed, the ones at Infantry Division Post may come closer to achieving asymptotic performance since their measured performance exceeded ARTEP standards during the live fire training.

A number of issues may be raised when the performances of these mortar platoons are examined. An extensive test of the I-81mm mortar approximately six months prior to observation of the unit conducting its ARTEP provided experience which would obviously not have been available normally. A unit does not typically have its forecasted allocation of training ammunition increased by approximately 4,000 rounds without some resultant change in performance. On the other side of the performance issue is personnel. While extensive live fire experience was maintained in the unit, the allocation of 11C MOS soldiers within the division was going to other battalions just prior to the ARTEP observations. The mortar units observed performed well, particularly when one considers that they did so with limited numbers of proficient soldiers. Two line companies were able to field only one gun crew each. In this case, the two gun crews each having one 81mm mortar carrier and crew acted as the firing section during each company's ARTEP. They gained more practice and experience but in fact had to fire missions usually conducted by three weapon crews. The battalion 4.2 inch mortar platoon had three weapon carriers rather than the usual four. The 4.2 inch mortar platoon leader, though a highly qualified mortarman and an excellent leader, was in fact an E-6 Staff Sergeant. It is impossible to predict how much better these otherwise excellent mortar units could have performed had they been staffed completely with competently trained personnel.

IMPC may provide the opportunity to observe consistent near optimum, or asymptotic performance of mortar skills. The students are a mix of relatively new lieutenants and experienced mortar NCOs who are trained intensively in all aspects of mortar platoon operational employment. At the completion of this training, they are fresh products of what has been called by many in the field the best professional training at the USAIS. The students are prepared to lead and train future mortar platoons as a result of extensive classroom and field training.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

A general conclusion, after having observed both institutional and unit mortar training, is that current mortar training presents several researchable problems based on inadequate or non-existent training. For example, current training of the 11C soldier includes no in-depth fire direction center (FDC) training, other than that which is acquired at unit level, until he reaches BNOC/CA where skill level three tasks are intended to be trained. It should be recognized that the majority of FDC computing tasks are skill level two, except two which are skill level three. Units reportedly have neither adequate time nor sufficient numbers of skilled instructors to comprehensively teach advanced FDC skills (see page 47). Weapons Crew Training Test observations support this conclusion.

A need exists to standardize fire direction center (FDC) procedures. Currently within the institutional setting, two methods of computing firing data are taught--the Graphical Firing Fan (GFF) and chart for the 107mm heavy mortar and the M16 plotting board for the 81mm mortar. The general results of current instruction and observations indicate that either method could reasonably be used for both mortars. Conducting a detailed examination aimed at the elimination of one method would result, first, in simplified training of FDC computers since they would be required to learn only one procedure for plotting instead of two. Second, the training burden as it relates to numbers of hours and instructors would be significantly reduced. Finally, a cost saving would be realized with the elimination of duplicate fire control equipment. Analysis of this dual plotting issue would be a reasonable undertaking.

USAIS programs of instruction make no provision for teaching the operation and use of handheld mortar fire direction calculators though they (TI-59) are available in the field. Previous research has indicated that the largest reduction of the mortar fire cycle time can be achieved by reducing the FDC computation time through the use of a digital fire direction calculator (HELMST-1, 1975). Although calculators (TI-59) are often available at unit level they are generally not being used (see p. 56). This is apparently due to a lack of trained personnel who remain apprehensive about experimenting with the calculator, if it is available.

There is no established selection criteria for soldiers who are being trained as 11C mortarman. During the final weeks of initial entry training (IET) an 11B trainee may be considered for attendance at the mortar qualification course depending upon overall U.S. Army requirements for mortarmen, commanders subjective evaluation of the trainee, and course capacity. The commanders subjective evaluation consists of a value judgment of the trainee's attitude, GT score, motor skills and physical fitness. Other preselection criteria have not been identified, let alone validated.

There is no "doctrinal" sustainment program published and in the field. Unit training is normally decentralized to the company/platoon level. The quantity and quality of which are based upon available resources and priorities determined by the individual commanders (Company or Battalion).

Priority given to regular formal unit mortar training is generally very low. On the average, units conduct less than one day of productive mortar training per week (see Appendix B). The effect of this lack of training is that even the most fundamental skills are not being acquired, practiced or sustained. Mortar skills taught at the institution are complex and highly proceduralized. Ineffective and infrequent unit training programs do not sustain these perishable skills, let alone refine or teach new skills.

There is a lack of integrated training conducted by the artillery FISTs and the mortar platoons. Currently, FISTs and mortar platoons usually only train together during ARTEP evaluations. Combined Arms Training between the FIST and Mortar platoons is essential to minimize fire misson times, enhance teamwork, maintain personnel proficiency, and expand individual skills and abilities. Performance of the mortar platoon on the battlefield will be critical to the maneuver infantry unit. Training for quick coordination begins with the same FIST team being with the unit during its mortar training. This coordinated training and familiarization effort must be an integral part of the maneuver unit's routine garrison and field training.

Currently, there not complete agreement between 11C Soldiers Manual task standards and the collective task standards used to evaluate mortar units during ARTEPs. In several instances, standards vary from an accuracy measurement or performance evaluation (training) to a specific time requirement during evaluation (ARTEP). Also, for each individual ARTEP mission, the entire indirect fire team is evaluated against a total time allowance. If a unit fails to achieve the standard, it cannot be clearly determined which element(s) used excessive amounts of time without establishing measurement procedures not called for in ARTEP 71-2. USAIS has recently initiated research in an attempt to resolve this lack of standardization. Early observations briefed by WCTT personnel suggest that ARTEP evaluation criteria need further definition.

There is currently a training and testing void associated with mean point of impact (MPI) gun registration. The MPI is not currently being taught in any institutional training course although it is one of the live-fire missions which is to be evaluated on the mortar ARTEP. To evaluate this mission, the ARTEP conditions call for a counter-mortar or counter-battery radar or two surveyed observation posts with M2 aiming circles and qualified observers to observe the impact of the rounds. Results of the Weapons Crew Training Test (WCTT) conducted at Fort Ord and Fort Hood and on-site observations at Fort Polk indicate that MPI registration missions are rarely, if ever, fired during ARTEPs because:

- The equipment needed to conduct an MPI is not available to any single unit.
- The forward observers are often not qualified (trained) to conduct an MPI mission for mortars.
- The FDC computers are not qualified (trained) to compute an MPI mission.

The use of meteorological data (MET) does not appear to be a valid mission/training requirement for mortars. To use MET data properly, a surveyed firing chart must be prepared with surveyed data for both the mortar position and the registration point. In addition, the FDC must receive the initial MET message at the time of registration and a subsequent MET Message which will supply the data for computation of firing corrections. Corrections for MET and re-registration are only valid within the transfer limits of the established Registration Point. Any targets that are not within the transfer limits must be engaged using normal adjustment procedures with no meteorological corrections. Also, the terrain and distance from the gun section to the meteorological station affect the accuracy and utility of the MET data received. Finally, current doctrine indicates that the longer a mortar section remains in one location the greater the probability it will be tracked and located by counter-mortar radar. This coupled with the requirements of the integrated battlefield for mobility, flexibility, and speed indicate that mortar sections will seldom remain in one location long enough to effectively use MET data even if it is available. MET data provides a unit with the capability to fire extremely accurate missions, but this information is of limited use, time consuming to acquire and train, and of questionable value to mortarmen on today's battlefield. In reality, a simple registration mission may become a seldom seen luxury.

Finally, the systematic use of simulation and alternative training methods should be explored further. Of the current training devices available, only the SABOT (22mm subcaliber device) is in broad use. The current growth of high technology in such areas as interactive videodisc and computer simulation have resulted in many new training possibilities which include application to mortars. Application of such technology may be appropriate for enhancing FDC skill acquisition and retention. This use of simulation and videodisc based instruction could teach calculator use.

Recommendations

To improve institutional, unit, and individual mortar training, and to enhance overall unit proficiency while maximizing effectiveness of limited training time and resources, the following recommendations are submitted.

- It may be appropriate to identify and validate more specific selection criteria for personnel to be trained as 11C Mortarmen.

- FDC computer tasks could be effectively trained to skill level two proficiency as a follow-on course at OSUT. This may be considered for better students based on resource availability. An alternative would be to create an additional skill identifier (ASI) with appropriate schooling for FDC personnel, or design and develop an exportable training course which will insure that the necessary skill level FDC expertise can be developed and implemented at the unit level. This area, in terms of exportable FDC training, is planned for continuing research efforts.

- o Examine training at the institution and in units to use a hand-held mortar fire direction calculator as a primary means of computing mortar firing data. Research into the effectiveness of the varied plotting and computational procedures needs to be conducted to ultimately reduce duplicate procedures.

- o Determine, through testing, the effectiveness of training the M16 plotting board only as the back-up system for both the 81mm and 107mm Mortars. This assumes that the hand-held calculator can be the most effective primary system.

- o Eliminate MPI Registration missions and evaluations for mortars or train properly for the mission.

- o Eliminate the use of meteorological (MET) messages and data for mortars since very little benefit is available with continued use. The resource expense does not warrant continued use.

- o Investigate the concept of FIST Team Forward Observer duty positions organic to maneuver unit TOE's, or a policy to insure continuity of FIST representation at the maneuver unit. The concept of the FIST appears excellent, but the effectiveness of its application should be examined.

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APPENDIX A

ANNOTATED BIBLIOGRAPHY

DeFranks, S.J. Jr. Delivery Accuracy for Indirect Fire (Technical Report 227). U.S. Army Material Systems Analysis Activity, Aberdeen Proving Ground, MD, June 1979.

This report defines delivery accuracy and contains estimates of delivery accuracy for the surface-to-surface indirect mode of fire. The common principles utilized to compute these estimates are also described. The most important of these principles are the techniques of fire, the computational methods and the major error groups contributing to delivery accuracy.

Estimates for delivery accuracy are provided for Army indirect fire, non-nuclear weapon systems. The list of systems includes the Army's 4.2 Inch Mortar, 81mm Mortar, 105mm Howitzer, 155mm Howitzer, 175mm Gun, and the 8 Inch Howitzer.

Director of Evaluation, United States Army Infantry School (USAIS), Fort Benning, GA. Mortar Systems Evaluation, DEV Report Number 4, Nov 1977.

In 1977 the Directorate of Evaluation, United States Army Infantry School, conducted an evaluation of the 81mm and 107mm (4.2inch) Infantry mortar systems. The objectives of this study were to:

o Collect demographic data on mortarmen.

o Determine the mortarman's attitudes about himself, his Military Occupational Specialty (MOS), institutional training, and his unit's mortar training.

o Determine the proportion of mortarmen who have received MOS institutional training, and to what level.

o Determine the amount of mortar training being conducted in tactical units.

o Measure individual mortar proficiency in tactical units.

o Identify the relationships between soldier, training, and performance.

Five hundred and thirty-one soldiers from 25 mortar platoons, representing six divisions and two separate brigades, were tested and surveyed. Analysis of this data yielded the following results/conclusions.

o While most first enlistment 11Cs take pride in being mortarmen, 57% of them indicated they would not re-enlist in the 11C MOS.

o Many mortarmen (49%) think they are expected to be able to do mortar skills that they have not been trained to do.

o While IMPC, ANCOC (11C) and BNCOC (11C) graduates felt these courses were very effective in preparing them for 11C assignments, AIT (11C) and IOBC (without IMPC) graduates felt these courses were ineffective in preparing them for 11C assignments.

o While most mortarmen indicated that unit training is necessary and that live firing exercises and training devices are effective means of training, most mortarmen indicated that their units do not train, live fire, or use training devices enough.

o Generally, school mortar training is perceived to be more effective than unit mortar training.

o While 40% of the platoon leaders have been trained in the Infantry Mortar Platoon Course, the vast majority of platoon members have not received school training (IMPC, Advanced NCO Course or Basic NCO Course) beyond AIT.

o Most platoon leaders indicated that their mortarmen train less than one day per week on mortar skills. An average of the responses reveals that gun crews train 5.3 hours per week, forward observers train 4.2 hours per week and FDC personnel train 4.3 hours per week.

o Most units live fire, fire smoke, and fire illumination once per quarter.

o Sixty percent of authorized mortar platoon personnel are actually available for daily training.

o TEC tapes are not being widely used by mortarmen.

o Individual mortar proficiency was generally less than adequate, as measured by USAIS-developed examinations:

	Average % Correct	
Examination	81mm	107mm
FO	43	
Fire w/o an FDC	54	43
Gunner's (Modified)	69	59
FDC	62	74
General Mortar Subjects	80	77

o Mortar skills are related to elementary mathematical skills. Many mortarmen are deficient in these basic math skills.

o School trained mortarmen generally performed better than non-school trained mortarmen.

o Subordinates of school trained leaders (platoon leaders or sergeants who were IMPC or ANCOC graduates) did not perform significantly better than subordinates of non-school trained leaders.

o Gun crews who live fire at least once per month performed significantly better on the Gunner's Exam than gun crews who live fire less frequently.

Funk, S.L., Johnson, C.A., Batzer, E., Gambell, T., Vandecaveye, G., Hiller, G.J. Training Detractors in FORSCOM Division and How They Are Handled (Research Report 1278). U.S. Army Research Institute for the Behavioral and Social Sciences, May 1980.

This report describes how leaders from division through company level view conditions which interfere or detract from combat training, and methods used to reduce the negative impact of training detractors. The study also explored the impact of DA imposed mandatory training on conducting effective combat training, and explored four resource areas previously thought to be areas where detractors could be found. Those resource areas were:

Personnel
Equipment and materiel
Time
Training areas and ranges

While the initial research was conducted at Fort Ord, California, the study reported here was conducted in five additional FORSCOM divisions. A companion report, titled "Actual Missions, Activities, and Job Tasks in Companies and Batteries (Task 1 Technical Report-Revised)" compares data from this study with the previous research conducted at Fort Ord.

The information gathering techniques included structured interviews tailored for various positions and levels of command, and questionnaires administered to personnel in company/battery leadership positions. Interviews were conducted by following a guide containing open-ended questions.

The information was analyzed using content analysis techniques for the interviews and computer tabulations for the questionnaires. Methods were used to ensure maximum inter-rater reliability in the collection of information both during the interviews and during the content analysis.

The most significant detractors reported in rank order by each level of command were:

Detractor	Company/Battery	Battalion	Brigade/DIVARTY	Division
Low Fill	1	1	1	1
Individual Performance	2	3	3	3
Turbulence	3	4	2	1
Installation support and taskings	4	2	2	2
Lack of equipment and material	5			
Lack of time	6			

The findings go on to describe each detractor, its impact on combat training, and methods being used to reduce the negative effects of detractors.

Giordano, D.J., Ursin, D.J., Zubal, O., Lutchendorf, T.E. Human Engineering Laboratory Mortar System Test (HELMST-1). U.S. Army Human Engineering Laboratory, Aberdeen Proving Ground, Maryland, April 1977.

HELMST-1 was conducted to measure the base-line performance of the 81mm mortar indirect fire team and provide information from which to determine the possible improvement in effectiveness through the introduction of new hardware and procedures. The field experiment was conducted during March-April 1975 at Fort Carson, Colorado. The performance of three ground-mounted 81mm mortar platoons was measured during registration and sheaf adjustment missions, shift missions, and polar-plot missions, wherein mortar to target range, observer to target range and offset from the line of fire, and rate of fire in fire for effect were varied.

On selected missions, data were obtained for a digital mortar fire-control calculator to compute firing data and for a laser range finder to adjust rounds onto a target. Total system and subsystem performance measures of accuracy, precision and time were computed and analyzed to assess current mortar effectiveness and determine possible improvements.

All three platoons tested were unable to deliver fire in a timely manner. Time from when the observer was given a target to engage until the first round was fired was greater than five minutes; time to deliver subsequent rounds was half as large, 2.5 minutes. The best composite times -- through the selection of the smallest incremental times for a platoon -- were four minutes and two minutes for first and subsequent rounds, respectively. The largest incremental t[illegible] on subsequent rounds, one minute, was required by the FDC to prepare the fire command.

Conclusions

o A laser range finder used by the FO will reduce the first round miss distance from the target and, therefore, the number of rounds and time to successfully engage a target.

o The reduction in the number of adjust rounds to enter fire for effect for a reduction in the miss distance of an adjust round can be predicted from a model which relates the miss distance of an adjust round and the number of subsequent adjust rounds to enter FFE.

o The largest reduction in mortar cycle time can be made by reducing the FDC computation time. This can be accomplished through the use of a digital fire direction calculator.

o Using current procedures for ali[illegible]ng the mortars parallel on the mounting azimuth, there is a potential for large errors that can reduce the effectiveness of fire without a registration and sheaf adjustment, and can increase the first round delivery error for a polar plot mission.

o Because mortar fire is more inaccurate than it is imprecise, the d[illegible]persion of the rounds about the target is not affected by rate of fire in f[illegible]e for effect and the gunner's ability to compensate for sight offset between rounds. Therefore, emphasis should be placed on increasing accuracy of fire before any great emphasis is placed on increasing precision of fire.

King, F. (Human Sciences Research, Inc.); Stein, E. S. (ARI); Sevilla, E. R., Jr. and Seed, R. J., III (HSR). Artillery engagement simulation. (Research Report 1245). U.S. Army Research Institute for the Behavioral and Social Sciences, May 1980.

The purpose of this report was to develop and evaluate a method for incorporating the field artillery battery into engagement simulation (ES) training exercises. Artillery fire in ES exercises is currently simulated by delivering artillery simulators to the place the maneuver commander requests. Artillerymen do not get useful training from this, and troop commanders develop unrealistic expectations of the responsiveness and accuracy of direct support artillery units.

Procedure:

By determining the data actually set on a gun after a simulated (dry) firing, the corresponding point of impact could be calculated and the artillery simulator be placed at the point where a round would land if live ammunition were used. A communications system was developed to integrate the artillery system--Forward Observer, Fire Direction Center, and guns--with the artillery engagement simulation (ARES) system--a Chief Artillery Controller, fire markers to place the simulators, gun controllers to observe the data on the gun, and a Fire Marker Control Center to calculate the burst locations.

A full-scale developmental test October 1979 exercised the control system by simulating 36 missions from a 155mm howitzer in response to calls and feedback from a forward observer. Each mission began at the initial request for fire and continued until the forward observer reported that the target had been hit.

Findings:

Over the 36 missions, the artillery battery improved its speed, accuracy, and consistency of performance. The participating artillerymen were enthusiastic and felt they had learned a great deal, indicating that the system was an effective training method in itself. Development of the system should continue, both to validate the ARES with actual maneuver troops and to extend the method to other indirect fire such as mortars.

Utilization of findings:

The artillery engagement simulation system developed here is compatible with both moderate fidelity training (REALTRAIN) and the high fidelity system soon to be fielded (MILES). The training procedures allow artillery units to become full partners in an overall combat training system which encourages learning in as realistic training environment as possible.

A draft training circular, designed for use by training managers of direct support artillery battalions, is being published separately.

Kuerr, M.C., Berger, D.C., Popelka, B.A. Sustaining Team Performance - A Systems Model. Defense Advanced Research Projects Agency, Arlington, VA, July 1979.

The purposes of this research were, first, to examine factors that influence the individual, organizational and collective skill retention within the military system, and, second, to design a model of variables that influence team performance changes over time.

Input variables fell into three categories: organizational and environmental, individual, and team-specific. The organization in which the team performs supplies to the team its individual members, and usually determines their number, selection, and training. It also assigns the team's mission or task, and defines the job of each team member. The environment determines working conditions -- including the level of emergent or unpredictable situations.

The second input category includes variables that affect individual skill retention or decay, such as the extent of the individual's original learning, the length of the interval between learning and use, the amount of practice during this "retention" interval, the type of task to be performed, as well as the quality of recall or transfer of information that is required.

The individual skill retention of the team members represents the reservoir of skill within the team. Conclusions based on the individual skill retention literature were:

1. Training to a high level of initial performance enhances skill retention. Minimal initial training (e.g., training until the first time the trainee can demonstrate the skill) is inadequate to sustain proficiency.

2. Skill on procedural tasks decays more rapidly than on continous control tasks. Therefore, procedural tasks need more training and more frequent refresher training.

3. Since skill performance aids (e.g., technical manuals and other job aids) reduce reliance on memory they enhance performance maintenance.

The last input category contains team-specific variables. The team's task and composition (number and ability of members), for instance, influence the level of team productivity. Furthermore, team processes such as communication, orientation, organization, adaptation, and motivation mediate effects of input variables on team output. In fact, communication and coordination requirements have been shown to degrade team performance to the point that total productivity is less than the potential sum of the products of individual members' efforts.

The system output, therefore, has both task-related and team process-related components. The focus of the present report, however, is on performance that is task-related.

Hypotheses derived from the team performance and team training literature were:

1. In operational military units, practice and other mission-related experience maintains or improves skills, even if it does not provide high fidelity training for individuals or for teams.

2. Task type and team size interact with team processes in their effects on team productivity.

3. Increasing team size degrades performance if it increases communication and coordination requirements; decreasing requirements for interactive processes enhances team performance.

4. Tasks performed in emergent situations benefit from team training, and tasks that are communication-oriented benefit from team training.

5. Team member ability strongly influences team productivity regardless of task type, team size, and other team performance variables.

Powers, T.R., McCluskey, M.R., Haggard, D.F., Boycan, G.G., Steinheiser, F. Jr. Determination of the Contribution of Live Firing to Weapons Proficiency (Technical Report 75-1). U.S. Army Research Institute for the Behavioral and Social Sciences, March 1975.

Two field tests were conducted to identify the contribution of live firing to weapons proficiency for two large-caliber weapon systems, the M60A1 tank and the 105mm howitzer. Fifty-six crews were involved in each test. The tank test dealt with the gunner's work with stationary and moving targets, and compared results from four experimental training methods using varying amounts of live firing and a training simulator. The artillery test dealt with a six-man crew firing at stationary targets, and compared results from training with varying amounts of live firing together with a simulator and dry firing. Each crew was given a live-fire criterion test, as well as paper-and-pencil measures. In both field tests, there were no statistically significant differences between training methods in the proficiency level of the trainees on the live-fire test. The attitude surveys showed some differences in the way in which trainees tended to view the various training methods.

Powers, T.R., McCluskey, M.R. Human Resources Research Organization. Task Analysis of Three Selected Weapons Systems. (Research Memorandum 76-20) U.S. Army Research Institute for the Behavioral and Social Sciences, Oct 1976.

The task was to conduct task analyses to identify the critical performance requirements for three selected weapons systems, and to identify the commonalities and differences in tasks within the three major weapons systems and other weapons of a similar but somewhat different nature. The three weapons used were:

1. The M60A1 Tank. This tank is armed with a 105mm main gun and is currently the main battle tank for the U.S. Army. Other weapons in the same general family are the newer M60A2 Tank and the M551 Armor Reconnaissance/Airborne Assault Vehicle (AR/AAV).

2. The 105mm Howitzer -- Self Propelled (SP). This is one of the principal artillery supporting weapons for the combat arms. Other weapons in the same general family are the 105mm Howitzer (Towed), the 155mm Howitzer (Towed), and the 8-Inch Howitzer (SP).

3. The 81mm Mortar. This is the principal supporting mortar used at platoon and company level. The only other weapon currently available in this family is the 4.2 Inch Mortar.

This report discusses the results of the research. Topics include identification of mission profiles, development of task inventories, administration of the task inventories to job incumbents, and analyses of the results.

Yates, L.G. Status of Unit Training Within USAREUR Units (Research Report 1207). U.S. Army Research Institute for the Behavioral and Social Sciences, May 1979.

To define the specific conditions that uniquely affect combat-arms unit training in the U.S. Army, Europe (USAREUR), a questionnaire and interview survey gathered information on training conditions from experienced company/battery commanders, battalion commanders, and S3s in 15 USAREUR infantry, armor, and field artillery battalions. Conditions investigated were: company/battery activities; training activity priorities, handicaps and constraints, resources, requirements, and methods and standards; and the commander's role in training and commander preparedness.

Although more time was reported spent in combat-related company/battery training activities (75%) than commanders theoretically recommended (66%), commanders rated the amount of time available for combat-related training as inadequate to borderline. Quality of personnel and equipment were rated satisfactory to very satisfactory for most activities.

Training priorities varied widely; armor units gave first priority to gunnery training, other branches to the Army Training and Evaluation Program (ARTEP) and personnel programs. Many training handicaps were reported: command emphasis on nontraining programs; lack of personnel and cross-training; constraints of limited training time, area, facilities, and funds; changing priorities; and nontraining missions. Most newly assigned enlisted and junior officer personnel needed additional training.

Training facilities seemed adequate. About a third of combat-related training can be done in garrison, and for half of that the garrison has most or all of the necessary features. Units spent an average 5.5 days a month at local training areas, which artillery commanders rated good for 70% of their training items, other branches for 51%. Units used major training areas about three times a year, rated the facilities good.

Two-thirds of the training materials listed had been used; materials were rated as adequate. Training literature was considered generally relevant, available, and adequate. Schools needed more flexibility in scheduling course quotas. Training ammunition supplies were rated as borderline.

Adequacy of training time was rated borderline, on the average; 73% of the commanders said they were able to schedule concurrent training. Most company/battery commanders reported initiating combat-relevant activities but few other activities. Schedule changes were a problem to 45% of the commanders. Most training (67%) was performance oriented, and 68% of the units used performance objectives standards. Field Manuals and Training Circulars were adequate.

The actual and idealized training roles corresponded well for company/battery commanders, not so well for battalion commanders. Commanders felt well-prepared to use available weapons systems but expressed a need for more maneuver and field training with support systems and other branches, and for better unit training in maintenance of weapons systems.

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INFANTRY MORTAR QUESTIONNAIRE

APPENDIX B: ANCOC/IMPC Noncommissioned Officer Responses

The total sample (N=116) includes subjects from ANCOC class 3-83, and IMPC classes 4-83 and 5-83. The responses identified with the questionnaire item are based on the total number of responses to that question and not to the sample total (N=116). The number of responses, by item, are presented with each question used as part of this survey. The nature of the questionnaire, designed earlier for field use, made some responses inappropriate in the institutional training environment. These items are so noted.

(Responses)
1. Your last name (Print):_____

2. Your Social Security Number:_____

(116)
3. Your rank (Circle one):

E1	E4	E7(19)	PMOS 11C (109)
E2	E5 (7)	O1	
E3	E6(90) 77.6%	O2	SMOS_____

(99)
4. To which type of mortar platoon/section are you assigned? (Circle one)

81mm(56) 4.2 inch(43)

(111)
5. Which of the following describes your battalion? (Circle one)

Light Infantry(26)	Airborne (7)	Drill Sgt (5)
Mech Infantry (41)	Airmobile (7)	Other (10)
	Armor/Cav(15)	

(106)
6. To which Division or Separate Brigade are you assigned? (Circle one)

1st Inf (Riley)(6)	5th Inf (Polk)(5)	25th Inf(3)	1st Cav(4)
1st Inf (Forward)(1)	5th Inf (Knox)	82d Abn(7)	194 Arm Bde
2d Inf (3)	7th Inf (7)	101st Ambl(5)	172 Inf Bde(5)
3d Inf (4)	8th Inf (5)	1st Arm(2)	193 Inf Bde(2)
4th Inf(6)	9th Inf (6)	2d Arm(3)	197 Inf Bde(4)
	24th Inf(5)	3d Arm(6)	Other(17)

(83)
7. How many more months do you expect to be in this unit? Guess, for many this training is between assignments.

(84)
8. Your present duty position (Circle one): (most recent)

Plt Ldr (7)	FD Chief (9)	FD Computer(3)	Asst Gunner
Plt SGT (54)64.3%	Squad Ldr (1)	RATELO	Ammo Bearer
Section Ldr (11)	Forward Obs	Gunner	Driver

(74)

9. How many months have you worked in your present duty position in this unit?_____
Best guess, or between assignments.

(79)

10. Throughout your Army career, how many months have you worked with mortars as a: (Multiple entries by almost the total sample. Key positions are presented.)

	81mm	4.2 inch
Plt Ldr	(20) $\bar{x}$ = 11 months	(10) $\bar{x}$ = 6 months
Plt SGT	(71) $\bar{x}$ = 18 months	(38) $\bar{x}$ = 11 months
Section Ldr	(59) $\bar{x}$ = 15 months	(26) $\bar{x}$ = 12 months
FD Chief	(31) $\bar{x}$ = 11 months	(35) $\bar{x}$ = 13 months
Squad Ldr	_____	_____
Forward Obs	_____	_____
FD Computer	(32) $\bar{x}$ = 14 months	(25) $\bar{x}$ = 9 months
RATELO	_____	_____
Gunner	(49) $\bar{x}$ = 11 months	(22) $\bar{x}$ = 7 months
Asst Gunner	_____	_____
Ammo Bearer	_____	_____
Driver	_____	_____
TOTAL	_____	_____

(Experience of the 79 respondents: 81mm only - 27; 4.2" only - 9; both weapons - 43)

11. In the spaces provided, write the month and year that you completed any of the following military courses (e.g., March 1976 = 03/76). If you did not attend a course, leave that space blank.

Advanced Individual Training (AIT) -11B ___/___ (MO YR)

(95) -11C ___/___ (MO YR) 1964 - 1979. The majority (48) had a mean time of 11.5 years in the 11C MOS.

-11E ___/___ (MO YR)

Primary NCO Course (PNCOC) ___/___ (MO YR)

Basic NCO Course (BNCOC) ___/___ (MO YR)

Advanced NCO Course (ANCOC) ___/___ (MO YR)

Officer Basic Course (OBC) ___/___ (MO YR)

Infantry Mortar Platoon Course (IMPC) ___/___ (MO YR) 21 ANCOC students had completed IMPC.

Other courses which include mortar training:

(9)

(identify) 9 listed division level FDC or mortar-related schools between 1976 and 1982. ____/____ MO YR

_____ ____/____ MO YR

(116)

12. Circle the highest civilian school grade you have completed:

						High School				College		Graduate School
06	07	08	09	10	11	12	13	14	15	16	17	18
					(1.7%)	(74.14%)	(<--24.14%-->					

(114)

13. Have you ever successfully completed: (Answer all three)

(114)Algebra?	Yes(65)57.02%	No_____
(111)Geometry?	Yes(33)29.73%	No_____
(107)Trigonometry?	Yes(11)10.28%	No_____

(115)

14. Circle one of the five following statements which best describes your use of TEC (Training Extension Course) Tapes:

(8)1. I do not know what TEC tapes are.

(11)2. I know what TEC tapes are.

(21)3. I know what TEC tapes are, and I know how to use TEC tapes.

(19)4. I know what TEC tapes are, I know how to use TEC tapes, and I use TEC tapes to help me do my job better.

(56)5. 48.7% I know what TEC tapes are, I know how to use TEC tapes, I use TEC tapes to help me do my job better, and I combine the use of TEC tapes with hands-on training.

15. Which one of the following courses did you attend last? If you did not attend any of these courses leave Items 15 thru 23 blank. (Circle one)

1. AIT (11B)
2. AIT (11C)
3. AIT (11E)
4. BNCOC
5. ANCOC
6. OBC
7. IMPC(21)

Poor responses invalidated this data generally.

16. How long has it been since you attended the above course? (Circle one)

1. 0 to 1 year ago
2. 1 to 2 years ago
3. 2 to 3 years ago
4. 3 to 4 years ago
5. more than 4 years ago

Poor responses invalidated this data generally.

For items 17 thru 51, you may AGREE, DISAGREE, or be UNDECIDED. If you agree with the statement, you are to AGREE STRONGLY or AGREE SOMEWHAT. If you disagree with the statement, you are to DISAGREE STRONGLY or DISAGREE SOMEWHAT. Use the following scale in circling your response to each statement:

AGREE STRONGLY = 5
AGREE SOMEWHAT = 4
UNDECIDED = 3
DISAGREE SOMEWHAT = 2
DISAGREE STRONGLY = 1

Responses (108)	AGREE STRONGLY	AGREE SOMEWHAT	UNDECIDED	DISAGREE SOMEWHAT	DISAGREE STRONGLY	$\bar{x}$ Response
17. The mortar training I received in this last course (the one you identified in #15 above) required a lot of work on my part.						$\bar{x} = 3.90$
(111) 18. This last course was so hard that most of the students could not understand all the material.						$\bar{x} = 2.52$
(109) 19. The mortar instructors in this last course knew their subject.						$\bar{x} = 4.61$
(109) 20. The mortar instructors in this last course could present the material well.						$\bar{x} = 4.59$
(109) 21. Time spent on mortar training in this last course was well used (little wasted time).						$\bar{x} = 3.95$
(111) 22. The instructors made it clear why the subjects they were teaching were important.						$\bar{x} = 4.42$
(109) 23. The mortar training I received in this last course helped prepare me to do the job I went into.						$\bar{x} = 4.07$
(111) 24. Generally speaking, platoon mortar training helps my unit perform better.						$\bar{x} = 4.61$
(116*) 25. Mortar live-firing makes a unit more effective.						$\bar{x} = 4.84$
(108) 26. My mortar platoon live-fires enough.						$\bar{x} = 2.39$
(113) 27. The use of mortar training devices such as the Bryant device, pneumatic device, Sabot device, and similar devices makes a unit more effective.						$\bar{x} = 3.40$
(108) 28. My unit makes good use of mortar training devices.						$\bar{x} = 3.03$
(109) 29. The training I receive in my unit teaches me to do my job well.						$\bar{x} = 3.54$
(54) 30. I think my unit's training is getting me ready for a higher job in my platoon (omit if you are a PSG or PLT LDR).						$\bar{x} = 3.43$
(106) 31. Most men in my platoon perform their duties to the best of their ability.						$\bar{x} = 4.07$
(106) 32. My leaders encourage friendly competition within my platoon during unit training.						$\bar{x} = 4.09$

AGREE STRONGLY = 5
AGREE SOMEWHAT = 4
UNDECIDED = 3
DISAGREE SOMEWHAT = 2
DISAGREE STRONGLY = 1

	AGREE STRONGLY	AGREE SOMEWHAT	UNDECIDED	DISAGREE SOMEWHAT	DISAGREE STRONGLY
(103) 33. I am proud to be a member of this platoon.	x = 4.52				
(102) 34. I get enough mortar training every week in my principal duty position.	x = 2.95				
(101) 35. If my platoon took an ARTEP today, we would do well on it.	x = 3.78				
(116*) 36. If I had to take my Skill Qualification Test (SQT) today, I would do well on the written part.	x = 4.36				
(115) 37. If I had to take my SQT today, I would do well on the performance part.	x = 4.57				
(114) 38. Usually I am required to do a higher job than my pay grade calls for.	x = 4.46				
(112) 39. I take pride in being a mortarman.	x = 4.92				
(34) 40. I will re-enlist as an 11C (answer if on 1st enlistment only).	x = 4.68				
(24) 41. I will re-enlist in a different MOS (answer if on 1st enlistment only).	x = 1.88				
(115) 42. I understand how FIST teams, FDCs, and gunners work together to put steel on the target.	x = 4.85				
(116*) 43. To learn FIST and FDC skills, the average soldier needs special training in math.	x = 4.20				
(111) 44. People expect me to be able to do mortar skills that I have not been trained to do.	x = 2.59				
(107) 45. I could do my job better if I had a chance to cross-train in other jobs in my platoon.	x = 2.79				
(110) 46. I don't do as well on tests as I can really do.	x = 2.47				
(113) 47. Many mortarmen fear live-firing.	x = 1.88				
(107) 48. Many mortarmen fear night live-firing.	x = 1.82				
(104) 49. The way I do my job helps my platoon perform better.	x = 4.56				
(111) 50. My mortar training has prepared me to perform mortarmen duties on the 81mm mortar.	x = 4.42				
(107) 51. My mortar training has prepared me to perform mortarmen duties on the 4.2 inch mortar.	x = 3.96				

*Denotes total sample (N=116) response.

QUESTIONS 52 thru 61 ARE TO BE ANSWERED BY: PLATOON LEADERS, PLATOON SERGEANTS and SQUAD LEADERS ONLY

(80)
52. How many hours per week do your mortar gun crews train on the mortar? 8 hrs or less (53.75%)

(79)
53. How many hours per week do you train on FIST-related subjects? 4 hrs or less (86.07%)

(79)
54. How many hours per week do your Fire Direction Center personnel train on FDC-related subjects? 8 hours or less (58.22%)

55. What is your mortar platoon's/section's authorized versus assigned strength (e.g., 26/20)? ____/____ AUTH/ASSG

81mm (N=30) 80.15%
4.2" (N=35) 77.20%

(95)
56. What area of mortar training do you consider to be the most critical/important? (Circle one)

A. FIST 3.16% B. Gunnery 7.37% C. FDC Procedures 89.47%

(60)
57. If your mortar platoon/section is understrength, in what duty position are you most critically short? (Circle one) (Most multiple identification.)

Plt Ldr (4)	FD Chief (4)	FD Computer(18)	Asst Gunner (14)
Plt SGT (1)	Squad Ldr (11)	RATELO (2)	Ammo Bearer (24)
Section Ldr (3)	Forward Obs	Gunner (14)	Driver (12)

(80)
58. Considering leave, CQ, guard duty, GED, SD, etc., approximately what percent of your assigned people are usually available to you for training on a daily basis? (e.g., 60%, 75%)

$\bar{x}$ = 72 %

(85)
59. How often does your mortar platoon/section live-fire? (Circle one)

$\bar{x}$ = 3.65
1. Never 2.35%
2. Once a year 5.88%
3. Once every 6 months 28.24%
4. Once every quarter 51.77%
5. At least once a month 11.77%

(83)
60. How often does your mortar platoon/section fire illumination? (Circle one)

$\bar{x}$ = 3.60
1. Never 1.21%
2. Once a year 8.43%
3. Once every 6 months 30.12%
4. Once every quarter 49.98%
5. At least once a month 10.84%

(82)
61. How often does your mortar platoon/section fire smoke? (Circle one)

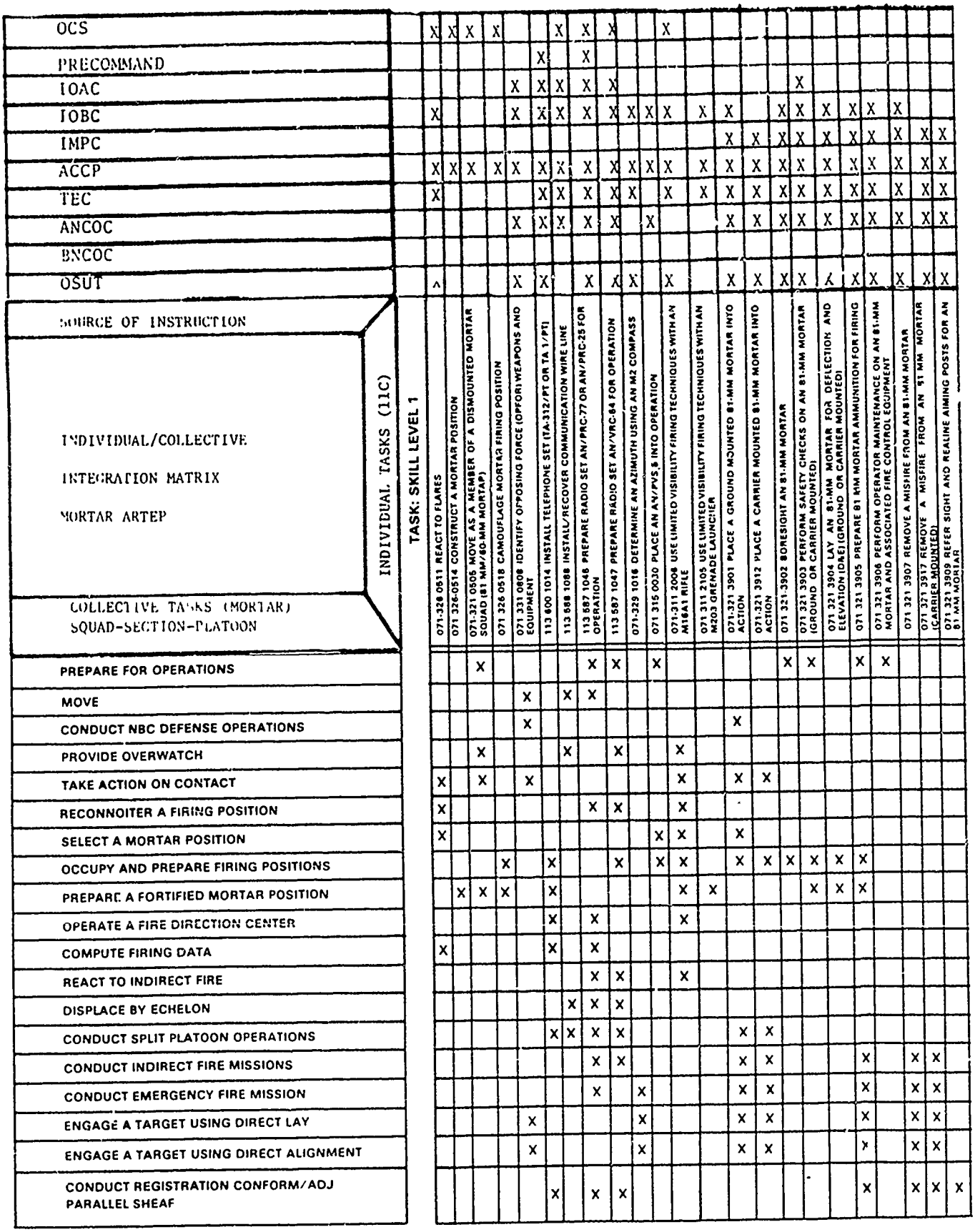
$\bar{x}$ = 3.5
1. Never 2.44%
2. Once a year 9.76%
3. Once every 6 months 34.15%
4. Once every quarter 42.68%
5. At least once a month 10.98%

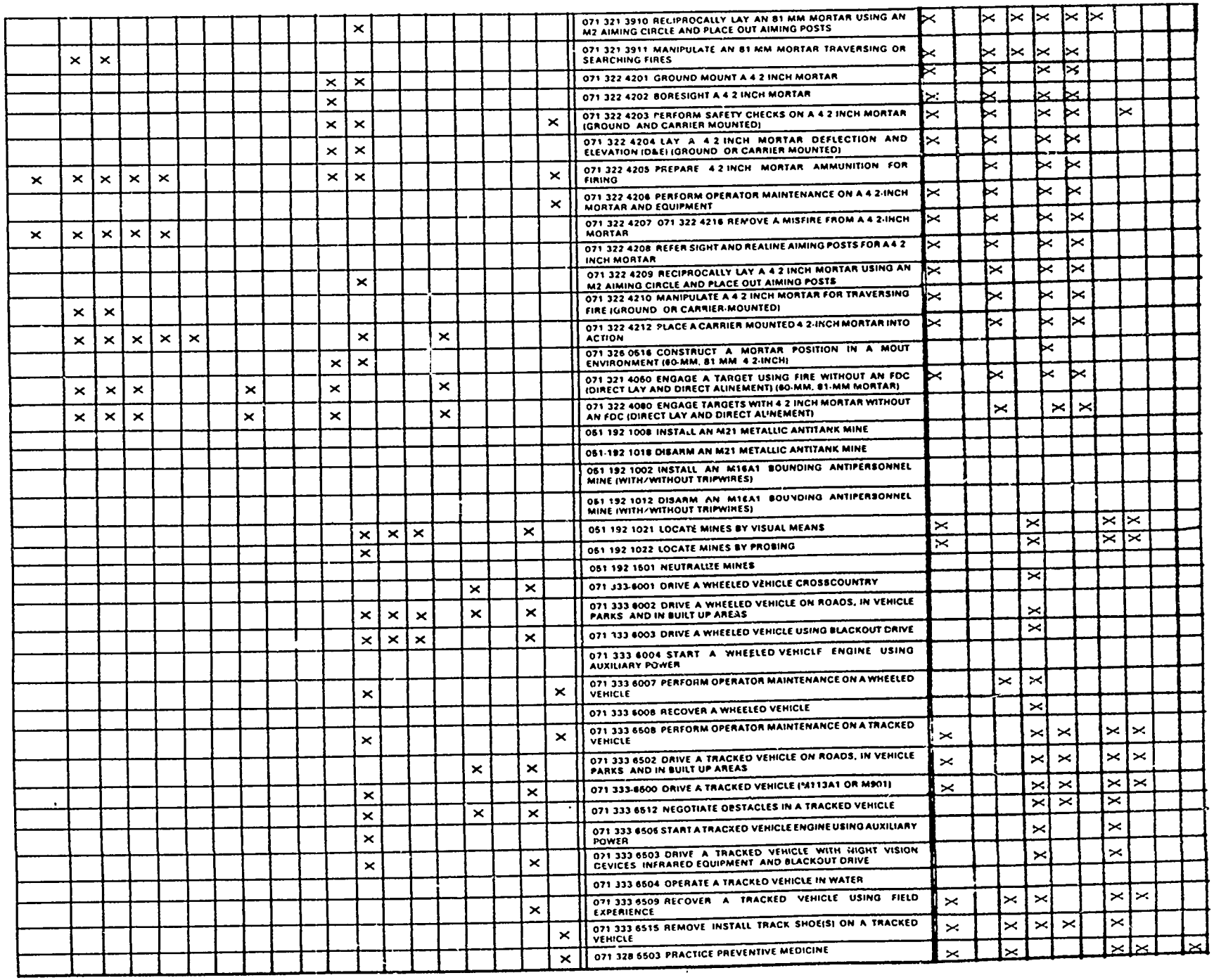
62. COMMENTS (Request any comments you may have on Infantry School instruction, your unit training program, and/or any changes, deletions or additions to mortar training you would recommend.)

Presented in text.

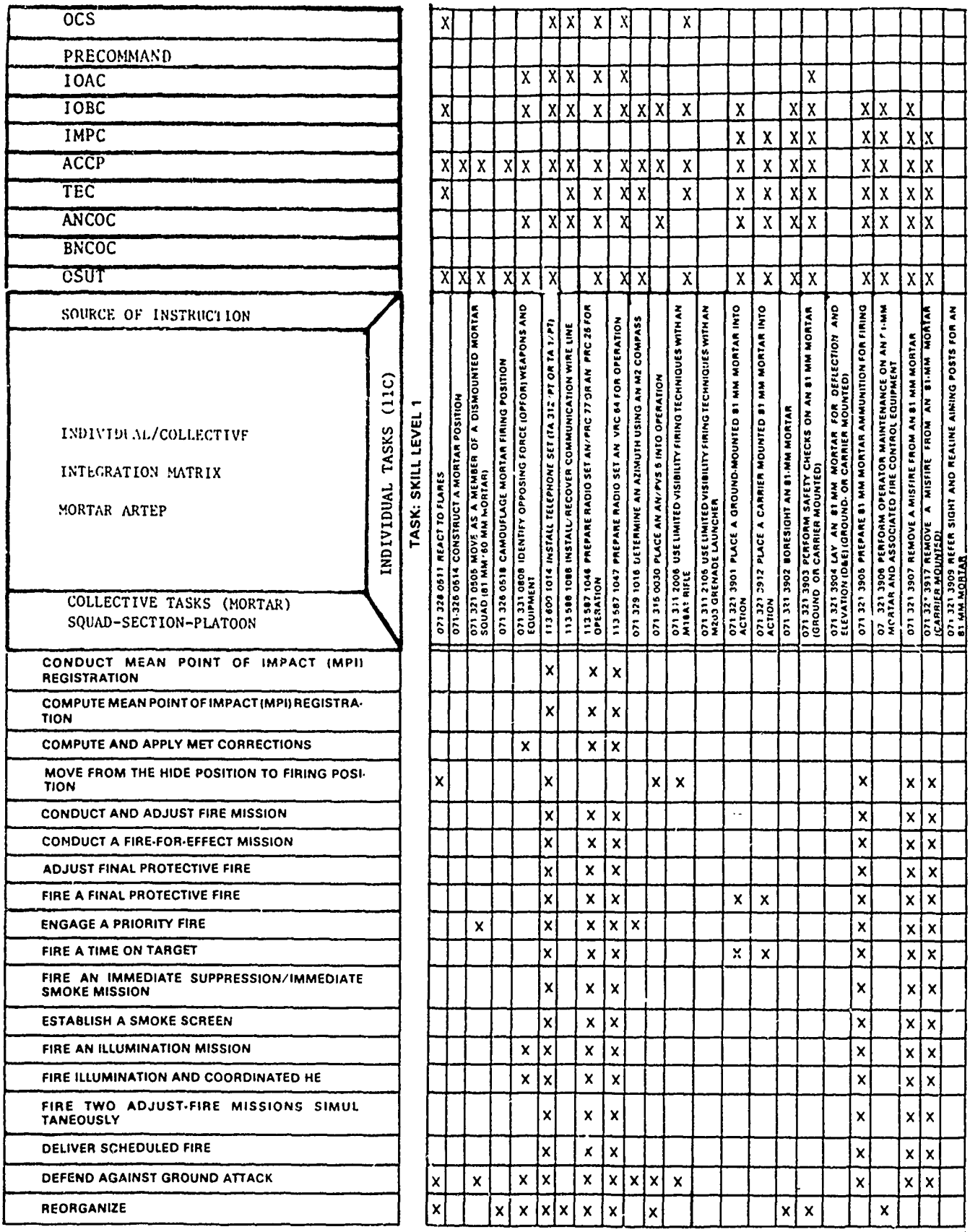
APPENDIX C

INDIVIDUAL/COLLECTIVE INTEGRATION MATRIX MORTAR ARTEP


OCS
PRECOMMAND
IOAC
IOBC
IMPC
ACCP
TEC
ANCOC
BNCOC
OSUT
SOURCE OF INSTRUCTION
INDIVIDUAL/COLLECTIVE
INTEGRATION MATRIX
MORTAR ARTEP
INDIVIDUAL TASKS (11C)
TASK: SKILL LEVEL 1
071-326-0511 REACT TO FLARES
071 326-0514 CONSTRUCT A MORTAR POSITION
071-321-0505 MOVE AS A MEMBER OF A DISMOUNTED MORTAR SQUAD (81 MM/60-MM MORTAR)
071 326 0518 CAMOUFLAGE MORTAR FIRING POSITION
071 331 0808 IDENTIFY OPPOSING FORCE (OPFOR) WEAPONS AND EQUIPMENT
113 600 1014 INSTALL TELEPHONE SET (TA-312/PT OR TA 1/PT)
113 588 1088 INSTALL/RECOVER COMMUNICATION WIRE LINE
113 587 1046 PREPARE RADIO SET AN/PRC-77 OR AN/PRC-25 FOR OPERATION
113 587 1047 PREPARE RADIO SET AN/VRC-64 FOR OPERATION
071-329 1016 DETERMINE AN AZIMUTH USING AN M2 COMPASS
071 315 0030 PLACE AN AVP/PVS,5 INTO OPERATION
071-311 2004 USE LIMITED VISIBILITY FIRING TECHNIQUES WITH AN M16A1 RIFLE
071 311 2105 USE LIMITED VISIBILITY FIRING TECHNIQUES WITH AN M203 GRENADE LAUNCHER
071-321 3901 PLACE A GROUND MOUNTED 81-MM MORTAR INTO ACTION
071-321 3912 PLACE A CARRIER MOUNTED 81-MM MORTAR INTO ACTION
071 321-3902 BORESIGHT AN 81-MM MORTAR
071 321 3903 PERFORM SAFETY CHECKS ON AN 81-MM MORTAR (GROUND OR CARRIER MOUNTED)
071 321 3904 LAY AN 81-MM MORTAR FOR DEFLECTION AND ELEVATION (DAE) (GROUND OR CARRIER MOUNTED)
071 321 3905 PREPARE 81 MM MORTAR AMMUNITION FOR FIRING
071 321 3906 PERFORM OPERATOR MAINTENANCE ON AN 81-MM MORTAR AND ASSOCIATED FIRE CONTROL EQUIPMENT
071 321 3907 REMOVE A MISFIRE FROM AN 81-MM MORTAR
071 321 3917 REMOVE A MISFIRE FROM AN 81 MM MORTAR (CARRIER MOUNTED)
071 321 3909 REFER SIGHT AND REALINE AIMING POSTS FOR AN 81 MM MORTAR
COLLECTIVE TASKS (MORTAR) SQUAD-SECTION-PLATOON
PREPARE FOR OPERATIONS
MOVE
CONDUCT NBC DEFENSE OPERATIONS
PROVIDE OVERWATCH
TAKE ACTION ON CONTACT
RECONNOITER A FIRING POSITION
SELECT A MORTAR POSITION
OCCUPY AND PREPARE FIRING POSITIONS
PREPARE A FORTIFIED MORTAR POSITION
OPERATE A FIRE DIRECTION CENTER
COMPUTE FIRING DATA
REACT TO INDIRECT FIRE
DISPLACE BY ECHELON
CONDUCT SPLIT PLATOON OPERATIONS
CONDUCT INDIRECT FIRE MISSIONS
CONDUCT EMERGENCY FIRE MISSION
ENGAGE A TARGET USING DIRECT LAY
ENGAGE A TARGET USING DIRECT ALIGNMENT
CONDUCT REGISTRATION CONFORM/ADJ PARALLEL SHEAF



071 321 3910	RECIPROCALLY LAY AN 81 MM MORTAR USING AN M2 AIMING CIRCLE AND PLACE OUT AIMING POSTS
071 321 3911	MANIPULATE AN 81 MM MORTAR TRAVERSING OR SEARCHING FIRES
071 322 4201	GROUND MOUNT A 4 2 INCH MORTAR
071 322 4202	BORESIGHT A 4 2 INCH MORTAR
071 322 4203	PERFORM SAFETY CHECKS ON A 4 2 INCH MORTAR (GROUND AND CARRIER MOUNTED)
071 322 4204	LAY A 4 2 INCH MORTAR DEFLECTION AND ELEVATION (D&E) (GROUND OR CARRIER MOUNTED)
071 322 4205	PREPARE 4 2 INCH MORTAR AMMUNITION FOR FIRING
071 322 4206	PERFORM OPERATOR MAINTENANCE ON A 4 2-INCH MORTAR AND EQUIPMENT
071 322 4207 071 322 4216	REMOVE A MISFIRE FROM A 4 2-INCH MORTAR
071 322 4208	REFER SIGHT AND REALINE AIMING POSTS FOR A 4 2 INCH MORTAR
071 322 4209	RECIPROCALLY LAY A 4 2 INCH MORTAR USING AN M2 AIMING CIRCLE AND PLACE OUT AIMING POSTS
071 322 4210	MANIPULATE A 4 2 INCH MORTAR FOR TRAVERSING FIRE (GROUND OR CARRIER-MOUNTED)
071 322 4212	PLACE A CARRIER MOUNTED 4 2-INCH MORTAR INTO ACTION
071 326 0516	CONSTRUCT A MORTAR POSITION IN A MOUT ENVIRONMENT (60-MM, 81 MM 4 2-INCH)
071 321 4060	ENGAGE A TARGET USING FIRE WITHOUT AN FDC (DIRECT LAY AND DIRECT ALINEMENT) (60-MM, 81-MM MORTAR)
071 322 4080	ENGAGE TARGETS WITH 4 2 INCH MORTAR WITHOUT AN FDC (DIRECT LAY AND DIRECT ALINEMENT)
051 192 1008	INSTALL AN M21 METALLIC ANTITANK MINE
051-192 1018	DISARM AN M21 METALLIC ANTITANK MINE
051 192 1002	INSTALL AN M16A1 BOUNDING ANTIPERSONNEL MINE (WITH/WITHOUT TRIPWIRES)
051 192 1012	DISARM AN M16A1 BOUNDING ANTIPERSONNEL MINE (WITH/WITHOUT TRIPWIRES)
051 192 1021	LOCATE MINES BY VISUAL MEANS
051 192 1022	LOCATE MINES BY PROBING
051 192 1501	NEUTRALIZE MINES
071 333-6001	DRIVE A WHEELED VEHICLE CROSSCOUNTRY
071 333 6002	DRIVE A WHEELED VEHICLE ON ROADS, IN VEHICLE PARKS AND IN BUILT UP AREAS
071 133 6003	DRIVE A WHEELED VEHICLE USING BLACKOUT DRIVE
071 333 6004	START A WHEELED VEHICLF ENGINE USING AUXILIARY POWER
071 333 6007	PERFORM OPERATOR MAINTENANCE ON A WHEELED VEHICLE
071 333 6008	RECOVER A WHEELED VEHICLE
071 333 6508	PERFORM OPERATOR MAINTENANCE ON A TRACKED VEHICLE
071 333 6502	DRIVE A TRACKED VEHICLE ON ROADS, IN VEHICLE PARKS AND IN BUILT UP AREAS
071 333-6500	DRIVE A TRACKED VEHICLE (M113A1 OR M901)
071 333 6512	NEGOTIATE OBSTACLES IN A TRACKED VEHICLE
071 333 6506	START A TRACKED VEHICLE ENGINE USING AUXILIARY POWER
071 333 6503	DRIVE A TRACKED VEHICLE WITH NIGHT VISION DEVICES INFRARED EQUIPMENT AND BLACKOUT DRIVE
071 333 6504	OPERATE A TRACKED VEHICLE IN WATER
071 333 6509	RECOVER A TRACKED VEHICLE USING FIELD EXPERIENCE
071 333 6515	REMOVE INSTALL TRACK SHOE(S) ON A TRACKED VEHICLE
071 328 6503	PRACTICE PREVENTIVE MEDICINE


OCS
PRECOMMAND
IOAC
IOBC
IMPC
ACCP
TEC
ANCOC
BNCOC
OSUT
SOURCE OF INSTRUCTION
INDIVIDUAL/COLLECTIVE
INTEGRATION MATRIX
MORTAR ARTEP
INDIVIDUAL TASKS (11C)
COLLECTIVE TASKS (MORTAR)
SQUAD-SECTION-PLATOON
TASK: SKILL LEVEL 1
071 326 0511 REACT TO FLARES
071-326 0514 CONSTRUCT A MORTAR POSITION
071 321 0505 MOVE AS A MEMBER OF A DISMOUNTED MORTAR SQUAD (81 MM-60 MM MORTAR)
071 326 0518 CAMOUFLAGE MORTAR FIRING POSITION
071 331 0808 IDENTIFY OPPOSING FORCE (OPFOR) WEAPONS AND EQUIPMENT
113 609 1014 INSTALL TELEPHONE SET (TA 312/PT OR TA 1/PT)
113 598 1088 INSTALL/RECOVER COMMUNICATION WIRE LINE
113 587 1046 PREPARE RADIO SET AN/PRC 77 FOR AN PRC 25 FOR OPERATION
113 587 1047 PREPARE RADIO SET AN VRC 64 FOR OPERATION
071 329 1016 DETERMINE AN AZIMUTH USING AN M2 COMPASS
071 315 0030 PLACE AN AN/PVS 5 INTO OPERATION
071 311 2008 USE LIMITED VISIBILITY FIRING TECHNIQUES WITH AN M16A1 RIFLE
071 311 2106 USE LIMITED VISIBILITY FIRING TECHNIQUES WITH AN M203 GRENADE LAUNCHER
071 321 3901 PLACE A GROUND-MOUNTED 81 MM MORTAR INTO ACTION
071 321 3912 PLACE A CARRIER MOUNTED 81 MM MORTAR INTO ACTION
071 321 3902 BORESIGHT AN 81-MM MORTAR
071 321 3903 PERFORM SAFETY CHECKS ON AN 81 MM MORTAR (GROUND OR CARRIER MOUNTED)
071 321 3904 LAY AN 81 MM MORTAR FOR DEFLECTION AND ELEVATION (D&E) (GROUND- OR CARRIER MOUNTED)
071 321 3905 PREPARE 81 MM MORTAR AMMUNITION FOR FIRING
07 321 3906 PERFORM OPERATOR MAINTENANCE ON AN 81-MM MORTAR AND ASSOCIATED FIRE CONTROL EQUIPMENT
071 321 3907 REMOVE A MISFIRE FROM AN 81 MM MORTAR
071 32? 3917 REMOVE A MISFIRE FROM AN 81-MM MORTAR (CARRIER MOUNTED)
071 321 3909 REFER SIGHT AND REALINE AIMING POSTS FOR AN 81 MM MORTAR
CONDUCT MEAN POINT OF IMPACT (MPI) REGISTRATION
COMPUTE MEAN POINT OF IMPACT (MPI) REGISTRATION
COMPUTE AND APPLY MET CORRECTIONS
MOVE FROM THE HIDE POSITION TO FIRING POSITION
CONDUCT AND ADJUST FIRE MISSION
CONDUCT A FIRE-FOR-EFFECT MISSION
ADJUST FINAL PROTECTIVE FIRE
FIRE A FINAL PROTECTIVE FIRE
ENGAGE A PRIORITY FIRE
FIRE A TIME ON TARGET
FIRE AN IMMEDIATE SUPPRESSION/IMMEDIATE SMOKE MISSION
ESTABLISH A SMOKE SCREEN
FIRE AN ILLUMINATION MISSION
FIRE ILLUMINATION AND COORDINATED HE
FIRE TWO ADJUST-FIRE MISSIONS SIMULTANEOUSLY
DELIVER SCHEDULED FIRE
DEFEND AGAINST GROUND ATTACK
REORGANIZE

																		071 321 3910 RECIPROCALLY LAY AN 81 MM MORTAR USING AN M2 AIMING CIRCLE AND PLACE OUT AIMING POSTS										
									X									071 321 3911 MANIPULATE AN 81 MM MORTAR TRAVERSING OR SEARCHING FIRES	X		X	X		X				
X									X									071 322 4201 GROUND MOUNT A 4 2 INCH MORTAR	X		X	X		X				
																		071 322 4202 BORESIGHT A 4 2 INCH MORTAR										
																		071 322 4203 PERFORM SAFETY CHECKS ON A 4 2-INCH MORTAR (GROUND AND CARRIER MOUNTED)										
																		071 322 4204 LAY A 4 2-INCH MORTAR DEFLECTION AND ELEVATION (D&E) (GROUND- OR CARRIER MOUNTED)										
	X	X	X	X	X	X	X	X	X	X	X	X	X	X				071 322 4205 PREPARE 4 2 INCH MORTAR AMMUNITION FOR FIRING			X		X	X				
X																		071 322 4206 PERFORM OPERATOR MAINTENANCE ON A 4 2 INCH MORTAR AND EQUIPMENT	X		X		X	X				
	X	X	X	X	X	X	X	X	X	X	X	X	X	X				071 322 4207 '071 322 4216 REMOVE A MISFIRE FROM A 4 2 INCH MORTAR	X		X		X	X				
																		071 322 4208 REFER SIGHT AND REALINE AIMING POSTS FOR A 4 2 INCH MORTAR										
																		071 322 4209 RECIPROCALLY LAY A 4 2 INCH MORTAR USING AN M2 AIMING CIRCLE AND PLACE OUT AIMING POSTS										
									X									071 322 4210 MANIPULATE A 4 2 INCH MORTAR FOR TRAVERSING FIRE (GROUND- OR CARRIER MOUNTED)	X		X		X					
								X		X								071 322 4212 PLACE A CARRIER MOUNTED 4 2-INCH MORTAR INTO ACTION	X		X		X	X				
														X				071 326 0516 CONSTRUCT A MORTAR POSITION IN A MOUT ENVIRONMENT (60 MM, 81 MM 4 2 INCH)					X					
									X									071 321 4050 ENGAGE A TARGET USING FIRE WITHOUT AN FDC (DIRECT LAY AND DIRECT ALINEMENT) (60 MM 81-MM MORTAR)	X		X		X	X				
									X									071 322 4080 ENGAGE TARGETS WITH 4 2 INCH MORTAR WITHOUT AN FDC (DIRECT LAY AND DIRECT ALINEMENT)			X		X	X				
X																		051 192 1008 INSTALL AN M21 METALLIC ANTITANK MINE	X		X	X			X	X		
X																		051 192 1018 DISARM AN M21 METALLIC ANTITANK MINE	X		X	X			X	X		
X																		051 192 1002 INSTALL AN M16A1 BOUNDING ANTIPERSONNEL MINE (WITH WITHOUT TRIPWIRES)	X		X	X			X	X		
X																		051 192 1012 DISARM AN M16A1 BOUNDING ANTIPERSONNEL MINE (WITH WITHOUT TRIPWIRES)	X		X	X			X	X		
X																		051 192 1021 LOCATE MINES BY VISUAL MEANS	X			X			X	X		
X																		051 192 1022 LOCATE MINES BY PROBING	X			X			X	X		
X																		051 192 1501 NEUTRALIZE MINES	X						X	X		
X																		071 333 6001 DRIVE A WHEELED VEHICLE CROSSCOUNTRY				X						
X																		071 333 6002 DRIVE A WHEELED VEHICLE ON ROADS, IN VEHICLE PARKS AND IN BUILT UP AREAS				X						
X																		071 333 6003 DRIVE A WHEELED VEHICLE USING BLACKOUT DRIVE				X						
X																		071 333-6004 START A WHEELED VEHICLE ENGINE USING AUXILIARY POWER				X			X			
X																		071 333 6007 PERFORM OPERATOR MAINTENANCE ON A WHEELED VEHICLE			X	X						
X																		071 333 6008 RECOVER A WHEELED VEHICLE				X						
X																		071 333 6538 PERFORM OPERATOR MAINTENANCE ON A TRACKED VEHICLE	X			X	X		X	X		
X																		071 333 6602 DRIVE A TRACKED VEHICLE ON ROADS, IN VEHICLE PARKS AND IN BUILT UP AREAS	X			X	X		X	X		
																		071-333-6600 DRIVE A TRACKED VEHICLE (M113A1 OR M901)										
																		071 333 6512 NEGOTIATE OBSTACLES IN A TRACKED VEHICLE										
																		071 333 6505 START A TRACKED-VEHICLE ENGINE USING AUXILIARY POWER										
																		071 333 6503 DRIVE A TRACKED VEHICLE WITH NIGHT VISION DEVICES INFRARED EQUIPMENT AND BLACKOUT DRIVE										
X																		071 333 6504 OPERATE A TRACKED VEHICLE IN WATER	X			X			X			
X																		071 333 6509 RECOVER A TRACKED VEHICLE USING FIELD EXPERIENCE	X		X	X			X	X		
X																		071 333 6515 REMOVE INSTALL TRACK SHOE(S) ON A TRACKED VEHICLE	X		X	X	X		X			
X																		071 328 5503 PRACTICE PREVENTIVE MEDICINE	X		X				X	X		X

SOURCE OF INSTRUCTION	INDIVIDUAL TASKS (11C)
OCS	
PRECOMMAND	
IOAC	
IOBC	
IMPC	
ACCP	
TEC	
ANCOC	
BNCOC	
OSUT	

INDIVIDUAL/COLLECTIVE

INTEGRATION MATRIX

MORTAR ARTEP

COLLECTIVE TASKS (MORTAR)
SQUAD-SECTION-PLATOON

TASK: SKILL LEVEL 2

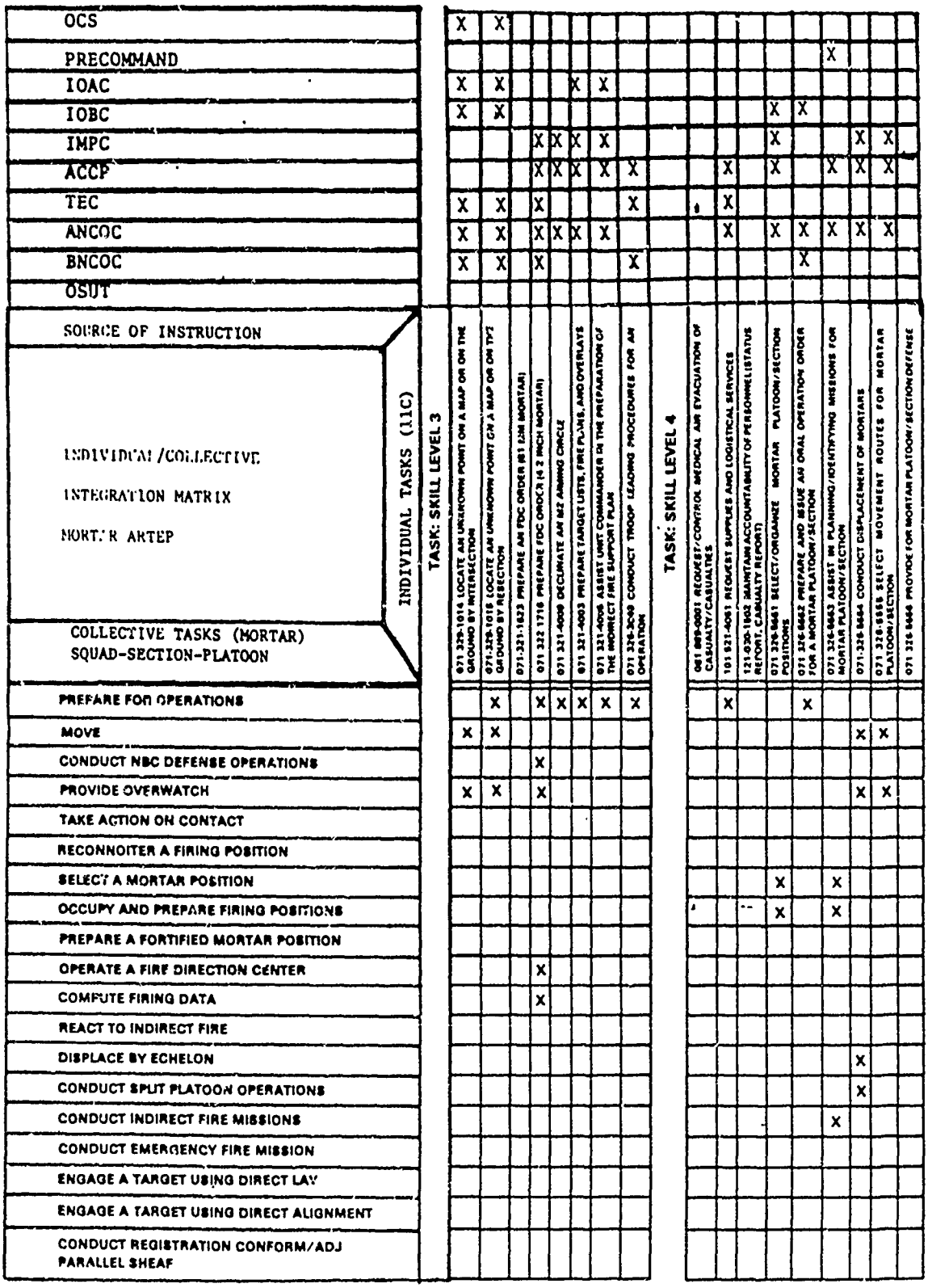
	071 329 1021 DETERMINE AN ENEMY TARGET LOCATION USING GRID COORDINATES	081 283 6002 LOCATE A TARGET BY SHIFT FROM A KNOWN POINT	081 283 6003 CALL FOR ADJUST INDIRECT FIRE	081 283 8004 LOCATE A TARGET BY POLAR PLOT	071 321 0810 EMPLACE RECOVER PYROTECHNIC EARLY WARNING DEVICES	113 587 2020 PREPARE TACTICAL FM RADIOS (AN/VRC 46 OR AN VRC 47) FOR OPERATION	113 571 2001 USE KAL 61B 1400 NUMERICAL CODE TO AUTHENTICATE TRANSMISSIONS AND ENCRYPT DECRYPT NUMBERS AND GRID ZONE LETTERS	113 571 2002 ENCODE AND DECODE MESSAGES USING A KTC 800 TACTICAL OPERATIONS CODE	113 594 1003 ESTABLISH AND ENTER OR LEAVE A RADIO NET	071 329 1031 DETERMINE AZIMUTHS USING A PROTRACTOR AND COMPUTE BACK AZIMUTH	071 329 1009 CONVERT AZIMUTHS (MAGNETIC OR GRID)	071 329 1007 DETERMINE DISTANCE WHILE MOVING BETWEEN TWO POINTS ON THE GROUND	071 329 1030 NAVIGATE WHILE MOUNTED	071 329 1004 DETERMINE THE ELEVATION OF A POINT ON THE GROUND USING A MAP	071 313 3451 PERFORM OPERATOR MAINTENANCE ON A CALIBER 50 M2 HB MACHINEGUN AND AMMUNITION	071 313 3453 LOAD, REDUCE A STOPPAGE UNLOAD AND CLEAR A CALIBER .50 MACHINEGUN	071 313 3454 ENGAGE TARGETS WITH A CALIBER 50 MACHINEGUN	071 313 3456 SET HEADSPACE AND TIMING ON A CALIBER .50 MACHINEGUN	071 313 2316 MOUNT AND DISMOUNT AN AN TVS 5 ON A CALIBER .50 MACHINEGUN	071 321 1600 PREPARE AN M18 PLOTTING BOARD FOR OPERATION AS AN OBSERVED CHART AND DETERMINE INITIAL FIRING DATA FOR MORTARS (PIVOT POINT)	071 321 1602 PROCESS SUBSEQUENT FO CORRECTIONS USING AN M16 PLOTTING BOARD (PIVOT BOARD)	071 321 1603 PREPARE AN M16 PLOTTING BOARD FOR OPERATION AS AN OBSERVED CHART (BELOW PIVOT POINT) AND MODIFIED OBSERVED CHART	071 321 1804 PROCESS SUBSEQUENT FO CORRECTIONS USING AN M16 PLOTTING BOARD AS A MODIFIED OBSERVED CHART	071 321 1805 DETERMINE DATA FOR SHEAF ADJUSTMENTS USING AN M16 PLOTTING BOARD
OCS	X	X	X	X			X	X	X	X	X	X	X	X					X				
PRECOMMAND																							
IOAC	X	X	X	X		X	X	X	X									X					
IOBC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
IMPC																			X	X	X	X	X
ACCP	X	X	X	X						X	X			X	X	X	X	X	X	X	X	X	X
TEC	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
ANCOC	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
BNCOC	X	X	X	X						X	X								X	X	X	X	X
OSUT	X	X	X	X											X	X	X	X	X	X			
PREPARE FOR OPERATIONS						X	X	X	X								X	X					
MOVE						X	X	X	X	X		X	X										
CONDUCT NBC DEFENSE OPERATIONS					X																		
PROVIDE OVERWATCH				X		X	X	X	X	X		X	X				X						
TAKE ACTION ON CONTACT																							
RECONNOITER A FIRING POSITION						X			X	X		X	X	X									
SELECT A MORTAR POSITION						X			X	X		X	X	X									
OCCUPY AND PREPARE FIRING POSITIONS						X			X	X				X					X	X	X	X	X
PREPARE A FORTIFIED MORTAR POSITION									X					X					X	X	X	X	X
OPERATE A FIRE DIRECTION CENTER	X	X				X	X	X	X										X	X	X	X	X
COMPUTE FIRING DATA				X	X				X	X		X							X	X	X	X	X
REACT TO INDIRECT FIRE									X	X													
DISPLACE BY ECHELON						X	X	X				X	X	X			X		X	X	X	X	X
CONDUCT SPLIT PLATOON OPERATIONS						X	X	X	X			X	X	X			X		X	X	X	X	X
CONDUCT INDIRECT FIRE MISSIONS			X			X	X	X	X											X	X	X	X
CONDUCT EMERGENCY FIRE MISSION		X		X					X														
ENGAGE A TARGET USING DIRECT LAY		X												X									
ENGAGE A TARGET USING DIRECT ALIGNMENT		X												X									
CONDUCT REGISTRATION CONFORM/ADJ PARALLEL SHEAF			X				X	X	X												X	X	X

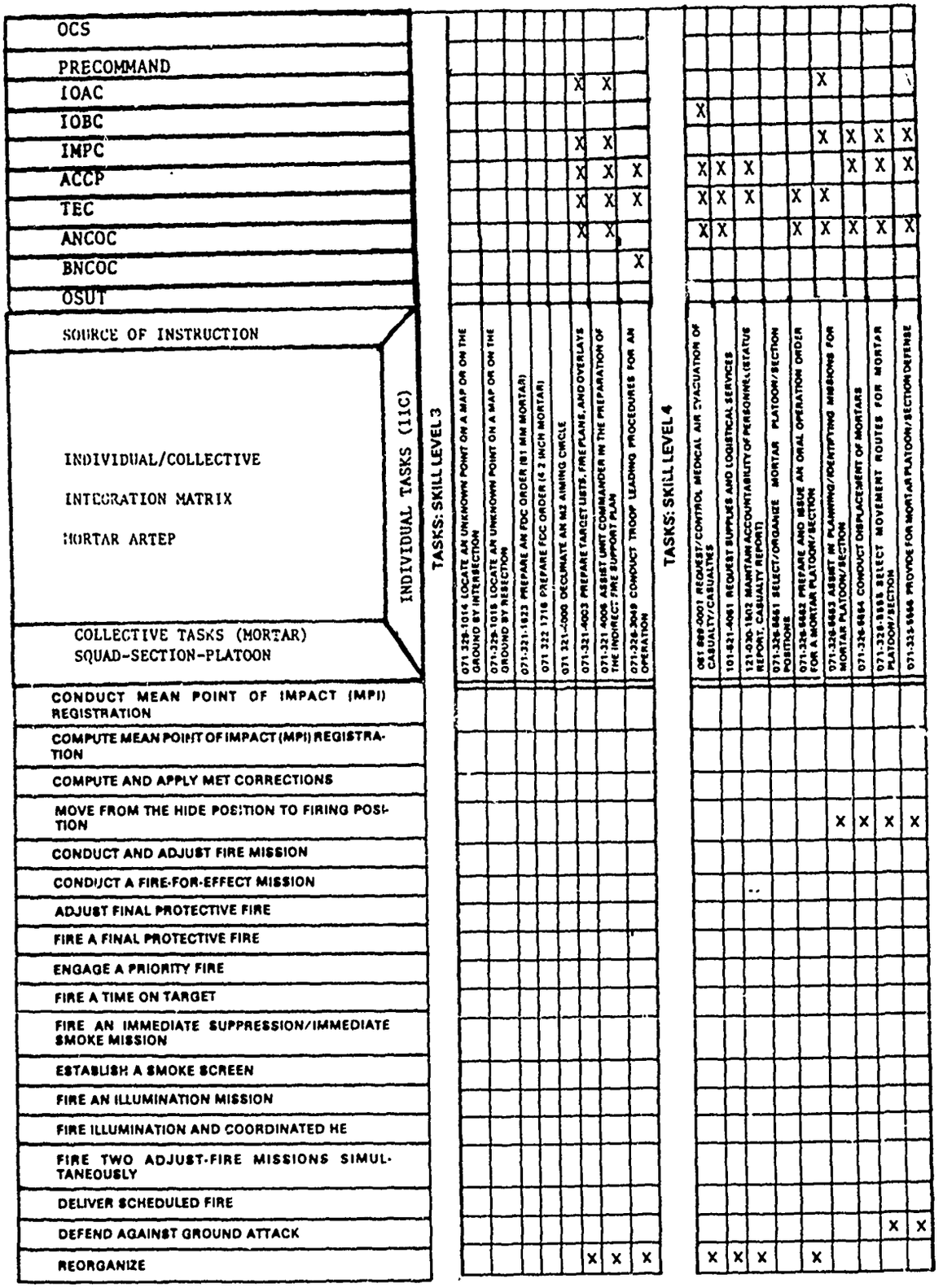
								X	X										071 321 1606 DETERMINE DATA FROM RE REGISTRATION AND APPLICATION OF CORRECTIONS		X	X	X	X	X				
								X	X										071 321 1607 RECORD INFORMATION ON FIRING DATA SHEET (81 MM MORTAR)	X	X	X	X	X	X	X			
								X	X										071 321 1620 DETERMINE FIRING CORRECTIONS USING AN M16 PLOTTING BOARD		X	X	X	X	X				
								X	X										071 321 1621 RECORD METEOROLOGICAL (MET) DATA USING MET DATA SHEET (81 MM MORTAR)		X	X		X	X				
								X	X										071 121 1622 DETERMINE AND APPLY MET FIRING CORRECTIONS (81 MM MORTAR)		X	X		X	X				
								X	X										071 321 1625 COMPUTE DATA FOR A POLAR MISSION USING AN M16 PLOTTING BOARD		X	X	X	X	X				
								X	X										071 321 1626 COMPUTE DATA FOR FINAL PROTECTIVE FIRE USING AN M16 PLOTTING BOARD		X	X	X	X	X				
X								X	X										071 321 1627 COMPUTE DATA FOR OPEN CONVERGED OR SPECIAL SHEAF USING AN M16 PLOTTING BOARD			X	X	X	X				
	X	X	X					X	X										071 321 1628 COMPUTE DATA FOR TRAVERSING OR SEARCHING FIRE USING AN M16 PLOTTING BOARD			X	X	X	X				
								X	X										071 321 1629 COMPUTE DATA FOR ILLUMINATION MISSION USING AN M 6 PLOTTING BOARD	X	X	X	X	X	X				
								X	X										071 321 1630 COMPUTE DATA FOR COORDINATED ILLUMINATION MISSION USING AN M 6 PLOTTING BOARD		X	X	X	X	X				
X								X	X										071 321 1660 DETERMINE ANGLE T WHEN USING AN M16 PLOTTING BOARD	X	X	X	X	X	X	X			
								X	X										071 322 1701 PREPARE A FIRING CHART OPERATION AND DETERMINE INITIAL FIRING DATA		X	X		X	X				
								X	X										071 322 1702 PROCESS SUBSEQUENT FO CORRECTIONS USING A FIRING CHART		X	X		X	X				
								X	X										071 322 1703 DETERMINE DATA FOR SHEAF ADJUSTMENT		X	X		X	X				
X								X	X										071 322 1704 DETERMINE DATA FROM RE REGISTRATION AND APPLICATION OF CORRECTIONS TO FDC EQUIPMENT		X	X		X	X				
								X	X										071 322 1705 RECORD INFORMATION ON FIRING DATA SHEET (4 2 INCH MORTAR)		X	X		X	X				
X								X	X										071 322 1706 APPLY REGISTRATION CORRECTIONS TO THE FIRE CONTROL EQUIPMENT FOR A 4 2 INCH MORTAR		X	X		X	X				
								X	X										071 322 1707 COMPUTE DATA FOR FPF MISSION USING FIRING CHART		X	X		X	X				
								X	X										071 322 1708 COMPUTE DATA FOR ZONE MISSION USING FIRING CHART		X	X		X	X				
X								X	X										071 322 1709 COMPUTE DATA FOR OPEN CONVERGED OR SPECIAL SHEAF			X		X	X				
								X	X										071 322 1710 COMPUTE DATA FOR ILLUMINATION MISSION USING FIRING CHART		X	X		X	X				
								X	X										071 322 1711 COMPUTE DATA FOR COORDINATED ILLUMINATION MISSION USING FIRING CHART		X	X		X	X				
								X	X										071 322 1712 RECORD METEOR (MET) DATA USING MET DATA SHEET (4 2 INCH)		X	X		X	X				
								X	X										071 322 1713 DETERMINE AND APPLY MET FIRING CORRECTIONS (4 2 INCH MORTAR)		X	X		X	X				
					X	X		X	X	X	X								071 322 1714 DETERMINE DATA FOR A 4 2 INCH MORTAR USING AN M16 PLOTTING BOARD AND GFS		X	X		X	X				
																		X	071 321 4012 STORE MORTAR AMMUNITION (60 MM 81 MM 4 2 INCH)	X		X		X	X				
																		X	071 321 4013 PREPARE AN M2 AIMING CIRCLE FOR OPERATION			X	X	X	X				
					X	X					X								071 321 4006 ORIENT AN M2 AIMING CIRCLE AND LAY MORTARS FOR DIRECTION		X	X	X	X	X	X			
											X								071 321 4001 BORESIGHT A MORTAR FOR DEFLECTION USING AN M2 AIMING CIRCLE			X		X	X				
											X								071 321 4002 BORESIGHT A MORTAR FOR ELEVATION USING AN M2 COMPASS			X	X	X	X				
X	X			X	X			X	X	X	X								071 321 4011 USE MORTAR FIRING TABLES (60 MM 81 MM 4,2 INCH)		X	X	X	X	X	X			
										X	X								071 321 4009 LAY A MORTAR FOR DIRECTION USING AN M2 COMPASS (GROUND MOUNTED)		X	X	X	X	X				
										X	X								071 321 4007 LAY A MORTAR FOR DIRECTION USING AN M2 COMPASS (CARRIER MOUNTED)			X	X	X	X				
											X								071 321 4008 SUPERVISE SQUAD DURING THE OCCUPATION OF A MORTAR FIRING POSITION		X	X		X	X				
	X	X	X																071 321 4051 ADJUST FIRE WITHOUT AN FDC USING DIRECT ALINEMENT (60 MM 81 MM MORTAR)	X		X		X	X				
	X	X	X																071 321 4052 LAY MORTAR FOR DIRECTION USING DIRECT ALINEMENT METHOD (FIRE WITHOUT FDC) (60 MM 81 MM MORTAR)	X		X		X	X				
	X	X	X																071 321 4053 FIRE A LADDER MISSION USING FIRE WITHOUT AN FDC (DIRECT ALINEMENT)			X		X	X				
	X	X	X																071 321 4054 FIRE A TRAVERSING MISSION USING FIRE WITHOUT AN FDC (60 MM 81 MM MORTAR)			X		X					
	X	X	X																071 321 4055 ENGAGE A DEEP TARGET USING SEARCHING FIRE WITHOUT AN FDC (60 MM 81 MM MORTAR)			X		X					
																			071 326 4006 INSTALL RECOVER A MECHANICAL AMBUSH										

SOURCE OF INSTRUCTION	071 323 1021 DETERMINE AN ENEMY TARGET LOCATION USING GRID COORDINATES	081 283 6002 LOCATE A TARGET BY SHIFT FROM A KNOWN POINT	081 283 6003 CALL FOR/ADJUST INDIRECT FIRE	081 283 6004 LOCATE A TARGET BY POLAR PLOT	071 331 0810 EMPLACE/RECOVER PYROTECHNIC EARLY WARNING DEVICES	113 587 2020 PREPARE TACTICAL FM RADIOS (AN/VRC 46 OR AN VRC 47) FOR OPERATION	113 671 2001 USE KAL 618 1400 NUMERICAL CODE TO AUTHENTICATE TRANSMISSIONS AND ENCRYPT/DECRYPT NUMBERS AND GRID ZONE LETTERS	113 671 2002 ENCODE AND DECODE MESSAGES USING A KTC 600 TACTICAL OPERATIONS CODE	113 894 1003 ESTABLISH AND ENTER OR LEAVE A RADIO NET	071 321 1031 DETERMINE AZIMUTHS USING A PROTRACTOR AND COMPUTE BACK AZIMUTH	071 329 1009 CONVERT AZIMUTHS (MAGNETIC OR GRID)	071 328-1007 DETERMINE DISTANCE WHILE MOVING BETWEEN TWO POINTS ON THE GROUND	071 329 1030 NAVIGATE WHILE MOUNTED	071 329 1004 DETERMINE THE ELEVATION OF A POINT ON THE GROUND USING A MAP	071 313 3451 PERFORM OPERATOR MAINTENANCE ON A CALIBER 50 M2 HB MACHINEGUN AND AMMUNITION	071 313-3453 LOAD, REDUCE A STOPPAGE, UNLOAD, AND CLEAR A CALIBER 50 MACHINEGUN	071 313 3464 ENGAGE TARGETS WITH A CALIBER 50 MACHINEGUN	071 313 3465 SET HEADSPACE AND TIMING ON A CALIBER 50 MACHINEGUN	071 316 2316 MOUNT AND DISMOUNT AN AN/TVS-5 ON A CALIBER 50 MACHINEGUN	071 321 1600 PREPARE AN M16 PLOTTING BOARD FOR OPERATION AS AN OBSERVED CHART AND DETERMINE INITIAL FIRING DATA FOR MORTARS (PIVOT POINT)	071 321 1602 PROCESS SUBSEQUENT FO CORRECTIONS USING AN M16 PLOTTING BOARD (PIVOT BOARD)	071 321 1603 PREPARE AN M16 PLOTTING BOARD FOR OPERATION AS AN OBSERVED CHART (BELOW PIVOT POINT) AND MODIFIED OBSERVED CHART	071 321 1804 PROCESS SUBSEQUENT FO CORRECTIONS USING AN M16 PLOTTING BOARD AS A MODIFIED OBSERVED CHART	071 321 1805 DETERMINE DATA FOR SHEAF ADJUSTMENTS USING AN M16 PLOTTING BOARD
OCS			X	X			X	X	X			X												
PRECOMMAND																		X	X					
IOAC			X	X		X	X	X	X				X											
IOBC			X	X		X	X	X	X			X	X		X	X	X	X	X	X	X	X	X	X
IMPC			X	X															X	X	X	X	X	X
ACCP			X	X											X	X	X	X	X	X	X	X	X	X
TEC			X	X		X	X	X	X			X			X	X	X	X	X	X	X	X	X	X
ANCOC			X	X		X	X	X	X			X			X	X	X	X	X	X	X	X	X	X
BNCOC		X	X										X						X	X	X	X	X	X
OSUT		X	X												X	X	X		X	X				
INDIVIDUAL/COLLECTIVE INTEGRATION MATRIX MORTAR ARTEP																								
INDIVIDUAL TASKS (11C)																								
COLLECTIVE TASKS (MORTAR) SQUAD-SECTION-PLATOON																								
CONDUCT MEAN POINT OF IMPACT (MPI) REGISTRATION						X	X	X	X															
COMPUTE MEAN POINT OF IMPACT (MPI) REGISTRATION						X	X	X	X										X	X	X	X	X	
COMPUTE AND APPLY MET CORRECTIONS							X		X										X	X	X	X	X	
MOVE FROM THE HIDE POSITION TO FIRING POSITION			X			X			X				X	X										
CONDUCT AND ADJUST FIRE MISSION						X			X										X	X	X	X	X	
CONDUCT A FIRE FOR EFFECT MISSION			X			X			X										X	X	X	X	X	
ADJUST FINAL PROTECTIVE FIRE			X			X			X										X	X	X	X	X	
FIRE A FINAL PROTECTIVE FIRE			X			X			X										X	X	X	X	X	
ENGAGE A PRIORITY FIRE			X			X			X								X				X	X	X	
FIRE A TIME ON TARGET			X			X			X															
FIRE AN IMMEDIATE SUPPRESSION/IMMEDIATE SMOKE MISSION			X			X			X												X	X	X	
ESTABLISH A SMOKE SCREEN						X			X												X	X	X	
FIRE AN ILLUMINATION MISSION			X			X			X												X	X	X	
FIRE ILLUMINATION AND COORDINATED HE			X			X			X												X	X	X	
FIRE TWO ADJUST FIRE MISSIONS SIMULTANEOUSLY			X			X			X												X	X	X	
DELIVER SCHEDULED FIRE						X			X												X	X	X	
DEFEND AGAINST GROUND ATTACK									X								X				X	X	X	
REORGANIZE				X		X			X							X	X		X	X				

TASKS: SKILL LEVEL 2

																		071 321 1606 DETERMINE DATA FROM RE REGISTRATION AND APPLICATION OF CORRECTIONS										
																		071 321 1607 RECORD INFORMATION ON FIRING DATA SHEET (81 MM MORTAR)										
																		071 321 1620 DETERMINE FIRING CORRECTIONS USING AN M16 PLOTTING BOARD										
														X				071 321 1621 RECORD METEOROLOGICAL (MET) DATA USING MET DATA SHEET (81 MM MORTAR)		X	X		X	X				
														X				071 321 1622 DETERMINE AND APPLY MET FIRING CORRECTIONS (81 MM MORTAR)		X	X		X	X				
																		071 321 1625 COMPUTE DATA FOR A POLAR MISSION USING AN M16 PLOTTING BOARD										
									X	X								071 321 1626 COMPUTE DATA FOR FINAL PROTECTIVE FIRE USING AN M16 PLOTTING BOARD		X	X	X	X	X				
																		071 321 1627 COMPUTE DATA FOR OPEN CONVERGED, OR SPECIAL SHEAF USING AN M16 PLOTTING BOARD										
																		071 321 1628 COMPUTE DATA FOR TRAVERSING OR SEARCHING FIRE USING AN M16 PLOTTING BOARD										
				X	X													071 321 1629 COMPUTE DATA FOR ILLUMINATION MISSION USING AN M16 PLOTTING BOARD	X	X	X	X	X	X	X			
																		071 321 1630 COMPUTE DATA FOR COORDINATED ILLUMINATION MISSION USING AN M16 PLOTTING BOARD										
																		071 321 1660 DETERMINE ANGLE T WHEN USING AN M16 PLOTTING BOARD										
																		071 322 1701 PREPARE A FIRING CHART OPERATION AND DETERMINE INITIAL FIRING DATA										
																		071 322 1702 PROCESS SUBSEQUENT FO CORRECTIONS USING A FIRING CHART										
												X						071 322 1703 DETERMINE DATA FOR SHEAF ADJUSTMENT		X	X		X	X				
																		071 322 1704 DETERMINE DATA FROM RE-REGISTRATION AND APPLICATION OF CORRECTIONS TO FDC EQUIPMENT										
																		071 322 1705 RECORD INFORMATION ON FIRING DATA SHEET (4 2-INCH MORTAR)										
																		071 322 1706 APPLY REGISTRATION CORRECTIONS TO THE FIRE CONTROL EQUIPMENT FOR A 4 2 INCH MORTAR										
									X	X								071 322 1707 COMPUTE DATA FOR FPF MISSION USING FIRING CHART		X	X		X	X				
																		071 322 1708 COMPUTE DATA FOR ZONE MISSION USING FIRING CHART										
																		071 322 1709 COMPUTE DATE FOR OPEN, CONVERGED, OR SPECIAL SHEAF										
				X	X													071 322 1710 COMPUTE DATA FOR ILLUMINATION MISSION USING FIRING CHART		X	X		X	X				
				X	X													071 322 1711 COMPUTE DATA FOR COORDINATED ILLUMINATION MISSION USING FIRING CHART		X	X		X	X				
														X				071 322 1712 RECORD METEOR (MET) DATA USING MET DATA SHEET (4 2 INCH)		X	X		X	X				
														X				071 322 1713 DETERMINE AND APPLY MET FIRING CORRECTIONS (4 2 INCH MORTAR)		X	X		X	X				
									X	X	X	X		X	X			071 322 1714 DETERMINE DATA FOR A 4 2 INCH MORTAR USING AN M16 PLOTTING BOARD AND GFS		X	X		X	X				
X																		071 321 4012 STORE MORTAR AMMUNITION (60-MM 81 MM, 4 2-INCH)	X		X		X	X				
X																		071 321 4013 PREPARE AN M2 AIMING CIRCLE FOR OPERATION			X	X	X	X				
																		071 321 4008 ORIENT AN M2 AIMING CIRCLE AND LAY MORTARS FOR DIRECTION										
																		071 321 4001 BORESIGHT A MORTAR FOR DEFLECTION USING AN M2 AIMING CIRCLE										
																		071 321 4002 BORESIGHT A MORTAR FOR ELEVATION USING AN M2 COMPASS										
																		071 321 4011 USE MORTAR FIRING TABLES (60-MM 81 MM, 4 2-INCH)										
																		071 321 4009 LAY A MORTAR FOR DIRECTION USING AN M2 COMPASS (GROUND-MOUNTED)										
																		071 321 4007 LAY A MORTAR FOR DIRECTION USING AN M2 COMPASS (CARRIER MOUNTED)										
																		071 321 4006 SUPERVISE SQUAD DURING THE OCCUPATION OF A MORTAR FIRING POSITION										
																		071 321 4051 ADJUST FIRE WITHOUT AN FDC USING DIRECT ALINEMENT (60 MM 81 MM MORTAR)										
																		071 321 4052 LAY MORTAR FOR DIRECTION USING DIRECT ALINEMENT METHOD (FIRE WITHOUT FDC) (60-MM, 81 MM MORTAR)										
																		071 321 4053 FIRE A LADDER MISSION USING FIRE WITHOUT AN FDC (DIRECT ALINEMENT)										
																		071 321 4054 FIRE A TRAVERSING MISSION USING FIRE WITHOUT AN FDC (60 MM 81 MM MORTAR)										
																		071 321 4055 ENGAGE A DEEP TARGET USING SEARCHING FIRE WITHOUT AN FDC (60 MM 81 MM MORTAR)										
X																		071 326 4006 INSTALL RECOVER A MECHANICAL AMBUSH				X	X					


OCS
PRECOMMAND
IOAC
IOBC
IMPC
ACCP
TEC
ANCOC
BNCOC
OSUT
SOURCE OF INSTRUCTION
INDIVIDUAL/COLLECTIVE
INTEGRATION MATRIX
MORTAR ARTEP
INDIVIDUAL TASKS (11C)
COLLECTIVE TASKS (MORTAR)
SQUAD-SECTION-PLATOON
TASK: SKILL LEVEL 3
071-326-1014 LOCATE AN UNKNOWN POINT ON A MAP OR ON THE GROUND BY INTERSECTION
071-326-1016 LOCATE AN UNKNOWN POINT ON A MAP OR ON THE GROUND BY RESECTION
071-321-1623 PREPARE AN FDC ORDER (81 (2in) MORTAR)
071 322 1716 PREPARE FDC ORDER (4.2 INCH MORTAR)
071 321-4009 DECLINATE AN M2 AIMING CIRCLE
071 321-4003 PREPARE TARGET LISTS, FIRE PLANS, AND OVERLAYS
071 321-4006 ASSIST UNIT COMMANDER IN THE PREPARATION OF THE INDIRECT FIRE SUPPORT PLAN
071 326-3049 CONDUCT TROOP LEADING PROCEDURES FOR AN OPERATION
TASK: SKILL LEVEL 4
081 889-0001 REQUEST/CONTROL MEDICAL AIR EVACUATION OF CASUALTY/CASUALTIES
101 921-4001 REQUEST SUPPLIES AND LOGISTICAL SERVICES
121-030-1002 MAINTAIN ACCOUNTABILITY OF PERSONNEL(STATUS REPORT, CASUALTY REPORT)
071 326 8461 SELECT/ORGANIZE MORTAR PLATOON/SECTION POSITIONS
071 326 8462 PREPARE AND ISSUE AN ORAL OPERATION ORDER FOR A MORTAR PLATOON/SECTION
071 326 8463 ASSIST IN PLANNING/IDENTIFYING MISSIONS FOR MORTAR PLATOON/SECTION
071-326 8464 CONDUCT DISPLACEMENT OF MORTARS
071 326 8555 SELECT MOVEMENT ROUTES FOR MORTAR PLATOON/SECTION
071 326 8466 PROVIDE FOR MORTAR PLATOON/SECTION DEFENSE
PREPARE FOR OPERATIONS
MOVE
CONDUCT NBC DEFENSE OPERATIONS
PROVIDE OVERWATCH
TAKE ACTION ON CONTACT
RECONNOITER A FIRING POSITION
SELECT A MORTAR POSITION
OCCUPY AND PREPARE FIRING POSITIONS
PREPARE A FORTIFIED MORTAR POSITION
OPERATE A FIRE DIRECTION CENTER
COMPUTE FIRING DATA
REACT TO INDIRECT FIRE
DISPLACE BY ECHELON
CONDUCT SPLIT PLATOON OPERATIONS
CONDUCT INDIRECT FIRE MISSIONS
CONDUCT EMERGENCY FIRE MISSION
ENGAGE A TARGET USING DIRECT LAY
ENGAGE A TARGET USING DIRECT ALIGNMENT
CONDUCT REGISTRATION CONFORM/ADJ PARALLEL SHEAF


OCS
PRECOMMAND
IOAC
IOBC
IMPC
ACCP
TEC
ANCOC
BNCOC
OSUT
SOURCE OF INSTRUCTION
INDIVIDUAL/COLLECTIVE
INTEGRATION MATRIX
MORTAR ARTEP
INDIVIDUAL TASKS (11C)
COLLECTIVE TASKS (MORTAR)
SQUAD-SECTION-PLATOON
TASKS: SKILL LEVEL 3
071-328-1014 LOCATE AN UNKNOWN POINT ON A MAP OR ON THE GROUND BY INTERSECTION
071-328-1018 LOCATE AN UNKNOWN POINT ON A MAP OR ON THE GROUND BY RESECTION
071-321-1823 PREPARE AN FDC ORDER (81 MM MORTAR)
071 322 1716 PREPARE FCC ORDER (4.2 INCH MORTAR)
071 321-0000 DECLIMATE AN M2 AIMING CIRCLE
071-321-4003 PREPARE TARGET LISTS, FIRE PLANS, AND OVERLAYS
071-321 4006 ASSIST UNIT COMMANDER IN THE PREPARATION OF THE INDIRECT FIRE SUPPORT PLAN
071-326-3049 CONDUCT TROOP LEADING PROCEDURES FOR AN OPERATION
TASKS: SKILL LEVEL 4
081 889-0001 REQUEST/CONTROL MEDICAL AIR EVACUATION OF CASUALTY/CASUALTIES
101-821-4061 REQUEST SUPPLIES AND LOGISTICAL SERVICES
121-030-1903 MAINTAIN ACCOUNTABILITY OF PERSONNEL (STATUS REPORT, CASUALTY REPORT)
071-326-8661 SELECT/ORGANIZE MORTAR PLATOON/SECTION POSITIONS
071-326-8662 PREPARE AND ISSUE AN ORAL OPERATION ORDER FOR A MORTAR PLATOON/SECTION
071-326-8663 ASSIST IN PLANNING/IDENTIFYING MISSIONS FOR MORTAR PLATOON/SECTION
071-326-8664 CONDUCT DISPLACEMENT OF MORTARS
071-328-8888 SELECT MOVEMENT ROUTES FOR MORTAR PLATOON/SECTION
071-326-8666 PROVIDE FOR MORTAR PLATOON/SECTION DEFENSE
CONDUCT MEAN POINT OF IMPACT (MPI) REGISTRATION
COMPUTE MEAN POINT OF IMPACT (MPI) REGISTRATION
COMPUTE AND APPLY MET CORRECTIONS
MOVE FROM THE HIDE POSITION TO FIRING POSITION
CONDUCT AND ADJUST FIRE MISSION
CONDUCT A FIRE-FOR-EFFECT MISSION
ADJUST FINAL PROTECTIVE FIRE
FIRE A FINAL PROTECTIVE FIRE
ENGAGE A PRIORITY FIRE
FIRE A TIME ON TARGET
FIRE AN IMMEDIATE SUPPRESSION/IMMEDIATE SMOKE MISSION
ESTABLISH A SMOKE SCREEN
FIRE AN ILLUMINATION MISSION
FIRE ILLUMINATION AND COORDINATED HE
FIRE TWO ADJUST-FIRE MISSIONS SIMULTANEOUSLY
DELIVER SCHEDULED FIRE
DEFEND AGAINST GROUND ATTACK
REORGANIZE

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

APPENDIX D
INDIRECT FIRE INFANTRYMAN TASK LIST
Responsibility for Training

			RESPONSIBILITY FOR TRAINING						
			INSTITUTION				UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-0502 SL - 1	Move as a member of a dismounted mortar squad (60-mm/81-mm mortar)		Q					A	Q
061-283-6002 SL - 2	Locate a target by shift from a known point		Q	R				A	A
061-283-6003 SL - 2	Call for/adjust indirect fire		Q	R				A	A
061-283-6004 SL - 2	Locate a target by polar plot			R				A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-326-0518 SL - 1	Camouflage mortar firing position	Q						A	Q
071-326-0516 SL - 1	Construct a mortar position in a MOUT ENVIRONMENT (60mm, 81mm, 4.2-inch)					*		A	Q
071-321-4012 SL - 2	Store mortar ammunition (60mm, 81mm, 4.2-inch)					*		A	Q
071-321-4013 SL - 2	Prepare an M2 aiming circle for operation			Q		*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-4006 SL - 2	Orient an M2 aiming circle and lay mortars for direction			Q	R	*		A	Q
071-321-4001 (RC) SL - 2	Boresight a mortar for deflection using an M2 aiming circle				R	*		A	Q
071-321-4002 (RC) SL - 2	Boresight a mortar for elevation using an M2 compass				R	*		A	Q
071-321-4011 SL -2	Use mortar firing tables (60mm, 81mm, 4.2-inch			Q		*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-4009 SL - 2	Lay a mortar for direction using an M2 compass (ground-mounted)					*		A	Q
071-321-4007 SL - 2	Lay mortar for direction using an M2 compass (carrier-mounted)				Q	*		A	Q
071-321-4008 SL - 2	Supervise squad during the occupation of a mortar firing position			Q					
071-321-4014 SL - 2C	Talk an untrained forward observer through a fire mission					*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-4000 SL - 3	Declinate an M2 aiming circle			Q		*		A	Q
071-321-4003 SL - 3	Prepare target lists, fire plans, and overlays				Q	*		A	Q
071-321-4005 SL - 3	Assist unit comdr in the preparation of the indirect fire support plan				Q	*		A	Q
071-321-4050 SL - 1	Engage a target using fire without an FDC--direct lay & alinement 81mm					*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-4080 SL - 1	Engage targets with 4.2-in. mortar without an FDC (direct lay & alinement)					*		A	Q
071-321-4051 SL - 2	Adjust fire without an FDC, using direct alinement (81mm mortar)			Q	R	*		A	Q
071-321-4052 SL - 2	Lay mortar for direction using direct alinement method without FDC--81mm			Q	R	*		A	Q
071-321-4053 SL - 2	Fire a ladder mission using fire without an FDC (direct alinement)			Q		*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-4054 SL - 2	Fire a traversing mission using fire without an FDC (81mm mortar)			Q	R	*		A	Q
071-321-4055 SL -2	Engage a deep target using searching fire without an FDC (81mm mortar)			Q					
071-326-5551 SL - 4	Select/organize mortar platoon/section positions				Q			A	A
071-326-5552 SL - 4	Prepare and issue an oral operation order for a mortar platoon/section				Q			A	A

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-326-5553 SL - 4	Assist in planning/identifying missions for mortar platoon/section				Q			A	A
071-326-5554 SL - 4	Conduct displacement of mortars				Q			A	A
071-326-5555 SL - 4	Select movement routes for mortar platoon/ section defense				Q			A	A
071-326-5556 SL - 4	Provide for mortar platoon/section defense				Q			A	A

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-1626 SL - 2C	Compute data for final protective fire using an M16 plotting board.				Q	*		A	Q
071-321-3901 SL - 1	Place a ground-mounted 81mm mortar into action	Q			R	*		A	A
071-321-3902 SL - 1	Boresight an 81mm mortar	Q			R	*		A	A
071-321-3903 SL - 1	Perform safety checks on an 81mm mortar (ground- or carrier-mounted)	Q			R	*		A	A

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-3904 SL - 1	Lay an 81mm mortar for deflection and elevation (D&E) (ground- or carrier-mounted	Q			IT	*		A	Q
071-321-3905 SL - 1	Prepare 81mm mortar ammunition for firing	Q			R	*		A	A
071-321-3906 SL - 1	Perform operator maintenance on an 81mm mortar and associated fire control equipment	Q			IT	*		A	A
071-321-3907 SL - 1	Remove a misfire from an 81mm mortar (ground-mounted)	Q			R	*		A	A

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-3909 SL - 1	Refer sight and realine aiming posts for an 81mm mortar	Q			IT	*		A	A
071-321-3910 SL - 1	Reciprocally lay a 81mm mortar using an M2 aiming circle and place out aiming posts	Q				*		A	A
071-321-3911 SL -1	Manipulate an 81mm mortar for traversing or searching fires	Q				*		A	A
071-321-3912 SL - 1	Place a carrier-mounted 81mm mortar into action	Q			R	*		A	A

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R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-3917 SL - 1	Remove a misfire from an 81mm mortar (carrier-mounted)	Q			R	*		A	A
071-321-1601 SL - 2	Prepare M16 plotting board for operation as an observed chart & determine firing data for mortars (pp)			Q	R	*		A	A
071-321-1602 SL - 2	Process subsequent FO corrections using an M16 plotting board (pivot point)			Q	R	*		A	A
071-321-1603 SL -2C	Prepare an M16 plotting board for operation as an observed chart (below pp) & modified observed chart			Q	R	*		A	A

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-1604 SL - 2C	Process subsequent FO corrections using an M16 plotting board as a modified observed chart			Q	R	*		A	A
071-321-1605 SL - 2C	Determine data for sheaf adjustments using an M16 plotting board			Q	R	*		A	A
071-321-1606 SL - 2C	Determine data from re-registration & application of corrections (81mm)			Q	R	*		A	Q
071-321-1607 SL - 2C	Record information on firing data sheet (81mm mortar)			Q	R	*		A	A

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-1620 SL - 2C	Determine firing corrections using an M16 plotting board			Q	R	*		A	A
071-321-1621 SL - 2C	Record meteorological (MET) data using MET data sheet (81mm mortar)				Q	*		A	Q
071-321-1622 SL - 2C	Determine and apply MET firing corrections (81mm mortar)				Q	*		A	Q
071-321-1625 SL - 2C	Compute data for a polar mission using an M16 plotting board				Q	*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-1627 SL - 2C	Compute data for open, converged, or special sheaf using M16 plotting board				Q	*		A	A
071-321-1628 SL - 2C	Compute data for traversing or searching fire using M16 plotting board				Q	*		A	Q
071-321-1629 SL - 2C	Compute data for illumination mission using an M16 plotting board				Q	*		A	Q
071-321-1630 SL - 2C	Compute data for coordinated illumination mission using M16 plotting board				Q	*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-321-1660 SL - 2C	Determine angle T when using an M16 plotting board				Q	*		A	Q
071-321-1623 SL - 3	Prepare an FDC order (81mm mortar)				Q	*		A	Q
071-322-4201 SL - 1	Ground-mount a 4.2-inch mortar	Q				*		A	Q
071-322-4202 SL - 1	Boresight a 4.2-inch mortar	Q				*		A	Q

Q - Qualification
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A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-4202 SL - 1	Boresight a 4.2-inch mortar	Q				*		A	Q
071-322-4203 SL - 1	Perform safety checks on a 4.2-inch mortar (ground- and carrier-mounted)	Q				*		A	Q
071-322-4204 SL - 1	Lay a 4.2-inch mortar for deflection and elevation (D&E) (ground- or carrier mounted)	Q				*		A	Q
071-322-4205 SL - 1	Prepare 4.2-inch mortar	Q				*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-4206 SL - 1	Perform operator maintenance on a 4.2-inch mortar and equipment	Q				*		A	Q
071-322-4207 SL - 1	Remove a misfire from a 4.2-inch mortar	Q				*		A	Q
071-322-4208 SL - 1	Refer sight and realine aiming posts for a 4.2-inch mortar					*		A	Q
071-322-4209 SL - 1	Reciprocally lay a 4.2-inch mortar using an M2 aiming circle & place out aiming posts				IT	*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-4210 SL - 1	Manipulate a 4.2-inch mortar for traversing fire (ground- or carrier mounted)				IT	*		A	Q
071-322-4212 SL - 1	Place a carrier-mounted 4.2-inch mortar into action	Q		Q	R	*		A	Q
071-322-4216 SL - 1	Remove a misfire from a 4.2-inch mortar (carrier-mounted)	Q				*		A	Q
071-322-1701 SL - 2C	Prepare a firing chart for operation and determine initial firing data			Q	R	*		A	Q

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A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-1702 SL - 2C	Process subsequent FO corrections using a firing chart			Q	R	*		A	Q
071-322-1703 SL - 2C	Determine data for sheaf adjustment			Q	R	*		A	Q
071-322-1704 SL - 2C	Determine data from re-registration and application corrections to FDC equipment			Q	R	*		A	Q
071-322-1705 SL - 2	Record information on firing data sheet (4.2-inch mortar)			Q	R	*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-1706 SL - 2C	Apply registration corrections to the fire control equipment for a 4.2-inch mortar			Q	R	*		A	Q
071-322-1707 SL - 2C	Compute data for final protective fire using firing chart			Q	R	*		A	Q
071-322-1708 SL - 2C	Compute data for a zone (area) mission using firing chart			Q	R	*		A	Q
071-322-1709 SL - 2C	Compute data for open, converged, or special sheaf using firing chart			Q	R	*		A	Q

Q - Qualification
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A - Additional Reinforcement
C - FDC Computer Task
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		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-1710 SL - 2C	Compute data for illumination mission using firing chart			Q	R	*		A	Q
071-322-1711 SL - 2C	Compute data for coordinated illumination mission using firing chart			Q	R	*		A	Q
071-322-1712 SL -2C	Record metrological (MET) data using MET data sheet (4.2-inch mortar)			Q	R	*		A	Q
071-322-1713 SL -2C	Determine and apply MET firing corrections (4.2-inch mortar)			Q	R	*		A	Q

Q - Qualification
R - Reinforcement Training
A - Additional Reinforcement
C - FDC Computer Task
* - IMPC - Task Taught

		RESPONSIBILITY FOR TRAINING							
		INSTITUTION					UNIT		
TASK NUMBER	TASK TITLE	AIT OSUT	PNCOC	BNCOC	ANCOC	SERVICE SCHOOL	SOJT	SELF STUDY	SCHEDULED TRAINING
071-322-1714 SL -2C	Determine data for a 4.2-inch mortar using an M16 plotting board and GFS			Q	R	*		A	Q
071-322-1716 SL - 3	Prepare FDC order (4.2-inch mortar)			Q	R	*		A	Q

APPENDIX E

TRAINING DEVICES

In order to overcome the problems of inadequate amounts of training ammunition, range and terrain limitations, range availability, and the dangers inherent in live fire exercises, several training devices are available for infantry mortars. Use of these devices is expected to improve mortar training and increase proficiency by adding realism, while at the same time preparing the indirect fire team to derive the most benefit from live fire exercises. A summary description of each device is presented at Table 20.

Attempts to evaluate the overall effectiveness of these devices did not produce sufficient data to yield a basis for predicting the training value of each device. This is attributable, in part, to the fact that the majority of these devices are not used consistently during the conduct of unit training programs. Results of training strategies using varying amounts of M-1 sabot comparative ammunition and ranges have indicated that some units tend to do as well during live fire exercises as those units who conduct all of their training using live ammunition.[4]

81mm Sabot. The 81mm mortar training device, M1, lets units train where mortar ranges are either limited in size or nonexistent. This device has two major parts: the 81mm Sabot round and the 22mm subcaliber cartridge.

The Sabot has an aluminum alloy body. It looks, feels, and drops into the tube like an 81mm round. It has a smooth bore 22mm barrel running from the tail which holds the 22mm subcaliber cartridge (Figure 3).

The Sabot is fired from the M29A1 mortar. When fired, the Sabot pops from the mortar barrel and hits ground within 15 meters of the mortar (the 22mm subcaliber round, meanwhile, flies on to its target). The Sabot is then recovered, cleaned, reloaded, and refired.

The 22mm Subcaliber Cartridge is produced in four different charge zones. The Sabot is issued as ammunition. When fired, the subcaliber projectile travels from 70 to 413.4 meters, depending on the charge and elevation chosen. When it hits, the projectile makes a noise but there are no fragments. The 22mm subcaliber projectile has a flight path and impact pattern similar to the standard 81mm service round except for a greatly reduced range. It acts more like standard ammunition than other training shells available.

The operation and maintenance of the Sabot can be learned in a short time. Skills and drills practiced by mortar crews, except charge and fuze settings, are the same as those for standard service rounds. With the Sabot, a soldier "selects" the charge instead of "cutting" it, a feature which does not appear in other mortar training devices.

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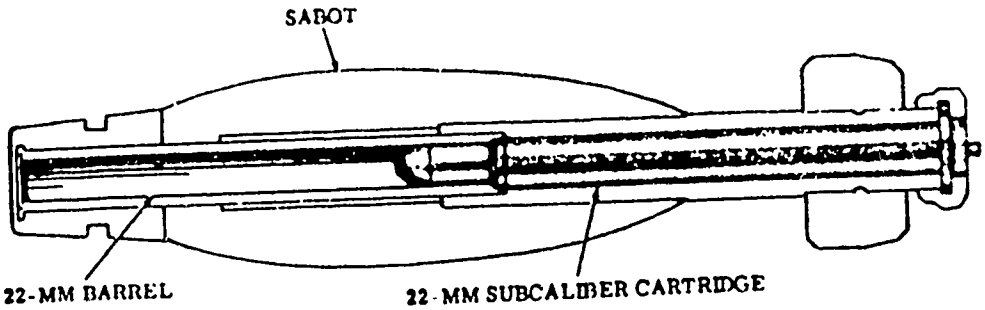
[4]TRADOC Combined Arms Test Activity (TCATA) (Mortar Training Weapons Crew Training Test), Mar 1982 - Ongoing.

Table 20

Mortar Training Devices

Device	Mortar to Which Applicable	Description	Training Priority	Advantage	Disadvantage
M1 Sabot	81mm	The M1 Sabot has two major components: the 81mm sabot and a 22mm subcaliber cartridge.	FO, FDC, Gun Crew	Closely simulates live fire.	Not substantial cost savings on full caliber.
60mm subcaliber assembly	107mm (4.2 inch)	The 60mm subcaliber assembly consists of a 60mm cannon modified so it can be inserted into a 107mm cannon.	FO, FDC, Gun Crew	Provides live-fire practice with less expensive ammunition.	Affected by wind.
a. M69 training shell	107mm (4.2 inch) with 60mm subcaliber assembly	60mm training shell (teardrop) with the M4 or M5A1 ignition cartridge and M32 primer.	Gun Crew FDC, FO	Does not require a large area nor create a dud area.	Slightly unrealistic training for FDCs and gun crews.
b. M49A4HE shell	107mm (4.2 inch) with 60mm subcaliber assembly.	60mm mortar service ammunition.	FO, FDC, Gun Crew		
c. M50A3 training	107mm (4.2 inch) with 60mm subcaliber assembly.	60mm mortar practice ammunition.	FO, FDC, Gun Crew	Simulates live ammunition at less cost.	Slightly unrealistic training for FDCs and gun crews.
81mm M68 inserting round	81mm	81mm training shell (teardrop).	Gun Crew, FDC, FO	Does not require a large area nor create a dud area.	Rounds do not simulate explosion.
M32 pneumatic subcaliber	107mm (4.2 inch) 81mm	The M32 pneumatic trainer comes in a carrying case. It consists of a barrel assembly, adapters for the 60mm, 81mm, and 107mm (4.2 inch) mortars, and a compressed-air bottle.	Gun Crew, FDC, FO	Portable and requires limited space.	Uses very small scale range and impact area. All FO corrections must be scaled. No ammunition to be handled.
Bryant device	81mm	The Bryant device consists of a miniature range map, tube adapter, barrel extension and miniature aiming posts.	FO, Gun Crew, FDC	Can be used indoors or in small areas at night.	Round spottings for FO not very realistic. No ammunition to be handled.
Burst simulator	107mm (4.2 inch) 81mm, 60mm	Simulates firing with paper, rags, cotton balls, or cutout models.	FO, FDC, Gun Crew	Can be used indoors.	Burst location not totally realistic. No ammunition handled.



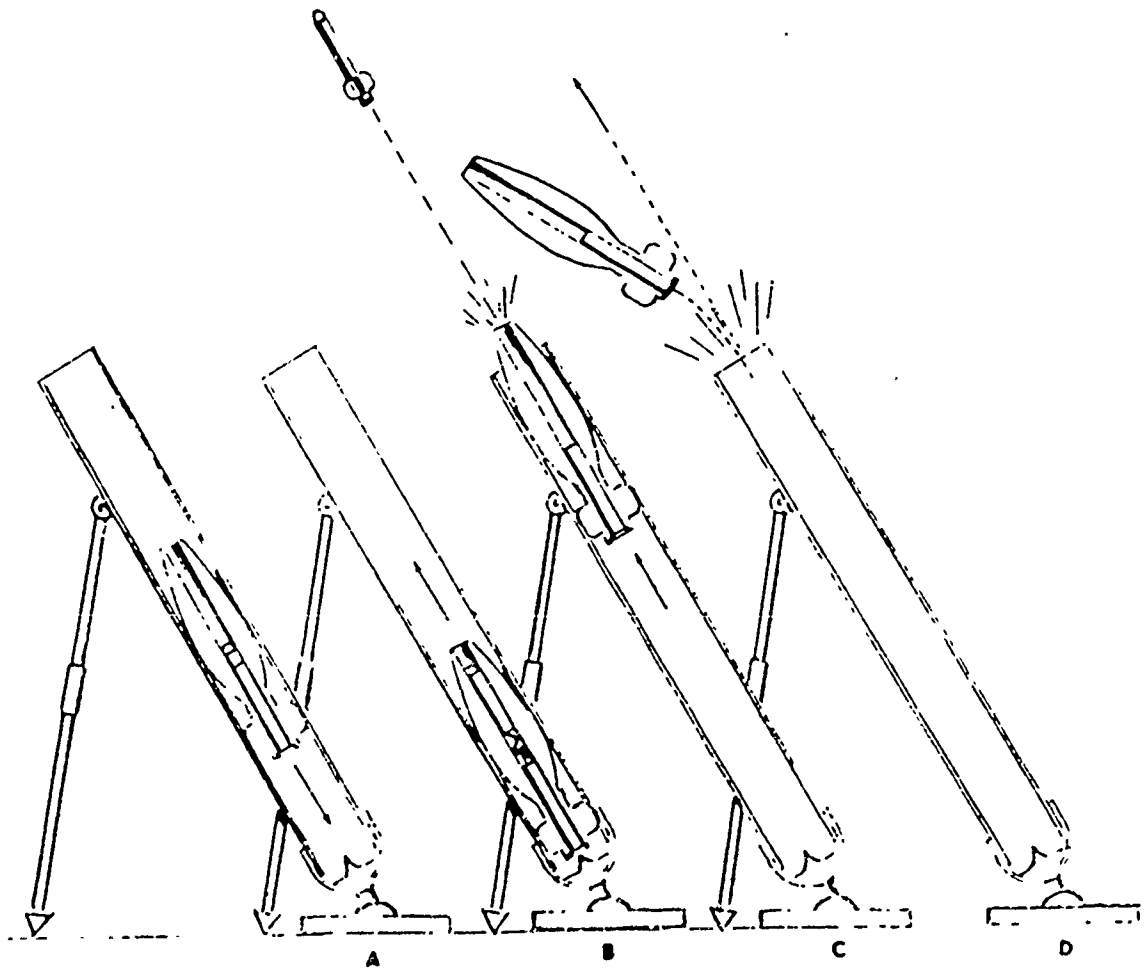


Figure 3. M-1 SABOT

A scale ratio of 1:10 is used to relate the difference in range and deviation between a subcaliber projectile and the standard 81mm service round. The minimum range area needed for firing through charge four is a range area 200 by 500 meters, with a 45-meter safety zone on each side of the flank targets.

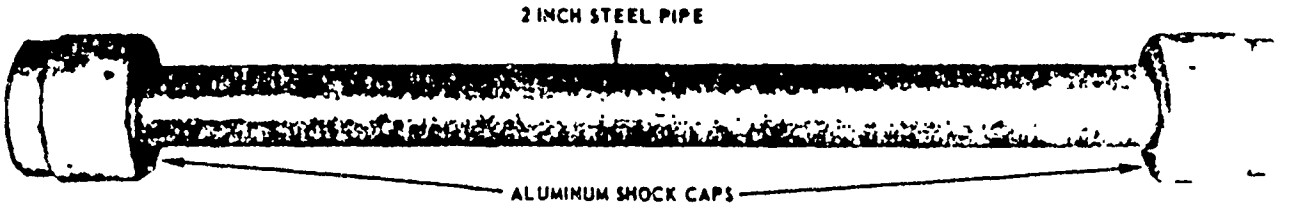
60mm Subcaliber Assembly. The subcaliber assembly consists of a 60mm (mortar tube) cannon modified to allow it to be inserted into the cannon tube of the 107mm mortar. The 60mm cannon M2 is the only barrel authorized for use. The components of the assembly are an insert, a filler block, and a filler block retreiver (Figure 4).

The insert consists of an M2, 60mm mortar cannon, fitted with two aluminum rings that allow the 60mm mortar cannon to fit snugly into the 107mm mortar cannon. The aluminum rings also prevent the rifling in the cannon from being scored and damaged. The filler block consists of a round steel pipe fitted with an aluminum shock cap on either end. These caps fit snugly into the cannon sithout damaging it. The aluminum cap receives the spherical projection on the base of the 60mm cannon and distributes the recoil shock. The center of each cap is threaded to receive the filler block retriever. The shock caps are made so that they fit over the striker pin of the 107mm mortar cannon, allowing all the shock to be exerted on the base end of the cannon rather than on the striker pin. The filler block retriever is a steel rod fitted with a handle on one end and is threaded so that it may be screwed into the shock cap of the filler block to remove it from the gun tube.

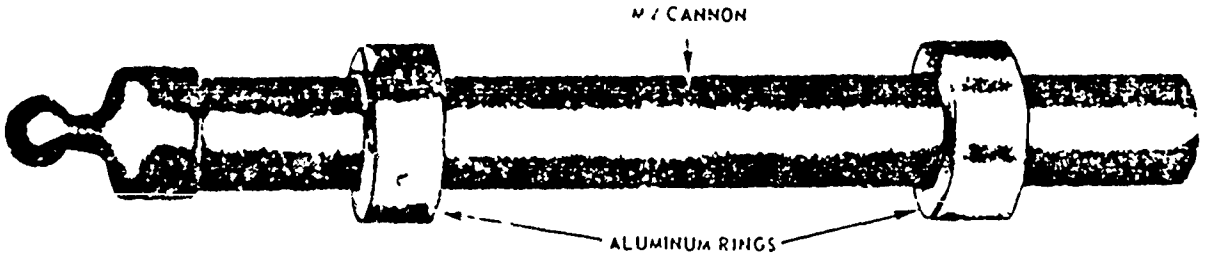
The subcaliber assembly does not affect the use of the sight or the traversing assembly slide or elevation mechanism of the 107mm mortar. To install the subcaliber assembly, the mortar is mounted, then the filler block is simply slid down the cannon. Finally, the insert (60mm cannon with rings) is slid down the cannon. The insert protrudes approximately 1 to 1-1/2 inches from the 107mm bore.

All types of 60mm mortar ammunition, including training practice and high explosive shells, may be fired from the subcaliber assembly. The 60mm mortar training shell is usually fired on a training shell range; the practice shell and the HE shell are used on a normal field firing range. When an ammunition shortage prevents field firing training with 107mm shells, 60mm practice or high explosive ammunition may be used as a substitute using this subcaliber device.

M32 Pneumatic Subcaliber Mortar Trainer. This trainer needs only about 14 meters of overhead clearance and a clear area to see rounds impact. It therefore has an indoor firing potential. The trainer can be used to train all members of the indirect fire team on any mortar now in use. This trainer has its own carrying case and consists of a subcaliber device, a pressurizing element, and subcaliber rounds. The pressurizing element, simulating the explosive charge with compressed air, shoots a subcaliber round out of the cannon. It can be adjusted to simulate different charges (Figure 5).



Filler Block



60mm Mortar Insert

Figure 4. 60mm Subcaliber Device.

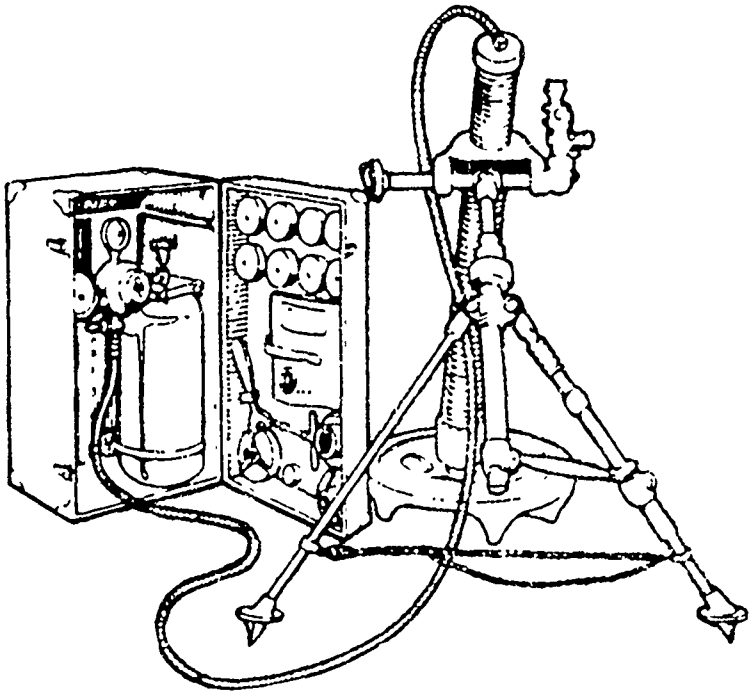


Figure 5. M-32 Pneumatic Subcaliber Device.

The pneumatic trainer is inserted in a mortar cannon and pressurized to the "charge" needed using a gauge. The mortar is laid and adjusted as it would be for any live-fire mission. The round is dropped into the device and is fired by compressed air. The round is affected significantly by high winds, which can throw it off target, making accurate forward observer (FO) corrections difficult. A commercial caliber .22 blank fires on the impact of the round. It makes a sharp noise and simulates the impact of a live mortar round for practice in spotting. The indirect fire team can be effectively trained with this device on a 500 - 1,000 or 2,000 - inch subcaliber range under calm wind conditions.

The tasks for which this device trains gunners are almost the same as those practiced during live-fire training. The firing tables used with the trainer, however, apply only to the trainer. Since no ammunition is handled, training is not obtained in cutting charges and fuzes are not set. If the device does not keep constant pressure, the rounds will be off-target which detracts from FO training.

Bryant Device. The Bryant Device was devised primarily for indoor use. The device consists of a miniature range map, a tube adaptor which holds a light source centered in the bore, a barrel extension bracket which supports a mirror, and a set of miniature aiming posts. The mirror is suspended above the muzzle and is held horizontally by a plumb bob attached to the corners of the mirror. The mirror is blacked out except for a small dot of reflective area to keep the reflected light dot (the simulated fire) small on the range map. The light source provides the beam of light which is reflected onto the range map which is placed in front of the mortar. Through the use of crew drills, the miniature aiming posts, and simulated firing motions, the mortar crew can fire the mission and the FO team can observe the fire and adjust the fire. The FDC can compute for the firing just as in a live fire situation (Figure 6).

Various small objects, such as match boxes, flashlight batteries, etc., may be used to simulate targets on the floor in front of the mortar. The scale of 6 inches equaling 100 meters is used to construct the target area. To operate the device, the forward observer is positioned to the right or left of the mortar. A screen is placed in front of the mortar so that the gun crew cannot see the target area. The FO determines the azimuth to the target and formulates an initial call for fire which he transmits to the Fire Direction Center.

When the FDC receives this request, the computer formulates an initial fire command. He determines his firing data using the M16 plotting board. A special firing table for the device must be used to obtain elevation and the proper range. The firing table is available as part of the Bryant Device and it contains a simulated charge element as well.

The gunner receives the initial fire command from the FDC, places the announced deflection and elevation on the sight and lays the mortar accurately on the aiming posts. The gunner fires the round by turning on the flashlight and announcing "Shot." A beam of light from the flashlight will be reflected from the mirror downward to the target area at distances that vary according to the angle of mortar elevation. Normal gunnery procedures are then followed to adjust fire.

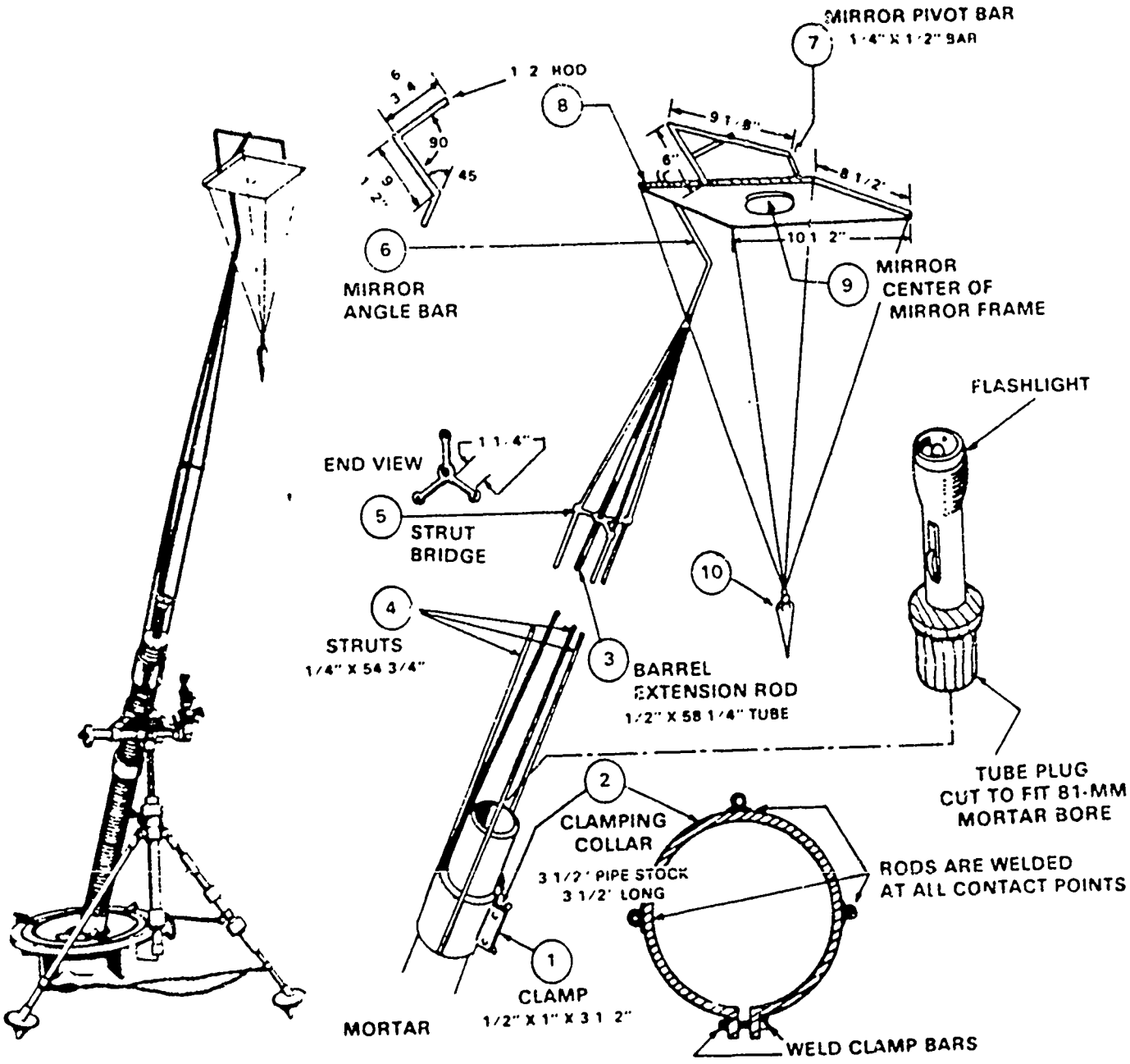


Figure 6. Bryant Device.

To make range corrections, the forward observer uses the scale that has been established (6 inches = 100 meters). To make deviation corrections, the FO uses the mil scale in his binoculars and then converts mils to meters using the standard mil-relation formula (WORM Formula). The range factor used in the mil-relation formula is determined by the target range scale.

Burst Simulator. The Burst Simulator method requires no prefabrication or construction of training aids, and can be conducted in a small area. All of the platoon's TO&E equipment is used and the entire platoon trains at the same time.

The Burst Simulator method of training can be conducted with little advance preparation. Any scale can be used as long as it is kept constant throughout the range, i.e., 1 foot = 100 meters. First, the forward observer's position is determined. From the FO's position, through the impact area, range markers are placed out at scale 1000 meter increments. Targets are then placed out in the impact area. The location of the mortar position is then determined. The mortar is mounted, boresighted, and laid for direction using M2 aiming circle or M2 compass. After the mortars are laid, the aiming posts are placed out on a referred deflection (if operating inside, the aiming posts are put in cans filled with sand or gravel). Another set of range markers is placed out, this time from the mortar position across the impact area. The mortar range markers are smaller than the FO range markers, to the same scale, and readable only in the immediate vicinity of the marker itself. The FDC is located in the vicinity of the guns and shielded from sight of the impact area. It will be connected to the FO by radio or wire and to the guns by wire for added realism. A burst simulator for each mortar is then constructed (Figures 7 and 8).

A typical fire mission will work as follows:

- The FO will send a call for fire to the FDC requesting a mark center sector or mark registration point.

- The FO uses its firing chart or plotting board and firing tables to determine the proper deflection, charge, and elevation for use with standard "A" ammunition. This information will be sent to the guns, where it will be placed on the sight and mortar aligned.

- The squad leader will then check the alignment and level of the mortar and read off the elevation to the ammo handler, who will then use a set of firing tables to determine what the range for the elevation and announced charge should be.

- The squad leader will have the assistant ammo handler move down range with the burst simulator and position himself at the range, guided by the mortar range markers.

- The gunner will refer the sight to 3200, and using hand and arm signals, have the assistant ammo handler move the burst simulator until it is centered on the vertical hairline of the sight.

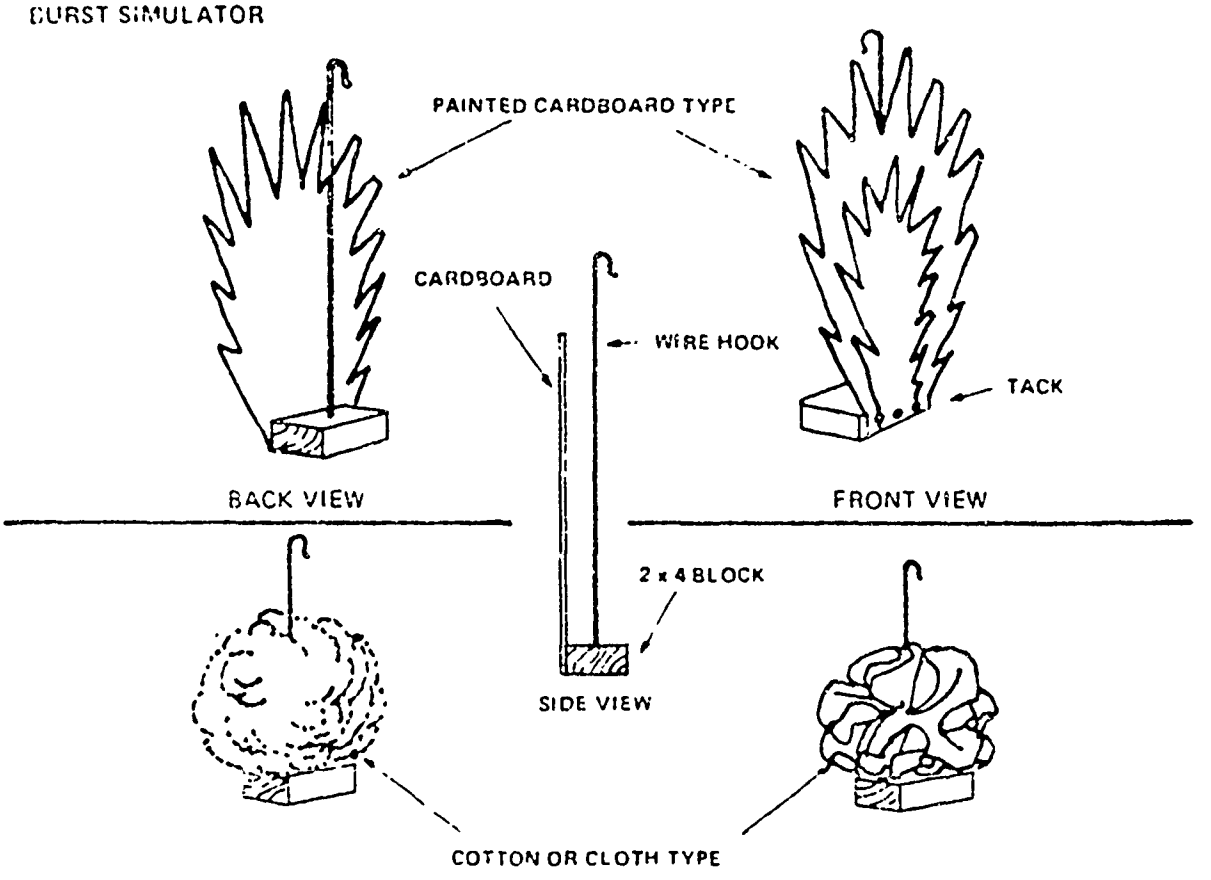


Figure 7. Burst Simulator.

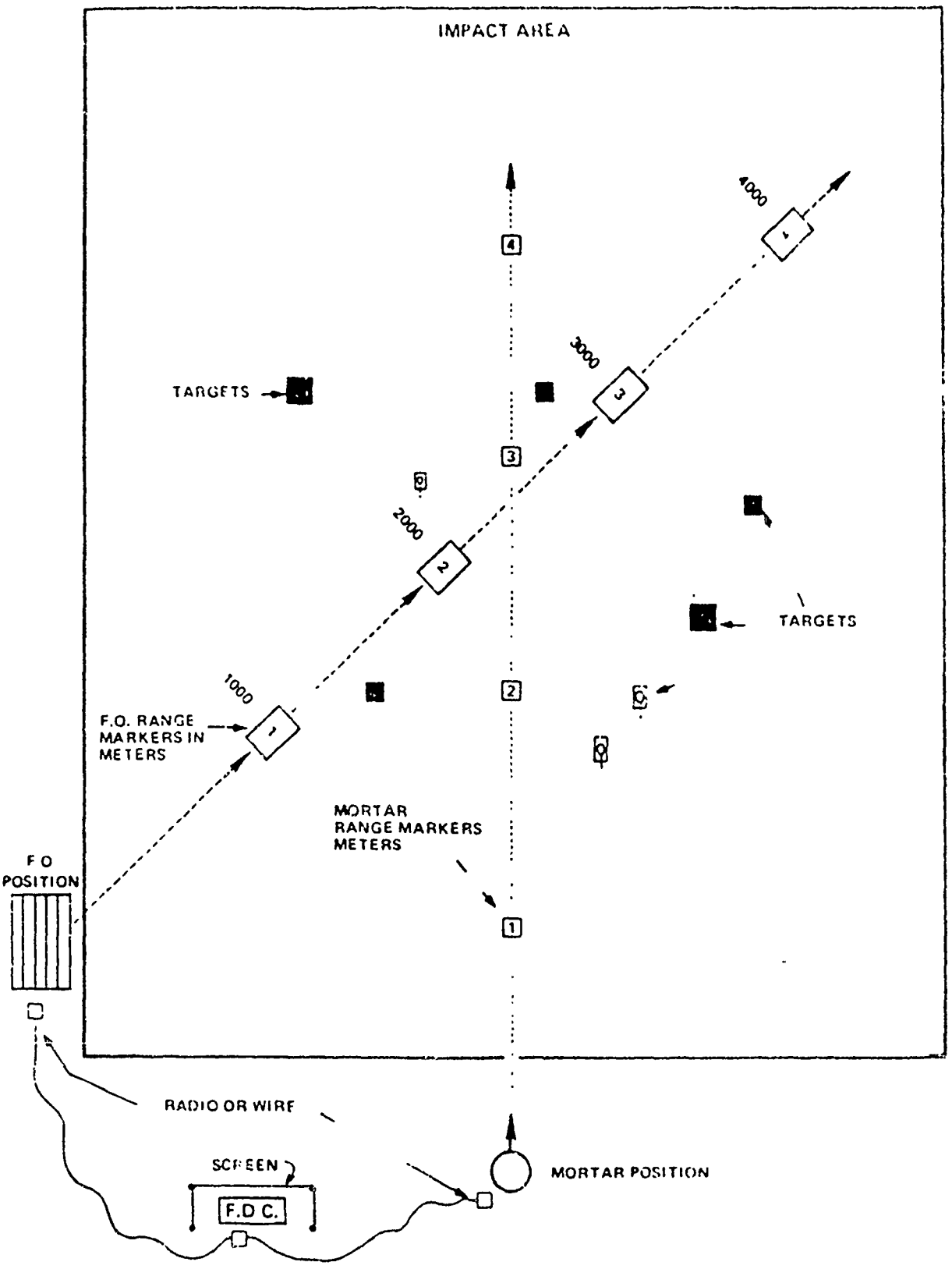


Figure 8. Burst Simulator Range.

- The assistant ammo handler will place the simulator on the ground and move off the range.

- The FO observes where the simulator has been placed and either makes a correction or sends in a new call for fire to engage one of the targets. He can determine the direction to the new target by using his compass, the deviation correction by measuring the mil spread using his military binoculars, and the range by looking at the FO range markers and using the mil-relation or "WORM" formula. This call for fire will be sent to the FDC and the same procedure followed.

- If the gunner has made a mistake in elevation, it will be reflected in the range to burst as determined by the ammo handler when reading off the firing tables. If there has been an error in deflection, this will show up as an error in deviation when the sight is referred back.