APPENDIX A

MORTAR TRAINING STRATEGY

This appendix provides a comprehensive unit training strategy for training mortarmen. Leaders have the means to develop a program for training their mortar units to full mission proficiency. This training strategy applies to ALL mortars in ALL organizations of the US Army. Although not prescriptive in nature, it must adapt to a unit's mission, local training resources, commander's guidance, and unit training status.

A-1. TRAINING PHILOSOPHY

This training strategy synchronizes institutional and unit components to produce units that are trained to win on the battlefield. It includes the training documents, institutional training, unit training, and training resources needed to achieve and sustain the required outcome. It covers the skills required for individual, crew, leader, and collective proficiency and ensures that the strategy is linked horizontally within CMF and vertically between officer and enlisted. This strategy integrates information from several publications (see References), including this manual, into a single-source document.

A-2. UNIT MORTAR TRAINING

Technical and tactical proficiency is based on sound training. The importance of skilled and proficient mortarmen must not be overlooked within the context of the battalion's overall training strategy. Unless leaders have a mortar background, they may not understand the distinct training requirements and tactical role of mortars. This ensures they will allocate priorities and resources to mortars, which are required for effective training. Therefore, leaders may also require training. This can be achieved by OPD and NCOPD instruction on mortars, which include both technical and tactical mortar subjects.

a. Once mortarmen have mastered their own tasks, they must be fully integrated into the training exercises of the company, battalion, or both. Only within the context of a full maneuver exercise can the mortar unit's indirect fire support ability be fully trained and evaluated. However, mortars suffer from not having a training device (such as MILES) to simulate the terminal effects of mortar rounds. As a result, maneuver units tend to under-employ their supporting mortars. Despite the current absence of such devices, there are other techniques to assess the effects of indirect fire. (These are outlined in GTA 25-6-7 and Appendix F of FM 25-4.) Fire missions not specifically using enemy targets — such as registration and adjusting final protective fires — should also be routinely conducted in maneuver exercises.

b. A training plan that employs mortarmen only as OPFOR riflemen is not effective for many reasons. Firstly, mortarmen are not being trained in the technical and tactical tasks pertinent to their mission. Secondly, riflemen are deprived of a valid training experience as OPFOR. Thirdly, maneuver units are not trained to employ their mortar indirect fire support.

A-3. MORTAR TRAINING AT THE TRAINING BASE

The mortar unit training strategy begins with the training base. Leaders must know what skills mortarmen bring with them when they report to their unit. This forms the base to build mortar training in the unit. The career pattern for NCOs and officers (lieutenants) is depicted in individual training. It entails alternating between the training base and units with progressively advanced levels of training and responsibility. Mortar training in the institution focuses on preparing the soldier for these positions. Depending on the course, the training focus includes technical training in mortar skills, mortar familiarization, and mortar issues update (Table A-1)

a. **One Station Unit Training (11C).** OSUT trains new soldiers for their initial assignment in infantry or mechanized units. Training is divided into two phases. Phase I (seven weeks) teaches common entry-level infantry tasks. Phase II continues to foster the self-discipline, motivation, physical readiness, and proficiency in combat survivability started in Phase I. The 11C soldiers receive instruction in mortar systems to prepare them for their specific unit assignments (light units 60-mm and 81-mm mortars; heavy units 81-mm, 4.2-inch, and 120-mm mortars). Soldiers receive familiarization on FDC and FO procedures and are required to pass a mortar gunner's examination to be awarded their MOS.

b. **Basic Noncommissioned Officer Course (11C).** BNCOC teaches junior NCOs to lead, train, and direct subordinates in the maintenance, operation, and employment of weapons and equipment. The instruction includes FDC procedures, fire planning, tactical employment of mortars, and maintenance. Soldiers are required to pass an FDC examination to complete the course.

c. **Advanced Noncommissioned Officer Course.** ANCOC prepares NCOs to lead a mortar platoon in combat as part of the battalion team. This includes fostering an understanding of the battalion task force concept and how it fights. Training that applies to mortars includes fire planning, FDC, and FO procedures. Personnel are required to pass an FDC examination to complete the course.

d. **Infantry Mortar Platoon Course.** IMPC provides lieutenants and NCOs (sergeant through master sergeant) with the working knowledge to supervise and direct the fire of a mortar platoon. Instructions include tactical employment of the mortar platoon, graphics, fire planning, mechanical training, FO procedures, and mortar ballistic computer procedures. Officers are awarded the additional skill identifier of 3Z. Commanders must ensure that IMPC graduates fill mortar leadership positions. The skills personnel have learned are complex and perishable and must be sustained in the unit. Personnel are required to pass an FDC examination to complete the course.

e. **Infantry Officer Basic Course.** IOBC trains lieutenants in weapons, equipment, leadership, and tactics. It also teaches them how to instruct their subordinates in the maintenance, operation, and employment of weapons and equipment for combat.

Students receive instruction in mechanical operation of the mortar as well as detailed instruction on FO procedures.

f. **Infantry Officer Advanced Course.** IOAC trains first lieutenants and captains in leadership, warfighting, and combat service support skills required to serve as company commanders and staff officers at battalion and brigade levels. Mortar training focuses on supervisory tasks.

g. **Pre-Command Course.** PCC is intended for field-grade officers (majors through colonel) designated for battalion and brigade command. Training consists of a review and update on mortar issues such as battle drills and safety.

COURSE	SKILL LEVEL						COURSE FOCUS
	1	2	3	4	5	OTHER	
ONE STATION UNIT TRAINING	X	X					A
BASIC NCO COURSE		X	X				C, D
ADVANCED NCO COURSE				X			C, D
INFANTRY MORTAR PLATOON COURSE			X	X	X	X	B, C, D
OFFICER CANDIDATE SCHOOL						X	C
INFANTRY OFFICER BASIC COURSE						X	C
INFANTRY OFFICER ADVANCED COURSE						X	D
PRE-COMMAND COURSE						X	C, D

A = MOS-PRODUCING C = FAMILIARIZATION
B = ADDITIONAL SKILL IDENTIFIER FOR OFFICERS D = REVIEW/UPDATE

Table A-1. Institution courses.

A-4. TRAINING IN UNITS

A unit training program consists of initial and sustainment training. Both may include individual and collective skills. Resources, such as devices, simulators, simulations, ranges, and ammunition, further develop skills learned in the institution. The critical aspect of unit training is to integrate soldiers into a collective, cohesive effort as a mortar squad or platoon member. Drills, STXs, and live fire drills develop these collective skills.

a. **Training Plan Development.** Training plans are developed at higher headquarters and published in the form of command guidance so that subordinate units can develop their plans. The process begins with identifying the unit's METL.

The METL contains all the collective tasks that a unit must perform to be successful in combat. FM 25-100 contains specific information on the METL development process.

(1) Commanders assess the unit's proficiency level in each METL task. Information for this assessment is obtained by reviewing past gunner's and FDC examinations, ARTEP results, and external evaluation AARs, and by observing the execution of current training. Individual proficiency can be checked by reviewing the SQT results for each soldier or the SQT summary to identify trends.

(2) Once the assessment is complete, the commander lists the tasks in priority. Tasks that are identified as untrained (U) and are critical to the mission have training priority, followed by tasks that need practice (P) and tasks that are trained (T) to standard. Resources (ranges, ammunition, equipment, and time) are requested to train those tasks that do not meet the standard (U and P), while sustaining the proficiency of the tasks that do meet the standard (T). The commander refines his plan in the form of a training guidance and training schedules. FM 25-2 contains specific information on the training plan development process.

(a) Initial training trains soldiers and units to a high degree of proficiency. New soldiers have not yet trained on all tasks associated with the mortar. Initial training ensures that each soldier, squad, and platoon has the basic core skills proficiency for their skill levels or their collective team. Initial training must be trained correctly to a rigid standard so that proficiency will be retained longer. Decay in skill proficiency will occur due to available training time, skill difficulty, or personnel turnover.

(b) Sustainment training helps maintain skills and proficiency within the band of excellence described in FM 25-100. Retraining maybe required if a long period elapses between initial and sustainment training. Once proficiency is demonstrated in a task or collective event, more difficult scenarios and exercises should be developed to train to a higher level of proficiency, while sustaining previously learned skills.

b. **Integrated Training Strategy.** Figure A-1 outlines a logical progression of events that a mortar platoon can adapt to its training strategy. Mortar squads and the FDC are dual-tracked to focus on their specific training needs. Both tracks must be integrated to develop a mortar platoon that fights as one unit. Individual and collective training must be evaluated against specific standards and discussed in AARs. Objective evaluations provide readiness indicators and determine future training requirements.

(1) *Common tasks.* These tasks are found in STP 7-11-BCHM14-SM-TG, Skill Levels 1-4. This manual contains the common tasks that all soldiers must know, regardless of MOS or duty position, to help them fight, survive, and win in combat. Mastery of these common tasks are a prerequisite for individual training specific to mortars. The communications and land navigation common tasks are vital.

(2) *MOS 11C tasks.* These tasks are found in STP 7-11C14-SM-TG for MOS 11C. This manual contains the individual tasks specific to mortarmen. The trainer's guide provides leaders the information to develop the individual portions of a unit training plan. Each 11C task is listed in this guide along with the following:

(a) Training extension courses. Service schools use TECs to support their expertise directly to units in the field. This is accomplished through lessons in the form of booklets, videoslides, audiotapes, and videotapes. These lessons focus on individual tasks and are stocked in unit learning centers and the local training support centers. TEC materials provide standardized instruction, which is helpful to soldiers as they move from unit to unit. Preparation time is also saved. However, trainers must ensure the lessons directly and fully support the training objectives.

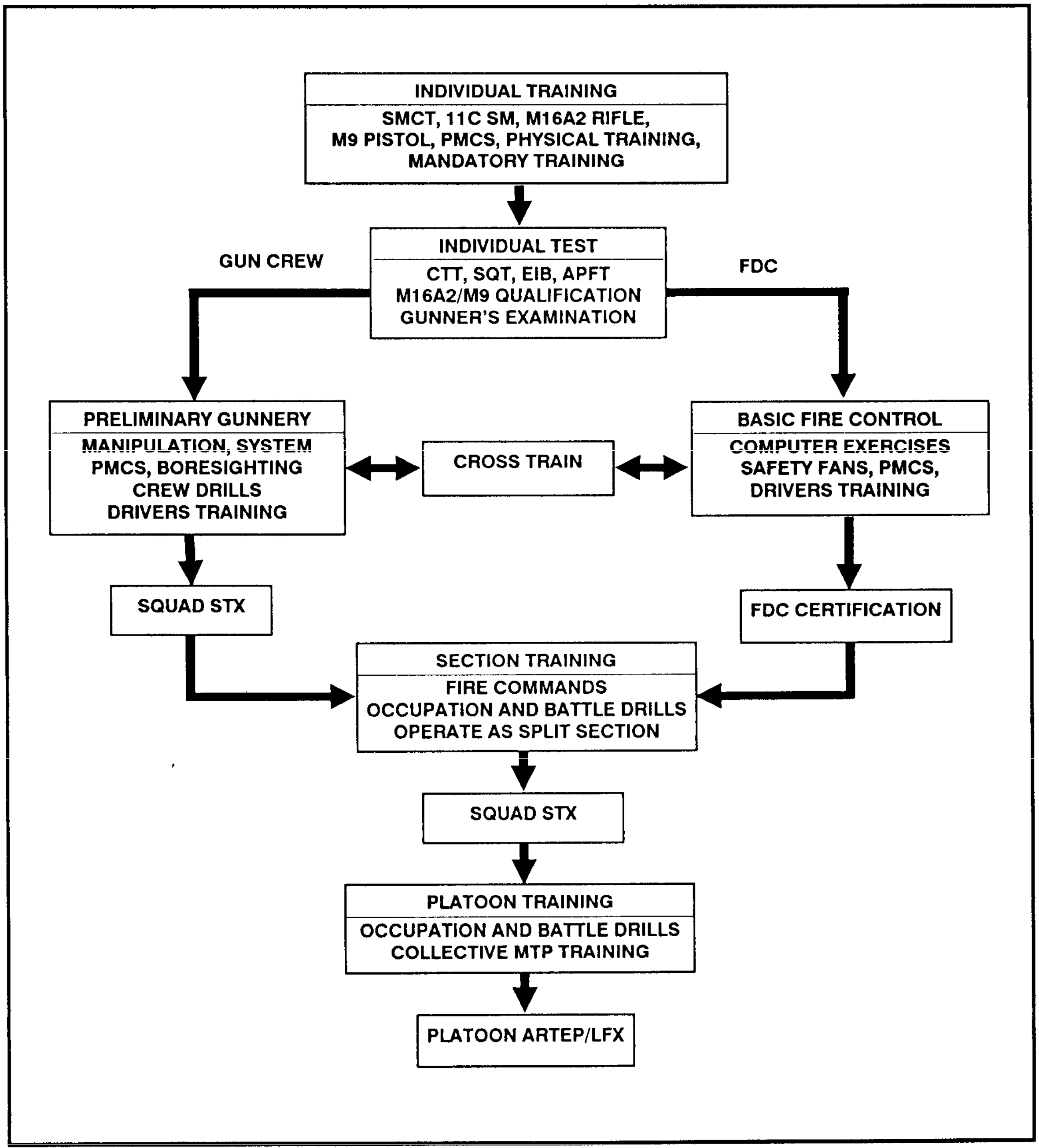


Figure A-1. Integrated training strategy.

(b) Army Correspondence Course Program. The ACCP provides printed training courses through the mail to soldiers. It is a valuable program for training the trainer, skill progression, and functional training for a specific speciality, MOS, or duty position. However, planning is needed. Leaders must identify courses that support the goals of the long-range training plan; soldier's enrollment must then be arranged. (ACCP includes infantry mortar platoon leaders courses.)

c. **Cross Training.** A soldier's individual training tends to focus on his duty position. The assistant computer concentrates on FDC tasks while the squad leader concentrates on mortar mechanical tasks and leading the squad. However, this focus should not exclude other mortar training. Continuous training in duty-specific tasks can become boring to soldiers and deprive them of gaining broad proficiency in their MOS. Casualties (whether in war or in training) can quickly render the mortars ineffective if key personnel are lost. These variables make cross training essential. For example, cross training ensures that a squad leader can assume the duties of a computer and that subordinates are ready to assume the roles of their supervisors.

d. **Collective Training.** Collective training includes squad, section, and platoon drills and exercises.

(1) *Squad training.*

(a) The core of this training is crew drills. There are squad-level mortar tasks in the infantry MTP. This training can be performed in garrison (using devices or live ammunition). Once these tasks are mastered, an increased challenge is introduced by performing them under different conditions such as urbanized terrain, limited visibility, or NBC. Cross training is accomplished at this level by rotating soldiers among duty positions, such as squad leader and FDC positions, while providing coaching.

(b) The foundation of this training is sound individual training. If individual proficiency is effectively sustained, new soldiers can be readily integrated into the unit during collective training. They arrive at the unit proficient in specific tasks learned in the training base. These new soldiers learn additional tasks while training with their experienced peers and their squad leaders.

(2) *Section and platoon training.*

(a) The core section and platoon tasks are found in the ARTEP MTP. This training usually consists of an exercise in the field: LFX, STX either alone or with a rifle company, or FTX as part of the battalion. LFXs may involve subcaliber, sabot, SRTR, or service ammunition. STXs and FTXs may entail dry fire, live fire, or devices, either alone or in combination.

(b) The FIST must be a part of this training. An LFX must never take place without the FISTs normally associated with the battalion. Trainers may wish to integrate these artillerymen into the mortar unit. This teaches the capabilities, limitations, and unique requirements of operating mortars.

(c) Another important area is the mortar's role in overall task force operations. This collective training mainly involves leaders in an FTX. However, mortars must be considered along with other fire support assets when conducting a MAPEX, CFX, TEWT, or CPX.

(3) *Collective training resources.*

(a) Drill books. Crew and battle drills are published in a pocket-sized ARTEP manual called a drill book for each unit organized under a different TOE. *(See ARTEP 7-90-Drill).*

- Battle drills are a specific category of collective tasks performed at squad, section, or platoon level. They are vital to the mortar's success in combat. Battle drills are mostly independent of METT-T and require minimal leader actions to execute. They are usually executed or initiated on a cue such as an enemy action or a simple leader order. Battle drills are standardized throughout the US Army and may not be modified in training. The mortar unit is required to be proficient in all battle drills contained in the drill book. Less critical drills are published in other sources such as training circulars or field manuals.
- Mortar drills are divided into two general areas. The first are those battle drills that previously were termed "crew drills." These focus on the mechanical manipulation of the mortar such as Lay for Small Deflection Change or Remove Misfire. Full proficiency in these tasks is a prerequisite for performing fire support missions. The second area encompasses those battle drills essential to combat survival. These include such tasks as React to Chemical Attack or Secure at Halt.

(b) Mission training plan. The MTP is a descriptive ARTEP document for training mortarmen to critical wartime mission proficiency. It gives the mortar platoon or section a clear description of "what" and "how" to train. This is achieved through comprehensive, detailed T&EOs, guidance on training exercises, and other related training management aids. While its focus is on collective training, the MTP also provides matrixes that identify individual tasks, common 11CSM tasks, and MQS tasks. Like the drill book, the mortar MTP applies to platoons or sections organized under a specific TOE. *(See ARTEP 7-90-MTP.)*

(c) Standards in Training Commission. STRAC outlines DA requirements for weapons training programs. It provides weapons standards, strategies, and resourcing for the 60-mm, 81-mm, 4.2-inch, and 120-mm mortars for different levels of unit training readiness. It specifies the amount and type of ammunition allocated to each mortar training event, and the annual frequency of that training event. For TRC A and TRC B units, the STRAC specifies that 90 percent of all squad leaders, gunners, and assistant gunners will have passed the mortar gunner's examination within the past six months and FDC personnel will have passed the FDC examination within the past six months (Appendix F). Also, it states that all mortar sections and platoons will have received a satisfactory rating IAW ARTEP MTP standards within the past six months.

(d) Battalion-level training model. BLTM is a means to qualify the cost of maintaining training readiness. This cost is expressed in terms of types of training events, their annual frequency, and the equipment miles/hours expended. This model is used to forecast and resource requirements to support the units specified training readiness level. It does not, however, prescribe what training a unit must conduct to maintain this level. Rather, BLTM provides a basis for understanding the trade-off between a unit's training resources and its training strategy developed. This helps leaders program training alternatives to achieve and maintain combat readiness.

The frequency of training events under BLTM are reflected in the battalion's long-range training plan. When fully developed, BLTM encompasses and replaces STRAC.

e. **Example Annual Mortar Training Programs.** Figures A-2 and A-3 are examples of battalion-level programs for training mortar units. Figure A-2 depicts a mechanized infantry battalion in USAREUR, and Figure A-3 depicts a light infantry battalion in CONUS. These examples are consistent with current guidance under the STRAC and BLTM.

JANUARY CMT ITEP BN CPX MAINTENANCE SQD DRILLS PLT STX SQD/SEC FDC DRILL (SRTR) INDIV WPN QUAL/SUSTAINMENT FDC CERITFICATION	**FEBRUARY** MAINTENANCE CO FTX BN FTX DEPEX SQD/SEC/FDC DRILL (SABOT) PLT FTX BN EXTERNAL EVAL/LFX	**MARCH** MAINTENANCE POST SUPPORT/CO MAPEX BN TEWT ITEP CMT INDIV WPN QUAL/SUSTAINMENT SQD/SEC/FDC DRILL (SRTR)
APRIL GUNNERY QUAL (MTA) CALFEX (MTA) MAINTENANCE GUNNER'S EXAM LFX (M60, .50-CAL, 4.2-INCH) CALFEX/LFX DRILL (SABOT)	**MAY** ITEP (SQT) BN CPX PLT STX MAINTENANCE SQD/SEC BATTLE DRILLS (SRTR/LITR)	**JUNE** CO FTX BN FCX BN DEPEX BN FTX (EXTERNAL EVAL [HTA]) MAINTENANCE SQD/SEC/FDC DRILL BN EXT EVAL/LFX
JULY POST SUPPORT ITEP (EIB) BN MAPEX INDIV WPN QUAL/SUSTAINMENT CMT SQD/SEC/FDC DRILL (SRTR) MAINTENANCE	**AUGUST** IG INSPECTION ITEP BN CPX MAINTENANCE SQD/SEC/FDC DRILL (SABOT) PLT STX FDC EXAM GUNNER'S EXAM	**SEPTEMBER** CO FTX MAINTENANCE BN DEPEX BN FTX-(REFORGER) SQD/SEC/FDC DRILL (SRTR) PLT STX
OCTOBER MAINTENANCE POST SUPPORT CO TEWT ITEP (CTT) CMT SQD/SEC/FDC DRILL (SABOT)	**NOVEMBER** INDIV WP QUAL/SUSTAINMENT GUNNERY QUAL (MTA) MAINTENANCE BN CFX SQD/SEC/FDC DRILL (SRTR) FDC EXAM GUNNERY QUAL (.50-CAL, M60) LFX	**DECEMBER** MAINTENANCE DEPEX POST SUPPORT ITEP INDIV WPN QUAL/SUSTAINMENT CMT SQD/SEC/FDC DRILL (SABOT)

Figure A-2. Example training program for mechanized infantry battalion in USAREUR.

JANUARY
- INDIV WPN QUAL/SUSTAINMENT
- CREW WPN QUAL/SUSTAINMENT
- MAINTENANCE
- SQD/SEC/FDC DRILL (SRTR)
- PLT/SEC LFX
- GUNNER'S EXAM
- FDC CERTIFICATION

FEBRUARY
- SQD/SEC/FDC DRILL (LITR)
- PLT FTX
- CO FTX
- BN FTX
- DEPEX
- MAINTENANCE
- PLT STX (81-mm ONLY)
- SUPPORT CO STX

MARCH
- POST SUPPORT/BN CPX
- SQD/SEC/FDC DRILL (SRTR)
- ITEP (SQT)/CMT
- CO TEWT
- BN EXTERNAL EVAL/LFX

APRIL
- INDIV WPN QUAL/SUSTAINMENT
- CREW WPN SUST
- MAINTENANCE
- SQD/SEC/FDC DRILL (LITR)
- SEC/PLT LFX

MAY
- SQD DRILL
- PLT STXs
- CO FTXs
- DEPEX
- BN FTX
- MAINTENANCE
- SUPPORT CO FTX

JUNE
- POST SUPPORT
- BN CPX
- CO MAPEX
- ITEP (EIB)
- SQD/SEC/FDC DRILL (LITR)

JULY
- NG & ROTC SUPPORT
- SQD/SEC/FDC DRILL (SRTR)

AUGUST
- INDIV WPN QUAL/SUSTAINMENT
- CREW WPN QUAL/SUSTAINMENT
- BN FTX
- CALFEX/LFX
- MAINTENANCE
- FDC EXAM
- SQD/SEC/FDC DRILL (LITR)

SEPTEMBER
- SQD DRILL
- MAINTENANCE
- CO FTXs
- BN CFX
- BN FTX (EXT EVAL)
- SQD/SEC/FDC DRILL (SRTR/LITR)
- PLT STX (81-mm)
- DEPEX

OCTOBER
- POST SUPPORT
- ITEP (CTT) CMT
- BN TEWT
- CO MAPEXs
- CPX (81-mm)
- SQD/SEC/FDC DRILL (LITR)

NOVEMBER
- IND WPN QUAL/SUSTAINMENT
- CREW WPN/SUSTAINMENT
- DEPEX
- MAINTENANCE
- SQD/SEC/FDC DRILL (SRTR)
- GUNNER'S EXAM
- FDC CERTIFICATION

DECEMBER
- POST SUPPORT
- ITEP (SQT)
- CMT
- SQD/SEC/FDC DRILL (LITR)

Figure A-3. Example training program for light infantry battalion in CONUS.

A-5. TRAINING EVALUATION

Evaluation cannot be separated from effective training. It occurs during the top-down analysis when planners develop the training plan. Planners use various sources of information to assess their unit's individual and collective training status. Evaluation is continuous during training. Soldiers receive feedback through coaching and AARs. Leaders also assess their own training plan and the instructional skills of their subordinate leaders. After training, leaders evaluate by sampling training or reviewing AARs. Much of this evaluation is conducted informally. Formal evaluations occur under the Individual Training and Evaluation Program (ITEP) and the Army Training and Evaluation Program (ARTEP) to assess individual and collective training respectively.

a. **Individual Training.**

(1) *Commander's evaluation.* The commander's evaluation is routinely conducted in units. Commanders select and evaluate individual tasks that support their unit mission and contribute to unit proficiency. This may be performed through local tests or assessments of soldier proficiency on crucial MOS tasks or common tasks. The commander's evaluation is based on year-round, constant evaluation by the chain of command. It is supported by the MOS 11C soldier's manuals, trainer's guides, and job books.

(2) *Common tasks test.* The CTT is a hands-on test that evaluates basic survival and combat tasks. It is taken directly from the STP 7-11BCHM14-SM-TG and STP 7-11C14-SM-TG. The CTT gives the unit commander regular, objective feedback on common task proficiency.

(3) *Skill qualification test.* The SQT is an annual written test specific to an MOS. The SQT for mortarmen is taken directly from STP 7-11C14-SM-TG. SQT results are also used in personnel management of Active Component soldiers. In units, SQT results can identify soldiers who are strong or weak in the tasks for their skill levels. The unit's SQT summary report reveals trends in such task performances. This helps establish the priority of individual tasks for future training. It also shows if past training was effective or ineffective.

(4) *Gunner's examination.* The gunner's examination is a continuation of the mortar-based drills in which a mortarman's proficiency as a gunner is established. The examination is contained FM 23-90, Chapter 9. It includes tasks, conditions, standards, and administrative procedures. It focuses on the individual qualification of the soldier in the role of a gunner. However, the gunner's success also depends on the collective performance of his assistants. Within these limitations, evaluators should try to standardize the examination. STRAC specify that the squad leader, gunner, and assistant gunner should pass the gunner's exam semiannually. All gunners should have a current qualification before an LFX (whether using service or subcaliber ammunition).

(5) *FDC certification.* FDC certification provides commanders a means to verify that their FDC mortarmen have the knowledge and skills for their positions: squad leader, FDC computer, section sergeant, platoon sergeant, and platoon leader. Certification ensures that ammunition is wisely expended and that training is conducted safely and effectively. Mortarmen are certified when they receive a passing score of 70 percent on each part of the two-part examination. (See Appendix F.)

b. **Collective Training.**

(1) *Army Training and Evaluation Program.* The aim of collective trainings to provide units the skills required to perform unit-level tasks. The ARTEP is the overall program for this collective training. It prescribes the collective tasks that a unit must successfully perform to accomplish its mission and to survive in combat. These tasks include conditions and performance standards, and they are located in MTPs and drill books.

(2) *External evaluation.* The commander formally determines the status of his collective training through external evaluation. The external evaluation gives the commander an objective appraisal of this status by using mortar expertise found outside the normal chain of command. The external evaluation is not a test in which a unit

passes or fails; it is a diagnostic tool for identifying training strengths and weaknesses. It must be emphasized that an external evaluation is not a specific training event but a means to evaluate a training event. Mortar units undergo external evaluations during an LFX, FTX, or a combination thereof. The unit maybe evaluated alone, as part of its parent unit, or with other mortar units. The MTP provides guidance on planning, preparing, and conducting an external evaluation.

(3) *Evaluation of forward observer.* The mortars can be no more effective than the FOs. It is critical that FIST FOs are present and evaluated during an externally evaluated mortar live-fire exercise. If an FO fails to meet his performance standards, the mortars should not be penalized. However, only as a last resort should the fire mission be deleted from the evaluation. The mortars should be given the opportunity to successfully complete the fire mission. This can be accomplished in the following:

(a) Start the fire mission over. However, ammunition constraints during live-fire may not permit this. The task may need to be repeated using devices or, less preferably, dry fire.

(b) Correct the call for fire or correction. The mortars should not have to use wrong firing data if the FO has made an incorrect call for fire or correction. This also wastes valuable training ammunition. The FO evaluator at the observation point can change the call for fire or correction to reflect proper procedures.

APPENDIX B

SAFETY PROCEDURES

Minimum and maximum elevations, dejection limits, and minimum fuze settings must be computed to ensure all rounds impact or function within the designated impact area. These data are then presented in graphical form on a range safety diagram. They are also arranged in a simplified format (the safety T) for each mortar squad leader. This chapter discusses the computation of safety data using tabular and graphical data.

B-1. SURFACE DANGER ZONES

Range control personnel or the OIC provides the safety officer with the precise location and size of the impact area. This can either be defined by a series of grid coordinates representing corner points, or by lateral azimuths and minimum and maximum distances from a fixed RP. Either method defines an area on the ground, perhaps irregularly shaped, within which all rounds fired must either impact or function. The safety officer must then compute the safety limits of this impact area and construct the safety diagram and the safety T. To compute the safety limits the safety officer must consider the following.

a. **Secondary Danger Areas** A **and B.** The safety officer must first determine whether the impact area limits provided to him include secondary danger areas A and B. These areas are established by AR 385-63.

(1) Secondary danger area A parallels the impact area laterally and is provided to contain fragments from rounds exploding on the right or left edges of the impact area (Figure B-1, page B-2). Depending on the mortar being fired, secondary danger area A varies from 250 to 400 meters.

(2) Secondary danger area Bison the downrange side of the impact area and area A. It contains fragments from rounds exploding on the far edge of the impact area. Depending on the mortar being fired, secondary danger area B varies from 300 to 500 meters (Figure B-1, page B-2).

NOTE: If, the designated impact area does not already consider areas A and B, it must be reduced by the appropriate amount to ensure no rounds impact within or outside of either area.

b. **Range and Deflection Probable Errors.**The initial impact area must be reduced again to account for the normal dispersion of rounds fired. The safety officer must determine the maximum probable errors for both range and deflection.

(1) The safety officer checks columns 3 and 4 of Table E in the tabular firing tables for the mortar and ammunition to be used. He checks all possible charge and elevation

combinations to ensure he has found the maximum probable errors at the distance to the far edge of the impact area.

(2) The safety officer then reduces the maximum range by a factor of 8 times the range probable error. He also adjusts the minimum range toward the center of impact by a factor of 12 times the range probable error.

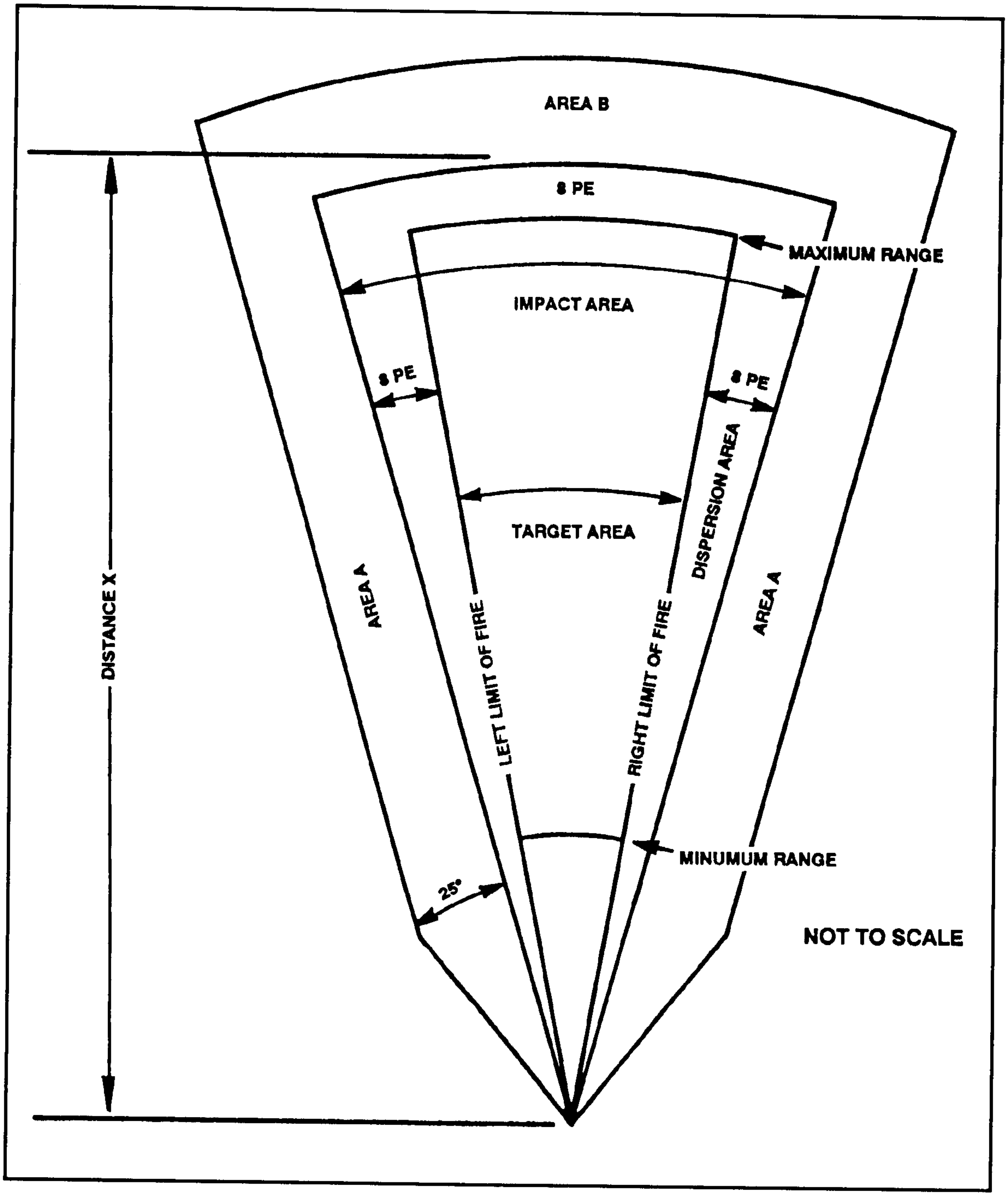


Figure B-1. Mortar surface danger zone.

(3) Once the ranges have been adjusted, the safety officer adjusts the left and right limits inward by a factor of 8 times the maximum deflection probable error.

NOTE: The safety officer must determine whether range control personnel have already performed this computation before designating the impact area.

c. **Vertical Interval and Crest Clearance.** The safety officer must compare the altitude of the mortar position and that of the impact area. If there are significant differences in the VI between these two areas, he must adjust the safety limits to preclude any rounds impacting short or long of the impact area (Figure B-2).

(1) The rule for determining the correct VI for safety purposes is called the *mini-max rule.* At the minimum range, the maximum altitude is selected. At the maximum range, the minimum altitude is selected. If the contour interval is in feet, it is converted to meters.

(2) The safety officer determines VI by subtracting the mortar firing position altitude from the altitude of the applicable range line. The resulting number is either positive or negative.

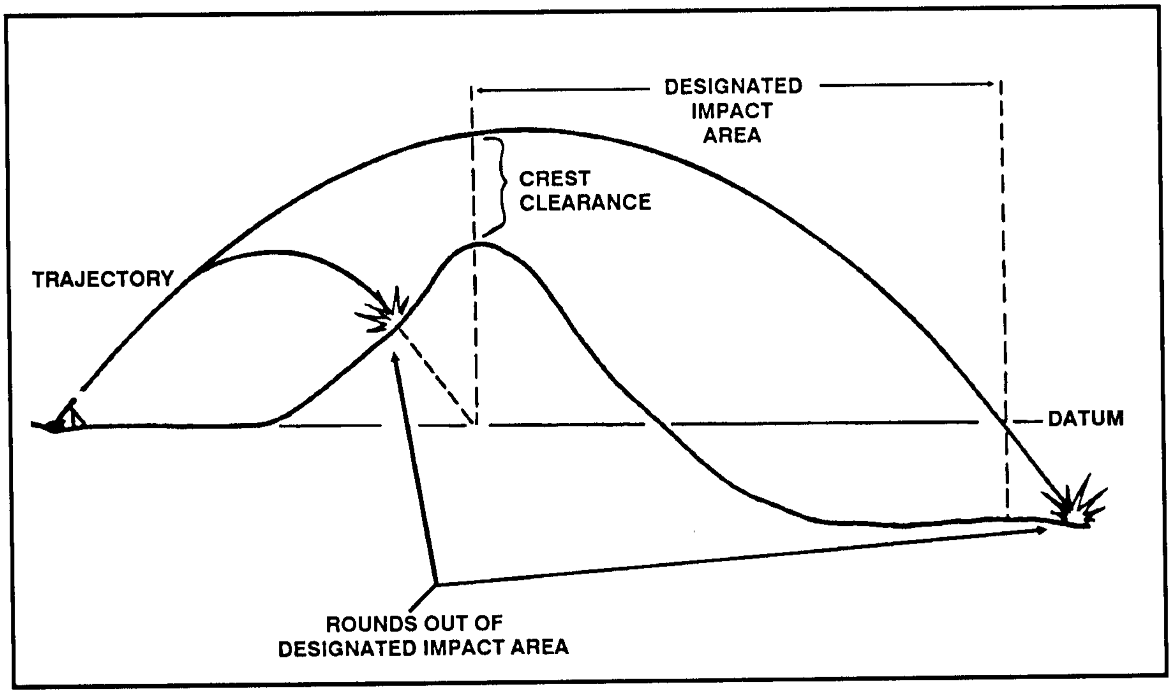


Figure B-2. Effects of VI and crest clearances.

(3) The safety officer adds half the value of the VI determined for each applicable range line, to that line. This either increases or decreases the apparent size of the impact area, depending on whether the VI is positive or negative.

(4) The safety officer must then make a map inspection to determine the highest point between the mortar position and the edge of the impact area. He then compares this highest point with the lowest maximum ordinate value found in Table E in the tabular firing tables. As long as the maximum ordinate exceeds the VI of the highest

point, no correction need be made. If not, all charge and elevation combinations that do not allow crest clearance must be noted and applied to the safety diagram.

d. **Drift** (4.2-inch only). The safety officer must modify the left and right limits of the safety diagram to compensate for the drift. The left limit must be moved to the left by the amount of the minimum drift for the charge and elevation combinations to be fired. The right limit must be moved to the left by the amount of the maximum drift for the charge and elevation combinations to be fired.

NOTE: Drift is a function of both time-of-flight and range. The safety officer must be careful to ensure he chooses the correct charge and elevation combination (the one that gives the minimum drift). A common mistake is to simply use the drift at minimum range, which is not always correct.

e. **Section Width and Depth** (manual plotting only). If a mortar near the center of the section is used as the adjusting mortar, any mortar significantly left or right of this “base” can put rounds out of impact, unless corrections are made. If the mortars are arranged in the firing position with any significant depth, the rearward or forward mortar can put rounds short or long of the impact area unless a correction is made.

(1) The safety officer must determine the width and depth of the mortar section as it is arranged on the ground (at the firing position). He then reduces the left and right limits by half the section width.

(2) The safety officer adds half the section depth to the minimum range and subtracts half the section depth from the maximum range.

f. **Registration and MET Corrections.** After a registration (survey chart), a reregistration, or a MET update has been conducted and corrections have been determined, the safety officer must modify the original basic safety diagram by applying the registration corrections. New elevations are determined that correspond to the minimum and maximum ranges. Deflections are modified by applying the total deflection correction to each lateral limit.

B-2. SAFETY DIAGRAM

The safety diagram graphically displays the computed safety limits. Data are logically presented and arranged for the FDC to use. Once the diagram is constructed, data from it are used to draw the safety T.

a. The range safety officer determines the lateral safety limits and the minimum and maximum ranges of the target area. These data must then be converted to deflections and elevations. In the case of mechanical time (illumination) and variable time (VT or PROX) fuzes, a minimum time setting must be determined. For example, assume the following limits were provided by the range safety officer:

- Left azimuth limit is 4,730 meters.
- Right azimuth limit is 5,450 meters.
- Minimum range (rein rg) is 2,400 meters.
- Maximum range (max rg) is 5,500 meters.
- From azimuth 4,730 to azimuth 5,030, the maximum range is 5,000 meters.

- Minimum range for fuze time is 2,700 meters.
- Authorized weapon and charge zone are the M252 81-mm mortar, and charges 1-4 (M821 HE round).
- Firing point 72 is located at grid FB60323872, altitude is 390 meters.

b. The basic safety diagram is constructed (Figure B-3) as follows:

(1) On a sheet of paper, draw a line representing the direction of fire for the firing unit. Label this line with its azimuth (AZ) and the referred deflection (DF) for the weapon system.

(2) Draw lines representing the lateral limits in proper relation to the line on which the section is laid. Label the lateral limits with the appropriate azimuths.

(3) Draw lines between the lateral safety limits to represent the minimum and maximum ranges. Label each line with the appropriate range. If the minimum range for fuze (FZ) time (TI) is different from the minimum range, draw a dashed line between the safety limits to represent the minimum range for FZ TI. Label the line with the appropriate range.

(4) Compute the angular measurements from the azimuth of lay to the left and right safety limits by comparing the azimuth of lay to the azimuth of each limit. On the diagram, draw arrows indicating the angular measurements and label them.

(5) Apply the angular measurements to the deflection corresponding to the azimuth of fire to determine the deflection limits (LARS).

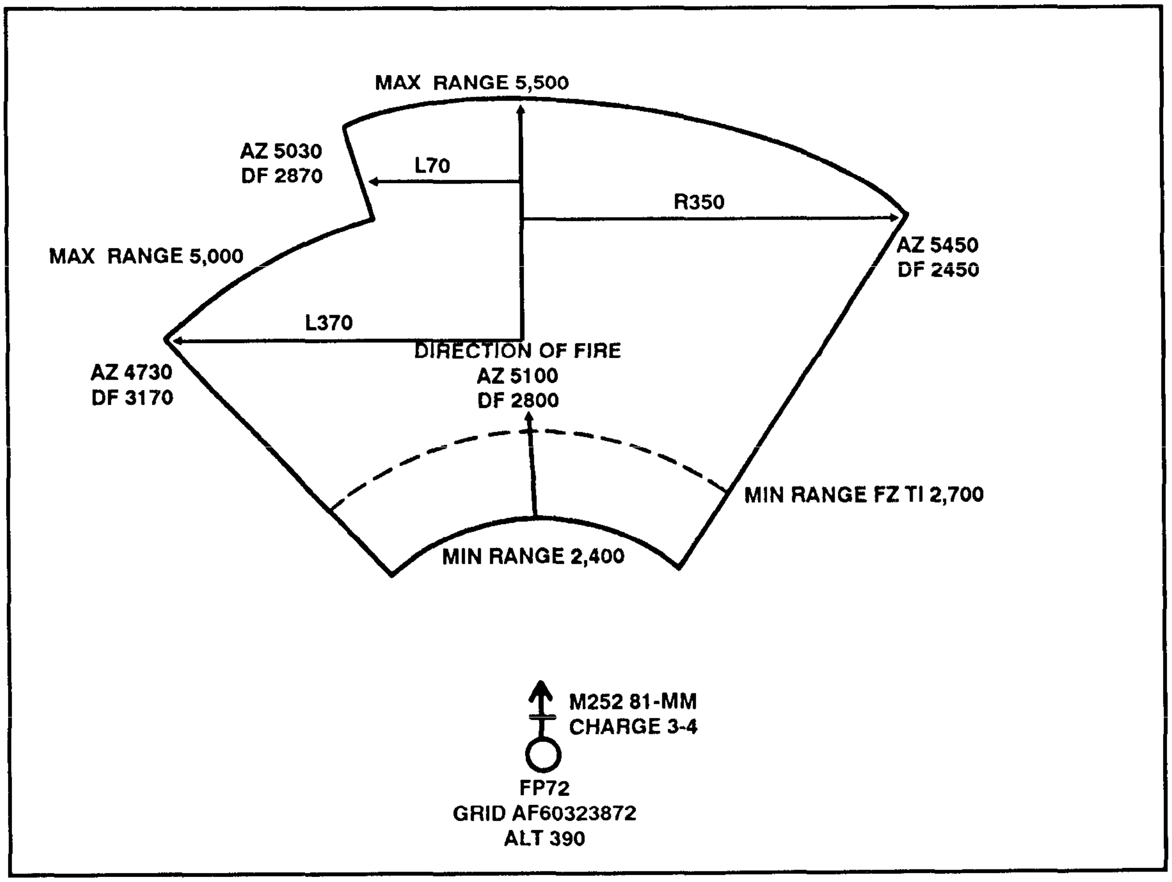


Figure B-3. Basic safety diagram.

c. Once the basic safety diagram is drawn, the FDC uses the tabular firing tables to determine the proper charges, elevations, and time settings. He then applies them to complete the diagram.

d. The safety T is a method of passing safety data onto the mortar squad leaders in a simplified form. The information needed by the squad leader is extracted from the completed safety diagram and placed on a 3-inch by 5-inch card or similar form. Figure B-4 shows the safety T taken from the completed range safety diagram.

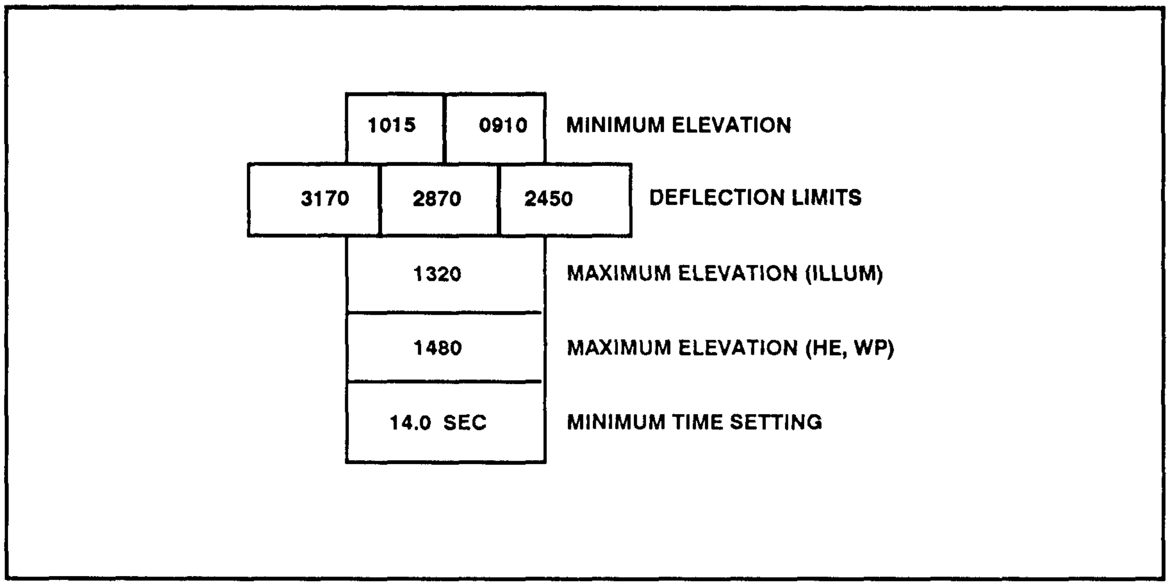


Figure B-4. Safety T.

APPENDIX C

FIELD-EXPEDIENT SURVEY TECHNIQUES

Surveyed locations may be provided by the artillery survey personnel. Normally, a map spot location to six-digit or eight-digit grid coordinates is estimated by the platoon supervisor most qualified. With the "roving mortars" concept, new methods of position location are needed. Two such methods are described in this appendix. The mortar position should be constantly improved to include more accurate platoon center location.

C-1. GRAPHIC RESECTION

A graphic resection can be used to establish the coordinates of a point or to check the accuracy of a map spot. If the resection cannot be performed from platoon center, the platoon center coordinates can be estimated on the basis of the coordinates of the nearby resected point. The platoon may be required to locate its own roving gun (split section); and primary, alternate, or supplementary position as accurately as possible. Often, the location of those positions can be determined by a simple map spot location. Whenever possible, a more accurate method of location should be used. Graphic resection is a simple method using the aiming circle, tracing paper, and a map.

a. Identify three distant points that also appear on a map (Figure C-l).

b. With an aiming circle, measure the azimuth to those points. Preferably, the angles between the points should be greater than 400 mils.

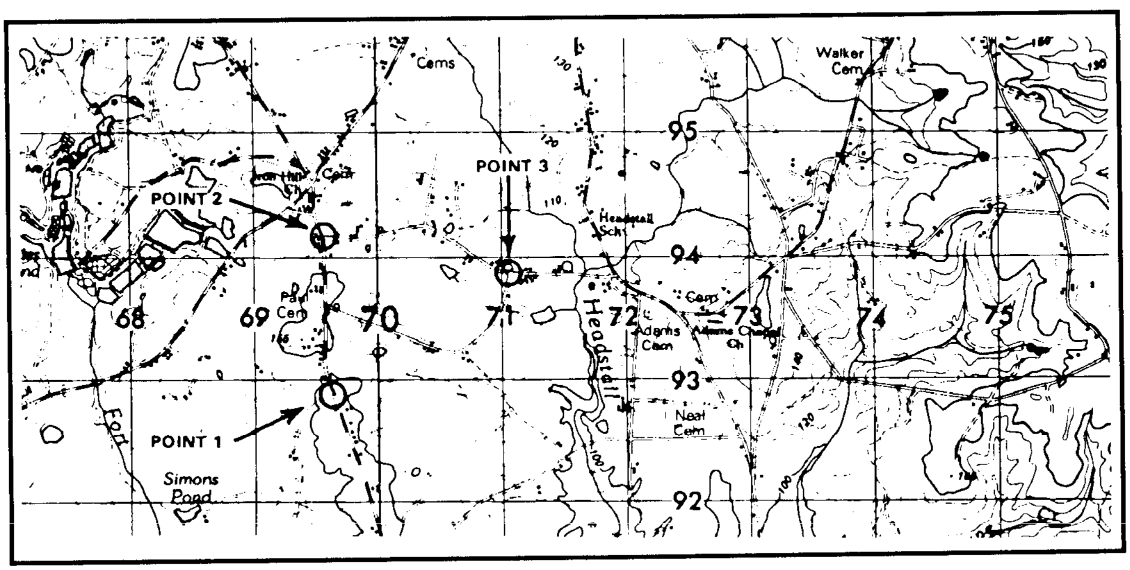


Figure C-1. Three distant points.

c. On tracing paper, place a dot representing the aiming circle location.
d. Draw a line from this dot in any direction (Figure C-2).

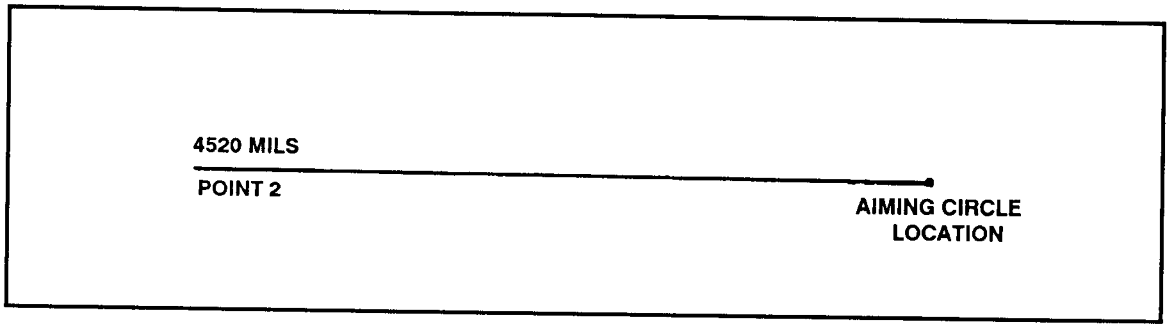


Figure C-2. Line drawn in any direction.

e. With a protractor aligned with the correct azimuth on the line (Figure C-3), draw two lines from the aiming circle location on the measured azimuths (Figure C-4).

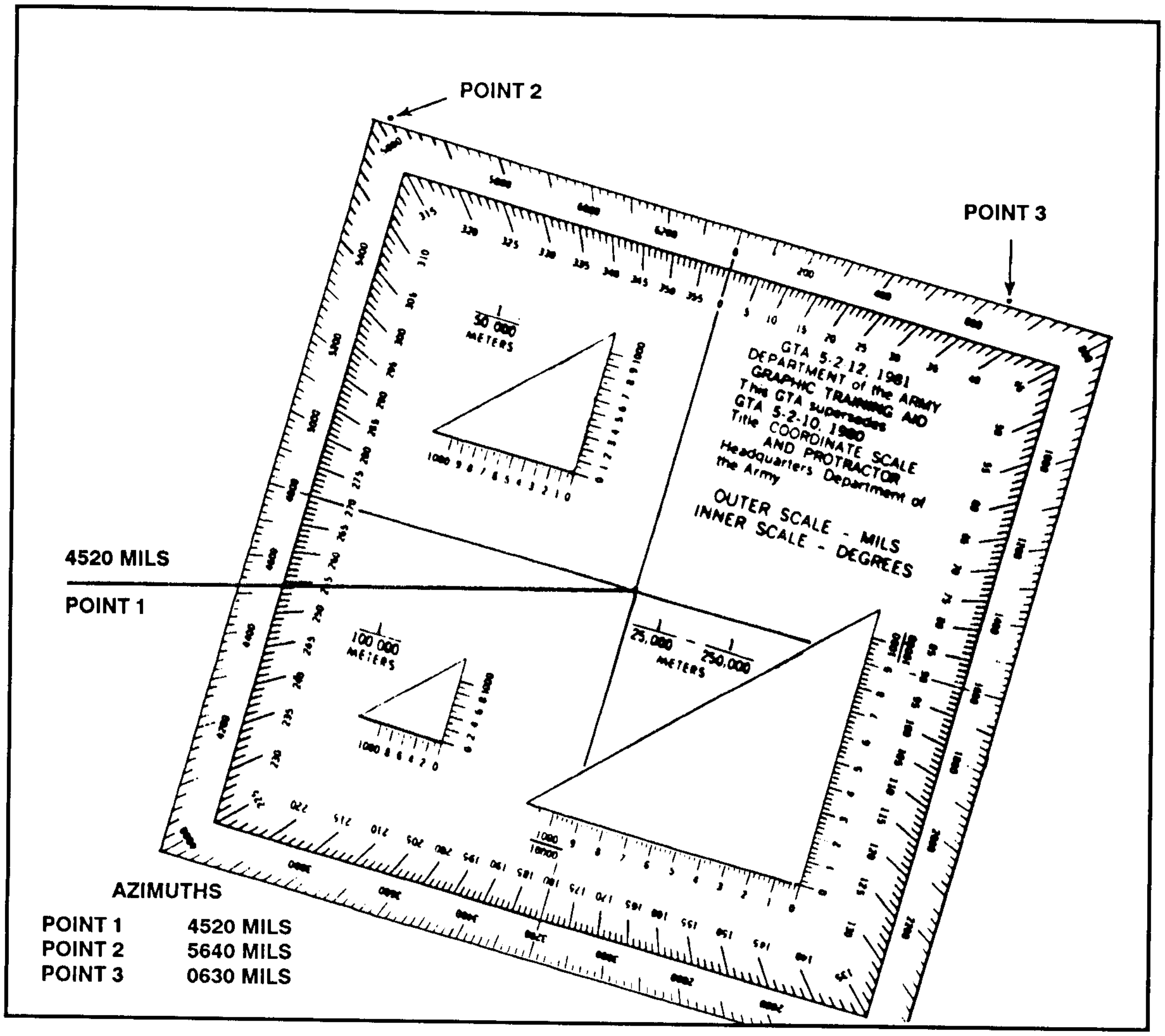


Figure C-3. Protractor aligned with correct azimuth.

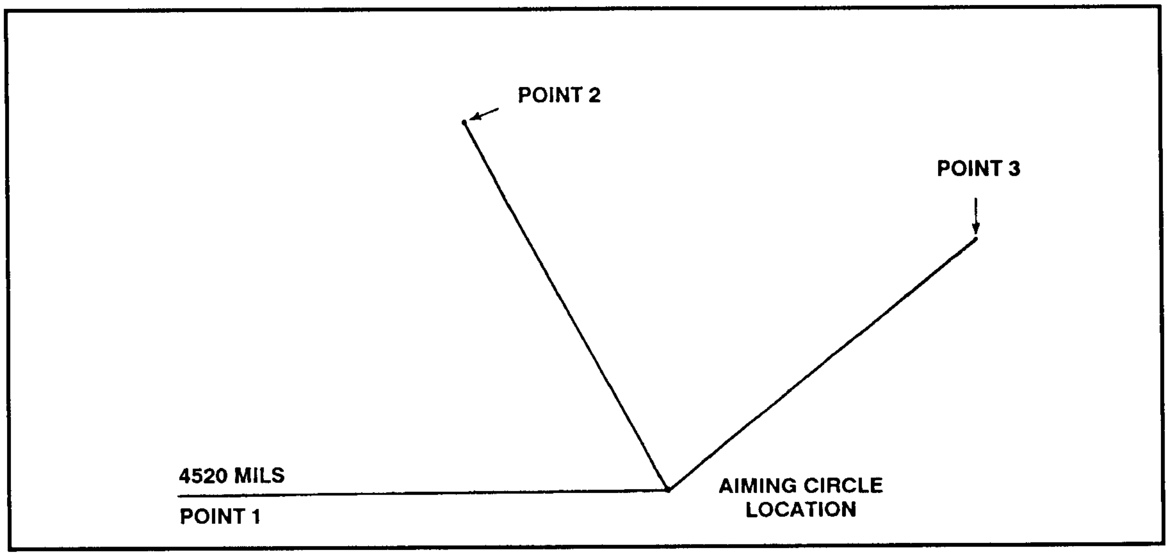


Figure C-4. Two more lines drawn from dot.

f. Place the tracing paper over the map of the area and slide it around until it is positioned so that the three lines pass through their respective distant points (Figure C-5). The dot on the tracing paper represents the location of the aiming circle (mortar position) on the map.

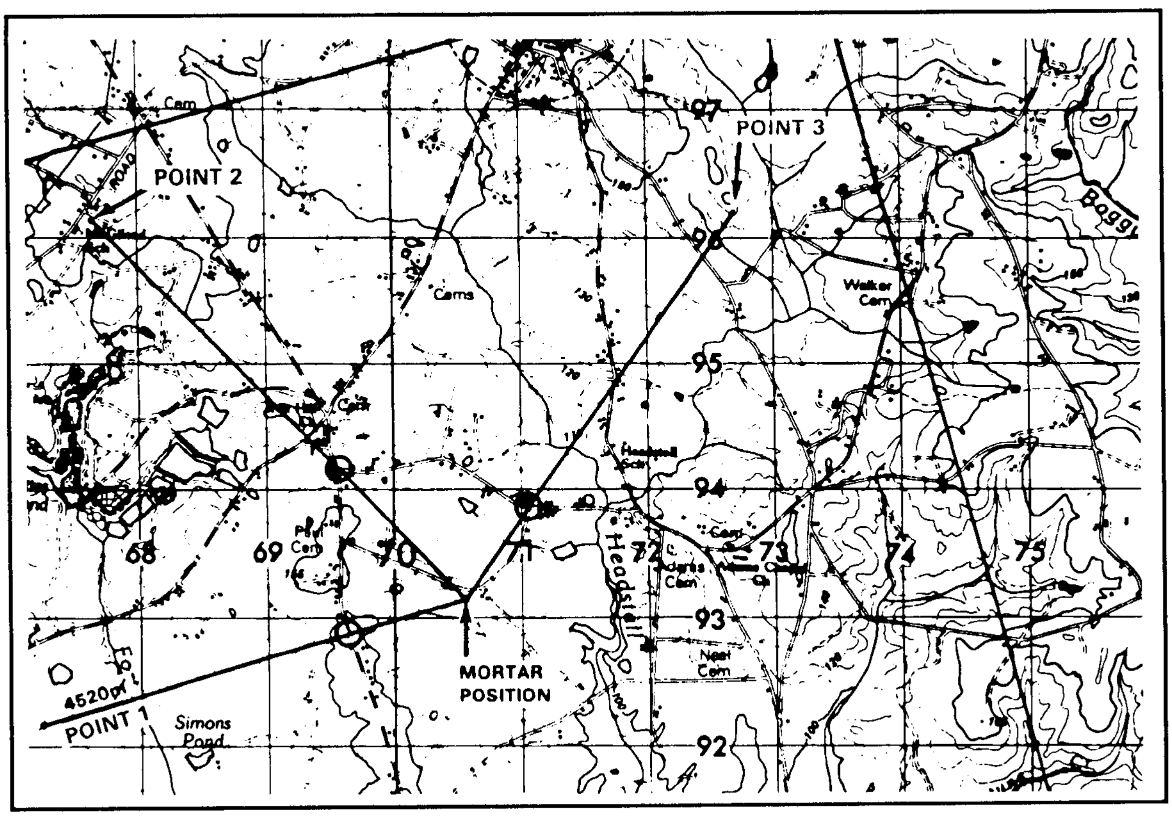


Figure C-5. Positioning of tracing paper.

g. If the agles are plotted with a standard protractor (accurate to about 10 mils) and oriented over a 1:50,000 scale map, the resection should be accurate within 100 meters.

C-2. HASTY SURVEY

A terrain feature or man-made object is needed close to the desired mortar position for a hasty survey. This identifies the mortar position on a map by eight-digit grid coordinates. The hasty survey begins at that point, using the pivot point of the M16/M19 plotting board to represent that selected known position (Figure C-6).

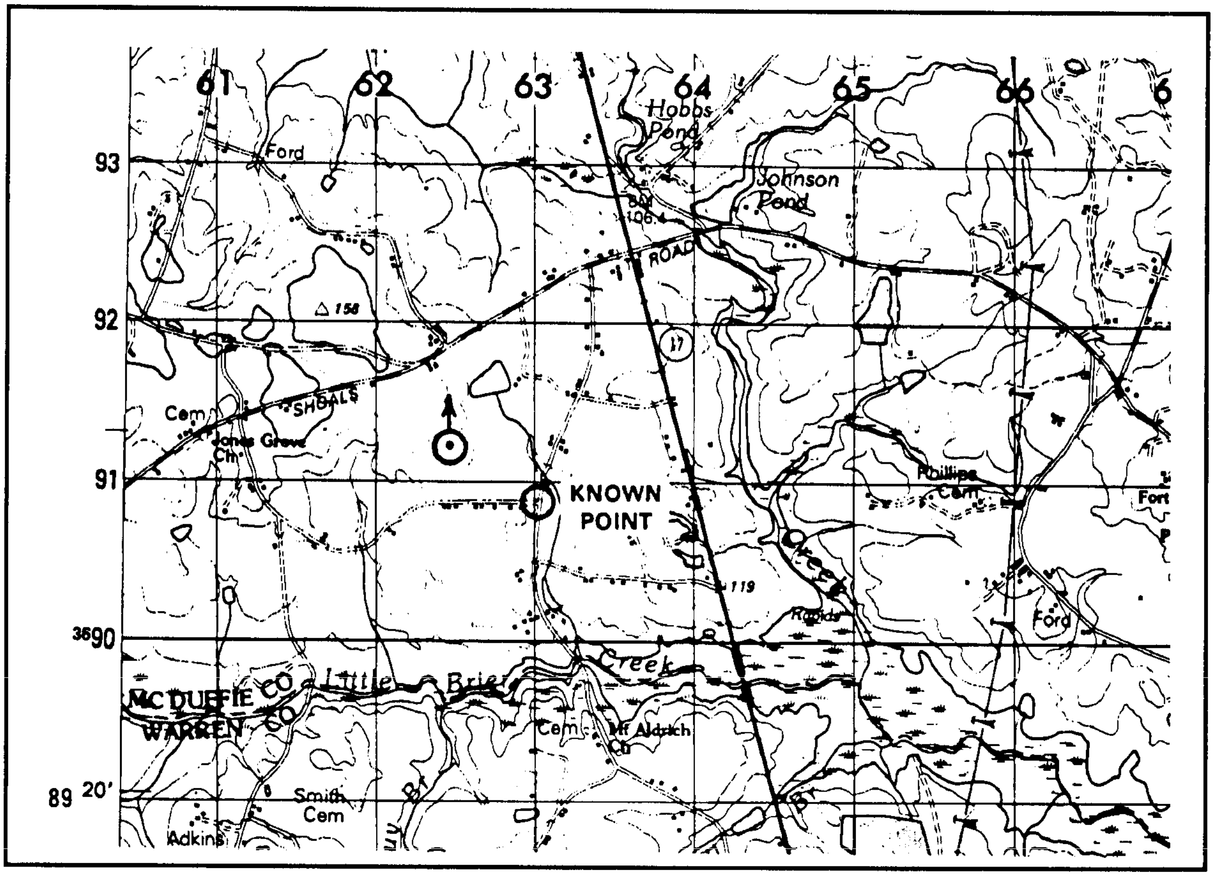


Figure C-6. Hasty survey.

a. To begin the hasty survey, set the M2 aiming circle over the known point, level it, index the declination constant using the azimuth micrometer knob, and, with the nonrecording (lower) motion, orient the magnetic needle toward north. Now the grid azimuth can be measured.

b. While the "circle" man is measuring the grid azimuths, an assistant (the "post" man) moves toward the desired mortar position with the two aiming posts. (Before moving, the "post" man will have joined the posts together and placed reflective or black tape strips exactly 2 meters apart on each post.) The posts thus become a subtense bar (Figure C-7).

c. At this point, the first leg of the hasty survey can be done. The "circle" man directs the "post" man to move toward the desired mortar position until he is within

290 meters and to place the posts into the ground. This point on the ground becomes traverse station 1 (TS-1).

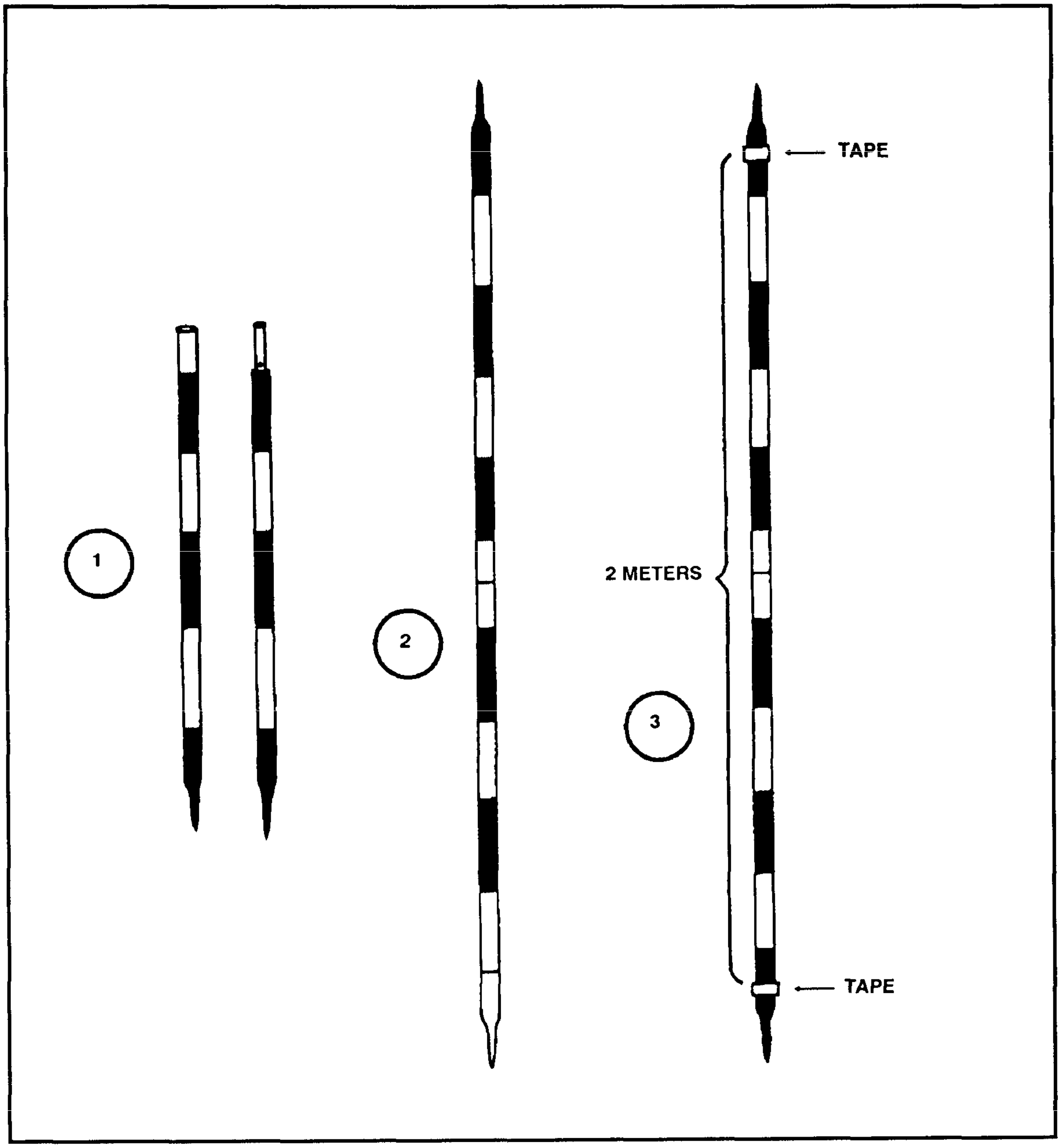


Figure C-7. Subtense bar.

d. The "circle" man then rotates the azimuth motion (upper motion) until the vertical crossline in the telescope is on the center of the posts. He records the azimuth to the posts and labels it traverse leg 1 (TL-1) (Figure C-8, page C-6).

e. Next, the “post” man removes the posts and holds them parallel to the ground, facing the aiming circle.

f. The “circle” man measures the mil angle between the two strips of tape on the posts (subtense bar) and records the mil reading along with the azimuth to TS-1 (Figure C-8).

g. The posts are then replaced into the ground. The “circle” man moves forward to this point and sets up the aiming circle directly over this point. This completes the first traverse leg.

h. This procedure is repeated until the desired mortar position is reached. Either the information obtained may be written down as an azimuth, a mil angle, and a traverse station or a diagram may be constructed (Figure C-9). (To avoid confusing others working with a hasty survey, any diagram should reflect the route of the various traverse legs and should be close to scale.)

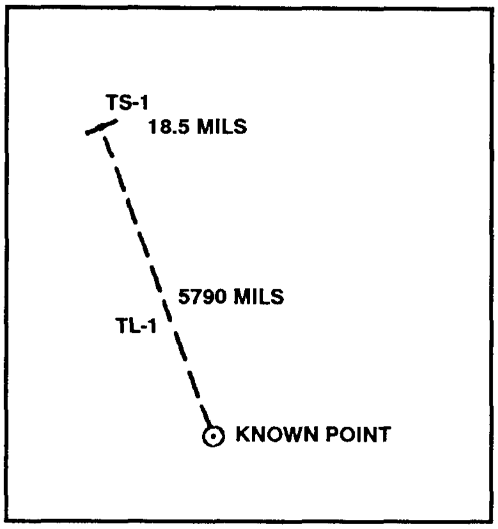
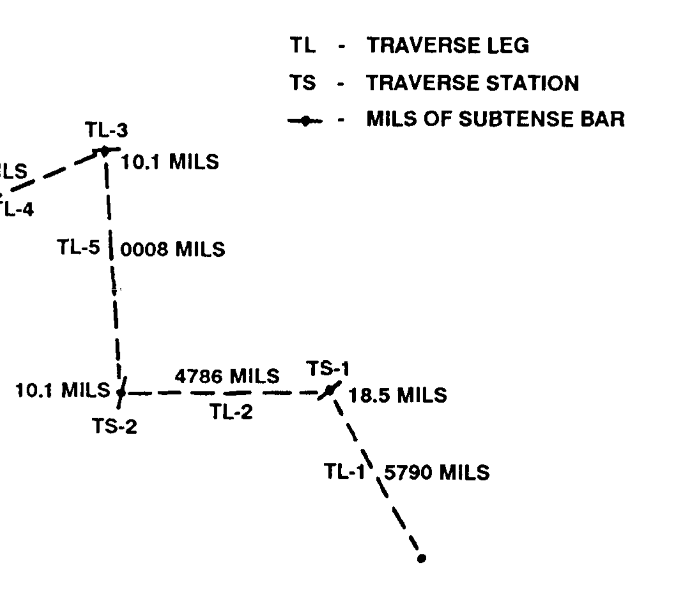


Figure C-8. Traverse leg 1.



TRAVERSE LEG	AZIMUTH (MILS)	MILS OF SUBTENSE (MILS)	= METERS
TL-1	5790	18.5	110
TL-2	4786	10.1	200
TL-3	0008	10.1	200
TL-4	4560	8.5	240
TL-5	5769	12.8	160

Figure C-9. Construction of a diagram.

(1) The information recorded by the “circle” man goes to the FDC either as the traverse legs are made or after all the legs have been completed. The beginning known point is represented by the pivot point of the M16/M19 plotting board.

(2) Starting at the pivot point, the data are applied on the board for each leg of the hasty survey – for example:

(a) The azimuth on the first traverse leg was 5790 mils.

(b) Index that information on the M16/M19 plotting board.

(c) The distance between the two strips of tape on the aiming posts was 18.5 mils.

(d) Refer to the distance tables (Table C-1) for the 2-meter subtense bar width; a mil angle of 18.5 mils is equal to a distance of 110 meters. (For the hasty survey, make one square on the plotting board equal to 25 meters.)

ANGLE (MILS)	DISTANCE (METERS)	ANGLE (MILS)	DISTANCE (METERS)	ANGLE (MILS)	DISTANCE (METERS)	ANGLE (MILS)	DISTANCE (METERS)	ANGLE (MILS)	DISTANCE (METERS)	ANGLE (MILS)	DISTANCE (METERS)
7.0	291.03	14.0	145.51	21.0	97.01	28.0	72.75	35.0	58.20	42.0	48.50
.2	280.99	.2	142.96	.2	95.86	.2	72.11	.2	57.97	.2	48.21
.5	271.62	.5	140.49	.5	94.75	.5	71.48	.5	57.38	.5	47.93
.8	262.86	.8	137.65	.8	93.66	.8	70.85	.8	56.98	.8	47.65
8.0	254.65	15.0	135.81	22.0	92.60	29.0	70.24	36.0	56.58	43.0	47.37
.2	246.93	.2	133.58	.2	91.56	.2	.69.64	.2	56.19	.2	47.10
.5	239.67	.5	131.42	.5	90.54	.5	69.05	.5	55.81	.5	46.82
.8	231.50	.8	129.34	.8	89.54	.8	68.47	.8	55.43	.8	46.56
9.0	226.35	16.0	127.32	23.0	88.57	30.0	67.90	37.0	55.05	44.0	46.29
.2	220.23	.2	125.36	.2	87.62	.2	67.34	.2	54.68	.2	46.08
.5	214.44	.5	123.46	.5	86.68	.5	66.79	.5	54.32	.5	45.77
.8	208.94	.8	121.62	.8	85.77	.8	66.24	.8	53.96	.8	45.47
10.0	203.73	17.0	119.83	24.0	84.88	31.0	65.71	38.0	53.60	45.0	45.26
.2	198.75	.2	118.09	.2	84.00	.2	65.18	.2	53.25		
.5	194.02	.5	116.41	.5	83.15	.5	64.67	.5	54.32		
.8	188.63	.8	114.77	.8	82.31	.8	64.16	.8	53.96		
11.0	185.20	18.0	113.17	25.0	81.48	32.0	63.66	39.0	52.23		
.2	181.08	.2	111.62	.2	80.68	.2	63.16	.2	51.90		
.5	177.14	.5	110.11	.5	79.89	.5	62.68	.5	51.57		
.8	173.38	.8	108.65	.8	79.11	.8	62.20	.8	51.24		
12.0	169.76	19.0	107.22	26.0	78.35	33.0	61.73	40.0	50.92		
.2	166.30	.2	105.82	.2	77.60	.2	61.26	.2	50.67		
.5	162.97	.5	104.47	.5	76.87	.5	60.81	.5	50.29		
.8	159.78	.8	103.15	.8	76.15	.8	60.36	.8	49.99		
13.0	156.70	20.0	101.86	27.0	75.45	34.0	59.91	41.0	49.68		
.2	153.75	.2	100.60	.2	74.75	.2	59.47	.2	49.38		
.5	150.90	.5	99.37	.5	74.07	.5	59.04	.5	49.08		
.8	148.16	.8	98.17	.8	73.41	.8	58.62	.8	48.79		
TO BE USED WITH 2-METER SUBTENSE ROD.											

Table C-1. Distance table for a 2-meter subtense rod.

(e) From the pivot point on the direction of 5790 mils, move 110 meters (4 2/5 squares) along the index line, place a dot, and circle it. This point, marked as TS-1, completes traverse leg 1.

(f) The azimuth for the second traverse leg was 4786 mils.

(g) Again, index this information on the plotting board.

(h) At TS-2, the mil angle measured for the 2-meter subtense bar width was 10.1 mils.

(i) Refer to the distance table for the 2-meter subtense bar width; 10.1 mils equals a distance of 200 meters.

(j) With 4786 mils indexed on the plotting board, move up 200 meters from TS-1 along or parallel to a vertical line (eight squares), place a dot, and circle it.

(k) This point, marked TS-2, completes traverse leg 2. Repeat the same procedure for traverse legs 3, 4, and 5.

(1) Rotate the M16/M19 plotting board until TS-5 (mortar position) is directly over the vertical centerline.

(m) Read the azimuth from the top of the plotting board; this is the direction from the known starting point to the base mortar squads position.

(n) Count the number of squares along the index line between the pivot point and TS-5 (remember: each square equals 25 meters). This is the straight-line distance from the known starting point to the base mortar squads position.

(o) If given data were properly applied in the example, a known starting point-base mortar squad azimuth should have been obtained of 5961 mils, and a known starting point-based mortar squad distance of 690 meters (+/-5 mils and 10 meters).

(p) Apply these data to the map. From the known starting point along the direction of 5961 mils, move 690 meters. The new point is the eight-digit grid coordinates for the base mortar squad's position.

(p) The FDC now establishes a modified-observed firing chart or, if the FO can find an eight-digit location in the target area, establish a surveyed firing chart.

APPENDIX D

MILITARY OPERATIONS IN URBANIZED TERRAIN

With the rapid development of urban areas worldwide, the possibility that a mortar element will be involved in MOUT has greatly increased. The characteristics of urban combat, such as high obstructions, close fighting, and good cover, lend themselves to extensive use of mortar fire in both offensive and defensive operations. The mortar is the commander's most devastating and responsive built-up area weapon due to its high angle of fire and its ability to penetrate buildings, to fire at unobserved target areas, and to obstruct the enemy's view.

D-1. OFFENSIVE EMPLOYMENT

In the offense, proper mortar employment is vital to success of any mission. Mortars provide the offensive-minded commander with the ability to change the defender's advantages of overhead cover and physical obstacles into disadvantages.

a. Light enemy overhead cover can be defeated with a combination of the mortar's high angle of fire and multioptional fuzes. This ability to penetrate overhead cover makes the mortar the ideal weapon to defeat enemy positions in buildings.

b. Short fields of fire work to the disadvantage of the defender by limiting his engagement capabilities. The defender is also vulnerable to unrestricted mortar engagement.

c. Mortar fires for rapid advance to a target area or for a systematic, building-by-building advance are identical except for the firing restrictions given the mortars and the mode of support they are placed in. During a rapid advance, mortars are normally in general support; during a systematic building-by-building advance, they are in direct support of the lead element.

(1) The attacking commander should ensure that his mortars have between one-third and two-thirds of their target engagement area beyond the forward edge of the target to obtain the best possible fire support coverage.

(2) Forward observers should initially be on key terrain overlooking the target or with the forward element of the attacking force to engage targets of opportunity. Exact locations for the FOs are locations that allow the best overall fire support for the commander.

(3) Smoke munitions should be used during a rapid advance to enhance obstacles created by rubble produced from previous fires. They reduce the ability of the enemy to acquire targets or to react to force movement.

d. Offensive action against a strip area defense uses a heavy mixture of smoke and HE munitions at the point of friendly penetration, shifting to friendly flanks as advancement occurs. This mixture of munitions denies the enemy visual observation at the point of penetration, while suppressing and neutralizing enemy positions in the area. Once an objective has been secured, the mortars provide the friendly force an in-depth defensive ability.

D-2. DEFENSIVE EMPLOYMENT

Disposition of mortar units in the defensive role provides the assistance needed to control key terrain and avenues of approach, to interlock fires between units, and to provide decisive firepower should rapid shifts in target areas be required to meet enemy threats.

a. Initial defensive deployment of unit mortars should be far enough forward to allow two-thirds of the mortar range to extend beyond the forward edge of the occupied area.

(1) FOs should be placed where they can observe the enemy force when it reaches the maximum range of engagement.

(2) As the enemy advances, unit mortars displace by section to prevent being engaged by enemy direct-fire weapons and to allow them to provide immediately responsive fire support to friendly forces.

b. As in the offense, extensive use of smoke and HE ammunition confuses the enemy as to friendly unit locations and limits or prevents enemy reaction to friendly force movement. Should penetration into the defended built-up area be made by enemy forces, mortar fire can be used to deny the enemy use of buildings, to create obstacles by reducing buildings to rubble, and to crater roadways.

c. Strip areas are defended the same as villages with emphasis on long-range engagement with HE munitions. For both urban areas and strip areas, mortars are normally in general support.

D-3. SPECIAL CONSIDERATIONS

MOUT produces special problems that must be considered such as position selection, munitions effects, limited or no-fire areas, and communications limitations.

a. Position selection is greatly influenced by mask and overhead clearance, hard-surface areas, and minimum range.

(1) Mask and overhead clearance may initially be difficult to achieve due to a combination of building heights and minimum-range requirements. Position selection should be open enough to allow full coverage of the sector of fire without mask or overhead interference at minimum ranges. Often, parking lots or parks must be used to achieve required clearances.

(2) The problem of hard surfaces must be resolved when using parking lots. Mortars tend to bounce and be inaccurate unless baseplates are cushioned by sandbags or other soft materials. Carrier-mounted mortars are ideal for use on hard surfaces. Aiming posts can be placed in cans of dirt to keep them upright.

b. Munition effects are another factor to consider. Rubble and smoke block or hinder both friendly and enemy forces. However, large expenditures of smoke and HE rounds require prestocking of ammunition.

c. The political climate may require that no-fire or limited-fire zones be set up to protect civilians, government buildings, and public utilities. Close coordination must be maintained between the forward unit elements and the mortar platoon to ensure no friendly troops are in the target area.

d. FM radio transmissions in built-up areas are likely to be erratic. Structures reduce radio ranges; however, remoting of antennas to upper floors or roofs may improve communications and enhance operator survivability. Another technique is the use of radio retransmissions. The use of existing civilian systems can supplement the unit's ability. Communications should be maintained by wire between FOs and FDC, and mortars.

APPENDIX E

FIRE DIRECTION EQUIPMENT

FIRE DIRECTION SETS, MORTARS

ITEM DESCRIPTION	NUMBER ISSUED WITH NEW KIT	NSN
FDC KIT, BOARD, PLOTTING, M16 (1:12,500), INCLUDES:	1	1220-00-602-7941
RANGE ARM (1:12,500)	1	1220-00-613-8533
DISK, AZIMUTH (1:12,500)	1	1220-00-756-3757
FDC KIT, BOARD, PLOTTING M19 (1:25,000)	1	1220-01-059-7989
COMPUTER SET, BALLISTICS, MORTAR, M23 KIT, INCLUDES:	1	1220-01-119-6049
CASE, CARRYING	1	
CASE, COMPUTER, BALLISTICS	1	
VEHICULAR BATTERY CABLE (CABLE ASSEMBLY, SPECIAL-PURPOSE, ELECTRICAL, CX-13152/PSG-2)	1	
VEHICULAR RECEPTACLE CABLE (CABLE ASSEMBLY, SPECIAL-PURPOSE, ELECTRICAL, CX-13148/PSG-2)	1	
AN/GRC-106 INTERFACE CABLE (CABLE ASSEMBLY, SPECIAL-PURPOSE, ELECTRICAL, CX-13150/GR)	1	
PRIMARY RADIO INTERFACE CABLE (CABLE ASSEMBLY, SPECIAL-PURPOSE, ELECTRICAL, CX-13151/PSG-2)	1	
OPERATORS MANUAL, TM 9-1220-246-12&P	1	

APPENDIX F

FIRE DIRECTION CENTER CERTIFICATION

The FDC certification tests the proficiency of soldiers to perform their duties as FDC computers and section sergeants.

Section I
CONDUCT OF THE PROGRAM

The FDC certification program (FDCCP) consists of a written test and a hands-on component. Either component may be changed to conform to a particular mortar organization.

F-1. ELIGIBLE PERSONNEL

Soldiers should meet the following criteria to be evaluated for certification:

- FDC radiotelephone operation.
- Fire direction center computer.
- Section sergeant.

F-2. QUALIFICATION

The FDCCP is designed to be a battalion-sponsored program that the battalion commander can use to certify FDC personnel. The goal is to certify all leaders under a standardized evaluation program.

a. Soldiers must receive a minimum score of 70 percent on the written and the hands-on component (to include a passing score on the mortar gunner's examination).

b. Soldiers may retest only once on any part of the test that they have failed. Soldiers who fail the retest will not be certified and will be required to repeat the FDCCP during the next evaluation. Those who fail a second time should be considered for administrative action.

F-3. GENERAL RULES

The FDCCP should be conducted at regiment/brigade level. Battalions should provide scorers (staff sergeants and above) who are IMPC/11C ANCOC graduates. Considerable training value can be obtained by using a centralized evaluation and by obtaining the experience of several units NCOs. Conditions should be the same for all candidates during the certification. The examining board ensures that information obtained by a candidate during testing is not passed to another candidate.

Section II
M16/M19 PLOTTING BOARD CERTIFICATION

This section tests the candidate's ability to perform FDC tasks using the M16/M19 plotting boards.

F-4. SUBJECTS AND CREDITS

The certification consists of, but is not limited to, the following tasks:

a. Prepare a plotting board for operation as an observed chart (pivot point).
b. Prepare a plotting board for operation as an observed chart (below pivot point).
c. Prepare a plotting board for operation as a modified-observed chart.
d. Prepare a plotting board for operation as a surveyed chart.
e. Process subsequent FO corrections on all charts.
f. Determine data for sheaf adjustments.
g. Determine data for registration, reregistration, and application of the corrections.
h. Record information on DA Form 2399 (Computer's Record).
i. Record MET data using MET data sheet.
j. Determine and apply MET corrections.
k. Locate and compute data for a grid mission.
l. Locate and compute data for a shift from a known point mission.
m. Locate and compute data for a polar mission.
n. Compute data for open, converged, and special sheaves.
o. Compute data for traversing fire.
p. Compute data for searching fire (60-mm, 81-mm, and 120-mm mortars).
q. Compute data for battlefield illumination.
r. Compute data data for a coordinated illumination/HE mission.
s. Determine angle T.
t. Prepare an FDC order (section sergeant).
u. Compute data for a zone mission (4.2-inch mortar only).
v. Locate an unknown point on a map or plotting board using intersection.
w. Locate an unknown point on a map or plotting board using resection.

Section III
MORTAR BALLISTIC COMPUTER CERTIFICATION

This section tests the candidate's ability to perform FDC tasks using the MBC.

F-5. SUBJECTS AND CREDITS

The certification consists of, but is not limited to, the following tasks:

a. Prepare an MBC for operation (minimum initialization).
b. Process subsequent FO corrections.
c. Determine data for sheaf adjustments.
d. Determine data for registration and reregistration.
e. Record information on DA Form 2399 (Computer's Record).

f. Record MET data using MET data sheet.
g. Determine MET corrections.
h. Compute data for a grid mission.
i. Compute data for a shift from a known point mission.
j. Compute data for a polar mission.
k. Compute data for open, converged, and special sheaves.
l. Compute data for traversing fire.
m. Compute data for searching fire (60-mm, 81-mm, and 120-mm mortars).
n. Compute data for battlefield illumination.
o. Compute data for a coordinated illumination / HE mission.
p. Determine angle T.
q. Prepare an FDC order (section sergeant).
r. Compute data for a zone mission (4.2-inch mortar only).
s. Locate an unknown point using intersection.
t. Locate an unknown point using resection.

Section IV
MORTAR BALLISTIC COMPUTER TEST

The following are various situations the candidate analyzes and then selects the appropriate answer.

F-6. SITUATION A

The following tasks place the MBC in operation.

TASK: Place the MBC into operation using internal or external power sources.

CONDITIONS: Given a BA 5588 / U battery, power supply cable, MBC, and a variable power supply.

STANDARD: Place the MBC into operation.

TASK: Operate the panel switches on the MBC.

CONDITIONS: Given an MBC.

STANDARD: Operate the panel switches without error.

TASK: Perform the MBC system self-test.

CONDITIONS: Given an operating MBC.

STANDARD: Perform the self-test without error and report any deficiencies, shortcomings, or failures to your supervisor.

TASK: Prepare an MBC with initialization data.

CONDITIONS: Given an MBC with setup, weapon, and ammunition data.

STANDARD: Enter the setup, weapon, and ammunition data into the MBC without error.

SETUP

TIME OUT: 30
TGT PREFIX: AB
TN: 0400-0800
ALARM: OFF
MINE: 010
MIN N: 060
GD: E00
LAT: +31
LISTEN ONLY: OFF
BIT RATE: 1200
KEYTONE: 1.4
BLK: SNG
OWN ID: A

WEAPON DATA

UNIT: A Co 2/41 IN
81-mm (M252)
CARRIER MOUNTED: NO
BP: A2 GRID
PA: 15880 88950
ALT: 410
AZ: 6400 DEF: 2800
A1: Dir 1600 Dis 035
A3: Dir 4800 Dis 035
A4: Dir 4800 Dis 070

AMMO DATA

TEMP: 70 degrees
HE: M374A2
WP: M374A2
ILL: M301A3

TASK: Compute data for a grid mission.

CONDITIONS: Given an initialized MBC, call for fire using grid coordinates as the method of target location, computer's record, FDC order, and data sheet.

STANDARD: Compute data for the mission's initial fire command to within 3 mils for deflection and elevation.

TASK: Record information on firing records.

CONDITIONS: Given a computer's record and data sheet, call for fire, FO's corrections, information to complete the FDC order, ammunition count, mortar platoon/section SOP, and MBC.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			T43	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT ☐ IMMEDIATE SUPPRESSION	SHIFT FROM:	POLAR:
GRID: 1515 9195	OT DIRECTION: ALTITUDE:	OT DIRECTION: ALTITUDE:
OT DIRECTION: 5850	☐ LEFT / ☐ RIGHT	DISTANCE:
ALTITUDE: 0350	☐ ADD / ☐ DROP	☐ UP / ☐ DOWN
	☐ UP / ☐ DOWN	VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Trucks in Wood line	METHOD OF CONTROL:
METHOD OF ENGAGEMENT:	MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ #2	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ 1 Rd	☐ L ☐ R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	V/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE HEQ in ADJ	☐ + ☐ −		
HED in FFE	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE 2 RDS	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE W/R	ANGLE T		

Figure F-1. Situation A.

1. What is the initial range?
   - (a) 3,018 meters
   - (b) 2,970 meters
   - (c) 3,087 meters
   - (d) 3,047 meters

2. What is the corecct fire command?

(a)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HED
MORTAR TO FIRE ..... #2
METHOD OF FIRE ..... 1Rd in ADJ
2 Rds HEQ in FFE
DEFLECTION 3042
CHARGE 6
TIME SETTING .....
ELEVATION 1039

(b)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HEQ
MORTAR TO FIRE ..... #2
METHOD OF FIRE ..... 1Rd in ADJ
2 Rds in FFE
DEFLECTION 3042
CHARGE 6
TIME SETTING .....
ELEVATION 1030

(c)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HEQ
MORTAR TO FIRE ..... #2
METHOD OF FIRE ..... 1Rd in AdJ
2 Rds HED in FFE
DEFLECTION 3042
CHARGE 6
TIME SETTING .....
ELEVATION 1019

(d)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HEQ
MORTAR TO FIRE ..... #2
METHOD OF FIRE ..... 1Rd in ADJ
2 Rds HED in FFE
DEFLECTION 3042
CHARGE 6
TIME SETTING .....
ELEVATION 1039

NOTE: The first round is fired, and the FO sends: RIGHT 100, DROP 100.

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTE: That round is fired, and the FO sends: DROP 50, FFE.

3. What is the correct subsequent fire command for the FFE?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	SEC	2 HEQ	2994			1080
(b)	SEC	2 HED	2994			1056
(c)	SEC	2 HED	2994			1072
(d)	SEC	2 HED	2994			1064

NOTE: The FO sends: END OF MISSION (EOM), FOUR TRUCKS DESTROYED, EST SIX CAS. The computer records: RAT AB0400, KNPT 00.

F-7. SITUATION B

A fire mission is conducted using the call for fire and FDC order in Figure F-2.

COMPUTER'S RECORD
For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			T43	

☐ ADJUST FIRE ☑ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID:
OT DIRECTION:
ALTITUDE:

SHIFT FROM: AB 0400
OT DIRECTION: 5590 ALTITUDE:
☑ LEFT / ☐ RIGHT 800
☐ ADD / ☑ DROP 200
☑ UP / ☐ DOWN 50

POLAR:
OT DIRECTION: ALTITUDE:
DISTANCE:
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Troops in Woodline
METHOD OF ENGAGEMENT:
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE	
METHOD OF ADJ	RANGE	MORTAR TO FIRE	
BASIS FOR CORRECTION	VI/ALT CORRECTION: ☐ + ☐ −	METHOD OF FIRE	
SHEAF CORRECTION	RANGE CORRECTION: ☐ + ☐ −	DEFLECTION	
SHELL AND FUZE HE D	CHARGE/RANGE	CHARGE	
METHOD OF FFE 2 Rds	AZIMUTH	TIME SETTING	
RANGE LATERAL SPREAD	ANGLE T	ELEVATION	
ZONE			
TIME OF OPENING FIRE W/R			

Figure F-2. Call for fire and FDC order.

TASK: Compute data for a shift mission.

CONDITIONS: Continued from Situation A.

STANDARD: Compute data for the mission to within 3 mils for deflection and elevation.

4. What is the correct initial fire command?

(a)

INITIAL FIRE COMMAND	
MORTAR TO FOLLOW	Sec
SHELL AND FUZE	HED
MORTAR TO FIRE	
METHOD OF FIRE	2 Rds
DEFLECTION	3226
CHARGE	5
TIME SETTING	
ELEVATION	0905

(b)

INITIAL FIRE COMMAND	
MORTAR TO FOLLOW	Sec
SHELL AND FUZE	HED
MORTAR TO FIRE	
METHOD OF FIRE	2Rds
DEFLECTION	3226
CHARGE	4
TIME SETTING	
ELEVATION	0905

(c)

INITIAL FIRE COMMAND	
MORTAR TO FOLLOW	Sec
SHELL AND FUZE	HED
MORTAR TO FIRE	#2
METHOD OF FIRE	2 Rds
DEFLECTION	3226
CHARGE	4
TIME SETTING	
ELEVATION	0953

(d)

INITIAL FIRE COMMAND	
MORTAR TO FOLLOW	Sec
SHELL AND FUZE	HED
MORTAR TO FIRE	
METHOD OF FIRE	2 Rds
DEFLECTION	2842
CHARGE	7
TIME SETTING	
ELEVATION	0980

NOTE: The FO sends: EOM, EST 30 PERCENT CAS. The computer records: RAT AB 0401, KNPT 01.

F-8. SITUATION C

The FO calls in a polar mission. Dislocation must be determined before the polar mission may be computed.

TASK: Determine an unknown location by using resection (SURV key).

CONDITIONS: Continued from Situation B.

STANDARD: Determine the unknown location as a grid coordinate to within 10 meters and record it as an FO location.

NOTE: The FO's call sign is T43.

TASKS: Compute firing data for a polar mission.

CONDITIONS: Continued from above using the call for fire and FDC order in Figure F-3.

STANDARD: Compute the firing data for the mission to within 3 mils for deflection and elevation.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			T43	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT ☐ IMMEDIATE SUPPRESSION	SHIFT FROM:	POLAR:
GRID:	OT DIRECTION: ALTITUDE:	OT DIRECTION: 6240 ALTITUDE:
OT DIRECTION:	☐ LEFT / ☐ RIGHT	DISTANCE: 1800
ALTITUDE:	☐ ADD / ☐ DROP	☐ UP / ☐ DOWN
	☐ UP / ☐ DOWN	VERTICAL ANGLE ☐ + / ☐ −
TARGET DESCRIPTION: POL Point		METHOD OF CONTROL:
METHOD OF ENGAGEMENT: WP in FFE		MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ: #2	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE	
METHOD OF ADJ: 1 Rd			
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	VI/ALT CORRECTION: ☐ + ☐ −	METHOD OF FIRE	
SHELL AND FUZE: HEQ in ADJ, WP+HEQ in FFE			
	RANGE CORRECTION: ☐ + ☐ −	DEFLECTION	
METHOD OF FFE: 3 WP 3 HEQ		CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE: W/R	ANGLE T		

Figure F-3. Situation C.

NOTE: The initial round is fired, and the FO sends: LEFT 100.

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTE: The round is fired and the FO sends: LEFT 50, ADD 50, FFE

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

5. What is the correct subsequent fire command for the fire for effect?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	SEC	3 HEQ 3 WP	2470			1092
(b)	SEC	3 HEQ 3 WP	2491			1131
(c)	SEC	3 HEQ 3 WP	2470			1092
(d)	SEC	3 HEQ 3 WP	2491			1088

NOTE: The FO calls back: EOM, POL POINT BURNING. The computer records: RAT AB0402, KNPT 02.

6. What is the FO's grid location?

(a) 1674389354 (b) 1684389254

(c) 1694389154 (d) 1615489943

NOTE: Clear the MBC before starting Situation D.

F-9. SITUATION D

Your platoon has moved to a firing range.

SETUP

TIME OUT: 30
TGT PREFIX: AA
TN: 0200-0600
ALARM: OFF
MINE: 003
MIN N: 089
GD: E01
LAT: +31
LISTEN ONLY: OFF
BIT RATE: 1200
KEYTONE: 1.4
BLK: SNG
OWN ID: A

WEAPON DATA

UNIT: A Co 2/41 IN
81-mm (M252)
CARRIER MOUNTED: NO
BP: A2 GRID
AP: 07550 93650
ALT: 460
AZ: 1600 DEF: 2800
A1: Dir 3200 Dis 035
A3: Dir 6400 Dis 035
A4: Dir 6400 Dis 070

AMMO DATA

TEMP: 70 degrees
HE: M374A2
WP: M375A2
ILL: M301A3

FO LOCATION

W13 AP: 08250 92550
ALT: 0500

TASK: Prepare an MBC with initialization data.

CONDITIONS: Given an MBC with setup, weapon, ammunition, and FO location data.

STANDARD: Enter the setup, weapon, and ammunition data into the MBC without error.

TASK: Store safety data in the MBC.

CONDITIONS: Continuation of situation D and safety diagram data.

STANDARD: Store the safety diagram data without error.

LLAZ: 1200
RLAZ: 2000
MIN RN: 0350
MAX RN: 4000
MIN CHG: 1
MAX CHG: 8

TASK: Store MET data (Figure F-4) and update to the current file in the MBC.

CONDITIONS: Given uninitialized MBC and a completed DA Form 3675.

STANDARD: Enter MET data in the MBC without error.

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is TRADOC.

IDENTIFICATION METB	TYPE MSG K	OCTANT Q	LOCATION $L_aL_aL_a$ or xxx	$L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	3	1	145	925	09	100	0	017	002

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	221	002	2947	1002
200	01	202	007	2976	0991
500	02	220	014	3011	0963
1000	03	190	008	2978	0919
1500	04	000	000	2939	0872
2000	05	063	015	2933	0821
3000	06	052	019	2918	0772
4000	07	058	025	2899	0729
[illegible]	08	064	028	2864	0689

Figure F-4. Situation D — first mission.

TASK: Conduct a registration using the MBC.

CONDITIONS: Given an initialized MBC, coordinated registration point, computer's record, data sheet, call for fire, and FDC order in Figure F-5.

STANDARD: Register the section and determine the firing corrections to within 3 mils for deflection and elevation, and to within 3 meters for range.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			W13	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 1085 9365
OT DIRECTION: 1200
ALTITUDE: 0400

SHIFT FROM: ____
OT DIRECTION: ____ ALTITUDE: ____
☐ LEFT / ☐ RIGHT ____
☐ ADD / ☐ DROP ____
☐ UP / ☐ DOWN ____

POLAR:
OT DIRECTION: ____ ALTITUDE: ____
DISTANCE: ____
☐ UP / ☐ DOWN ____
VERTICAL ANGLE ☐ + / ☐ − ____

TARGET DESCRIPTION: RP
METHOD OF CONTROL:
METHOD OF ENGAGEMENT:
MESSAGE TO OBSERVER: Prepare to REG RP00

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ: #2	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ: 1Rd	☐ L ☐ R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	V/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE: HE Q	☐ + ☐ −		
	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE: WR	ANGLE T		

Figure F-5. Situation D — second mission.

7. What is the correct initial fire command?

(a)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW: Sec
SHELL AND FUZE: HE Q
MORTAR TO FIRE: #2
METHOD OF FIRE: 1 Rd
2 Rds in FFE
DEFLECTION: 2800
CHARGE: 6
TIME SETTING:
ELEVATION: 0936

(b)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW: Sec
SHELL AND FUZE: HE Q
MORTAR TO FIRE: #2
METHOD OF FIRE: 1 Rd
DEFLECTION: 2801
CHARGE: 6
TIME SETTING:
ELEVATION:
0965

(c)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW: Sec
SHELL AND FUZE: HE Q
MORTAR TO FIRE: #2
METHOD OF FIRE: 1 Rd
DEFLECTION: 2800
CHARGE: 6
TIME SETTING:
ELEVATION: 0936

(d)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW: Sec
SHELL AND FUZE: HE Q
MORTAR TO FIRE: #2
METHOD OF FIRE: 1 Rd
2 Rds in FFE
DEFLECTION: 2801
CHARGE: 6
TIME SETTING:
ELEVATION: 0965

8. What is the angle T?

(a) 0450 mils
(b) 0500 mils
(c) 0400 mils
(d) 0300 mils

NOTE: The FO sends: LEFT 100, ADD 150.

9. What is the correct elevation?

(a) 1069 mils (c) 0961 mils
(b) 1042 mils (d) 1061 mils

NOTES: 1. The FO sends: RIGHT 50, ADD 50.

2. That round is fired, and the FO sends: DROP 25, EOM, REGISTRATION COMPLETE

10. What is the RCF?

(a) +44 (c) +51
(b) -51 (d) -44

11. What is the DEFK?

(a) R33 (c) L36
(b) R36 (d) L33

TASK: Compute data for sheaf adjustment.

CONDITIONS: Given an initialized MBC, completed registration mission, computer's record, and corrections from the FO for the adjustment of the remainder of the section.

STANDARD: Adjust the sheaf and determine the sheaf data to within 3 mils for deflection and elevation.

NOTE: The FDC sends an MTD, "Prepare to adjust sheaf," and the FO replies, "Section right."

12. What is the correct subsequent command?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	1 Rd S/R #2 DNF	2840	7		1023
(b)	Sec	1 Rd S/R #2 DNF	2837			1030
(c)	Sec	S/R	2840	7		1023
(d)	Sec	S/R	2838			1050

NOTE: The FO calls back: NUMBER 1 GUN RIGHT 60; NUMBER 3 GUN LEFT 20; NUMBER 4 ADJUSTED.

13. What are the correct subsequent commands?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	#1	DNF	1) 2823			
			3) 2845			1017
(b)	#3		2845			
	#1		2823			1017
(c)	#3	DNF	2872			
	#1		2851			1001
(d)	#1		2821			1024
	#3	DNF	2842			

NOTE: The FO spots the last round and sends: EOM, SHEAF ADJUSTED. The computer records as: (EOMRAT) AA0200, KNPT 00.

F-10. SITUATION E

While the section is referring and realigning their aiming posts, the section leader hands you a call for fire.

TASK: Compute data for a shift mission.

CONDITIONS: Continue from Situation D using the call for fire in Figure F-6.

STANDARD: Compute data for the mission to within 3 mils for deflection and elevation.

TASK: Record all information on firing records.

CONDITIONS: Given a computer's record and data sheet, call for fire, FO's corrections, information to complete the FDC order, ammunition count, mortar platoon/section SOP, and MBC.

STANDARD: Record and compute the mission. Correctly complete all required blocks and spaces on the computer's record. Record the information and data needed for the type of mortar and ammunition being fired at the end. Complete the data sheet.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			W13	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT ☐ IMMEDIATE SUPPRESSION	SHIFT FROM: RP00	POLAR:
GRID:	OT DIRECTION: 1400 ALTITUDE:	OT DIRECTION: ALTITUDE:
OT DIRECTION:	☐ LEFT / ☑ RIGHT 500	DISTANCE:
ALTITUDE:	☐ ADD / ☑ DROP 200	☐ UP / ☐ DOWN
	☐ UP / ☑ DOWN 50	VERTICAL ANGLE ☐ + / ☐ −
TARGET DESCRIPTION: Troops in Bunker		METHOD OF CONTROL:
METHOD OF ENGAGEMENT:		MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ: #2	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ: 1 Rd	☐ L ☐ R		
BASIS FOR CORRECTION: RP00	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION: CVG #2	VI/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE: HEQ in ADJ	☐ + ☐ −		
HED in FFE	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE: 3 Rds	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE: W/R	ANGLE T		

Figure F-6. Situation E.

14. What is the correct initial fire command?

(a)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ...... Sec
SHELL AND FUZE ...... HE Q
MORTAR TO FIRE ...... #2
METHOD OF FIRE ...... 1 Rd in Adj
3 Rds HED in FFE
DEFLECTION 2572
CHARGE 6
TIME SETTING ......
ELEVATION 1071
......

(b)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ...... Sec
SHELL AND FUZE ...... HED
MORTAR TO FIRE ...... #2
METHOD OF FIRE ...... 1 RD
......
DEFLECTION 2674
CHARGE 7
TIME SETTING ......
ELEVATION 1047
......

(c)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ...... Sec
SHELL AND FUZE ...... HE Q
MORTAR TO FIRE ...... #2
METHOD OF FIRE ...... 1 Rd in ADJ
3 Rds HED in FFE
DEFLECTION 2672
CHARGE 7
TIME SETTING ......
ELEVATION 1054
......

(d)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ...... Sec
SHELL AND FUZE ...... HE Q
MORTAR TO FIRE ...... #2
METHOD OF FIRE ...... 1 Rd in ADJ
3 Rds HED in FFE
DEFLECTION 2674
CHARGE 7
TIME SETTING ......
ELEVATION 1047
......

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTE: The FO spots the first round and sends: ADD 100. That round is fired, and the FO sends: RIGHT 50, ADD 50, FFE.

TASK: Compute data for a converged sheaf.

CONDITIONS: Given an initialized MBC using a grid coordinate as the method of target location, computer's record, and data sheet.

STANDARD: Compute the firing data for the initial and subsequent fire commands to within 3 mils for deflection and elevation.

15. What is the correct subsequent fire command for the FFE?

SUBSEQUENT COMMANDS

	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	3 HE D	1) 2662			
			2) 2672			
			3) 2682			
			4) 2692			1030
(b)	Sec	3 HE D	1) 2681			1009
			2) 2671			1008
			3) 2661			1006
			4) 2651			1005
(c)	Sec	3 HE D	1) 2684			1002
			2) 2674			1000
			3) 2664			0999
			4) 2654			0997
(d)	Sec	3 HE D	1) 2674			1000
			2) 2664			0999
			3) 2654			0998
			4) 2644			0998

NOTE: The FO sends: EOM. BUNKER DESTROYED, EST 50 PERCENT CAS RAT AA0201, KNPT 01.

F-11. SITUATION F

The FO calls in a new mission.

TASK: Compute data for a grid mission using the call for fire and FDC order in Figure F-7.

CONDITIONS: Given an initialized MBC, call for fire using grid coordinates as the method of target location, computer's record, and data sheet.

STANDARD: Compute data for the mission's initial fire command to within 3 mils for deflection and elevation.

COMPUTER'S RECORD
For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			W13	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 1015 9305
OT DIRECTION: 1320
ALTITUDE: 380

SHIFT FROM:
OT DIRECTION: ALTITUDE:
☐ LEFT / ☐ RIGHT
☐ ADD / ☐ DROP
☐ UP / ☐ DOWN

POLAR:
OT DIRECTION: ALTITUDE:
DISTANCE:
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Foot Bridge 100m ATT 2400
METHOD OF ENGAGEMENT:
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ: #2	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ: 1 Rd	☐ L ☐ R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION: 100 M	VI/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE: HE Q	☐ + ☐ −		
	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE: 3 Rds	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE: W/R	ANGLE T		

Figure F-7. Situation F.

NOTE: The initial round is fired, and the FO sends: RIGHT 100, ADD 100.

16. What is the correct subsequent command?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)			2586			0912
(b)			2584			0965
(c)			2686			0941
(d)			2694			1072

NOTE: The FO spots the round and sends: ADD 50, FFE.

TASK: Compute data for a traversing mission using the call for fire and FDC order in Figure F-7.

CONDITIONS: Given an MBC with a mission already in progress.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation, and determine turns to the nearest one-half turn.

17. What is the correct subsequent command for the FFE?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	3 Rds	(1) 2599	6		1086
			(2) 2594			1086
			(3) 2605			1080
			(4) 2710			1080
(b)	Sec	3 Rds	(1) 2602	6		1056
			(2) 2595			1061
			(3) 2589			1065
			(4) 2582			1069
(c)	Sec	3 Rds	(1) 2613	5		1060
			(2) 2601			1059
			(3) 2589			1056
			(4) 2576			1053
(d)	Sec	3 Rds	(1) 2578			1087
			(2) 2569			1072
			(3) 2561			1060
			(4) 2553			1053

NOTES: The FO sends: EOM, BRIDGE DESTROYED, RAT AA0202, KNPT 02.

F-12. SITUATION G

W13 sends in the fire request in Figure F-8.

TASK:	Record information on firing records.
CONDITIONS:	Given a computer's record and data sheet, call for fire, FO's corrections, information to complete the FDC order, ammunition count, mortar platoon/section SOP, and MBC.
STANDARDS:	Record and compute the mission. Correctly complete all required blocks and spaces on the computer's record. Record the information and data needed for the type of mortar and ammunition being fired at the end. Complete the data sheet.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			W13	

- ☑ ADJUST FIRE ☐ FIRE FOR EFFECT
- ☐ IMMEDIATE SUPPRESSION

GRID: ____ OT DIRECTION: ____ ALTITUDE: ____

SHIFT FROM: AA 0202

OT DIRECTION: 1290 ALTITUDE: ____

☑ LEFT / ☐ RIGHT 200

☐ ADD / ☑ DROP 400

☑ UP / ☐ DOWN 50

POLAR: OT DIRECTION: ____ ALTITUDE: ____ DISTANCE: ____ ☐ UP / ☐ DOWN ____ VERTICAL ANGLE ☐ + / ☐ − ____

TARGET DESCRIPTION: PIO

METHOD OF ENGAGEMENT: Prox in FFE

METHOD OF CONTROL:

MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE 1+2	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ #2	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE	
METHOD OF ADJ 1 Rd	RANGE	MORTAR TO FIRE	
BASIS FOR CORRECTION AA0202	VI/ALT CORRECTION: ☐ + ☐ −	METHOD OF FIRE	
SHEAF CORRECTION	RANGE CORRECTION: ☐ + ☐ −	DEFLECTION	
SHELL AND FUZE HEQ in ADJ Prox in FFE	CHARGE/RANGE	CHARGE	
METHOD OF FFE 3 Rds	AZIMUTH	TIME SETTING	
RANGE LATERAL SPREAD	ANGLE T	ELEVATION	
ZONE			
TIME OF OPENING FIRE W/R			

Figure F-8. Situation G — first mission.

W13 immediately sends in another fire request. The section leader assigns No. 1 and No. 2 guns to the first mission (SHIFT), and No.2 and No.3 guns to the second mission (POLAR).

TASK: Compute data for a shift mission using the call for fire and FDC orders in Figure F-8.

CONDITIONS: Given an initialized MBC, call for fire using shift from a known point, computer's record, and data sheet.

STANDARD: Compute data for the mission to within 3 mils for deflection and elevation.

TASK: Compute firing data for a polar mission using the call for fire and FDC orders in Figure F-9.

CONDITIONS: Given an initialized MBC, call for fire, computer's record, and data sheet.

STANDARD: Compute the firing data for the mission to within 3 mils for deflection and elevation.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			W13	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID:
OT DIRECTION:
ALTITUDE:

SHIFT FROM:
OT DIRECTION: ALTITUDE:
☐ LEFT / ☐ RIGHT
☐ ADD / ☐ DROP
☐ UP / ☐ DOWN

POLAR:
OT DIRECTION: 1520 ALTITUDE:
DISTANCE: 2400
☐ UP / ☑ DOWN 100
VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Stalled BMP
METHOD OF CONTROL:
METHOD OF ENGAGEMENT:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE 3 + 4	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ #3	DEFLECTION CORRECTION: ☐L ☐R	SHELL AND FUZE	
METHOD OF ADJ 1 Rd	RANGE	MORTAR TO FIRE	
BASIS FOR CORRECTION	VA/LT CORRECTION: ☐+ ☐−	METHOD OF FIRE	
SHEAF CORRECTION	RANGE CORRECTION: ☐+ ☐−	DEFLECTION	
SHELL AND FUZE HE Q in ADJ WP in FFE	CHARGE/RANGE	CHARGE	
METHOD OF FFE 3 Rds	AZIMUTH	TIME SETTING	
RANGE LATERAL SPREAD	ANGLE T	ELEVATION	
ZONE			
TIME OF OPENING FIRE W/R			

Figure F-9. Situation G — second mission.

TASK: Compute firing data for a polar mission using the call for fire and FDC orders in Figure F-9.

CONDITIONS: Given an initialized MBC, call for fire, computer's record and data sheet.

STANDARD: Compute the firing data for the mission to within 3 mils for deflection and elevation.

18. What is the correct range for the first round in mission one?

(a) 2,408 meters
(b) 3,628 meters
(c) 3,354 meters
(d) 2,508 meters

19. What is the correct initial fire command for mission two?

(a)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW 3 + 4
SHELL AND FUZE H E Q
MORTAR TO FIRE #3
METHOD OF FIRE 1 Rd in ADJ
3 WP in FFE
DEFLECTION 2532
CHARGE 6
TIME SETTING
ELEVATION 0883

(b)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW 3 + 4
SHELL AND FUZE H E Q
MORTAR TO FIRE #3
METHOD OF FIRE 1 Rd in ADJ
3 WP in FFE
DEFLECTION 2556
CHARGE 6
TIME SETTING
ELEVATION 0892

(c)

INITIAL FIRE COMMAND	
MORTAR TO FOLLOW	3 + 4
SHELL AND FUZE	H E Q
MORTAR TO FIRE	#3
METHOD OF FIRE	1 Rd in ADJ
	3 RDS in FFE
DEFLECTION	2553
CHARGE	6
TIME SETTING	
ELEVATION	0907

(d)

INITIAL FIRE COMMAND	
MORTAR TO FOLLOW	3 + 4
SHELL AND FUZE	H E Q
MORTAR TO FIRE	#3
METHOD OF FIRE	1 Rd in ADJ
	3 WP in FFE
DEFLECTION	2553
CHARGE	6
TIME SETTING	
ELEVATION	0947

NOTE: The firest mission's initial round is fired, and the FO sends: RIGHT 50, DROP 100.

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

20. What is the correct subsequent command for mission one?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	#2		2556	4		0939
(b)	#2	1 Rd	2547	4		1112
(c)			2543	4		0895
(d)			2543	4		0928

NOTE: The FO spots the round for mission two and sends: DROP 50, FFE.

21. What is the correct subsequent command for the second mission?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	3 WP	2549			0962
(b)		3 WP	2527			0922
(c)	3+4	3 WP	2527			0922
(d)	3+4	3 WP	2551			0921

NOTES: 1. The FO spots the second round for the first mission and sends: ADD 50, FFE.

2. The FO calls back on the second mission: EOM, BMP DESTROYED, RAT AA204, KNPT 04.

22. What is the correct subsequent command for the first FFE mission?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	3+4	3 Prox	2559			1081
(b)	1+2	3 Prox	2557	5		1094
(c)	1+2	3 Prox	2559			1081
(d)	1+2	3 Prox	2557	5		1107

NOTE: The FO sends: EOM, EST 80 PERCENT CAS, RAT AA0203, KNPT 03.

F-13. SITUATION H

The company commander orders the mortar platoon to displace. The platoon occupies the new position. The initialization data below is entered into the MBC.

TASK: Prepare an MBC with initialization data.

CONDITIONS: Given an MBC with weapon and FO location data.

STANDARD: Enter the weapon and FO location data into the MBC without error.

WPN DATA

81-MM (M252)
CARRIER MOUNTED: NO
BP: A2 GRID AP: 13150 92910
ALT: 0420
AZ: 5340 DEF: 2800
A1: Dir 0540 Dis 035
A3: Dir 3740 Dis 035
A4: Dir 3740 Dis 070

FO LOCATION

F21 AP: 09850 93100
ALT: 0300

TASK: Store a no-fire line/zone in the MBC.

CONDITIONS: Given an initialized MBC and coordinates for a no-fire line/zone.

STANDARD: Store a no-fire line/zone without error.

NO-FIRE LOCATION

ZN1 04 PTS
PT1 09450 93300
PT2 10650 93300
PT3 10650 93500
PT4 09450 93500

TASK: Store safety data in the MBC.

CONDITIONS: Given an initialized MBC and a completed safety diagram.

STANDARD: Store the safety diagram data without error.

SAFETY DATA

LLAZ 4940
RLAZ 5740
MIN RN 0450
MAX RN 3800
MIN CHG 1
MAX CHG 7

The company commander has directed that an FPF be placed at grid 10850 93410. The platoon leader informs the FO, and the FO sends the call for fire in Figure F-10.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			F21	FPF

☑ ADJUST FIRE ☐ FIRE FOR EFFECT ☐ IMMEDIATE SUPPRESSION	SHIFT FROM: OT DIRECTION: ___ ALTITUDE: ___	POLAR: OT DIRECTION: ___ ALTITUDE: ___
GRID: 1085 9341 OT DIRECTION: 1300 ALTITUDE: 280	☐ LEFT / ☐ RIGHT ___ ☐ ADD / ☐ DROP ___ ☐ UP / ☐ DOWN ___	DISTANCE: ___ ☐ UP / ☐ DOWN ___ VERTICAL ANGLE ☐ + / ☐ − ___
TARGET DESCRIPTION: FPF		METHOD OF CONTROL: Section Left
METHOD OF ENGAGEMENT: Danger Close HED in ADJ		MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ: 1 Rd	☐ L ☐ R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION: L 140	VI/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE: HED in ADJ	☐ + ☐ −		
HEQ in FFE	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE: 5 Rds	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE: AMC	ANGLE T		

Figure F-10. Situation H.

TASK: Compute firing data for an FPF.

CONDITIONS: Given an initialized MBC, a call for fire (requesting adjustment of an FPF), computer's record, and data sheet.

STANDARD: Compute data for an FPF to the nearest 3 mils for deflection and elevation.

NOTE: No. 4 gun is the danger-close gun.

23. What is the burst point grid for the first round?

(a) 1085093410

(b) 1078893304

(c) 1092093411

(d) 1079093000

24. What are the correct initial deflections and elevations?

		DEF (mils)	ELEV (mils)			DEF (mils)	ELEV (mils)
(a)	No. 1	3128	1045	(c)	No. 1	3040	0945
	No. 2	3127	1045		No. 2	3039	0994
	No. 3	3126	1046		No. 3	3038	0946
	No. 4	3200	0900		No. 4	3200	0900
(b)	No. 1	3180	0995	(d)	No. 1	3141	0969
	No. 2	3179	0995		No. 2	3141	0969
	No. 3	3178	0994		No. 3	3141	0969
	No. 4	3124	0900		No. 4	3141	0969

NOTE: The FO spots the round and sends: NO. 4 GUN LEFT 25, ADD 25.

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTE: The round is fired and the FO sends: NO. 4 GUN ADJUSTED, REPEAT NO. 3 GUN

25. What is the correct deflection and elevation for No. 3 gun?

	DEF (mils)	ELEV (mils)		DEF (mils)	ELEV (mils)
(a)	3134	1059	(c)	3126	0974
(b)	3124	1050	(d)	3134	0950

NOTES: 1. The FO spots the round and sends: RIGHT 25.

2. That round is fired and the FO sends: NO. 3 ADJUSTED, REPEAT NO. 2 GUN

3. The round is fired, and the FO sends: RIGHT 25, ADD 25.

26. What is the correct deflection and elevation for the No. 2 gun?

	DEF (mils)	ELEV (mils)		DEF (mils)	ELEV (mils)
(a)	3126	0974	(c)	3136	0981
(b)	3141	0977	(d)	3141	0997

NOTES: 1. The round is fired, and the FO sends: NO. 2 ADJUSTED, REPEAT NO. 1 GUN.

2. The round is fired, and the FO sends: EOM, FPF ADJUSTED.

F-14. SITUATION I

A short time after adjusting the FPF you receive the call for fire and FDC order in Figure F-11.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			F21	

☐ ADJUST FIRE ☐ FIRE FOR EFFECT
☑ IMMEDIATE SUPPRESSION

GRID: 1065 9435
OT DIRECTION:
ALTITUDE:

SHIFT FROM:
OT DIRECTION: ALTITUDE:
☐ LEFT / ☐ RIGHT
☐ ADD / ☐ DROP
☐ UP / ☐ DOWN

POLAR:
OT DIRECTION: ALTITUDE:
DISTANCE:
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Smoke
METHOD OF ENGAGEMENT:
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE ....Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ	DEFLECTION CORRECTION: ☐L ☐R	SHELL AND FUZE	
METHOD OF ADJ		....	
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	VI/ALT CORRECTION: ☐+ ☐−	METHOD OF FIRE	
SHELL AND FUZE ....WP		....	
....	RANGE CORRECTION: ☐+ ☐−	DEFLECTION	
METHOD OF FFE ....2 Rds		CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE ....W/R	ANGLE T	....	

Figure F-11. Situation I.

TASK: Compute data for a grid mission using the call for fire and FDC order in Figure F-11.

CONDITIONS: Given an initialized MBC, call for fire using grid coordinates as the method of target location computer's record, and data sheet.

STANDARD: Compute data for the missions initial fire command to within 3 mils for deflection and elevation.

27. What is the correct initial fire command?

(a)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW	Sec
SHELL AND FUZE	WP
MORTAR TO FIRE	
METHOD OF FIRE	2 Rds
DEFLECTION	2808
CHARGE	6
TIME SETTING	
ELEVATION	1087

(c)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW	Sec
SHELL AND FUZE	HE Q
MORTAR TO FIRE	
METHOD OF FIRE	1 Rd
2 Rds in FFE	
DEFLECTION	2813
CHARGE	6
TIME SETTING	
ELEVATION	1052

(b)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW	Sec
SHELL AND FUZE	WP
MORTAR TO FIRE	
METHOD OF FIRE	2 Rds
DEFLECTION	2813
CHARGE	6
TIME SETTING	
ELEVATION	1052

(c)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW	Sec
SHELL AND FUZE	WP
MORTAR TO FIRE	
METHOD OF FIRE	1 Rd in ADJ
2 Rds WP in FFE	
DEFLECTION	2809
CHARGE	6
TIME SETTING	
ELEVATION	1067

NOTE: The FO sends: EOM, AREA SCREENED, RAT AA0205, KNPT 05.

F-15. SITUATION J

The commander wants a screen at grid 11850 94150. The platoon leader informed the FSO and the FO. A short time later you receive the call for fire in Figure F-12.

TASK: Compute firing data for a quick-smoke mission.

CONDITIONS: Given an initialized MBC, call fire fire (requesting a quick smoke mission), weather conditions, smoke card, computer's record, and data sheet.

STANDARD: Compute the initial and subsequent fire commands to the nearest 3 mils for deflection and elevation, and the correct number of rounds in the FFE.

COMPUTER'S RECORD
For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			F21	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 1185 9415
OT DIRECTION: 1110
ALTITUDE: 300

SHIFT FROM: ______
OT DIRECTION: ______ ALTITUDE: ______
☐ LEFT / ☐ RIGHT ______
☐ ADD / ☐ DROP ______
☐ UP / ☐ DOWN ______

POLAR:
OT DIRECTION: ______ ALTITUDE: ______
DISTANCE: ______
☐ UP / ☐ DOWN ______
VERTICAL ANGLE ☐ + / ☐ – ______

TARGET DESCRIPTION: Screen Suspected Enemy Plt 300m Wide
METHOD OF ENGAGEMENT: Crosswind - 9 Min Duration
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE ... Sec	DEFLECTION ...	MORTAR TO FOLLOW ...	
MORTAR TO ADJ ... #1	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE ...	
METHOD OF ADJ ... 1 Rd		...	
BASIS FOR CORRECTION ...	RANGE ...	MORTAR TO FIRE ...	
SHEAF CORRECTION ...	VI/ALT CORRECTION: ☐ + ☐ –	METHOD OF FIRE ...	
SHELL AND FUZE ... HEQ/WP in ADJ WP in FFE		...	
	RANGE CORRECTION: ☐ + ☐ –	DEFLECTION ...	
METHOD OF FFE ...		CHARGE ...	
RANGE LATERAL SPREAD ...	CHARGE/RANGE ...	TIME SETTING ...	
ZONE ...	AZIMUTH ...	ELEVATION ...	
TIME OF OPENING FIRE ... W/R	ANGLE T ...	...	

Figure F-12. Situation J.

NOTE: Temperature gradient–neutral
Wind speed–9 knots
Humidity–60percent

28. What is the deflection for the last round fired?

(a) 2468 mils (c) 2388 mils
(b) 2498 mils (d) 2598 mils

NOTES: 1. The FO spots the round and sends: LEFT 50, ADD 100.
2. The round is fired and the FO sends: ADD 100.
3. The FO spots the round and sends: REPEAT WP
4. The FO sees the WP and sends: FFE, CONTINUOUS FIRE FROM THE LEFT.

29. What is the time interval between rounds?

(a) 20 seconds (c) 12 seconds
(b) 10 seconds (d) 6 seconds

30. What is the total number of WP rounds computed for the mission?

(a) 37 rounds (c) 41 rounds
(b) 40 rounds (d) 28 rounds

NOTE: The FO calls back: EOM, AREA SCREENED, RAT AA0206, KNPT 06.

F-16. SITUATION K

The platoon leader has been ordered to displace No. 3 and No. 4 guns to a new firing point. Enter the following weapon data:

TASK: Prepare an MBC with initialization data.
CONDITIONS: Given an MBC with weapon data.
STANDARD: Enter the weapon data into the MBC without error.

WPN DATA

BP: B3
CARRIER MOUNTED: NO
GRID: 10750 91300

ALT: 0350
AZ: 6400 DEF: 2800
B4: Dir 4900 Dis 040

Shortly after the section occupies its new position, another fire request is received. Use the call for fire and FDC order in Figure F-13 to compute the mission.

TASK: Compute firing data for a polar mission using the call for fire and FDC orders in Figure F-13.

CONDITIONS: Given an initialized MBC, call for fire, computer's record, and data sheet.

STANDARD: Compute the firing data for the mission to within 3 mils for deflection and elevation.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			W13	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT ☐ IMMEDIATE SUPPRESSION	SHIFT FROM:	POLAR:
GRID:	OT DIRECTION: ____ ALTITUDE: ____	OT DIRECTION: 0750 ALTITUDE: ____
OT DIRECTION:	☐ LEFT / ☐ RIGHT	DISTANCE: 3700
ALTITUDE:	☐ ADD / ☐ DROP	☐ UP / ☑ DOWN 100
	☐ UP / ☐ DOWN	VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Tanks in Open	METHOD OF CONTROL:
METHOD OF ENGAGEMENT:	MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ #2	DEFLECTION CORRECTION: ☐L ☐R	SHELL AND FUZE	
METHOD OF ADJ 1 Rd	RANGE	MORTAR TO FIRE	
BASIS FOR CORRECTION	W/ALT CORRECTION: ☐+ ☐−	METHOD OF FIRE	
SHEAF CORRECTION	RANGE CORRECTION: ☐+ ☐−	DEFLECTION	
SHELL AND FUZE HE Q in ADJ WP in FFE	CHARGE/RANGE	CHARGE	
METHOD OF FFE 3 Rds	AZIMUTH	TIME SETTING	
RANGE LATERAL SPREAD	ANGLE T	ELEVATION	
ZONE			
TIME OF OPENING FIRE W/R			

Figure F-13. Situation K.

31. What is the correct initial fire command?

(a)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW B Sec
SHELL AND FUZE
MORTAR TO FIRE #3
METHOD OF FIRE 1 Rd
3 WP in FFE
DEFLECTION 2803
CHARGE 8
TIME SETTING
ELEVATION 0951

(b)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW #1
SHELL AND FUZE HEQ
MORTAR TO FIRE
METHOD OF FIRE 1 Rd
3 WP in FFE
DEFLECTION 2803
CHARGE 8
TIME SETTING
ELEVATION 0981

(c)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW B Sec
SHELL AND FUZE HEQ
MORTAR TO FIRE #3
METHOD OF FIRE 1 Rd in ADJ
3 Rds WP in FFE
DEFLECTION 2796
CHARGE 8
TIME SETTING
ELEVATION 0962

(d)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW Sec
SHELL AND FUZE HEQ
MORTAR TO FIRE #1
METHOD OF FIRE 1 Rd in ADJ
3 Rds WP in FFE
DEFLECTION 2796
CHARGE 8
TIME SETTING
ELEVATION 0962

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTE: The FO send the correction: ADD 50, FFE.

32. What is the correct subsequent command?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	3 Rds WP	B 3+4 2787			0949
			#1+2 2536			1033
(b)	Sec	3 Rds WP	B 3+4 2799			0968
			#1+2 2542			1039
(c)	Sec	3 Rds WP	2787			0949
(d)	Sec	3 Rds WP	2536			1033

NOTE: The FO sends: EOM, TANKS BURNING, RAT AA0207, KNPT 07.

F-17. SITUATION L

The No. 3 and No. 4 guns have now displaced back to their position with the rest of the platoon. Another mission is received in the FDC. Use the call for fire and FDC order in Figure F-14 to compute the mission.

TASK: Compute data for a searching mission using the call for fire and FDC order in Figure F-14.

CONDITIONS: Given an MBC with a mission already in progress.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation, and determine turns to the nearest one-half turn.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			F21	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 1042 9534
OT DIRECTION: 0250
ALTITUDE: 380

SHIFT FROM:
OT DIRECTION: ALTITUDE:
☐ LEFT / ☐ RIGHT
☐ ADD / ☐ DROP
☐ UP / ☐ DOWN

POLAR:
OT DIRECTION: ALTITUDE:
DISTANCE:
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + / ☐ –

TARGET DESCRIPTION: CO in Open 100x300 ATT 5430
METHOD OF ENGAGEMENT:
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ #2	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE	
METHOD OF ADJ 1 Rd			
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	VI/ALT CORRECTION: ☐ + ☐ –	METHOD OF FIRE	
SHELL AND FUZE HEQ			
	RANGE CORRECTION: ☐ + ☐ –	DEFLECTION	
METHOD OF FFE 12 Rds		CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE W/R	ANGLE T		

Figure F-14. Situation L.

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTES: 1. The FO spots the initial round and sends a correction: RIGHT 200, DROP 200.

2. That round is fired, and the FO sends his next correction: LEFT 50, DROP 100.

3. That round is fired, and the observer calls back: ADD 50, FFE.

33. What is the correct deflection, charge, andelevationfor thenear edge of the target?

	DEF(mils)	CHG	ELEV(mils)		DEF(mils)	CHG	ELEV(mils)
(a)	2652	6	1062	(c)	2645	7	1072
(b)	2642	7	1083	(d)	2642	6	1072

34. What is the correct deflection, charge, and elevation to the far edge of the target?

	DEF (mils)	CHG	ELEV (mils)		DEF (mils)	CHG	ELEV (mils)
(a)	2649	6	0982	(c)	2645	7	1051
(b)	2649	7	0997	(d)	2649	7	0982

NOTE: The FO observes the FFE and sends: EOM, TROOPS DISPENSING, RAT AA0208, KNPT08.

F-18. SITUATION M

At dusk of the same day, the FDC receives another fire request. Use the call for fire and FDC order in Figure F-15 to compute the mission.

TASK: Compute data for a traversing mission using the call for fire and FDC order in Figure F-15.

CONDITIONS: Given an MBC with a mission already in progress.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation, and determine turns to the nearest one-half turn.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			F21	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 1189 9410
OT DIRECTION: 1150
ALTITUDE: 400

SHIFT FROM: ______
OT DIRECTION: ______ ALTITUDE: ______
☐ LEFT / ☐ RIGHT ______
☐ ADD / ☐ DROP ______
☐ UP / ☐ DOWN ______

POLAR:
OT DIRECTION: ______ ALTITUDE: ______
DISTANCE: ______
☐ UP / ☐ DOWN ______
VERTICAL ANGLE ☐ + / ☐ − ______

TARGET DESCRIPTION: Landing Zone 450X50 ATT 0550
METHOD OF ENGAGEMENT:
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: See	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ: #2	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE	
METHOD OF ADJ: 1 Rd			
BASIS FOR CORRECTION: Special	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION: W 450	VI/ALT CORRECTION: ☐ + ☐ −	METHOD OF FIRE	
SHELL AND FUZE: HEQ in ADJ, WP in FFE			
	RANGE CORRECTION: ☐ + ☐ −	DEFLECTION	
METHOD OF FFE: 5 Rds		CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE: W/R	ANGLE T		

Figure F-15. Situation M.

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and &levation.

NOTES: 1. *The FO spots the round andsenh the correction: LEFT 200, DROP 200.*

2. *The round is fired, and the FO sends another correction: RIGHT 100, ADD 25.*

3. *The round is spotted by the FO, and he sends the correction: LEFT 50 FFE, TRAVERSE RIGHT.*

35. What is the subsequent command for the FFE?

SUBSEQUENT COMMANDS

	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	6 Rds WP	1) 2580			1119
			2) 2638			1126
			3) 2676			1131
			4) 2713			1147
(b)	Sec	5 Rds	1) 2645	Traverse Right	1 Turn	1115
			2) 2685			1119
			3) 2724			0862
			4) 2762			0867
(c)	Sec	5 Rds WP	1) 2598	Traverse Right	1 Turn	1122
			2) 2637			1126
			3) 2677			1129
			4) 2716			1132
(d)	Sec	6 Rds WP	1) 2617			1124
			2) 2676			1129
			3) 2735			0910
			4) 2762			0915

36. How many turns are there between rounds?

(a) 1/2 turn

(b) 1 turn

(c) 1 1/2 turns

(d) 2 turns

NOTE: The FO observes the FFE and sends: EOM LZ DESTY

F-19. SITUATION N

It is now dark and the platoon is prepared for night firing. The FDC receives a fire request. Use the call for fire and FDC order in Figure F-16 to compute the mission.

TASK: Compute firing data for an illumination mission.

CONDITIONS: Given an initialized MBC, call for fire, computer's record, and data sheet.

STANDARDS: Compute data for an illumination mission to the nearest 3 mils for deflection and elevation, and time setting to within one-tenth of a second.

COMPUTER'S RECORD
For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			F21	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 1125 9385
OT DIRECTION: 1100
ALTITUDE:

SHIFT FROM:
OT DIRECTION: ALTITUDE:
☐ LEFT / ☐ RIGHT
☐ ADD / ☐ DROP
☐ UP / ☐ DOWN

POLAR:
OT DIRECTION: ALTITUDE:
DISTANCE:
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + /☐ –

TARGET DESCRIPTION: Suspected Enemy Movement ILL
METHOD OF ENGAGEMENT:
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE #1	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ 1 Rd	☐L ☐R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	VI/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE ILL	☐+ ☐–		
	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE	☐+ ☐–	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE W/R	ANGLE T		

Figure F-16. Situation N – first mission.

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARD: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTE: The round is fired and the FO sends the correction: RIGHT 200, DROP 400, DOWN 100.

37. What is the correct subsequent command?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	#1	1 Rd	3088		26.4	1026
(b)			3089		28.9	1021
(c)	#1	1 Rd	3089		26.4	1026
(d)			3088		26.4	1026

TASK: Compute data for a coordinated illumination mission using the call for fire in figure F-17..

CONDITIONS: Given an initialized MBC, call for fire, computer's record, and data sheet.

STANDARDS: Compute firing data for the deflection and elevation to within 3 mils for all high-explosive and illumination rounds for the initial and subsequent fire commands.

NOTE: The round is fired, and the FO sends a coordinated illumination and HE call for fire.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			F21	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 1125 9385
OT DIRECTION: 1100
ALTITUDE: 300

SHIFT FROM:
OT DIRECTION: ALTITUDE:
☐ LEFT / ☐ RIGHT
☐ ADD / ☐ DROP
☐ UP / ☐ DOWN

POLAR:
OT DIRECTION: ALTITUDE:
DISTANCE:
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Enemy Veh
METHOD OF ENGAGEMENT: WP in FFE
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

Figure F-17. Situation N – second mission.

38. What is the correct FDC order?

(a)

FDC ORDER	
MORTAR TO FFE	2+3
MORTAR TO ADJ	#2
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ in ADJ
	WP in FFE
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	W/R

(b)

FDC ORDER	
MORTAR TO FFE	Sec
MORTAR TO ADJ	#2
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ in ADJ
	WP in FFE
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	AMC

(c)

FDC ORDER	
MORTAR TO FFE	2+3+4
MORTAR TO ADJ	#2
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ in ADJ
	WP in FFE
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	AMC

(d)

FDC ORDER	
MORTAR TO FFE	Sec
MORTAR TO ADJ	#2
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ in ADJ
	WP in FFE
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	W/R

TASK: Compute data for subsequent FO corrections using the MBC.

CONDITIONS: Given an MBC with a mission already in progress and corrections from the FO to apply.

STANDARDS: Compute data for the corrections to within 3 mils for deflection and elevation.

NOTES: 1. No. 1 gun fires an illumination round and the FO sends: MARK ILLUM.

2. The mark time is 50 seconds.

3. Illumination and HE rounds are fired and the FO calls back: HE, DROP 100.

39. What is the range to the target for this correction?

(a) 2,358 meters (c) 2,198 meters

(b) 2,318 meters (d) 2,258 meters

NOTE: Illumination and HE rounds are fired, and the FO calls back: HE, RIGHT 50, DROP 50, FFE.

40. What is the correct deflection and elevation for the No. 2, No. 3, and No. 4 guns in the FFE?

	DEF (mils)	ELEV (mils)		DEF (mils)	ELEV (mils)
(a)	2946	1047	(c)	2946	1063
(b)	2946	1055	(d)	2946	1070

NOTE: The FO observes the FFE and sends: EOM, VEHICLES BURNING, RAT AA0409, KNPT 09.

F-20. SITUATION O

The following are questions relating to various MBC situations:

41. When the MBC is connected to a radio, it is proper procedure to conduct a modem test.

TRUE FALSE

42. While operating the MBC, the MBC becomes unusually hot and a hissing sound is detected, The first thing to do is turn the MBC off.

TRUE FALSE

43. When storing the MBC, the battery can be left in the computer for an unlimited length of time.

TRUE FALSE

44. While operating the MBC using an external power source in the vehicle, the vehicle should not be started.

TRUE FALSE

45. Never use a sharp object, such as a pencil, to press the switches when operating the MBC.

TRUE FALSE

46. The MBC is waterproof when one switch on the keyboard is punctured.

TRUE FALSE

47. Before operating the MBC, the first step is to place a battery into the battery compartment.

TRUE FALSE

48. The last check before operating the MBC is to conduct a self-test.

TRUE FALSE

49. How many types of messages can the MBC receive from a DMD?

a. 4

b. 9

c. 14

d. 19

50. When receiving a completed fire request (FR) message from the DMD, why must you review it before processing the mission?

a. To prevent errors.

b. To be able to send an MTO.

c. To receive an ACK.

d. To manually enter the GRID switch.

51. When entering SET-UP data, what two entries must be the same as the DMD to communicate digitally?

a. Listen Only and Bit Rate.

b. Bit Rate and Block Mode.

c. Key Tone and Black Mode.

d. Bit Rate and Key Tone.

52. After pushing the COMPUTE switch during a mission and the display window displays *RANGE ERROR*, what is the correction?

a. End the mission.

b. Clear the MET.

c. Verify AMMO menu.

d. Enter a higher charge and recompute.

53. When receiving an FR from a DMD or over the radio, the display window displays SAFETY VIOLATION. What corrective action should be taken?

a. Recompute.

b. Send an MTO.

c. Send a CMD message.

d. Clear out safety diagram.

54. Which FM or TM is used when performing a PMCS on the MBC?

a. FM 23-90.

b. TM 9-1350-261-10.

c. TM 9-1300-257-10.

d. TM 9-1220-246-12&P.

55. After entering safety data into the MBC, the need for safetyT's is no longer warranted.

TRUE FALSE

Section V
PLOTHNG BOARDS

F-21. SITUATION A

You are going to the firing range. The platoon leader goes to range control and gets the safety information. Using the information below, construct a safety diagram.

TASK: Construct a safety diagram on the M16 plotting board.

CONDITIONS: Given an M16 plotting board, right and left limit azimuths, minimum and maximum ranges, type of weapon, firing point with either 8 or 10-digit grid coordinates, charge zones, and firing table.

STANDARD: Convert left and right limits to deflections, and minimum and maximum ranges to elevations. Construct a diagram on an M16 plotting board without error.

Mortar grid: 06406580
Left limit azimuth: 4800
Right limit azimuth: 5600
Maximum range: 4,000
Minimum range: 500
Charge zone: 2 – 8
Referred deflection: 2800

56. What are the left and right deflections?

	LEFT DEF (mils)	RIGHT DEF (mils)
(a)	2400	1200
(b)	4800	5600
(c)	2800	2400
(d)	3200	2400

57. What is the minimum elevation (mils that can be fired at the maximum range)?

(a) 0941 mils (b) 1471 mils
(c) 0907 mils (d) 1428 mils

F-22. SITUATION B

You move out to the field. The platoon leader determines an eight-digit grid and an altitude to the mortar position. He instructs you to construct a modified-observed firing chart.

TASK: Prepare a plotting board for operation using the modified-observed firing chart.

CONDITIONS: Given an M16 plotting board, 1:50,000 map, mil protractor, area of responsibility, a direction of fire (DOF), an eight-digit coordinate to the mortar position, target or registration point (RP), and a grid intersection to represent the pivot point.

STANDARD: Superimpose a grid system on the M16 plotting board using the grid intersection given without error.

TASK: Forward plot a target to the modified-observed chart from an observed chart.

CONDITIONS: Given an M16 plotting board, data sheet with previously fired targets, setup data, computer's record, call for fire, and firing table.

STANDARDS: Plot the target, compute the firing data to within 1 mil with a 10-mil tolerance for deflection and 25 meters for range with a 25-meter tolerance, and record and update firing records without error.

Mortar grid: 07506539 — Altitude: 440 meters
OP No. 1: 096660 — Altitude: 450 meters
Direction of fire: 2020 mils
Grid intersection: 09/64
Mounting azimuth: 2000 mils
Referred deflection: 4800 mils
Forward plot AC070 — Chart deflection: 4536 mils
Chart range: 2,950 meters
Altitude: 440 meters

The section leader receives a call for fire and checks the map. He then hands you the call for fire in Figure F-18 and instructs you to compute the mission.

TASK: Compute data for a grid mission using the call for fire and FDC order in Figure F-18.

CONDITIONS: Given an M16 plotting board, sector of fire, 1:50,000 map, protractor, computer's record, tabular firing tables, call for fire for a grid mission, FO corrections, paper, and pencil.

STANDARD: Determine the deflection to within 1 mil with a 10-mil tolerance and the range to within 25 meters with a 25-meter tolerance.

TASK: Determine the vertical interval (VI) between the mortar altitude and the target altitude.

CONDITIONS: Given the mortar altitude and the target altitude.

STANDARD: Determine the VI to the nearest whole meter and the range correction to apply without error.

TASK: Determine VI to the nearest whole meter and the range correction to apply without error.

CONDITIONS: Given an M16 plotting board, altitude of the mortar position, call for fire with the target altitude, and a firing table.

STANDARDS:

a. Apply the VI correction without error when computing a mission.

b. Record and update firing records.

c. Determine deflections to the nearest 1 mil with a 10-mil tolerance.

d. Determine the range to within 25 meters with a 25-meter tolerance.

e. Convert the range to the correct charge and elevation.

TASK: Compute angle T.

CONDITIONS: Given the observer to target (OT) direction, direction of fire (GT), No. 2 pencil, and paper.

STANDARDS:

a. Determine the angle T to the nearest 1 mil.

b. Record the angle T to the nearest 10 mils.

c. Send the angle T to the nearest 100 mils to the FO.

d. Notify the FO in the message to observer (MTO) when the angle T exceeds 500 mils.

COMPUTER'S RECORD
For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			H51	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT ☐ IMMEDIATE SUPPRESSION	SHIFT FROM:	POLAR:
GRID: 098 654	OT DIRECTION: ALTITUDE:	OT DIRECTION: ALTITUDE:
OT DIRECTION: 1800	☐ LEFT / ☐ RIGHT	DISTANCE:
ALTITUDE: 490	☐ ADD / ☐ DROP	☐ UP / ☐ DOWN
	☐ UP / ☐ DOWN	VERTICAL ANGLE ☐ + / ☐ −
TARGET DESCRIPTION: ENY DEF POS		METHOD OF CONTROL:
METHOD OF ENGAGEMENT:		MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ #2	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ 1 Rd	☐ L ☐ R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	VI/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE HEQ	☐ + ☐ −		
	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE 2 Rds	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE W/R	ANGLE T		

Figure F-18. Situation B – first mission.

58. What is the initial chart deflection?

(a) 3205 mils (b) 5205 mils

(c) 2800 mils (d) 0700 mils

59. What is the command range to fire the first round? (The chart range is 2,300 meters.)

(a) 2,300 meters (b) 2,325 meters

(c) 2,375 meters (d) 2,275 meters

NOTE: The FO spots the first round and sends these corrections: RIGHT DROP 50, FFE; OT direction 1800.

60. What is the correct subsequent fire command?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)		2 Rds	5365	2450 / 4		0840
(b)	Sec	2 Rds	5140	2250		1002
(c)	Sec	2 Rds	5382	2450		0840
(d)		2 Rds	5140	2250		1002

NOTE: The rounds are fired and the FO sends EOM. Update and mark as target AC071.

You receive the call for fire in Figure F-19, page F-54, and see that it is in your area of operations. You are instructed to compute the mission.

TASK: Compute data for a grid mission using the call for fire and FDC order in Figure F-19, page F-54.

CONDITIONS: Given an M16 plotting board, sector of fire, 1:50,000 map, protractor, computer's record, tabular firing tables, call for fire for a grid mission, FO corrections, paper, and No. 2 pencil.

STANDARD: Determine deflection to within 1 mil with a 10-mil tolerance and range to within 25 meters with a 25-meter tolerance.

TASK: Determine the vertical interval (VI) between the mortar altitude and the target altitude.

CONDITIONS: Given the mortar altitude and target altitude.

STANDARD: Determine the VI to the nearest whole meter and the range correction to apply without error.

TASK: Determine VI and the correction to apply when computing a mission using the M16 plotting board.

CONDITIONS: Given an M16 plotting board, altitude of the mortar position, call for fire with the target altitude, and firing table.

STANDARDS:

a. Apply the VI correction without error when computing a mission.

b. Record and update firing records.

c. Determine deflections to the nearest 1 mil with a 10-mil tolerance.

d. Determine the range to within 25 meters with a 25-meter tolerance.

e. Convert range to the correct charge and elevation.

TASK: Compute angle T.

CONDITIONS: Given the observer-target (OT) direction, direction of fire (GT), No. 2 pencil, and paper.

STANDARDS:

a. Determine the angle T to the nearest 1 mil.

b. Record the angle T to the nearest 10 mils.

c. Send the angle T to the nearest 100 mils to the FO.

d. Notify the FO in the message to observer (MTO) when the angle T exceeds 500 mils.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			H51	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: 115 648
OT DIRECTION: 1900
ALTITUDE: 490

SHIFT FROM: ______
OT DIRECTION: ______ ALTITUDE: ______
☐ LEFT / ☐ RIGHT ______
☐ ADD / ☐ DROP ______
☐ UP / ☐ DOWN ______

POLAR:
OT DIRECTION: ______ ALTITUDE: ______
DISTANCE: ______
☐ UP / ☐ DOWN ______
VERTICAL ANGLE ☐ + / ☐ − ______

TARGET DESCRIPTION: Bunkers
METHOD OF CONTROL:
METHOD OF ENGAGEMENT: HED in FFE
MESSAGE TO OBSERVER:

Figure F-19. Situation B – second mission.

61. What is the FDC order?

(a)

FDC ORDER	
MORTAR TO FFE	Sec
MORTAR TO ADJ	
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	W/R

(b)

FDC ORDER	
MORTAR TO FFE	Sec
MORTAR TO ADJ	#2
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	W/R

(c)

FDC ORDER	
MORTAR TO FFE	Sec
MORTAR TO ADJ	
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ in ADJ
HED in FFE	
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	W/R

(d)

FDC ORDER	
MORTAR TO FFE	Sec
MORTAR TO ADJ	#2
METHOD OF ADJ	1 Rd
BASIS FOR CORRECTION	
SHEAF CORRECTION	
SHELL AND FUZE	HEQ in ADJ
HED in FFE	
METHOD OF FFE	3 Rds
RANGE LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	W/R

You are handed the call for fire and FDC order in Figure F-20 and are instructed to compute the mission.

TASK: Compute data for a shift mission using a plotting board.

CONDITIONS: Given a plotting board, computer's record, firing table, call for fire for a shift mission, and FO corrections.

STANDARD: Determine deflection to within 1 mil with a 10-mil tolerance and range to within 25 meters with a 25-meter tolerance.

COMPUTER'S RECORD
For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			H51	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID:
OT DIRECTION:
ALTITUDE:

SHIFT FROM: AC 070
OT DIRECTION: 2000 ALTITUDE:
☑ LEFT / ☐ RIGHT 300
☐ ADD / ☑ DROP 500
☐ UP / ☑ DOWN 50

POLAR:
OT DIRECTION: ALTITUDE:
DISTANCE:
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: M G Position
METHOD OF ENGAGEMENT:
METHOD OF CONTROL:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ #2	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE	
METHOD OF ADJ 1 Rd			
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION Conv #2	VI/ALT CORRECTION: ☐ + ☐ −	METHOD OF FIRE	
SHELL AND FUZE HEQ			
	RANGE CORRECTION: ☐ + ☐ −	DEFLECTION	
METHOD OF FFE 2 Rds		CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE W/R	ANGLE T		

Figure F-20. Situation B – third mission.

62. What is the initial deflection?

(a) 4606 mils | (b) 4994 mils
(b) 4800 mils | (d) 4660 mils

63. The initial chart range is 2,375 meters. What is the command range?

(a) 2,325 meters | (b) 2,350 meters
(c) 2,375 meters | (d) 2,400 meters

NOTE: The FO spots the first round and sends this correction: ADD 50, FFE.

64. What is the final deflection for the adjusting mortar?

(a) 4999 mils | (b) 4805 mils
(c) 4665 mils | (d) 4611 mils

NOTE: The adjusted chart range is 2,450 meters.

65. What is the deflection for No. 3?

(a) 4627 mils | (b) 4611 mils
(c) 4595 mils | (d) 4665 mils

NOTE: The FO sends EOM. Mark as target AC073.

You receive the call for fire, check the map, and issue the FDC order to the computers. Using the call for fire and FDC order in Figure F-21, compute the mission.

TASK: Compute data for a polar mission using a plotting board.

CONDITIONS: Given an M16 plotting board prepared for operation to include the mortar position, reference points, and FO positions plotted; firing tables; computer's record; call for fire using the polar method of target location; and subsequent corrections.

STANDARDS: Determine deflection to the nearest 1 mil with a 10-mil tolerance, determine range to 25 meters with a 25-meter tolerance, and convert range to the correct charge and elevation.

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			H51	

- [x] ADJUST FIRE - [ ] FIRE FOR EFFECT
- [ ] IMMEDIATE SUPPRESSION

GRID:
OT DIRECTION:
ALTITUDE:

SHIFT FROM:
OT DIRECTION: ALTITUDE:
☐ LEFT / ☐ RIGHT
☐ ADD / ☐ DROP
☐ UP / ☐ DOWN

POLAR:
OT DIRECTION: 2200 ALTITUDE:
DISTANCE: 1500
☐ UP / ☐ DOWN
VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: 3 Stalled Tanks
METHOD OF CONTROL:
METHOD OF ENGAGEMENT:
MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ 1 Rd	☐ L ☐ R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	WALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE HEQ in ADJ	☐ + ☐ −		
HEQ/WP in FFE	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE 2 HEQ/2 WP	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE W/R	ANGLE T		

Figure F-21. Situation B – fourth mission.

66. What is the correct initial fire command?

(a)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HEQ
MORTAR TO FIRE ..... #2
METHOD OF FIRE ..... 1 RD
2 HEQ/2 WP in FFE
DEFLECTION 5131
CHARGE 6
TIME SETTING .....
ELEVATION 0886

(b)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HEQ
MORTAR TO FIRE .....
METHOD OF FIRE ..... 1 Rd
2 HEQ/2 WP in FFE
DEFLECTION 5269
CHARGE 6
TIME SETTING .....
ELEVATION 0886

(c)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HEQ
MORTAR TO FIRE .....
METHOD OF FIRE ..... 1 Rd
2 HEQ/2 WP in FFE
DEFLECTION 5131
CHARGE 6
TIME SETTING .....
ELEVATION 0839

(d)

INITIAL FIRE COMMAND

MORTAR TO FOLLOW ..... Sec
SHELL AND FUZE ..... HEQ
MORTAR TO FIRE ..... #2
METHOD OF FIRE ..... 1 Rd
2 HEQ/2 WP in FFE
DEFLECTION 5269
CHARGE 6
TIME SETTING .....
ELEVATION 0839

NOTE: The FO spots the first round and sends: DROP 50, FFE.

67. WhaT is the correct subsequent fire command?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	2HEQ 2WP	5260			0839
(b)		2HEQ 2WP	5140			0886
(c)	Sec	2HEQ 2WP	5140			0839
(d)		2HEQ 2WP	5260			0886

NOTE: The FO sends: EOM.

F-23. SITUATION C

Your platoon is moving to a defensive position for a few days. Your platoon leader has the site surveyed. He then instructs you to set up a surveyed firing chart and to conduct a coordinated registration. Using the information below, construct a surveyed chart. Using the information in Figure F-22, conduct the registration mission.

TASK: Construct a surveyed firing chart.

CONDITIONS: Given an M16 plotting board, a grid intersection to represent the pivot point, a surveyed mortar position, a surveyed registration point, and a referred deflection.

STNDARDS: Determine the direction of fire to the nearest mil, determine the mounting azimuth to the nearest 50 mils and superimpose the deflection scale without error.

TASK: Compute data for a registration mission using a plotting board.

CONDITIONS: Given an M16 plotting board, surveyed mortar position, and surveyed registration point.

STANDARDS:

a. Determine the deflection to within 1 mil with a 10-mil tolerance.

b. Determine the range to within 25 meters with a 25-meter tolerance.

c. Convert the range to the correct charge and elevation without error.

Mortar grid: 06726544 Altitude: 450 meters
RP No. 1 grid: 09946362 Altitude: 400 meters
Referred deflection: 3800 mils
Grid intersection: 08/64

68. What is the direction of fire?

(a) 2270 mils (b) 2130 mils

(c) 3800 mils (d) 2170 mils

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			H51	

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID: ______
OT DIRECTION: 2350
ALTITUDE: ______

SHIFT FROM: ______
OT DIRECTION: ______ ALTITUDE: ______
☐ LEFT / ☐ RIGHT ______
☐ ADD / ☐ DROP ______
☐ UP / ☐ DOWN ______

POLAR:
OT DIRECTION: ______ ALTITUDE: ______
DISTANCE: ______
☐ UP / ☐ DOWN ______
VERTICAL ANGLE ☐ + / ☐ − ______

TARGET DESCRIPTION:
METHOD OF CONTROL:
METHOD OF ENGAGEMENT:
MESSAGE TO OBSERVER: Register RP

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ: #2	DEFLECTION CORRECTION:	SHELL AND FUZE	
METHOD OF ADJ: 1 Rd	☐ L ☐ R		
BASIS FOR CORRECTION	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	VI/ALT CORRECTION:	METHOD OF FIRE	
SHELL AND FUZE: HEQ	☐ + ☐ −		
	RANGE CORRECTION:	DEFLECTION	
METHOD OF FFE	☐ + ☐ −	CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE: W/R	ANGLE T		

Figure F-22. Situation C – first mission.

69. What is the command deflection and command range for the first round?

	DEF (mils)	RANGE (meters)
(a)	3373	3,775
(b)	3820	3,750
(c)	3820	3,675
(d)	3773	3,625

NOTE: The FO spots thefint round and senck these corrections: LEFT 50, ADD 50.

70. What is the deflection and elevation for the second round?

	DEF (mils)	RANGE (meters)
(a)	3831	0880
(b)	3801	0839
(c)	3959	0896
(d)	3781	0862

NOTES: 1. The FO spots the second round and sends: ADD 25, EOM, REGISTRATION COMPLETE.

2. The FDC sends a message to the FO: PREPARE TO ADJUST SHEAF.

3. The FO sends: SECTION LEFT

TASK: Compute firing data for a sheaf adjustment using the plotting board.

CONDITIONS: Given an M16 plotting board, an active registration mission, FO corrections for sheaf adjustments, computer's record, and firing tables.

STANDARD: Determine total range correction (TRC) to apply within 25 meters range with a 25-meter tolerarice.

71. What is the correct subsequent fire command?

	SUBSEQUENT COMMANDS					
	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV
(a)	Sec	1Rd S/L #2 DNF	3830	3750		0862
(b)	Sec	1Rd S/L #2 DNF	3830	3750		0896
(c)	Sec	1 Rd	3802	3750		0880
(d)	Sec	1Rd S/L #2 DNF	3785	3750		0839

NOTES: 1. The FO makes a spotting and sends: NO. 3, RIGHT 10; NO. 1, RIGHT 20; NO. 4 ADJUSTED, EOM S/A.

2. The command range to the taqet is 3,750 meters.

72. What are the deflections for the No. 3 and No. 1 guns?

	NO. 3 DEF (mils)	NO. 1 DEF (mils)
(a)	3777	3780
(b)	3843	3840
(c)	3793	3797
(d)	3822	3825

TASK: Determine firing corrections.

CONDITIONS: Given the altitude of a mortar position and registration point (RP) in meters, chart deflection, chart range, adjusted deflection, adjusted range for the RR or a completed computer's record for a registration mission.

STANDARDS: Determine corrections to include:

a. Altitude correction to within 1 meter.

b. Range difference to the nearest 25 meters.

c. Range correction factor (RCF) to within 1 meter.

d. Deflection correction to within 1 mil.

73. The initial chart deflection was 3820 mils and the final chart deflection was 3830 mils. What is the deflection correction for RP No. 1?

(a) R10 (b) 0

(b) L10 (d) L30

74. The initial chart range was 3,700 meters and the RP was hit at a command range of 3,750 meters. What is the range correction factor (RCF)?

(a) +50 (b) +20

(c) -50 (d) +75

After updating and computing all the corrections, you receive a call for fire. The section leader hands you the call for fire and FDC order in Figure F-23 and instructs you to compute the mission.

TASK: Compute data for a shift mission using a plotting board.

CONDITIONS: Given a plotting board, computer's record, firing table, call for fire for a shift mission, and FO corrections.

STANDARD: Determine deflection to within 1 mil with a 10-mil tolerance and range to within 25 meters with a 25-meter tolerance.

TASK: Compute firing data from a surveyed firing chart for a total range correction mission using a plotting board.

CONDITIONS: Given an M16 plotting board, an RP with deflection correction and range correction factors, call for fire, computer's record, and firing tables.

STANDARD: Determine total range correction to apply within 25 meters for range with a 25-meter tolerance.

75. What is the total range correction for this mission?

(a) -25 (b) +70

(c) 3500 (d) +45

COMPUTER'S RECORD

For use of this form, see FM 23-91. The proponent agency is TRADOC.

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
			H51	

- [x] ADJUST FIRE ☐ FIRE FOR EFFECT
- ☐ IMMEDIATE SUPPRESSION

GRID:

OT DIRECTION:

ALTITUDE:

SHIFT FROM: RP #1

OT DIRECTION: ALTITUDE:

☐ LEFT / ☑ RIGHT 150

☐ ADD / ☑ DROP 200

☐ UP / ☐ DOWN

POLAR:

OT DIRECTION: ALTITUDE:

DISTANCE:

☐ UP / ☐ DOWN

VERTICAL ANGLE ☐ + / ☐ −

TARGET DESCRIPTION: Truck Park

METHOD OF ENGAGEMENT:

METHOD OF CONTROL:

MESSAGE TO OBSERVER:

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE Sec	DEFLECTION	MORTAR TO FOLLOW	
MORTAR TO ADJ	DEFLECTION CORRECTION: ☐ L ☐ R	SHELL AND FUZE	
METHOD OF ADJ 1 Rd			
BASIS FOR CORRECTION RP1	RANGE	MORTAR TO FIRE	
SHEAF CORRECTION	W/ALT CORRECTION: ☐ + ☐ −	METHOD OF FIRE	
SHELL AND FUZE HEQ in ADJ WP in FFE			
	RANGE CORRECTION: ☐ + ☐ −	DEFLECTION	
METHOD OF FFE 4 Rds		CHARGE	
RANGE LATERAL SPREAD	CHARGE/RANGE	TIME SETTING	
ZONE	AZIMUTH	ELEVATION	
TIME OF OPENING FIRE W/R	ANGLE T		

Figure F-23. Situation C – second mission.

APPENDIX G

TERRAIN MORTAR POSITIONING

To increase survivability on the battlefield, a mortar platoon section must take advantage of the natural cover and concealment afforded by the terrain and existing vegetation. Each mortar is positioned to fit the folds and vegetation of terrain without regard to the bursting diameter of the mortar's ammunition. When mortars are positioned without regard to standard formations, firing corrections (M16/M19 plotting boards) are required to obtain a standard sheaf in the target area. These corrections compensate for the terrain positioning of the mortars (Figure G-1).

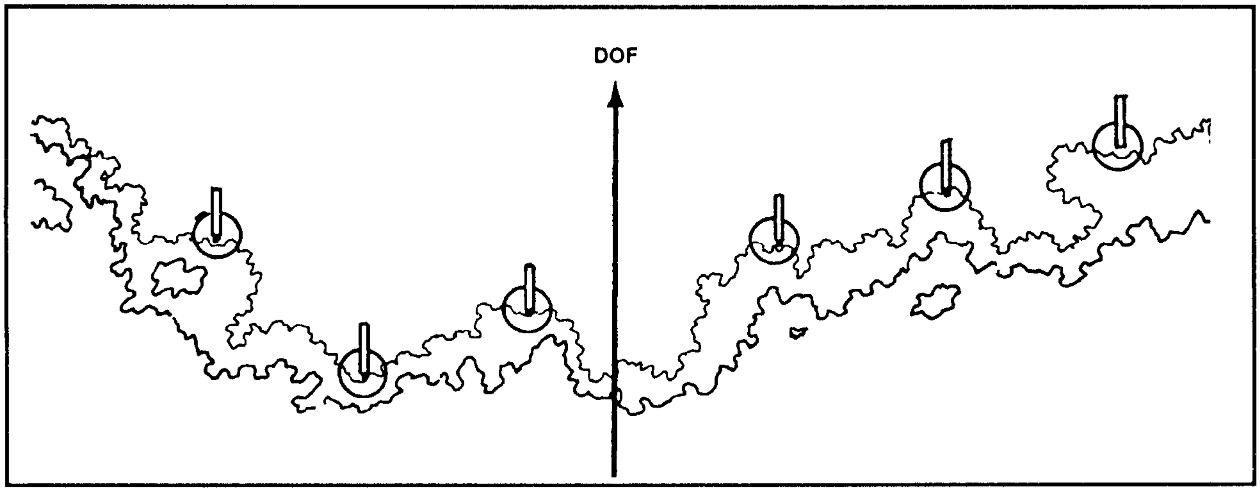


Figure G-1. Positioning of mortars with respect to terrain.

G-1. PIECE DISPLACEMENT

To determine the position corrections for each mortar, a platoon must know the relative position of the mortars in the area. Piece displacement is the number of meters the piece is forward or behind and right or left of platoon center. It is measured on a line parallel (forward or behind) and perpendicular (right or left) to the azimuth of lay (Figure G-2, page G-2). Piece displacement can be determined by estimation, pacing, or hasty traverse.

a. **Estimation Technique.** Using the estimation technique (the least desirable), the platoon leader or section chief estimates the displacement about the platoon center perpendicular to the azimuth of lay.

b. **Pacing Technique.** The pacing technique provides accuracy in small open areas but is time consuming. The lateral distance from the base piece and the distance forward or behind the base piece to each mortar must be measured.

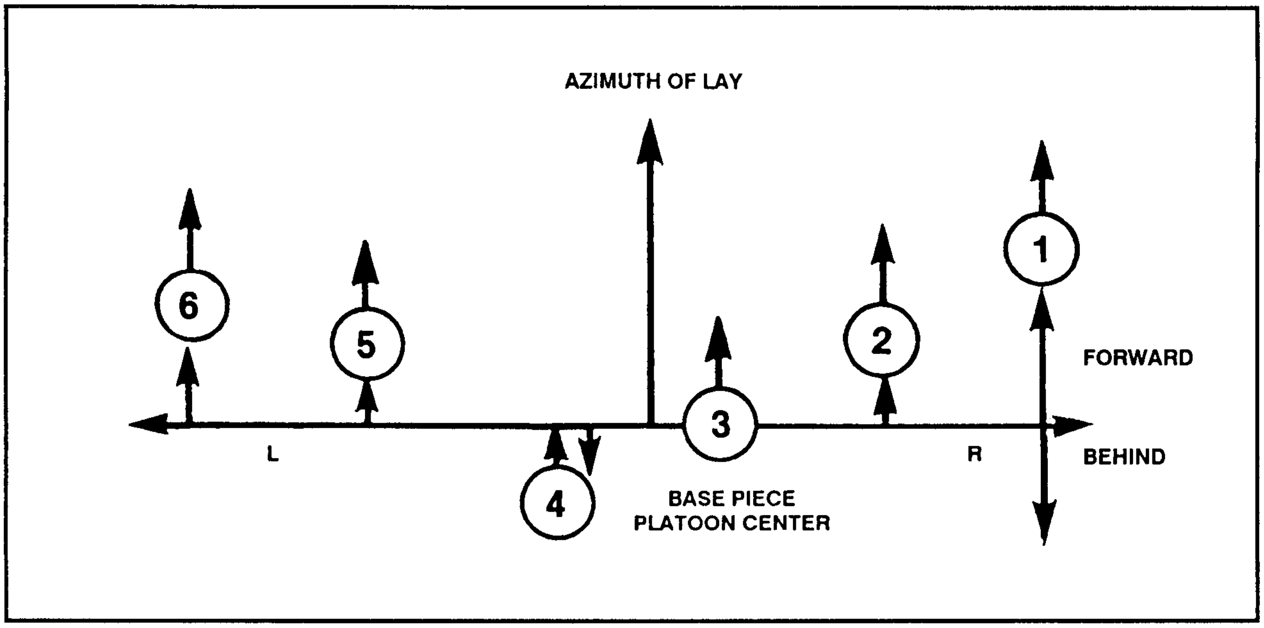


Figure G-2. Piece displacement relative to base piece.

c. **Hasty Traverse Technique.** The hasty traverse technique is the most accurate and rapid technique for determining piece displacement. The deflection and distance from each mortar to the aiming circle must be measured to plot their locations on the M16/M19 plotting board. These deflections are recorded and reported to the FDC. The distance from each mortar to the aiming circle can be determined by the following methods:

(1) *Straight-line pacing.* Each squad has one man to pace the distance from the mortar to the aiming circle. He can be guided on a straight line by the gunner sighting through the mortar sight.

(2) *Subtense bar.* When using a subtense bar for TMPC computations, a 2-meter rod is used. It is held parallel to the ground at the aiming circle location. Each gunner traverses his sight from one end to the other and records the number of mils traversed by the sight. This value is used to enter a subtense table (See Appendix C, Table C-1) to determine the number of meters between the mortar and the aiming circle. Distances up to 250 meters can be measured to within a fraction of a meter.

d. Once the deflection and distance values are known for each mortar, their locations can be plotted on the M16/M19 plotting board. The pivot point represents the location of the base piece. The location of the aiming circle is plotted in relation to the base piece. The other mortars are plotted in relation to the aiming circle.

G-2. M16/M19 PLOTTING BOARD

The computer uses the M16/M19 plotting for computing TMPCs. The grid base represents the target area. The small squares can be assigned any convenient value (10 meters is recommended). The arrow and center line on the base represent the direction of fire. The vernier scale is used to help determine azimuths and deflections.

a. To prepare the base for use in computing TMPCs, the computer draws a series of lines parallel to the centerline representing the burst lines for each mortar. The center line, running through the pivot point, is the burst line for the base piece. The remaining burst lines are constructed left and right of the center line by letting each small square equal 10 meters and drawing the burst lines parallel to the center line. The distance between burst lines is equal to the bursting diameter of the mortar systems' HE ammunition. For the M224 mortar, the distance is 30 meters; for the M29A1 mortar, the distance is 35 meters; for the M252 and M30 mortars, the distance is 40 meters; and for the M120, the distance is 60 meters. A burst line is drawn for each mortar in the platoon or section (Figure G-3).

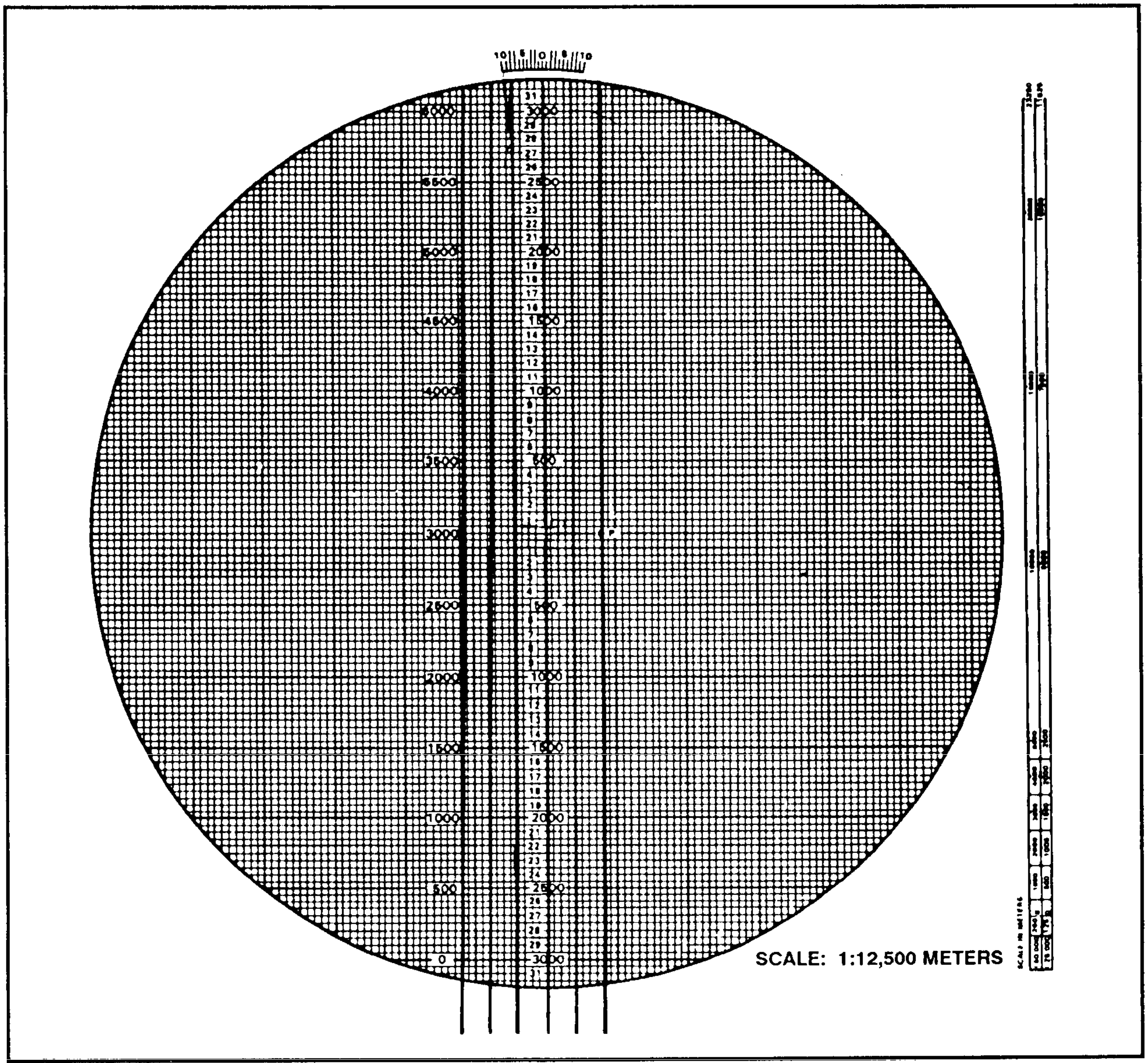


Figure G-3. Burst lines for a six-mortar 4.2-inch mortar platoon.

b. The clear rotating disk of the plotting board is used to plot the location of each mortar. The disk has an azimuth scale around the outside edge; a temporary lay deflection scale must be superimposed on the disk. The lay deflection scale increases from left to right as does the azimuth scale. Deflection 3200 always corresponds to the azimuth of lay when determining piece displacement (Figures G-4a to G-4d). Once superimposed, the lay deflection scale is used to plot the location of the aiming circle and the mortars as shown in the following steps.

EXAMPLE

Given: Azimuth of lay is 6400 mils.

The deflection and distances from the aiming circle to each mortar are:

Mortar	Deflection (mils)	Distance (meters)
No. 1	800	200
No. 2	1900	135
No. 3 (Base Piece)	2400	95 (Figure G-4a)
No. 4	2950	120
No. 5	3400	140
No. 6	3950	115

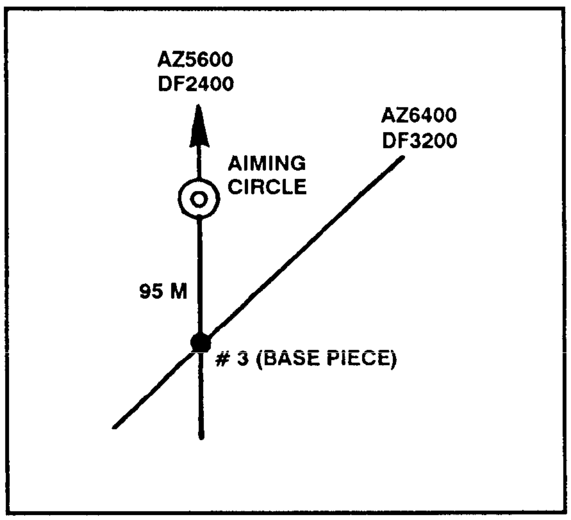


Figure G-4a. Determination of piece displacement.

Step 1. Index the lay deflection from the aiming circle to No. 1 (1800 mils over the center line arrow).

Step 2. Count 200 meters parallel to the center line down from the aiming circle. Place a circled dot there and label it No. 1. (Figure G-4b.)

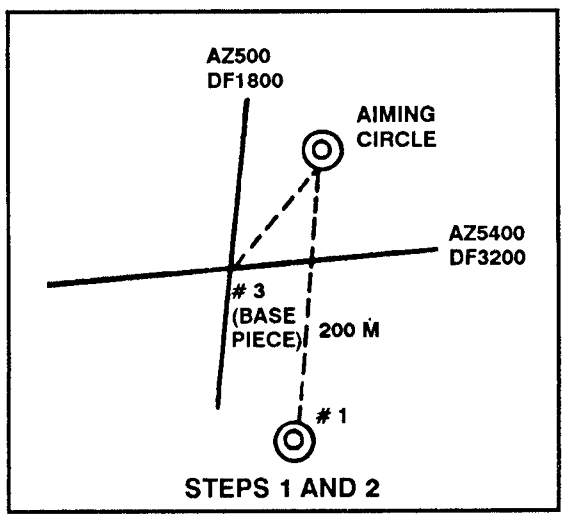


Figure G-4b. Determination of piece displacement (continued).

Step 3. Index the lay deflection from the aiming circle to No, 2 (1900 mils over the center line arrow). (Figure G-4c).

Step 4. Count 135 meters parallel to the center line down from the aiming circle. Place a circled dot there and label it No. 2.

Step 5. Index the lay deflection from the aiming circle to the No. 4 (2950 mils over the center line arrow).

Step 6. Count 120 meters parallel to the center line down from the aiming circle. Place a circled dot there and label it No. 4.

Step 7. Follow the same procedures to plot No. 5 and No. 6. (Figure G-4d.)

NOTE: Once all mortar locations are plotted, erase the temporary lay deflection scale and superimpose a referred deflection scale as performed when setting up the M16/M19 plotting board. For example, if the referred deflection is 2800, the referred deflection scale is superimposed on the disk beginning with 2800 corresponding with the azimuth of lay. The deflection increases to the left and decreases to the right.

Step 8. Index the azimuth of lay (6400 mils over the center line arrow) and read the displacement of each mortar right/left and forward/behind the base piece.

ANSWERS

Mortar	*Displacement*	
No. 1	130R	30F
No. 2	60R	30F
No. 3 (Base Piece)		—
No. 4	40R	45B
No. 5	95L	70B
No. 6	145L	15B

(R- right; L-left; F-forward; B-behind)

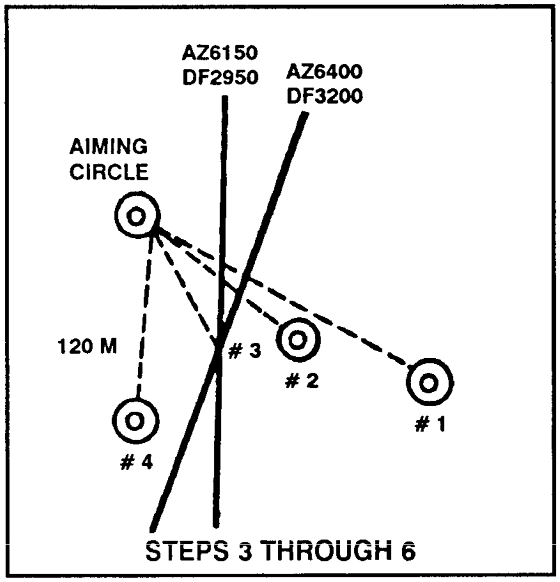


Figure G-4c. Determination of piece displacement (continued).

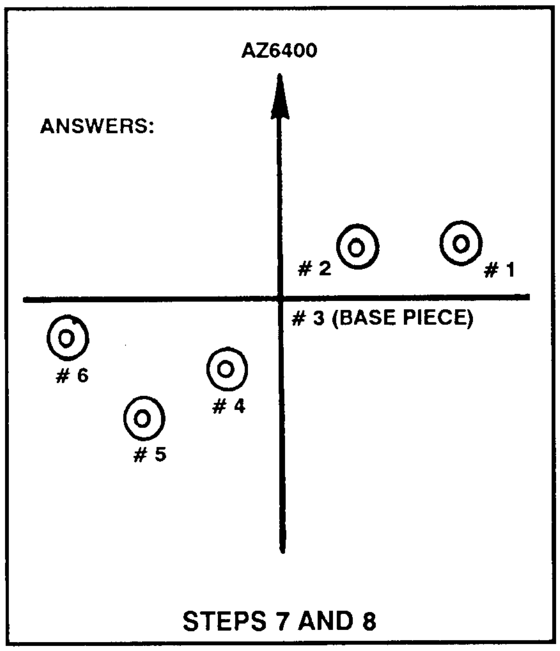


Figure G-4d. Determination of piece displacement (continued).

c. TMPCs are computed before occupation of a position by the mortars when possible, but they can be computed after occupation. They are applied to each mortar's firing data to achieve standard sheafs in the target area. The TMPCs are computed and applied whenever the mortar platoon occupies a position that is wider than the width of the mortar system's sheaf or deeper than the bursting diameter of its HE ammunition,

d. TheTMPCs are most accurate at the range and direction for which they were computed. They are considered valid 2,000 meters over and short of the center range and 200 mils left and right of the center azimuth of the sector (Figure G-5).

(1) The TMPCs provide acceptable sheafs on targets as long as the platoon position is within the dimension parameters below:

Six guns – 400 meters wide by 200 meters deep.

Four guns -250 meters wide by 200 meters deep.

Three guns – 200 meters wide by 100 meters deep.

Two guns – 100 meters wide by 100 meters deep.

(2) The box formed by the dimension parameters is centered over the platoon and oriented perpendicular to the azimuth of lay. If the platoon is spread out more than indicated dimensions, a degradation in the effectiveness of sheafs can be expected as fires are shifted throughout the sector away from the center range and deflection (Figure G-6).

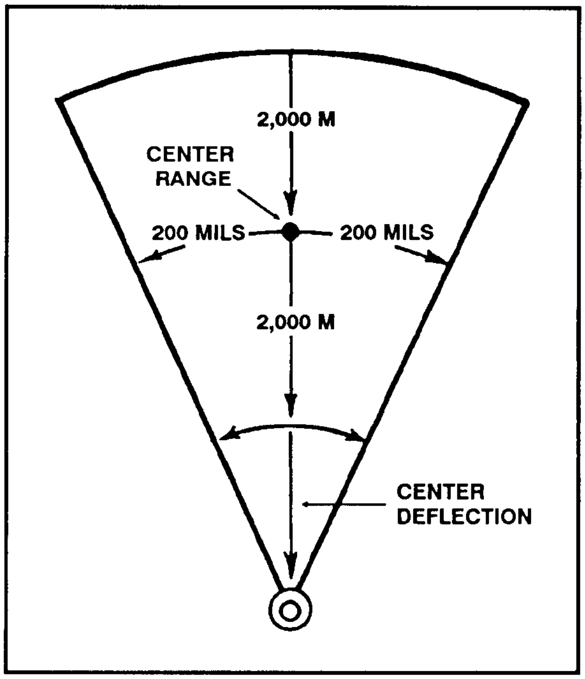


Figure G-5. Transfer limits of TMPCs.

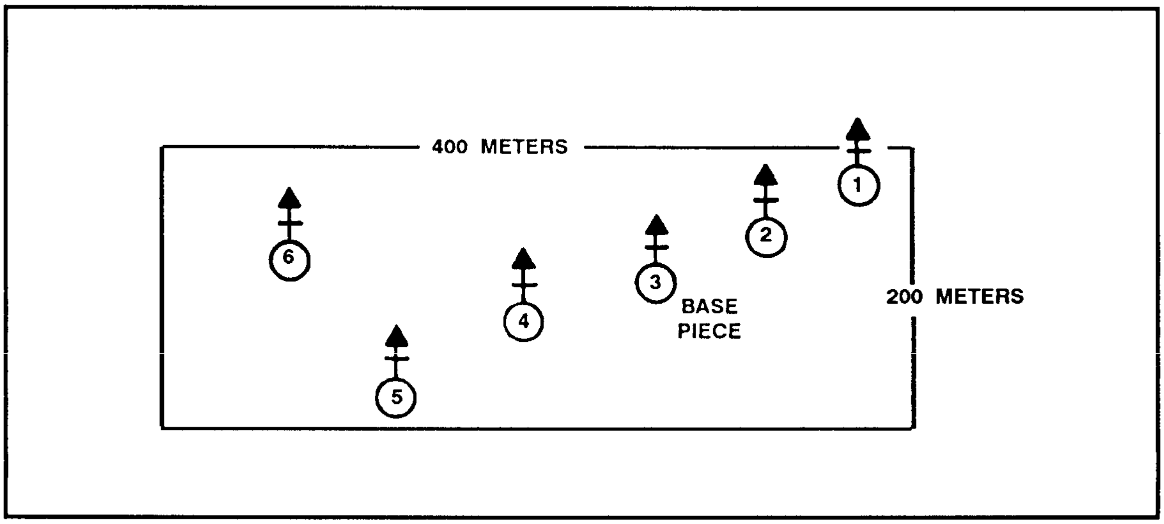


Figure G-6. Dimension parameters for six-mortar platoon.

(3) Since a mortar unit's area of responsibility covers an area larger than the TMPC limits, TMPCs should be computed for three sectors: primary, left, and right.

Sectors can also be computed for shorter or longer ranges to provide valid corrections throughout the mortar systems available range.

(4) When using TMPCs, the platoon leader must establish an SOP directing that primary TMPC sector data are used unless otherwise indicated. If other than the primary sector is to be used, it is indicated in the corrections to apply in the FDC order or immediately following the announcement of MORTAR TO FOLLOW in the initial fire command:

EXAMPLE

SECTION, LEFT SECTOR, HIGH-EXPLOSIVE PROXIMITY, DEFLECTION. . . .

NOTE: The absence of any instruction concerning TMPCs in the initial fire command indicates that corrections for the primary sector will be fired. The command, CANCEL TERRAIN CORRECTIONS indicates that no TMPCs are to be used for that mission.

G-3. DETERMINATION OF TMPCs

Before the TMPC can be computed, the piece displacement for each mortar must be plotted on the M16/M19 plotting board from a hasty traverse, when possible.

a. If it is not and piece displacement relative to the azimuth of lay is known, the following method is used to plot the weapons on the plotting board:

(1) Index the azimuth of lay on the plotting board.

(2) Plot the mortars right/left and forward/behind the platoon center (base piece).

(3) After piece displacement (for a given azimuth of lay) has been determined and plotted, compute corrections for a TMPC sector on the terrain mortar position or special correction worksheet.

NOTE: The TMPC worksheet can also be used to compute individual gun corrections for special missions such as attitude missions.

(4) TMPC computations are performed in a step-by-step format on the worksheet. The data required for the computations are as follows:

- Piece displacement.
- Center range and deflection to sector.
- Charge (60/81/120 mm) or elevation (4.2-inch) to center range.

(5) An example of a computation of TMPCs using DA Form 5424-R (Terrain Mortar Position/Special Corrections Worksheet) is as follows (Figure G-7, page G-8):

(a) A six-gun mortar platoon firing from the same location is laid on an azimuth of 6400 mils.

(b) Referred deflection is 2800 mils.

(c) Center range is 4,500 meters.

(d) The information below is provided to the FDC:

Mortar	*Displacement Relative to Azimuth of Lay*		
No. 1	130R	30F	R – right
No. 2	60R	30F	L – left
No. 3 (Base Piece)	–	–	F – forward
No. 4	40L	45B	B – behind
No. 5	95L	70B	
No. 6	145L	15B	

TERRAIN MORTAR POSITION/SPECIAL CORRECTIONS WORKSHEET

SECTOR: LEFT (PRIMARY) RIGHT		TRANSFER LIMITS LEFT	CENTER	RIGHT		CHARGE OR ELEVATION 0800
CENTER DEFLECTION + 200m	DF	3000	2800	2600	DF	CENTER DEFLECTION - 200m
CENTER RANGE + 2000M	RG	2500 (MAXIMUM)	4500	6500 (MINIMUM)	RG	CENTER RANGE - 2000M

(1) MORTAR NO	(2) CORRECT TO BURST LINE NO	(3) POSITION LATERAL CORRECTION (L or R)	(4) 100/R (MIL CONVERSION TABLE) ~CENTER RANGE	(5) POSITION DEFLECTION CORRECTION (3) × (4) / 100 (L or R)	(6) POSITION RANGE CORRECTION (F = -) (B = +)	(7) CORRECTED RANGE (6) ≈ 10M PLUS CENTER RANGE	(8) FUZE SETTING ~ (7)	(9) POSITION TIME CORRECTION (8) MINUS FS ~ CENTER RANGE
		≈ 5M	≈ 1m	≈ 1m	≈ 10M	≈ 10M	0.1, FSI	0.1, FSI
1	1	L50	23	L12	-30	4470	32.5	-0.1
2	2	L20	23	L5	-30	4470	32.5	-0.1
3	3	0	23	0	0	4500	32.6	—
4	4	0	23	0	+40	4540	32.8	+0.2
5	5	R15	23	R3	+70	4570	32.9	+0.3
6	6	R25	23	R6	+20	4520	32.7	+0.1

LEGEND:
100/R - Number of mils required to move the strike of the round 100 meters for a specified range.
F - Forward
B - Behind or Back.
0.1, FSI - Fuze Setting Increment.
~ - Corresponding To
≈ To The Nearest

DA Form 5424-R, May 85

Figure G-7. Example of completed DA Form 5424-R.

(e) The transfer limits block is computed as follows:

- Circle the sector for which the corrections are to be computed, primary (P),
- Record the charge (60/81/120-mm) or the elevation (4.2-inch) used to achieve the center range (for reference purposes only).
- Record the referred deflection to the center (C) (2800), left (L) (3000), and right (R) (2600) limits of the sector.
- Record the minimum (2500), center (4500), and maximum (6500) ranges for the sector.

NOTE: See FM 7-90 for a blank reproducible copy of DA Form 5424-R.

b. Determination of TMPCs for the center sector includes the following:

(1) Index the center of sector deflections on the M16/M19 plotting board.

(2) Determine the burst line to which each mortar corrects. Record this in the correct to burst line number (block 2). When determining the proper burst line for each mortar, start with the far right mortar, in relation to the direction of fire, and correct it to the far right mortar to the second burst line. Continue by correcting the second far right mortar to the second burst line from the right. Each mortar is corrected to the nearest burst line that has not been used by another mortar.

c. Record the position lateral correction required to move each mortar to its selected burst line in column 3 to the nearest 5 meters. Record the required position range correction (the number of meters forward or behind platoon center) in column 6 to the nearest 10 meters. If the mortar is forward of platoon center, the correction is a minus; if it is behind platoon center, the correction is a plus.

d. Using the mil conversion table (deflection conversion table) (Table G-l), determine the 100/R value at the center range for the sector and record it in block 4. The largest 100/R value used is 40; if 100/R is larger than 40, enter in block 4. Now, perform the computation shown in the heading of block 5. Label the corrections L or R. The sign used in block 3 always carries to block 5. Express and record the value to the nearest mil.

RANGE	100/R	RANGE	100/R
1000	102	4100	25
1100	92	4200	24
1200	85	4300	24
1300	73	4400	23
1400	73	4500	23
1500	68	4600	23
1600	64	4700	22
1700	60	4800	22
1800	57	4900	21
1900	54	5000	21
2000	51	5100	21
2100	48	5200	20
2200	46	5300	20
2300	44	5400	19
2400	42	5500	19
2500	41	5600	19
2600	39	5700	19
2700	38	5800	18
2800	36	5900	18
2900	35	6000	18
3000	34	6100	17
3100	33	6200	17
3200	32	6300	17
3300	31	6400	17
3400	30	6500	16
3500	29	6600	16
3600	28	6700	16
3700	28	6800	16
3800	27	6900	15
3900	26	7000	15
4000	26	–	–

Table G-1. Mil (deflection) conversion.

e. In column 7, add the position range correction to the center range to obtain the corrected range. This value is used to compute the position time correction in column 9.

f. Enter the tabular firing table at the corrected range and extract the fuze setting. Record this value in column 8. Subtract the fuze setting corresponding to the center range from the value in column 8 and record the difference in column 9,

g. The values in columns 5, 6, and 9 are either sent to the guns and applied by the squad leader to the command data for each mission fired, or the FDC computes and applies the data, and it sends the corrected command data to each mortar for each mission.

G-4. APPLICATION OF TMPCs TO FIRING DATA

The position deflection correction is simply added to the deflection by the squad leader if the correction is left or subtracted if the correction is right. The position time correction for fuze M564 (4.2-inch) is added to the command fuze setting by the squad leader to obtain his fuze setting to fire,

a. To apply the position range correction, the squad leader must have a tabular firing table (TFT). He enters the TFT at the charge and elevation issued by the FDC and extracts the corresponding command range, He then adds his position range correction to the command range to determine his range to fire. He then reenters the TFT at the range to fire and extracts the charge to fire if he is a 4.2-inch squad leader or the elevation to fire if he is a 60/81/120-mm squad leader. Since the command data issued by the FDC include any corrections for vertical interval, when the position range correction is applied to the command range, corrections for vertical interval are already included.

EXAMPLE

A 4.2-inch mortar platoon is engaging a target at a range of 5,000 meters and a deflection of 2950. (The target is within the transfer limits of the primary TMPC sector.) The FDC issues the initial fire command: PLATOON, HE QUICK, NUMBER TWO GUN, TWO ROUNDS FUZE TIME, DEFLECTION TWO NINE FIVE ZERO (2950), CHARGE 35 3/8, TIME 34.7, ELEVATION ZERO EIGHT ZERO ZERO (0800)."

b. Applying TMPCs for the No. 2 mortar, the squad leader adds 4 mils to the command deflection 2950 to determine his deflection to fire (2954). To determine his charge to fire, he enters the TFT at elevation 0800 with extension and charge 35 3/8. He extracts the corresponding command range (5000) for that charge and adds his position range correction (–30) to determine his range to fire (4970). He then reenters the TFT at the range to fire and extracts the corresponding charge to fire (35 1/8). To determine his time setting to fire, the squad leader adds his position time correction (-0.1) to the command time setting (34.7) and fires a time setting of 34.6.

c. Coupled with a registration, TMPCs eliminate the need to adjust the sheaf, thereby saving ammunition and decreasing the chances of detection by enemy countermortar radar.

d. Determining TMPCs for left and right sectors is accomplished with the same procedure using the center deflection to each of the sectors. The same applies to computing TMPCs for ranges that are outside the original TMPC sectors.

NOTE: The procedures are the same for the 60/81/120-mm mortars with the exceptions mentioned.

G-5. HASTY TERRAIN POSITIONS

When the advance party cannot conduct a reconnaissance of a mortar position due to time constraints or conduct hasty occupation of a hip-shoot position, TMPCs cannot be computed before occupation of the position by the mortar crews. Therefore, a modified technique of terrain mortar positioning can be used that still allows near maximum use of the terrain to provide cover and concealment for the platoon while placing acceptable sheaves on target (Figure G-8).

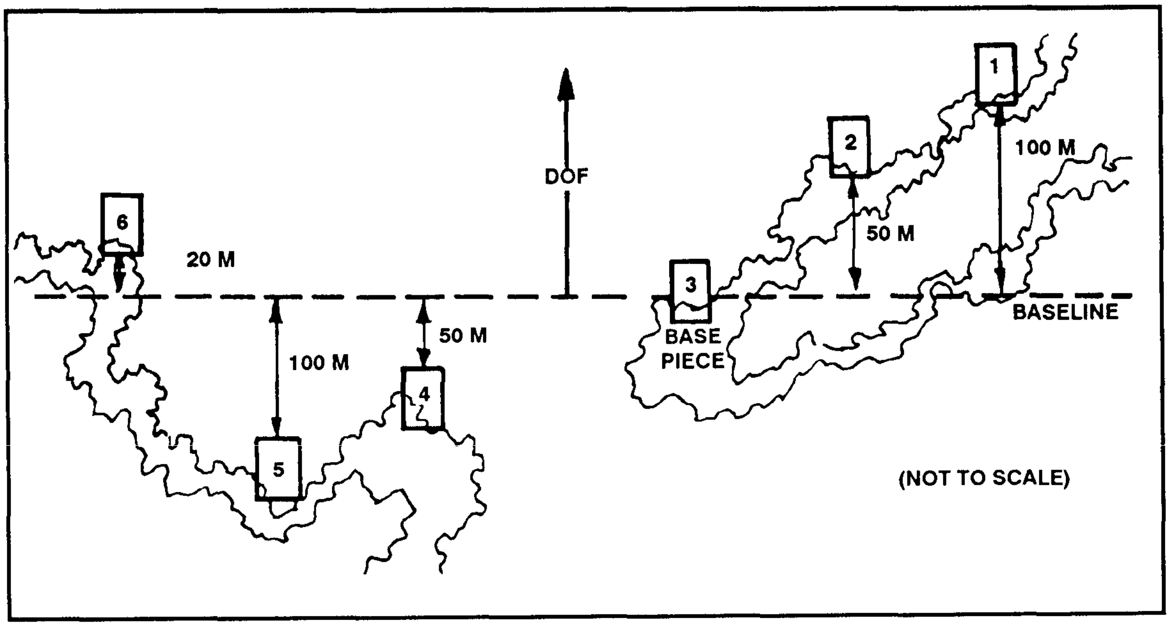


Figure G-8. Hasty positioning with respect to terrain.

a. To use the modified technique, the platoon occupies the position, conforming to the folds and tree lines of the terrain. It maintains a lateral dispersion between mortars equal to the bursting diameter of an HE round.

b. An imaginary line (base line) is drawn through the base piece perpendicular to the direction of fire (azimuth of lay). From this line, the squad leader determines the distance to his mortar. Mortars, other than the base piece, will either be on line with, forward of, or behind the basepiece. The distance from the base line can be measured by a squad member while the mortar is being laid or estimated by the squad leader. This distance is referred to as the position range correction and is recorded for future use by the squad leader. It is also given to the FDC for future use in computing TMPCs for the left and right sectors of fire. This position range correction is applied to the command data and issued by the FDC for afire mission in the same manner as described in applying normal TMPCs.

c. The modified terrain mortar positioning technique establishes TMPCs for the primary sector and allows the platoon to rapidly engage targets, upon occupation of the position, up to 200 mils left or right of the azimuth of lay and achieve an acceptable sheaf on target. As soon as time allows, the FDC must compute TMPCs for the left and right sectors using the same procedures described in computing normal TMPCs to achieve acceptable sheaves on targets in those sectors.

d. There are no position deflection corrections for the primary sector. There will be position deflection corrections for the left and right sectors. Position time corrections should be computed as quickly as possible for the primary sector if fuze M564 is to be used.

This manual is correct to 31 October 1957

*TM 9–3071–1

TECHNICAL MANUAL No. 9–3071–1 | HEADQUARTERS, DEPARTMENT OF THE ARMY WASHINGTON 25, D. C., *6 January 1958*

60-MM MORTARS M2 and M19; 60-MM MORTAR MOUNT M5; 60-MM MORTAR BASEPLATE M1; 81-MM MORTARS M1 AND M29; AND 81-MM MORTAR AND MOUNTS M4, M23A1, M23A2, AND M23A3

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*This manual supersedes that portion of TM 9–1260, 14 March 1952, pertaining to field maintenance.

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CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the use of personnel responsible for field maintenance of this materiel. They contain information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations. This manual does not contain information which is intended primarily for the using organization, since such information is available to ordnance maintenance personnel in the pertinent operator's technical manuals or field manuals.

b. This manual contains a description of and procedures for removal, disassembly, inspection, repair, and assembly of the materiel listed below—

60-mm mortar M2
60-mm mortar M19
60-mm mortar mount M5
60-mm mortar baseplate M1
81-mm mortar M1
81-mm mortar M29
81-mm mortar mount M4
81-mm mortar mounts M23A1, M23A2, and M23A3

c. The appendix contains a list of current references, including supply manuals, technical manuals, and other available publications applicable to the materiel.

d. TM 9–3064, FM 23–85, and FM 23–90 contain operating and lubricating instructions for the materiel and contain all maintenance operations allocated to using organizations in performing maintenance work within their scope.

e. This manual differs from TM 9–1260 as follows:

(1) Adds information on—
81-mm mortar mount M23A2.
81-mm mortar mount M23A3.

(2) Revises information on—
Inspection.
60-mm mortar mount M5.
81-mm mortar mount M4.

(3) Deletes reference to—
Depot maintenance.
60-mm mortar mount M2.
81-mm mortar mount M1.
81-mm mortar mount M23.

2. Field Maintenance Allocation

The publication of instructions for disassembly and repair is authority for the performance by field maintenance units of replacement and repair in accordance with allocation of maintenance parts listed in appropriate columns of the current ORD 8 supply manuals pertaining to these weapons.

3. Forms, Records, and Reports

a. General. Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining this equipment. The value of accurate records must be fully appreciated by all persons responsible for compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of materiel to be inspected, repaired, or used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of materiel in the hands of troops and for delivery of materiel requiring further repair to ordnance shops in arsenals, depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the materiel upon completion of its repair.

b. Authorized Forms. The forms generally applicable to units maintaining these weapons are listed in the appendix. For a listing of all forms, refer to DA Pam 310–2. For instructions on use of these forms, refer to FM 9–10.

c. Field Report of Accidents.

(1) *Injury to personnel or damage to materiel.* The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in SR 385–10–40. These reports are required whenever accidents involving injury to personnel or damage to materiel occur.

(2) *Ammunition.* Whenever an accident or malfunction involving the use of ammunition occurs, firing of the lot which malfunctions will be immediately discontinued. In addition to any applicable reports required in (1) above, details of the accident or malfunction will be reported as prescribed in SR 700–45–6.

d. Report of Unsatisfactory Equipment or Materials. Any deficiencies detected in the equipment covered herein which occur under the circumstances indicated in AR 700–38, should be immediately reported in accordance with the applicable instructions in cited regulation.

Section II. DESCRIPTION AND DATA

4. Description

a. The mortars are smooth-bore, muzzle-loading, high angle-of-fire weapons. The 60-mm mortar M2 and the 81-mm mortars M1 and M29 consist of a tube and base cap containing a fixed firing pin. The 60-mm mortar M19 contains a firing mechanism which can be set for either drop fire or lever fire.

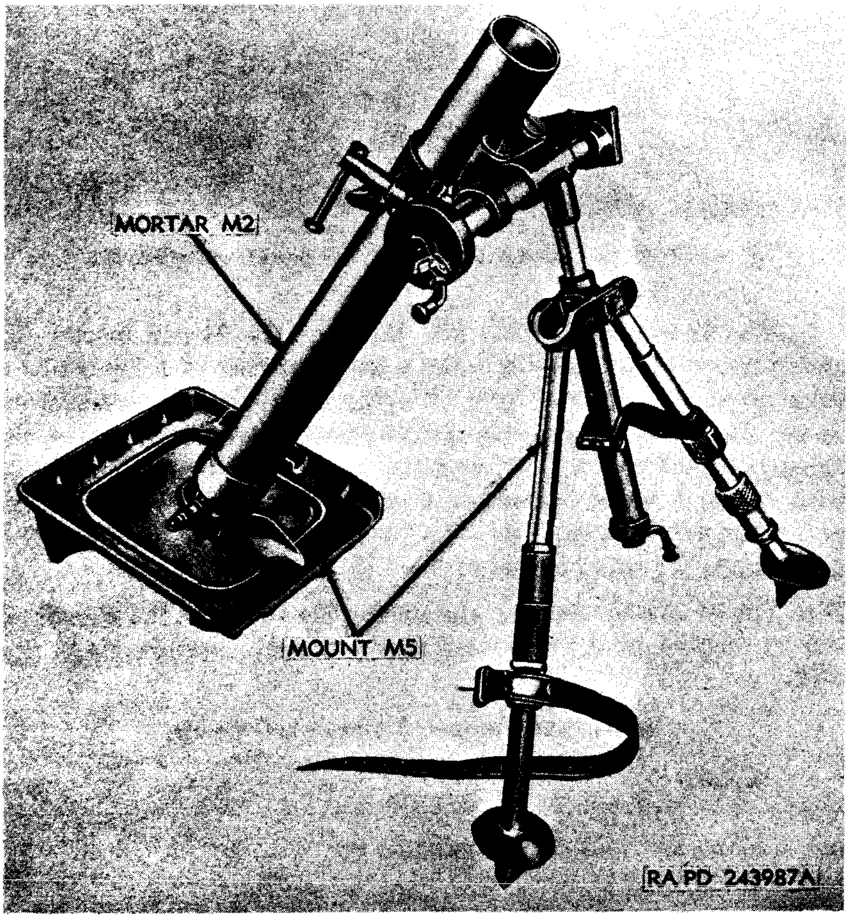

Figure 1. 60-mm mortar M2 and mount M5.

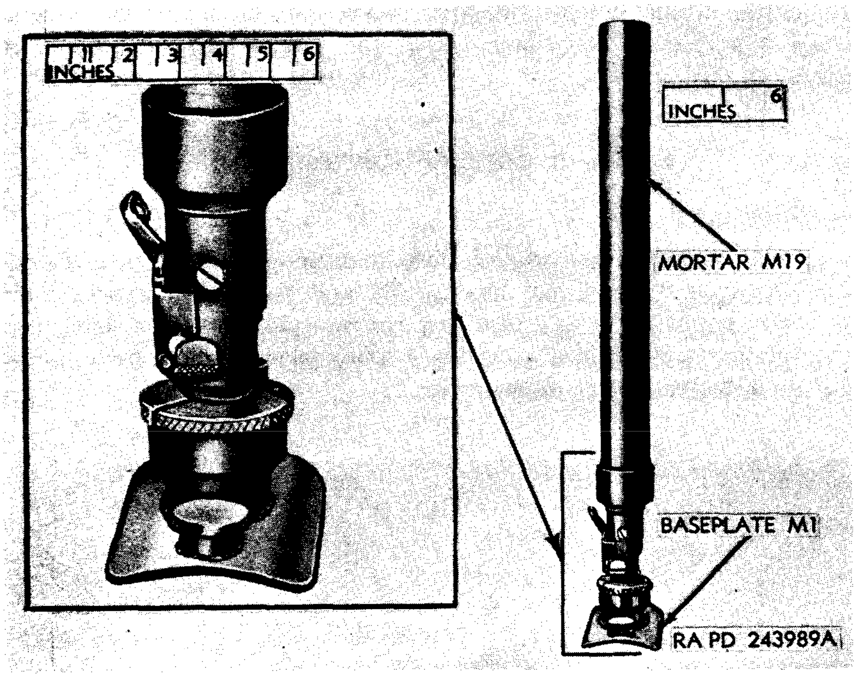

Figure 2. 60-mm mortar M19 and 60-mm mortar baseplate M1.

b. The 60-mm mortar M2 and M19 and the 81-mm mortar M1 and M29 are equipped with mounts which consist of a bipod and a yoke provided with screw-type elevating and traversing mechanisms to lay the mortar and a spring-type shock absorber to absorb the shock of recoil in firing. The 60-mm mortar M19 can be equipped with a mount M5 or secured in a suitable baseplate for the proper performance of the mortar. The various combinations of mortars and mounts are listed in table I.

c. The 81-mm mortar M1 and mount M4 (without the baseplate) can be secured in the baseplate of the mortar carriers M4A1 and M21.

Table I. Combinations of Mortars and Mounts

Mortar	Mount	Figure
60-mm mortar M2	60-mm mortar mount M5	1
60-mm mortar M19	60-mm mortar baseplate M1 60-mm mortar mount M5	2 3

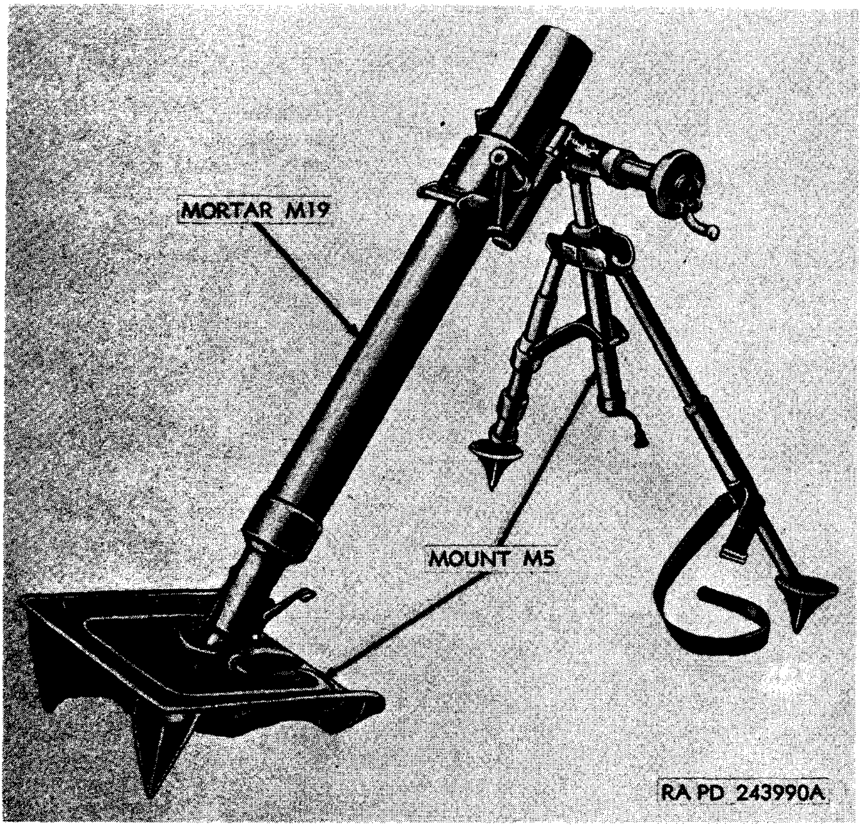

Figure 3. 60-mm mortar M19 and mount M5.

Table I—Continued

Mortar	Mount	Figure
81-mm mortar M1	31-mm mortar mount M4 81-mm mortar mount M4 without baseplate, mounted on mortar carrier M4A1 or M21.	4 6
81-mm mortar M29	81-mm mortar mount M23A1 and 81-mm mortar baseplate M23A1	5
81-mm mortar M29	81-mm mortar mount M23A2	
81-mm mortar M29	81-mm mortar mount M23A3	

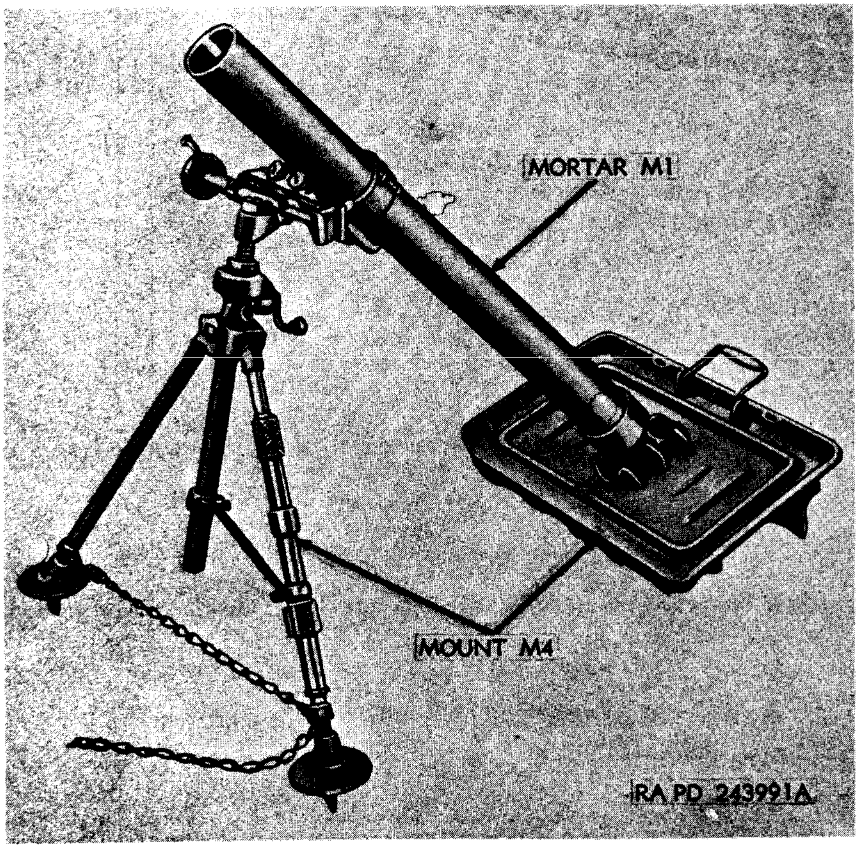

Figure 4. 81-mm mortar M1 and mount M4.

5. Differences Between Models

a. Differences Which Affect Troop Use. Refer to FM 23–85, FM 23–90, and TM 9–3064.

b. Differences Which Affect Ordnance Maintenance.

(1) The base cap of 60-mm mortar M2 is one piece with a removable firing pin; the combination base cap of 60-mm mortar M19 consists of a base cap extension and a base cap which houses a firing mechanism that can be set for either drop fire or lever fire. Some 60-mm mortars M2, upon designation by the Chief of Ordnance, are being converted to mortars M19 in accordance with MWO ORD A43–W4.

(2) The 81-mm mortar mount M4 has two compression springs in the shock absorbing mechanism while the 81-mm mortar mounts M23A1, M23A2, and M23A3 have one spring.

(3) When the 81-mortar M1 and mount M4 are used on mortar carriers, the removable baseplate of the mortar mount is

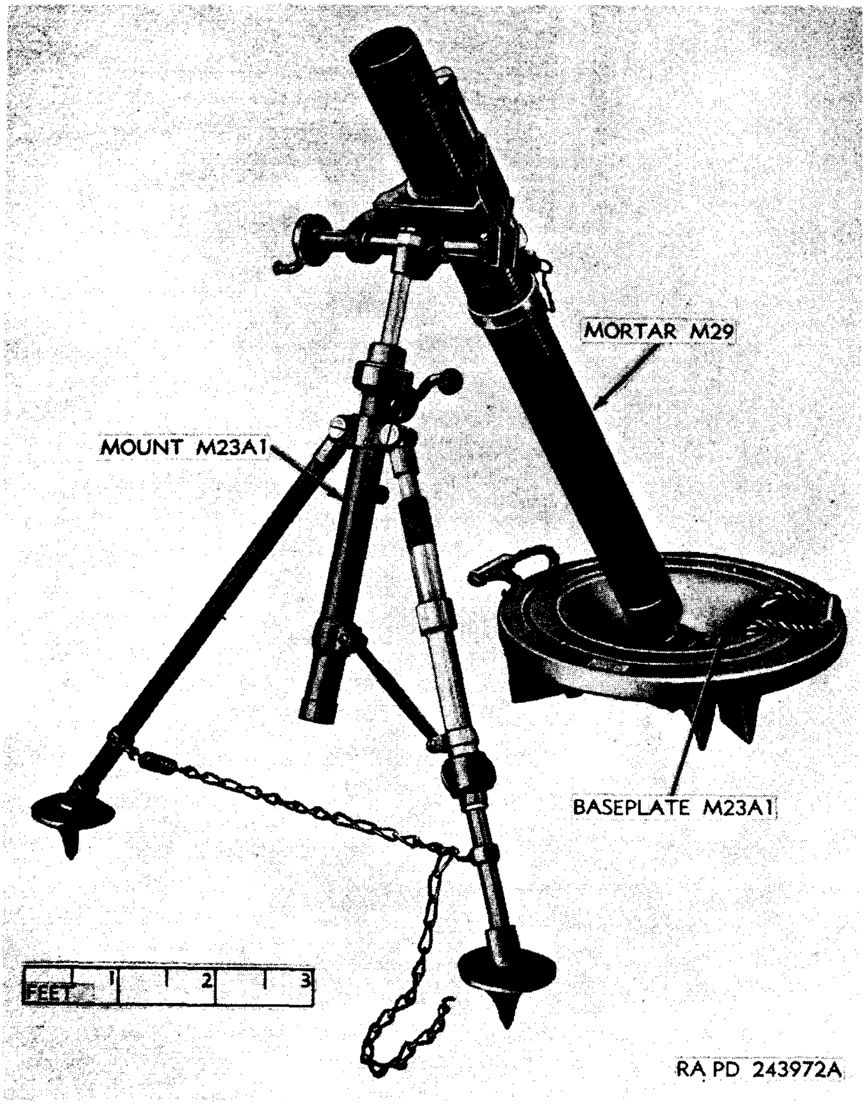

Figure 5. 81-mm mortar M29, mount M23A1, and baseplate M23A1.

replaced with a fixed baseplate which is a component of the vehicle body.

(4) The mount M23A2 is identical with the mount M23A1 except that it is provided with a one-piece titanium baseplate.

(5) The mount M23A3 is identical with the mount M23A1 except that it is provided with a one-piece aluminum baseplate.

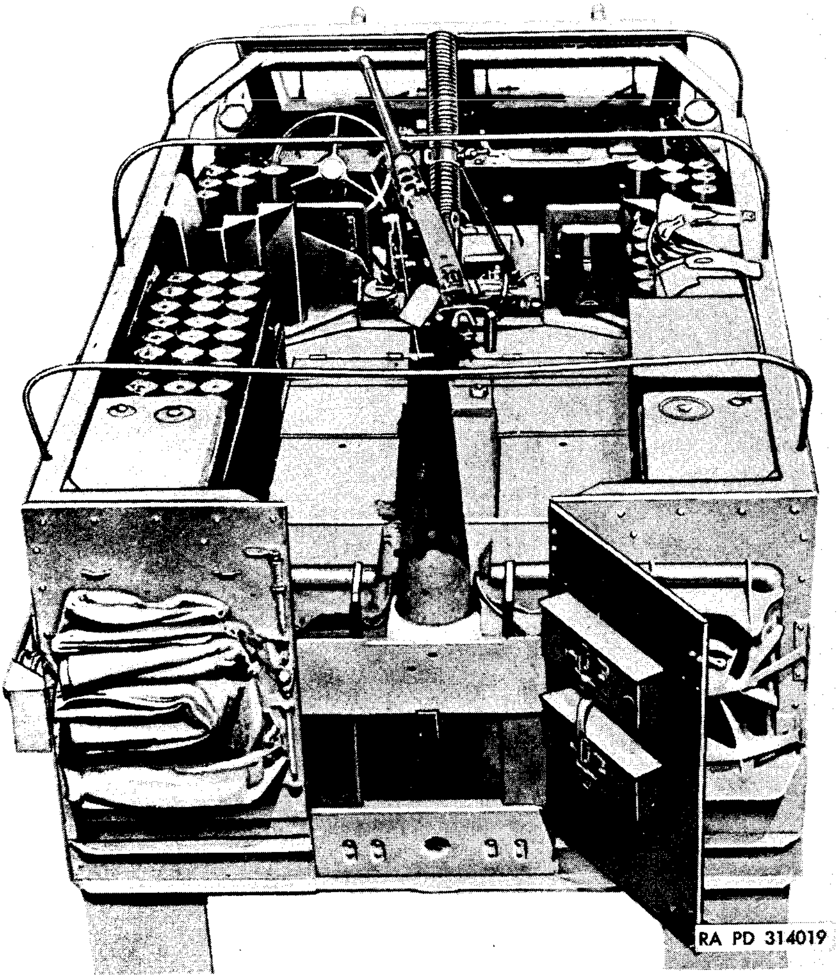

Figure 6. 81-mm mortar M1 and mount M4 (without baseplate) on mortar carrier M21.

6. Tabulated Data

a. 60-mm Mortar M2 and Mount M5.

Weight of mortar M2 and mount M5	42 lb
Weight of mortar M2	12.8 lb
Weight of mount M5 less baseplate	16.4 lb
Weight of baseplate	12.8 lb
Length of mortar	28.58 in.
Elevation (approx)	40 to 85 deg
Traverse, right or left (approx)	125 mils
One turn of traversing handwheel (approx)	15 mils

b. 60-mm Mortar M19, Mount M5, and Baseplate M1.

Weight of mortar and baseplate M1	20.5 lb
Weight of mortar and mount M5	45.2 lb

Weight of mortar	16.0 lb
Weight of baseplate M1	4.5 lb
Weight of mount M5 w/o baseplate	16.4 lb
Weight of baseplate (mount M5)	12.8 lb
Length of mortar	32.23 in.
Elevation, w/mount M5	40 to 85 deg
Elevation, w/baseplate M1	up to 85 deg
Traverse, w/mount M5, right or left	125 mils
One turn of traversing handwheel (approx)	15 mils

c. 81-mm Mortar M1 and Mount M4.

Weight of mortar M1 and mount M4	132 lb
Weight of mortar M1	44.5 lb
Weight of mount M4 less baseplate	42.5 lb
Weight of baseplate	45.0 lb
Length of mortar	49.82 in.
Elevation (approx)	40 to 85 deg
Traverse, right or left (approx)	90 mils
One turn of traversing handwheel (approx)	15 mils

d. 81-mm Mortar M29, and Mount M23A1, and Baseplates M23 and M23A1.

Weight of mortar and mount	107.0 lb
Weight of mortar	28.0 lb
Weight of mount less baseplate	31.0 lb
Weight of baseplate	48.0 lb
Length of mortar	51.0 in.
Elevation (approx)	40 to 85 deg
Traverse, right or left (approx)	70 mils
One turn of traversing handwheel (approx)	7 mils

CHAPTER 2

PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR FIELD MAINTENANCE

7. General

Tools and equipment and maintenance parts over and above those available to the using organization are supplied to ordnance field maintenance units for maintaining and repairing the materiel.

8. Parts

Maintenance parts are listed in Department of the Army Supply Manuals ORD 8 SNL A–33, ORD 8 SNL A–43, and ORD 8 SNL A–82 which are the authority for requisitioning replacements. Requisitions for ORD 9 parts will contain a complete justification of requirements.

9. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this materiel are listed in ORD 6 SNL J–10, Sec. 2. and are authorized for issue by TA and TOE.

10. Special Tools and Equipment

The special tools and equipment in table II are listed in Department of the Army Supply Manual ORD 6 SNL J–12. This tabulation contains only those special tools and equipment necessary to perform the operations described in this manual, is included for information only, and is not to be used as a basis for requisitions.

Note. Special tool sets in ORD 6 SNL J–12, in addition to special tools, also contain standard and commonly used tools and equipment specifically applicable to this materiel.

Table II. Special Tools and Equipment for Field Maintenance

Item	Identifying No.	References		Use
		Fig.	Par.	
CHEST, tool, metal w/tray, 7 in. h, 7 in. w, and 10 in. lg.	41–C–853	7	-----------	To stow tools.
HANDLE, wrench, firing mechanism housing adapter, lg overall 18 in. (60-mm mortar M19 only).	7230831	7	29*c*, 32*a*(4)	Remove and install firing mechanism housing adapter. Used with WRENCH 7230830.
TOOL, cleaning, firing pin vent (81-mm mortar M1 only).	5025032	7	55, 59*a*	Clean firing pin vent.
TOOL, cleaning, firing pin vent (60-mm mortar M2 only).	5154575	7	27*a*	Clean firing pin vent.
WRENCH, adapter, firing mechanism housing (60-mm mortar M19 only).	7230830	8	29*c*, 32*a*(4)	Remove and install firing mechanism housing adapter. Used with HANDLE 7230831.
WRENCH, spanner, face flat key type, dia $\frac{15}{16}$ in., lg 5⅝ in. (60-mm mortar mount M5 only).	7228728	8	33*b*, 36	Remove and install traversing tube spindle nut assembly.
WRENCH, spanner, hook, dble-end, dia $2\frac{5}{16}$ to 3⅛ in., lg 9¼ in. (81-mm mortar mounts M4, M23A1, M23A2, and M23A3).	6128199	8	65*c*, *k*; 68*g*, *i*	Remove and install top and side gear case covers.

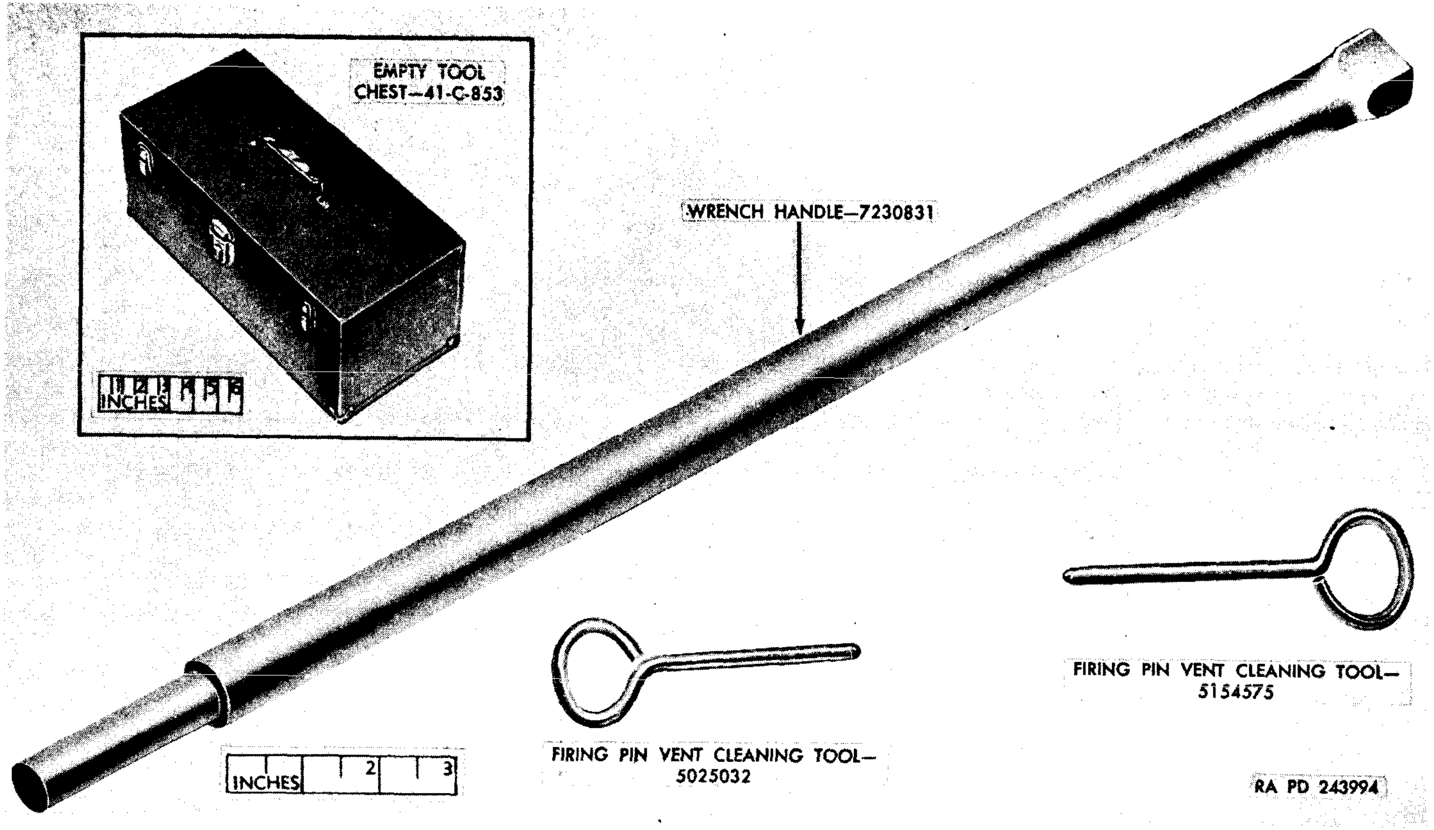

Figure 7. Special maintenance tools and tool chest for mortars.

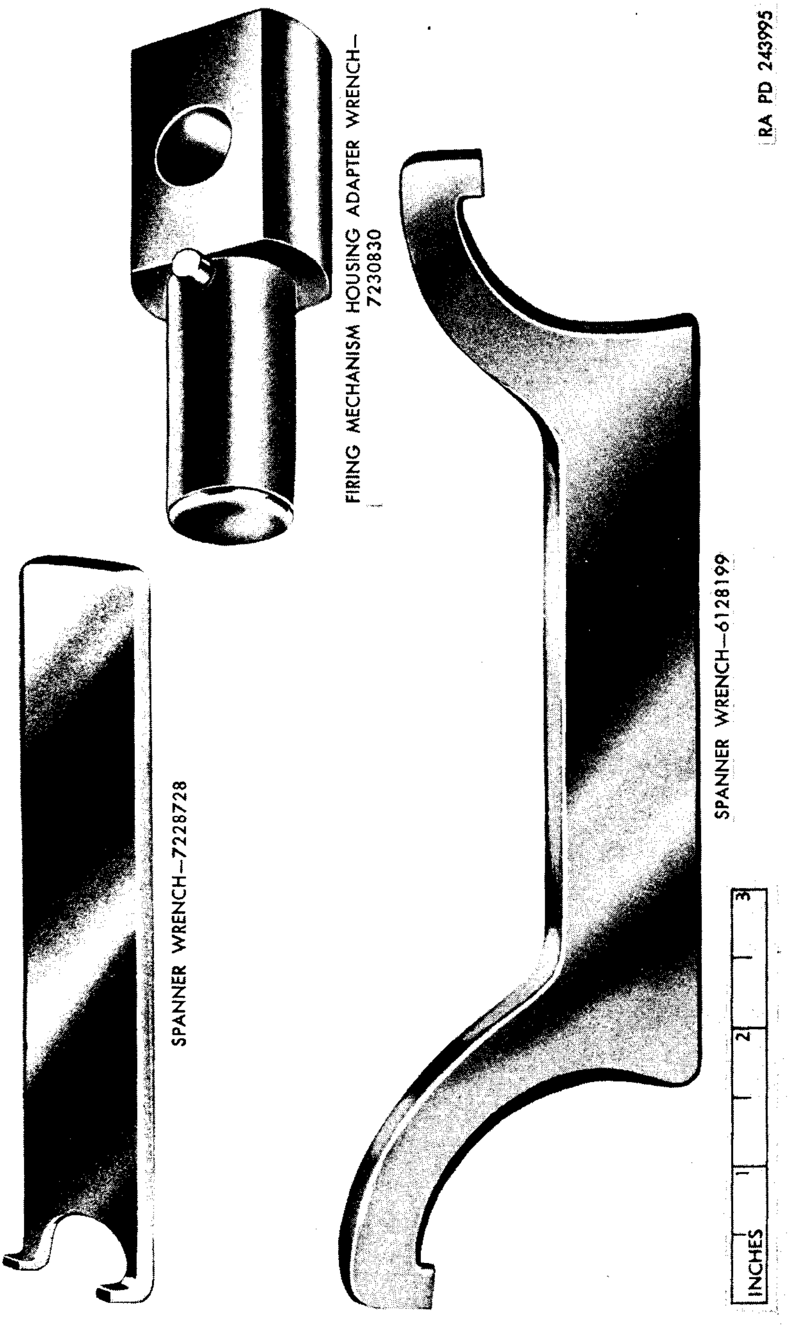

Figure 8. Special maintenance tools for mortars and mounts.

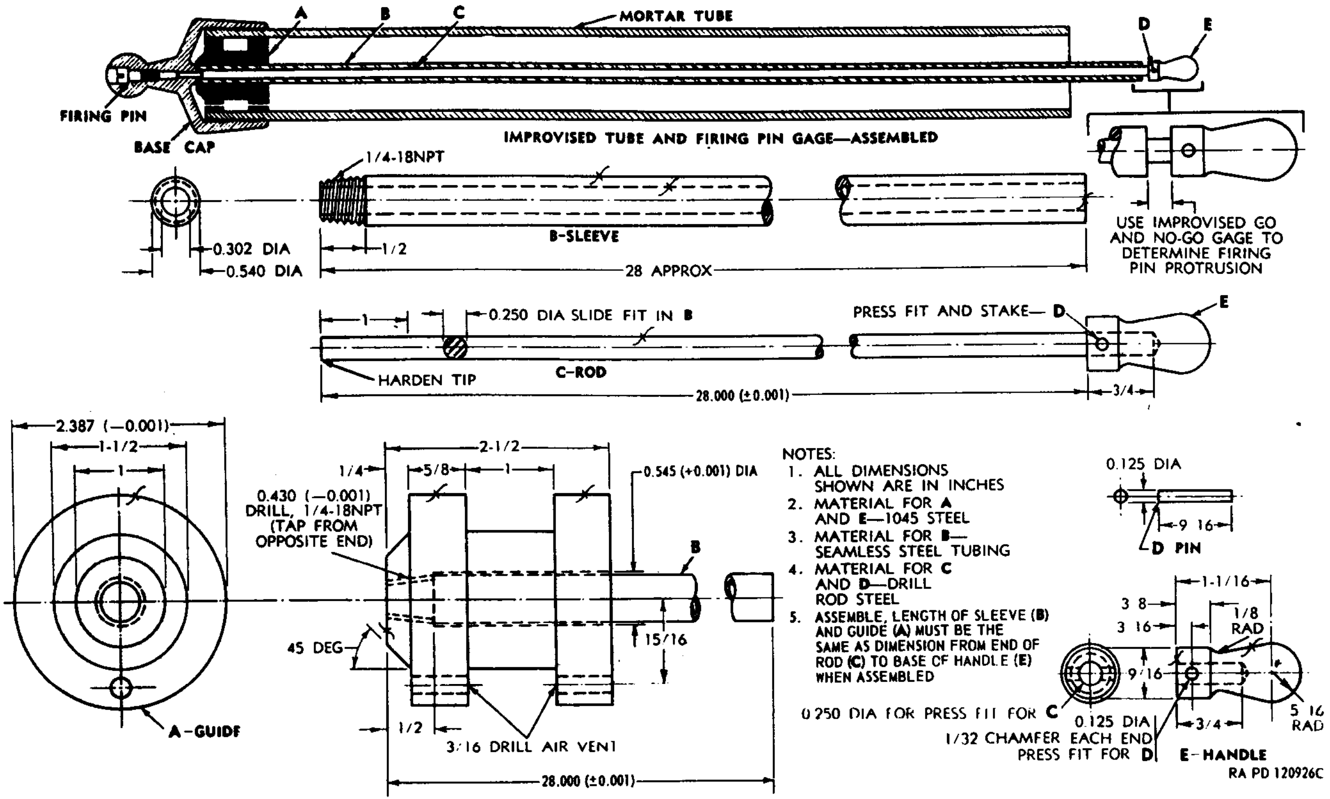

Figure 9. Improvised tube and firing pin gage for 60-mm mortars.

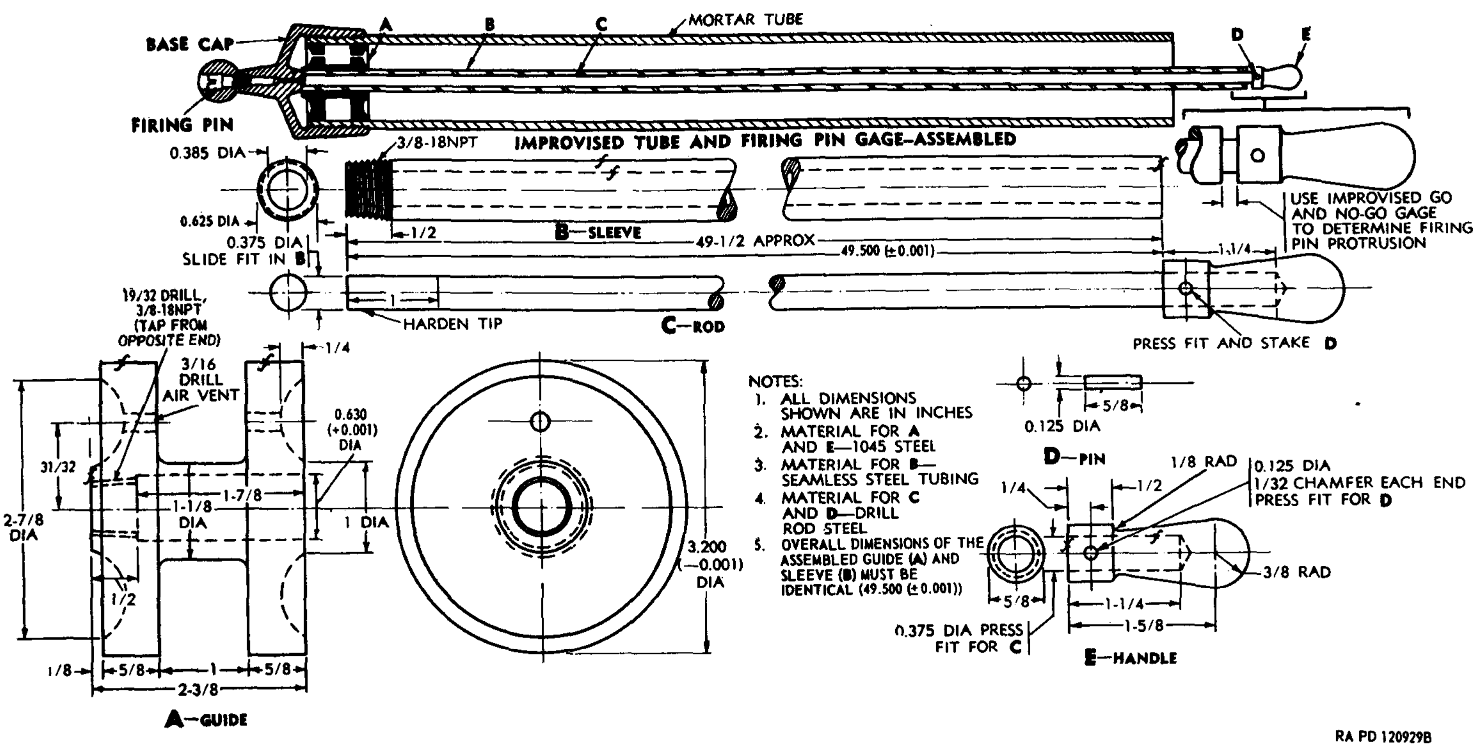

Figure 10. Improvised tube and firing pin gage for 81-mm mortars.

11. Improvised Tools

The list of improvised tools in table III applies only to field organizations engaged in reworking or repairing a large number of weapons. Illustrations giving dimensioned details are included to enable these maintenance organizations to fabricate these tools locally, if desired. These tools are not essential for repair and are not available for issue. The data furnished are for information only.

Table III. Improvised Tools for Field Maintenance

Item	References		Use
	Fig.	Par.	
GAGE, tube and firing pin, 60-mm.	9	26*c*, 30*a*	To check tube clearance and firing pin protrusion.
GAGE, tube and firing pin, 81-mm.	10	58	To check tube clearance and firing pin protrusion.
GAGE, go and no-go	11	26*c*, 30*e*	To check firing pin protrusion. Used with GAGE, tube and firing pin.

FIRING PIN PROTRUSION STANDARDS (USE FOR IMPROVISING GO AND NO-GO GAGE)		
MORTAR MODEL	DROP FIRE	
	MINIMUM (INCHES)	MAXIMUM (INCHES)
60-MM MORTAR M2	0.055	0.063
60-MM MORTAR M19	0.047	0.101
81-MM MORTAR M1	0.050	0.056
81-MM MORTAR M29	0.050	0.056
	LEVER FIRE	
	MINIMUM (INCHES)	MAXIMUM (INCHES)
60-MM MORTAR M19	0.085	0.101

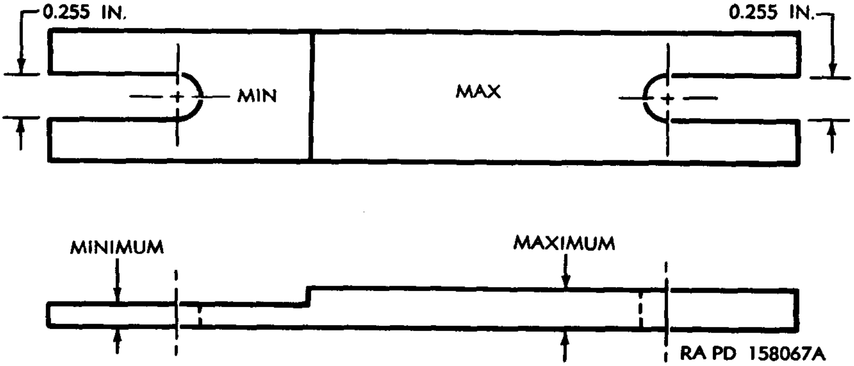

Figure 11. Improvised go and no-go gage for checking firing pin protrusion.

CHAPTER 3
INSPECTION

Section I. GENERAL

12. Scope

This chapter provides specific instructions for the inspection, by ordnance maintenance personnel, of the materiel in the hands of troops, in units alerted for oversea duty, and in ordnance shops.

13. Purpose of Inspection

Inspections are made for the purposes of determining the condition of an item as to serviceability, recognizing conditions that would cause failure, assuring proper application of maintenance policies at prescribed levels, and determining the ability of a unit to accomplish its maintenance and supply missions.

14. Categories of Inspection

In general, three categories of inspection are performed by ordnance field maintenance personnel.

a. Inspection of Materiel in Hands of Troops.

(1) *Spot-check inspection.* A spot-check inspection is an annual inspection performed on a percentage of materiel in order to ascertain the adequacy and effectiveness of organizational maintenance and supply. Included within the scope of spot-check inspections is inspection of equipment to detect incipient failures before unserviceability occurs; inspection to ascertain the availability and use of technical and supply manuals and lubrication orders; inspection to determine the accuracy of records; authorized levels of equipment and supplies, practice of supply economy, preservation and safekeeping of tools, availability of repair parts and supplies, and knowledge of the proper procedures for requisitioning supplies and equipment and follow-up thereon.

(2) *Command maintenance inspection.* Command maintenance inspection is performed annually on at least 50 percent of materiel within a unit or organization. The purpose of the inspection is to insure adequacy and effectiveness

of organizational and supply procedures; determine condition of materiel; ascertain availability and use of technical manuals, supply manuals, and lubrication orders; determine the accuracy of records, authorized level of equipment and supplies, practice of supply economy, preservation and safekeeping of tools.

b. Preembarkation Inspection. This inspection is conducted on materiel in alerted units scheduled for oversea duty to insure that such materiel will not become unserviceable or worn out in a relatively short time. It prescribes a higher percentage of remaining usable life in serviceable materiel to meet a specific need beyond minumum serviceability.

c. Ordnance Shop Inspection.

(1) *Initial inspection.* This is an inspection of materiel received in ordnance shops for the purpose of determining the degree of repair and parts requirement. This includes determination of modification work orders to be applied.

(2) *In-process inspections.* These are inspections performed in the process of repairing the materiel as prescribed in chapter 5. This is to insure that all parts conform to the prescribed standards, that the workmanship is in accordance with approved methods and procedures, and that deficiencies not disclosed by the preliminary inspection are found and corrected.

(3) *Final inspection.* This is an acceptance inspection performed by a final inspector, after repair has been completed, to insure that the materiel is acceptable for return to user according to the standards established. Detailed instructions are contained in chapter 5.

Section II. INSPECTION OF MATERIEL IN HANDS OF TROOPS

15. General

Warning: Before starting the inspection, be sure that the mortar is cleared. Do not have live ammunition in the vicinity of the work.

a. Check to see that the weapon has been cleaned of all corrosion-preventive compound, grease, excessive oil, dirt, or foreign matter which might interfere with proper functioning or obscure the true condition of the parts.

b. Refer to TM 9–1100 for responsibilities and fundamental duties of inspecting personnel, the necessary notice and preparations to be made, forms to be used, and general procedures and methods to be followed by inspectors. Materiel to be inspected includes organizational spare parts and equipment and the stocks of cleaning and preserving materials. In the course of this technical inspection the inspector will accomplish the inspection in paragraph 16.

16. Inspection

a. General.

(1) Determine serviceability; i.e., the degree of serviceability, completeness, and readiness for immediate use, with special reference to safe and proper functioning of the materiel. If the materiel is found serviceable, it will be continued in service. In the event it is found unserviceable or incipient failures are disclosed, the deficiencies will be corrected on the spot or advice given as to corrective measures, when applicable, or, if necessary, the materiel will be tagged for delivery to, and repair by, ordnance maintenance personnel.

(2) Determine causes of mechanical and functional difficulties that troops may be experiencing and for apparent results of lack of knowledge, misinformation, neglect, improper handling and storage, security, and preservation.

(3) Check to see that all authorized modifications have been applied, that no unauthorized alterations have been made, and that no work beyond the authorized scope of the unit is being attempted. Check the index in DA Pam 310–4 and the current modification work order files for applicable modification work orders.

(4) Instruct the using personnel in proper preventive-maintenance procedures where found inadequate.

(5) Check on completeness of the organizational maintenance allowances and procedures for obtaining replenishments.

(6) Check storage conditions of general supplies and ammunition.

(7) Initiate a thorough report on materiel on "deadline," with reasons therefor, for further appropriate action.

(8) Report to the responsibile officer any carelessness, negligence, unauthorized modifications, or tampering. This report should be accompanied by recommendations for correcting the unsatisfactory conditions.

b. Assembled Mortar and Mount.

(1) Record the serial numbers on the inspection form.

(2) Make an overall inspection of the materiel for general appearance, condition, and loose, missing, or broken parts. Check castings and weldments for cracks or breaks.

(3) See if bearing and sliding surfaces, hinge joints, latches, and other movable parts are clean, free of rust and other foreign matter, and properly lubricated in accordance with LO 9–U3, LO 9–U4, LO 9–260, and LO 9–710–1.

(4) Check if paint has deteriorated or become damaged, leaving exposed portions of bare metal.

(5) Check elevating and traversing mechanisms for ease of operation and backlash. Backlash should not exceed one-eighth of a turn of handwheel.

(6) Check if cross leveling mechanism works freely, with locking sleeve loose. See if level vial is serviceable and scribe lines are distinct.

(7) Clamp should grip mortar firmly.

(8) Elevating and traversing mechanisms should have no bind and cranks should be undamaged.

c. Mortar.

(1) Spherical projection at bottom of mortar should be smooth and free of all rust, burs, and scores.

(2) Check inside of tube for dents and rough spots. Tube should permit free falling of a dummy round.

(3) Base cap should be screwed tight on the tube; on 81-mm mortar M29, the base plug is brazed to the tube.

(4) Firing pin should cause sufficient indentation on ignition cartridge for firing. Adjustable firing pin should retract and fire selector should be operative.

(5) Quadrant seat should be free of burs.

d. Mount.

(1) Check straps, chains, spring, buckles, and hooks for condition.

(2) Check dovetail sight socket for distortion and burs. Check fit of sight.

(3) See if lettering on nameplate is legible.

(4) Sliding bracket should grip leg; if loose, check if modified (par. 39*b* or 63*c*).

(5) Legs should be straight and rigid. Clevises should lock legs firmly in open position.

(6) Mortar clamp parts should not be bent. Guides should be smooth.

(7) Oil cups should be identified by a red circle.

(8) Clamp should retract on shock absorber and return to original position.

(9) Check if crank detent holds traversing handwheel crank in folded and extended positions.

(10) On 81-mm mortars of M23-series, mounting ring should be intact and air vent hole open.

e. Baseplate.

(1) Baseplates should not be warped or cracked and should not rock on a smooth and level surface.

(2) Latches should be operative and handles intact. Sockets should be smooth and free of all rust, burs, and scores.

(3) On baseplate M1, threads on baseplate body and hinged cap should be undamaged; link and pin on cap should not be distorted.

(4) On 60-mm mortar mount M5, the lock lever should secure base cap of mortar firmly.

(5) On 81-mm mortar mounts of series, the inner ring socket cap should have a snug fit but revolve by hand pressure.

Section III. PREEMBARKATION INSPECTION

17. General

a. Serviceable materiel (materiel meeting the requirements of par. 16) will be inspected in accordance with the standards set forth in paragraph 18. These standards are not serviceability standards as such but reflect criteria to meet a specific need beyond minimum serviceability.

b. The standards prescribed in paragraph 18 provide for a high percentage of remaining usable life in serviceable materiel to insure that materiel being shipped overseas will not become unserviceable or worn out in a relatively short time.

c. Newly manufactured and issued materiel, which has been accepted in accordance with Department of the Army specifications, will not be rejected by an Army inspector except for well grounded reasons. All such rejections will be reported immediately to higher authority.

18. Inspection

a. Surfaces.

(1) Painted surfaces will be carefully inspected for presence of rust under the paint. This condition is evidenced by rust particles coming through the coating of paint. If rust is detected, the painted surfaces will have to be repainted (TM 9–2851).

(2) Rigid restrictions on shiny metal surfaces will not be carried to an extreme. A worn surface is objectionable from the standpoint of visibility when it is capable of reflecting

light, somewhat as a mirror does. No weapon will be rejected for oversea shipment unless exterior parts have a distinct shine.

b. Mortar.

(1) The policy is to ship overseas only those tubes which have the following bore diameters:

(*a*) 60-mm mortars .... 2.392 to 2.410 in.

(*b*) 81-mm mortars .... 3.205 to 3.226 in.

(2) Any mortar tube which has been declared "serviceable" but fails to meet the above requirements will not be considered acceptable for oversea shipment.

(3) Base cap should be gas tight on tube, ball smooth, and finish intact. Maximum clearance between ball and socket should not exceed one thirty-second inch.

(4) Quadrant seat should be free of burs; clamp position marks and aiming lines should be legible.

(5) Firing pin should cause sufficient indentation on ignition cartridge for firing. Adjustable firing pin should retract.

c. Mount.

(1) All movable elements must perform smoothly, without binding. Shock absorber guides must be smooth.

(2) Elevating mechanisms which bind, or on which backlash exceeds one-eighth of a turn of the handwheel when measured at an elevation of 1,075 mils (60°), are unsatistory.

(3) Traversing mechanisms which bind, or on which the backlash exceeds one-eighth of a turn of the handwheel when measured at an elevation of 1,075 mils (60°), are unsatisfactory.

(4) Bipod legs should be straight and feet secure to legs; clevis should lock legs firmly.

(5) Chain or straps must be intact.

(6) Finish must be intact.

d. Baseplate.

(1) Finish must be intact and latches operative.

(2) Threads on baseplate M1 should be clear.

Section IV. ORDNANCE SHOP INSPECTION

19. Inspection

a. General. A technical inspection similar to that in paragraph 16 is also made of materiel turned in to field maintenance shops for repair. In addition, the inspector performs the inspections listed below in order to determine the cause of unserviceability, the extent of required repairs, and an estimate of replacement parts. He also performs a troubleshooting inspection (table IV), as necessary, to localize and identify any malfunctions.

b. Mortar.

(1) Check mortar tube for pits. Pits not exceeding 3/8 inch in length or width and 0.010 inch in depth are allowable. Such pits will not be cause for condemnation but such tubes will require honing. A dummy round or improvised tube and firing pin gage (fig. 9 or 10) should fall freely in tube; if not, it will be necessary to remove dents or replace tube or mortar.

(2) Base cap should show no evidence of leakage. If it does and no distortion is evident, joint will have to be made tight. If distortion is evident, replacement of parts is required.

(3) Maximum clearance between ball projections on base cap and socket in baseplate should not be over 1/32 inch for all models except 81-mm mortars of M23 series for which it is 0.039 inch; if clearance is excessive, it will require correction by placing base cap in socket and peening lips of socket against ball.

(4) Check protrusion of firing pin by seating the improvised tube and firing pin gage (fig. 9 or 10) over the firing pin and measuring, with a feeler gage or improvised go and no-go gage (fig. 11), the distance between the handle and the tube of the gage. Firing pins not meeting the standards shown in table VII will require replacement.

c. Mount.

(1) Play in elevating mechanism of 81-mm mortar mounts is the cumulative effect of wear between the working parts. As no integral adjustment is provided to take up this wear, parts will have to be replaced to reduce backlash. The likely order of wear and necessary replacement is elevating gear, elevating pinion, screw sleeve, and guide tube. The elevating gear bearing washer and elevating screw body are primarily important only as they affect the wear of other parts.

(2) Backlash in 60-mm mortar mounts can be reduced by replacement of elevating screw and nut; wear may be found in elevating screw, elevating nut, and elevating nut lower bearing. If mechanism binds, elevating screw should be checked for straightness and corrected.

(3) If traversing mechanism binds, the traversing screw should be checked for straightness and corrected. Backlash can be reduced by adjustment and, if this is not sufficient, by replacement of defective parts (pars. 34–36).

d. Baseplates.

(1) Check baseplates carefully for indications of incipient fracture. Small cracks may be welded but major repairs are not ordinarily practicable and a badly bent or cracked plate will require replacement.

(2) Check sockets and latches of baseplates for smoothness and operation.

20. Troubleshooting

The troubleshooting inspection in table IV is to be performed, as necessary, to localize and identify any malfunctions.

Table IV. Troubleshooting

Malfunction	Probable causes	Corrective action
Failure to drop fire	Fixed firing pin loose, worn, or broken	Tighten or replace (pars. 25–28).
	Firing pin worn, broken, or distorted	Replace (pars. 29–33).
	Firing pin bushing loose	Tighten.
	Dents in tube	Remove dents (par. 27*c*) or replace mortar (pars. 29–32).
Failure to lever fire	Firing pin bushing plugged or loose	Clean or straighten.
	Firing pin worn, broken, or distorted	Replace (pars. 29–32).
	Firing spring set or broken	Replace (pars. 29–32).
	Dents in tube	Remove dents (par. 27*c*) or replace mortar (pars. 29 and 32).
Failure of mount to return to prefiring position.	Shock absorber springs set or broken	Replace (pars. 45–48, 73–76, and 89–92).
	Shock absorber guides burred or scored	Remove burs and scores.
	Air vent holes plugged (mounts M23A1, M23A2, and M23A3).	Clean.
Binding in traversing mechanism	Traversing screw burred or not straight	Remove burs or straighten.
	Expanding bearing too tight	Loosen bearing adjusting nut.
Excess backlash in traversing mechanism	Worn traversing screw or nut	Replace (pars. 33–36, 69–72, and 85–88).
	Expanding bearing loose or worn (60-mm mount M5 and 81-mm mounts M4, M23A1, M23A2, and M23A3).	Tighten bearing adjusting nut or replace (pars. 33–36, 69–72, and 85–88).
Binding in elevating mechanism	Elevating screw burred or not straight	Remove burs or straighten.
	Lower nut bearing too tight (60-mm mount M5).	Loosen bearing adjusting nut.
	Elevating gear or pinion burred (81-mm mounts M4, M23A1, M23A2, and M23A3).	Remove burs.

Table IV—Continued

Malfunction	Probable causes	Corrective action
Excess backlash in elevating mechanism	Elevating spindle, gear, or pinion worn (81-mm mounts M4, M23A1, M23A2, and M23A3).	Replace (pars. 65–68 and 81–84).
	Elevating spindle, nut, or bearing worn (60-mm mount M5).	Replace (pars. 41–44).
	Lower nut bearing too loose (60-mm mount M5).	Tighten adjusting nut.
Cross-leveling adjustment cannot be maintained.	Operating parts worn; on all mounts, wear may be in sliding bracket, locking sleeve, locking ring, leg body, and adjusting nut.	Replace (pars. 37–40, 61–64).
Binding in cross-leveling mechanism	Working parts burred, scored, or distorted; this may occur in adjusting nut, leg body, sliding sleeve, locking ring, locking sleeve, and sliding turnbuckle clamp.	Remove burs and scores, restore shape, or replace (pars. 37–40, and 61–64).
Failure of legs to stay in open position (60-mm mount M5).	Clevis latch spring weak or broken	Replace (pars. 37–40).

CHAPTER 4
GENERAL MAINTENANCE

21. Scope

a. This chapter contains important general maintenance information.

b. In chapters 5 and 6, major units are disassembled, repaired, or replaced. A final inspection is given in chapter 7. These instructions are supplementary to instructions for the using organizations contained in FM 23–85, FM 23–90, and TM 9–3064.

22. Processing

a. Cleaning.

(1) *General.* Refer to FM 23–85, FM 23–90, and TM 9–3064 for using arms information on cleaning, cleaning agents, precautions to be observed in cleaning, and cleaning of materiel received from storage. Information for ordnance personnel is given below.

(2) *Cleaning materiel received from storage.*

(*a*) Materiel received in ordnance shops from storage will be cleaned by one of the following processes, whichever is applicable or available: Process C–3, Petroleum solvent in two steps (TM 9–1005); Process C–7, Vapor degreasing (TM 9–1005); Process C–14, Steam cleaning (TM 9–1005).

(*b*) If some time is to elapse before the start of repair or rebuild operations, apply a light grade of oil to all polished metal surfaces to prevent rusting.

(3) *Cleaning after repair.* After repair operations and prior to assembly, remove shop dirt and other foreign matter from all metal surfaces. This can be done by process C–3, process C–7, or process C–4 (Petroleum solvent applied by scrubbing or wiping) (TM 9–1005).

(4) *Cleaning after shop inspection.* After shop inspection, dip in a tank containing fingerprint remover oil (type A), remove (use rubber gloves), and dry thoroughly with dry compressed air (provided with moisture filter traps) or by wiping with clean, lint-free, dry cloths.

b. Application of Lubricants and Preservatives.

(1) Apply preservatives as soon as possible after cleaning (*a* above).

(2) Apply lubricating grease No. 0 (OG–O) to working parts of firing, elevating, traversing, shock absorbing, and cross-leveling mechanisms.

(3) Apply heated rust-preventive compound (heavy) to interior of tube and to all exterior finished surfaces and to all exposed nuts, bolts, screws, chains, etc., not already preserved.

c. Storing Mortar Materiel.

(1) Wrap mount in Grade C, Type I greaseproof barrier-material. Mounts may be boxed or stacked. If mounts are boxed, they may be stored one or more to a box.

(2) Segregate and store mortars on dunnage. Whenever wooden dunnage touches metal, place a layer of Grade C, Type I greaseproof barrier-material between wood and metal.

(3) Segregate and store base plates on dunnage. Whenever wooden dunnage touches metal, place a layer of Grade C, Type I greaseproof barrier-material between wood and metal.

23. General Repair Methods

a. Disassembly and Assembly Procedures.

(1) In disassembling a unit, remove the major subassemblies and assemblies whenever possible. Subassemblies may then be disassembled, as necessary, into individual parts.

(2) During assembly, subassemblies should be assembled first and then intalled to form a complete unit.

(3) Exercise caution when removing and installing taper pins. Attempts to force a tapered pin in the wrong direction may result in damage to the mechanism.

(4) Complete disassembly of a unit is not always necessary in order to make a required repair or replacement. Good judgment should be exercised to keep disassembly and assembly operations to a minimum.

b. Replacements of Parts.

(1) Unserviceable and unrepairable assemblies will be broken down into items of issue and serviceable parts will be returned to stock.

(2) When assembling a unit, replace taper pins and cotter pins with new ones, if possible. If screws or nuts are damaged, they should be replaced.

(3) All springs should be replaced, if they are broken; kinked, cracked, fail to function properly, or fail to meet specific requirements listed in table VII.

(4) If a required new part is not available, reconditioning of the old part is required. Such parts should be examined carefully after reconditioning to determine their suitability. Parts which cannot be repaired or reclaimed to the required standards (chs. 5 and 6) will be replaced.

c. Use of Tools.

(1) Care must be exercised to use tools that are suitable for the task to be performed in order to avoid unnecessary mutilation of parts and/or damage to tools.

(2) A number of special tools (ch. 2) are provided for maintenance of the mortars and mounts. These tools should be used only for the purpose for which they are intended.

d. Welding and Riveting. For welding instructions and welding materials, refer to TM 9–2852 and Department of the Army Supply Catalog ORD 3 SNL K–2.

e. Repairing Damaged Threads. Damaged threads should be repaired by use of a thread restorer or by chasing on a lathe.

f. Restoring Damaged Surfaces. Damaged surfaces will be restored, using materials and tools consistent with tolerances given in chapters 5 and 6.

g. Removal of Corrosion.

(1) There are various methods and materials for removing corrosion. These should be carefully selected in order that surfaces being processed will not be damaged beyond serviceability.

(2) Crocus cloth will be used to remove corrosion from polished surfaces. Aluminum oxide abrasive cloth, files, or scrapers are permissible where critical dimensions will not be altered by their use and where the mechanic is fully instructed in their use and in the possible consequences of their improper use.

(3) Sandblasting is permissible on surfaces of baseplate which require painting. Compressed air should be used to remove sand left after sandblasting. Do not dip materiel in water to remove sand.

24. Lubrication

Prior to shop inspection, lubricate the elevating, traversing, cross-leveling, and firing mechanisms. This is necessary in order to permit proper functioning of these mechanisms during the final inspection. Do not overlubricate; use as little oil as is necessary for proper functioning.

REFERENCES

DOCUMENTS NEEDED

These documents must be available to the intended users of this publication.

ARTEP 7-90-Drill. Drills for the Infantry Mortar Platoon, Section, and Squad. February 1990.

ARTEP 7-90-MTR Mission Training Plan for the Infantry Mortar Platoon, Section, Squad. August 1989.

DA Form 2188-R. Data Sheet. March 1977.

DA Form 2399. Computer's Record. October 1971.

DA Form 2408-4. Weapon Record Data. January 1979.

DA Form 2601-1. MET Data Correction Sheet for Mortars. October 1971.

DA Form 2601-2-R. MET Data Correction Sheet 6400 Mils (Mortars). October 1971.

DA Form 3675. Ballistic MET Message. January 1971.

DA Form 4176. Target Plotting Grid Field Artillery Graduated in Mils and Meters, Scale 1:25,000. October 1973.

DA Form 5424-R. Terrain Mortar Position/Special Corrections Worksheet. May 1985.

DA Form 5472-R, Computer's Record (MPI). October 1985.

*FM 7-90. Tactical Employment of Mortars. June 1985. (TBP)

*FM 23-90. Mortars. June 1990.

*FT 4.2-H-2. Mortar, 4.2-inch, M30. August 1968.

*FT 4.2-K-2. Mortar, 4.2-inch, M30. June 1984.

*FT 60-P-1. Mortar, 60-mm, M224. March 1980.

*FT 81-AQ-1. Firing Table for Mortar, 81-mm: M29A1 and M29. August 1981.

*FT 81-AR-1. Mortar, 81-mm, M252. October 1986.

FT 81-AI-3. Mortar, 81-mm, M29A1 and M29. March 1973.

GTA 7-1-29. M16 Plotting Board. 1982.

*STP 7-11 C14-SM-TG. Soldier's Manual, Skill Levels 1/2/3/4 and Trainer's Guide, MOS 11C, Indirect Fire Infantryman. September 1988.

STP 7-11C-JB. Job Book, MOS 11C, Indirect Fire Infantryman, Skill Levels 1/2. April 1989.

*TM 9-1220-246-12&P. Operator's and organizational Maintenance Manual Including Repair Parts and Special Tools List for Mortar Ballistic Computer Set, M23. August 1985.

DOCUMENTS RECOMMENDED

These readings contain relevant supplemental information.

AR 385-63. Policies and Procedures for Firing Ammunition for Training Target Practice Combat. October 1983.

FM 3-10B. Employment of Chemical Agents(u). November 1966.

FM 3-50, Deliberate Smoke Operations. July 1984.

FM 6-30. Observed Fire Procedures. April 1991.

TC 6-40. Field Artillery, Manual Cannon Gunnery. December 1988.

*This source was also used to develop this publication.

DATA SHEET

For use of this form, see FM 23-91; the proponent agency is TRADOC

SETUP		WEAPON DATA			FO DATA		
TIME OUT		UNIT	WPN ____	WPN ____	FO	ALT	GRID
TGT PRFX			DIR ____	DIR ____			
TGT NO		____ mm CAR					
ALARM	☐ ON ☐ OFF	☐ YES ☐ NO	DIS ____	DIS ____			
MIN E		BP	WPN ____	WPN ____			
MIN N							
GD ☐ E ☐ W		E	DIR ____	DIR ____			
LAT ☐ + ☐ -		N	DIS ____	DIS ____			
LISTEN	☐ ON ☐ OFF	ALT					
BIT RATE		AZ	WPN ____	WPN ____			
KEY TONE		DEF	DIR ____	DIR ____			
BLK	☐ SNG ☐ DBL	ELE					
OWNER ID			DIS ____	DIS ____			

AMMUNITION DATA

TEMPERATURE ____________ TYPE ☐ HE ☐ WP ☐ ILL ☐ CS ☐ TNG

LOT NUMBER									
WEIGHT									
ON HAND									
RECEIVED									
TOTAL									
ROUNDS EXPENDED									
ROUNDS REMAINING									

TARGET DATA

TARGET ID			CHART DATA		FIRING CORRECTIONS				FIRING DATA				INTELLIGENCE				ROUNDS	
TGT NO	GRID	ALT	DEFL	RG / CHG	DEFL CORR	RANGE CORR	ALT / VI	ALT CORR	DEFL	RG / CHG	FUZE TIME SETTING	ELEV	TIME FIRED	TGT DES	MET OF ENG	SUR	EXP	REM

MET DATA CORRECTION SHEET 6400 MILS(MORTARS)

For use of this form, see FM 23 91, the proponent agency is TRADOC

FIRING DATA			MET MESSAGE			
CHARGE	CHART RANGE	ELEVATION	TYPE	STATION		DATE
ALTITUDE OF MORTARS (M)			TIME	ALT MDP		LINE NUMBER
ALTITUDE OF MDP			WIND DIRECTION	WIND VELOCITY	AIR TEMP	AIR DENSITY
SECTION ABOVE + BELOW — MDP △ H		+ —	△ H CORRECTIONS		△ T ±	△ D ±
			CORRECTED VALUES			

WIND COMPONENTS

WHEN DIRECTION OF WIND IS LESS THAN DIRECTION OF FIRE ADD	
DIRECTION OF WIND	
TOTAL	
DIRECTION OF FIRE	

	(RP) I	II	III	IV	V	VI	VII	VIII
CHART DIRECTION OF WIND (6400 IS LESS THAN CORRESPONDING DIRECTIONAL VARIATION TO CHECK POINTS)								
DIRECTIONAL VARIATION TO CHECK POINTS								
CHART WIND TO CHECK POINTS								
DEFLECTION CORRECTIONS								
WIND VELOCITY (KNOTS)								
CROSS WIND COMPONENT	L R	L R	L R	L R	L R	L R	L R	L R
CROSS WIND	L R	L R	L R	L R	L R	L R	L R	L R
CROSS WIND CORRECTION FACTOR								
DEFLECTION CORRECTION	L R	L R	L R	L R	L R	L R	L R	L R
RANGE CORRECTIONS								
WIND VELOCITY (KNOTS)								
RANGE WIND COMPONENT	T H	T H	T H	T H	T H	T H	T H	T H
RANGE WIND	T H	T H	T H	T H	T H	T H	T H	T H
RANGE WIND UNIT CORRECTION								
RANGE WIND CORRECTION	±	±	±	±	±	±	±	±

	KNOWN VALUE	STANDARD VALUES	VARIATION FROM STANDARD	UNIT CORRECTIONS	PLUS	MINUS
POWDER TEMP	△V= —		D I			
AIR TEMP			D I			
AIR DENSITY			D I			
PROJECTILE WT	☐	☐	D I			
				BALLISTIC RANGE CORR		

ABSOLUTE REGISTRATION CORRECTIONS

REGISTRATION CORRECTION	±	L R
RP MET CORRECTION	±	L R
ABSOLUTE REG CORRECTION	±	L R

DIRECTIONAL CORRECTIONS

	I (RP)	II	III	IV	V	VI	VII	VIII
BALLISTIC RANGE CORR	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
RANGE WIND CORRECTION	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
TOTAL RANGE CORRECTION	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
MET CORRECTION	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R
ABSOLUTE REG CORRECTION	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R
CORRECTIONS TO APPLY	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R	+ L — R

DA Form 2601-2-R, 1 OCT 71

COMPUTER'S RECORD (MPI)

For use of this form, see FM 23-91; the proponent agency is TRADOC.

UNIT ______ DATE ______ TIME ______

MESSAGE TO OBSERVERS

PREPARE TO OBSERVE MPI REGISTRATION

OP# ______ DIR ______ VA ± ______

OP# ______ DIR ______ VA ± ______

REPORT WHEN READY TO OBSERVE

OBSERVER'S READINGS

ROUND NO	OP #	OP #
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
(MUST BE SIX USABLE AZIMUTHS)		
TOTAL OF AZIMUTHS *(ADD EACH COLUMN)*		
AVG OF AZIMUTHS *(TOTAL ÷ 6)*		
DIR TO MPI		

VERTICAL ANGLE COMPUTATIONS

RP ALTITUDE ______

OP # ______	OP # ______
RP ALT ______	RP ALT ______
OP ALT ______	OP ALT ______
VI ± ______	VI ± ______
OP RANGE ______	OP RANGE ______
W/RXM ______	W/RXM ______

(VI ÷ RN IN THOUSANDS = VA)

100/R ______	100/R ______
VI ÷ 100/R ______ *(NEAREST 1)*	VI ÷ 100/R ______ *(NEAREST 1)*
VA ± ______ *(NEAREST MIL)*	VA ± ______ *(NEAREST MIL)*

DATA SECTION

81-MM/60-MM

RP GRID ______ CHA ______ ELE ______

RP ALT ______	MPI ALT ______
MORT ALT ______	MORT ALT ______
VI ± ______	VI ± ______
ALT CORR ± ______	ALT CORR ± ______
RP CHART DATA	**MPI DATA**
DEF ______	DEF ______
RN ______ *(MINUS ALT CORR)*	RN ______ *(MINUS ALT CORR)*
DEF CORR	**RANGE CORR**
RP DEF ______	RP RN ______
MPI DEF ______	MPI RN ______
DIFF L/R ______	DIFF ± ______
DEF CORR L/R ______ *(TO APPLY, REVERSE SIGN)*	RCF ± ______ *(TO APPLY, REVERSE SIGN)*

4.2-INCH

MPI ALT ______ CHA FIRED ______

MORT ALT ______ CHA CORR ± ______

VI ______

(USE THIS VI TO COMP CHA CORR)
(SUBTRACT IF + ADD IF -)

CHART CHARGE TO MPI ______

CHART DEFL TO MPI ______

(DRAW THE ADJ CHG GAGE LINE FROM THE MPI POINT TO THE CHART CHG OF THE MPI POINT)

CHART RANGE TO MPI ______

DEFL FIRED ______

DEFL CORR R/L ______

(DETERMINE THE LARS CORR TO GET FROM MPI TO RP DEFL)

GRID OF MPI ______

DA Form 5472-R, OCT 85 (Replaces DA Form 2399-1-R, 1 OCT 71, which is obsolete.)

Glossary

AAR	after-action report
AC	Active Component
ACCP	Army Correspondence Course Program
A/F	adjust tire
AMC	at my command
ANCOC	Advanced Noncommissioned Officer Course
ARTEP	Army Training and Evaluation Program
bn	battalion
BNCOC	Basic Noncommissioned Officer Course
BLTM	battalion-level training model
CALFEX	combined arms live-fire exercise
CFX	command field exercise
chg	charge
CMD	command message to observer
CMT	combined mortar training
co	company
CONUS	continental United States
CPX	command post exercise
CS	a chemical agent ("tear gas")
CSR	controlled supply rate
CSS	combat service support
ctg	cartridge
CTT	Common Tasks Test
D	delta
DA	Department of the Army
DCT	deflection conversion table
DEPEX	deployment exercise
DMD	digital message device
DOF	direction of fire
DS	direct support
EIB	Expert Infantryman Badge
EOM	end of mission
eval	evaluation
exam	examination
FA	field artillery
FDC	tire direction center
FDCCP	Fire Direction Center Certification Program
FFE	fire for effect
FIST	fire support team
FM	frequency modulation; field manual
FO	forward observer
FPF	final protective fires
FPL	final protective line
FSCL	fire support coordination line
FSCOORD	fire support coordinator
FSE	fire support element
FSO	fire support officer
FT	firing table
FTX	field training exercise
GD	grid declination
GMT	Greenwich mean time
GS	general service
GT	gun-target
GTA	graphic training aid
HE	high explosive
HEQ	high-explosive quick

HOB	height of burst
HTA	Hohenfels training area
IAW	in accordance with
ID	identification
IET	initial entry training
IG	inspector general
ILL	illuminating
IMP	impact
IMPC	Infantry Mortar Platoon Course
IN	infantry
indiv	individual
IOAC	Infantry Officer Advanced Course
IOBC	Infantry Officer Basic Course
IS	immediate smoke
ITEP	Individual Training and Evaluation Program
LD	line of departure
LED	light-emitting diode
LFX	live fire exercise
LRTR	long-range training round
m̸	mils
M	meter(s)
MAPEX	map exercise
max	maximum
MAZ	mounting azimuth
MBC	mortar ballistic computer
MDP	MET datum plane
MET	meteorological
METL	mission-essential task list
METT-T	mission, enemy, terrain, troops and time available
MILES	multiple-integrated laser engagement system
min	minimum, minute(s)
mm	millimeter
MOS	military occupational specialty
MOUT	military operations on urbanized terrain
MPI	mean point of impact
MPS	meters per second
MQS	military qualification standards
MTA	major training area
MTO	message to observer
MTP	mission training publication
NBC	nuclear, biological, chemical
NCO	noncommissioned officer
NCOES	noncommissioned officer education system
NCOPD	noncommissioned officer professional development
NG	Army National Guard
NGF	naval gunfire
No.	number
NSN	national stock number
OIC	officer in charge
OP	observation point
OPD	officer professional development
OPFOR	opposing forces
OES	officer education system
OSUT	one-station unit training
OT	observer-target
PCC	Pre-Command Course
PD	point-detonating
PE	probable error
plt	platoon
PROX	proximity
RALS	right add, left subtract
RATELO	radiotelephone operator
RC	Reserve Component
RCF	range correction factor
rd	round
ROTC	Reserve Officers' Training Corps
RP	reference point; red phosphorus; registration point
RPM	rounds per minute

S3	operations and training officer
sec	section
SFC	sergeant first class
SGT	sergeant
SL	section left
SM	soldier's manual
SOI	signal operation instructions
SOP	standing operating procedure
SQ	superquick
sqdn	squadron
SQT	skill qualification test
SR	section right
SRTR	short-range training round
SSG	staff sergeant
STP	soldier training publication
STRAC	Standards in Training Commission
STX	situational training exercise
TC	training circular
TEC	training extension course
T&EO	training and evaluation outline
TEWT	tactical exercise without troops
TFC	technical fire control
TFT	tabular firing table
TG	training guide
TM	technical manual
TMPC	terrain mortar positioning correction
TOC	tactical operations center
TOE	table of organization and equipment
TOF	time of flight
TOT	time on target
TRADOC	Training and Doctrine Command
TRC	total range correction
USAREUR	United States Army, Europe
USAIS	United States Army Infantry School
VA	vertical angle
VI	vertical interval
vs	versus
VT	variable time
WP	white phosphorus
wpn	weapon
W/R	when ready

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