FM 3-09.8

Field Artillery Gunnery

JULY 2006

HEADQUARTERS
DEPARTMENT OF THE ARMY

This publication is available at
Army Knowledge Online (www.us.army.mil) and
General Dennis J. Reimer Training and Doctrine
Digital Library at (www.train.army.mil).

Field Manual
No. 3-09.8

Headquarters
Department of the Army
Washington, DC, July 31, 2006

Field Artillery Gunnery

Contents

Distribution Restriction: Approved for public release, distribution is unlimited.

Figures

Tables

Gunnery Tables

Preface

This manual describes how the field artillery (FA) gunnery program is executed to produce combat-proficient FA personnel, leaders, crews, and sections. This manual provides standards, principles, and techniques for achieving technical proficiency and safety in the operation of Field Artillery systems and weapons.

FM 3-09.8 is an integrated presentation that addresses all FA systems in a safe, technically and doctrinally grounded, progressive, task-oriented training model. This manual is designed for artillery leaders at all levels and is a resource for all types of artillery units. The programs outlined in this manual follow the concepts and guidance provided in FM 7-0 and FM 7-1.

The tasks, conditions, and standards in this manual are based on system technical manuals, training products, and tasks in military occupational specialty (MOS) 13-series Soldier's manuals, and Army Training and Evaluation Program (ARTEP) 6-series mission training plans. In all cases, use only the most current technical manuals as references when executing the tables. All FA units are encouraged to provide ideas to upgrade the tasks, conditions, and standards in this manual.

This publication applies to the Active Army, the Army National Guard (ARNG)/Army National Guard of the United States (ARNGUS), and the U.S. Army Reserve (USAR) unless otherwise stated.

The proponent for this publication is the U.S. Army Training and Doctrine Command (TRADOC). Submit changes for improving this publication on DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) and forward it to the Deputy Chief of Staff Operations and Plans, G3, United States Army Field Artillery School, Fort Sill, Oklahoma 73503.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

This page intentionally left blank.

Chapter 1
Introduction

This manual provides the guidelines for implementing an FA gunnery program that incorporates all FA systems. The objective is a safe, technically and doctrinally grounded, progressive, task-oriented training model. FA, as a system of systems, requires integrating functions or tasks performed by the critical elements of the gunnery team to provide timely and accurate fires. The artillery tables provide the commander with a systematic means of training and qualifying each of the sections/crews/teams that are critical to the solution of the gunnery problem. The tables provide progressive, gated training—from MOS-qualified individual tasks through collective tasks at the section level. These tables also provide all FA leaders and Soldiers with the "what" and "how" to train materials that are standard across the Army.

The FA commander continuously assesses the unit's proficiency and readiness to perform mission-essential tasks. Each commander implements gunnery programs to achieve and sustain unit readiness and proficiency in these tasks. The commander uses all the resources available to implement an efficient gunnery program; this maximizes the use of ammunition, training area availability, and Soldier training time to sustain proficiency. The unit master gunner is a primary advisor and manager of the commander's gunnery program.

FA master gunners are the commander's key resource and the unit focal point for administering the training and qualification programs in this manual. Master gunners are selected for their technical education and skills in their MOS, training management, and individual instructor proficiency, as well as for breadth of proficiency in various artillery skills. A master gunner is an operations staff asset, having specified training management responsibilities for gunnery, technical standardization, and safety oversight. The master gunner is responsible for the selection, training, and certification of evaluators for implementing the tables in this manual. He will assist in the execution of the commander's safety certification program. The master gunner will also assist the commander in developing programs and training future master gunners in the organization.

SCOPE

1-1. FM 3-09.8 is a design standardizing gunnery training for the FA force in the midst of changes brought on by the contemporary operational environment (COE). COE is a "condition" applied in the effective training of FA units. (For a more detailed discussion of the application of the conditions for training under COE, see Appendix D.) Effective FA training throughout the years has always required tough, thorough, and achievable standards. Technical proficiency and flexibility in a resource- and time-constrained environment is the hallmark of the FA branch.

GENERAL CONTENT

1-2. The general content of FM 3-09.8 provides—

- Tables with procedures and individual tasks based on the associated system technical manuals (TMs) for the equipment assigned to the section being trained. References are provided for all tasks in the tables.
- Focus on FA gunnery procedures, in the provision of an Armywide FA standard gunnery training program, in a common tabular format consistent with maneuver branch tables.
- Procedures for certification/qualification of all crews/sections involved in gunnery. For the purpose of this manual, certification refers only to the commander's live-fire safety certification program as presented in chapter 2. The tables provide crew/section/team qualification tables (Radar Table VIII, chapter 5) as required to support the commander's assessment of training readiness, in accordance with AR 220-1.

STANDARDIZATION

1-3. Standardization is simply the best in practice provided as a guideline to unit commanders and Soldiers for application in their training environment. Using these practices depends on the planning and expertise of Soldier leaders in their environment. This manual is a prescriptive source to sustain the technical body of knowledge in a force performing a multitude of Soldier tasks related and unrelated to gunnery proficiency. Standardization—

- Provides prescriptive guidelines and rationale for standardized gunnery in U.S. Army FA units.
- Accommodates command, table of organization and equipment (TOE), and unit-peculiar requirements (such as theater of operations, mission-essential task list [METL], airborne, and air assault) while capturing artillery standards at the same time.
- Provides baseline proficiency requirements for unit(s) retraining from nonartillery employments.
- Allows commanders to incorporate training conditions, exercises, and focus.

SINGLE SOURCES

1-4. Though a single-source document, this manual is not an encyclopedic, multivolume recapitulation of technical manuals. This manual is designed to be used with the up-to-date technical manuals required for the safe and effective operation of all FA systems. Single source—

- Provides actual information or bibliographical references to artillery documentation for training FA tables to standard.
- Provides a living document to the field Army by reference to the requirements for updated technical manuals as they are developed for current and new systems.

TASK-BASED TRAINING STRATEGY

1-5. The artillery tables represent a task-based training strategy linked to required resources to assist the commander and training manager in the development of realistic, battle-focused gunnery training. The artillery training and standards in this manual are, by design, related to other available descriptive collective training strategies available to unit leaders. These strategies include the following:

- The Combined Arms Training Strategies (CATS) for artillery battalions include a strategy, the supporting resources and recommended events, training aids, devices, simulators, and simulations (TADSS), and supporting training support packages (TSP) for the training of the artillery tables. The CATS ammunition resources are based on the Standards in Training Commission (STRAC) allocations.
- DA Pam 350-38 provides descriptive strategies, combining ammunition allocations and TADSS based on the overarching CATS.

ARTILLERY TABLE TRAINING AND QUALIFICATION

1-6. The overall training and qualification program of the FA tables provides a methodology for progressively training sections and crews and integrating them into the system of systems that is the FA unit. The cost of training an FA unit requires that leaders take full advantage of the training benefits of every round of ammunition fired during live-fire exercises. Unit leaders ensure that unit training plans maximize the benefits of available resources by taking advantage of multi-echelon training opportunities.

1-7. The iterative, gated, tabular model, illustrated in figure 1-1, is designed to ensure that all sections and crews can safely and effectively perform required gunnery tasks before entering live-fire. Artillery live-fire exercises are executed after the command assessment of readiness for training at this level. The commander must assess the status of each element participating in live-fire table VIII to ensure that participants are trained to perform the required tasks safely, as validated by dry-fire tables for the section. Successful table VIII training qualifies all members of the FA team, provides a readiness benchmark to the command, and prepares the unit for collective training at battery and battalion levels requiring the presence and participation of all elements of the FA team. Planning appropriate training exercises and thoughtful expenditure of scarce resources allows all elements to share the training benefits.

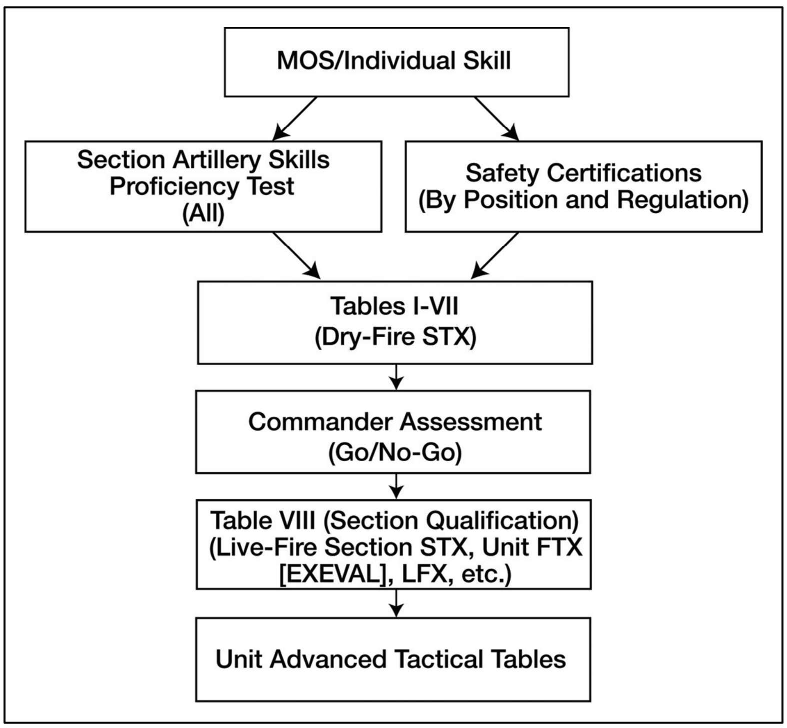


Figure 1-1. Gunnery progression chart

1-8. FA gunnery training programs belong to commanders, leaders, and Soldiers and prepare them to perform their missions in combat. The effective and efficient use of resources in a standardized program, as provided in this manual, allows for unit flexibility in executing training while also attaining branch standards and readiness requirements. The baseline tasks, conditions, and standards are provided here. Units enhance the training value by adding conditions appropriate to the unit and any anticipated theater of operations and by executing appropriate tactics, techniques, and procedures (TTP) while delivering safe and accurate fires on target.

QUICK REFERENCE GUIDE FOR USERS

1-9. The artillery tables in this manual support the training and qualification of —

- observation teams (fire support team [FIST], battery fire support team [BFIST], combat observation lasing team [COLT], and Knight) in chapter 3:
- Delivery Sections (Howitzer and Launchers) in chapter 4.
- Radar Sections (AN/TPQ-36 and -37) in chapter 5.
- Fire Direction Center (FDC)/Battery Operations Center (BOC)/Platoon Operations Center (POC) (Cannon and MLRS) in chapter 6.

1-10. Each chapter includes artillery skills proficiency tests (ASPTs) for each section type. The ASPT is a gate for the tables to be conducted semiannually. Table 1-1 shows the required frequency of training and the gates for each table. Hyperlinks are provided for users with an electronic version of this field manual. The artillery tables are consistent with the events and resources in the unit CATS and DA Pam 350-38.

Table 1-1. Required training frequency and table gates

Table Number	*Table Contents*	*Gate*	*Frequency*	*Page Number*
		Observer Sections/Teams		
ASPT	Basic Required Skills	Yes for Tables III-VIII	Semiannual	3-23
Table I	Individual Tasks	Yes for Tables II-VIII	Semiannual	3-23
Table II	Team/Section Tasks	Yes for Tables III-VIII	Semiannual	3-26
Table III	Occupation of the OP	Yes for Table VIII	Semiannual	3-27
Table IV	Standard Fire Missions	Yes for Tables V-VIII	Semiannual	3-28
Table V	Special Fire Missions	Yes for Tables VII-VIII	Semiannual	3-28
Table VI	Lethal and Nonlethal Fire-Planning			To be published in a subsequent revision
Table VII	Training	Yes for Table VIII	Semiannual	3-29
Table VIII.A Stryker/Knight	Qualification on Direct Fire System (Day)	Yes for Table VIII	Semiannual	3-33
Table VIII.A	BFIST Direct/Indirect (Day)	Yes for Table VIII B	Semiannual	3-34
Table VIII.B	BFIST Direct/Indirect (Night)	Yes for Table VIII.C (BFIST only)	Semiannual	3-34
Table VIII.C	Qualification Live Fire		Semiannual	3-35

Table 1-1. Required training frequency and table gates

Table Number	*Table Contents*	*Gate*	*Frequency*	*Page Number*
Delivery Sections (Howitzer)				
ASPT	Basic Required Skills	Yes for Tables III-VIII	Semiannual	4-1
Table I	Individual/Leader Tasks	Yes for Tables II-VIII	Semiannual	Includes safety certificatio n 4-53
Table II	Special Tasks	Yes for Tables III-VIII	Semiannual	Air assault capable units only 4-54
Table III	Machine Gun Training/Qualificati on	Yes for Table VIII	Semiannual	4-55
Table IV	Direct Fire Procedures	Yes for Table VIII	Semiannual	4-62
Table V A/B	Deliberate Occupations Day/Night	Yes for Tables VI-VIII	Semiannual	4-63
Table VI	Preparation to Fire Under Unique Conditions	Yes for Table VIII	Semiannual	4-75
Table VII	Training	Yes for Table VIII	Semiannual	4-86
Table VIII	Qualification LTX	Yes for Unit LFX	Semiannual	4-93
Delivery Section (Launchers)				
ASPT	Basic Required Skills	Yes for Tables III-VIII	Semiannual	4-94
Table I	Individual Tasks Includes safety certification	Yes for Tables II-VIII	Semiannual	4-111
Table III	Machine Gun Training/Qualificati on	Yes for Table VIII	Semiannual	4-112
Table IV	Conduct OPAREA Occupation	Yes for Table VIII	Semiannual	4-111
Table V	Reload Procedures	Yes for Table VIII	Semiannual	4-114
Table VI	Prepare HIMARS for Air Transport	Yes for Qualification	Semiannual	4-119
Table VII	Training	Yes for Table VIII	Semiannual	4-138
Table VIII	Qualification	Yes for Unit LFX	Semiannual	4-138

Table 1-1. Required training frequency and table gates

Table Number	*Table Contents*	*Gate*	*Frequency*	*Page Number*
		Radar Sections		
ASPT	Basic Required Skills	Yes for Tables III-VIII	Semiannual	5-2
Table I	Individual Tasks	Yes for Tables II-VIII	Semiannual	5-20
Table III	Machine Gun Training/Qualification	Yes for Table VIII	Semiannual	5-20
Table IV	RSOP	Yes for Table VIII	Semiannual	5-21
Table V	March Order	Yes for Tables VI-VIII	Semiannual	5-21
Table VI	Perform Surveillance and Locate Targets	Yes for Table VII	Semiannual	5-22
Table VII	Training	Yes for Table VIII	Semiannual	5-23
Table VIII	Qualification	Yes for Unit LFX	Semiannual	5-23
		FDC/BOC/POC Section		
ASPT	Basic Required Skills	Yes for Table VIII	Semiannual	6-2
Table I	Individual Tasks Includes safety certification	Yes for Table VIII	Semiannual	6-17
Table IV	Occupation and Setup	Yes for Tables VI-VIII	Semiannual	6-20
Table V	Compute Firing Data	Yes for Tables VII-VIII	Semiannual	6-22
Table VI	Provide Command and Control	Yes for Table VIII	Semiannual	6-22
Table VII	Training	Yes for Table VIII	Semiannual	6-23
Table VIII	Qualification	Yes for Unit LFX	Semiannual	6-23

Chapter 2
Safety

The basic rule for preventing firing incidents is to recognize that individuals make errors, and the best safeguard against those errors is an independent doublecheck of all operations in which human error could cause a firing incident (sometimes referred to as the two-man rule). A fundamental aspect of safety is that no one person performs a critical live-fire task then checks that task himself. For every critical task required for firing artillery safely, there is a person or persons designated to verify the task. Verification of data includes independent checks by independent means.

SECTION I – CERTIFICATION, BATTLE FOCUS, DUTIES, AND RESPONSIBILITIES

2-1. Live-fire safety is critical when training artillery units. The commander's certification of leaders in the required safety procedures is a gate for all subsequent live-fire training (for delivery sections, see chapter 4). Training individual leader safety tasks is a critical first step in training the Field Artillery Gunnery Tables.

CERTIFICATION

2-2. Conducting live-fire safety checks and verification is an integral responsibility in most leader duty positions in FA units. Qualifying leaders to perform their responsibilities includes live-fire safety procedures and positive checks required to perform duties as OIC, RSO, and safety-certified section chief. Commanders are responsible for the safety certification/qualification of individual leaders to perform in the duty positions listed in paragraph 2-3..

INDIVIDUAL SAFETY CERTIFICATION

2-3. The duty positions in a FA firing battery that require knowledge or skills that directly impact on live-fire safety will be certified during individual certification of skills. A written test, a hands-on component, or both may verify this certification. Written questions are available for leaders on the Fires Knowledge Network, Master Gunner site (http://sill-www.army.mil/mg/). Tasks to support the hands-on component are in appendix C. The duty positions requiring individual certification are—

- Battery commander.
- Battery executive officer (XO).
- Battery fire direction officer (FDO).
- Platoon leader.
- Firing battery chief.
- Gunnery sergeant.
- Platoon sergeant.
- Section chief.
- FDC chief computer operator.

SECTION/CREW/TEAM TRAINING

2-4. All sections/crews/teams that contribute directly to solving the gunnery problem will be trained in a dry status, prior to live-fire qualification. Where available, TADSS will be used to support training such as—

- GUARDFIST II.
- Call for fire trainer for FIST/COLT/Knight training.
- PC-based fire control panel trainer for MLRS training.
- FSCATT for howitzer section training.

BATTLE FOCUS

2-5. Live-fire safety requirements normally associated with ranges and range safety (such as the Safety T) also apply to combat. The requirement to compute and check left and right limits, minimum and maximum charges, fuze settings, deflections, and quadrant elevations are as critical in avoiding fratricide and violation of FSCM during combat as are range safety precautions during live-fire training.

RESPONSIBILITIES AND DUTIES

COMMANDERS OF FIELD ARTILLERY BATTALIONS AND LARGER UNITS

2-6. Commanders establish and maintain a safety training and certification program for their personnel. This program trains and qualifies firing battery personnel in safety procedures for their specific areas of responsibility. When the commander is satisfied that the personnel are qualified to perform the safety duties as required, he certifies them. Personnel who have not completed annual training and certification will not be appointed as OIC or RSO. Additionally, the commander must—

- Comply with the installation procedures for certifying OIC/RSO/LRSO.
- Conduct risk management for all range operations.

OFFICER IN CHARGE

2-7. The OIC is the battery commander or his command safety-certified representative. The OIC is responsible for all aspects of safety in the firing unit and on the assigned firing range. Before the firing exercise, the RSO (XO or platoon leader) provides the OIC with the required safety data and firing limitations. The OIC verifies that the unit is in the proper firing position, supervises the conversion of the safety data into a safety diagram, and ensures that another command safety-certified individual verifies the diagram. The safety data determined from the safety diagram provide right and left deflection limits, minimum (min) and maximum (max) quadrant elevations (QEs) for authorized charges, and minimum safe fuze times. The Safety T, modified as needed by the XO's minimum QE, is given to the appropriate members of the firing battery. The OIC ascertains locations of friendly personnel who may inadvertently become exposed to artillery fires (through the installation RCO). The OIC ensures dissemination of this information to platoon leaders, platoon sergeants, and section chiefs, as appropriate, to guard against fratricide.

XO OR PLATOON LEADER

2-8. The XO or platoon leader-RSO is responsible for the safety practices of the firing element and ensures that the section chiefs have safety data.

Cannon Units

2-9. The XO or platoon leader determines the lowest QE that can be fired safely from the firing position and ensures that projectiles clear all immediate crests (for the XO's minimum QE, see page 2-41). The FDO, the platoon sergeant, and/or the gunnery sergeant will assist.

MLRS Units

2-10. The XO or platoon leader RSO ensures that section chiefs report firing data to the POC/BOC and that the launcher danger area F and exclusion area I are clear.

FIRE DIRECTION OFFICER

2-11. The FDO has primary responsibility for computing safety data and ensuring that all safety data are updated after registration and receipt of current meteorological data. The FDO, assisted by the chief computer operator, plots the impact area on a map or chart in the FDC and ensures that all firing data are within prescribed safety limits before they are sent to the firing sections. The FDO is responsible for adjusting minimum QE for intervening crests.

FIRE DIRECTION CENTER CHIEF COMPUTER OPERATOR

2-12. The FDC chief computer assists the FDO in verifying initialization data in the Advanced Field Artillery Tactical Data System (AFATDS)/ LCU. The FDC assists in constructing the safety diagram and in verifying the data for the Safety T and the adjustment of minimum QE for intervening crest.

GUNNERY SERGEANT/CHIEF OF FIRING BATTERY (CFB)/PLATOON SERGEANT

2-13. The gunnery sergeant/CFB/platoon sergeant helps the XO or platoon leader and must be prepared to perform many of the duties in the absence of the XO or platoon leader.

HOWITZER SECTION CHIEF

2-14. The howitzer section chief supervises all practices at or near the weapon. These practices include verifying that the announced safety data are applied to the weapon and that the proper charge, fuze, and projectiles are fired. The howitzer section chief has final responsibility for firing the weapon and performs the following prefire checks, (in accordance with applicable operator-level TM-10 series):

- Checks the serviceability and type of ammunition and fuze used.
- Ensures the proper emplacement of safety stakes/tape.
- Physically verifies that every charge is correct before loading.
- Verifies the fuze/time setting on each round before loading.
- Announces the time fuze setting on the round (for comparison with the announced fire command).
- Checks deflection and quadrant for each round by visual inspection of data, sight picture, and leveling vials. Using the gunner's quadrant, to verify quadrant, is mandatory for the first rounds fired in each new mission.

MLRS Section Chief

2-15. The launcher section chief is responsible for the safe operation of the weapon system by the crew—from the upload of live rockets through rocket launch(es). The launcher section chief ensures that all procedures in the launcher are conducted in accordance with applicable technical manuals and all reports and checks are verified in accordance with the procedures outlined in this chapter. The launcher section chief is ultimately responsible for ensuring that munitions are neither armed nor fired until firing data is properly verified as safe. The launcher section chief also ensures that the gunner is trained to properly read and use a Safety T.

RANGE CONTROL OFFICER

2-16. The RCO gives the following safety data to the firing unit OIC:

- Grid coordinates of the firing position.
- Lateral safety limits.
- Minimum and maximum ranges.
- Authorized ammunition to be fired (fuse, projectile, and charge).
- Maximum ordinate (high angle or low angle).
- Hours during which firing is to be conducted.

RANGE SAFETY OFFICER

2-17. Before granting clearance to fire, the RSO—

- Ensures that weapons and personnel are properly positioned.
- Ensures that authorized ammunition and explosives (to include proper charge, fuse, and fuse settings) are used.
- Ensures that firing settings and weapons systems are within prescribed safety limits and verified.
- Ensures that the SDZ is clear of all unauthorized personnel.
- Ensures that proper hearing protection is worn by personnel in noise hazard areas.
- Ensures that proper eye protection is worn by personnel within eye hazard areas.
- Ensures that permission is received from range control to begin training and live-fire operations.
- Conducts final coordination with the OIC before beginning live-fire operations. (This coordination will include a summary of checks, inspections, and actions that the RSO has completed and verification that required communications have been established and a "hot status" has been received from range control.)
- Orders immediate cease fire or check fire when an unsafe condition occurs.
- Is physically present at the training site.
- Reports all accidents and ammunition malfunctions to the range OIC.
- Verifies, upon completion of firing or firing order, to the OIC that all weapons and weapons systems are clear and safe before allowing removal of weapons from the firing area.

LASER RANGE SAFETY OFFICER

2-18. The LRSO—

- Ensures that unit personnel employing lasers receive thorough safety briefings (including explanations of specific laser-related hazards, safety equipment, and detailed range safety procedures) and comply with procedures in DA Pam 385-63, chapter 18.
- Knows and observes horizontal and vertical safety limits of the laser range.
- Follows unit SOPs for laser operations and training exercises.
- Ensures that all personnel engaged in laser operations, including personnel in target areas, maintain continuous communications.
- Ceases laser operations immediately if communications or positive control of the laser beam is lost.

2-19. The LRSO takes extreme caution when using a target-designating laser in conjunction with ordnance delivery aircraft. The onboard laser seeker may lock onto the designator or its radiated energy (beam or reflected beam) instead of the target. The LRSO uses the following procedures to reduce this risk:

- Ensures that the pilot of the attacking aircraft has positive knowledge of the location of the designator and the target area before releasing munitions.
- Designates the approach paths and briefs both the designating and forward air controller and the aircrews before conducting the mission. Plans aircraft approach paths to preclude crossing laser

designator beams with the laser seeker. (The laser seeker should intersect the designator beam well forward of the laser firing point, angling toward the target.)

- Ensures that only mission-essential personnel are within the area of effects for the weapon employed from the designator or direct or reflected beam of the laser designator during operations.
- Does not launch or release munitions on a heading toward the laser designator. See applicable technical manuals for recommended employment procedures.

OBSERVER

2-20. The observer ensures that the impact area is clear of personnel and equipment prior to firing and spots all fired rounds. When the G/VLLD, mini-eyesafe laser infrared observation set (MELIOS), LLDR, or any other device is used for lasing, the observer must ensure that all applicable laser safety procedures are followed.

SECTION II – PROCEDURES

2-21. The following safety procedures include firing and computational procedures for both MLRS and cannons. These procedures are identical to those in FM 6-40/MCWP 3-1.6.19, FM 6-50, and FM 6-60 and are consolidated here for convenience. These procedures comply with AR 385-63/MCO P3570.1B and DA Pam 385-63; however, if local range regulations are more restrictive than the material in this manual, follow the local range regulations.

CANNON SAFETY

2-22. The following section identifies the specific duties of cannon battery personnel before, during, and after firing.

2-23. Specific duties of safety personnel before firing include, **but are not limited to**, the following:

- Verify that the data the RCO gives to the OIC apply to the unit firing, that the unit is in the correct location, and that the data are correct (OIC and RSO).
- Compute and verify the safety diagram (at least two safety-certified personnel, normally the platoon leader and FDO).
- Ensure that all personnel and equipment are clear from surface danger area E before firing (see DA Pam 385-63 for the dimensions of surface danger area E for specific weapon systems).
- Check the DA Form 581 (*Request for Issue and Turn-In of Ammunition*) and range safety card to ensure that only authorized ammunition is fired (platoon leader or platoon sergeant).
- Ensure that no safety violations occur at or near the weapon(s) (all members of the firing unit).
- Check the weapons for correct boresighting (section chief).
- Verify the lay of the battery (platoon leader or platoon sergeant).
- Compute and verify minimum QE (platoon leader or FDO).
- Compare minimum QE with the QE for minimum range shown on the safety diagram. Use the larger of the two as the minimum QE (platoon leader or FDO).
- Verify that the section chief has safety data (Safety T). Ensure that section chiefs are advised of all friendly personnel in the area who may inadvertently be exposed to FA direct or indirect fires (platoon leader or platoon sergeant).
- Supervise and check the emplacement of safety aids (stakes, tape, and other devices) (platoon leader, platoon sergeant, or gunnery sergeant).
- Verify that range clearance has been obtained (platoon leader or FDO).

2-24. Specific duties of safety personnel during firing include, **but are not limited to**, the following:

- Verify the serviceability of ammunition (section chief).
- Supervise key safety personnel in the performance of their duties (OIC or RSO).

- Verify that the charges, projectiles, and fuses being fired are only those prescribed on the safety card (section chief, platoon leader, or platoon sergeant).
- Visually inspect to ensure that the correct shell-fuze combination, time (if required), and charge are properly prepared and loaded on each round. Verify that the correct number of remaining powder increments are removed to the powder pit before loading and firing each round (section chief).
- Verify that rounds are not fired below the minimum QE or above the maximum QE (section chief, platoon leader, or platoon sergeant).
- Verify that rounds are not fired outside the lateral (deflection) safety limits specified on the range safety card (section chief, platoon leader, or platoon sergeant).
- Verify that time-fused rounds are not fired with fuze settings that are less than the minimum time prescribed on the safety diagram (section chief, platoon leader, or platoon sergeant).

2-25. On all commands that are unsafe to fire, command "CHECK FIRING," and give the reason(s) why the command is unsafe (section chief or anyone observing an unsafe act), as in the following examples:

DANGER

"UNSAFE TO FIRE 3 MILS OUTSIDE RIGHT SAFETY LIMIT AND 20 MILS ABOVE MAXIMUM QUADRANT ELEVATION."

"UNSAFE TO FIRE 5 MILS BELOW MINIMUM QUADRANT ELEVATION."

- Recompute and issue updated Safety Ts (FDC)—
  - When a registration is completed.
  - When meteorological conditions change.
  - When restrictions change.
- Suspend firing when any unsafe condition exists (any person who sees an unsafe act). Examples of unsafe conditions include the following:
  - Powder bags exposed to fire.
  - Personnel smoking near pieces of ammunition.
  - Improper handling of ammunition.
  - Time fuze previously set and not reset to safe.
  - Personnel or aircraft directly in front of the weapon.
  - Primer inserted into the firing assembly before breech is closed (separate-loading ammunition).
  - Failure to inspect powder chamber and bore after each round is fired.
  - Failure to swab powder chamber after each round of separate-loading ammunition is fired.

2-26. Specific duties of safety personnel after firing include, **but are not limited to**, the following:

- Verify that unused powder increments are disposed in an approved place in the correct manner.
- Verify that all unfired ammunition is properly accounted for, repacked, and returned to the ammunition resupply point.
- Verify policing of the firing position.
- Verify collection and proper disposal of all Safety Ts.

CANNON SAFETY AIDS

2-27. From the range safety card, the FDO prepares a safety diagram and Safety Ts for the safety-certified personnel. Safety aids are used to ensure that only safe data are fired from the position. Two such safety aids are the safety stakes and Safety Tape. These aids are used as a visual check to ensure that the howitzer is laid within safety limits.

M102 OR M119A1 HOWITZER

2-28. Emplace safety aids for the M102 or M119A1 howitzer as follows:

- Deflection safety aids (M102).
  - Set off the left deflection limit on the pantel by using the deflection counter.
  - Traverse the tube to establish the proper sight picture on the aiming point.
  - Emplace the safety stake against the right side of the lunette and drive it firmly into the ground.
  - Mark the right deflection limit in the same manner, but emplace the safety stake on the left side of the lunette.
- Deflection safety aids (M119A1).
  - Lay in the center of traverse as shown in figure 2-1 (A).
  - Determine the left deflection limit and traverse the tube to the maximum left. Traverse the carriage right until the tube is at the left deflection limit. Emplace the left deflection limit safety stake as shown in figure 2-1 (B).
  - Determine the right deflection limit, and traverse the tube to the maximum right. Traverse the carriage left until the tube is at the right limit. Emplace the right deflection limit safety stake as shown in figure 2-1 (C).
- Quadrant elevation safety aids (M102 and M119A1).
  - Use the cam follower as an index mark.
  - Set off the maximum QE on the fire control quadrant. Elevate the tube until the bubbles center in the elevation level vials.
  - Mark the cam with a piece of tape in line with the cam follower.
  - Mark the minimum QE in the same manner.

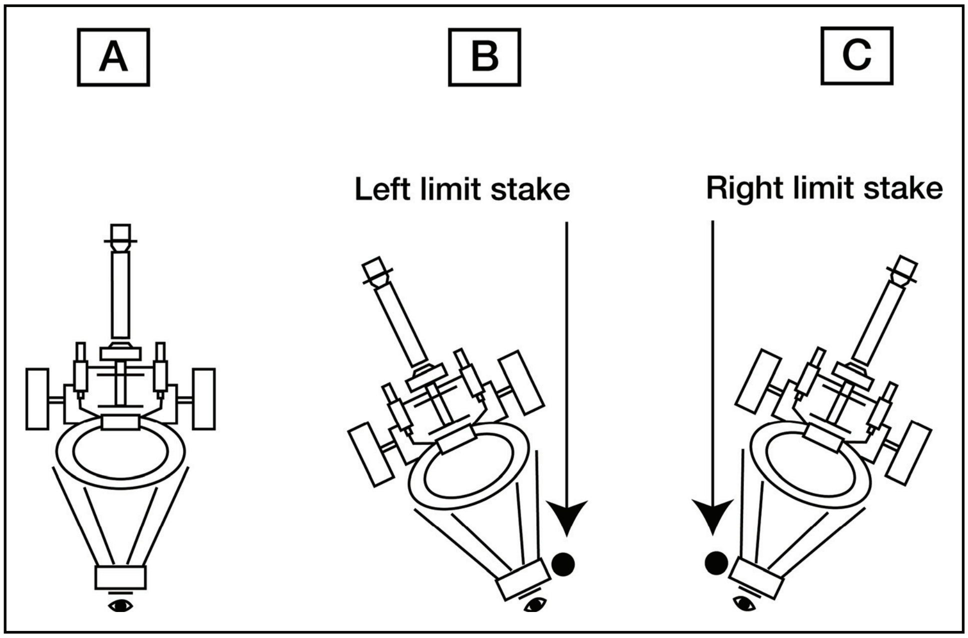


Figure 2-1. Emplacing safety stakes for M119A1

M198 HOWITZER

2-29. Emplace safety tape on the M198 howitzer as follows:

- Deflection safety aids.
  - With the tube parallel to the azimuth of lay (AOL) (deflection 3,200), place a piece of tape over the azimuth (AZ) counter (bottom carriage).
  - Set off the left deflection limit on the pantel by using the deflection counter. Traverse the tube to establish the proper sight picture on the aiming point.
  - Using a straightedge, draw a line (on the tape placed on the bottom carriage) directly below the azimuth counter index mark on the upper carriage. Record the left deflection limit next to that line.
  - Mark the right deflection limit in the same manner.
- Quadrant elevation safety aids.
  - With the tube elevated at 0 mil, place a piece of tape on the trunnion support, and draw a straight line as an index.
  - Set off the minimum QE on the fire control quadrant. Elevate the tube until the bubble centers in the elevation level vial.
  - Place a piece of tape on the quadrant mount. Draw a line across from the index line established on the trunnion support. Record the minimum QE next to that line.
  - Mark the maximum QE in the same manner.

M109A2-A5 HOWITZER

2-30. Emplace safety aids on the M109A2-A5 howitzer as follows:

- Deflection safety aids. (These may be marked on the exterior and/or interior of the hull.)
  - Make an index mark on the top carriage with a piece of tape.
  - Set off the left deflection limit on the pantel using the reset counter. Traverse to pick up a proper sight picture on the aiming point.

- Place a piece of tape on the bottom of the carriage directly under the index mark.
- Mark the right deflection limit in the same manner.

- Quadrant elevation safety aids. (These may be marked on the exterior or the interior of the weapon.) Mark the exterior of the weapon as follows:
  - Make an index mark on the tube with a piece of tape.
  - Set off the maximum QE on the fire control quadrant. Elevate the tube until the bubble centers in the elevation level vial.
  - Place a mark on the top carriage in line with the index mark.
  - Mark the minimum QE in the same manner.

SECTION III – MANUAL COMPUTATION OF SAFETY DATA

2-31. Minimum and maximum quadrant elevations, deflection limits, and minimum fuze settings must be computed to ensure that all rounds fired impact or function in the target area. These data are presented and arranged in a logical manner on a Safety T. This section describes how to manually compute safety data using tabular and graphical equipment. (As stated earlier, the RCO gives the OIC the lateral safety limits and the minimum and maximum ranges of the target areas These data must be converted to fuze settings, deflections, and quadrants.) The computations discussed in this section should be performed by two safety-certified personnel working independently.

MANUAL SAFETY COMPUTATION PROCEDURE

2-32. Manual safety computations are completed in four steps—beginning with receiving the range safety card and ending with constructing the Safety T. These steps are listed in table 2-1.

Table 2-1. Manual safety computation

Step	*Action*
1	Receive the range safety card (produced by unit or from range control).
2	Construct the safety diagram per the instructions in table 2-2, page 2-11.
3	Construct and complete the computation matrix. (Use figure 2-4 [page 2-17] for low-angle safety matrix and figure 2-13 [page 2-35] for high-angle safety matrix).
4	Construct the Safety T and disseminate per the unit SOP.

Note. Figures 2-17 (page 2-38) and 2-18 (page 2-39) represent locally reproducible safety computation forms. Reproduce these forms on 8½ x 11-inch paper. FM 6-40/MCWP 3-1.1.19 prescribes these forms.

SAFETY CARD

2-33. A range safety card (figure 2-2), which prescribes the hours of firing, the area where the firing will take place, the location of the firing position, limits of the target area (per AR 385-63/MCO P3570.1B), and other pertinent data is approved by the RCO and provided to the OIC. The OIC of firing gives a copy of the range safety card to the position safety officer, who constructs the safety diagram based on the prescribed limits.

Note. The range safety card shown in figure 2-2 is used for all safety computation examples in this chapter.

Range Safety Card

Unit/STR	**K 3/11**	ScheduledDate In	**Ø5/30/98**	ScheduledDateOut	**Ø5/30/98**
		Time In	**Ø7ØØ**	Time Out	**2359**

Firing Point **185** **(6Ø26 411Ø) HT 37Ø.Ø** Impact Area S. CARLTON AREA

Weapon **M198** **(155)** Ammunition M1Ø7, M11Ø, M116, M825, M485, M557, M582, M732, M577

Type of Fire: LOW ANGLE: HE, WP, M825, ILA, M116

Type of Fire: HIGH ANGLE: HE, M825, ILA

Direction Limits: (Ref GN): Left 134Ø mils Right 19ØØ mils

Low-Angle PD Minimum Range	3,9ØØ meters	Minimum Charge 3GB
Fuze TI and High-Angle Minimum Range	4,ØØØ meters	Minimum Charge 3GB

To Establish Minimum Time for Fuze VT Apply +5.5 Seconds to the Low-angle PD Minimum Range

Maximum Range to Impact	6,2ØØ meters	Maximum Charge 4GB

COMMENTS

From AZ 134Ø to AZ 15ØØ maximum range is 57ØØ

SPECIAL INSTRUCTIONS

Shell illumination (all calibers)

A. Maximum QE will not exceed QE for maximum range to impact.

B. One initial illumination check round will be fired to ensure illumination flare remains in impact area.

C. If initial illumination flare does not land in impact area, no further illumination will be fired at that DF and QE.

D. ensure that all succeeding rounds are fired at a HOB sufficient to provide complete burnout before reaching the ground.

E. For 155-mm Howitzer, charge 7 not authorized when firing proj illumination, M485.

Uncleared ammunition (fuses, projectiles, powder) will not be used.

Figure 2-2. Example range safety card

BASIC SAFETY DIAGRAM

2-34. Upon receiving the range safety card, the FDO constructs a basic safety diagram. The basic safety diagram graphically portrays the data on the range safety card, or it is determined from the surface danger zone (DA Pam 385-63, chapter 11) and need not be drawn to scale. Information shown on the basic safety diagram includes the minimum and maximum range lines; the left, right, and intermediate (if any) azimuth limits; the deflections corresponding to the azimuth limits; and the AOL.

2-35. Table 2-2 shows the steps for constructing a basic safety diagram. Figure 2-3 (page 2-12) is an example of a completed safety diagram.

Table 2-2. Construction of a basic safety diagram

Step	*Action*
1	On the top third of a sheet of paper, draw a line representing the AOL for the firing unit. Label this line with its azimuth and the common deflection for the weapon system. **Note.** If the AOL is not provided, do the following to determine AOL: • Subtract the maximum left azimuth limit from the maximum right azimuth limit. • Divide this value by two. • Add the result to the maximum left azimuth limit, and express the result to the nearest 100 mils. (Expressing to the nearest 100 mils makes it easier for the aiming circle operator to lay the howitzers.)
2	Draw lines representing the lateral limits in proper relation to the AOL. Label these lines with the corresponding azimuth from the range safety card.
3	Draw lines between these lateral limits to represent the minimum and maximum ranges. Label these lines with the corresponding ranges from the range safety card. These are the diagram ranges. ***Note***. If the minimum range for fuze time is different from the minimum range, draw a dashed line between the lateral limits to represent the minimum range for fuze time. Label this line with the corresponding range from the range safety card. This is the minimum time diagram range.
4	Compute the angular measurements from the AOL to each lateral limit. On the diagram, draw arrows indicating the angular measurements and label them.
5	Apply the angular measurements to the deflection corresponding to the AOL (common deflection) and record the result. This will be added to the drift and GFT deflection correction determined in the safety matrixes to produce the deflection limits on the Safety T. ***Note.*** If no GFT deflection correction has been determined— deflection limits = drift + diagram deflection. ***Note***. If a GFT setting has been determined— deflection limits = drift + GFT deflection correction + diagram deflection. Drift is applied to the basic safety diagram by following the “left least, right most” rule. The lowest (least) drift is applied to all left deflection limits, and the highest (greatest) drift is applied to all right deflection limits.
6	Label the diagram with the following information from the range safety card: firing point location (grid and altitude), charge, shell, fuze, angle of fire, and AOL.

2-36. When the basic safety diagram is complete, it will be constructed to scale in red on the firing chart. Plot the firing point location as listed on the range safety card. Using temporary azimuth indexes, an RDP, and a red pencil, draw the outline of the basic safety diagram:

- First draw the azimuth limits to include doglegs.
- Then, by holding the red pencil firmly against the RDP at the appropriate ranges, connect the azimuth lines.

Note. Only after drawing the basic safety diagram on the firing chart may the base piece location be plotted and deflection indexes be constructed. Should the diagram be drawn from the base piece location, it would be invalid unless the base piece was located over the firing point marker.

2-37. After the basic safety diagram has been drawn on a sheet of paper and on the firing chart, it is drawn on a map of the impact area using an RDP and a pencil. These limits must be drawn accurately because they will be used to determine altitudes for vertical intervals. Determine the maximum altitude along the minimum range line. This is used to ensure that the quadrant fired will cause the round to clear the highest point along the minimum range line and impact (function) within the impact area. At the maximum range, select the minimum altitude to ensure that the round will not clear the lowest point along the maximum range. Once the altitudes have been selected, label the basic safety diagram with the altitudes for the given ranges.

Note. The rule for determining the correct altitude for safety purposes is called the mini-max rule. At the minimum range, select the maximum altitude; at the maximum range, select the minimum altitude. If the contour interval is in feet, use either the GST or divide feet by 3.28 to determine the altitude in meters (feet ÷ 3.28 = meters). This rule applies to both manual and automated procedures.

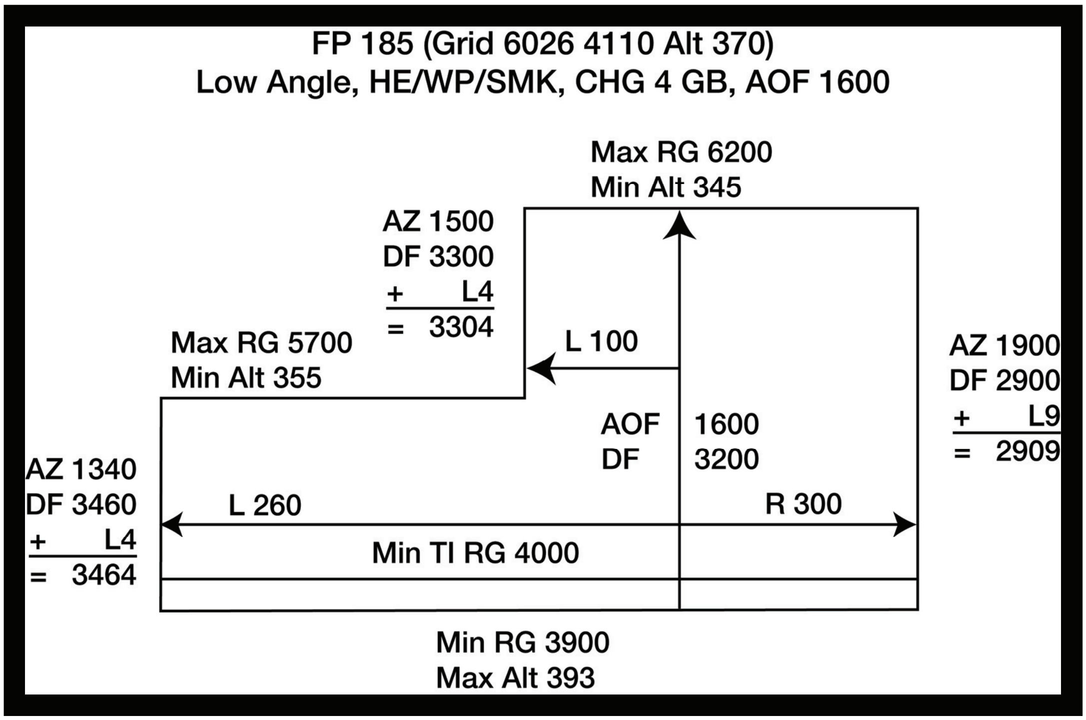


Figure 2-3. Example of a completed safety diagram (HE/WP/SMK)

COMPUTATION OF LOW-ANGLE SAFETY DATA

2-38. Use the steps outlined in table 2-3 and in the matrix in figure 2-4 as examples for organizing computations. The low-angle safety matrix is used for all munitions except M712 CLGP (Copperhead). Paragraph 2-49 (page 2-31) describes M712 safety computations. The data are determined by either graphical or tabular firing tables. In the case of expelling charge munitions, the safety table located in the firing tables or firing table addenda is used to determine elevation, time of flight, fuze setting, and drift. Use artillery expression for all computations except where noted. A completed low-angle safety matrix is shown in figure 2-5 (page 2-16).

Note. The safety tables used to compute the examples in this chapter are located after the illumination and M825 low-angle examples (page 2-11).

Table 2-3. Low-angle procedures

Step	*Action*
1	On the top third of a blank sheet of paper, construct the basic safety diagram in accordance with the range safety card (see table 2-2 [page 2-10] for procedures).

Table 2-3. Low-angle procedures

Step	*Action*
2	In the middle third of the sheet of paper, construct the low-angle safety matrix (figure 2-4, page 2-15).
3	Record the diagram ranges from the basic safety diagram.
4	Record the charge from the range safety card.
5	Enter the range correction, if required. The range correction is necessary only if a nonstandard condition exists and is not already accounted for in a GFT setting, such as correcting for the always heavier than standard white phosphorous projectile. See figure 2-4, paragraph (b) (page 2-15) to determine range correction. If a range correction is required, it is expressed to the nearest 10 meters. If no range correction is required, enter 0 (zero).
6	Determine the total range. Total range is the sum of the diagram range and the range correction. **Total range is expressed to the nearest 10 meters.**
7	Enter the Range K. Range K is required only if a GFT setting has been obtained but cannot be applied to a GFT (for example, determining illumination safety with an HE GFT setting). Range K is simply the total range correction from the GFT setting expressed as a percentage. This percentage, when multiplied by the total range, produces the entry range. If no GFT setting is available (for example, preoccupation safety), enter 1.0000 as the Range K. If a GFT setting is available, (for example, postoccupation safety), enter the Range K expressed to four decimal places (for example, 1.1234). Step 7a shows how to compute Range K.
7a	Divide Range ~ Adjusted Elevation by the Achieved Range from the GFT setting to determine Range K. Range ~ Adjusted Elevation Divided by Achieved Range = Range K
8	Determine the entry range. Multiply the total range by Range K to determine the entry range. If Range K is 1.0000, the entry range will be identical to the total range. **Entry range is expressed to the nearest 10 meters.**
9	Following the mini-max rule, determine the VI by subtracting the unit altitude from the altitude corresponding to the diagram range, and record it. **VI is expressed to the nearest whole meter.** ***Note.*** Diagram range is used to compute VI and site because this is the actual location of the minimum range line. VI is not computed for minimum time range lines. The range correction, total range, and Range K are used to compensate for nonstandard conditions and represent the aiming point that must be used to cause the round to cross the diagram range.
10	Compute and record site to the diagram range. Use the GST from the head of the projectile family when possible. **Site is expressed to the nearest whole mil.**
11	Determine the elevation from table C (base ejecting) or TFT/GFT (bursting), and record it. **Elevation is expressed to the nearest whole mil.** ***Note.*** GFT settings are not used to determine elevation. Range K represents total corrections; therefore, using a GFT setting would double the effects of those corrections.
12	Compute the quadrant elevation and record it. Quadrant elevation is the sum of elevation and site. Quadrant elevation is expressed to the nearest whole mil.
13	Determine and record the minimum fuze setting for M564/M565 fuses. These fuze settings correspond to the entry range and are extracted from table C (base ejecting) or TFT/GFT (bursting). **Fuze settings are expressed to the nearest tenth of a fuze setting increment.** ***Note.*** Minimum fuze settings are determined only for minimum range lines and may be computed for separate minimum fuze range lines.

Table 2-3. Low-angle procedures

Step	*Action*
14	Determine and record the minimum fuze setting for M582/M577 fuzes. These fuze settings correspond to the entry range and are extracted from table C (base ejecting) or TFT/GFT. **Fuze settings are expressed to the nearest tenth of a second**. ***Note.*** Minimum Fuze settings are determined only for minimum range lines and may be computed for separate minimum fuze range lines.
15	Determine and record the time of flight corresponding to the entry range from table C, (base ejecting) or TFT/GFT (bursting). **Time of flight is expressed to the nearest tenth of a second.**
16	Determine the minimum fuze setting for M728/M732 fuses. Add 5.5 seconds to the time of flight, and express to the next higher whole second. The VT fuze is designed to arm 3.0 seconds before the time set. They have been known to arm up to 5.5 seconds before the time set. That is why this value is added and always expressed up to the next whole second. **VT fuze settings are expressed up to the next higher whole second.** ***Note.*** Minimum fuze settings are determined only for minimum range lines and may be computed for separate minimum **fuze** range lines.
17	Determine and record drift corresponding to the entry range from table C (base ejecting) or TFT/GFT (bursting). Drift is applied to the basic safety diagram by following the “left least, right most” rule. The lowest (least) drift is applied to all left deflection limits, and the highest (greatest) drift is applied to all right deflection limits. **Drift is expressed to the nearest whole mil.**
18	Ensure that computations are verified by a second safety-certified person.
19	On the bottom third of the sheet of paper, record the data on the Safety T.

(a)		(b)		(c)		(d)		(e)	(f)	(g)	(h)		(i)		(j)	(k)	(l)	(m)	(n)	(o)	(p)
DIAGRAM		RG		TOT		RG		ENTRY								M564/	M582			M728	
RG	+	CORR	=	RG	X	K	=	RG	CHG	VI	SI	+	EL	=	QE	M565	M577	TOF+	5.5=	M732	DFT

(a) This is the minimum or maximum range from the range safety diagram.

(b) This is the range correction for nonstandard conditions from table F (tabular firing tables), if required. This is typically for preoccupation safety or corrections for nonstandard conditions not included in the Range K factor in column (d), such as WP ■ weight. Examples of nonstandard conditions accounted for in (b) include, but are not limited to, difference in projectile square weight, difference in muzzle velocity, or any nonstandard condition accounted for prior to determining a Range K factor. If there is no change from standard, or all nonstandard conditions are accounted for in the Range K factor, this value is zero (0). To determine a range correction from table F, use the following formula:

		NONSTANDARD		STANDARD		CHANGE IN		RG CORR		RANGE
RANGE	CHG	CONDITION	–	CONDITION	=	STANDARD	X	FACTOR	=	CORRECTION

(c) This is the sum of the diagram range and the range correction. If there is no range correction, the total range will be the same as the diagram range.

(d) This is the Range K factor determined by using FM 6-40/MCWP 3-1.6.19, appendix F, paragraph F-6, technique 2. This is for postoccupation safety. It represents total corrections for a registration, MET + VE, or other subsequent MET technique. It represents all nonstandard conditions—unless a separate nonstandard condition such as change in square weight for WP is listed separately in column (b). It is multiplied by the total range to determine entry range. If there is no Range K, enter 1.0000.

(e) This is the sum of the total range times the Range K factor. If there is no Range K factor, the entry range will be the same as the total range. Entry range is the range to which elevation is determined.

(f) This is the charge from the range safety card for this set of safety computations.

(g) This is the vertical interval from the range safety diagram.

(h) This is the site determined to the diagram range by using the GST or TFT from the head of the projectile family (for example, the site for the M110 WP projectile is determined with the AM-2; M825 site is computed using the AN-2). Site is computed to the diagram range, as that is where the vertical intervals are determined.*

(i) This is the elevation from table C (base ejecting) or GFT/TFT (bursting).*

(j) This is the sum of elevation and site. It is the minimum or maximum quadrant elevation corresponding to the minimum or maximum range.

(k) This is the minimum fuse setting for the M564/565 fuze from table C (base ejecting), or GFT/TFT (bursting), corresponding to the entry range.*/**

(l) This is the minimum fuze setting for the M582/M577 fuze from table C (base ejecting) or GFT/TFT (bursting), corresponding to the entry range.*/**

Note. This also applies to the M762, M767, and MOFA fuses.

(m) This is the time of flight from table C (base ejecting) or GFT/TFT (bursting), corresponding to the entry range.*/**

(n) This is the safety factor applied to the time of flight to determine VT fuze data.**

(o) This is the sum of TOF + 5.5. It is the minimum fuse setting for M728/M732 VT fuses.**

(p) This is the drift corresponding to the entry range from table C (base ejecting), or GFT/TFT (bursting). Drift is applied to the range safety diagram by using the "left least; right most" rule. The "least" or lowest drift is applied to all left deflection limits, and the "most" or greatest drift is applied to all right deflection limits.

*See Table 2-4 (page 2-17) to determine the correct source table or addendum for computations.

** Computed only for minimum entry ranges and only if applicable to the ammunition and the range safety card.

Figure 2-4. Low-angle safety matrix

4■ HE/SMK (M116) Low Angle Chg 4GB

Diagram RG	+ RG CORR	= TOT RG	x RG K	= Entry RG	Chg	VI	SI	+ EL	= QE	M564/ M565	M582/ M577	TOF +	5.5 =	M728/ M732	DFT
3900	+ 0	= 3900	x 1.0000	= 3900	4GB	+23	+6	+225	= 231	--	13.7	/	19.2	~ 20.0	L4
4000	+ 0	= 4000	x 1.0000	= 4000	4GB	--	--	--	--	--	14.1		--	--	--
5700	+ 0	= 5700	x 1.0000	= 5700	4GB	-15	-3	+362	= 359	--	--		--	--	--
6200	+ 0	= 6200	x 1.0000	= 6200	4GB	-25	-5	+408	= 403	--	--		--	--	L9

WP (M110, Weight Unknown) Low Angle Chg 4GB

Determining Range Correction for ■ Weight Unknown Projectile

Range	Chg	Nonstandard Condition	-	Standard Condition	=	Change in Standard	x	RG CORR Factor	=	Range Correction
3900	4GB	8 ■	-	4 ■	=	4 ■	x	+28	=	+112 ~ + 110
4000	4GB	8 ■	-	4 ■	=	4 ■	x	+28	=	+112 ~ + 110

Diagram RG	+ RG CORR	= TOT RG	x RG K	= Entry RG	Chg	VI	SI	+ EL	= QE	M564/ M565	M582/ M577	TOF +	5.5 =	M728/ M732	DFT
3900	+ (+110)	= 4010	x 1.0000	= 4010	4GB	+23	(+6)	+ 232	= 238	--	--		--	--	--
4000	+ (+110)	= 4110	x 1.0000	= 4110	4GB	--	--	--	--	--	14.6		--	--	--

Figure 2-5. Example low-angle safety matrix (shell HE/WP/SMK)

SAFETY T

2-39. The Safety T is a convenient method of arranging safety data and is used to verify the safety of fire commands (see figure 2-6). The information needed by the FDO, XO, or platoon leader and section chief is organized in an easy-to-read format. The Safety T is labeled with a minimum of firing point location, charge, projectiles(s), fuze(s), angle of fire, and AOL. Other optional entries are subject to unit SOP. Any time new safety data are determined, new Safety Ts are constructed and issued after the old Safety Ts have been collected (for example, after a move or after a registration or MET + VE). Use only one charge per Safety T.

> ***Note.*** The examples in this chapter demonstrate which data is transferred from the safety matrix to the Safety T. This data is in bold type in the matrix and the associated Safety T.

2-40. The FDO ensures that all data transmitted from the FDC is within the limits of the Safety T. The section chief ensures that all data applied to the ammunition or howitzer is within the limits of the Safety T. The FDO must ensure that deflection to fire is between the deflections listed on the Safety T then determine if the quadrant elevation corresponding to that deflection is between the minimum and maximum QE on the Safety T. Finally, the FDO must ensure that the fuze setting is equal to (or greater) than the minimum fuze setting listed on the Safety T for the specific fuze type.

> ***Note.*** Figure 2-6 (DA Form 7353-R, *Universal Safety T*) represents a locally reproducible form. Reproduce this form on 8½ x 11-inch paper. FM 6-40/MCWP 3-1.6.19 prescribes this form. DA Form 7353-R is also available on the Army Publishing Directorate Web site at www.APD.army.mil.

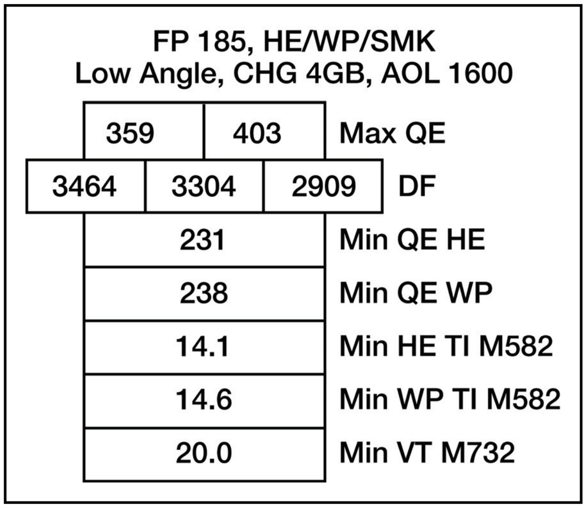


Figure 2-6. Example of a completed Safety T

Table 2-4. Tables and addenda required for safety computations

Weapon System	*Safety Required for*	*Base Projectile*	*Firing Table for Base Projectile*	*Firing Table Addendum*
M101A1	M314 M444	HE HE	105-H-7 105-H-7	N/A ADD-B-2
M102/ M119	M314 M444	HE HE	105-AS-3 105-AS-3	N/A ADD-F-1
M198 or M109A3/A5/A6	M485 M449 M483A1 M483A1 M825 M825 M825A1 M825A1 M692/ M731 M718/ M741 M898	HE HE HE DPICM HE DPICM HE DPICM DPICM DPICM DPICM	155-AM-2 155-AM-2 155-AM-2 155-AN-2 155-AM-2 155-AN-2 155-AN-2 155-AN-2 155-AN-2 155-AN-2 155-AN-2	N/A ADD-I-2 ADD-R-1 ADD-J-2 ADD-T-0 w/ch 1 ADD-Q-O w/ch 1, 2 ADD-T-0 w/ch 1 ADD-Q-0 w/ch 1, 2 ADD-L-1 w/ch 1, 2 ADD-N-1 w/ch 1 ADD-W-0

UPDATING SAFETY DATA AFTER DETERMINING A GFT SETTING

2-41. After a GFT setting is determined (the result of registration or MET + VE technique), the FDO must compute new safety data. The GFT setting represents all nonstandard conditions in effect at the time it was determined. The effect on safety is that, if the data determined before the GFT setting was found to no longer represent the safety box, it could result in an unsafe condition if not applied to safety computations. In order to update safety, new elevations are determined, which correspond to the minimum and maximum ranges. Deflections are modified by applying the GFT deflection correction to each lateral limit. Minimum fuze settings are also recomputed. The basic safety diagram drawn in red on the firing chart does not change. It was drawn on the basis of azimuths and ranges, and it represents the actual limits.

2-42. There are two techniques for updating safety computations: using the Range K method and applying a GFT setting to a GFT. Both methods use the same safety matrices and apply to both low- and high-angle fire. The preferred technique for updating safety computations is to apply a GFT setting to the appropriate GFT. Unfortunately, not all munitions have associated GFTs. Application of total corrections is the same as for normal mission processing. The total corrections, in the form of a GFT setting or Range K, must be applied in accordance with the data on which they were determined (for example, the GFT setting for an HE registration applies to all projectiles in the HE family, while a MET + VE for DPICM would apply to all projectiles in the DPICM family). If automation is available, a false registration with M795 graze burst data may be used to determine total corrections for all projectiles in the DPICM family. The principle difference between the two techniques is the manner in which minimum fuze setting is determined.

DETERMINING MINIMUM FUZE SETTING USING A GFT WITH A GFT SETTING APPLIED

2-43. When a GFT setting is applied and a fuze setting is to be determined, it is extracted opposite the time gaugeline (if it is the fuze listed on the GFT setting) or as a function of elevation (for all others). Use the procedures in table 2-5 to update safety using a GFT with a GFT setting applied.

DETERMINING FUZE SETTING USING THE RANGE K TECHNIQUE

2-44. To simplify updating safety, the Range K technique determines all fuze settings as a function of elevation. The difference between registered fuze settings and fuze settings determined using the Range K technique in actual firings and computer simulations varies by only zero to two tenths (0.0-0.2) of a fuze setting increment/second. The safety requirements in AR 385-63/MCO P3570.1B and incorporation of minimum fuze setting range lines adequately compensate for the difference in computational techniques. Figure 2-7 (page 2-58) demonstrates how to update safety when no GFT is available, using the Range K technique. Use the procedures in table 2-3, page 2-12 (low angle) or table 2-9, page 2-32 (high angle) to update safety using the Range K technique.

Table 2-5. Low-angle procedures using a GFT with GFT setting applied

Step	*Action*
1	On the top third of a blank sheet of paper, construct the basic safety diagram per the range safety card. (See table 2-2, page 2-11 for procedures.)
2	In the middle third of the sheet of paper, construct the low-angle safety matrix (see figure 2-4, page 2-15).
3	Record the diagram ranges from the basic safety diagram.
4	Record the charge from the range safety card.
5	Enter the range correction, if required. This range correction is only necessary if a nonstandard condition exists which requires a change in aiming point and is not already accounted for in a GFT setting, such as correcting for the always heavier than standard white phosphorous projectile. See Figure 2-4, paragraph (b) (page 2-15) to determine range correction. If a range correction is required, it is artillery expressed to the nearest 10 meters. If no range correction is required, enter 0 (zero).
6	Determine the total range. Total range is the sum of the diagram range and the range correction. **Total range is expressed to the nearest 10 meters.**
7	Range K. This is not used when determining data with a GFT with a GFT setting applied, as the elevation gauge line represents Range K.

Table 2-5. Low-angle procedures using a GFT with GFT setting applied

Step	*Action*
8	Entry Range. This value is the same as the total range. **Entry range is artillery expressed to the nearest 10 meters.**
9	Following the mini-max rule, determine the Vertical Interval by subtracting the unit altitude from the altitude corresponding to the Diagram Range, and record it. **VI is artillery expressed to the nearest whole meter.** ***Note.*** Diagram range is used to compute VI and SITE because this is the actual location of the minimum range line. VI is not determined for minimum fuze range lines. The range correction, total range, and Range K are used to compensate for nonstandard conditions, and represent the aiming point which must be used to cause the round to cross the diagram range.
10	Compute and record site to the diagram range. Use the GST from the head of the projectile family whenever possible. **Site is artillery expressed to the nearest whole mil.**
11	Place the MHL on the entry range, determine the elevation from the elevation gauge line on the GFT, and record it. **Elevation is artillery expressed to the nearest whole mil.**
12	Compute the quadrant elevation and record it. Quadrant elevation is the sum of elevation and site. **Quadrant elevation is artillery expressed to the nearest whole mil.**
13	Using the procedures from appendix G, FM 6-40/MCWP 3-1.6.19, determine and record the minimum fuze setting for M564/M565 fuses. These fuze settings correspond to the entry range. If the GFT setting was determined using the M564/M565 fuze, then determine the fuze setting opposite the time gauge line. If the GFT setting was not determined using the M564/M565 fuze, then extract the fuze setting corresponding to adjusted elevation. **Fuze settings are artillery expressed to the nearest tenth of a fuze setting increment.** ***Note.*** Minimum **fuze** settings are only determined for minimum range lines and may be computed for separate minimum **fuze** range lines.
14	Using the procedures from appendix G, FM 6-40/MCWP 1.6.19, determine and record the minimum **fuze** setting for M582/M577 fuses. These **fuze** settings correspond to the entry range. If the GFT setting was determined using the M582/M577 **fuze**, then determine the **fuze** setting opposite the time gauge line. If the GFT setting was not determined using the M582/M577 **fuze**, extract the **fuze** setting corresponding to adjusted elevation. . **Fuze settings are artillery expressed to the nearest tenth of a second.** ***Note*:** Minimum fuze settings are only determined for minimum range lines and may be computed for separate minimum fuze range lines.
15	Using the procedures from appendix G, FM 6-40/MCWP 1.6.19, determine and record the time of flight corresponding to the entry range. Extract the time of flight corresponding to adjusted elevation from the TOF scale. **Time of flight is artillery expressed to the nearest tenth of a second.**
16	Using the procedures in appendix G, FM 6-40/MCWP 1.6.19, determine the minimum fuze setting for M728/M732 fuses. Add 5.5 seconds to the time of flight. **VT fuze settings are expressed up to the next higher whole second.** ***Note.*** Minimum **fuze** settings are only determined for minimum range lines and may be computed for separate minimum **fuze** range lines.
17	Determine and record drift corresponding to adjusted elevation. Drift is applied to the basic safety diagram by following the “left least, right most” rule. The smallest (least) drift is applied to all left deflection limits, and the greatest (most) drift is applied to all right deflection limits. **Drift is artillery expressed**

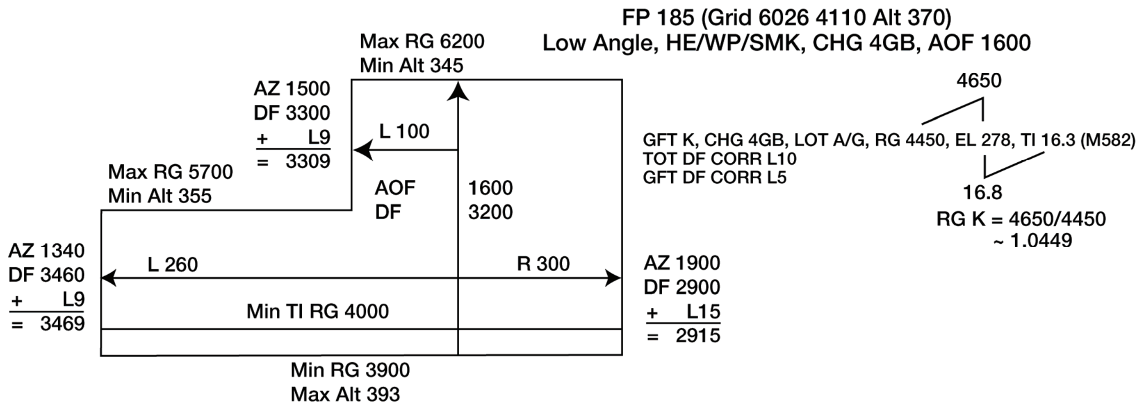
Table 2-5. Low-angle procedures using a GFT with GFT setting applied

Step	Action
	to the nearest whole mil.
18	Ensure that computations are verified by a second safety-certified person.
19	On the bottom third of the sheet of paper, record the data on the Safety T.

2-45. Figures 2-5 through 2-12 and table 2-6 provide examples of low-angle safety.

Table 2-6. Examples of low-angle safety

Figure No.	*Title*	*Description*
2-5	Example of low-angle safety matrix, shell HE/WP/SMK	Completed low-angle safety matrix for shell HE/WP/SMK
2-6	Example of a completed Safety T	Safety T for low angle for shell HE/WP/SMK
2-7	Example of postoccupation low-angle safety with Range K applied (shell HE/WP/SMK)	Completed postoccupation safety matrix and Safety T for shell HE/WP/SMK
2-8	Example of a low-angle safety matrix (shell M825)	Completed low-angle safety matrix and Safety T for shell M825 (improved smoke and DPICM family)
2-9	Example of safety table data (M825)	Extracts from FT ADD-T-O to be used for safety computation examples only
2-10	Example of postoccupation low-angle safety with Range K applied (shell M825)	Completed postoccupation safety matrix and Safety T for shell M825
2-11	Example of a low-angle safety matrix (shell illumination)	Completed low-angle safety matrix for shell illumination
2-12	Example safety table data (M485 illumination)	Extracts from FT 155-AM-2 to be used for safety computation examples only



4■ HE/SMK (M116) Low Angle CHG 4GB

Diagram RG	+	RG CORR	=	TOT RG	x	RG K	=	Entry RG	CHG	VI	SI	+EL	=	QE	M564/ M565	M582/ M577	TOF	+ 5.5	= M728/ M732	DFT
3900	+	0	=	3900	x	1.0449	=	4080	4GB	+23	+6	+238	=	244	--	14.5	/	20.0	~ 20.0	L4
4000	+	0	=	4000	x	1.0449	=	4180	4GB	--	--	--		--	--	14.8		--	--	--
5700	+	0	=	5700	x	1.0449	=	5960	4GB	-15	-3	+386	=	383	--	--		--	--	--
6200	+	0	=	6200	x	1.0449	=	6480	4GB	-25	-5	+436	=	431	--	--		--	--	L10

WP (M110, Weight Unknown) Low Angle CHG 4GB

Determining Range Correction for ■ Weight Unknown Projectile

Range	CHG	Nonstandard Condition	-	Standard Condition	=	Change in Standard	x	RG CORR Factor	=	Range Correction
3900	4GB	8 ■	-	4 ■	=	4 ■	x	+28	=	+112 ~ + 110
4000	4GB	8 ■	-	4 ■	=	4 ■	x	+28	=	+112 ~ + 110

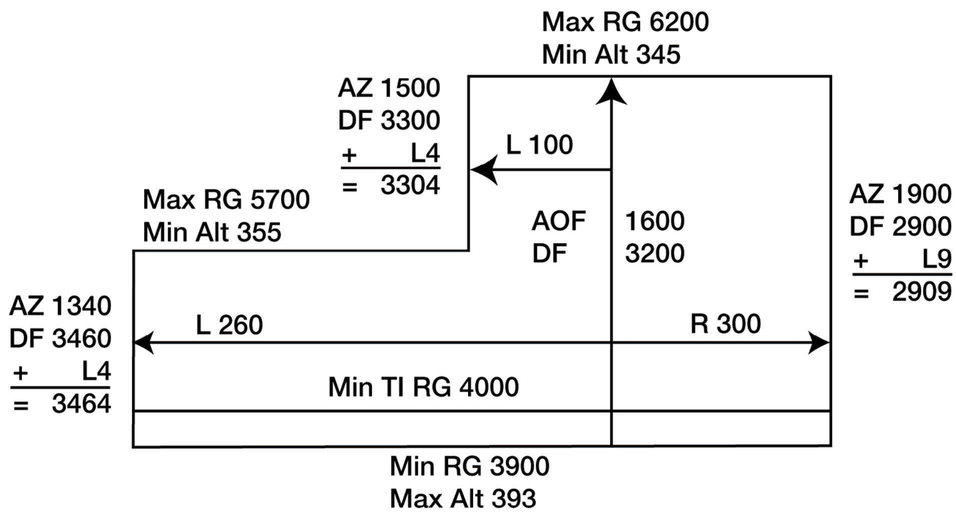
Diagram RG	+	RG CORR	=	TOT RG	x	RG K	=	Entry RG	CHG	VI	SI	+ EL	=	QE	M564/ M565	M582/ M577	TOF	+ 5.5	= M728/ M732	DFT
3900	+	(+110)	=	4010	x	1.0449	=	4190	4GB	+23	(+6)	+ 245	=	251	--	--		--	--	--
4000	+	(+110)	=	4110	x	1.0449	=	4290	4GB	--	--	--	=	--	--	15.3		--	--	--

FP 185, HE/WP/SMK Low Angle, CHG 4GB, AOL 1600
GFT K, CHG 4GB, LOT A/G, RG 4450, EL 278, TI 16.3 (M582)
TOT DF CORR L 10, GFT DF CORR L 5

	383	431	Max QE
3469	3309	2915	DF
	244		Min QE HE
	251		Min QE WP
	14.8		Min HE TI (M582)
	15.3		Min WP TI (M582)
	20.0		Min VT (M732)

Figure 2-7. Example of postoccupation low-angle safety with Range K applied (shell HE/WP/SMK)

FP 185 (Grid 6026 4110 Alt 370)
Low Angle, M825, CHG 4GB, AOF 1600



M825 Low Angle CHG 4GB

Diagram RG	+	RG CORR	= TOT RG	x RG K	= Entry RG	CHG	VI	SI	+EL	= QE	M564/ M565	M582/ M577	TOF +	5.5 =	M728/ M732	DFT
3900	+	0	=3900	x 1.0000	= 3900	4GB	+23	+6	+254	= 260	--	--		--	--	L4
4000	+	0	=4000	x 1.0000	= 4000	4GB	--	--	--	--	--	15.1		--	--	--
5700	+	0	=5700	x 1.0000	= 5700	4GB	-15	-3	+423	= 420	--	--		--	--	--
6200	+	0	=6200	x 1.0000	= 6200	4GB	-25	-6	+486	= 480	--	--		--	--	L9

FP 185, M825
Low Angle, CHG 4GB, AOL 1600

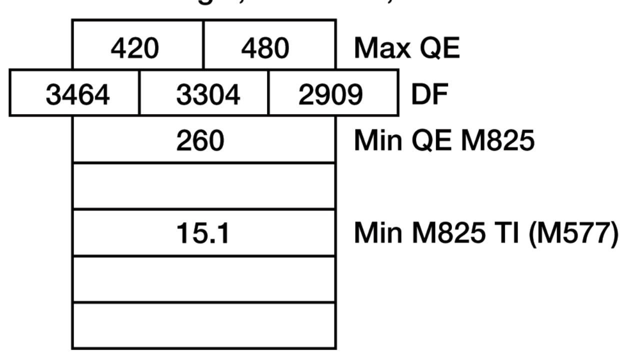


Figure 2-8. Example of a low-angle safety matrix (shell M825)

Ballistic Data for Safety Computations

FT ADD-T-0 Projectile Improved Smoke M825

Projectile Family = DPICM

Explanation:

The following listings contain ballistic data for safety computations. They are not to be used to compute firing data as they do not account for submunition/payload delivery. These listings are to be used in conjunction with chapter 15 of FM 6—40/MCWP 1.6.19 for safety computations only.

Listing Data:

The listings are arranged by charge as follows:

Charge:	**Page**
3G = Charge 3, M3A1	2
4G = Charge 4, M3A1	5
5G = Charge 5, M3A1	8
3W = Charge 3, M4A2	12
4W = Charge 4, M4A2	15
5W = Charge 5, M4A2	19
6W = Charge 6, M4A2	23
7W = Charge 7, M4A2	28
7R = Charge 7, M119A2	34

Columnar Data:

Column:

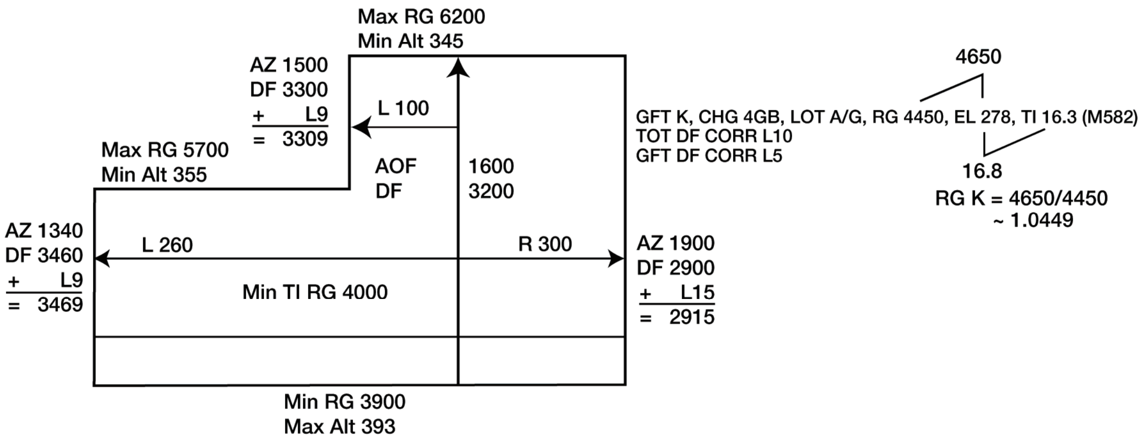
1. Range – The distance measured on the surface of a sphere concentric with the earth from the muzzle to a target at the level point.
2. Elevation – The angle of the gun in the vertical plane required to reach the range tabulated in column 1. The maximum elevation shown represents the highest angle at which predictable projectile flight is possible under standard conditions of MET and material.
3. Fuze setting M577 – Fuze setting for a graze burst—numbers to be set on the fuze MTSQ M577 or ET M762 that will produce a graze burst at the level point when firing under standard conditions. This setting will produce a graze burst at the time of flight listed in column 4.
4. Time of flight – The projectile travel time under standard conditions from the muzzle to the level point at the range in column 1. Time of flight is used as fuze setting for fuze MTSQ M577 and fuze ET M762.
5. Azimuth correction to compensate for drift – Because of the right-hand twist of the tube, the drift of the projectile is to the right of the vertical plane of fire. This drift must be compensated for by a correction to the left.

Figure 2-9. Example of safety table data (M825)

Ballistic Data for Safety Computations FT ADD-T-0 Projectile Improved Smoke M825 Projectile Family = DPICM				
Charge 4G				
Range (M)	*Elevation (Mil)*	*Fuze Setting (M577)*	*Time of Flight (Sec)*	*Drift (Mil)*
0	0.0		0.0	0.0
3800	246.4	14.2	14.2	3.9
3900	254.3	14.6	14.6	4.0
4000	262.3	15.1	15.1	4.2
4100	270.4	15.5	15.5	4.3
4200	278.6	16.0	16.0	4.4
4300	287.0	16.4	16.4	4.6
4400	295.5	16.9	16.9	4.8
4500	304.1	17.3	17.3	4.9
4600	312.9	17.8	17.8	5.1
4700	321.8	18.3	18.3	5.2
4800	330.9	18.8	18.8	5.4
4900	340.2	19.3	19.3	5.6
5000	349.7	19.8	19.8	5.8
5100	359.4	20.3	20.3	6.0
5200	369.3	20.8	20.8	6.2
5300	379.5	21.3	21.3	6.4
5400	389.9	21.9	21.9	6.6
5500	400.5	22.4	22.4	6.8
5600	411.5	23.0	23.0	7.0
5700	422.8	23.5	23.5	7.3
5800	434.5	24.1	24.1	7.5
5900	446.5	24.7	24.7	7.8
6000	459.0	25.4	25.4	8.1
6100	472.0	26.0	26.0	8.4
6200	485.5	26.7	26.7	8.7
6300	499.7	27.3	27.3	9.0
6400	514.6	28.1	28.1	9.4
6500	530.4	28.8	28.8	9.8
6600	547.3	29.6	29.6	10.2
6700	565.4	30.5	30.5	10.7
6800	585.2	31.4	31.4	11.2
6900	607.3	32.4	32.4	11.8
7000	632.5	33.5	33.5	12.5
7100	663.2	34.9	34.9	13.5
7200	705.5	36.7	36.7	14.9
**********	************	************	************	************

Ballistic Data for Safety Computations FT ADD-T-0 Projectile Improved Smoke M825 Projectile Family = DPICM				
Charge 4G				
Range (M)	***Elevation (Mil)***	***Fuze Setting (M577)***	***Time of Flight (Sec)***	***Drift (Mil)***
7200	852.1	42.4	42.4	21.0
7100	894.3	44.0	44.0	23.2
7000	924.8	45.0	45.0	25.0
6900	950.0	45.9	45.9	26.6
6800	971.9	46.6	46.6	28.2
6700	991.6	47.2	47.2	29.7
6600	1009.7	47.8	47.8	31.2
6500	1026.4	48.3	48.3	32.6
6400	1042.1	48.7	48.7	34.1
6300	1056.9	49.2	49.2	35.6
6200	1071.0	49.6	49.6	37.2
6100	1084.4	49.9	49.9	38.7
6000	1097.3	50.3	50.3	40.3
5900	1109.7	50.6	50.6	42.0
5800	1121.6	50.9	50.9	43.7
5700	1133.2	51.2	51.2	45.6
5600	1144.3	51.5	51.5	47.5
5500	1155.2	51.8	51.8	49.5
5400	1165.7	52.1	52.1	51.7
5300	1175.9	52.3	52.3	54.0
5200	1185.9	52.5	52.5	56.6
5100	1195.6	52.8	52.8	59.3
5000	1205.1	53.0	53.0	62.3
4900	1214.3	53.2	53.2	65.6
4800	1223.3	53.4	53.4	69.3
4700	1232.1	53.6	53.6	73.4
4600	1240.7	53.8	53.8	78.1
4500	1249.1	54.0	54.0	83.4
4400	1257.2	54.2	54.2	89.4
4300	1265.2	54.4	54.4	96.4
4200	1272.9	54.6	54.6	104.5
4100	1280.4	54.8	54.8	113.9
4000	1287.7	55.0	55.0	124.9
3900	1294.7	55.2	55.2	138.0
3800	1301.5	55.4	55.4	153.3
3700	1308.0	55.6	55.6	171.2
3669	1310.0			

FP 185 (Grid 6026 4110 Alt 370)
Low Angle, M825, CHG 4GB, AOF 1600



M825 Low Angle CHG 4GB

Diagram RG	+	RG CORR	=	TOT RG	x	RG K	=	Entry RG	CHG	VI	SI	+ EL	=	QE	M564/ M565	M582/ M577	TOF + 5.5 =	M728/ M732	DFT
3900	+	0	=	3900	x	1.0449	=	4080	4GB	+23	+6	+ 269	=	275	--	--	--	--	L4
4000	+	0	=	4000	x	1.0449	=	4180	4GB	--	--	--		--	--	15.9	--	--	--
5700	+	0	=	5700	x	1.0449	=	5960	4GB	-15	-3	+ 454	=	451	--	--	--	--	--
6200	+	0	=	6200	x	1.0449	=	6480	4GB	-25	-6	+ 527	=	521	--	--	--	--	L10

FP 185, M825
Low Angle, CHG 4GB, AOL 1600

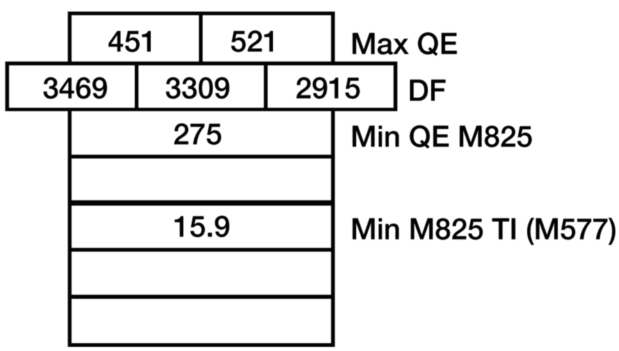
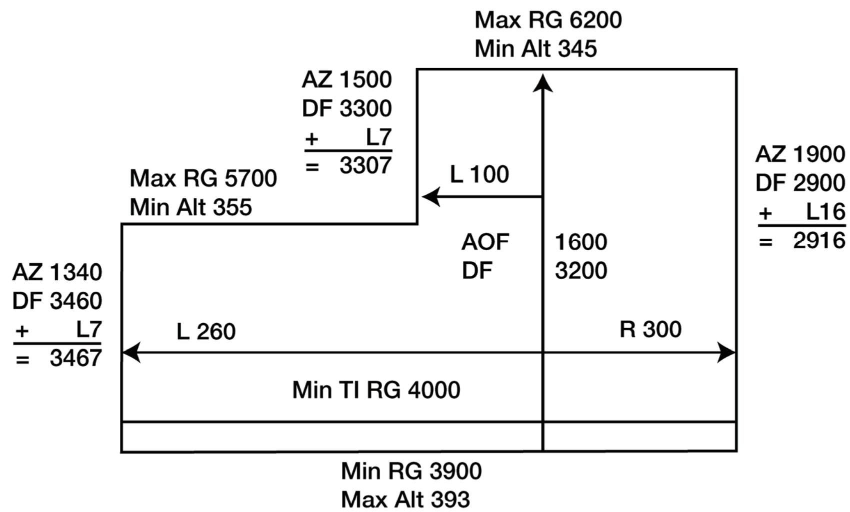


Figure 2-10. Example of postoccupation low-angle safety with Range K applied (shell M825)

FP 185 (Grid 6026 4110 Alt 370)
Low Angle, Illum, CHG 3GB, AOF 1600



Illum Low Angle CHG 3GB

Diagram RG	+	RG CORR	=	TOT RG	x	RG K	=	Entry RG	CHG	VI	SI	+EL	= QE	M564/ M565	M582/ M577	TOF	+ 5.5	= M728/ M732	DFT
3900	+	0	=	3900	x	1.0000	=	3900	3GB	+23	+7	+290	= 297	--	--		--	--	L7
4000	+	0	=	4000	x	1.0000	=	4000	3GB	--	--	--	--	--	16.2		--	--	--
5700	+	0	=	5700	x	1.0000	=	5700	3GB	-15	-4	+497	= 493	--	--		--	--	--
6200	+	0	=	6200	x	1.0000	=	6200	3GB	-25	-7	+587	= 580	--	--		--	--	L16

FP 185, Illum
Low Angle, CHG 3GB, AOL 1600

	493	580	Max QE
3467	3307	2916	DF
	297		Min QE HE

	16.2		Min Illum TI M577

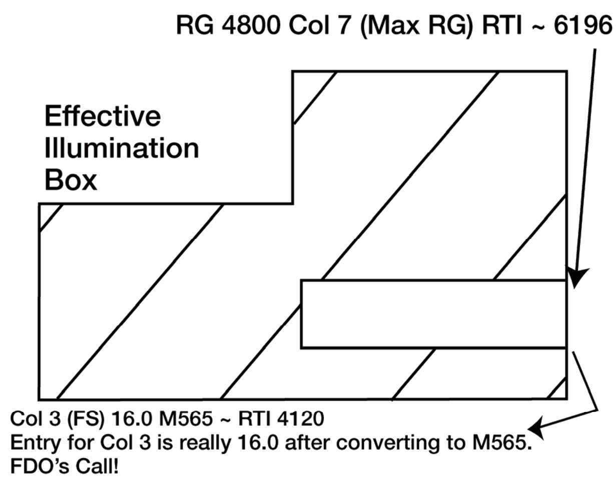


Figure 2-11. Example of a low-angle safety matrix (shell illumination)

Ballistic Data for Safety Computations

FT 155-AM-2 Projectile Illumination M485/M485A1/M485A2

Projectile Family = HE

Explanation:

The following listings contain ballistic data for safety computations. They are not to be used to compute firing data as they do not account for submunition/payload delivery. These listings are to be used in conjunction with chapter 15 of FM 6-40/MCWP 1.6.19 for safety computations only.

Listing Data:

The listings are arranged by charge as follows:

Charge:	Page	
1G = Charge 1, M3A1	2	(not applicable M198 Howitzer)
2G = Charge 2, M3A1	4	
3G = Charge 3, M3A1	6	
4G = Charge 4, M3A1	9	
5G = Charge 5, M3A1	12	
3W = Charge 3, M4A2	16	
4W = Charge 4, M4A2	19	
5W = Charge 5, M4A2	23	
6W = Charge 6, M4A2	27	
7W = Charge 7, M4A2	32	
8 = Charge 8, M119,M119A1	38	

Columnar Data:

Column:

6. Range – The distance measured on the surface of a sphere concentric with the earth from the muzzle to a target at the level point.
7. Elevation – The angle of the gun in the vertical plane required to reach the range tabulated in column 1. The maximum elevation shown represents the highest angle at which predictable projectile flight is possible under standard conditions of MET and material.
8. Fuze setting M565 – Fuze setting for a graze burst numbers to be set on the fuze MT M565 that will produce a graze burst at the level point when firing under standard conditions. This setting will produce a graze burst at the time of flight listed in column 4.
9. Time of flight – The projectile travel time under standard conditions from the muzzle to the level point at the range in column 1. Time of flight is used as fuze setting for fuze MTSQ M577 and fuze ET M762.
10. Azimuth correction to compensate for drift – Because of the right-hand twist of the tube, the drift of the projectile is to the right of the vertical plane of fire. This drift must be compensated for by a correction to the left.

Figure 2-12. Example of safety table data, M485 illumination

Ballistic Data for Safety Computations FT 155-AM-2 Projectile Illumination M485/M485A1/M485A2 Projectile Family = HE				
Charge 3G				
Range (m)	***Elevation (mil)***	***Fuze Setting (M565)***	***Time of Flight (sec)***	***Drift (mil)***
0	0.0		0.0	0.0
100	6.4		0.4	0.1
3800	280.9	15.1	15.2	6.5
3900	290.0	15.5	15.7	6.7
4000	299.4	16.0	16.2	7.0
4100	308.8	16.5	16.6	7.2
4200	318.5	17.0	17.1	7.5
4300	328.3	17.5	17.6	7.7
4400	338.4	18.0	18.1	8.0
4500	348.6	18.5	18.7	8.3
4600	359.1	19.0	19.2	8.6
4700	369.8	19.5	19.7	8.9
4800	380.8	20.1	20.3	9.2
4900	392.0	20.6	20.8	9.5
5000	403.6	21.2	21.4	9.8
5100	415.5	21.8	21.9	10.1
5200	427.8	22.3	22.5	10.5
5300	440.5	23.0	23.2	10.9
5400	453.7	23.6	23.8	11.3
5500	467.4	24.2	24.4	11.7
5600	481.7	24.9	25.1	12.1
5700	496.7	25.6	25.8	12.6
5800	512.4	26.3	26.5	13.1
5900	529.1	27.1	27.3	13.6
6000	547.0	27.9	28.1	14.2
6100	566.2	28.7	28.9	14.9
6200	587.3	29.6	29.9	15.6
6300	610.9	30.6	30.9	16.5
6400	638.3	31.8	32.1	17.5
6500	672.1	33.2	33.5	18.8
6600	722.3	35.2	35.5	21.0
************	************	************	************	************

Ballistic Data for Safety Computations FT 155-AM-2 Projectile Illumination M485/M485A1/M485A2 Projectile Family = HE				
Charge 3G				
Range (m)	***Elevation (mil)***	***Fuze Setting (M565)***	***Time of Flight (sec)***	***Drift (mil)***
6600	842.7	39.7	40.0	27.1
6500	892.6	41.4	41.7	30.2
6400	926.2	42.5	42.8	32.5
6300	953.2	43.4	43.7	34.5
6200	976.6	44.1	44.4	36.5
6100	997.4	44.7	45.0	38.3
6000	1016.4	45.2	45.6	40.1
5900	1033.9	45.7	46.1	42.0
5800	1050.3	46.2	46.5	43.8
5700	1065.8	46.6	47.0	45.6
5600	1080.4	47.0	47.3	47.5
5500	1094.4	47.4	47.7	49.5
5400	1107.7	47.7	48.0	51.5

DETERMINATION OF MAXIMUM EFFECTIVE ILLUMINATION AREA

2-46. All illumination safety data are for graze burst; therefore, when illumination fire mission data are computed, the QE determined includes the appropriate HOB. This will prevent achieving a 600-meter HOB (750-meter HOB for 105 mm) at the minimum and maximum range lines. Before processing illumination fire mission, determine the maximum effective illumination area for the current range safety card. This area should be plotted on the firing chart to help determine if illumination can be fired and to let the forward observers know where they can fire illumination effectively. This area will always be significantly smaller than the HE safety area. See table 2-7 for steps outlining the general procedure. This area can be increased by computing high-angle data.

Note. The procedures used to determine the maximum effective illumination area can be used for all expelling charge munitions to show their maximum effective engagement area.

Table 2-7. Procedures to determine maximum effective illumination area

Step	*Action*
1	Look at the TFT, part 2, column 7 (RTI) and enter the nearest range listed without exceeding the maximum range.
2	Determine the corresponding range to target in column 1. This is the maximum range the unit can achieve with a 600-meter (155-mm) HOB and keep the projectile in the safety box if the fuze fails to function.
3	Determine the minimum range for which a 600-meter (155 mm) HOB is achieved and have the fuze function no earlier than the minimum range line. Look at the TFT, part 2, column 3 and enter the nearest listed FS that is not less than the determined minimum FS. Column 3 is the fuze setting for the M565 fuze, so if M577 is to be used, the fuze setting must be corrected by using table B. Determine the corresponding range to target in column 1.

Table 2-7. Procedures to determine maximum effective illumination area

Step	*Action*
4	The area between these two lines is the maximum effective illumination area where a 600-meter HOB (155-mm) is achieved; the fuze functions no earlier than the minimum range line and the round does not exceed the maximum range line if the fuze fails to function. ***Note.*** High-angle fire produces a much greater effective illumination area. The FDO must use column 6, range to fuze function, to determine the minimum effective illumination range line. The maximum effective illumination range line is determined by using fuze setting corresponding to column 7 (range to impact).

SAFETY CONSIDERATIONS FOR M549/M549A1 RAP

2-47. RAP safety data are computed using the low-angle safety matrix or high-angle safety matrix, as appropriate. The only difference is that a safety buffer must be incorporated for rocket failure or rocket cap burn through. For firing in the rocket-off mode, a 6,000-meter buffer must be constructed beyond the maximum range line to preclude the projectile exceeding the maximum range line. For firing in the rocket-on mode, a 6,000-meter buffer must be constructed short of the minimum range line to preclude the projectile falling short of the minimum range line.

SAFETY CONSIDERATIONS FOR M864 BASE BURN DPICM/M795A1 BASE BURN HE

2-48. Base burn safety data are computed using the low-angle safety matrix or high-angle safety matrix as appropriate. The only difference is that a safety buffer must be incorporated for base burn element failure. A 5,000-meter buffer must be constructed short of the minimum range line to preclude the projectile falling short of the minimum range line.

SAFETY PROCEDURES FOR M712 COPPERHEAD

2-49. Copperhead safety data are determined from ballistic data developed specifically for the Copperhead projectile. Computations are much like those for normal projectiles. The Copperhead round should never be fired with standard data. Therefore, computing safety data requires solving a Copperhead MET-to-target technique for each listed range using the FT 155-AS-1, as covered in chapter 13, section 1, FM 6-40/MCWP 1.6.19. See table 2-8 for steps to compute Copperhead safety. SDZs for shell Copperhead are significantly different from normal indirect fire SDZs. DA Pam 385-63, chapter 11, contains the Copperhead SDZs.

2-50. All ranges listed on the range safety card may not fall within the ranges listed in the TFT charge selection table for that charge and mode. Therefore, additional safety computations may be required for additional charge(s) and mode(s) to adequately cover the impact area. If ranges listed on the range safety card overlap charge and mode range limitations in the charge selection table, then safety for both affected charges and modes must be computed.

Table 2-8. Copperhead safety data procedures

Step	*Action*
1	Construct the basic safety diagram.
2	For low angle, circle the lower left-hand corner of the safety diagram. Proceed in a clockwise manner and circle every other corner. For high angle, start in the lower right-hand corner and circle every other corner in a clockwise manner.
3	Complete a Copperhead MET-to-target technique for each circled corner. Record the FS, deflection, and QE in the Safety T. The lower left-hand corner will provide the minimum FS, maximum left deflection, and minimum QE. The upper right-hand

Table 2-8. Copperhead safety data procedures

Step	*Action*
	corner will provide the maximum right deflection and maximum QE. Intermediate deflections and ranges will provide intermediate deflection limits.

COMPUTATION OF HIGH-ANGLE SAFETY DATA

2-51. The safety data for high-angle fire is computed in the same manner as that for low-angle fire except for the ballistic variations caused by the high trajectory. Site is computed differently (by using the 10 mil site factor and the angle of site/10) and mechanical or electronic fuze settings are not determined. Table 2-9 contains the steps required to compute high-angle safety.

Note. It is the FDO's responsibility to ensure that all high-angle fuze settings will cause the fuze to function within the safety box.

2-52. Use the steps outlined in table 2-9 and in the matrix in figure 2-13 (page 2-35) as examples for organizing computations. The high-angle safety matrix is used for all munitions except M712 CLGP (Copperhead). The data are determined by either graphical or tabular firing tables. In the case of expelling charge munitions, the safety table located in the firing tables or firing table addenda is used to determine elevation, time of flight, fuze setting, and drift. Use artillery expression for all computations except where noted.

Note. The safety tables that are used to compute the high-angle examples are located after the low-angle safety examples.

Table 2-9. High-angle safety procedures

Step	*Action*
1	On the top third of a blank sheet of paper, construct the basic safety diagram per the range safety card (see table 2-2 [page2-11] for procedures).
2	In the middle third of the sheet of paper, construct the high-angle safety matrix (figure 2-13, page 2-35).
3	Record the diagram ranges from the basic safety diagram.
4	Record the charge from the range safety card.
5	Enter the range correction, if required. This range correction is only necessary if a nonstandard condition exists which requires a change in aiming point and is not already accounted for in a GFT setting, such as correcting for the always heavier than standard white phosphorous projectile. See figure 2-13, paragraph (b) (page 2-35) to determine range correction. If a range correction is required, it is artillery expressed to the nearest 10 meters. If no range correction is required, enter 0 (zero).
6	Determine the total range. Total range is the sum of the diagram range and the range correction. **Total range is expressed to the nearest 10 meters.**
7	Enter the Range K. Range K is only required if a GFT setting has been obtained but cannot be applied to a GFT (such as determining Illumination safety with a HE GFT setting). Range K is simply the total range correction from the GFT setting expressed as a percentage. This percentage, when multiplied by the total range, produces the entry range. If no GFT setting is available (for example, preoccupation safety), then enter 1.0000 as the Range K. If a GFT setting is available (for example, postoccupation safety), then enter the Range K expressed to four decimal places (for example, 1.1234). Step 7a demonstrates how to compute Range K.

Table 2-9. High-angle safety procedures

Step	***Action***
7a	Divide Range ~ Adjusted Elevation by the Achieved Range from the GFT setting to determine Range K. Range ~ Adjusted Elevation Divided by Achieved Range = Range K
8	Determine the entry range. Multiply the total range times Range K to determine the entry range. If Range K is 1.0000, then the entry range will be identical to the total range. **Entry range is artillery expressed to the nearest 10 meters.**
9	Following the mini-max rule, determine the vertical interval by subtracting the unit altitude from the altitude corresponding to the diagram range, and record it. **VI is artillery expressed to the nearest whole meter.** ***Note***. Diagram range is used for computations of VI and Site because this is the actual location of the minimum range line. The range correction, total range, and Range K are used to compensate for nonstandard conditions. These represent the aiming point which must be used to cause the round to cross the diagram range.
10	Determine and record the angle of site divided by 10 to the diagram range. This is performed by dividing the angle of site (use the appropriate GST, if possible) by 10. <**SI/10 is artillery expressed to the nearest tenth of a mil and has the same sign as the VI.**
11	Determine and record the 10 mil site factor from the GFT or TFT that heads the projectile family. **10 mil site factor is artillery expressed to the nearest tenth of a mil and is always negative.** ***Note***. Remember to use the diagram range to compute 10 mil site factor.
12	Compute and record site. Site is the product of <SI/10 times 10 mil site factor. **Site is artillery expressed to the nearest whole mil.**
13	Determine the elevation from Table C (base ejecting) or TFT/GFT (bursting), and record it. **Elevation is artillery expressed to the nearest whole mil.** ***Note.*** GFT settings are not used to determine elevation, as Range K represents total corrections, and to use a GFT setting would double the effects of those corrections.
14	Compute the quadrant elevation and record it. QE is the sum of elevation and site. **QE is artillery expressed to the nearest whole mil.**
15	Determine and record drift corresponding to the entry range from Table C (base ejecting) or TFT/GFT (bursting). Drift is applied to the basic safety diagram by following the “left least, right most” rule. The lowest (least) drift is applied to all left deflection limits, and the highest (greatest) drift is applied to all right deflection limits. **Drift is artillery expressed to the nearest whole mil.**
16	Ensure that computations are verified by a second safety-certified person.
17	On the bottom third of the sheet of paper, record the data on the Safety T.

Note. Minimum fuze settings are not computed for high-angle safety. It is the FDO’s responsibility to ensure that all fuze settings will cause the projectile to function in the impact area.

2-53. Figures 2-14 through 2-16 and table 2-10 provide examples of high-angle safety.

Table 2-10. Examples of high-angle safety

Figure No.	*Title*	*Description*
2-14	Example of high-angle safety (shell HE)	Completed high-angle safety matrix and Safety T for shell HE
2-15	Example of high-angle safety (shell M825)	Completed high-angle safety matrix and Safety T for shell M825
2-16	Example of high-angle safety (shell illumination)	Completed high-angle safety matrix and Safety T for shell illumination

(a)		(b)		(c)		(d)		(e)	(f)	(g)	(h)	(i)		(j)		(k)		(l)	(m)
DIAGRAM		RG		TOT		RG		ENTRY											
RG	+	CORR	=	RG	X	K	=	RG	CHG	VI	<SI/10 X10mil Si Fac		=	SI	+	EL	=	QE	DRIFT

(a) This is the minimum or maximum range from the range safety diagram.

(b) This is the range correction for nonstandard conditions from table F (tabular firing tables), if required. This is typically for reoccupation safety or corrections for nonstandard conditions not included in the Range K factor in column (d), such as WP ■ weight. Examples of nonstandard conditions accounted for in (b) include, but are not limited to, difference in projectile square weight, difference in muzzle velocity, or any nonstandard condition accounted for prior to determining a Range K factor. If there is no change from standard, or all nonstandard conditions are accounted for in the Range K factor, this value is zero (0). To determine a range correction from table F (tabular firing tables), use the following formula:

		NONSTANDARD		STANDARD		CHANGE IN		RG CORR		RANGE
RANGE	CHG	CONDITION	–	CONDITION	=	STANDARD	X	FACTOR	=	CORRECTION

(c) This is the sum of the diagram range and the range correction. If there is no range correction, then the total range will be the same as the diagram range.

(d) This is the Range K factor determined by using technique 2 in FM 6-40/MCWP 1.6.19. This is for postoccupation safety. It represents total corrections for a registration, MET + VE, or other subsequent MET technique. It represents all nonstandard conditions—unless a separate nonstandard condition such as change in square weight for WP is listed separately in column (b). It is multiplied by the total range to determine Entry Range. If there is no Range K, enter 1.0000.

(e) This is the sum of the total range times the Range K factor. If there is no Range K factor, then the entry range will be the same as the total range. Entry range is the range to which elevation is determined.

(f) This is the charge from the range safety card for this set of safety computations.

(h) This is the angle of site divided by 10, determined by dividing vertical interval by entry range in thousands.

(i) This is the 10 mil site factor, determined from the GFT or TFT from the head of the projectile family; such as 10 mil site factor for the M110 WP projectile would be determined with the AM-2; M825 10 mil site factor would be computed using the AN-2.*

(j) This is site, the product of <site/10 X 10 mil site factor (Note. Site is determined for the diagram range).*

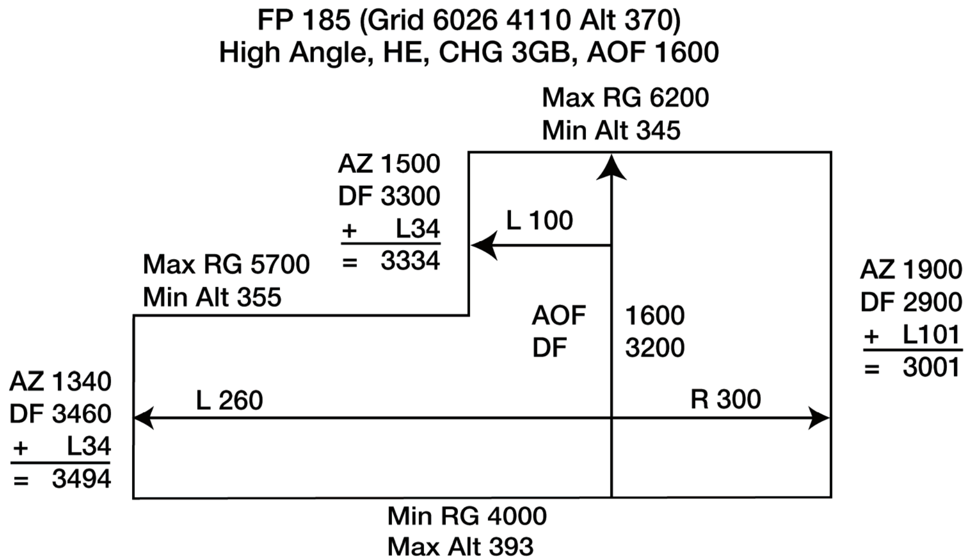
(k) This is the elevation to impact from Table C (base ejecting), or GFT/TFT (bursting).*

(l) This is the sum of elevation and site. It is the minimum or maximum quadrant elevation corresponding to maximum or minimum range.

(m) This is the drift corresponding to Table C (base ejecting), or GFT/TFT (bursting). Drift is applied to the range safety diagram by using the "left least; right most;" rule. The "least" or lowest drift is applied to all left deflection limits, and the "most" or greatest drift is applied to all right deflection limits.

** See table 2-4 (page 2-17) to determine the correct source table or addendum for computations.

Figure 2-13. High-angle safety matrix



4 ■ HE High Angle CHG 3GB

Diagram Range	+	Range CORR	=	Total Range	x	Range K	=	Entry Range	CHG	VI	<SI/10	x	10mil Si Fac	=	SI	+	EL	=	QE	DRIFT
4000	+	0	=	4000	x	1.0000	=	4000	3GB	+23	+0.6	x	-1.0	=	-1	+	1247	=	1246	L101
5700	+	0	=	5700	x	1.0000	=	5700	3GB	-15	-0.3	x	-5.2	=	+2	+	1052	=	1054	--
6200	+	0	=	6200	x	1.0000	=	6200	3GB	-25	-0.4	x	-15.0	=	+6	+	954	=	960	L34

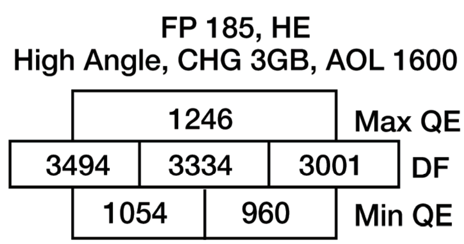
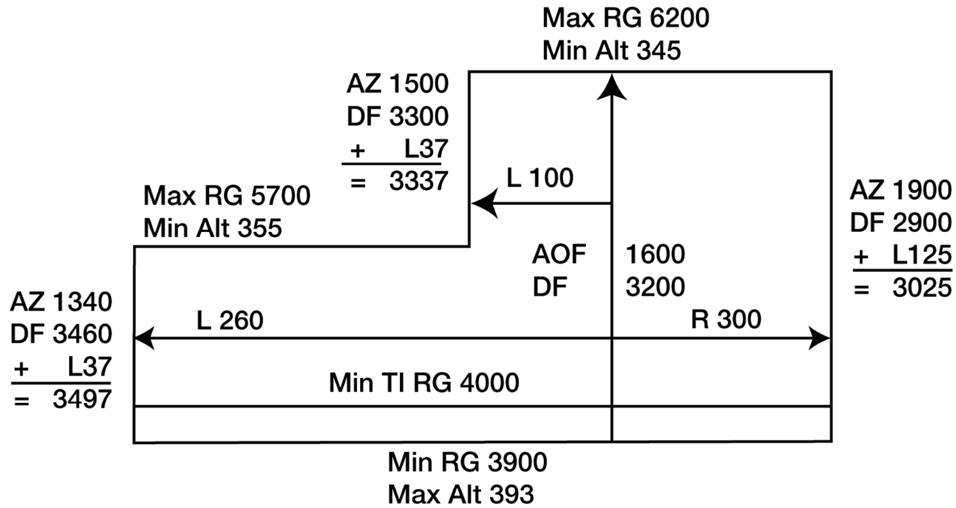


Figure 2-14. Example of a high-angle safety matrix (shell HE)

FP 185 (Grid 6026 4110 Alt 370)
High Angle, M825, CHG 4GB, AOF 1600



M825 High Angle CHG 4GB

Diagram Range	+	Range CORR	=	Total Range	x	Range K	=	Entry Range	CHG	VI	<SI/10	x	10mil Si Fac	=	SI	+	EL	=	QE	DRIFT
4000	+	0	=	4000	x	1.0000	=	4000	4GB	+23	+0.6	x	-0.7	=	0	+	1288	=	1288	L125
5700	+	0	=	5700	x	1.0000	=	5700	4GB	-15	-0.3	x	-2.8	=	+1	+	1133	=	1134	--
6200	+	0	=	6200	x	1.0000	=	6200	4GB	-25	-0.4	x	-4.4	=	+2	+	1071	=	1073	L37

FP 185, M825
High Angle, CHG 4GB, AOL 1600

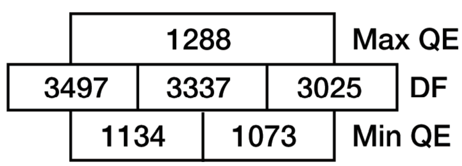
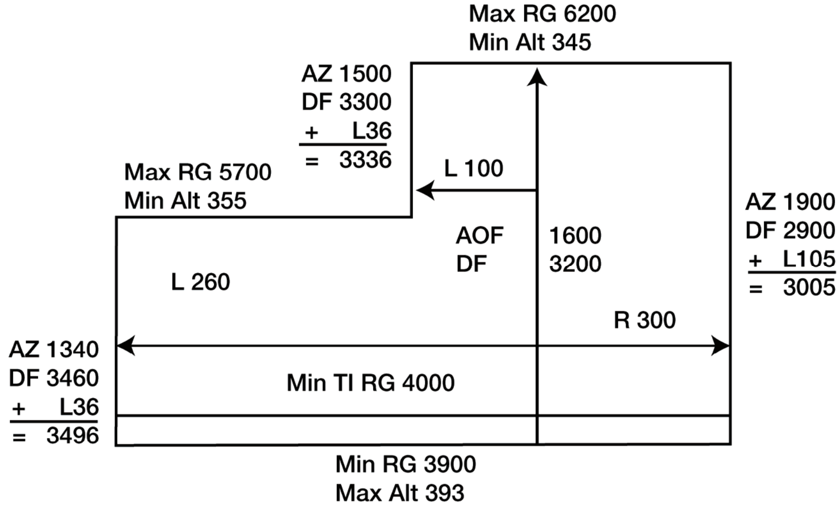


Figure 2-15. Example of a high-angle safety matrix (shell M825)

FP 185 (Grid 6026 4110 Alt 370)
High Angle, Illum, CHG 3GB, AOF 1600



Illum High Angle CHG 3GB

Diagram Range	+	Range CORR	=	Total Range	x	Range K	=	Entry Range	CHG	VI	<SI/10	x	10mil Si Fac	=	SI	+	EL	=	QE	DRIFT
4000	+	0	=	4000	x	1.0000	=	4000	3GB	+23	+0.6	x	-1.0	=	-1	+	1253	=	1252	L105
5700	+	0	=	5700	x	1.0000	=	5700	3GB	-15	-0.3	x	-5.3	=	+2	+	1066	=	1068	--
6200	+	0	=	6200	x	1.0000	=	6200	3GB	-25	-0.4	x	-15.0	=	+6	+	977	=	983	L36

FP 185, Illum
High Angle, CHG 3GB, AOL 1600

	1252		Max QE
3496	3336	3005	DF
1068		983	Min QE

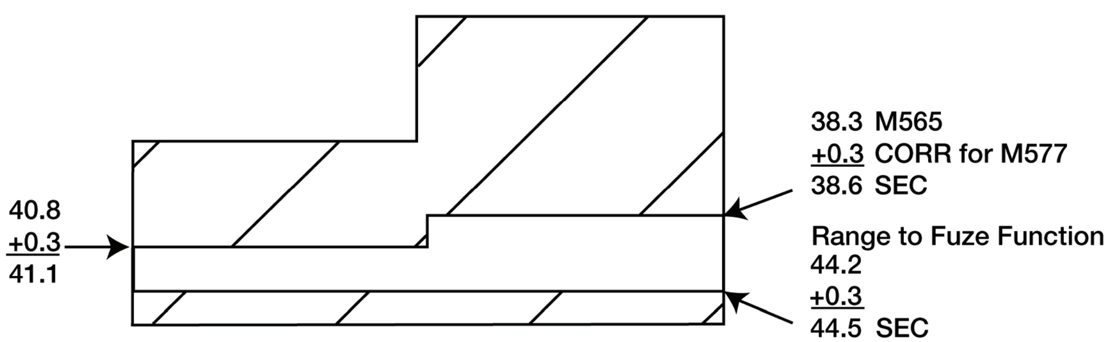


Figure 2-16. Example of a high-angle safety matrix (shell illumination)

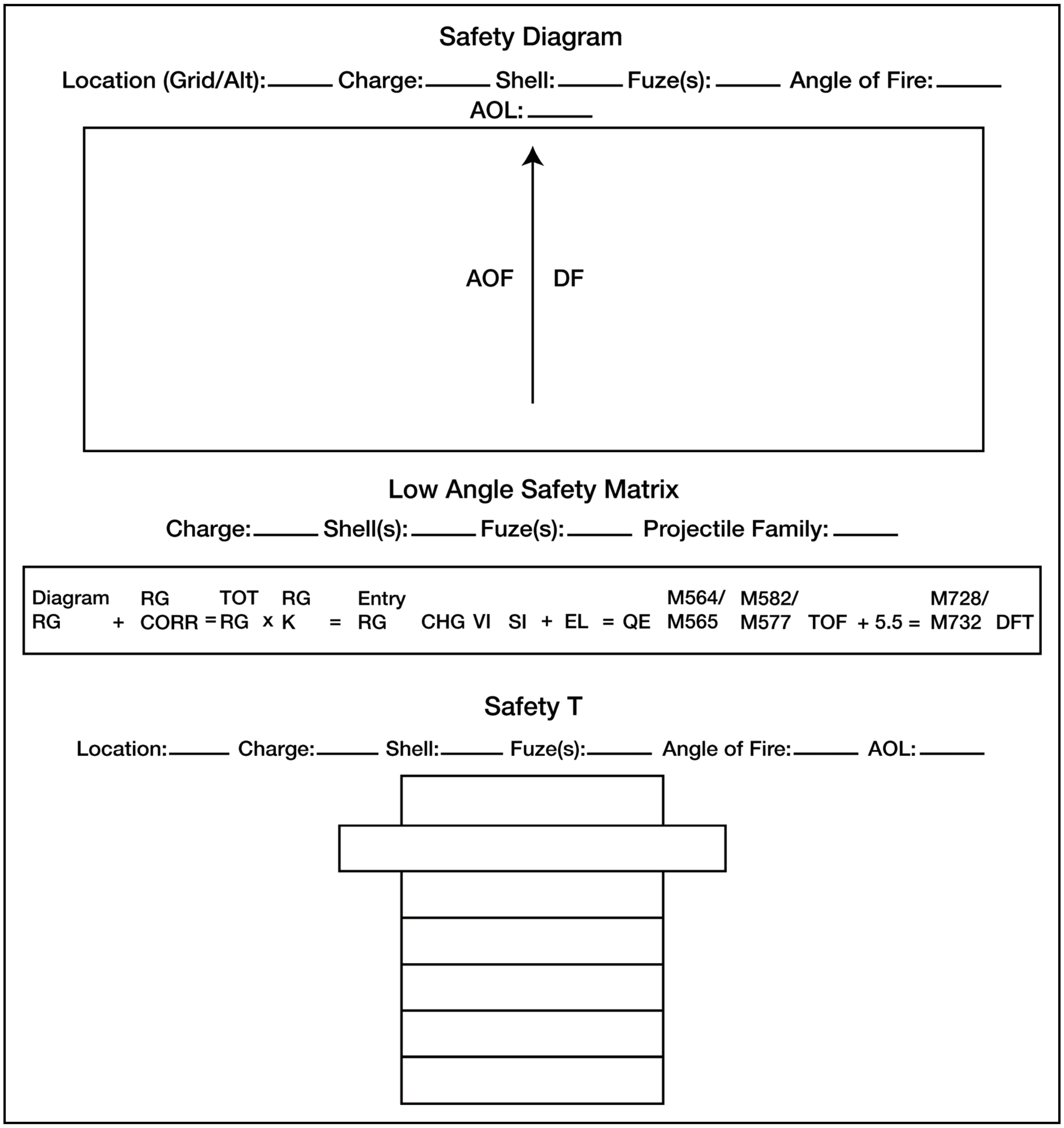
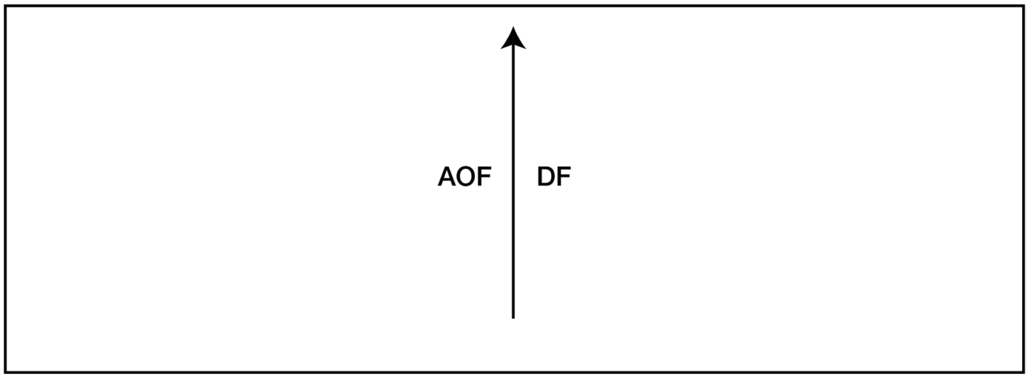


Figure 2-17. Low-angle safety computations

Safety Diagram

Location (Grid/Alt):_____ Charge:_____ Shell(s):_____ Angle of Fire:_____
AOL:_____



High Angle Safety Matrix

Charge:_____ Shell(s):_____ Projectile Family:_____

Diagram RG	+	RG CORR	=	Total RG	x	RG K	=	Entry RG	CHG	VI	<SI/10mil	Si Fac	=	SI	+	EL	=	QE	DRIFT

Safety T

Location:_____ Charge:_____ Shell(s):_____ Angle of Fire:_____ AOL:_____

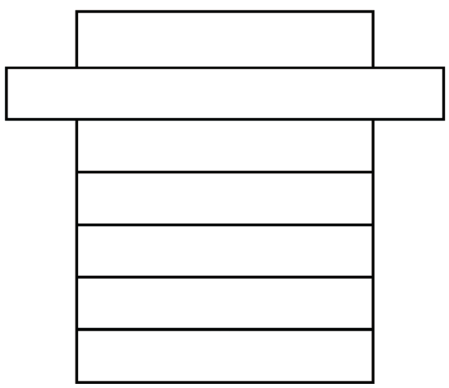


Figure 2-18. High-angle safety computations

SECTION IV – DETERMINING MINIMUM QUADRANT ELEVATION

> The XO or platoon leader is responsible for determining the lowest QE that can be safely fired from his position that will ensure projectiles clear all visible crests (minimum QE).

MINIMUM QUADRANT ELEVATION

ELEMENTS OF COMPUTATION

2-54. A minimum quadrant for each howitzer is ALWAYS determined. The maximum of these minimum quadrants is the XO's minimum quadrant. Using the RFT in appendix A is the fastest method of computing minimum QE. The QE determined from appendix A is always equal to or greater than (more safe) manual computations. Manual computations are more accurate than the rapid-fire tables and are used if the sum of the site to crest and the angle needed for a 5-meter vertical clearance is greater than 300 mils. Figure 2-19 shows the following elements of minimum QE.

- PCR is the horizontal distance between the piece and the crest—expressed to the nearest 100 meters. Procedures for measurement are discussed in page2-42 .

Note. All angles are determined and expressed to the next higher mil.

- Angle 1 is the angle of site to crest measured by the weapons. Procedures are discussed in paragraph 2-42.
- Angle 2 is the vertical angle required to clear the top of the crest. For quick, time, and unarmed proximity (VT) fuses, a vertical clearance of 5 meters is used. For armed VT fuses, see paragraph 2-44 .
- Angle 3 is the complementary angle of site. It is the complementary site factor (TFT, table G) for the appropriate charge at the PCR multiplied by the sum of angles 1 and 2. Site is the sum of angles 1, 2, and 3.

Note. The entry argument for table G is PCR. If it is not listed, do not interpolate; use the next higher listed value.

- Angle 4 is the elevation (TFT, table F) for the appropriate charge corresponding to the PCR.
- Angle 5 is a safety factor equivalent to the value of two forks (TFT, table F) for the appropriate charge at the PCR.
- The sum of angles 1 through 5 is the minimum QE for the weapon and the charge computed.

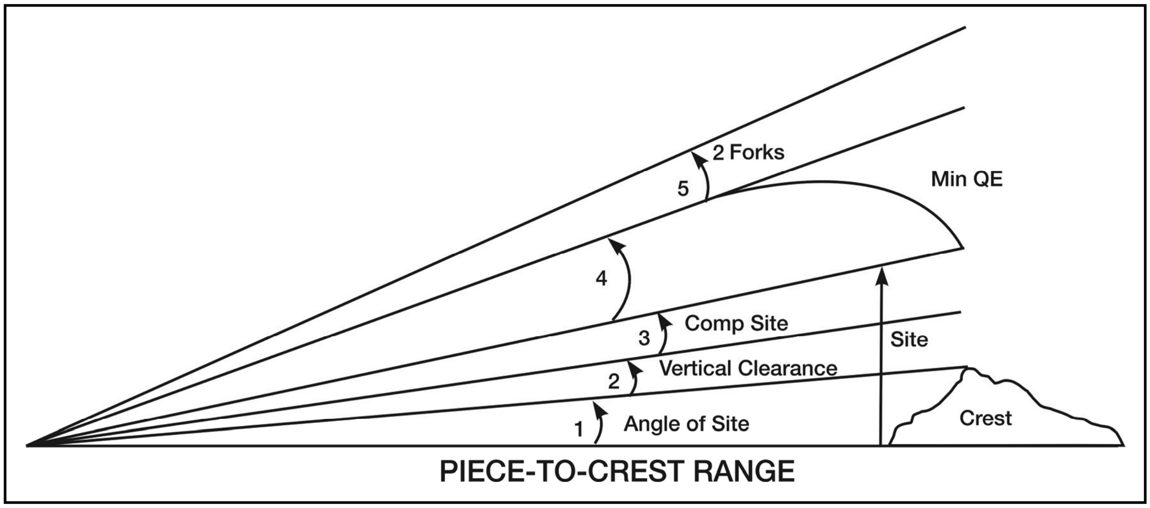


Figure 2-19. Angles of minimum QE

MEASURING ANGLE OF SITE TO CREST

2-55. As soon as the piece is "safed," prefire checks have been conducted, and ammunition has been prepared, position improvement begins with verification of site to crest as measured by the advance party. The advance party measures site to crest with an M2 compass or aiming circle. The section chief measures the angle of site to crest and reports this information to the XO or platoon leader. To measure the angle of site to crest, the section chief sights along the bottom edge of the bore, has the tube traversed across the probable field of fire, and has the tube elevated until the line of sight clears the crest at the highest point. He then centers all bubbles on the elevation mount and reads the angle of site to the crest from the elevation counter. This angle of site and the PCR are reported as part of the section chief's report.

MEASURING PIECE-TO-CREST RANGE

2-56. There are five methods that can be used to measure PCR—

- Taping. This is the most accurate method; however, it is normally too time-consuming.
- Subtense. This method is fast and accurate.
- Map measurement. This method is fast and accurate if the obstacle can be accurately located (for example, a lone tree will not appear on a map).
- Pacing. This method is time-consuming and depends on the distance and accessibility to the crest.
- Estimation. This method is the least accurate, but it is used when other methods are not feasible.

2-57. Regardless of the method used to measure PCR, the XO or platoon leader must verify PCR before he computes QE. He can do this by using any of the five methods.

COMPUTATION FOR FUSES OTHER THAN ARMED VT

2-58. The XO or platoon leader performs the computations indicated in this section if the sum of angles 1 and 2 (figure 2-19) exceeds 300 mils or if the RFTs are not available. All angles are determined and expressed to the next higher mil. Table 2-11 lists the steps and provides an example of an XO's or platoon leader's manual computations.

Table 2-11. Manual minimum QE computations.

Step	*Action*
1	Howitzer 1 (M198) reports a site to crest of 16 mils at a PCR of 1,100 meters.
2	∠1 = site to crest = 16 mils
3	∠2 = (VI x 1.0186) ÷ PCR (in thousands) = (5 x 1.0186) ÷ 1.1 = 4.6 ≈ 5 mils This VI is a 5-meter vertical clearance safety factor. It can also be computed by using the GST. Solve in the same way as angle of site (4.6 ≈ 5).
4	∠3 = (∠1 + ∠2) x CSF = (16 + 5) x 0.010 = 0.210 ≈1 mil
5	∠4 = EL = 74.1 ≈ 75 mils
6	∠5 = 2 Forks (TFT, table F, column 6) = 2 x 2 = 4 mils
7	Minimum QE = ∠1 + ∠2 + ∠3 + ∠4 + ∠5 = 16 + 5 + 1 + 75 + 4 = 101 mils

2-59. The same example is solved in table 2-12 by using the RFTs in appendix A.

Table 2-12. RFT minimum QE computations

Step	*Action*
1	Determine if the RFT can be used (∠1 + ∠2 ≤ 300 mils). Use appendix A, page A-1. Since the sum of angles 1 and 2 is less than or equal to 300 (16 + 5 = 21), the RFT can be used.
2	Determine RFT value. Enter the appropriate RFT. The entry arguments are howitzer (M198), propellant (M3A1, GB), fuze (PD), PCR (1100), and charge (3). The correct table is on appendix A, page A-7. The RFT value is 86. This value equals the sum of angles 2, 3, 4, and 5 (∠2 + ∠3 + ∠4 + ∠5). ***Note.*** Use the RFT labeled “M557, M564” for all minimum QE computations except armed VT. For armed VT, use the RFT labeled “M728.”
3	Determine the RFT minimum QE. This value equals the sum of angle 1 and the RFT value (16 + 86 = 102).

2-60. One howitzer section may report a site to crest that is unusually high. If the XO or platoon leader determines that it is the result of a single narrow obstruction (such as a tree), the piece can be called out of action when firing a deflection that would engage the obstruction. This would enable the platoon to use the next lower site to crest. Other alternatives are to remove the obstruction or move the weapon.

2-61. Table 2-13 shows why minimum QE is computed for all guns, regardless of which has the largest site to crest.

Table 2-13. RFT example for howitzer platoon

GUN	*CHG*	*PCR*	*SITE TO CREST*	*+ RFT*	*= MINIMUM QE*
1	3GB	800	128	64	192
2	3GB	1,000	105	80	185
3	3GB	1,500	92	116	208
4	3GB	1,200	115	93	208

COMPUTATIONS FOR ARMED VT FUZE (LOW-ANGLE FIRE)

2-62. The method of computing the XO's minimum QE for firing a projectile fused with an M728 or M732 fuze depends on the method in which the fuze is used. The proximity (VT) fuze is designed to arm 3 seconds before the time set on the fuze; however, some VT fuses have armed as early as 5.5 seconds before the time set on the fuze. Because of the probability of premature arming, a safety factor of 5.5 seconds is added to the time of flight to the PCR. Since time on the setting ring is set to the whole second, the time determined in computing minimum safe time is expressed up to the nearest whole second. A VT fuzewill not arm earlier than 2 seconds into time of flight, which makes it a bore-safe fuze.

2-63. In noncombat situations, the XO or platoon leader determines the minimum safe time by adding 5.5 seconds to the time of flight to the minimum range line as shown on the range safety card. The minimum QE determined for fuses quick and time is also valid for fuze VT.

2-64. In combat situations, the XO or platoon leader determines the minimum QE and a minimum safe time for fuze VT. The minimum QE determined for PD fuses is safe for VT fuses if the fuze setting to be fired is equal to or greater than the minimum safe time determined in the computation (paragraph 2-41). If the XO or platoon leader finds it necessary to fire a VT fuze with a time less than the minimum safe time, he must modify the minimum QE. He does this by increasing the vertical clearance to ensure that the fuze will not function as it passes over the crest. In addition, he must ensure the fuze will not function over any intervening crests along the gun-target line (see paragraph 2-46).

2-65. If the projectile is to be fired with the VT fuze set at a time less than the minimum safe time, allowance must be made for vertical clearance of the crest. Vertical crest clearances for armed M728 and M732 VT fuses fired over ordinary terrain for all howitzer systems is 70 meters.

2-66. If the projectile is to be fired over marshy or wet terrain, the average HOB will increase. The vertical clearance is increased to 105 meters. If the projectile is fired over water, snow, or ice, the vertical clearance is 140 meters.

2-67. The minimum QE for armed fuze VT, when a fuze setting less than the minimum safe time is fired, is based on the PCR and a vertical clearance as indicated in paragraph d and paragraph e above.

2-68. Figure 2-20 shows a decision tree for applying armed VT minimum QE.

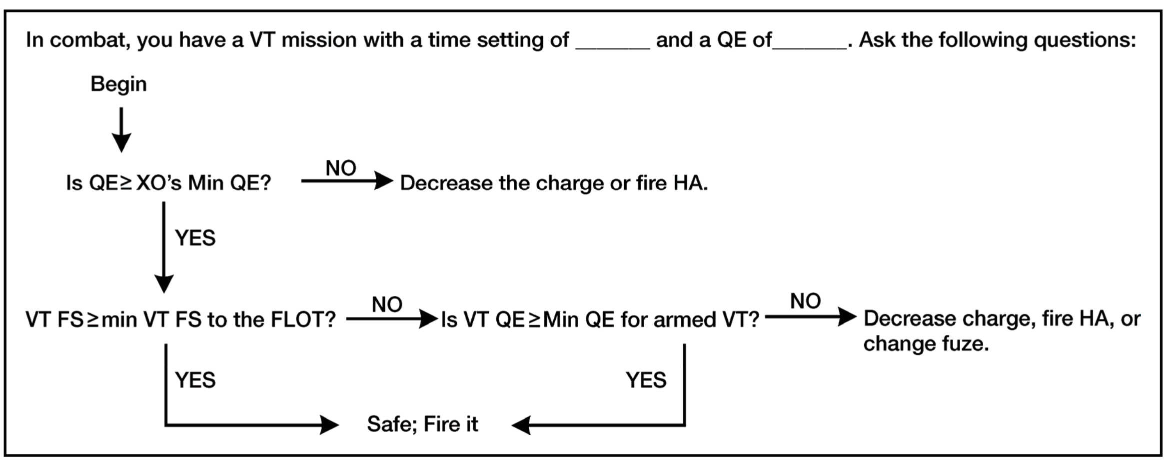


Figure 2-20. Armed VT decision tree

2-69. Table 2-14 shows an example of computations to determine minimum QE for an armed VT fuze.

Table 2-14. Manual armed VT minimum QE computations

Step	*Action*
1	Howitzer 1 (M198) reports a site to crest of 16 mils at a PCR of 1,100 meters.
2	∠1= site to crest= 16 mils
3	∠2 = (VI x 1.0186) ÷ PCR (in thousands) = (70 x 1.0186) ÷ 1.1 = 64.8 ≈ 65 mils This VI is a 70-meter vertical clearance safety factor. It can also be computed by using the GST. Solve in the same way as angle of site (64.7 ≈ 65)
4	∠3 = (∠1 + ∠2) x CSF = (16 + 65) x 0.010 = 0.710 ≈ 1 mil
5	∠4 = EL = 74.1 ≈ 75 mils
6	∠5 = 2 Forks (TFT, Table F, column 6) = 2 x 2 = 4 mils
7	Minimum QE = ∠1 + ∠2 + ∠3 + ∠4 + ∠5 = 16 + 65 + 1 + 75 +4 = 161 mils
8	Determine minimum safe time. This value is the sum of TOF to PCR and 5.5 expressed up to the next higher second (4.1 + 5.5 = 9.6 ≈ 10.0 sec).

2-70. The same example is solved in table 2-15 by using the RFT in Appendix A.

Table 2-15. RFT minimum QE computations

Step	*Action*
1	Determine if the RFT can be used (∠1 + ∠2 ≤ 300 mils). This is done manually since page A-1 (Appendix A) uses a vertical clearance of 5 meters. See step 3 in table 2-14 for ∠2. Since the sum of angles 1 and 2 is less than or equal to 300 (16 + 65 = 81), the RFT can be used.
2	Determine RFT value. Enter the appropriate RFT. The entry arguments are howitzer (M198), propellant (M3A1, GB), fuze (M728 or M732), PCR (1,100), and charge (3). The correct table is in Appendix A, page A-13. The RFT value is 147. This value equals the sum of angles 2, 3, 4, and 5 (∠2 + ∠3 + ∠4 + ∠5).
	Note: Use the RFT labeled "M557, M564" for all minimum QE computations except armed VT. For armed VT, use the RFT labeled "M728."
3	Determine the RFT minimum QE. This value equals the sum of angle 1 and the RFT value (16 + 147 = 163).
4	Determine minimum safe time. Use the same entry arguments as in step 2. The minimum safe time is 10.0.

2-71. If the VT fuze setting to be fired is equal to or greater than the minimum safe VT time, the minimum QE for fuses quick and time applies. If the fuze setting to be fired is less than the minimum safe time, the minimum QE determined for armed VT applies.

USING MINIMUM QUADRANT ELEVATION

2-72. After computing minimum QE for each charge authorized, the XO or platoon leader must compare the minimum QE to the QE required to clear the minimum range line. The XO must then select the highest quadrant for each charge to be used as the minimum QE to be fired from that position.

INTERVENING CREST

2-73. FDOs must ensure that artillery fires clear intervening crests. Intervening crests are defined as any obstruction between the firing unit and the target not visible from the firing unit. The following are the possible options, listed in order of preference:

- Option 1: Determine firing data to the crest (include all nonstandard conditions) and add two forks (table 2-16).
- Option 2: Determine a minimum QE in a similar manner as XO's minimum QE (table 2-17, page 2-47).
- Option 3: Use the trajectory tables in the appendix of the TFT.

2-74. Option 1 is preferred because it incorporates all current nonstandard conditions that will affect the projectile along the trajectory. Based on the availability of corrections for nonstandard conditions, the FDO has the responsibility to determine if this really is the best option. Table 2-16 lists the steps.

Table 2-16. Intervening crest, option 1.

Step	*Action*
1	Upon occupation, the FDO analyzes the terrain for intervening crests.
2	Upon determining the altitude of this crest, he computes QE firing data to this point. The best solution includes all available corrections for nonstandard conditions (current and valid GFT setting).
3	Add the value of two forks (TFT, table F, column 6) to the QE determined in step 2 to ensure that round-to-round variations (probable errors) will clear this crest.
4	The FDO then records this QE and charge on his situation map as a check to ensure that rounds will clear the intervening crest.
5	Upon receipt of a fire mission, the FDO will compare his intervening crest QE to his fire mission quadrant. One of three situations will occur: 1. The target is located short of the intervening crest. The FDO does not consider the effects of the crest at this time. 2. The mission QE exceeds intervening crest QE by a significant margin—indicating the round will clear the crest. 3. Fire mission QE exceeds intervening crest QE by only a small margin or is less than intervening crest QE, indicating the round may or may not clear the crest. The FDO must determine if the round will clear after considering the following: • Have all nonstandard conditions been accounted for? • How old is the current MET message? • Are registration corrections being applied to this mission? • Upon realizing that the round may not or will not clear the crest, the FDO can fire either high angle or a reduced charge. The quickest choice would be to fire high angle, but tactical situations may prevent this. Firing a lower charge will increase dispersion more than high angle. For example, at a range of 6,000 meters, the following applies: ▪ Low angle, charge 5: Probable error in range = 15 meters ▪ High angle, charge 5: Probable error in range = 17 meters ▪ Low angle, charge 4: Probable error in range = 23 meters ▪ If a lower charge is selected, steps 2 through 5 must be repeated.
6	If VT fuses are to be fired (M700 series), the FDO must take additional action to ensure that the VT fuze does not arm before passing over the crest. Follow the steps for determining armed VT minimum QE and FS in paragraph 2-41.

2-75. Option 2 does not include current corrections for all nonstandard conditions. Table 2-17 lists the steps.

Table 2-17. Intervening crest, option 2

Steps	*Action*
1	Upon occupation, the FDO analyzes the terrain for intervening crests.
2	The FDO determines and announces the grid and map spot altitude to the crest.
3	The HCO plots the grid and determines and announces range to the crest.
4	The VCO computes angle of site to the crest. This is the same as determining site to crest for a howitzer.
5	Determine if the RFT can be used ($\angle 1 + \angle 2 \leq 300$ mils). Angle 1 equals angle of site to the crest. Refer to ST 6-50-20, page A-1. Since $\angle 1$ and $\angle 2$ decrease with range, this should not be a problem.
6	Determine RFT value. Enter the appropriate RFT. The entry arguments are howitzer (M198), propellant (M3A1, GB), fuze (M728 or M732), PCR (1100), and charge (3). The correct table is on ST 6-50-20, page A-13. The RFT value is 147. This value equals the sum of angles 2, 3, 4, and 5 ($\angle 2 + \angle 3 + \angle 4 + \angle 5$). ***Note***. Use the RFT labeled "M557, M564" for all minimum QE computations except armed VT. For armed VT, use the RFT labeled "M728."
7	Determine RFT intervening crest QE. This value is the sum of the angle of site to the crest and the RFT value.
8	If VT is fired, enter the appropriate table and extract the correct information.
9	Follow steps 4 and 5 of table 2-16.

2-76. Option 3 is the least preferred option and uses the trajectory charts in the appendix of the TFT. This offers a quicker but less accurate method to clear the intervening crest. The FDO must make a judgment call when to use these charts. The FDO must use caution when making this decision.

PALADIN FIRING SAFETY

2-77. Firing safety is paramount—every secondary independent check verification ensures that fired rounds impact and detonate on the desired target. Failure to conduct secondary independent checks is the primary contributing factor to M109A6 Paladin firing incidents. Conducting procedurally correct crew drills can help prevent firing incidents from occurring. The most frequent types of firing incidents during Paladin live-fire operations that can be prevented by secondary independent checks are—

- Firing at load elevation.
- Degraded operations (appendix A, FM 3-09.70) –The leadership must be proactive under degraded operations.
- Charge error.

2-78. Target location and verification of target location are critical factors in fire mission FM processing as well. The POC/BOC verifies target location at the battery level. Targets must be physically plotted and checked to ensure that they plot safely and do not violate any FSCM. The following techniques aid the FDC in ensuring that all target grids are cleared for safe engagement.

BOXED SAFETY

2-79. Safety is computed in accordance with FM 6-40/MCWP 1.6.19standards and can be derived from automated range safety. The FDO computes safety from the center of radius grid used in the move order. The safety data is valid for howitzers firing within a 750-meter radius of the surveyed grid. Using the range fan, the FDO maximizes his safety box by determining his own limits within an approved impact area. The left and right limits are input in the move order message format. The FDO determines minimum and maximum quadrants.

2-80. The minimum and maximum quadrants and charge-specific data are sent to the howitzers by digital means on a SYS;PTM. The section chief enters the data into the Automatic Fire Control System (AFCS). Minimum QE is entered into the AFCS. Maximum QE is input as maximum tube elevation. The FDO must specify charge using this technique. He must select the optimum charge to fire based on the tactical situation. Every mission sent to the howitzer must be checked, and the specified charge must be sent down to the howitzers. The POC must check and resolve intervening crests (see figure 2-21).

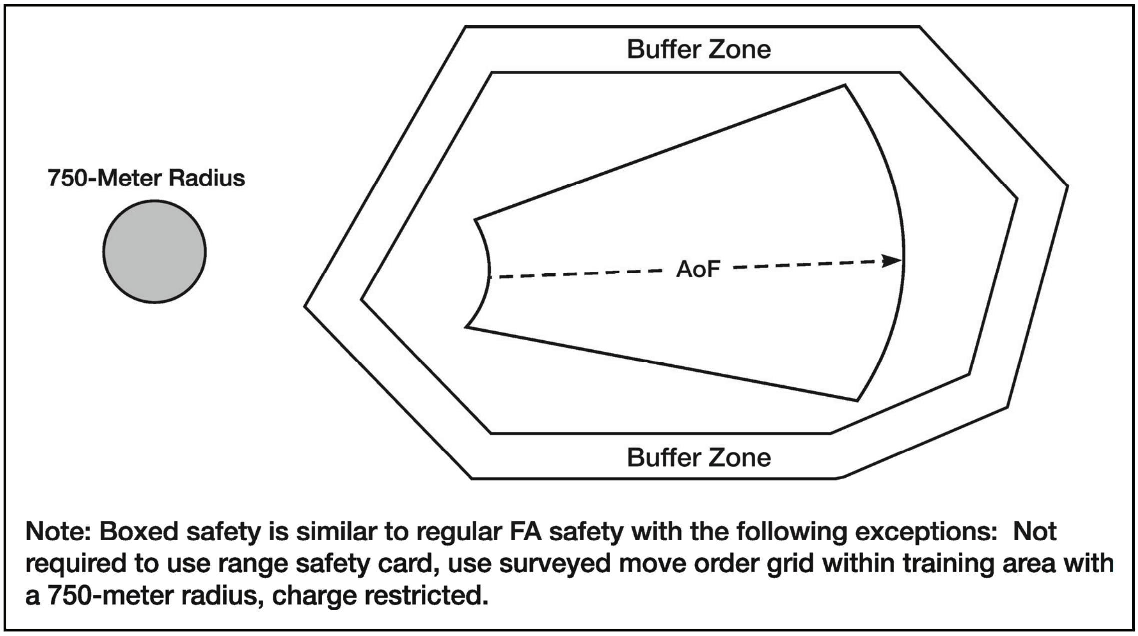


Figure 2-21. Boxed safety

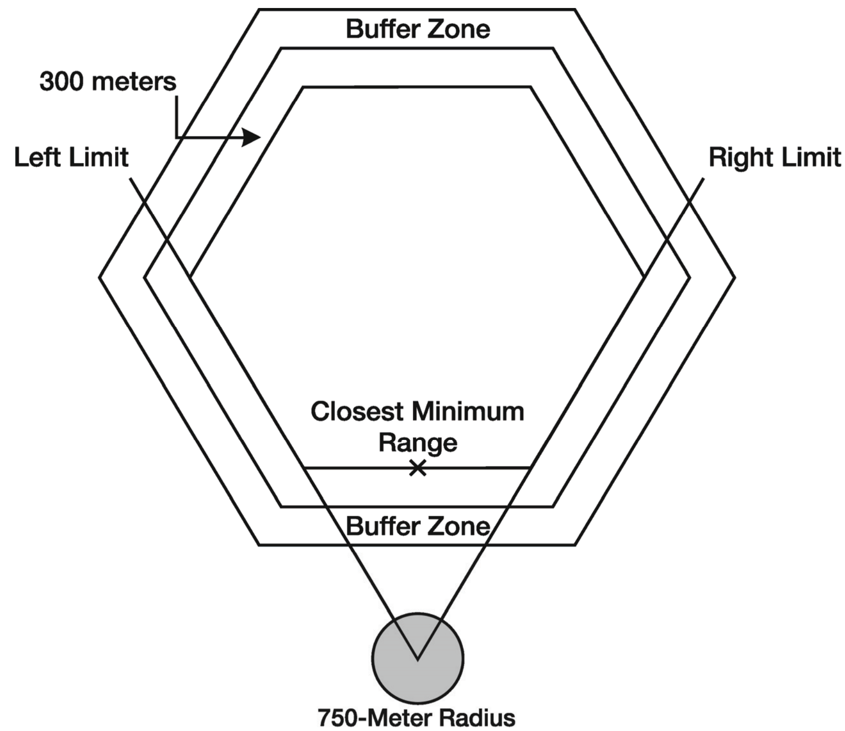
UNBOXED SAFETY

2-81. This technique requires the FDO to shrink the perimeter of the selected impact area 300 meters or per local range safety regulations (whichever is safest) to account for PEs. The minimum quadrant to fire is computed using the lowest optimum charge to the closest minimum range of the impact area.

2-82. The POC transmits minimum QE to the howitzer using the SYS;PTM format, and the COS inputs minimum QE into the AFCS. The FDO does not send the howitzers a maximum QE. Not sending a maximum QE allows the platoon greater flexibility to engage targets within their sectors and enables firing of different charges per mission. The FDO determines the left and right azimuth limits using the outermost edges of the shrunken impact area. The limits are sent to the howitzers on the movement order format. All data is safe as long as howitzers remain within a 750-meter radius of the occupation grid (see figure 2-22). The following are key points in unboxed safety:

- Minimum QE is computed using the lowest optimum charge.
- Left and right limits are sent on the movement order format.
- Multiple charges can be fired.
- Impact area is reduced by 300 meters or per local range safety regulations (whichever is safest) to allow for probable errors.
- Howitzer pairs work within a 750-meter radius.

Note. Boxed safety is similar to regular FA safety with the following exceptions:
- Not required to use range safety card.
- Use surveyed move order grid within training area with a 750-meter radius.
- Charge restricted.



Note: Minimum range is computed for lowest optimum charge. Grid fired must be verified by at least three independent checks (FO/FIST, Battalion FDC, POC). Howitzers input Min QE. Left and right limits on move order. Multiple charges can be fired.

Figure 2-22. Unboxed safety

COMBAT SAFETY

2-83. Combat safety (see figure 2-23) is similar to unboxed safety with the following exceptions:

- Minimum QE is computed to the minimum range line (for example, FLOT/brigade CFL).
- Left and right limits are computed to the brigade boundaries and sent in the move order.
- The POC must check intervening crests.

Note. Minimum range is computed for lowest optimum charge. Grid fired must be verified by at least **three** independent checks (FO/FIST, battalion FDC, POC/BOC). Howitzers input minimum QE and left and right limits on move order. Multiple charges can be fired.

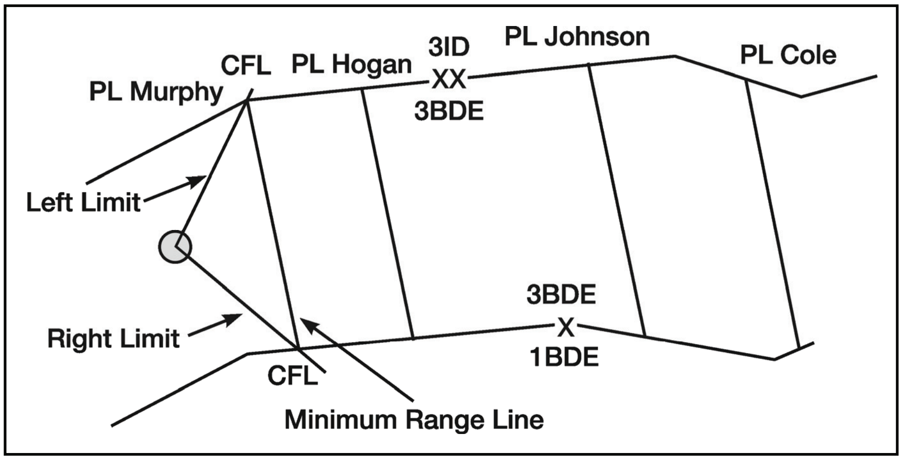


Figure 2-23. Combat safety

ILLUMINATION SAFETY

2-84. Illumination safety (see figure 2-24) is similar to boxed safety and is computed using an approved safety box in an impact area. Computations are made per the procedures in FM 6-40/MCWP 1.6.19. The FDO computes minimum and maximum quadrants. Maximum QE is computed using range to impact. The POC transmits the calculated data/Safety T to the howitzers via SYS;PTM. The chief records the data but does not enter the Safety T limits into the AFCS. The key points are—

- Similar to boxed safety.
- Illumination Safety T is sent to guns via SYS;PTM.
- The howitzer section chief does not enter Safety T data into AFCS, but records the data.

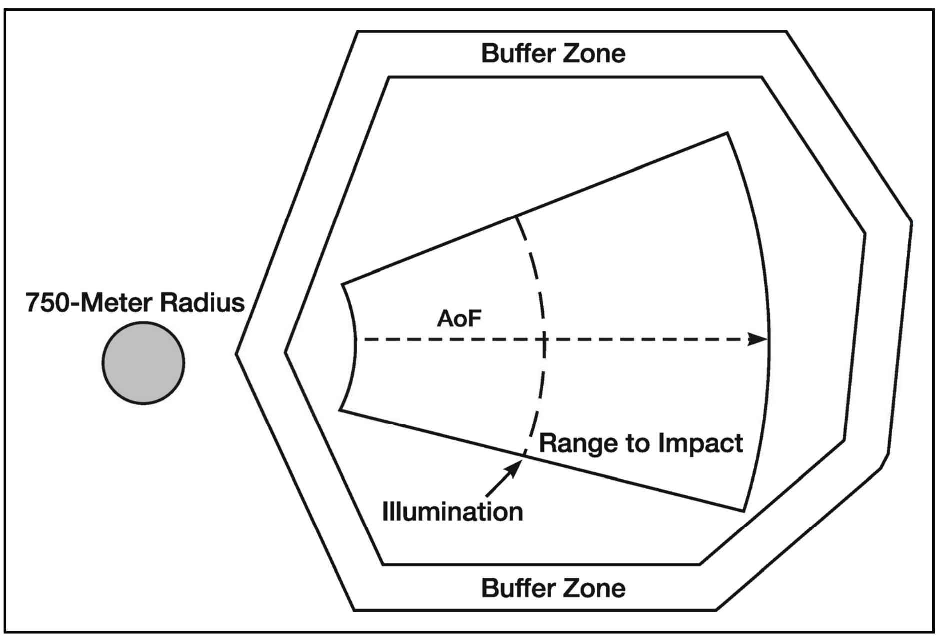


Figure 2-24. Illumination safety

SECTION V – MLRS SAFETY PROCEDURES

2-85. MLRS safety data may be calculated using a launcher's fire control system (two check launchers) or the SDC. The SDC may be used to compute safety data for OPAREA method 1, point-to-point, and firing point methods of safety computation. Using the procedures in this chapter, check launchers determine the data required to manually develop the Safety T. The SDC can also determine the data required for the Safety T and produce the Safety T. SDC-generated Safety T data will be verified by one the following methods:

- The input of SDC data by a safety-certified individual and verified by a **second** safety-certified individual. This process will be performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data compared. The data on these Safety Ts will be identical.
- The input of SDC data by a safety-certified individual and verified by a **second** safety-certified individual and by a check launcher performing the required check missions and commanded data being within ±5 mils in AZ and QE and 0.5 seconds fuze time.

2-86. The following section will explain in detail how the FDC develops the SDZ diagram, along with step-by-step procedures for the firing data that will be used to develop a Safety T.

2-87. SDC is a user-friendly operator interface wrapped around an existing FORTRAN program that calculates MLRS ballistic firing data. SDC uses the same ballistic algorithm that is resident on the launcher FCS. SDC calculates and displays a Safety T for the M270, M270A1, IPDS, advanced concept technology demonstration (ACTD) HIMARS, and M142 HIMARS launchers using the methods outlined in this chapter and FM 6-60, for example, point-to-point, firing point, and OPAREA method 1. SDC provides commanders with an alternate means of developing safety data for live firings. **Using tactical equipment (check launchers) is optional when the SDC program is used. All other safety procedures and requirements outlined in this chapter still apply.**

2-88. The MLRS launcher FCS performs many repetitive self-tests during operations. Built into both the launcher hardware and software, these tests check and continually monitor the launcher throughout its operation. Additional manual checks should focus on areas of potential crew error in the area (based on historical data and observations) that has caused most launcher-related firing incidents. Checks that verify the accuracy and validity of all data input into the AFATDS/FDS, SDC, and launcher FCS eliminate most of the causes of firing incidents.

2-89. MLRS firing data (azimuth, QE, and fuze setting) are computed by the FCS and SDC. To complete a firing sequence, the LM must be oriented and maintain accuracy within ±3 mils in quadrant elevation and ±3 mils azimuth of the FCS solution (command versus actual data displayed on the FCP). If for any reason the LDS fails (part wear, adverse mechanical failure, and so forth) thus preventing the LM from reaching or maintaining its computed ballistic firing window, the FCS will cancel the fire mission and not allow the crew to fire the rockets.

2-90. Additionally, while conducting every fire mission, the FCS further verifies its LM position by comparing its SRP/PDS data (or PNU on the IPDS, M270A1, ACTD HIMARS, and M142 HIMARS) against a mechanical reference provided by azimuth and elevation resolvers. The azimuth resolver is attached to the rotating gear of the launcher turret and the elevation resolver is attached to the LM pivot point where the cage and turret are connected. A failure of agreement between the FCS and its mechanical resolvers will alert the crew with a warning message. Any indication of a system error (built in test (BIT) light or critical failure prompt on the FCP) will cause the crew to immediately abort the mission in progress and troubleshoot the fault before continuing. Strict adherence to the operator manual's procedures and all FCS warning indicators are necessary.

2-91. Operator error is minimized by verifying launcher firing data. A safety-certified individual must make this verification. The independence of this check is maintained in two ways: 1) by ensuring that safety data is input and verified by two different safety-certified personnel and 2) by a minimum of two check launchers when conducting static firings to obtain safety data. This includes launcher startup data, MET data, and any subsequent MET updates, target grid coordinates, altitudes, and grid zones. It also consists of a comparison of the command firing data from the FCS of both launchers. Tolerance between check system command data is ±5 mils in azimuth and quadrant elevation and 0.5 seconds in fuze time.

2-92. The ±5 mil requirement between check systems does not apply when using SDC. SDC-generated Safety T data will be verified by one of two methods.

- In the first method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual. This process will be performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data compared. The data on these Safety Ts must be the same.
- In the second method, a safety-certified individual inputs SDC data which is verified by a second safety-certified individual and by a check launcher performing the required check missions and commanded data being within ±5 mils in AZ and QE and 0.5 seconds in fuze time.

Notes.

When using the SDC program, ensure that safety data input is input by a safety-certified individual and verified by a second safety-certified individual.

Ensure that the MET data is valid. See chapter 6 of this manual or FM 6-15 for more information on MET use criteria.

The M270A1, ACTD HIMARS, M142 HIMARS, and IPDS launchers do not require calibration. Verifying the GPS data is done by map spot (PLGR, resection, and so forth).

The check launchers can be used as the firing launchers after completing the Safety T and purging all databases.

2-93. Ensure that safety data input is input by a safety-certified individual and verified by a second safety-certified individual (for example, gunner and section chief for the FCS, and operations officer and battery FD NCO for the AFATDS/FDS). Both the gunner and section chief of the firing launcher must verify that the actual data (displayed at aim) falls within the Safety T when conducting live-fire exercises using the safety computations in section IV or FM 6-60.

2-94. Additionally, the PADS-established SCP must always be verified. A copy of the data is sent via a location status message to the BOC or POC, where it is verified by map spotting and printed out in hard copy and retained. The BOC or POC file this information for historical record. The BOC or POC verify that the MET data and impact area target location were correctly entered by the FDS/AFATDS operator and transmitted digitally to the firing launcher(s) where the data are automatically entered into the FCS. Independent verification of startup data by the launcher section chief and the platoon leader ensures that accurate position data is used during fire mission computation. The gunner ensures, and the section chief verifies, that start-up and update data are properly entered into the launcher FCS. Independent verification of start-up data by the launcher section chief and the platoon leader ensures that accurate position data is used during fire mission computation.

2-95. Procedures for firing safety involve a properly calibrated launcher, verification that the FCS is functioning properly, and verification of launcher-firing position within a designated firing area. Strict adherence to operator’s manual procedures and all FCS warning indicators are necessary. Additionally, a printed copy of the launcher’s command data sent via MFR to the BOC or POC for historical record is required.

2-96. Using observers located near and properly oriented on the impact area to observe safe impact for M28A1 or M28A2 training rockets for safety verification depends on local installation range SOPs. If spotting of the rocket impact is required, visual observers and/or radar tracking (AN/TPQ-36, -37, or -47) may be used.

Note. Sample MLRS firing safety checklist are provided on pages 2-88 and 2-91.

SECTION VI – COMPUTATION OF MLRS/HIMARS SAFETY DATA

GENERAL

Note. Do not use M270 or M270A1 safety data for HIMARS. Compute safety data separately for each weapon system.

2-97. Units using these procedures must be thoroughly familiar with the applicable terms contained in DA Pam 385-63. To develop safety data for MLRS, there are three things that must be done:

- Obtain a (range-specific) range safety card.
- Develop an SDZ diagram.
- Develop a Safety T based on munitions and current MET.

2-98. The installation RCO provides a range safety card to the OIC. This card states the location coordinates of the launcher firing area and the location coordinates of the target(s) to be engaged. In some cases, the range safety card will also contain left and right azimuth limits and minimum/maximum ranges to impact. The RCO also identifies any special instructions that must be followed in firing at that range (road guards, time constraints, Air Force overflights, and so forth).

2-99. Developing the SDZ diagram requires implementing the SDZ requirements referenced in the TRADOC safety letters. The SDZ diagram is developed and maintained in the FDC. It is used to ensure that targets lie within the target selection box and to define the launcher danger area, noise hazard area, and exclusion areas between the firing points and the target selection box. The following terms and definitions along with values in table 2-18 will be used to identify the SDZ for MLRS:

- Surface danger zone. The ground and airspace designated within the training complex (to include associated safety areas) for vertical and lateral containment of projectiles, fragments, debris, and components resulting from the firing launching, or detonation of weapon systems to include explosives and demolitions.
- Installation impact area. An area that has been established by the installation RCO.
- Usable portion of the installation impact area. That portion of the installation impact area that a unit has been allowed to use, that is perpendicular to the azimuth of fire, and completely within the installation impact area.
- SDZ impact area. That portion of the impact area defined by applying Wmax, Xmax, and Ymax inward from the usable portion of the impact area.
- Target area. The area inside a specific point or location to which the weapon is fired (AR 385-63/MCO P3570.1B). In addition, the point or location within the surface danger zone where targets are emplaced for weapon system engagement (DA Pam 385-63).
- Target selection box. That area inside the SDZ where targets must lie to meet the standard of containing all but 1:1,000,000 normally functioning rounds.
- Launcher danger area (area F). The area immediately behind the firing point or area that is at risk from blast and debris.
- Noise hazard area. The area to the rear and flanks of the firing point in which a noise hazard exists. The launcher danger area is included in the noise hazard area.
- Exclusion areas I and II. That part of the SDZ between the firing point and the target selection box in which there is danger from short rounds.
- Exclusion area III (M26 and M28 Only). That part of the SDZ that extends 1,800 meters from the near edge of the SDZ impact area toward the firing point.

- Safety T. A four-space table that shows the left and right azimuth limits and the minimum and maximum QE for firing the M28A1/A2 (see figure 2-31, page 2-61).

Table 2-18. M28A1/A2 (combined) safety

Range to Target (meters)	*W*	*X*	*Y*
8,000 to 9,000	770	2,525	1,905
9,001 to 10,000	855	2,155	1,635
10,001 to 11,000	945	1,795	1,440
11,001 to 12,000	1,045	1,485	1,290
12,001 to 13,000	1,155	1,220	1,185
13,001 to 14,000	1,290	1,175	1,115
14,001 to 15,000	1,475	1,275	1,075

2-100. The Safety T defines the left and right limits for firing azimuth and the minimum and the maximum limits for firing QE. It is maintained in the FDC and in the firing launchers.

Note. A six-space table that includes the minimum and maximum fuze times is used when computing safety for firing the M26 rockets (along with other restrictions that is, fin failure impact area, Exclusion area III [Area C], and so forth). See DA Pam 385-63.

MLRS SURFACE DANGER ZONE VALUES

2-101. The following terms and abbreviations are used to define MLRS safety danger zones.

AOF	Azimuth of fire.
H	Height of the launcher above mean sea level.
Distance W	A distance to either side of the target wide enough to include all debris (payload, warhead skin, and rocket motor) from normally functioning rounds. Distance W is the maximum lateral distance a projectile will ricochet after impacting within the dispersion area. Distance W defines the maximum lateral edge of the ricochet area.
Wmax	The maximum possible value of W. For OPAREAs, this is the value of W at a range from the rear edge of the OPAREA to the geographic center of the usable portion of the installation impact area.
Distance X	A distance beyond the target adequate to contain rockets when the fuze fails to function (M26/A1/A2/M28). Distance X is further defined as the maximum distance a rocket will travel when fired or launched at a given quadrant with a given propulsion system (M28A1/A2).
Xmax	The maximum possible value of X. For OPAREAs, this is the value of X at a range from the forward edge of the OPAREA to the geographic center of the usable portion of the installation impact area.
Distance Y	A distance short of the target sufficient to include all debris (payload, warhead skin, and rocket motor) from normally functioning rounds.
Ymax	The maximum possible value of Y. For OPAREAs, this is the value of Y at a range from the forward edge of the OPAREA to the geographic center of the usable portion of the installation impact area.
Area F	The area immediately to the rear of the launcher that is directly exposed to blast and debris (launcher danger area).

COMPUTING SAFETY DATA

SAFETY COMPUTING METHODS

2-102. There are three methods to compute safety data for mlrs live firing: OPAREA, point-to-point, and firing point. All of these methods apply to all of the SDZ requirements previously discussed.

Note. The numerical values for AZ, range, and QE in all of the figures in this section are provided to assist in understanding the procedures for computing safety.

- OPAREA method. This method requires a larger impact area but allows the unit to derive a single Safety T for an entire launcher OPAREA firing into a target area. Selecting targets from within the target selection box ensures that the firing unit will meet the 1:1,000,000 DA safety standard. This method allows the unit to conduct more realistic and tactically driven live-fire exercises, thus significantly enhancing training. There are two techniques (method 1 and method 2) to derive safety data using the OPAREA method. Both techniques will yield the same azimuth limits and minimum and maximum quadrants if the minimum and maximum altitudes/elevations at the minimum and maximum ranges of the target area are used. Method 2 has the execution steps in different order of application. OPAREA safety works well when conducting live-fire exercises with the M28A1/A2 training rocket (reduced range). Small impact areas may preclude using OPAREA safety procedures.
- Point-to-point method. This method allows the unit to derive a Safety T from a specific firing point to a specific point target that lies within a target area.
- Firing point method. This method allows the unit to derive a Safety T for a single firing point (firing into a target area). Selecting targets from within the target selection box ensures that the firing unit will meet the 1:1,000,000 DA safety standard.

SAFETY COMPUTING PHASES

2-103. Safety computations for each of these methods are completed in four phases—

- Phase I—applying the SDZ requirements (for the specific munitions) to the installation impact area.
- Phase II—deriving the firing limits in both AZ and QE.
- Phase III—applying the SDZ requirements (for the specific munitions) to the launcher firing point or OPAREA.
- Phase IV—completing the flight corridor.

2-104. Paragraphs 2-106, 2-120, 2-131, and 2-145 contain step-by-step procedures the FDC uses to develop the SDZ diagram.

OPAREA METHOD 1 OF COMPUTING SAFETY

2-105. This method requires a larger impact area but allows the unit to derive a single Safety T for an entire launcher OPAREA firing into a target area.

Phase I OPAREA Method 1

2-106. Apply the SDZ requirements to the installation impact area (see figure 2-25, page 2-56).

Notes.

1. Both techniques will yield the same azimuth limits and minimum and maximum quadrants if the minimum and maximum altitudes/elevations at the minimum and maximum ranges of the target area are used. Method 2 has the execution steps in different order of application.

---

2. If you have been issued a range safety card from your range control office that takes into account the MLRS SDZ requirements referenced in the TRADOC safety letters, the OIC/firing unit must complete the SDZ diagram for their firing point(s) or firing OPAREA(s).

- **Step 1**. Plot and draw the installation impact area on a map or overlay. If the existing installation impact area to be used for MLRS firing is not a square or rectangle, the unit must draw a square or rectangle inside the existing impact area. One side of the square or rectangle must be perpendicular to the AOF from the center of the OPAREA to the center of the impact area. The procedures in step 4 are only valid when applied to a square or rectangular impact area (see Figure 2-25).
- **Step 2.** Index the geographic center of the usable portion of the installation impact area (target) (see figure 2-25).
- **Step 3.** Index the center of the proposed firing OPAREA. Draw a circle around the index. (The size of the circle will be allocated by range control.) This radius may be larger or smaller depending upon the training area and/or impact area available to the unit. All of the OPAREA firing points must be located in this OPAREA circle.

Note. If given an irregular firing OPAREA by range control, you must construct a circular firing OPAREA that remains completely inside the area that you received from range control.

Note. As an example, we will use a large firing OPAREA with a radius of 1,000 meters for graphical simplicity.

- **Step 4.** Draw a line connecting the two indices from steps 2 and 3.
- **Step 5.** Using the appropriate munition-specific table (table 2-18, page 2-54), derive and apply the appropriate values of Wmax, Xmax, and Ymax to the edges of the installation impact area (toward target) (see figure 2-25). For OPAREAs, the entry value for Wmax is the range from the rear edge of the OPAREA to the target. The entry value for Xmax is the range from the forward edge of the OPAREA to the target. The entry value for Ymax is the range from the forward edge of the OPAREA to the target. This is the SDZ impact area.

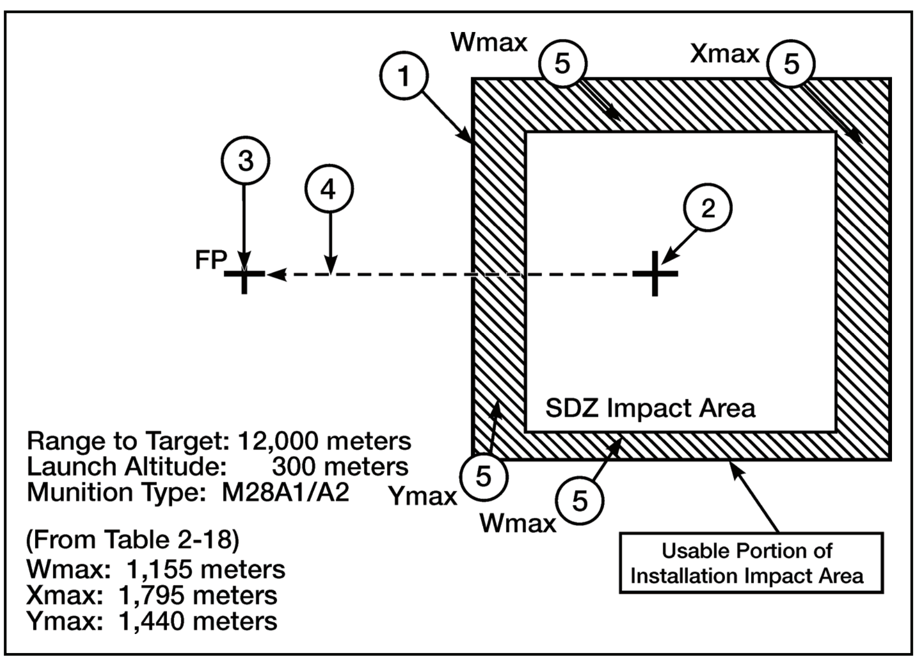


Figure 2-25. Example impact area

Phase II OPAREA Method 1

2-107. Determine the left and right azimuth limits of the OPAREA.

- **Step 1**. Mark the most forward, rearward, right, and left positions along the circumference of the OPAREA circle from phase I (see figure 2-26).
- **Step 2.** Draw a safety fan from both the left and right positions (from step 1), which will keep all rounds within the SDZ impact area. You must also apply any azimuth restrictions imposed by the range control for the OPAREA (use the more restrictive of the two sets of azimuth limits). Measure the left and right limits of each fan (see Figure 2-26). These are the initial left and right azimuth limits for the entire live-fire OPAREA. (You will determine the final azimuth limits with FCS in step 8.)

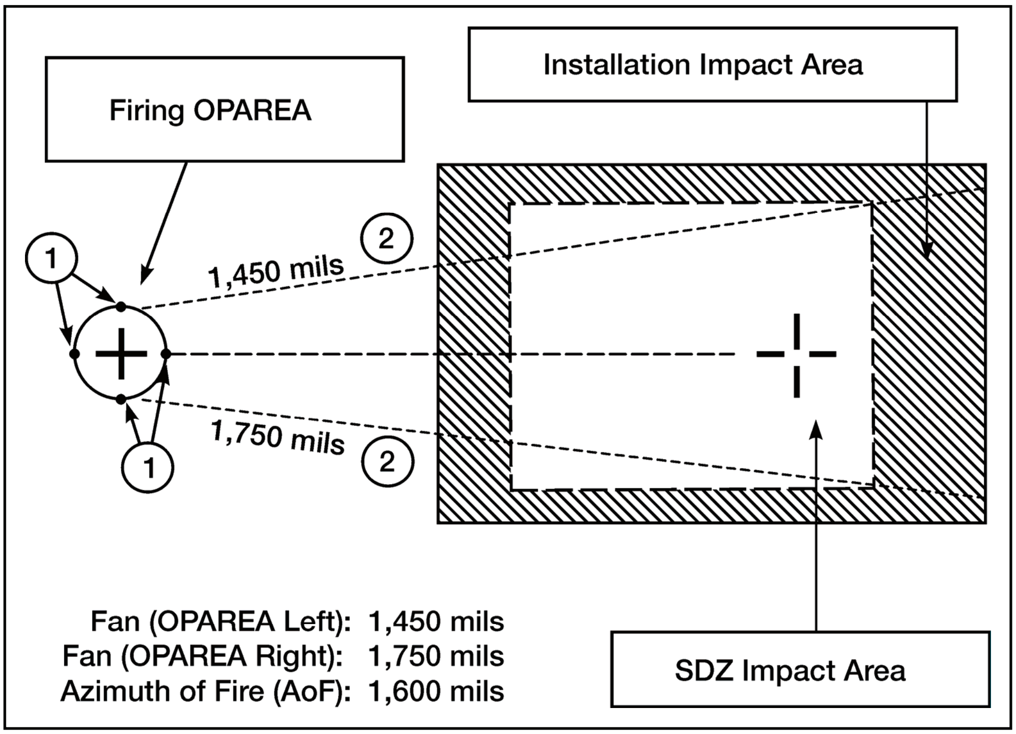


Figure 2-26. Example OPAREA azimuth limits

- **Step 3.** Apply the lower (or left-most) value of the left azimuth limits (derived from the left-most position) to the right-most position. Apply the higher (or right-most) value of the right azimuth limits (derived from the right-most position) to the left-most position. Ensure that these azimuths are marked separately and distinctly from the previous fans. They will be used to complete a "target selection box" and will be referred to as "crossover azimuths." Selecting targets within this box reduces the chance of a normally functioning rocket traveling outside the impact area to an acceptable level of less than 1:1,000,000 (figure 2-27).

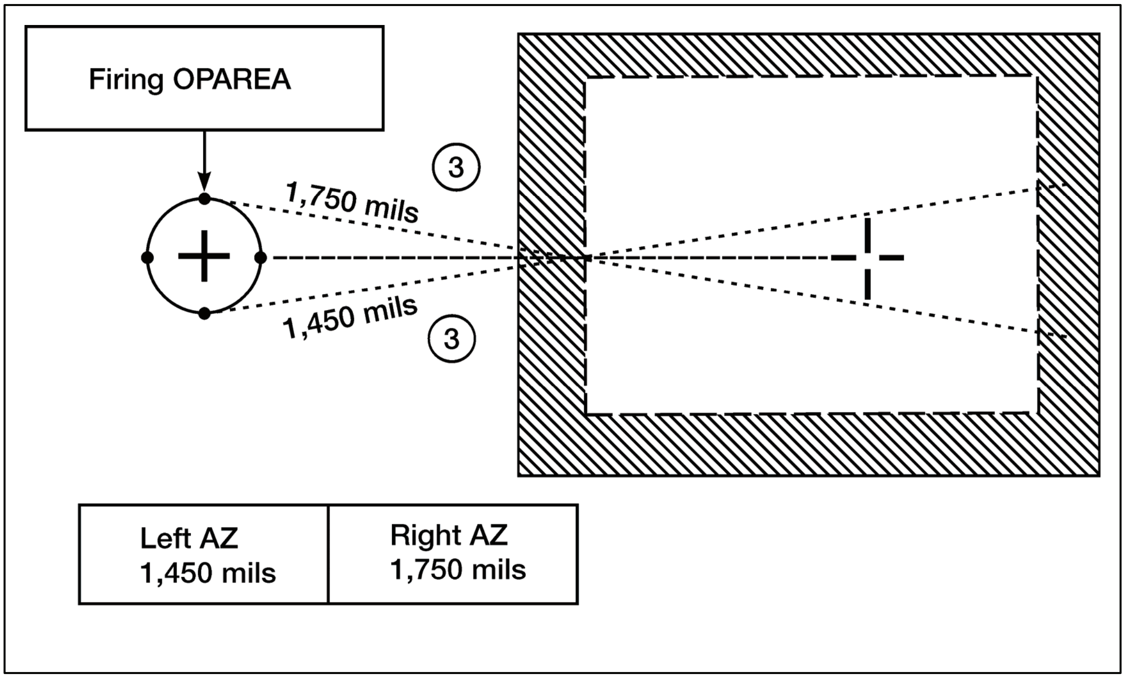


Figure 2-27. Example development of target selection box azimuth limits

2-108. Derive the minimum and maximum range limits.

Note. Range control may or may not provide a range safety card with the minimum and maximum ranges identified. If minimum and maximum range is supplied, you must use these values.

- **Step 4**. Measure the minimum range from the most rearward position in the OPAREA to a point just beyond the intersection of the left and right crossover azimuths. Ensure this point is inside the SDZ impact area. From this point, or if this point is short of the SDZ impact area, move along the azimuth limits until you can draw an arc between the original (not the crossover azimuths) left and right azimuth limits and remain wholly within the SDZ impact area (see figure 2-28). In drawing the minimum range arc, you must consider munitions capabilities and any minimum range restrictions issued by range control.

Note. To use OPAREA safety, the crossover point of the left and right azimuth limits must occur just inside or short of the SDZ impact area. If the crossover point is too far into the SDZ impact area (or beyond it), the target selection box cannot be constructed inside the SDZ impact area and OPAREA safety cannot be used.

- **Step 5.** Measure the maximum range from the most forward position in the OPAREA to the most distant point inside the SDZ impact area that will scribe an arc between the left and right azimuth limits and remains wholly within the SDZ impact area (see figure 2-28).

Note. For the example in Figure 2-28, the crossover point was inside the SDZ impact area and the range to the crossover point was 7,100 meters. The minimum and maximum range arcs for the example were based on the M28A1 minimum and maximum ranges of 8,000 and 15,000 meters. These arcs fall inside the original SDZ impact area azimuth limits. (Remember, radius of example OPAREA is 1,000 meters.) Measure the minimum range from the most rearward position—10,000 meters. Measure the maximum range from the most forward position—13,000 meters.

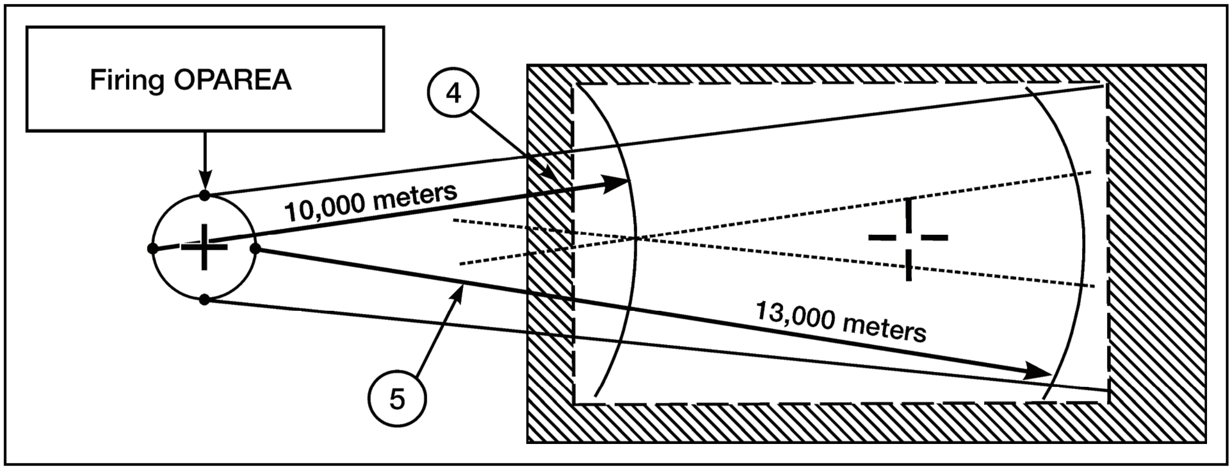


Figure 2-28. Example development of target selection box range limits

- **Step 6.** Apply the minimum range from step 4 to the most forward position in the OPAREA by drawing an arc between the left and right azimuth limits at the minimum range (see figure 2-29).
- **Step 7.** Apply the maximum range from step 5 to the most rearward position in the OPAREA by drawing an arc between the left and right azimuth limits at the maximum range (see figure 2-29). This arc completes the drawing of the target selection box. (Range control may impose additional range limits.)

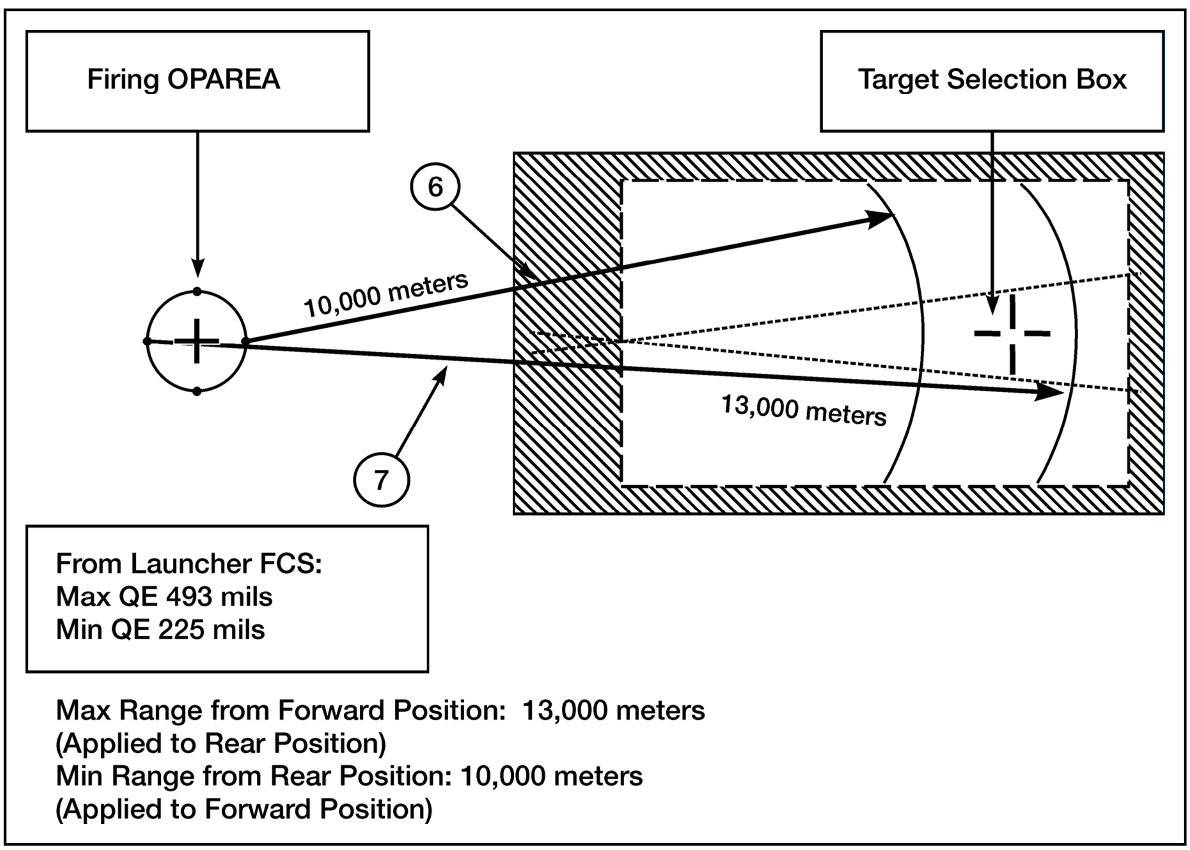


Figure 2-29. Example development of minimum and maximum quadrant

Note. When using SDC, you are not required to use the check launchers. All other safety procedures and requirements outlined in this chapter and local range regulations still apply.

- **Step 8.** Compute the Safety T using two check launchers at a minimum. Both check launchers must use the current MET to conduct four dry-fire missions, for a total of eight FMs¯from front, rear, left, and right OPAREA extremes as listed below (see figure 2-30, page 2-61). The FDC will compare the command data between the two check launchers to ensure they agree within ±5 mils in azimuth and QE. (Range control may impose stricter tolerances.) The FDC will use the most restrictive command data. Regardless of method used, the FDC must incorporate the applicable range regulation tolerances for your specific installation.

2-109. SDC-generated Safety T data will be verified by one of two methods.

- In the first method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual. This process is performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data are compared. The data on these Safety Ts must be exactly the same.
- In the second method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual and by a check launcher performing the required check missions with command data within ±5 mils in AZ and QE and 0.5 seconds fuze time.

2-110. The FDC must ensure that the maximum altitude/elevation data from the target area is used at minimum range and that the minimum altitude/elevation from the target impact area is used at maximum range when computing safety data (mini-max rule). However, the actual launcher/firing point altitude/elevation and actual target location elevation/altitude MUST be used during the live-fire regardless of method used to properly account for vertical interval.

Note. When using the SDC program, ensure that safety data is input by a safety-certified individual and verified by a second safety-certified individual. This process will be performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data compared. The data on these Safety Ts must be exactly the same.

- **Fire mission 1**. Forward-most OPAREA position to the lower left corner of the target selection box. Apply the maximum altitude from the target area at minimum range (mini-max rule). This yields the minimum QE.
- **Fire mission 2**. Rearward-most OPAREA position to the upper left corner of the target selection box. Apply the minimum altitude from the target area at maximum range (mini-max rule). This yields the maximum QE.
- **Fire mission 3**. Left-most OPAREA position to the lower right corner of the target selection box. Apply the minimum altitude from the target area at maximum range (mini-max rule). This yields the right azimuth limit.
- **Fire mission 4**. Right-most OPAREA position to the lower left corner of the target selection box. This yields the left azimuth limit.

Note. Check launchers can be used as firing launchers after completing the Safety T and purging all databases.

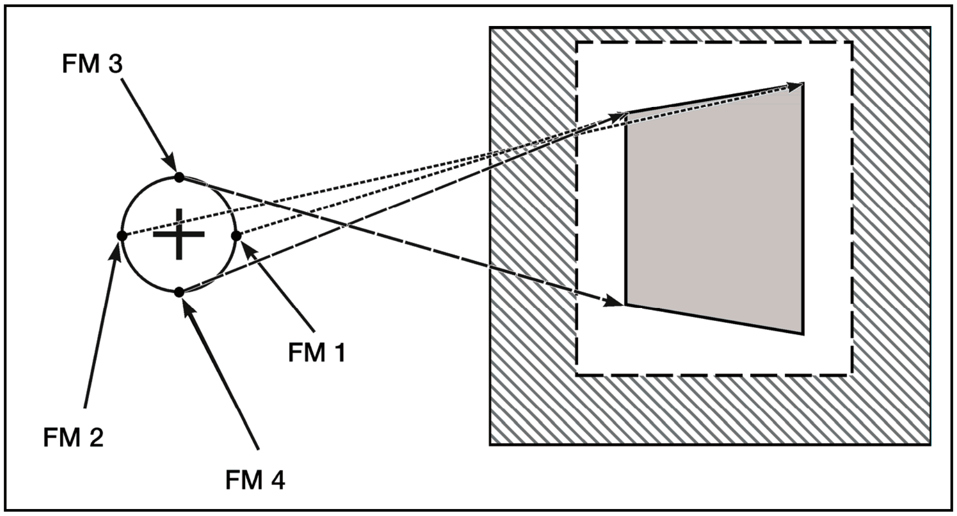


Figure 2-30. Safety T computations (fire missions)

Note. The target selection box size has been increased for viewing purposes. For a more accurate relative size of the target selection box, see figures 2-29 or 2-33.

2-111. This completes the Safety T that establishes firing limits for the launcher within the OPAREA (see figure 2-31).

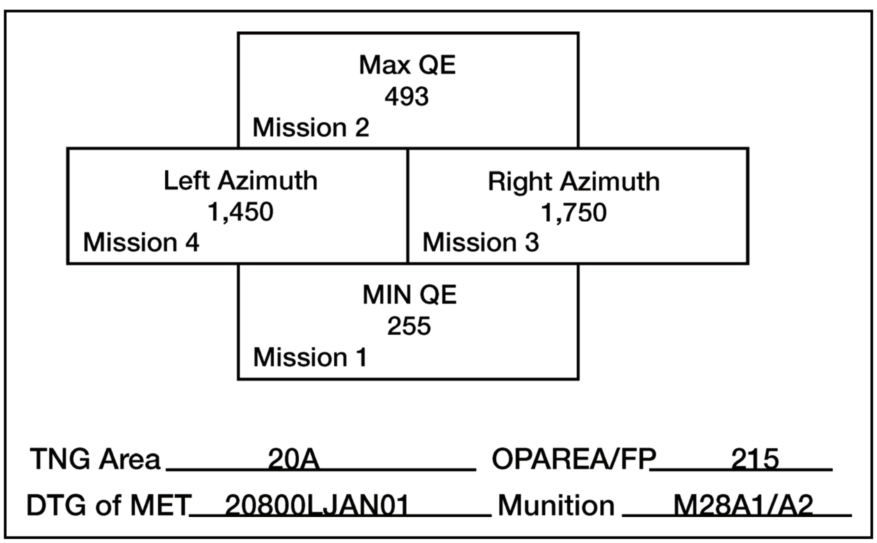


Figure 2-31. Example Safety T

Phase III OPAREA Method 1

2-112. Apply the SDZ requirements (for specific munitions) to the launcher OPAREA and complete the flight corridor.

2-113. This phase applies the launcher danger area (area F) and noise hazard area requirements to the OPAREA. This is done by applying those requirements around the rear half of the circumference of the OPAREA (see figure 2-32). Although these actual danger areas are a function of the specific launcher location, controlling entry to the areas derived in this phase will allow more freedom of movement for the launcher and will add realism to the live-fire training exercise.

- **Step 1.** Area F (launcher danger area) is the area immediately to the rear of the launcher, which is directly exposed to blast and debris. Divide the OPAREA in half by drawing a line through its center, perpendicular to the AZ to the target constructed in Phase I. Extend outward along this line to a point 400 meters on each side around the rear half of the OPAREA (see figure 2-32).
- **Step 2.** The NHA extends an additional 300 meters for the M28A1/A2 behind Area F. Only mission-essential personnel wearing double hearing protection can occupy it. There are two means of constructing the NHA. The first is the most simple, while the second method minimizes the size of the NHA, thus allowing less use of the training area.

2-114. Construct NHA using method A.

- **Step 2a.** The following instructions apply to our example of a 1,000-meter radius OPAREA. Draw a box that extends 400 meters plus the radius of your firing OPAREA to the left and right (the 1,000-meter radius plus 400 meters) as well as 1,700 meters (the 1,000-meter radius plus 400 meters plus 300 meters) to the rear of the center of the firing OPAREA. The result for our example is a box 2,800 meters wide and 1,700 meters deep. Standard instructions for constructing the NHA using method A is simply to add 300 meters to the rear depth of area F. Put simply, go left and right 400 meters from the edge of your specific firing OPAREA, add a total of 700 meters to the rear edge of your firing OPAREA, and create a rectangle as shown on the left side of figure 2-34 (page 2-66). Go to phase IV OPAREA method 1..

2-115. Construct NHA using method B.

- **Step 2b.** From the center of the OPAREA, draw an arc (400 meters plus the radius of the OPAREA) to the rear of the center of the OPAREA along the AOF to intersect the line developed in step 1. (See figure 2-32, method B, to establish area F.)
- **Step 2c.** Draw two lines parallel to the AOF on the left and right sides that extend back from the perpendicular line drawn in step 1. (See figure 2-32, method B.)
- **Step 2d.** From the center of the OPAREA, draw a line along the AOF to the rear that is equal to the radius of OPAREA + 400 meters + 300 meters.
- **Step 2e.** From the end of this line, draw an arc that intersects the two lines in step 2c to enclose the NHA.

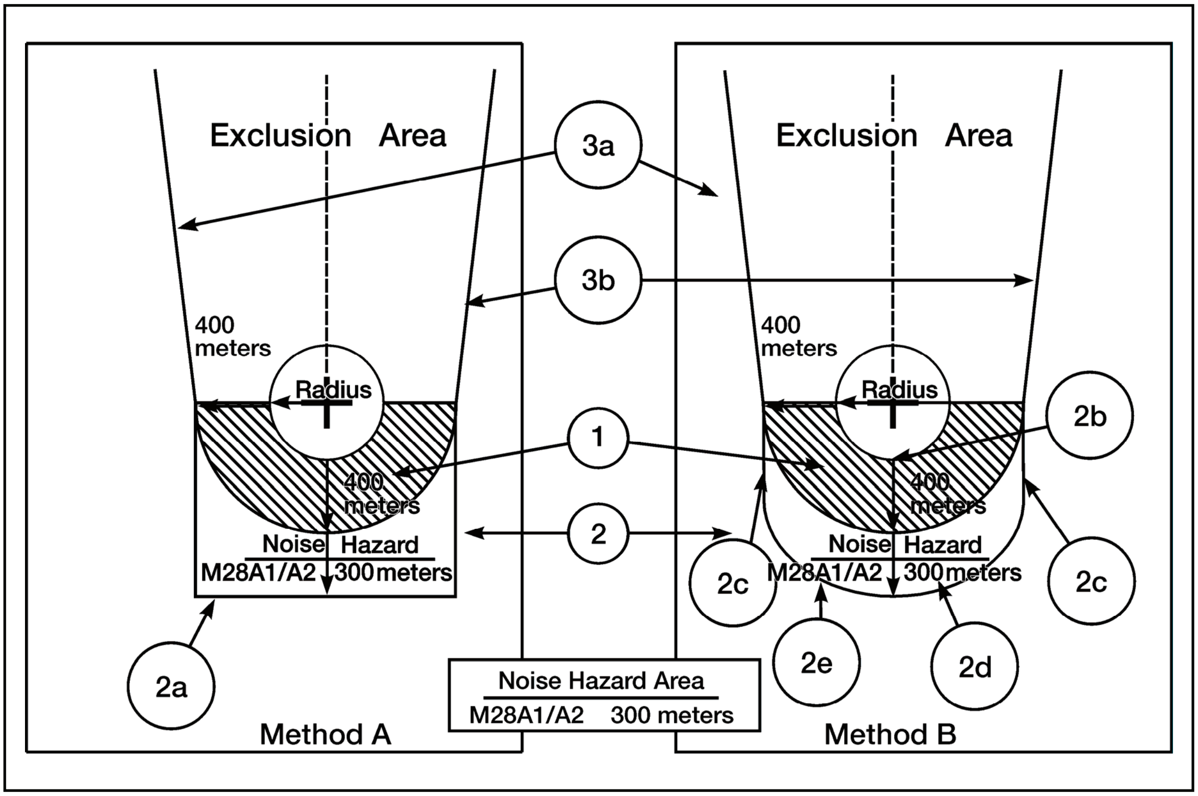


Figure 2-32. Firing OPAREA SDZ requirements

Phase IV OPAREA Method 1

2-116. Complete the flight corridor.

- **Step 1.** Construct line segments from points (3a and 3b) forward to the near edge of the installation impact area. The line segments should be parallel to the left and right azimuth limits, respectively. Since these line segments begin at points 400 meters to the left and right of the OPAREA, danger area A (320 meters) has been accounted for. This describes the general flight corridor (see figure 2-32).
- **Step 2.** The exclusion area is that area of the SDZ flight corridor within a specified distance of the far edge of the firing area. It is endangered by failure of the rocket motor during the boost phase. The distance is based on acceptance of risk (approved by the installation commander per TRADOC safety letters).

2-117. Construct exclusion area I.

- **Step 2a.** Construct an arc, from the forward edge of the OPAREA, with a radius that extends beyond the OPAREA by the distance in table 2-19 (based on the level of accepted risk for exclusion area I). The area between the arc and the front of the OPAREA is exclusion area I. The example in figure 2-33 shows both a 1:10,000 short round probability (2,500 meters) and a 1:1,000 short round probability (1,000 meters).

2-118. Construct exclusion area II.

- **Step 2b.** The area between the arc of exclusion area I and the front of the impact area is exclusion area II for the M28A1/A2 training rocket (reduced range). Exclusion area II can only be occupied under waiver per TRADOC safety letters. Exclusion area I cannot be occupied (see figure 2-33).

- **Step 2c.** The AZ and range limits determined in steps 3, 6, and 7 of phase II also describe a small area around the target. This is the target selection box. All targets selected from this box will fall within the Safety T for the live-fire OPAREA (see figure 2-33).

Table 2-19. Exclusion areas

Short Round Probability M28A1 and M28A2	*Exclusion Area I*	*Exclusion Area II*
1 per 1,000 firings	1,000 meters	See note
1 per 10,000 firings	2,500 meters	See note

Note. This distance will vary based on range to target and the size of the impact area. It is the area between exclusion area I and the SDZ impact area.

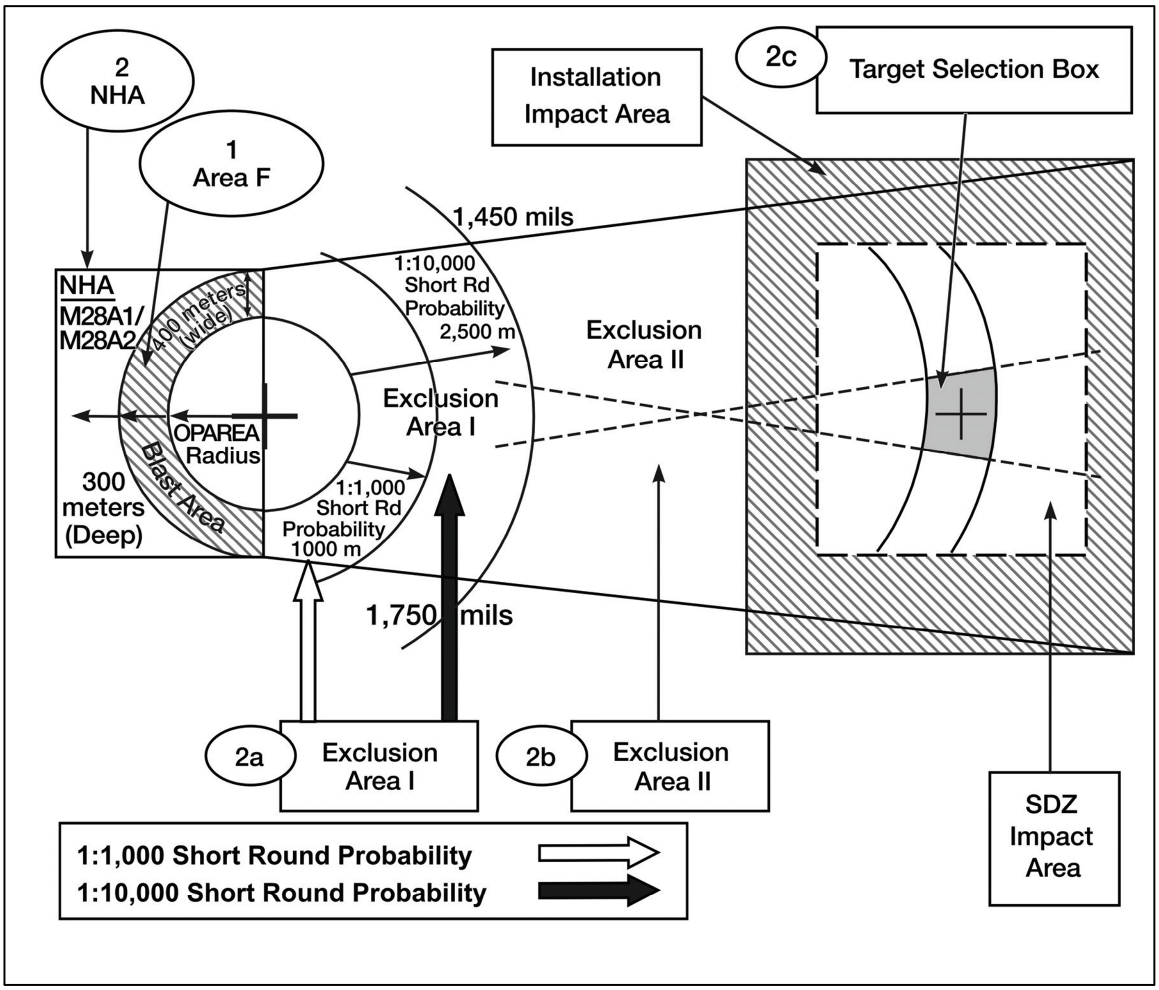


Figure 2-33. Example exclusion areas M28A1/A2

OPAREA METHOD 2 OF COMPUTING SAFETY

2-119. This method requires a larger impact area but allows the unit to derive a single Safety T for an entire launcher OPAREA firing into a target area.

Phase I OPAREA Method 2

2-120. Apply the SDZ requirements to the installation impact area.

Note. Both techniques will yield the same azimuth limits and minimum and maximum quadrants if the minimum and maximum altitudes/elevations at the minimum and maximum ranges of the target area are used. The two methods differ in the order of the execution steps.

Note. If you have been issued a range safety card from your range control office that takes into account the MLRS SDZ requirements referenced in the TRADOC safety letters, proceed to Step 1 of Phase II. Normally, the OIC receives this with the range card from range control.

- **Step 1.** Plot and draw the installation impact area on a map or overlay. If the existing installation impact area to be used for MLRS firing is not a square or rectangle, the unit must draw a square or rectangle inside the existing impact area. One side of the square or rectangle must be perpendicular to the azimuth of fire from the firing point to the center of the impact area. The procedures in step 4 are only valid when applied to a square or rectangular impact area. Index the approximate geographic center of the installation impact area (target) (see figure 2-34).
- **Step 1a.** Index the geographic center of the installation impact area (target) (see figure 2-34).
- **Step 2.** Index the center of the proposed firing OPAREA. Draw a circle around the index. The size of the circle will be allocated by range control. This radius may be larger or smaller, depending upon the training area and/or impact area available to the unit. All of the OPAREA firing points must be located in this OPAREA circle (see figure 2-34).

Note. If range control gives you an irregular firing OPAREA, you must construct a circular firing OPAREA that remains completely inside the area that you received. To compute OPAREA safety, a circle with a radius must be used.

Note. As an example, we will use a large firing OPAREA with a radius of 1,000 meters for graphical simplicity.

- **Step 3.** Draw a line connecting the two indices from steps 1a and 2 (see figure 2-34).
- **Step 4.** Using the appropriate munition-specific table (table 2-18, page 2-54), derive and apply the appropriate values of Wmax, Xmax, and Ymax to the edges of the installation impact area (toward target). For OPAREAs, the entry value for Wmax is the range from the rear edge of the OPAREA to the target. The entry value for Xmax is the range from the forward edge of the OPAREA to the target. The entry value for Ymax is the range from the forward edge of the OPAREA to the target. Based on these entry ranges, extract the appropriate values from Table 2-18 (page 2-54) and apply them from the edges of the installation impact area toward the target. This is the SDZ impact area (see figure 2-34).

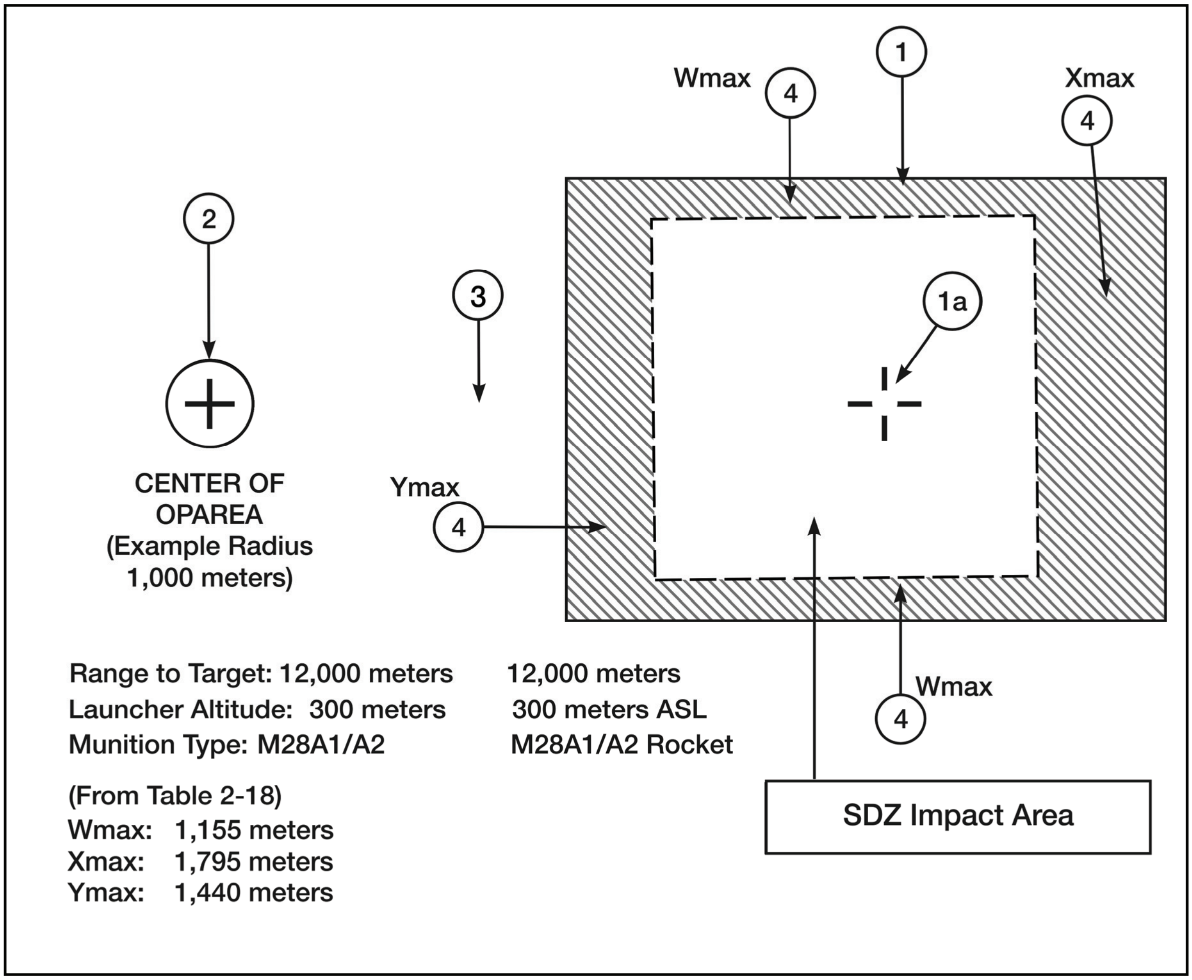


Figure 2-34. Example impact area

Phase II OPAREA Method 2

2-121. Determine the initial left and right azimuth limits of the OPAREA.

- **Step 1.** Mark the most forward, rearward, right, and left positions along the circumference of the OPAREA circle from phase I OPAREA method 2 (see figure 2-35).

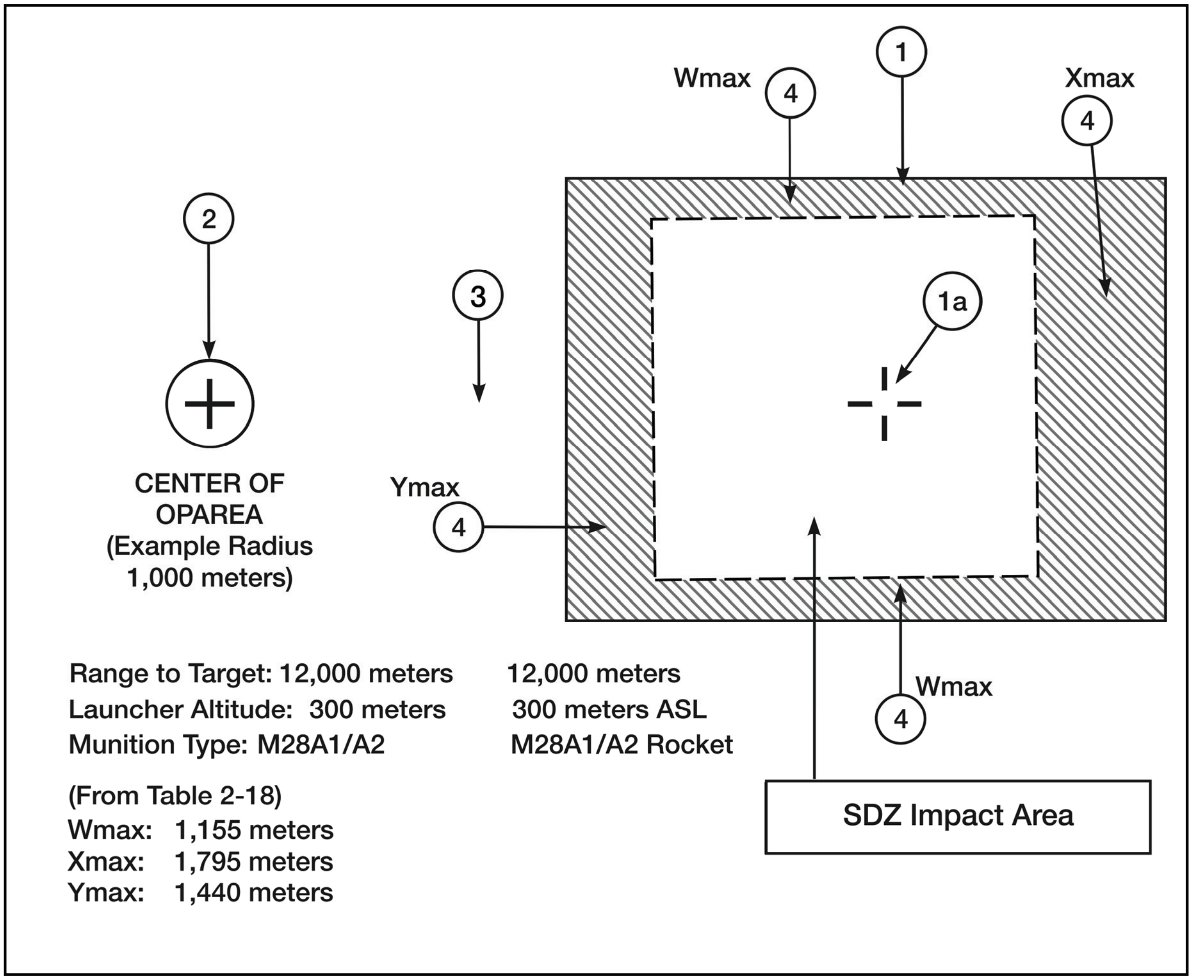


Figure 2-35. Example OPAREA azimuth limits

- **Step 2.** Draw a safety fan from both the left and right positions (from Step 1), which will keep all rounds within the SDZ impact area. You must also apply any azimuth restrictions imposed by range control for the OPAREA (use the more restrictive of the two sets of azimuth limits). Measure the left and right limits of each fan (see figure 2-35). These are the left and right azimuth limits for the entire live-fire OPAREA.
- **Step 3.** Measure the maximum range from the most forward position in the OPAREA to the most distant point inside the SDZ impact area that will scribe an arc between the left and right azimuth limits that remains completely within the SDZ impact area (see figure 2-36).

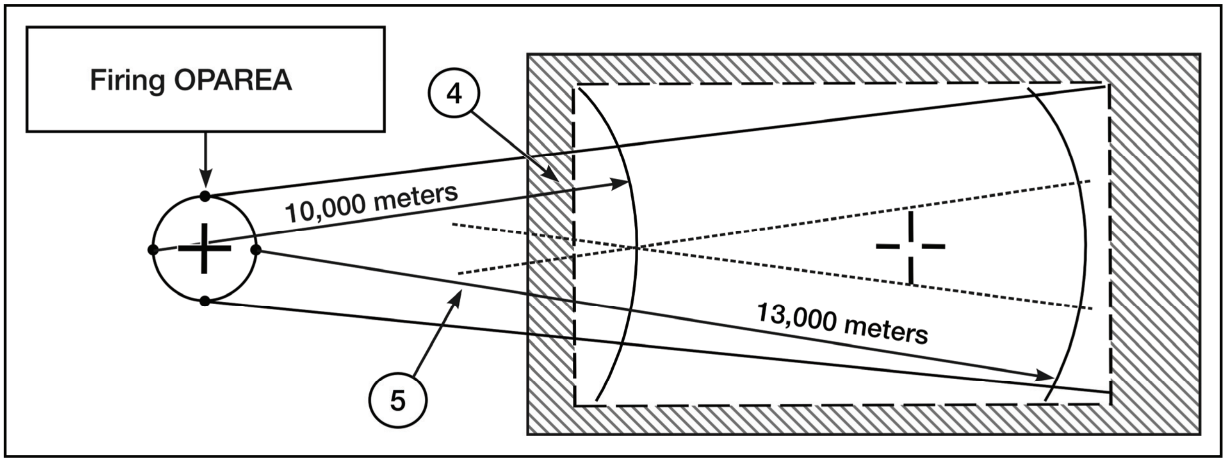


Figure 2-36. Example of development of target selection box range limits

---

Note. For the example shown in figure 2-36, the crossover point was inside the SDZ impact area and the range to the crossover point was 7,100 meters. The minimum and maximum range arcs for the example were based on the M28A1 minimum and maximum ranges of 8,000 and 15,000 meters, respectively. These arcs fall inside the original SDZ impact area azimuth limits. (Remember, the radius of the example OPAREA is 1,000 meters.) Measure the minimum range from the most rearward position—10,000 meters. Measure the maximum range from the most forward position—13,000 meters.

Note. When using SDC, you are not required to use the check launchers. All other safety procedures and requirements outlined in this chapter and local range regulation still apply.

- **Step 4.** Draw an arc between the original left and right azimuth limits and remain completely within the SDZ impact area. Measure the minimum range from the most rearward position in the OPAREA to the lower left-hand corner of this arc. Ensure that this point is inside the SDZ impact area (figure 2-36). In drawing the minimum range arc, you must consider munition capabilities and any minimum range restrictions issued by range control.
- **Step 5.** Compute the Safety T using two check launchers at a minimum. Both check launchers must use the current MET to conduct four dry-fire missions, for a total of eight FMs—from front, rear, left, and right OPAREA extremes as listed below (see figure 2-37, page 2-69). The FDC will compare the command data between the two check launchers to ensure that they agree within ±5 mils in AZ and QE. (Range control may impose stricter tolerances.) The FDC will use the most restrictive command data. Regardless of the method used, the FDC must incorporate the applicable range regulation tolerances for your specific installation.

2-122. SDC-generated Safety T data is verified by one of two methods.

- In the first method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual. This process is performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data are compared. The data on these Safety Ts must be exactly the same.
- In the second method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual and by a check launcher performing the required check missions with command data within ±5 mils in AZ and QE and 0.5 seconds fuze time.

2-123. The FDC must ensure that the maximum altitude/elevation data from the target area is used at minimum range and that the minimum altitude/elevation from the target impact area is used at maximum range when computing safety data (mini-max rule). However, the actual launcher/firing point altitude/elevation and actual target location elevation/altitude MUST be used during the live-fire regardless of the method used to properly account for vertical interval.

Note. When using the SDC program, ensure that safety data is input by a safety-certified individual and verified by a second safety-certified individual.

- **Fire mission 1**. Forward-most OPAREA position to the lower left corner of the target area. Apply the maximum altitude of the target area at minimum range (mini-max rule). This yields the minimum QE.
- **Fire mission 2**. Rearward-most OPAREA position to the upper left corner of the target area. Apply the minimum altitude of the target area at maximum range (mini-max rule). This yields the maximum QE.
- **Fire mission 3**. Left-most OPAREA position to the lower right corner of the target area (mini-max rule). This yields the right azimuth limit.
- **Fire mission 4**. Right-most OPAREA position to the lower left corner of the target area. This yields the left azimuth limit.

Note. The check launchers can be used as the firing launchers after completing the Safety T and purging of all databases.

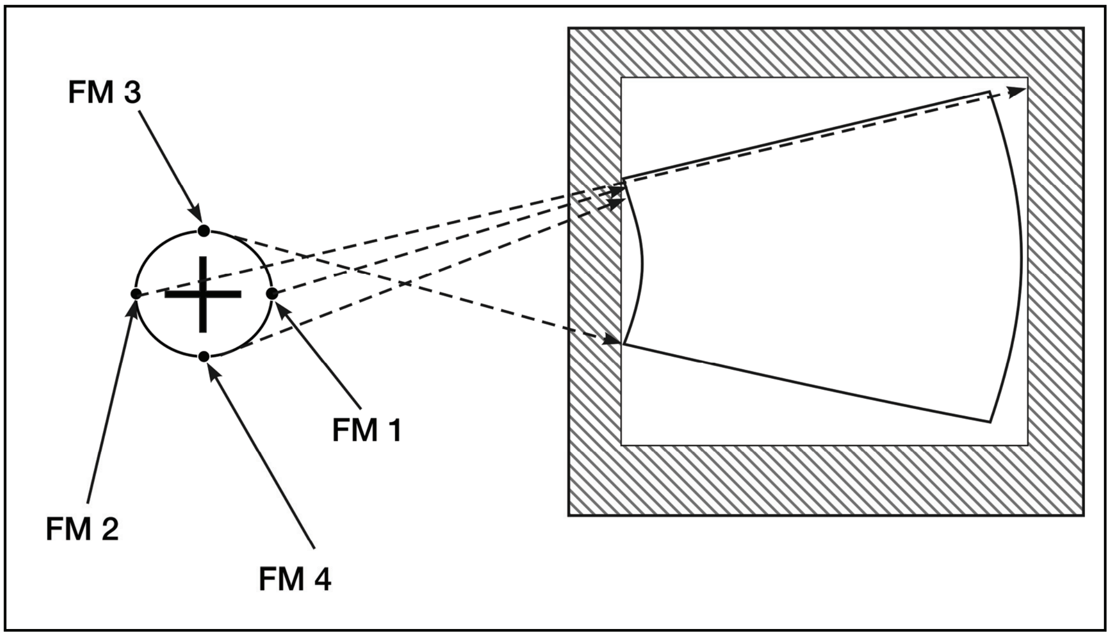


Figure 2-37. Safety T computations (fire missions)

2-124. This completes the Safety T that establishes firing limits for the launcher within the OPAREA (see figure 2-38).

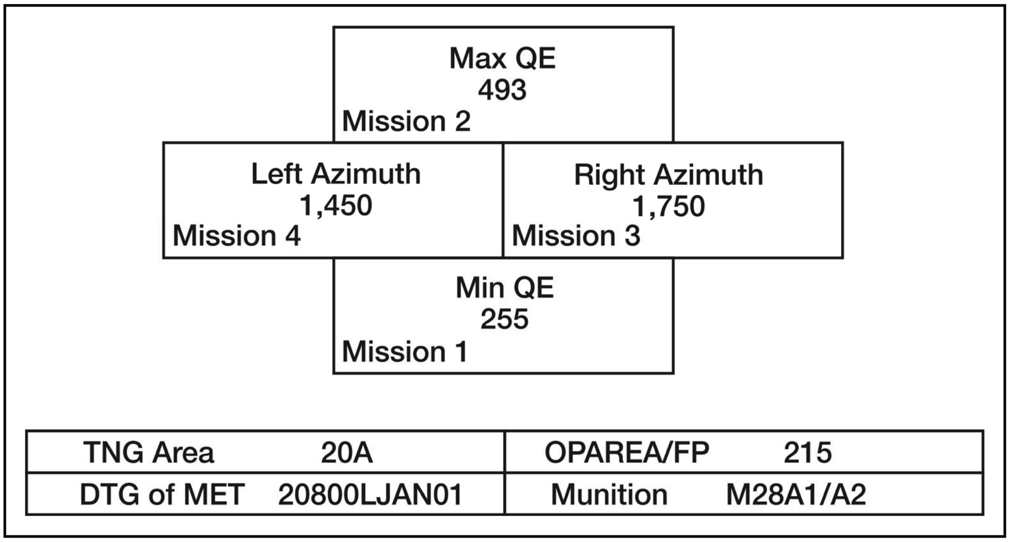


Figure 2-38. Example Safety T

Phase III OPAREA Method 2

2-125. Apply the SDZ requirements (for the specific munition) to the launcher OPAREA and complete the flight corridor. This phase applies the launcher danger area (area F) and noise hazard area requirements to the OPAREA. This is done by applying those requirements around the rear half of the circumference of the OPAREA (see figure 2-39). Although these actual danger areas are a function of the specific launcher location, controlling entry to the areas derived in this phase will allow more freedom of movement for the launcher and will add realism to the live-fire training exercise.

- **Step 1.** Area F (launcher danger area) is the area immediately to the rear of the launcher, which is directly exposed to blast and debris. Divide the OPAREA in half by drawing a line through its center, perpendicular to the AZ to the target constructed in Phase I. Extend outward along this line to a point 400 meters on each side around the rear half of the OPAREA (see figure 2-39).
- **Step 2.** The NHA extends an additional 300 meters for the M28A1/A2 behind Area F. Only mission-essential personnel wearing double hearing protection can occupy it. There are two means of constructing the NHA. The first is the most simple, while the second method minimizes the size of the NHA, thus allowing less use of training area.

2-126. Construct NHAusing method A.

- **Step 2a.** The following instructions apply to our example of a 1,000-meter radius OPAREA. Draw a box that extends 400 meters plus the radius of your firing OPAREA to the left and right (the 1,000-meter radius plus 400 meters) as well as 1,700 meters (the 1,000-meter radius plus 400 meters plus 300 meters) to the rear of the center of the firing OPAREA. The result for our example is a box 2,800 meters wide and 1,700 meters deep. Standard instructions for constructing the NHA using method A is simply to add 300 meters to the rear depth of area F. Put simply, go left and right 400 meters from the edge of your specific firing OPAREA, add a total of 700 meters to the rear edge of your firing OPAREA, and create a rectangle as shown on the left side of figure 2-39. Go to phase IV OPAREA method 2.

2-127. Construct NHAusing method B.

- **Step 2b.** From the center of the OPAREA, draw an arc (400 meters plus the radius of the OPAREA) to the rear of the center of the OPAREA along the AOF to intersect the line developed in step 1. (See figure 2-39, method B, to establish area F.)
- **Step 2c**. Draw two lines parallel to the AOF on the left and right sides that extend back from the perpendicular line drawn in step 1. (See figure 2-39, method B.)

- **Step 2d.** From the center of the OPAREA, draw a line along the AOF to the rear that is equal to the radius of OPAREA + 400 meters + 300 meters.
- **Step 2e.** From the end of this line, draw an arc that intersects the two lines in Step 2c to enclose the noise hazard area.

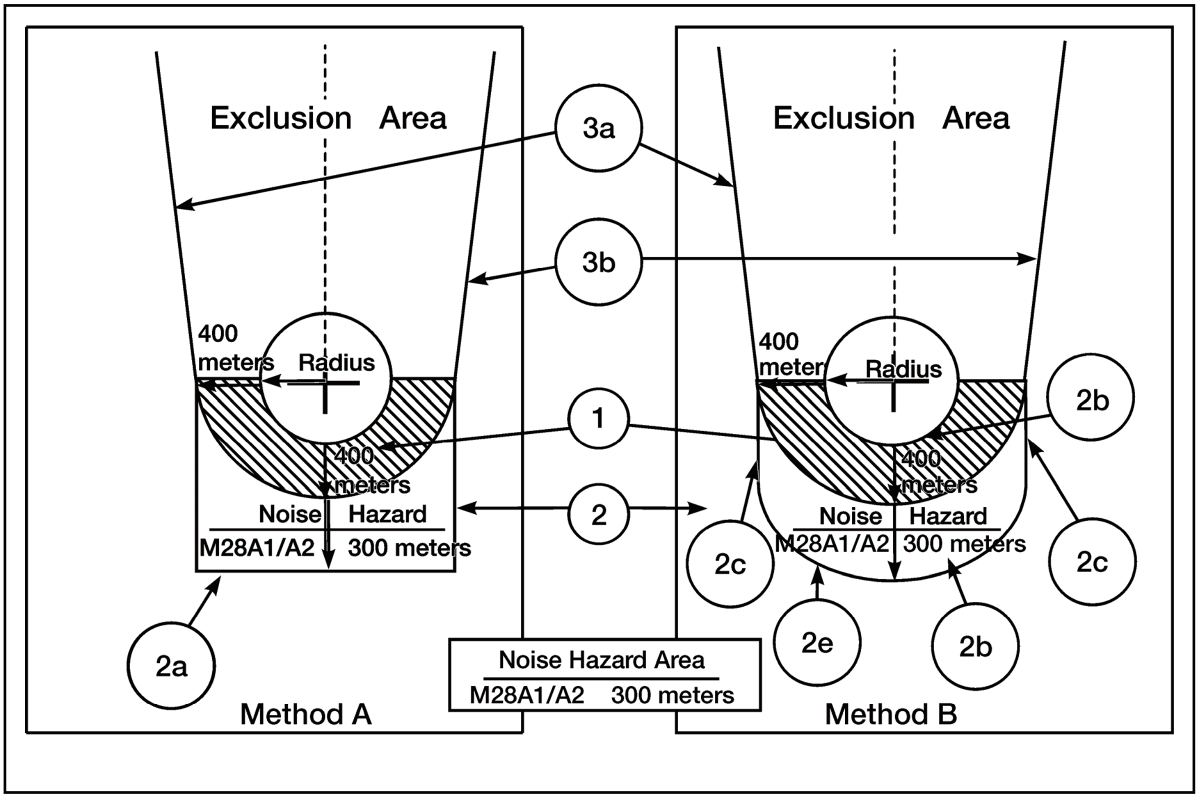


Figure 2-39. Firing OPAREA SDZ requirements

Phase IV OPAREA Method 2

2-128. Complete the flight corridor.

- **Step 1.** Construct line segments from points (3a and 3b) forward to the near edge of the installation impact area. The line segments should be parallel to the left and right azimuth limits, respectively. Since these line segments begin at points 400 meters to the left and right of the OPAREA, danger area A (320 meters) has been accounted for. This describes the general flight corridor (see figure 2-39).
- **Step 2.** The exclusion area is that area of the SDZ flight corridor within a specified distance of the far edge of the firing area. It is endangered by failure of the rocket motor during the boost phase. The distance is based on acceptance of risk (approved by the installation commander per TRADOC safety letters).

2-129. Construct exclusion area I.

- **Step 2a.** Construct an arc, from the forward edge of the OPAREA, with a radius that extends beyond the OPAREA by the distance in table 2-17, page 2-47 (based on the level of accepted risk for exclusion area I). The area between the arc and the front of the OPAREA is exclusion area I. The example in figure 2-39 shows both a 1:10,000 short round probability (2,500 meters) and a 1:1,000 short round probability (1,000 meters).

2-130. Construct exclusion area II.

- **Step 2b.** The area between the arc of exclusion area I and the front of the impact area is exclusion area II for the M28A1/A2 training rocket (reduced range). Exclusion area II can only be occupied under waiver per TRADOC safety letters. Exclusion area I cannot be occupied (see figure 2-40).
- **Step 2c.** The AZ and range limits determined in steps 2, 3, and 4 of phase II also describe a small area around the target. This is the target selection box. All targets selected from within this box will fall within the Safety T for the live-fire OPAREA (see figure 2-40).

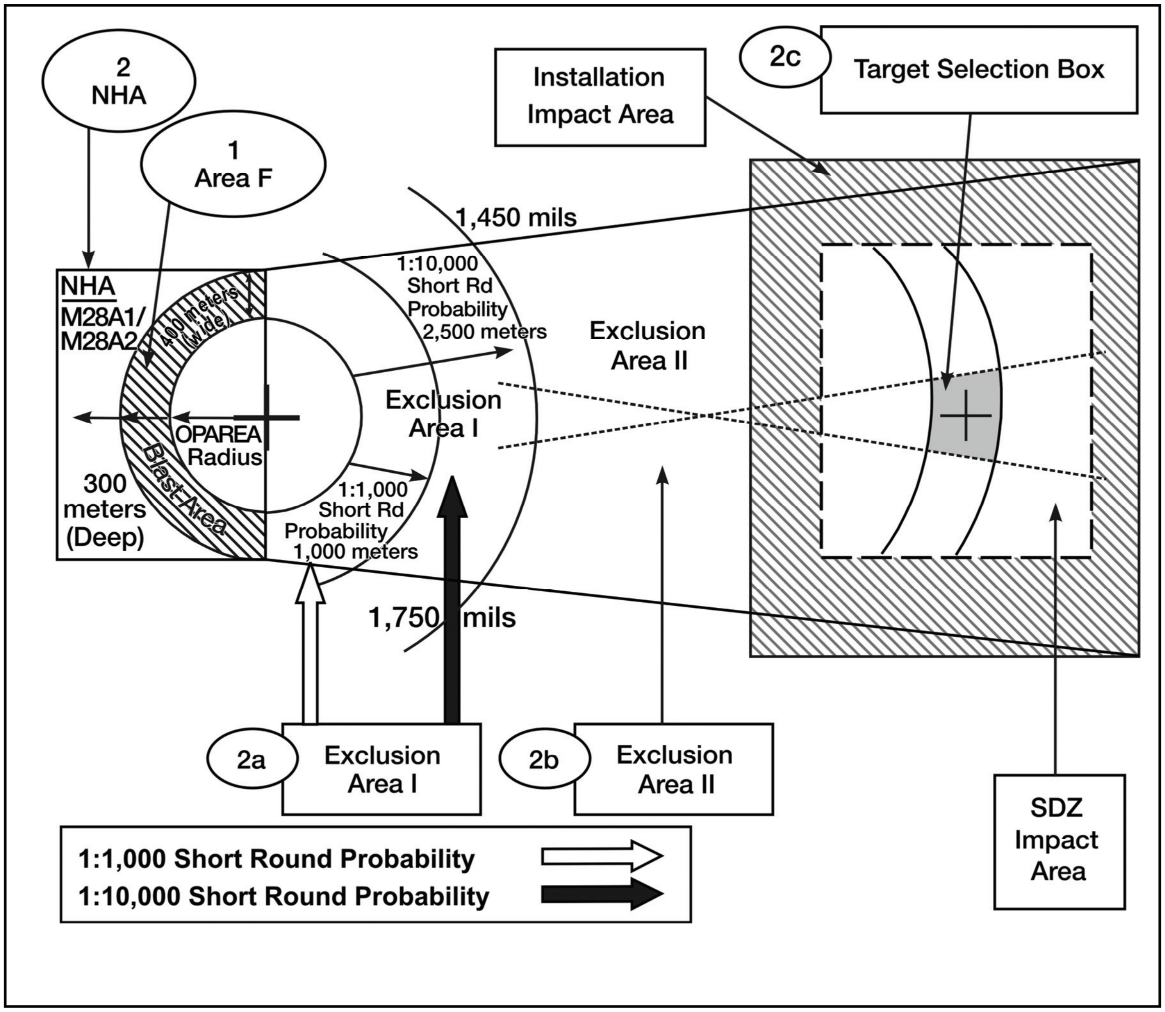


Figure 2-40. Example of exclusion areas for M28A1/A2

- **Step 3.** Apply the lower (or left-most) value of the left azimuth limits (derived from the left-most position) to the right-most position. Apply the higher (or right-most) value of the right azimuth limits (derived from the right-most position) to the left-most position. Ensure that these azimuths are marked separately and distinctly from the previous fans. They will be used to complete a target selection box and will be referred to as “crossover azimuths.” Selecting targets within this box reduces the chance of a normally functioning rocket traveling outside the impact area to an acceptable level of less than 1:1,000,000 (see figure 2-41).

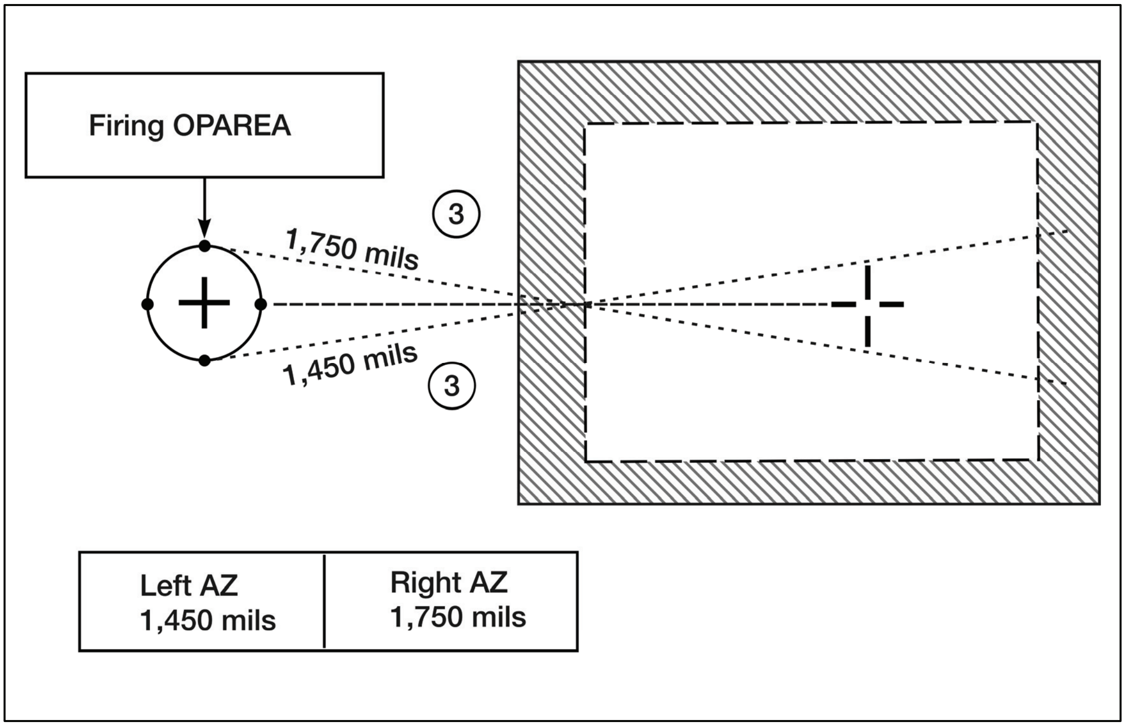


Figure 2-41. Example of the development of target selection box azimuth limits

- **Step 4.** Apply the minimum range from step 3 of phase II to the most forward position in the OPAREA by drawing an arc between the left and right azimuth limits at the minimum range (see Figure 2-42).
- **Step 5.** Apply the maximum range from step 3 of phase II to the most rearward position in the OPAREA by drawing an arc between the left and right azimuth limits at the maximum range (see figure 2-42). This arc completes the drawing of the target selection box. (Range control may impose additional range limits.)

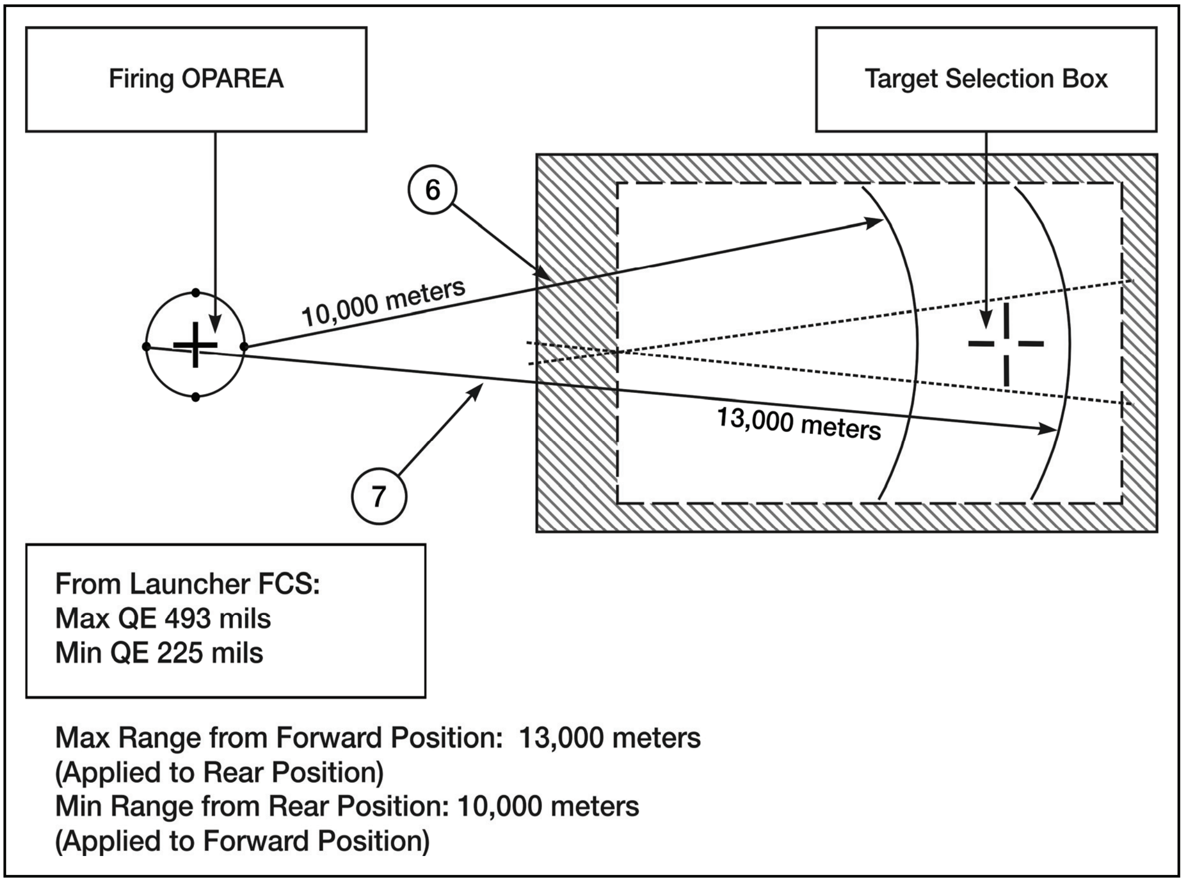


Figure 2-42. Example of the development of target selection box range limits

POINT-TO-POINT METHOD OF COMPUTING SAFETY

2-131. Point-to-point method allows the unit to derive a Safety T from a specific firing point to a specific point target that lies within a target area.

Phase I Point-to-Point Method

2-132. Apply the SDZ requirements to the installation impact area (figure 2-43).

Note. If you have been issued a range safety card from your range control office that takes into account the MLRS SDZ requirements referenced in the TRADOC safety letters, proceed to step 1 of phase II. Normally, the OIC receives this with the range card from range control.

Note. The target box given by range control for computational procedures is a very small box in which the exact target grid is located (normally 200 meters square). Range control may also give azimuth and range limits from the firing point. If you are not required by range control to use the point-to-point method, use the firing point method to increase your target selection opportunities.

- **Step 1.** Plot and draw the installation impact area on a map or overlay. If the existing installation impact area to be used for MLRS firing is not a square or rectangle, the unit must draw a square or rectangle inside the existing impact area. One side of the square or rectangle must be perpendicular to the azimuth of fire from the firing point to the geographic center of the usable portion of the impact area. The procedures in step 4 are only valid when applied to a square or rectangular impact area.

- **Step 1a.** Index the geographic center of the usable portion of the installation impact area (target) (see figure 2-43).
- **Step 2.** Index the firing point (see figure 2-43).
- **Step 3.** Draw a line connecting the two indices from steps 1 and 2 (see figure 2-43, page 2-75).
- **Step 4.** Using the appropriate munition-specific table (table 2-18, pages 2-54), derive and apply the appropriate values of Wmax, Xmax, and Ymax to the edges of the usable portion of the installation impact area (toward target). The entry values for Wmax, Xmax, and Ymax are the ranges from the specified firing point on the range safety card to the specific point target listed on the range safety card. This is the SDZ impact area (see figure 2-43).

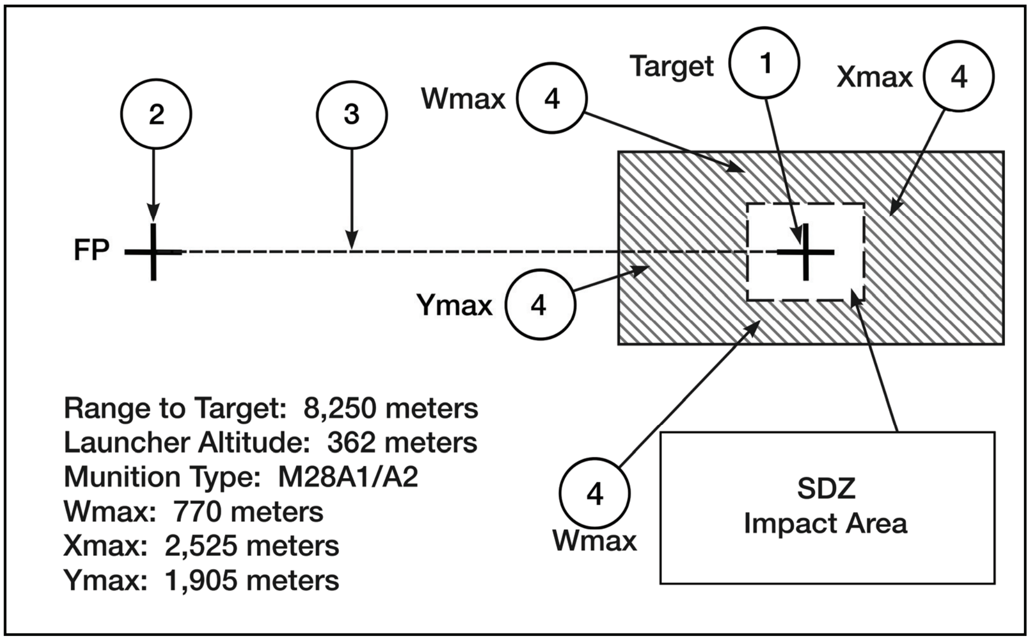


Figure 2-43. Example of an impact area

Phase II Point-to-Point Method

2-133. Determine the initial left and right azimuth limits.

- **Step 1.** Draw lines from the firing point to the right and left inner edges (far corners) of the SDZ impact area, which will keep all rounds within the SDZ impact area. The azimuths for these lines will be stated on the range safety card. This will be your initial left and right limit. These limits will be further refined in step 2 (see figure 2-44).

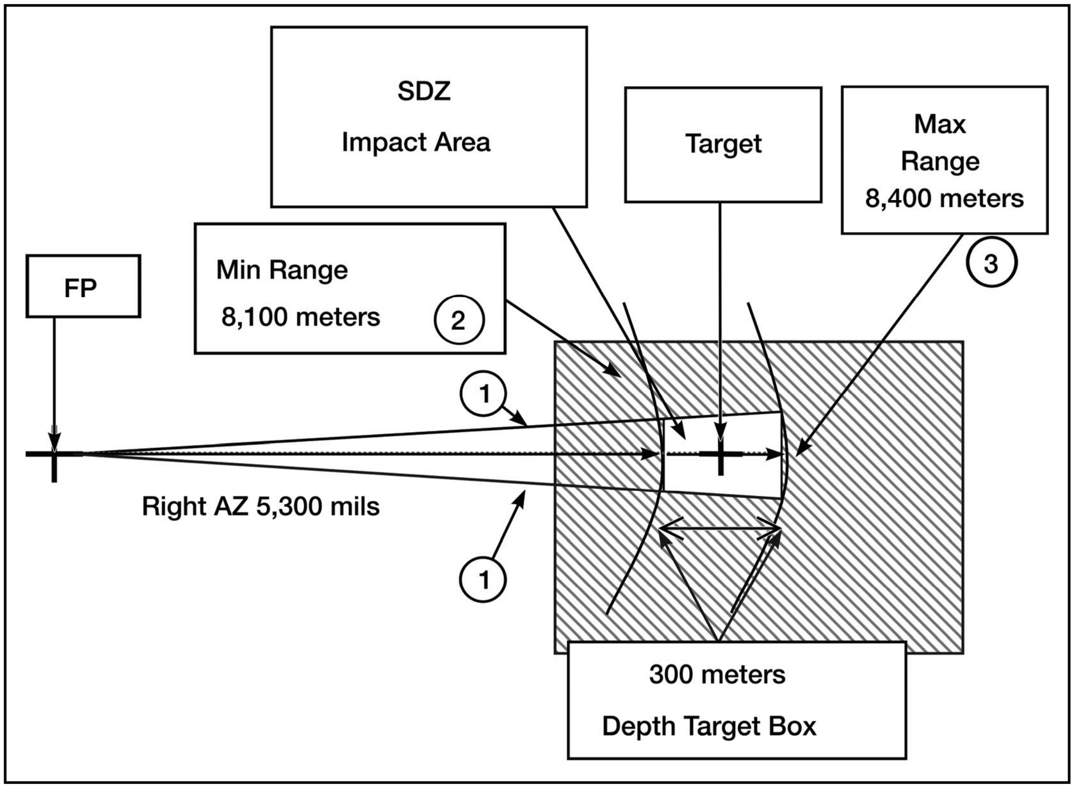


Figure 2-44. Example of azimuth limits calculations

2-134. Derive the Minimum and Maximum Values for QE.

- **Step 2.** Determine the minimum range at which a vertical line can be scribed between the left and right azimuth limits that lies completely within the SDZ impact area (see figure 2-44) developed in phase I or given by range control. This line shows the minimum range limit of the target box. You must also observe any additional range restrictions imposed by the range safety office (or munitions limitations).
- **Step 3.** Determine the maximum range at which a vertical line can be scribed between the left and right azimuth limits that lies completely within the SDZ impact area (see figure 2-44). This line shows the maximum range limit of the target box. You must also observe any additional range restrictions imposed by the range safety office (or munitions limitations).

Note. When using SDC, you are not required to use check launchers. All other safety procedures and requirements outlined in this chapter and local range regulations still apply.

2-135. Determine safe firing data and compute the Safety T.

- **Step 4.** Using the current MET message, compute the Safety T using two check launchers at a minimum. Check launchers will conduct two dry-fire missions each and determine firing data from the specified firing point to the lower left-hand corner and upper right-hand corner of the target box as presented along the gun target line (see figure 2-45). The FDC will compare the command data between the two check launchers to ensure that they agree within ±5 mils in azimuth and QE. Range control may impose stricter tolerances. SDC-generated Safety T data will be verified by one of two methods:
- In the first method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual. This process is performed twice (the second time with a different

safety-certified SDC operator) and both sets of Safety T data compared. The data on these Safety Ts must be exactly the same.

- In the second method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual and by a check launcher performing the required check missions and command data being within ±5 mils in AZ and QE and 0.5 seconds fuze time.

2-136. The FDC must ensure that the maximum altitude/elevation data from the target area is used at minimum range and that the minimum altitude/elevation from the target impact area is used at maximum range when computing safety data (mini-max rule). However, the actual launcher/firing point altitude/elevation and actual target location elevation/altitude MUST be used during the live-fire regardless of method used to properly account for vertical interval.

Note. When sing the SDC program, ensure that two different safety-certified personnel verify safety data input. This process will be performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data compared. The data on these Safety Ts must be identical.

Note. The check launchers can be used as the firing launchers after completing the Safety T and purging all databases.

- **Fire mission 1.** From the specified firing point (location will be given on the range safety card) to the lower left-hand corner of the target box. Apply the maximum altitude at minimum range. This yields the left azimuth limit and minimum QE.
- **Fire mission 2.** From the specified firing point (location will be given on the range safety card) to the upper right-hand corner of the target box. Apply the minimum altitude at maximum range. This yields the right azimuth limit and the maximum QE.

2-137. The check launchers with current MET will report their actual (if layed on target) and command check data to the FDC. The FDC will compare the command data between the two check launchers to ensure that they agree within ±5 mils in AZ and QE. (Range control may impose stricter tolerances.) The FDC will use the more restrictive command data. Regardless of method used, the FDC must incorporate the applicable range regulation tolerances for your specific installation.

2-138. SDC-generated Safety T data will be verified by one of two methods:

- In the first method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual. This process will be performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data compared. The data on these Safety Ts must be exactly the same.
- In the second method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual and by a check launcher performing the required check missions and command data being within ±5 mils in AZ and QE and 0.5 seconds fuze time.

2-139. The FDC must ensure that the maximum altitude/elevation data from the target area is used at minimum range and that the minimum altitude/elevation from the target impact area is used at maximum range when computing safety data (mini-max rule). However, the actual launcher/firing point altitude/elevation and actual target location elevation/altitude MUST be used during the live-fire regardless of method used to properly account for vertical interval.

2-140. This completes the Safety T for the point-to-point method. See figure 2-46 for an example.

Note. If the local range safety regulation lists a variance/tolerance between check systems, the range-specific tolerances will be used.

Note. The check launchers can be used as the firing launchers after completing the Safety T and purging all databases.

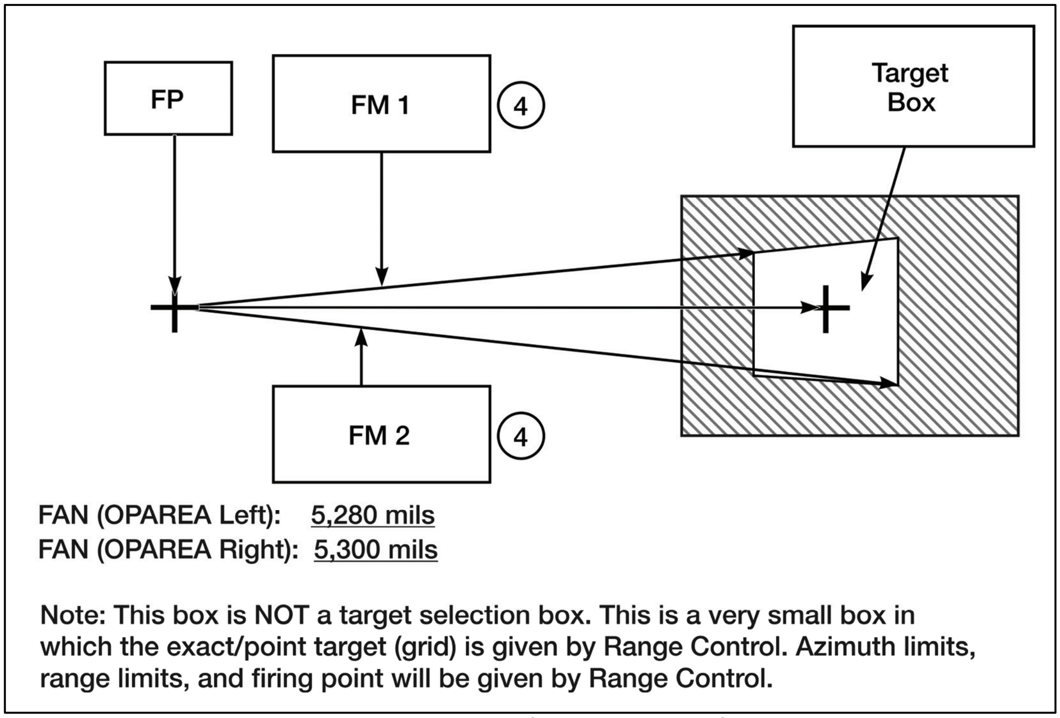


Figure 2-45. Example of computing safety data

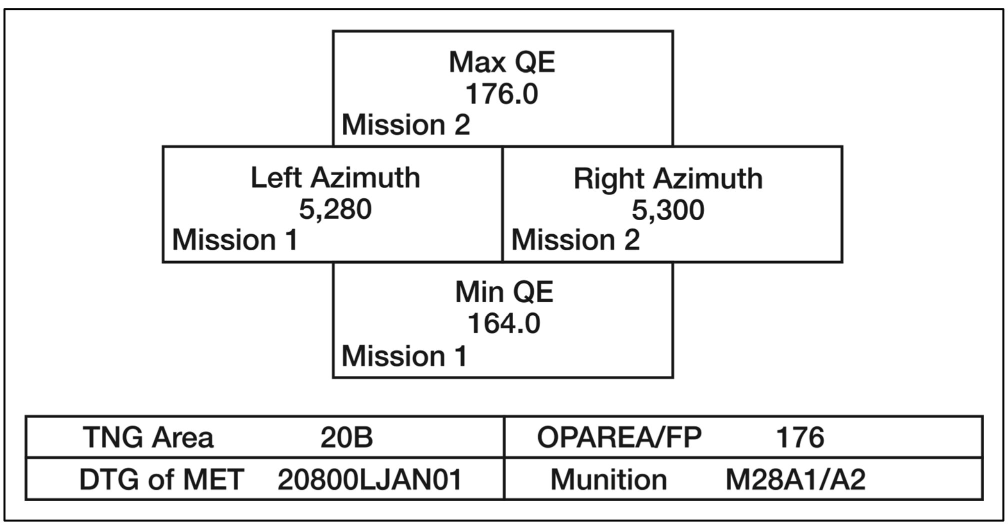


Figure 2-46. Example of a Safety T

Phase III Point-to-Point Method

2-141. Apply the SDZ requirements to the launcher firing point.

- **Step 1.** Area F (launcher danger area) is the area immediately to the rear of the launcher that is directly exposed to blast and debris. It extends 350 meters to the left and right of the launcher firing point (perpendicular to the AOF) and 400 meters to the rear of the firing point (parallel to the AOF). Personnel are prohibited from occupying this area (see figure 2-47).

- **Step 2.** The NHA extends behind area F. Only mission-essential personnel wearing double hearing protection can occupy this area. Draw a box that extends beyond area F an additional 300 meters, for M28A1 or M28A2 training rockets, to the rear of the firing point (see figure 2-47).

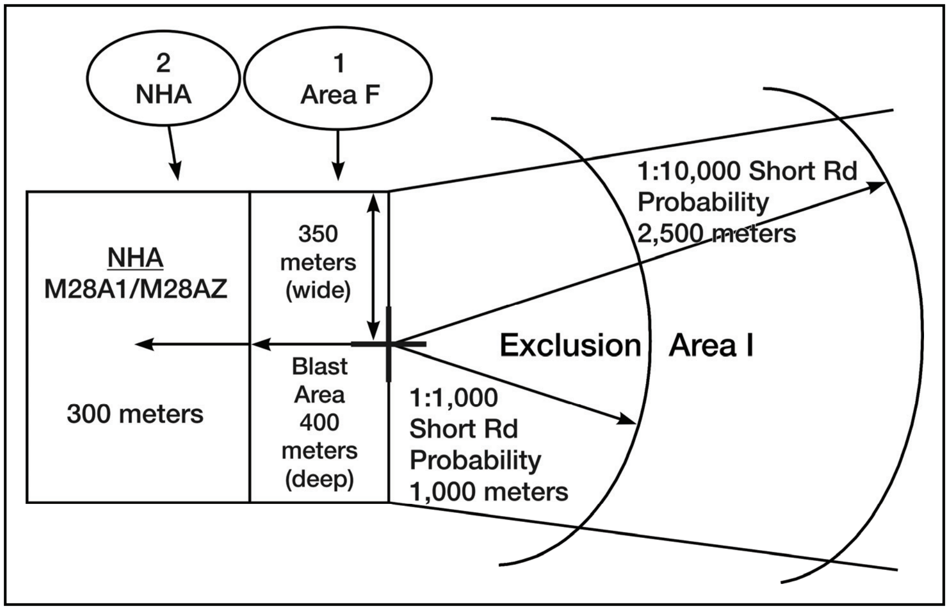


Figure 2-47. Example of a noise hazard area

Phase IV Point-to-Point Method

2-142. Complete the flight corridor.

- **Step 1.** Draw lines from the left and right forward edge of Area F to the left and right rear edge of the installation impact area, respectively, that are parallel to the left and right azimuth limits (see figure 2-48).
- **Step 2.** The exclusion area is that area of the SDZ flight corridor within a specified distance of the downrange edge of the firing area. It is endangered by failure of the rocket motor during the boost phase (see figure 2-48).

2-143. Construct exclusion area I.

- **Step 2a.** Construct an arc, centered on the firing point, with a radius derived from table 2-17, page 2-47 (based on the level of accepted risk for Exclusion Area I). The area between the arc and the firing point is Exclusion Area I (see figure 2-48).

Note. A 1:1,000 or 1:10,000 short round probability is used when calculating risk under waiver in accordance with AR 385-63/MCO P3570 and DA Pam 385-63.

2-144. Construct exclusion area II.

- **Step 2b.** The area between the arc of exclusion area I and the forward edge of the SDZ impact area is exclusion area II for the M28A1/A2 training rocket (reduced range) (see figure 2-48).

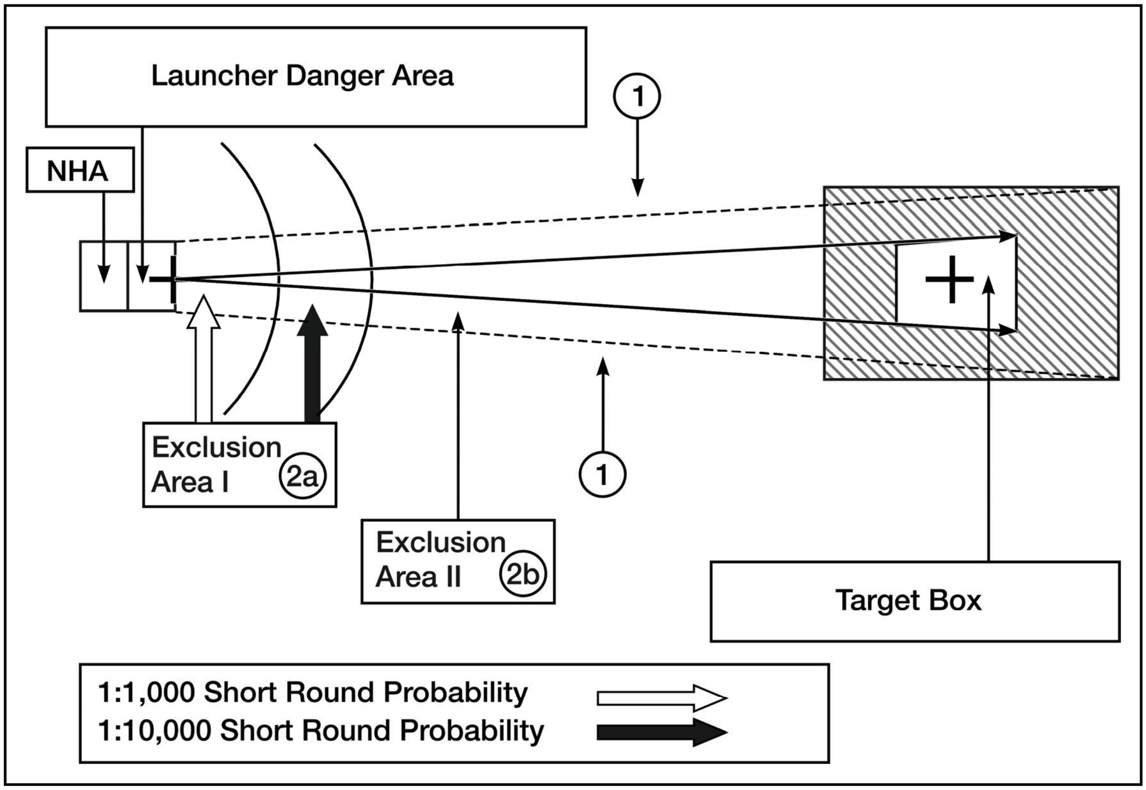


Figure 2-48. Flight corridor

Note. Exclusion area II can only be occupied under waiver in accordance with the TRADOC safety letters. Exclusion area I cannot be occupied.

FIRING POINT METHOD OF COMPUTING SAFETY

2-145. The firing point method allows the unit to derive a Safety T for a single firing point (firing into a target area).

Phase I Firing Point Method

2-146. Apply the SDZ Requirements to the installation impact area.

Note. The difference between the firing point method of computing safety and the point-to-point method of computing safety is that, with the firing point method, a larger target selection box allows the launcher to fire at different targets, whereas the point-to-point method allows firing at one target within a much smaller target box.

Note. If you have been issued a range safety card from your range control office that takes into account the MLRS SDZ requirements referenced in the TRADOC safety letters, proceed to step 1 of phase II. Normally, the OIC receives this with the range card from range control.

- **Step 1.** Plot and draw the installation impact area on a map or overlay. If the existing installation impact area to be used for MLRS firing is not a square or rectangle, the unit must draw a square or rectangle inside the existing impact area. One side of the square or rectangle must be perpendicular to the AOF from the firing point to the geographic center of the usable portion of the impact area. The procedures in step 4 are only valid when applied to a square or rectangular impact area.

- **Step 1a.** Index the geographic center of the usable portion of the installation impact area (target) (see figure 2-49).
- **Step 2.** Index the firing point (see figure 2-49).

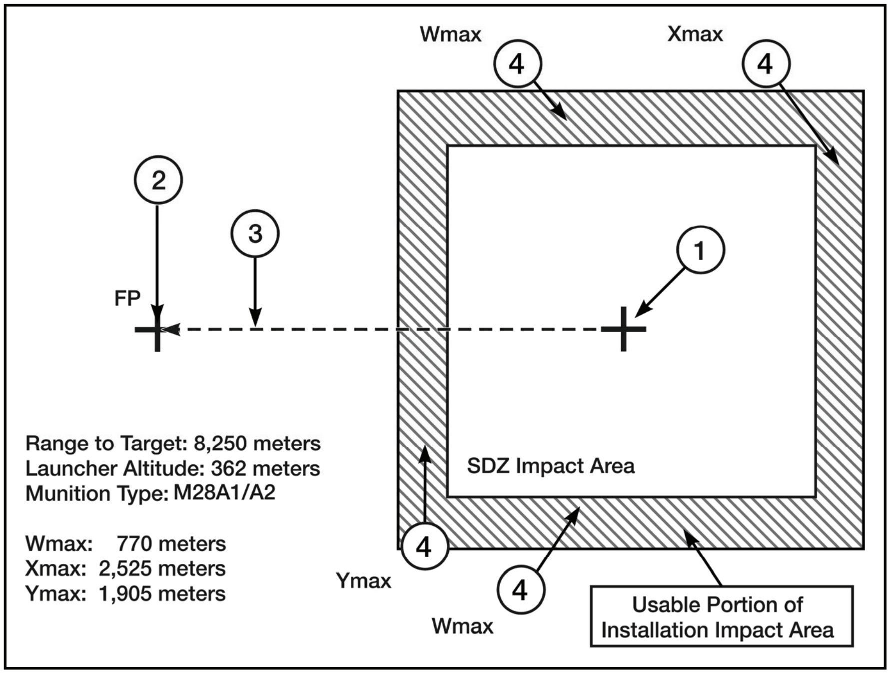


Figure 2-49. Example of an impact area

- **Step 3.** Draw a line connecting the two indices from steps 1a and 2 (see figure 2-49).
- **Step 4.** Using the appropriate munition-specific table (table 2-18, page 2-54), derive and apply the appropriate values of Wmax, Xmax, and Ymax to the edges of the usable portion of the installation impact area (toward target). The entry value for Wmax is the range from the FP to the target. The entry value for Xmax is the range from the FP to the target. The entry value for Ymax is the range from the FP to the target. This is the SDZ impact area (see figure 2-49).

Phase II Firing Point Method

2-147. Determine the initial left and right azimuth limits.

- **Step 1.** Draw lines from the firing point to the right and left edges of the SDZ impact area, which will keep all rounds within the SDZ impact area. Draw the left line from the firing point to the upper left-hand corner of the SDZ impact area. Repeat this process by drawing a line from the firing point to the upper right-hand corner of the SDZ impact area. This will be your initial left and right limit. These limits will be further refined in step 2. You must also apply any azimuth restrictions imposed by range control for the firing area (see figure 2-50, page 2-98).

2-148. Derive the minimum and maximum values for QE.

***Note*.** Range control may or may not provide a range safety card with the minimum and maximum ranges identified. If minimum and maximum range is supplied, you must use those values.

- **Step 2.** Determine the minimum range at which an arc can be scribed between the left and right azimuth limits and lie completely within the SDZ impact area. Draw a line on the arc between the left and right azimuth limits (see figure 2-50). This line shows the minimum range limit of the target selection box/target area. The target selection box and target area are the same area when using the firing point method of safety computation. You must also observe any additional range restrictions imposed by the range safety office. (For our example, installation range safety office limitations of 8,000 and 13,000 meters were applied.)

- **Step 3.** Determine the maximum range at which an arc can be scribed between the left and right azimuth limits and lie completely within the SDZ impact area. Draw a line on the arc between the left and right azimuth limits (see figure 2-50). This line shows the maximum range limit of the target selection box/target area. The target selection box and target area are the same area when using the firing point method of safety computation. You must also observe any additional munition-specific limitations or range restrictions imposed by the range safety office.

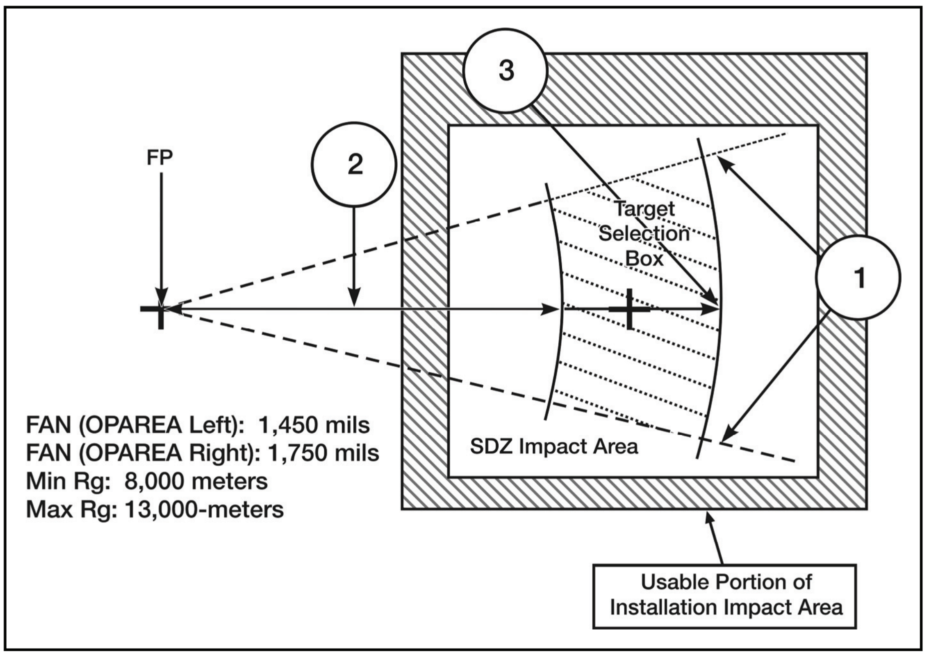


Figure 2-50. Example of azimuth limits

2-149. Determine the safe firing data and compute the Safety T.

Note. When using SDC, you are not required to use the check launchers. All other safety procedures and requirements outlined in this chapter and local range regulation still apply.

Note. The check launchers can be used as the firing launchers after completing the Safety T and purging all databases.

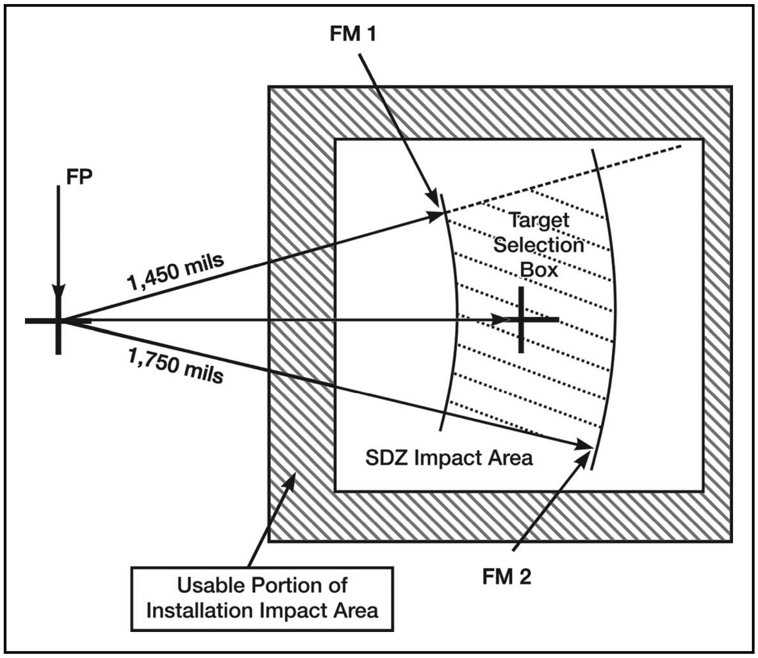


Figure 2-51. Example of fire missions for Safety T

- **Step 4.** Using the current MET message, compute the Safety T using two check launchers at a minimum. Check launchers will conduct two dry-fire missions each and determine firing data from the specified firing point to the lower left-hand corner and upper right-hand corner of the target selection box. The target selection box and target area are the same area when using the firing point method of safety computation (see figure 2-51).
- **Fire mission 1.** From the specified firing point to the lower left-hand corner of the target selection box/target area. Apply the maximum altitude at minimum range. This yields the left azimuth limit and minimum QE.
- **Fire mission 2.** From the specified firing point to the upper right-hand corner of the target selection box/target area. Apply the minimum altitude to the maximum range. This yields the right azimuth limit and the maximum QE.

2-150. The check launchers with current MET will report their actual and command check data to the FDC. The FDC will compare the command data between the two check launchers to ensure that they agree within ±5 mils in azimuth and QE. (Range control may impose stricter tolerances.) The FDC will use the more restrictive command data. Regardless of method used, the FDC must incorporate the applicable range regulation tolerances for your specific installation.

2-151. SDC-generated Safety T data will be verified by one of two methods:

- In the first method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual. This process is performed twice (the second time with a different safety-certified SDC operator) and both sets of Safety T data compared. The data on these Safety Ts must be exactly the same.
- In the second method, a safety-certified individual inputs SDC data, which is verified by a second safety-certified individual and by a check launcher performing the required check missions and command data within ±5 mils in AZ and QE and 0.5 seconds fuze time.

2-152. The FDC must ensure that the maximum altitude/elevation data is used at minimum range and that the minimum altitude/elevation is used at maximum range when computing safety data (mini-max rule). However, the actual launcher/firing point altitude/elevation and actual target location elevation/altitude MUST be used during the live-fire regardless of method used to properly account for vertical interval.

2-153. This completes the Safety T for the firing point method (see figure 2-52).

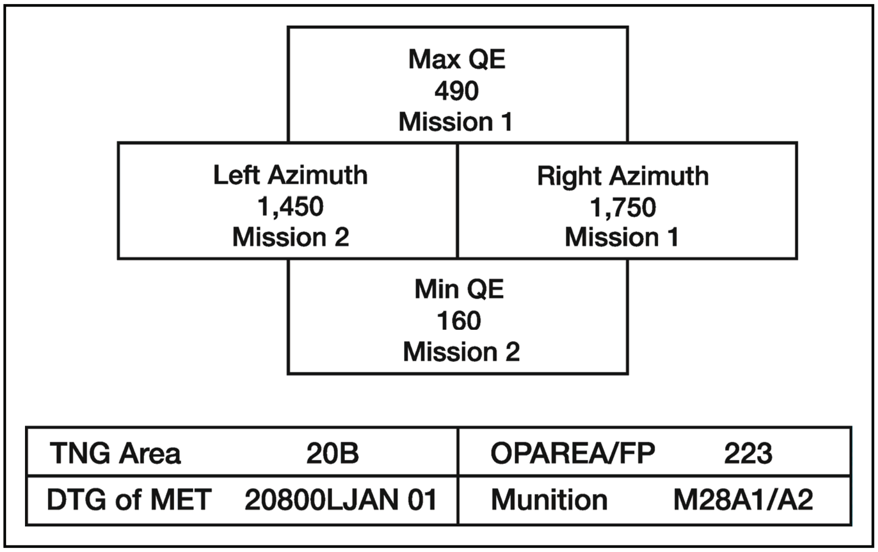


Figure 2-52. Example of a Safety T

Phase III Firing Point Method

2-154. Complete the launcher danger areas.

- **Step 1.** Area F (launcher danger area) is the area immediately to the rear of the launcher that is directly exposed to blast and debris. It extends 350 meters to the left and right of the launcher firing point (perpendicular to the AOF) and 400 meters to the rear of the firing point (parallel to the AOF). Personnel are prohibited from occupying this area (see figure 2-53).
- **Step 2.** The NHA extends behind area F. Only mission-essential personnel wearing double hearing protection can occupy this area. Draw a box that extends beyond area F an additional 300 meters for M28A1/A2 to the rear of the firing point (see figure 2-53).
- **Step 3.** The exclusion area is that area of the SDZ flight corridor within a specified distance of the downrange edge of the firing area. It is endangered by failure of the rocket motor during the boost phase (see figure 2-53).

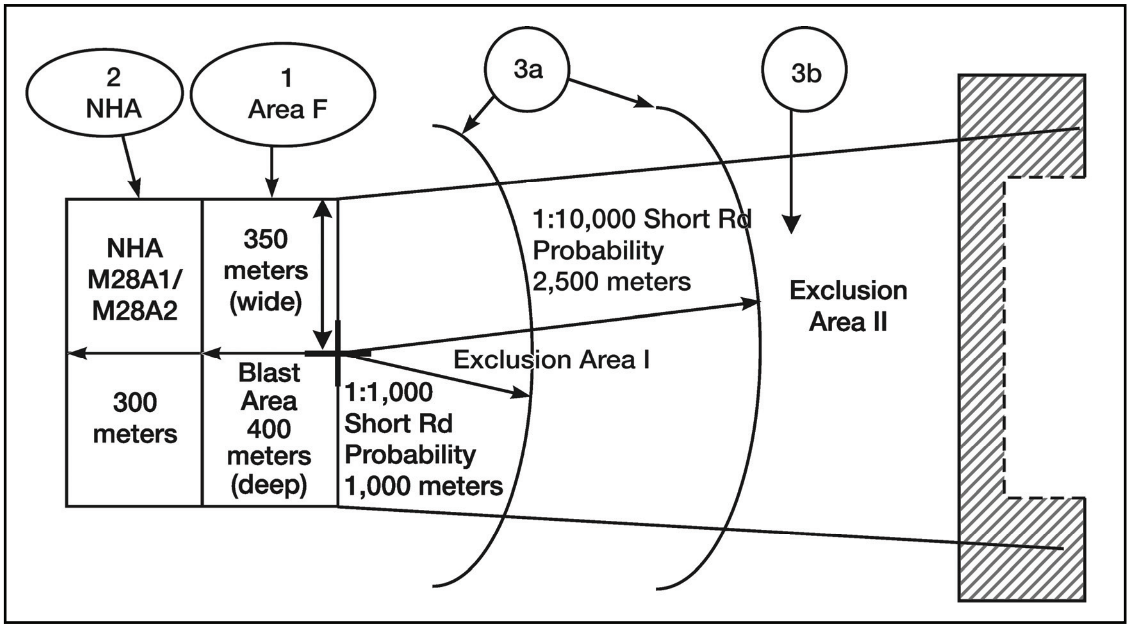


Figure 2-53. Example of M28A1/A2 exclusion areas

2-155. Construct exclusion Area I.

- **Step 3a.** Construct an arc, centered on the firing point, with a radius derived from table 2-19, page 2-64 (based on the level of accepted risk for exclusion area I). The area between the arc and the firing point is exclusion area I (see figure 2-53).

Note. A 1:1,000 or 1:10,000 short round probability is used when calculating risk under waiver per the TRADOC safety letters.

2-156. Construct exclusion area II.

- **Step 3b.** The area between the arc of exclusion area I and the forward edge of the SDZ impact area is exclusion area II for the M28A1/A2 training rocket (reduced range).

Note. Exclusion area II can only be occupied under waiver per TRADOC safety letters. Exclusion area I cannot be occupied.

SECTION VII – CHECK DATA FOR M270A1/ACTD HIMARS/M142 HIMARS/IPDS/M270

Note. When using SDC, you are not required to use check launchers. SDC alleviates the need for check launchers; all other safety procedures and requirements outlined in this chapter and local range regulations still apply.

2-157. Check data is the process of developing and verifying firing data by using a minimum of two check launchers to determine the most accurate data possible to ensure safe live-fire exercises. This section contains procedures for the safe operation of the M270A1, ACTD HIMARS, M142 HIMARS, IPDS, and M270. See example live-fire safety checklists and check data checklists, pages 2-88 and 2-91.

Note. The term "ACTD HIMARS" refers to the prototype variant that currently uses the IPDS FCS. All other HIMARS launchers are the M142 HIMARS.

2-158. There are three methods used to develop a Safety T (OPAREA, point-to-point, and firing point). Each of these methods requires two check launchers at a minimum to develop a Safety T. The check launchers will determine firing data for the required number of fire missions based on the method selected. Check launchers will report their actual and command data to the FDC. The FDC will apply the applicable range regulation tolerances specific to your installation and use the more restrictive command data.

2-159. The FDC must ensure that the maximum altitude/elevation data is used at minimum range and that the minimum altitude/elevation is used at maximum range when computing safety data (mini-max rule). However, the actual launcher/firing point altitude/elevation and actual target location elevation/altitude MUST be used during the live-fire regardless of method used to properly account for vertical interval.

Note. The check launchers can be used as the firing launchers after completing the Safety T and purging all databases.

M270A1, ACTD HIMARS, M142 HIMARS, AND IPDS

2-160. The following material covers M270A1-, ACTD HIMARS-, M142 HIMARS-, and IPDS-unique operational functions relating to check data. The introduction of GPS as a source of navigation presents new operational factors that must be addressed. The following procedures incorporate the new operational factors and MUST be followed when using the M270A1, M142 HIMARS, ACTD HIMARS, and IPDS launcher for check data:

- The database must be purged of any previous fire mission or MET data.
- The section chief will verify FCS resolver readouts and ensure that they are within the correct tolerances (at stow).

Note. IPDS and ACTD HIMARS azimuth resolver ±1.8, elevation resolver ±2.0, M270A1 azimuth resolver ±2.0, elevation resolver ±2.0. M142 HIMARS azimuth resolver ±1.3 mils, elevation resolver ±1.0. All launchers must be parked within ±100 mils of the FCS-command parking heading and less than 89 mils slope (M270A1, M270, and IPDS can fire up to a 266-mils slope). Check launchers and firing launchers will use the same current MET.

- Check data can be computed from the firing point or an alternate location with the M270A1, and M142 HIMARS. IPDS and ACTD HIMARS must occupy the FP.
- Valid weekly GPS keys will be used and the chief will verify that the launcher is operating in the GPS-aided mode (keys loaded and verified).
- If it is not possible to operate in the GPS-aided mode prior to moving to the firing point to develop firing data, the launcher must perform a system parameter update on a verified SCP and ensure that the launcher performed a ZUPT.

Note. The M270A1 and M142 HIMARS launchers will not accept a position update while in the GPS-aided mode. ACTD HIMARS and IPDS will ignore a position update once the vehicle is moved.

- A digital or manual fire mission requires the chief and gunner to verify that the launcher's ballistic solution is computed by either occupying the firing point or by using the assigned firing point location.
- A manual fire mission requires the chief or gunner to read back all data to the FDC. If check launchers are not using the ballistic solution function, they must occupy the mission firing point

and lay their LM on target and report the actual and command data to the FDC. This ensures that the FCS performs a complete computation of the fire mission (displaying CMD and actual data) using all external factors, thereby providing the most accurate data possible.

Note. M270A1, ACTD HIMARS, M142 HIMARS, and IPDS launchers do not require calibration.

WARNING

Standard MET WILL NOT be used to develop check data.

Note. Check launchers WILL use the command data (not actual data) in developing Safety T data.

Note. The check launchers can be used as the firing launchers after completing the Safety T and purging all databases.

M270

2-161. The following action/procedures must be followed when using the M270 launcher for check data:

- The database must be purged of any previous fire mission, firing points, and MET data.
- The section chief will verify FCS resolver readouts and ensure that they are within the correct tolerances (±1.8 mils azimuth, ±2.0 mils QE).
- All launchers must be parked within ±100 mils of the FCS-command parking heading and less than 89 mils slope recommended (M270 can fire up to a 266-mils slope).
- Check launchers and firing launchers will use the same current MET.
- Check launcher must complete a successful calibration; the launcher chief records odometer scale factor, azimuth crab angle, and elevation crab angle. Launcher must perform a PDS update on a verified SCP before moving to the firing point.

Note. SRP realignment should be conducted at this time. It must not expire during check data missions.

- A digital or manual fire mission requires the chief and gunner to verify that the launcher is occupying the assigned firing point.
- A manual fire mission requires the chief or gunner to read back all data to the FDC and verify that the launcher is occupying the assigned firing point.
- When aiming the LM on target to compute a firing solution, launchers must wait for the LM to finish aiming before using the CMD data. Laying on target is not necessary when using the Preview FM Data option to acquire CMD data. The Preview FM Data option only displays CMD data; to obtain the firing solution (actual data), the LM must be laid.

Note. Check launchers WILL use the command data (not actual data) in developing Safety T data.

WARNING

Standard MET WILL NOT be used to develop check data.

Note. The check launchers can be used as the firing launchers after completing the Safety T and purging all databases.

EXAMPLE OF A LAUNCHER LIVE-FIRE SAFETY CHECKLIST	
BEFORE FIRING	
1.	Launcher completes calibration; launcher chief records odometer scale factor, azimuth crab angle, and elevation crab angle. ***Note***. IPDS, ACTD HIMARS, M142 HIMARS, M270A1 launchers do not require calibration.
2.	Launcher crews receive a prefire safety briefing from the FDC/OIC.
3.	FDC/OIC reviews the Safety T with the launcher chiefs.
4.	Section chief conducts a prefire safety briefing with his crew and reviews the Safety T.
5.	Section chief verifies that the correct option is selected for Hang Fire “STOP,” Misfire “STOP,” Use LP/C 2 on Rocket Malfunction, “NO.” Section chief reviews hang fire and misfire procedures according to SOP.
6.	Chief verifies resolvers (at stow). ***Note***.M270, IPDS, HIMARS azimuth resolver ±1.8, elevation resolver ±2.0, M270A1 azimuth resolver ±2, elevation resolver ±2. M142 HIMARS azimuth resolver ±3 mils, elevation resolver ±3.0 mils.
7.	Chief will verify that no immediate mask is present at the FP. If mask is present, it will be measured and reported to the FDC for input. ***Note.***High QE will be selected by launchers during start-up procedures.
LAUNCHER CHECKLIST	
8.	Chief inspects ammunition (dents, cracks, gouges, shorting plug) before performing loading and records lot/SN.
9.	Launcher chief ensures that the gunner purges all previous MET and FMs from the FCS database.
10.	The launcher moves to the SCP and updates (M270). If GPS is not available for the M270A1, ACTD HIMARS, M142 HIMARS, IPDS, the launcher must perform a system parameter update. ***Note***. If firing from a GPS-aided launcher, SCP updates are not required.
11.	Chief sends a “LCHR STATUS” to the FDC.
12.	Launcher receives current MET from the FDC.
13.	If manual MET is used, section chief will verify MET by reading back to the FDC. ***Notes***. Recommend that a few lines of MET be read back to the FDC even if it was sent digitally. The range safety officer will verify all start-up data to include verification of current MET in use.
14.	Chief verifies that gunner performs rocket select (if required) before launcher receiving the fire mission from the FDC.
15.	Gunner transmits digital “WILL COMPLY” to the FDC.
16.	Chief and gunner review and record the fire mission.
17.	Launcher moves to the firing point.
18.	Launcher is parked on firing point (distance from FP marker based on range control limits) or within the OPAREA.

EXAMPLE OF A LAUNCHER LIVE-FIRE SAFETY CHECKLIST	
19.	Launcher is parked within ±100 mils (or within range control limits if less) of the parking heading.
20.	Gunner lays the LM.
21.	Chief visually verifies that the LM is oriented downrange (towards the AOF).
22.	Chief ensures that the TC hatch and doors are closed, vent fan switch is set to MED, firing damper is set to the firing position, and cab pressure gauge reads 0.25 inches of water.
23.	Chief and gunner verify that the actual data falls within the Safety T.
24.	Chief directs gunner to arm and fire. Chief reports “SHOT” to the controlling FDC. ***Note***. During multiple firings, chief and gunner must ensure that the firing data stays within the Safety T. If the firing data blanks out during firing, a check fire must be initiated (safe rockets) and the FDC notified.
AFTER FIRING	
25.	Chief reports “ROUNDS COMPLETE” to the FDC.
26.	Chief verifies that no tube or grass fires exist. ***Note***. The LM is not to be stowed until all rounds are declared safe by the OIC.
27.	FDC announces that all rounds were observed safe and instructs the launcher to stow his LM.
28.	Launcher stows and moves off the firing point.

EXAMPLE OF AN OIC/FDC LIVE-FIRE SAFETY CHECKLIST	
BEFORE FIRING	
1.	Ensure that the target is entered into the C2 system and verified by map spot.
2.	Ensure that the start-up and calibration SCP grids are verified by survey. ***Note***. IPDS, ACTD HIMARS, M142 HIMARS, M270A1 launchers do not require calibration. ***Note***. When using SDC, you are not required to usecheck launchers. SDC alleviates the need for check launchers; all other safety procedures and requirements outlined in this chapter and local range regulations still apply.
3.	Ensure that the surface danger zone computation and safety diagram are posted and verified by the OIC.
4.	Ensure MET validity. ***Note***. Up to 4-hour-old MET message may be used except during day/night transitions or frontal passages. See FM 6-60 or FM 6-15 for more information on MET checking procedures.
5.	Ensure that at least two launchers have dry-fired each check mission one time each and that their firing solutions meet range-specific check tolerances. If SDC is used to develop the Safety T, ensure that two safety-certified individuals verify all data input.
6.	Ensure that launcher chief has verified that no immediate mask is present at the FP. If mask is present, it will be measured and reported to the FDC for input.
7.	FDC conducts downrange mask checks and inputs data if required.
8.	FDC computes the data for each Safety T. On the Safety T, he will annotate the firing point/OPAREA they apply to, the time the MET data was flown and the date it was prepared, and the munitions in use. SDC automatically annotates this data on the Safety T.
9.	The FDC and the OIC/NCOIC verify the Safety T data.
10.	OIC conducts a prefire safety briefing with the launcher chiefs.
11.	Road guards are briefed and posted (if applicable).

EXAMPLE OF AN OIC/FDC LIVE-FIRE SAFETY CHECKLIST	
12.	Observers have received necessary training, are briefed, have the required items, and are posted.
13.	FDC verifies that the range is clear, radar is set (if applicable), and observers are oriented to observe the rockets.
14.	Communication is established and maintained between the OIC, FDC, firing launcher, observers, radar (if applicable), and road guards (if applicable). If at any time communication is lost between any of these elements, all firing will be halted.
15.	FDC contacts range control for a wet check-in code.
16.	FDC receives a launcher status.
17.	FDC transmits MET to launcher. If MET is manually entered, it will be read back to FDC and verified. ***Note.*** Recommend that a few lines of MET be read back to the FDC even if it was sent digitally. ***Note.*** The same MET that was used to compute the Safety T must be sent to launcher for the live-fire mission.
18.	OIC/FDC ensures that radar is set (if applicable), observers are ready, exclusion area I is clear of personnel, and the roads are blocked (if applicable).
19.	FDC transmits fire mission.
20.	LCHR moves to the firing point, parks on the heading, and lays the LM.
21.	FDC and OIC (FDC) ensure receipt of "Advanced Ready," and verify the data is safe. ***Note***.The OIC will ensure that a DA Form 7232-R (*MLRS FDC Fire Mission Log*) is maintained in the FDC. ***Note***. If steps 1-21 are completed and verified, the launcher is prepared to fire.
DURING FIRING	
22.	FDC sends the fire command.
23.	Ensure that the chief reports "SHOT" to the controlling FDC.
24.	Road guards remain in place (if applicable).
25.	Communication is maintained.
26.	All rockets launched safe; ensure that the chief reports "ROUNDS COMPLETE" to the FDC. ***Note***. The LM is not to be stowed until all rounds are declared safe by the OIC.
AFTER FIRING	
27.	Ensure that the FDC receives the MFR.
28.	Observers and/or radar (if applicable) report rounds observed safe.
29.	FDC announces that all rounds were observed safe, then instructs the launcher to stow the LM.
30.	Launcher stows and moves off the firing point.
31.	FDC/FDNCO prints out all data for the fire mission.

EXAMPLE OF A ***LAUNCHER CHECK DATA CHECKLIST***	
BEFORE COMPUTING CHECK DATA	
1.	Launcher completes calibration; launcher chief records odometer scale factor, azimuth crab angle, and elevation crab angle. ***Note***. IPDS, ACTD HIMARS, M142 HIMARS, M270A1 launchers do not require calibration.
2.	Launcher crews receive a check data briefing from the FDC/OIC.
3.	Chief conducts a check data briefing with his crew.
4.	Section chief verifies that the correct option is selected for Hang Fire "STOP," Misfire "STOP," Use LP/C 2 on Rocket Malfunction, "NO." Section chief reviews hang fire and misfire procedures per SOP.
5.	Chief verifies resolvers (at stow). ***Note***. M270, ACTD HIMARS, IPDS azimuth resolver ±1.8, elevation resolver ±2.0; M270A1 azimuth resolver ±2.0, elevation resolver ±2.0. M142 HIMARS azimuth resolver ±3 mils, elevation resolver ±3.0 mils.
6.	If mask is present at the FP, it will be measured and reported to the FDC for input. ***Note***. High QE will be selected by launchers during start-up procedures.
LAUNCHER CHECKLIST	
7.	Chief ensures that the gunner purges previous MET, fire missions, and firing points from the FCS database.
8.	For M270 launchers, update its current location with the FP data given to develop the Safety T. ***Note***. Not required for M270A1 or M142 HIMARS in the GPS-aided mode; IPDS/ACTD HIMARS must occupy the actual FP.
9.	Chief sends a "LCHR STATUS" to the FDC.
10.	Launcher receives current MET from the FDC.
11.	If manual MET is used, section chief will verify MET by reading back to the FDC. ***Note***. Recommend that a few lines of MET be read back to the FDC even if it was sent digital. ***Note.*** The range safety officer will verify all start-up data to include verification of current MET in use.
12.	Launcher receives fire mission.
13.	Gunner transmits digital "WILL COMPLY" to the FDC.
14.	Chief and gunner review and record the fire mission.
15.	Launcher moves to the firing point (required for ACTD HIMARS/IPDS; optional for M142 HIMARS/M270A1/M270) and selects a routine that computes command data without aiming the LM.
16.	Launcher is parked on firing point (distance from FP marker based on range control limits) or within the OPAREA (required for ACTD HIMARS/IPDS; optional for M270A1/M270/ M142 HIMARS).
17.	All launchers are parked within ±100 mils (or within range control limits if less) of the parking heading.
18.	Gunner lays the LM (required for ACTD HIMARS/IPDS; optional for M270A1/M270/M142 HIMARS).
19.	Chief visually verifies that the LM is oriented downrange toward the AOF. ***Note***. The section chief will ensure that AZ, QE, and fuze time and other pertinent data are recorded on DA Form 7233-R *(MLRS Launcher Fire Mission Log)* before rocket launch.
20.	Chief reads CMD data to the FDC.

EXAMPLE OF A CHECK DATA CHECKLIST USING LAUNCHERS (OIC/FDC Check Data Checklist)	
SAFETY T DEVELOPMENT	
1.	Ensure that the target is entered into the C2 system and verified by map spot.
2.	Ensure that the start-up and calibration SCP grids are verified by survey. ***Note***. IPDS, ACTD HIMARS, M142 HIMARS, M270A1 launchers do not require calibration.
3.	Ensure MET validity. ***Note***. Up to 4-hour-old MET message may be used except during day/night transitions or frontal passages. See FM 6-60 or FM 6-15 for more information on MET checking procedures.
4.	Ensure that at least two launchers have dry-fired each check mission one time each and that their firing solutions meet range-specific check tolerances.
5.	Ensure that the launcher chief has verified that no immediate mask is present at the FP. If a mask is present, it will be measured and reported to the FDC for input.
6.	FDC conducts downrange mask checks and inputs data if required.
7.	FDC contacts range control for a wet check-in code.
8.	FDC receives a launcher status.
9.	FDC transmits MET to launcher. If MET is manually entered, it will be read back to FDC and verified. ***Note***. Recommend that a few lines of MET be read back to the FDC even if it was sent digitally. ***Note***. The same MET that was used to compute the Safety T must be sent to launcher for the live-fire mission.
10.	FDC transmits fire mission.
11.	Ensure that LCHR moves to the firing point, parks on the heading, and lays the LM. (Required for ACTD HIMARS/IPDS; optional for M142 HIMARS/M270A1/M270.)
12.	Chief reads back CMD data to the FDC.
13.	FDC computes the data for each Safety T. The Safety T will include the firing point/OPAREA they apply to, the time the MET data was flown and the date it was prepared, and the munition in use.
14.	Safety T data is verified by the FDC and the OIC/NCOIC.
15.	Check data launchers are ordered to purge their databases and ensure that no previous FMs, FPs, or MET exists in the FCS. This is required only if the launcher will be a live-fire launcher.

EXAMPLE OF A SDC CHECK DATA CHECKLIST (OIC/FDC Check Data Checklist)	
SAFETY T DEVELOPMENT	
1.	Ensure that the target is entered into the C2 system and verified by map spot.
2.	Ensure that the start-up and calibration SCP grids are verified by survey. ***Note***. IPDS, M142 HIMARS, M270A1, ACTD HIMARS launchers do not require calibration.
3.	Ensure MET validity. ***Note***. Up to 4-hour-old MET message may be used except during day/night transitions or frontal passages. See FM 6-60 or FM 6-15 for more information on MET checking procedures.
4.	Develop and plot the SDZ requirements on a map or overlay. Identify the geographical location of the target box or target selection boxes whichever is applicable. Range control may or may not provide these locations.
5.	Ensure that at least two safety-certified individuals verify all data input into the SDC. FDC computes the data for each Safety T. The Safety T will include the firing point/OPAREA they apply to, the time the MET data was received and the date it was prepared, and the munitions in use.
6.	Safety T data is verified by the FDC and the OIC/NCOIC.
7.	FDC contacts range control for a wet check-in code. ***Note***. The firing launcher must use the same valid MET that was used in computing the Safety T. Safety Ts will be updated upon receipt of new MET.

This page intentionally left blank.

Chapter 3

Fire Support Tables

This chapter provides commanders, fire support officers (FSOs) and FSNCOs a standardized method of training and qualifying the fire support teams (FISTs) assigned to their organizations. The chapter includes training and qualification standards for all FISTs, Combat Observation and Lasing teams, Knight teams, and Stryker fire support (FS) teams.

INTRODUCTION

3-1. The training and qualification of Observer teams (FIST, COLT, and Knight), as well as the joint teams such as enlisted tactical air control (ETAC) teams and Naval surface fire support teams, share many common tasks. Both Observer teams and joint teams must be proficient at observed fire procedures, tactical movement, and force protection. They also must be able to communicate with the supported delivery means or fire control element (FCE) and be familiar with doctrine and requirements of the supported force. However, many critical differences related to the mission and equipment of each element must also be addressed. These differences will be addressed in both the ASPT and the fire support qualification tables. Table 3-1 is a summary of the content of the fire support qualification tables and the elements trained.

Table 3-1. Summary of tasks and tables for FS elements

Table	*FIST (LIGHT)*	*BFIST*	*COLT*	*KNIGHT*
Artillery Skills Proficiency Test		*BFIST*	*BFIST/ HMWVV*	*HMWVV*
a. Vehicle skills proficiency			RWS	RWS
b. Mission equipment package proficiency		X	X	X
c. Mounted land navigation		X	X	X
d. Dismounted land navigation	X	X	X	X
e. Prepare laser range finder/ designator for operation dismounted mode	X	X	X	X
f. Operate SINCGARS ICOM	X	X	X	X
g. Terrain sketch	X	X	X	X
h. Combat vehicle identification (ROC-V)	X	X	X	X
Table I (Individual) Common to All	X	X	X	X
Table II (Section)	X	X	X	X
Table III (Occupation of Observation Posts)	X	X	X	X
Table IV (Standard Missions)	X	X	X	X
Table V (Special Missions)	X	X	X	X
Table VI (Lethal and Nonlethal Fires and Effects Planning) -To be Published in Subsequent FM Revision	X	X	X	X
Table VII (Training)	X	X	X	X

Table 3-1. Summary of tasks and tables for FS elements

Table	*FIST (LIGHT)*	*BFIST*	*COLT*	*KNIGHT*
Table VIII A (Qualification on Direct Fire System/BFIST Direct/Indirect Fires) Day		Bradley Tables I-VIII	Bradley Tables or RWS Qual	HMWVV/ RWS Table
Table VIII.B (BFIST Direct/Indirect Fires) (Night)	X	X	X	
Table VIII.C (Qualification Live Fire)	X	X	X	X

TARGET LOCATION

3-2. The observer provides the accurate location and size of the target for the gunnery solution, one of the five critical elements for accurate predictive fires. To accomplish that task, the observer must be proficient at map reading and land navigation and know the location at all times. He must be proficient on the equipment assigned that assists with target location and designation and must be able to communicate with the delivery unit or means.

COMPANY FSO RESPONSIBILITIES

3-3. In addition to executing essential fire support tasks/essential field artillery tasks (EFST/EFAT), the ESO is the maneuver commander's principal advisor in all matters pertaining to indirect fires and effects. The ESO must be well grounded in maneuver doctrine and be able to recommend the appropriate fire support means to support the commander's intent as well as the recommended FSCM to prevent fratricide.

FORCE PROTECTION

3-4. The FIST/COLT/Knight must be proficient in all force protection tasks, including qualification on assigned direct fire systems, selection and occupation of OPs, tactical movement techniques, basic rifle marksmanship, and CBRN protective measures and the standard battle tasks of the supported unit.

TRAINING WITH FIRE SUPPORT TABLES

3-5. The fire support tables provide a progressive, gated approach to training to assist commanders in the assessment of training and horizontal integration of training across the combined arms team. Using these tables assures the commander of the supported Bradley-equipped infantry company that the BFIST can be integrated into combat formations and can direct fire battles while maintaining the capability to simultaneously deliver indirect fires as required.

3-6. The tables also provide the means for Crawl, Walk, Run (C, W, R) training for the FIST leaders to use during Sergeant's Time training, as refresher training, or as a prelude to evaluating training. The content of the ASPT and Tables I-V provide the individual and collective tasks to support the routine training of FISTs.

SECTION I. ARTILLERY SKILLS PROFICIENCY TEST FOR FIRE SUPPORT

3-7. The ASPT evaluates the FIST/COLT/Knight member's ability to execute selected FS-related skills. The tasks listed in this chapter provide the unit commander a means to evaluate the fire support team member's basic proficiency before live-fire exercises. The ASPT can also be used as a guide for identifying team strengths and weaknesses. The commander, master gunner, and senior FSO should use ASPT results when structuring the unit's annual gunnery training program.

REQUIREMENTS

3-8. All MOS 13F personnel and any personnel assigned to a FIST/COLT/Knight (regardless of MOS or grade) will be assessed in the ASPT. FS personnel are required to pass the ASPT prior to FISTs qualification. To pass the ASPT, an observer must receive a GO on all stations. If an observer fails a task, he must be retrained and retested on that station until he receives a GO. Appropriate manuals and other references listed for each station must be used to prepare, administer, and evaluate the ASPT.

Note.: Evaluators must have passed the ASPT within 6 months before the testing.

SAFETY PRECAUTIONS

3-9. The commander will incorporate risk assessment in planning all aspects of this training. The unit will conduct a safety briefing for each station in accordance with the unit SOP.

EVALUATION PROCEDURES

Administrative Process

3-10. Before the Soldiers arrive, the evaluator sets up the equipment and materials needed at each test station. When the Soldiers arrive, the evaluator logs the Soldiers in on a roster at each station and provides each Soldier with all materials and equipment displayed, as outlined on this section and in the Test Administrative Guide for that station. The evaluator reads the instructions to the Soldier exactly as written in the guide for each station. The evaluator must use the criterion-scoring checklist provided for each task to evaluate each Soldier's performance. As each Soldier finishes or the time limit is up (whichever occurs first), the evaluator checks the Soldier's performance as either GO or NO-GO, informs him of his performance on that task and directs him either to the next station or to further training.

Administrative Procedures for Soldiers Receiving a NO-GO

3-11. If a Soldier does not meet the standard indicated on the criterion-scoring checklist, he receives a NO-GO. The Soldier must then be critiqued on that task, given an explanation of his mistakes, and told what to do to correct them. Soldiers will be retrained and retested in accordance with the local SOP.

Evaluation Criteria

3-12. See attached criterion-scoring checklist for each task provided in the test station administrative guidance.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED

3-13. The personnel, equipment, and material in the following list should be considered for all stations but their use depends on the task to be trained. Additional items, if required, are listed in the Test Administrative Guide for each particular station:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).

- Lensatic compass.
- Binoculars.

PLANNING CONSIDERATIONS

3-14. The evaluator tasked to conduct the ASPT should consider the following elements during his planning:

Identify the Type of ASPT

3-15. The Evaluator must determine whether the ASPT will be a diagnostic test or record test. A "diagnostic" ASPT identifies the unit's strengths and weaknesses, provides information for the gunnery program, and assesses newly assigned personnel. A "record" ASPT allows commanders to certify proficiency of Soldiers to meet artillery table prerequisites.

Determine the Test Site

3-16. Establish a test site that will support the testing of all stations; for example, Station 7, Conduct a Terrain Sketch, requires a clear view of surrounding terrain at ranges representing those of an OP. Refer to the station conditions for each station to determine what is needed for that station.

Construct a Test Station Diagram (Flow Chart)

3-17. Before rehearsing the test, create a test station diagram or flow chart. This diagram will facilitate management and control of the test. It will also aid in briefing Soldiers and evaluators. The diagram should include the following elements: test stations, control station, direction of rotation, movement schedule, and aid station/warm-up tent, if available.

Determine Resources

3-18. The evaluator must determine the resources necessary to support the ASPT. He must consider the support of the test site, as well as the training aids required to conduct the test to standard. The evaluator can determine training aids or actual equipment, such as a desktop computer, for ROC-V, BFIST, and laser range finders (LRFs) by referring to the individual station in this and following chapters. To support the test site, the NCOIC must determine the amount of support needed to conduct the test; for example, BFIST with drivers, transportation to and from the test site, tents for warm-up briefings, stopwatches, tables for scoring, chairs, medical support, and class I support if needed. Once the NCOIC has determined the resources needed, he must coordinate the use of personnel and equipment. This coordination will usually be made through the master gunner or battalion S3.

Select Evaluators

3-19. Evaluators should be selected as far in advance as possible. This gives the NCOIC time to select the most qualified personnel available and time to coordinate with other units, if necessary; it also allows the evaluator time to prepare. If the FSO/FSNCO must draw on resources from outside his unit, he should request assistance from the master gunner. After the evaluators have been selected, the FSNCO will brief them on their duties and responsibilities, the test schedule and location, and the station they will be testing.

Test Evaluators

3-20. Evaluators must be technically proficient in performing all tasks to standard. Each evaluator is tested on all test stations.

Conduct a Rehearsal

3-21. Because of the size and scope of this test, it must be rehearsed before it is administered. This rehearsal will be conducted at the test site with all evaluators present. The FSNCO should check each station to ensure that the evaluator is aware of his duties and responsibilities, the station is set up correctly with all training aids and test materials on hand, and testing is conducted in accordance with the Test Administrative Guides.

Conduct the ASPT

3-22. Before the testing, the FSNCO must ensure that the stations are set up and all equipment and training aids are available. He must also ensure that the Soldiers are briefed on safety and the station locations and that the Soldiers are assigned to the test stations. During testing, the FSNCO will spot-check each station to ensure the task standards are being maintained and the evaluators are maintaining a roster of personnel evaluating and annotating the scorecards correctly.

Conduct the AAR for the ASPT

3-23. The battalion master gunner or CSM should conduct an AAR to help the FSNCO understand his actions and interactions during the conduct of the ASPT. The AAR should be conducted before the unit commander's debrief and should consist of a discussion of the strengths and weaknesses of the training event. This will allow the FSNCO to better prepare the commander's debrief as well as prepare him for the next ASPT.

Prepare Debrief

3-24. Once the test is complete, the FSNCO will prepare a brief for the commander informing him of the ASPT results. (This information will also be retained for training records.) As soon as the Soldiers complete the training and before anyone leaves the test site, the Soldiers' scorecards will be collected. The evaluators can provide additional information about a Soldier's test performance. After all data is collected, they prepare a summarization of the results. Information from test results must be interpreted to determine the strengths and weaknesses of the unit. At a minimum, this report will contain the following data:

- A roster, by duty position, of each Soldier tested.
- The scores of each Soldier tested.
- The percentage of Soldiers passing the ASPT.
- The percentage of GOs per station.
- The percentage of NO-GOs per station.
- Recommended corrective action.

Test Stations

3-25. Each station consists of a Test Administrative Guide and criterion-scoring checklist as required.

Integrated Combined Arms Battle Focused Training

3-26. All combat vehicle crew proficiency tests and qualification tables (such as the Bradley Gunnery Skills Test, Bradley Tables I-VIII, Stryker Skills Proficiency Test, and Remote Weapon Station [RWS] Qualification) should be integrated with the training and qualification ranges of the supported force when feasible.

TEST STATIONS

FIST TASKS FOR ASPT	
1.	Vehicle Skills Proficiency Tests
2.	Mission Equipment Package Test Station
3.	Mounted Land Navigation Test Station
4.	Dismounted Land Navigation Test Station
5.	Prepare Laser Range Finder/Designator for Operation Dismounted Mode Test Station
6.	Operate SINCGARS ICOM W/VIC-1 Test Station
7.	Construct a Terrain Sketch Test Station
8.	Recognition of Combat Vehicles Test Station

TEST STATION 1 –
BRADLEY GUNNERY SKILLS PROFICIENCY TEST STATION*

1. Clear, remove, disassemble, assemble, and install an M242 25-mm gun.
2. Load an M242 25-mm gun feeder.
3. Apply immediate action on an M242 25-mm gun.
4. Unload and clear an M242 25-mm gun feeder.
5. Install an M240C coax machine gun.
6. Load, fire, and apply immediate action on an M240C coax machine gun.
7. Clear an M240C coax machine gun and unload 7.62-mm ammunition.
8. Remove an M240C coax machine gun.
9. Disassemble (field strip) and assemble an M240C coax machine gun.
10. Boresight turret weapons systems.
11. Load and unload the 25-mm HE ready box.
12. Load and unload the 25-mm AP ready box.
13. Prepare a Bradley range card.
14. Identify combat vehicles.

REMOTE WEAPON STATION (RWS) SKILL PROFICIENCY TEST STATION*

1. Performance Checklists (M2 HB caliber .50)
   - Station 1. Clear, disassemble, assemble, set headspace and timing, and perform a function check on the M2 HB caliber .50 machine gun.
   - Station 2. Load a caliber .50 machine gun, reduce a stoppage, and unload and clear a caliber .50 machine gun.
2. Performance Checklists (MK-19 grenade machine gun)
   - Station 1. Disassemble, assemble, and perform a function check on an MK-19 machine gun.
   - Station 2. Load, apply immediate action, unload, and clear an MK-19 machine gun.
3. Performance Checklists (all weapons)
   - Station 1. Prepare a range card.
   - Station 2. Identify combat vehicles.

Note. The combat vehicle proficiency test stations should be integrated with the training conducted by the supported force.

*Comprises 14 stations of FM 3-22.1. Test may be taken with supported Bradley unit when possible.

MISSION EQUIPMENT PACKAGE TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 2 (BFIST, STRYKER, KNIGHT)

TASK: Prepare the Mission Equipment Package for Operation 061–354—3000

CONDITIONS: As a vehicle driver fire support specialist in an assembly area; given Stryker or M707 (Knight) and TM 9-2350-362-10; when directed by the fire support team sergeant.

STANDARDS: In sequence, without damage to self, others, or equipment.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M7 BFIST, M998A1, Stryker vehicle, or Knight vehicle.
- Vehicle TM.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 7 minutes
- Total time (per crewman): 12 minutes

OTHER INFORMATION: Before the crewman arrives, the evaluator will ensure that the assigned fire support vehicle w/MEP is functional and that a distant communication station is operational.

INSTRUCTIONS TO THE CREWMAN: *"In front of you is an (M7 BFIST/Stryker/ Knight/FIST-V vehicle). You must prepare the mission equipment package (MEP) for operation within 7 minutes. All components of the MEP must be safely and correctly mounted, turned on, aligned, or boresighted. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

STANDARDS:

Performance Steps:
1. Set all vehicle power switches and circuit breakers to OFF.
2. Verify that the turret (travel) lock is engaged.
3. Verify that the isolation platform is in the lock position (operate).
4. Mount G/VLLD.
5. Mount nightsight.
a. Set MODE switch on power distribution unit (PDU) to TAC.
b. Set nightsight power switch to ON.
6. Turn PDU to the ON position.
7. Turn AN/PSG-11 (PLGR) on (BFIST and Knight only).
a. Place PLGR on CONT MODE.
b. Place PLGR on FOM1.
8. Set LCU (lightweight computer unit) power switch to ON.
a. Observe the LCU power and lamp indicators illuminate.
9. Turn targeting station control panel (TSCP) ON.
c. Wait 25 seconds for initialization.
d. Ensure that PLGR displays "remote activate zerorize only."
Note.: Stryker vehicles need to verify that the vehicle motion sensor (VMS) is switched on before aligning the inertial navigation system (INS).
10. Align INS.
a. Push INS ALIGN on the TSCP keypad.
b. Press PREV menu twice.
c. Press SETUP.
d. Press INS SETUP.
e. Verify that TSCP displays "aligning."
11. Boresight nightsight to the G/VLLD.

Performance Measures	***GO***	***NO-GO***
1. Verified that all vehicle power was off.		
2. Verified that the travel lock was engaged (locked).		
3. Verified that the isolation platform was in target (locked) position.		
4. Mounted G/VLLD.		
5. Mounted nightsight.		
6. Turned PDU to the ON position.		
7. Turned PLGR ON.		
8. Set LCU power switch to ON.		

Performance Measures	*GO*	*NO-GO*
9. Turned TSCP ON.		
10. INS aligned.		
11. Boresighted nightsight to the G/VLLD.		

MOUNTED LAND NAVIGATION TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 3 (FIST, BFIST, STRYKER, KNIGHT, COLT)

TASK: Navigate from One Point on the Ground to Another Point While Mounted for Operation 071-329-1030

CONDITIONS: Given a standard 1:50,000-scale topographic map of the area, a coordinate scale, a protractor, and a compass; while mounted in a vehicle with cross-country capability; and tasked to move from a known start point to one or more distant points.

STANDARDS: Direct the driver to the designated point(s) at a rate of 9 kilometers per hour using terrain association and dead reckoning.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M7 BFIST, M998A1 FISTV, Stryker vehicle, and Knight vehicle.
- Vehicle TM.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 160 minutes
- Total time (per vehicle): 165 minutes

OTHER INFORMATION: Before the Soldiers arrive, the evaluator will select an area that has varying terrain and vegetation. The area must be large enough to have eight points that are 1,000 to 5,000 meters apart. Each point is on or near an identifiable terrain feature and is marked on the ground with a sign containing a letter or number. Dummy signs are placed not less than 100 meters or more than 200 meters to the right and left of the correct point. Clearly mark all correct points on the map. Prepare a sheet of paper giving the azimuth and distance for each leg of the course. Have pencils available for the Soldiers.

INSTRUCTIONS TO THE SOLDIER: *"You are currently located in the TAA. Your grid location is as follows: ____________________. You must align your INS, and move to and* *record each of the eight points provided. Do you understand the requirements of this test? Do you have any questions?"* (Start the time.)

Performance Measures	***GO***	***NO-GO***
1. Terrain association. Wrote the correct letter or number found at the end of each leg of the course.		

DISMOUNTED LAND NAVIGATION TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 4 (FIST, STRYKER, KNIGHT, COLT)

TASK: Navigate from One Point on the Ground to Another Point While Dismounted

CONDITIONS: Given a 1:50,000 scale map, a compass, a starting point, and the coordinates of three points along a 3,000-meter cross-country course. The designated points will be located on prominent terrain features. Soldiers will wear load bearing equipment (LBE), rucksack packed according to unit TACSOP, Kevlar™ helmet, and will carry assigned weapon.

STANDARDS: Move on foot to each of the three designated points in sequence at a rate of 3,000 meters per hour.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- 1:50,000 scale map.
- Compass.
- Protractor.
- Pencils.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 60 minutes
- Total time (per Soldier): 65 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will select an area that has varying terrain and vegetation. The area must be large enough to have three points that are 500 to 1,000 meters apart. Each point is on or near an identifiable terrain feature and is marked on the ground with a sign containing a letter or number. Dummy signs are placed not less than 100 meters or more than 200 meters to the right and left of the correct point.

Clearly mark all correct points on the map. Prepare a sheet of paper giving the azimuth and distance for each leg of the course. Have pencils available for the Soldiers. Time standard may be corrected for local terrain and weather.

INSTRUCTIONS TO THE SOLDIER: *"Your grid location is as follows: ____________ _______. You are to move on foot to each of the three designated points, record the data at that point, and complete the course in 1 hour. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	*GO*	*NO-GO*
1. Moved from the starting point to each of the designated points in succession.		
2. Moved to each point and recorded the data found at that point.		
3. Completed course within 1 hour.		

PREPARE LASER RANGE FINDER/DESIGNATOR FOR OPERATION DISMOUNTED MODE TEST STATION STATION 5 (ALL)

TASK: Prepare Laser Range Finder/Designator (G/VLLD, Melios, Viper, LLDR) for Operation Dismounted Mode (061-274-5100) (061-283-1960)

CONDITIONS: Given a laser range finder/designator w/power conditioner, dismounted collimator, compass, and an area of observation.

STANDARDS: Soldier performs PMCS on all equipment, properly sets up the laser range finder/designator in a dismounted mode in accordance with the appropriate TM, prepares for night operations, and performs initial check of equipment.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Declinated compass.
- Operational laser range finder/designator.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time (per Soldier): 15 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will select an area with a panoramic view of surrounding terrain such as an OP and have an operational AN/TVQ-2 (G/VLLD) or AN/PVS-6 Melios or LLDR ready for the Soldier.

INSTRUCTIONS TO THE CREWMAN: *"You are currently located at an OP. You must successfully perform pre-operation checks, properly set up the laser range finder/designator for 24-hour operations, and perform the initial check of equipment in accordance with the TM. This is a timed event. You will have 10 minutes to complete the assigned tasks. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

G/VLLD 061-274-5100		
Performance Measures	***GO***	***NO-GO***
1. The Soldier properly identified all equipment.		
2. The Soldier performed PMCS in accordance with the TM.		
3. The Soldier properly set up the equipment for 24-hour operations.		
4. The Soldier performed an operational check on the assigned laser range finder/designator.		

Melios 061-283-1960		
Performance Measures	***GO***	***NO-GO***
1. Performed before-operation checks and services.		
2. Boresighted MLRF (Melios laser range finder).		
3. Selected a target with distinct vertical edges at a range greater than 100 meters.		
4. Measured target range and observed that the range display indicates the correct range to the target.		
5. Declinated compass/vertical angle measurement (C/VAM).		
6. Zeroed C/VAM in the three different positions at each azimuth position.		
7. Lazed the target and record data.		
8. Performed four-shot compensation procedure.		
9. Lazed the target and record data.		
10. Performed shutdown procedures.		

OPERATE SINCGARS ICOM W/VIC-1 TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 6 (ALL)

TASK: Operate Single-Channel Ground and Airborne Radio System ICOM W/VIC-1 (061-275-8004)

CONDITIONS: Given a single-channel ground and airborne radio system (SINCGARS), intercommunications (ICOM) set (AN/VIC-1), operational secure net control station (NCS), electronic counter-countermeasures (ECCM), fill device with frequency hopping (FH) data, unit signal operating instructions (SOI), TM 11-5820-890-10-1, and DA Form 2404 (*Equipment Inspection and Maintenance Worksheet*) and distant station.

STANDARDS: Successfully prepare the SINCGARS (ICOM) with VIC-1 for operation; perform preventive maintenance checks and services (PMCS) and operator troubleshooting procedures; and correctly establish communications from a control box in all required modes with a distant station.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- SINCGARS ICOM, AN/VIC-1.
- Fill device with frequency hopping data.
- SOI.
- TM 11-5820-890-10-1.
- Operational distant station.
- DA Form 2404.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time (per Soldier): 15 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will check communications with the distant station and ensure that all equipment is operational.

INSTRUCTIONS TO THE CREWMAN: *"You must successfully prepare the SINCGARS (ICOM) with VIC-1 for operation; perform preventive maintenance checks and services (PMCS) and operator troubleshooting procedures; and correctly establish communications from a control box in all required modes with a distant station. You have 10 minutes to complete the task. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	***GO***	***NO-GO***
1. Initiated DA Form 2404.		
2. Performed safety safeguards.		
3. Performed operator's PMCS and troubleshooting procedures.		
4. Prepared intercommunications set for operations.		
5. Prepared SINCGARS for operation.		
6. Operated radio set in SC mode. Performed radio check with NCS.		
7. Operated SINCGARS in FH mode. Performed secure radio check with the NCS.		
8. Operated SINCGARS in data mode.		
9. Used remote operation.		
10. Performed operator's troubleshooting procedures.		
11. Performed stopping procedures.		

CONSTRUCT A TERRAIN SKETCH TEST STATION TEST ADMINISTRATIVE GUIDE STATION 7 (ALL)

TASK: Construct a Terrain Sketch (061-283-5002), STP 6-13F14-SM-TG

CONDITIONS: You will be given a observer location, map with OF fan, declinated compass, binoculars, a pad of paper, pencils, an information sheet containing a zone of observation and responsibility, a location of three fired-on targets, and the location of a registration point and an object to be center reference point (CRP).

STANDARDS: Present an accurate panoramic representation of the terrain in the zone of observation and responsibility. Indicate the location of all three targets and the registration point. Complete the terrain sketch within 10 minutes.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Declinated compass.
- Tactical overlay with zone of supported unit, location of three fired-on targets, a registration point, and object to be CRP.
- Map with OF fan.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time (per Soldier): 15 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will select an area with a panoramic view of surrounding terrain, such as an OP, and have pencils available for the Soldier.

INSTRUCTIONS TO THE CREWMAN: *"You are currently located at an OP. Your grid location is as follows: __________________. You must successfully construct a terrain* *sketch with direction measured within ±100 mils of actual direction in accordance with FM 6-30. You have 10 minutes to complete the task. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	***GO***	***NO-GO***
1. Drew skyline.		
2. Drew intermittent crests, hills, and ridges.		
3. Drew natural terrain features.		
4. Drew all manmade objects.		
5. Measured the direction to all known points, reference points, and terrain features.		
6. Labeled all points with direction and name of point using "T" format.		
7. Labeled observer's name, date, and location in lower right corner.		

RECOGNITION OF COMBAT VEHICLES TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 8 (ALL)

TASK: Recognition of Combat Vehicles

CONDITIONS: You will be seated at the computer and administered the computer-assisted ROC-V (Visible) posttest (all FIST, COLT, and Knight) and the ROC-V (1st or 2nd Gen) BFIST/Knight.

STANDARDS: Each Soldier will achieve a minimum score of 70 on each sub-test (ROC-V Visible, SMCT, ROC-V [1st or 2nd Gen if equipped with night-vision sights]).

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Computer hardware/software requirements as specified in POI for ROC-V.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 30 minutes
- Total time (per Soldier): 35 minutes

OTHER INFORMATION: The commander must determine the appropriate threat vehicles to include in the record test based on METL. The ROC-V instructor module allows the selection of combat vehicles to be included. The program of instruction (POI) for ROC-V Train-the-Trainer, ROC-V (Visible), ROC-V (1st Gen), and ROC-V (2nd Gen) are available on CD-ROM and at http://rocv.army.mil/rocv/ROCV_desc.php.

INSTRUCTIONS TO THE CREWMAN:

ACTION: Complete Visible Posttest.

1. Select the posttest button and allow the test to load. An image will appear on the screen.

2. Select the vehicle name from the choices presented on the screen.

3. The next image will appear. Repeat step.

4. When finished with the last vehicle, an AAR will appear. You may scroll to view the entire screen. The AAR summarizes how well you identified the targets in the images. The answers you correctly gave are shaded in green. Incorrect answers are colored red. If you answered both correctly and incorrectly for the same target during the testing process, the button will appear with both green and red. Clicking in a red box will show your answer along with the correct vehicle so that you may see the differences between the two.

5. Click on the Next button.

6. This will end the posttest and you will be taken to the ROC-V main menu.

ACTION: Complete the SMCT Test.

1. Click on the SMCT Test button.

2. The Login Screen appears. Complete login information screen and click on the Next button.

3. Select type and difficulty level for the test you would like to take. Click on the Next button.

4. Complete the SMCT test.

5. When finished with last vehicle, another AAR like the first will appear. Click on the Next button to continue.

6. This will end the SMCT test and you will be taken to the ROC-V main menu.

"Do you understand the requirements of this test? Do you have any questions? You may begin." (Start the time.)

PERFORMANCE MEASURES: The performance measures for this task are included in the computer-based training and pre-/posttests. As demonstrated levels of performance increase, the time standards may be adjusted to increase the degree of difficulty of the tasks or to simulate combat conditions as required.

SECTION II – FIRE SUPPORT TABLES

3-27. The fire support tables are designed to train the observer teams in the fire support tasks necessary to provide timely and accurate indirect fires in support of the maneuver commander's intent. The tables provide a structure of progressive, gated training from individual through FIST to live-fire qualification at the artillery team level.

FIRE SUPPORT TABLE I: INDIVIDUAL TASKS

3-28. Tasks listed in FS Table I are the basic individual tasks that members of the FIST must master before proceeding to team-level tasks. Once the FIST has demonstrated proficiency in the basic skills required to set up and operate the equipment by successfully completing the ASPT, they use those skills to perform the basic tasks listed in Table I. The training on the basic individual tasks in FS Table I and basic team tasks in FS Table II (page 3-26) should be trained and evaluated during the weekly Sergeant's Time/team training. Sample questions are available on the Fires Knowledge Network, Master Gunner Site for the commander's use in developing an examination for Table I tasks.

FS Table I – Basic FIST skills (individual).

Task Number	*Task Title*	*Reference*
Skill Level 1		
Subject Area 2: Map Reading (SL 1)		
071-074-0002	Determine a Grid Azimuth Using an M2 Compass	STP 6-13F14-SM-TG
071-329-1004	Determine the Elevation of a Point on the Ground Using a Map	STP 6-13F14-SM-TG
071-329-1009	Convert Azimuths	STP 6-13F14-SM-TG
071-329-1014	Locate an Unknown Point on a Map and on the Ground by Intersection	STP 6-13F14-SM-TG
071-329-1015	Locate an Unknown Point on a Map and on the Ground by Resection	STP 6-13F14-SM-TG
071-510-0001	Determine Azimuth Using a Protractor	STP 6-13F14-SM-TG
071-510-0002	Compute Back Azimuth	STP 6-13F14-SM-TG
071-520-0001	Orient a Map Using an M2 Compass	STP 6-13F14-SM-TG
113-610-2044	Navigate Using the AN/ PSN-11	STP 6-13F14-SM-TG
Subject Area 3: Communications (SL 1)		
061-275-8004	Operate SINCGARS ICOM w/VIC-1	STP 6-13F14-SM-TG
061-275-8007	Operate in a Radiotelephone Net	STP 6-13F14-SM-TG
061-275-8010	Use Field Wire Laying Techniques	STP 6-13F14-SM-TG
Subject Area 4: Digital Operations (SL 1)		
061-299-5004	Maintain TAFCS Communications	STP 6-13F14-SM-TG
061-300-5003	Incorporate the Printer into the TAFCS	STP 6-13F14-SM-TG
061-300-5006	Process Geometry Data in the TAFCS	STP 6-13F14-SM-TG
061-300-5007	Update Unit Data in TAFCS	STP 6-13F14-SM-TG
061-300-5010	Configure Received Message Types	STP 6-13F14-SM-TG
061-300-5011	Process Messages for Transmission	STP 6-13F14-SM-TG
061-300-5012	Disseminate Information Via Data Distribution	STP 6-13F14-SM-TG

FS Table I – Basic FIST skills (individual).

Task Number	***Task Title***	***Reference***
061-300-5013	Enter Commander's Guidance into the TAFCS	STP 6-13F14-SM-TG
061-300-5014	Prepare the TAFCS for Fire Mission Processing	STP 6-13F14-SM-TG
061-300-5015	Process Target Information	STP 6-13F14-SM-TG
061-300-5033	Initialize the AFATDS	STP 6-13F14-SM-TG
061-300-5034	Shut Down the AFATDS Workstation	STP 6-13F14-SM-TG
061-300-5035	Manage Map Functions	STP 6-13F14-SM-TG
061-300-5045	Run Munitions Calculator	STP 6-13F14-SM-TG
061-300-5046	Initiate a Target List Search	STP 6-13F14-SM-TG
061-300-5047	Process a Received Fire Support Munitions Restriction Guidance Using an AFATDS	STP 6-13F14-SM-TG
061-300-5134	Manage the Master Unit List (MUL) Using AFATDS	STP 6-13F14-SM-TG
061-300-5182	Load AFATDS Software	STP 6-13F14-SM-TG
061-300-5183	Process Survey Control Point Information	STP 6-13F14-SM-TG
061-300-5184	Process MET Data	STP 6-13F14-SM-TG
061-355-5104	Transmit Information Messages	STP 6-13F14-SM-TG
061-355-5109	Process Medical Evacuation Information	STP 6-13F14-SM-TG
061-299-5002	Maintain Support Data	STP 6-13F14-SM-TG
061-299-5101	Perform LCU Shutdown Procedures	STP 6-13F14-SM-TG
061-299-5105	Enter Firefinder Search Parameters	STP 6-13F14-SM-TG
061-299-5302	Retrieve Data from Artillery Target Intelligence Files	STP 6-13F14-SM-TG
061-299-5304	Build a Fire Plan	STP 6-13F14-SM-TG
061-299-5305	Process a FASCAM Fire Plan	STP 6-13F14-SM-TG
061-301-5002	Process an Area Fire Mission Using the AN/PSG-7	STP 6-13F14-SM-TG
061-301-5010	Process Graphics Data in the AN/PSG-7	STP 6-13F14-SM-TG
061-301-5011	Process Fire Plan Information Using the AN/PSG-7	STP 6-13F14-SM-TG
061-301-8000	Prepare the AN/PSG-7 for Operation	STP 6-13F14-SM-TG
061-301-8001	Perform Self-Location Using the AN/PSG-7	STP 6-13F14-SM-TG
061-302-8000	Enter Member and Authentication Data	STP 6-13F14-SM-TG
061-302-8001	Transmit Information Messages with the AN/PSG-7	STP 6-13F14-SM-TG
061-302-8002	Establish the AN/PSG-7 Operational Parameters	STP 6-13F14-SM-TG
061-355-5106	Initialize the Graphics Map	STP 6-13F14-SM-TG
061-355-5107	Process Monitored Messages	STP 6-13F14-SM-TG
061-355-5108	Process Routed Messages	STP 6-13F14-SM-TG
Subject Area 5: Observed Fire Procedures (SL 1)		
061-283-1001	Measure Direction Within the Target Area	STP 6-13F14-SM-TG
061-283-1002	Locate a Target by Grid Coordinates	STP 6-13F14-SM-TG
061-283-1003	Locate a Target by Polar Plot	STP 6-13F14-SM-TG
061-283-1004	Locate a Target by Shift from a Known Point	STP 6-13F14-SM-TG
061-283-1011	Engage Targets with Indirect Fires	STP 6-13F14-SM-TG

FS Table I – Basic FIST skills (individual).

Task Number	*Task Title*	*Reference*
061-283-5002	Construct a Terrain Sketch	STP 6-13F14-SM-TG
Subject Area 7: Fire Support Planning (SL 1)		
061-284-1011	Post Information on a Situation Map/Overlay	STP 6-13F14-SM-TG
Subject Area 8: Fire Support Vehicle Operations (SL 1)		
061-354-2000	Prepare the Targeting Head for Operation	STP 6-13F14-SM-TG
091-109-7000	Operate a Power Generator Set	STP 6-13F14-SM-TG
Skill Level 2		
Subject Area 1: Fire Support Vehicle Operations (SL 2)		
061-354-1002	Operate the Smoke Grenade Launchers	STP 6-13F14-SM-TG
061-354-5200	Prepare the Smoke Grenade Launchers	STP 6-13F14-SM-TG
Subject Area 10: Communications (SL 2)		
061-275-8014	Supervise the Operations of SINCGARS	STP 6-13F14-SM-TG
Subject Area 11: Digital Operations (SL 2)		
061-300-5052	Validate Movement Request	STP 6-13F14-SM-TG
061-300-5064	Process a Movement Order Using AFATDS	STP 6-13F14-SM-TG
061-300-5148	Verify Trigger Events	STP 6-13F14-SM-TG
061-355-5201	View, Update, or Transmit Database Records from the Graphics Map	STP 6-13F14-SM-TG
061-301-5001	Process a Precision Registration Mission Using the AN/PSG-7	STP 6-13F14-SM-TG
061-301-5006	Conduct a Final Protective Fire Mission Using the AN/PSG-7	STP 6-13F14-SM-TG
Subject Area 13: Laser Operations (SL 2)		
061-274-3987	Construct a Laser Range Safety Fan	STP 6-13F14-SM-TG
061-274-5200	Engage Targets with Copperhead Munition	STP 6-13F14-SM-TG
061-354-2007	Measure Cloud Height	STP 6-13F14-SM-TG
Subject Area 14: Fire Support Planning (SL 2)		
061-284-1001	Process Platoon Forward Observer Target List	STP 6-13F14-SM-TG

FIRE SUPPORT TABLE II: BASIC FIST SKILLS (TEAM)

3-29. The basic team tasks in FS Table II include both individual and team tasks that are prerequisites for successful execution of tasks in subsequent tables. Unit CATS provide guidance to train FS Table II tasks.

FS Table II – Basic FIST skills (team).

Task Number	*Task*	*Reference*
061-275-8013	Construct a Field Expedient Antenna	STP 6-13F14-SM-TG
061-275-8014	Supervise the Operation of SINCGARS	STP 6-13F14-SM-TG
061-276-1012	Install Antenna Group OE-254/GRC	STP 6-13F14-SM-TG
113-573-0002	Conduct Operations Security (OPSEC) Procedures	STP 21-24-SMCT

FS Table II – Basic FIST skills (team).

Task Number	*Task*	*Reference*
113-573-8006	Use an Automated Signal Operation Instruction (SOI)	STP 21-24-SMCT
061-300-5147	Input Trigger Events for the Current Situation	STP 6-13F14-SM-TG
061-300-5181	Load Digital Maps	STP 6-13F14-SM-TG
061-300-5185	Process a Fire Plan with AFATDS	STP 6-13F14-SM-TG
061-300-5186	Process Movement Data	STP 6-13F14-SM-TG
061-300-5200	Process Target Search Results	STP 6-13F14-SM-TG
061-300-5300	Determine Rules for a Trigger Event	STP 6-13F14-SM-TG
061-300-5400	Determine Commander's Guidance	STP 6-13F14-SM-TG
061-300-5401	Process Fire Support Plans	STP 6-13F14-SM-TG
061-299-5104	Enter and Process an Operations Order	STP 6-13F14-SM-TG
061-302-8000	Enter Member and Authentication Data	STP 6-13F14-SM-TG
061-301-5000	Process Recorded Target's and Known Points using the AN/PSG-7	STP 6-13F14-SM-TG
061-301-5007	Process Monitored Messages on the AN/PSG-7	STP 6-13F14-SM-TG
061-301-5008	Process Routed Messages as a FIST Using the AN/PSG-7	STP 6-13F14-SM-TG
06-1-A039	Participate in Fire Support Rehearsal Operations	ARTEP 6-115-MTP
06-1-A048	Plan Fires in Support of Maneuver Operations	ARTEP 6-115-MTP
06-1-A049	Participate in Rehearsal Operations (Company Fire Support Team)	ARTEP 6-115-MTP

FIRE SUPPORT TABLE III: OCCUPATION OF THE OP

3-30. Selecting and occupying the OP and positioning the FIST-V or BFIST in the maneuver formation are critical tasks that share many of the same requirements. The changing face of the asymmetrical battlefield under COE may have an impact on the use and importance of static OPs, but the tactical considerations in selecting and occupying an OP also apply to the physical location of the observer in a tactical formation. The tasks in FS Table III include establishing operations to most effectively accomplish the EFSTs necessary to support the commander's intent. This training should be conducted as a STX in a field environment. FS Table III is a gate for FS Table VIII.E.

FS Table III – Occupation of the OP

Task Number	*Task*	*Reference*
06-5-A006	Establish an Observation Post (Fire Support Team)	ARTEP 6-115-MTP
06-5-A047	Establish Fire Support Operations	ARTEP 6-115-MTP
061-301-8000	Prepare AN/PSG-7 (FED) for Operation	TM 11-7025-275-10 3, 4, 5, 6
061-283-2051	Establish an Observation Post	
061-355-5100	Prepare the FOS Device for Operation	STP 6-13F14-SM-TG
061-355-5102	Initialize the FOS Device	STP 6-13F14-SM-TG
061-355-5103	Establish Operational Parameters in FOS Device	STP 6-13F14-SM-TG
061-299-5000	Prepare TAFCS for Operation	STP 6-13F14-SM-TG
061-301-8000	Prepare the AN/PSG-7 for Operation	STP 6-13F14-SM-TG

FS Table III – Occupation of the OP

061-302-8002	Establish the AN/PSG-7 Operational Parameters	STP 6-13F14-SM-TG
061-355-5106	Initialize the Graphics Map	STP 6-13F14-SM-TG
061-300-5000	Prepare the TAFCS for Operations	STP 6-13F14-SM-TG
061-300-5001	Configure the TAFCS Database	STP 6-13F14-SM-TG
061-300-5002	Establish TAFCS Communication Configurations	STP 6-13F14-SM-TG
071-326-5703	Construct Individual Fighting Positions	STP 21-1-SMCT
052-191-1361	Camouflage Yourself and Your Individual Equipment	STP 21-1-SMCT
052-191-1362	Camouflage Equipment	STP 21-1-SMCT
191-376-4114	Control Entry to and Exit From a Restricted Area	STP 21-1-SMCT
301-371-1000	Report Intelligence Information	STP 21-1-SMCT
301-371-1050	Implement Operations Security Measures	STP 21-1-SMCT
071-331-0815	Practice Noise, Light, and Litter Discipline	STP 21-1-SMCT

FIRE SUPPORT TABLE IV: STANDARD FIRE MISSIONS

3-31. The tasks in FS Table IV are the standard fire missions, which include the basic skills that must be mastered before proceeding to FS Table V. These tasks should be trained during Sergeant's Time training using available simulation such as the call for fire trainer (CFFT), GUARDFIST II, or training set fire support observation (TSFO). These tasks should be trained using all tactical communications, digital entry devices, and day and night vision devices assigned to the section.

FS Table IV – Standard fire missions

Task Number	*Task*	*Reference*
061-301-5001	Process a Precision Registration Mission Using the AN/PSG-7	STP 6-13F14-SM-TG
061-354-2031	Conduct a High-Burst Registration	STP 6-13F14-SM-TG
061-283-2104	Conduct a Mortar Registration	STP 6-13F14-SM-TG
06-5-A008	Abbreviated PR	STP 6-13F14-SM-TG
061-283-1013	Conduct a Suppression Mission	STP 6-13F14-SM-TG
061-283-1014	Conduct an Immediate Suppression Mission	STP 6-13F14-SM-TG
061-283-2051	Establish an Observation Post	STP 6-13F14-SM-TG
061-283-2104	Conduct a Mortar Registration	STP 6-13F14-SM-TG

FIRE SUPPORT TABLE V: SPECIAL FIRE MISSIONS

3-32. The missions in FS Table V use many of the same procedures as the standard fire missions in Table IV, such as target identification and location and elements of CFF but require different tactics, techniques, and procedures (T,T,P) because of the differences in munitions, method of fire, delivery means, or other unique requirements. FS Table V tasks should be trained under the same conditions as discussed for FS Table IV using available simulation.

FS Table V – Special fire missions.

Task Number	*Task*	*Reference*
061-283-2023	Conduct a Quick Smoke Mission	STP 6-13F14-SM-TG 4, 5, 6
061-283-2021	Conduct an Immediate Smoke Mission	STP 6-13F14-SM-TG 4, 5, 6
061-283-2002	Conduct Final Protective Fires	STP 6-13F14-SM-TG 4, 5, 6
061-283-1021	Conduct Coordinated Illumination Conduct a SADARM Mission	STP 6-13F14-SM-TG
061-283-2206	Request Fire on Irregularly Shaped Targets	STP 6-13F14-SM-TG
061-284-5005	Control Close Air Support	STP 6-13F14-SM-TG
061-284-5006	Engage a Moving Target with Indirect Fire	STP 6-13F14-SM-TG
06-1-A050	Coordinate, Direct, and Adjust Other Fire Support Assets	ARTEP 6-115-MTP

FIRE SUPPORT TABLE VI: LETHAL AND NONLETHAL FIRES AND EFFECTS PLANNING

3-33. To be published in a subsequent revision of this FM.

FIRE SUPPORT TABLE VII: TRAINING

3-34. Table VII (table 3-7) integrates the fire missions and tasks of previous tables to provide a means to evaluate all tasks in a dry status prior to live fire. This table is a gate for live-fire qualification, and must assess performance of all critical tasks listed in Table VIII.E, Qualification. Table VII tasks will be evaluated during an STX or LTX using available simulations, such as CFFT.

FS Table VII – Training

Task Number	*Task*	*Reference*
06-5-A047	Establish Fire Support Operations	ARTEP 6-115-MTP
06-5-A006	Establish an Observation Post	ARTEP 6-115-MTP
06-2-A000.06-C000	Establish and Maintain Communications	ARTEP 6-115-MTP
06-5-A008	Conduct Fire Missions (Fire Support Team)	ARTEP 6-115-MTP

EVALUATION

3-35. Annually, each FIST/COLT/Knight must be externally evaluated on the missions and tasks in Table VII as a gate prior to Table VIII.E or other LFX. Senior FS personnel from the battalion/squadron, and brigade/regiment FSEs should evaluate the company-level FISTs in coordination with the battalion master gunner. This is a commander’s evaluation with the primary staff responsibility assigned to the battalion master gunner. The selection of qualified evaluators will depend on the unit’s assets, mission, and the prior training of personnel available.

3-36. The collective tasks in table 3-6 are the MTP tasks to be evaluated. Training support packages (TSPs) have been developed and are available on the Fort Sill Training and Doctrine Web Site to support Table VII, Evaluation. The TSPs (0011A Company FIST, 105-mm Towed; 0012A Company FIST 155-mm SP) contain the orders, scenario, and supporting materials to conduct an evaluation using available simulation (TSFO, GUARDFIST II, CFFT). The simulation must facilitate the use of tactical communications and digital devices.

FIRE MISSIONS

3-37. The following types of fire missions may be evaluated under Task 06-5-A008, Conduct Fire Missions (Fire Support Team). The commander must determine, based on his METL assessment, which fire missions will be evaluated. Simulation provides an opportunity to plan and conduct missions with munitions that may not be fired live because of safety limitations such as FASCAM.

- Request and Adjust Area Fire (Voice and Digital)
  - Adjust fire, low-angle, forward observer
  - Adjust fire, forward observer using: G/VLLD or radar observed
  - Adjust fire, high-angle, forward observer
  - Adjust Fire, high-angle, forward observer G/VLLD or radar observed
  - Adjust fire, coordinated illumination
  - Adjust fire, simultaneous missions
  - Adjust illumination
  - Adjust smoke
  - Adjust FPF
- Conduct a Registration
  - Conduct precision registration
  - Conduct registration with radar
  - Conduct HB/MPI registration, with at least two observers
  - Conduct an abbreviated registration
- Fire for Effect Missions
  - Time on Target (TOT); at my command (AMC); TOT
  - Large segmented target/irregular shaped target
  - FASCAM (target of opportunity)
  - Priority target; or final protective fire
  - Immediate suppression
  - Immediate smoke
  - Schedule of fire/fire plan
  - Engage a moving target, AMC, or TOT
  - SADARM

EVALUATION PROCEDURES

3-38. Time is a critical factor in most, but not all, fire missions. In some missions, correct procedures are more important than observer time standards. For missions such as Registrations and Adjustment of Final Protective Fires (FPF), the critical factors for a successful mission are accurate target location and correct procedures, not time. Fire Mission grading procedures are provided in appendix B.

> ***Note***: A single time standard for observer times will be used for evaluating fire missions. This time standard does not reflect a difference between manual and digital procedures and may differ from the time standards published in ARTEP manuals.

3-39. The evaluation of Table VII tasks should replicate as closely as possible the conditions under which Table VIII.E, Live-Fire Evaluation, will be conducted. The critical evaluation criterion for Table VII tasks is ensuring that the FS section/team being evaluated can safely call for and adjust indirect fires.

Table VII Evaluation Scenario (Sample)

TASK 1: Establish an Observation Post, 06-5-A006:

SUBTASKS:

1. Establish Fire Support Operations, 06-5-A047
2. Establish and Maintain Communications, 06-2-A000.06-C000

CONDITIONS: The FIST/COLT/Knight is provided an operation order and tactical overlays and briefed that the supported unit is conducting combat operations. The enemy situation requires continuous observation of the battle area. EFSTs have been assigned to the FIST/COLT/Knight for execution.

STANDARDS: See ARTEP 6-115-MTP (06-5-A006, 06-5-A047, 06-2-A000.06-C000)

TASK 2: Conduct Fire Missions (Fire Support Team) 06-5-A008:

SUBTASKS: Selected fire missions from those listed in paragraph 3-10.b (page 3-29). Based on the commander's METL assessment, these missions will be evaluated using the evaluation criteria on the sample score sheets (appendix B). The FIST/COLT/Knight team must achieve a minimum score of 70 percent on all missions evaluated. The evaluation of training tasks in Table VII is the confirmation that the team/section can perform all fire missions on the unit METL to standard. The limited training resources available are inadequate to support a live-fire evaluation of every FIST/COLT/Knight on every fire mission. Follow-on Live-Fire Exercises for Artillery (Table VIII) must be multi-echelon and provide concurrent training for all elements of the artillery system.

AFTER-ACTION REVIEW (AAR)

3-40. The evaluator will conduct an AAR of all tasks and missions evaluated in Table VII. The time allocated for Table VII must include sufficient time for retraining and reevaluating any task not achieving a GO.

BFIST TABLE VII.A

3-41. Bradley Tables I-VIII are gates for the integrated direct/indirect fire tables. The master gunner should coordinate the scheduling of the BFIST tables with the supported units' Bradley Fighting Vehicles (BFV) tables. BFIST Table VII.A and Tables VIII.A and B (Day/Night) should be scheduled together over a 2-day period to reduce orientation and setup time. The objective is to integrate direct and indirect fires to form a team collective effort that train TTP to the task standards required.

DEVELOPMENT OF EXERCISE

3-42. Units determine specific threat target types and engagement distances. Chapter 8 of FM 3-22.1, FM 6-30, and this chapter provide evaluation procedures and standards. Certain guidelines apply to all BFIST tables.

Concept of the BFIST Tables

3-43. Leaders use a "scenario-based training" concept to develop the BFIST tables, which they resource based on the unit METL. Each engagement's tactical scenario includes battlefield awareness, situational awareness, and SOPs. The crew then makes decisions based on this scenario.

Example 1. The BFIST crew occupies an OP position behind an infantry company in the defense. The crew is presented with a moving Bronevaya Maschina Piekhota–Soviet Armored Troop Carrier (BMP) at 1,200 meters, an RPG team at 600 meters, and a T-72 at 4,000 meters. The crew should report the BMP and the RPG team and should initiate a report to the maneuver commander on the T-72. The maneuver commander then makes the tactical decision to request fire on the T-72.

Example 2. The BFIST crew has pushed forward with a dismounted scout section and set up an OP. The BFIST's EFST is to place fires on the attacking enemy's tank elements and then engage the direct-fire targets. The BFIST crew occupies a turret-defilade position. They are presented with or are engaged by (signature device) an RPG team at 400 meters and a T-72 at 3,000 meters. They should engage the RPG team first, and then initiate a fire mission on the T-72.

General Requirements

3-44. BFIST Table VII.A. is a gate for BFIST Tables VIII.A and B, Integrated Indirect and Direct Fire Qualification. Leaders conduct BFIST qualification in accordance with the guidelines and standards in this chapter and in chapter 8, FM 3-22.1.

- The Brigade FSO develops an OPORD to support the execution of the mission.
- The unit master gunner coordinates all necessary resources and personnel to support the gunnery exercise and coordinates the schedule with the supported unit's BFV tables and crew gunnery training.
- The crews or FISTs will operate, scan, and laser targets in FIST mode. They will engage direct-fire targets in gun mode. This trains them to maintain their weapons status for their primary mission.
- BFIST crews must fire these tables in order to receive proper training on the total vehicle operation. They must train as much as possible to ensure that they can smoothly move from FIST mode to gun mode. They must know how to quickly and accurately reacquire target(s) and engage with the 25 mm or coax.

FIST TABLE VIII

3-45. Executing the qualification tables for FISTs/COLTs/Knights is the culminating event for section/team qualification and includes all of the critical tasks that an observer team or section must master to qualify as combat ready. The unit training plan must be coordinated with the supported units' conduct of BFV tables or qualification of direct fire systems such as the RWS on the Stryker vehicle and the HMWVV.

STRYKER/KNIGHT TABLE VIII.A

MK-19 RWS

3-46. Vehicle commanders equipped with the MK-19 RWS will have passed the MK-19 RWS Skills Test (table 3-2) within the previous 3 months and received a GO on qualification in accordance with the Stryker Weapons Proficiency Qualification (SWPQ) table standards listed in table 3-3 (page 3-34) within the previous 6 months before executing FS Table VII A.

Table 3-2. MK-19 RWS skills test.

MK-19 Remote Weapon Station Qualification			
Day Qualification	***Rounds***	***Frequency***	***DODIC***
Task 1. Zero	4	4	B584
Task 2.	7	4	B584
Task 3.	7	4	B584
Task 4.	7	4	B584
Task 5.	14	4	B584
Task 6.	7	4	B584
Task 7.	7	4	B584
Task 8.	7	4	B584
Task 9.	7	4	B584
Task 10.	14	4	B584
Task 11.	7	4	B584
	Total	352	
Note: The table is conducted once for practice and once for record.			

M2 CAL .50 RWS QUALIFICATION

3-47. Vehicle commanders equipped with the M2 Cal .50 RWS will pass the M2 Cal .50 RWS Skills Test (table 3-4, page 3-35) within the past 3 months and receive a GO on qualification in accordance with the SWPQ table standards listed in table 3-5 (page 3-35) within the past 6 months.

Table 3-3. MK-19 SWPQ table

Task	*Target*	*Rds*	*Time/ Secs*	*Standards GO/ NO-GO*	*Target Set*
1. Confirm Zero	Dismounted infantry, 400m	4	N/A	2 rds in 10 m	
2. Engage stationary target (stationary).	Dismounted infantry, 400-600 m	7	50/30	1 x rd w/in 10 m	7 x IRETS 1 x bank of 4 1 x bank of 3
3. Engage stationary target (stationary). CBRN	Infantry in trench, 400-600 m	7	50/30	1 x rd w/in 10 m	6 x IRETS 2 x banks of 3 1 x 10-m trench
4. Engage stationary target (stationary). MANUAL OP	1 x frontal truck, 800-1,000 m	7	50/30	1 x tgt down Tgt sensitivity: 3 rds	1 x stationary truck

Table 3-3. MK-19 SWPQ table

Task	*Target*	*Rds*	*Time/ Secs*	*Standards GO/ NO-GO*	*Target Set*
5. Engage multiple targets (stationary).	1 x bunker, 200-400 m	7	50/30	Burst on target	CL IV 1 x fighting psn
	1 x trench, 200-400 m	7		1 x rd w/in 10 m	Same as Eng #2
6. Engage moving target (stationary). *SWING TASK	1 x flank truck, 600-800 m	7	50/30	1 x tgt down, Tgt sensitivity: 3 rds	1 x moving truck
7. Engage stationary target (moving).	1 x RPG team, 200-400 m	7	50/30	1 x rd w/in 10 m	3 x IRETS 1 x bank of 3
8. Engage moving target (stationary). NIGHT *SWING TASK	1 x flank truck, 800-1,000 m	7	50/30	1 x tgt down Tgt sensitivity: 3 rds	1 x moving truck
9. Engage stationary target (stationary). NIGHT	1 x window, 200-400 m	7	50/30	1 x round through window	1 x window
10. Engage multiple targets (stationary). NIGHT	1 x flank truck, 400-600 m	7	50/30	1 x tgt down (3 rds)	1 x stationary truck 3 x IRETS 1 x bank of 3
	1 x RPG Tm, 200-400 m	7		1 x rd w/in 10 m	
11. Engage stationary target (stationary). CBRN, NIGHT	1 x bunker, 200-400 m	7	50/30	Burst on target	CL IV 1 x fighting psn
Total Rounds		***88***			
Remarks:					

• RWS only	• Swing tasks – engagements #5 and #7
• 80% target location known; 20% unknown (must be engagements #6 and #9)	• Critical engagements (must pass) – 1 x CBRN engagement and any 2 x night engagements

Table 3-4. M2 cal .50 RWS qualification table

M2 Cal .50 Remote Weapon Station Qualification			
Day Qualification	***Rounds***	***Frequency***	***DODIC***
Task 1. Zero	14	4	A557
Task 2.	14	4	A557
Task 3.	14	4	A557
Task 4.	14	4	A557
Task 5.	28	4	A557
Task 6.	14	4	A557
Task 7.	14	4	A557

Table 3-4. M2 cal .50 RWS qualification table

M2 Cal .50 Remote Weapon Station Qualification			
Day Qualification	***Rounds***	***Frequency***	***DODIC***
Task 8.	14	4	A557
Task 9.	14	4	A557
Task 10.	28	4	A557
Task 11.	14	4	A557
Total		***728***	
Note. The table is conducted once for practice and once for record.			

Table 3-5. M2 cal .50 SWPQ table.

Task	***Target***	***Rds***	***Time/ Secs***	***Go/No-Go Standards;***	***Target Set***
1. Confirm Zero	Dismounted infantry, 400 m	14	N/A	Burst on target	
2. Stationary target (vehicle stationary)	Dismounted infantry, 400-600 m	14	50/30	1 x tgt set down	7 x IRETS 1 x bank of 4 1 x bank of 3
3. Stationary target (vehicle stationary)	Infantry in trench, 400-600 m, CBRN	14	50/30	1 x tgt set down	6 x IRETS 2 x banks of 3 1 x 10-m trench
4. Stationary target (vehicle stationary)	1 x stationary frontal truck, 800-1,000 m, MANUAL OP	14	50/30	1 x tgt down Tgt sensitivity: 3 rds	1 x stationary frontal truck
5. Multiple targets (vehicle stationary)	1 x bunker, 200-400 m	14	50/30	Burst on target	CL IV 1 x fighting position
	1 x trench, 200-400 m	14		1 x tgt set down	Same as Eng #2
6. Moving target (vehicle stationary) *SWING TASK	1 x moving flank truck, 600-800 m	14	50/30	1 x tgt down, Tgt sensitivity: 3 rds	1 x moving flank truck
7. Stationary target (vehicle moving)	1 x RPG team, 200-400 m	14	50/30	Tgt set down	3 x IRETS 1 x bank of 3
8. Moving target (vehicle stationary) *SWING TASK	1 x moving flank truck, 800-1,000 m, NIGHT	14	50/30	1 x tgt down Tgt sensitivity: 3 rds	1 x moving flank truck
9. Stationary target (vehicle stationary)	1 x window, 200-400 m, NIGHT	14	50/30	1 x round through window	1 x window

Table 3-5. M2 cal .50 SWPQ table.

10. Multiple targets (vehicle stationary)	1 x stat flank truck, 400-600 m	14	50/30	1 x tgt down (3 rds)	1 x stationary flank truck
	1 x RPG Tm, 200-40 0m, NIGHT	14		Tgt set down	3 x IRETS; 1 x bank of 3
11. Stationary target (vehicle stationary)	1 x bunker, 200-400 m, CBRN, NIGHT	14	50/30	Burst on target	CL IV 1 x fighting position
Total Rounds		***182***			
Remarks: • RWS only • Digital commo linked w/engagements • Swing tasks – engagements #5 and #7 • 80% target location known; 20% unknown (must be engagements #6 and #9) • Standards for each engagement – GO/NO-GO; suppress enemy only			• Critical engagements (must pass) – 1 x CBRN engagement and any 2 x night engagements • 182 rds cal .50 vs. 280 authorized day/night total • Standards for SWPC – Pass/Fail; must pass 70% of engagements (7 out of 10) Day/Night combined (must pass 2 x night engagements)		

BFIST TABLES VIII.A AND VIII.B

3-48. Chapter 8 of FM 3-22.1, this chapter, and FM 6-30 provide evaluation procedures and standards. Certain guidelines apply to all BFIST tables. Bradley Tables I-VIII and BFIST Table VII.A are gates for the integrated direct/indirect fire tables, BFIST Table VIII.A and B (Day/Night). All BFISTs must qualify on BFIST Tables VIII.A and B on an annual basis in accordance with STRAC guidance (see figure 3-1).

LIVE-FIRE REQUIREMENTS

3-49. Leaders conduct live-fire collective tasks on the range complex that provides the best available observed-fire targets, maneuver area, and direct-fire targets.

3-50. Leaders can conduct crew practice (BFIST Table VII) and qualification (BFIST Table VIII.A/B) on the same range; however, they use a different target-presentation sequence for each.

3-51. When the target array consists of more than one target, all targets are presented for a particular task simultaneously. They require crews to use proper battlefield analysis, situational awareness, and engagement techniques.

3-52. Targets should represent realistic threat arrays that a crew might encounter on the battlefield. Leaders can include friendly targets to emphasize the importance of fratricide training. Figures 3-2, 3-3, 3-4, and 3-5 (pages 3-37 through 3-39) provide examples of how the engagement sequence and range operation may be accomplished.

EVALUATED COLLECTIVE TASKS

- Plan Fires in Support of Maneuver Forces
- Participate in Rehearsal Operations
- Boresight an M7 BFIST
- Establish an Observation Post
- Conduct Fire Missions
- Engage Targets with 25-mm Cannon or Coaxial Machine Gun on M7 BFIST

Figure 3-1. Illustration of BFIST Tables VIII.A and VIII.B.

Stage 1: Conduct AA procedures in Assembly Area and prepare for 5-7 km road march.
Stage 2: Move point-to-point along route reporting progress to the release point (Baseline)
Stage 3: At the Release Point move to baseline and call laid and set to Tower.

- BFIST is set (no ammunition in the feeder)
- Once in BP1ADVR/FS9 starts Terrain sketch
- Cycle ghost round and initialize zeroing procedures for the 25-mm cannon and coax
- Not more than two BFIST on the range and then only if one is in the Clearing Pit

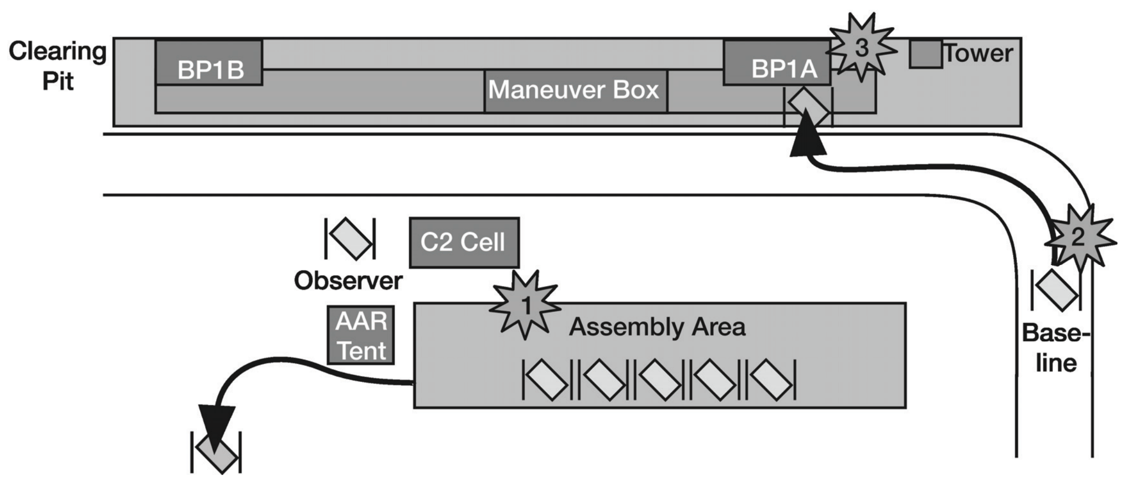


Figure 3-2. Illustration of BFIST Tables VIII.A and VIII.B, Stages 1-3.

Stage 4: Tower notifies BFIST: *"Scouts report that there are enemy armored vehicles to the front. Engage and report."*
Stage 5: BFIST identifies location of armor column, bases, and sends digital FFE to the FSE.
Stage 6: Tower notifies BFIST: *"Scouts report light armor vehicles to your front. Engage and report."*
Stage 7: BFIST engages target with direct fire.

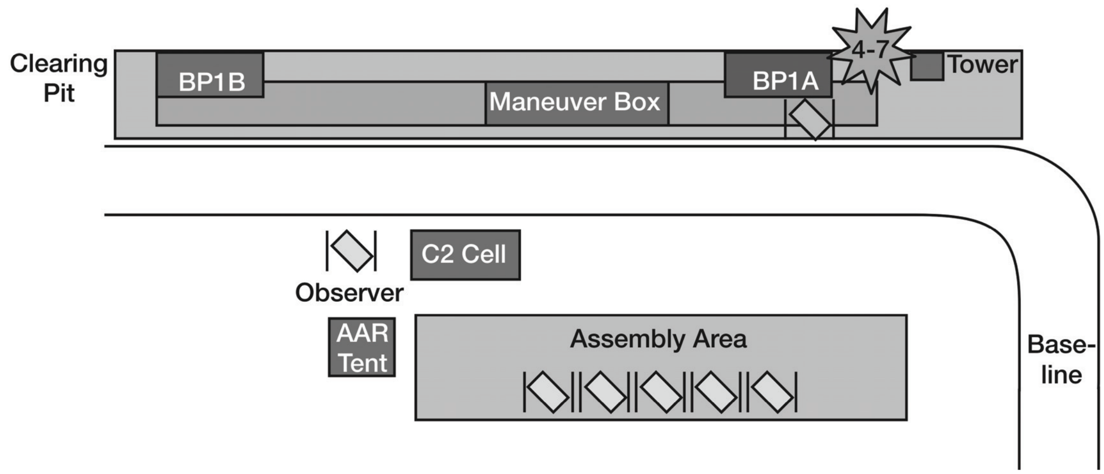


Figure 3-3. Illustration of BFIST Tables VIII.A and VIII.B, Stages 4-7.

Stage 8: BFIST suppresses the target, Tower reports. *"You are being engaged by direct fire. Provide Immediate Suppression and move out of BP1A on order to move to BP1B."*

Stage 9: When directed, BFIST moves out of BP1A. Tower instructs BFIST to identify and engage with indirect fires hostile armor while on the move and then occupy BP1B for corrections.

Stage 10: At EOM, Tower instructs BFIST: *"Start another terrain sketch and report when set."*

The next BFIST should exit the Assembly Area and start the land navigation route to the Baseline.

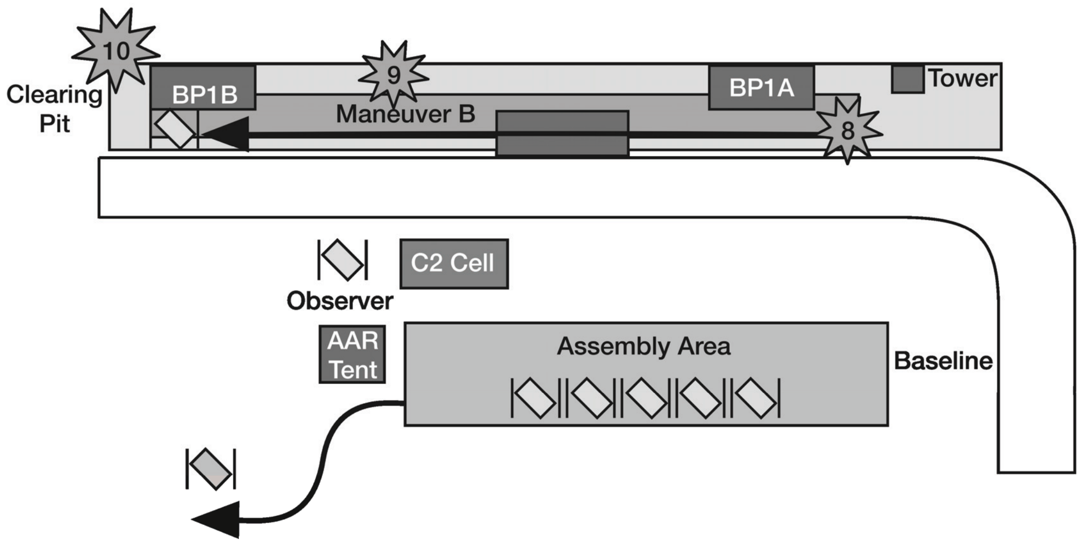


Figure 3-4. Illustration of BFIST Tables VIII.A and VIII.B, Stages 8-10.

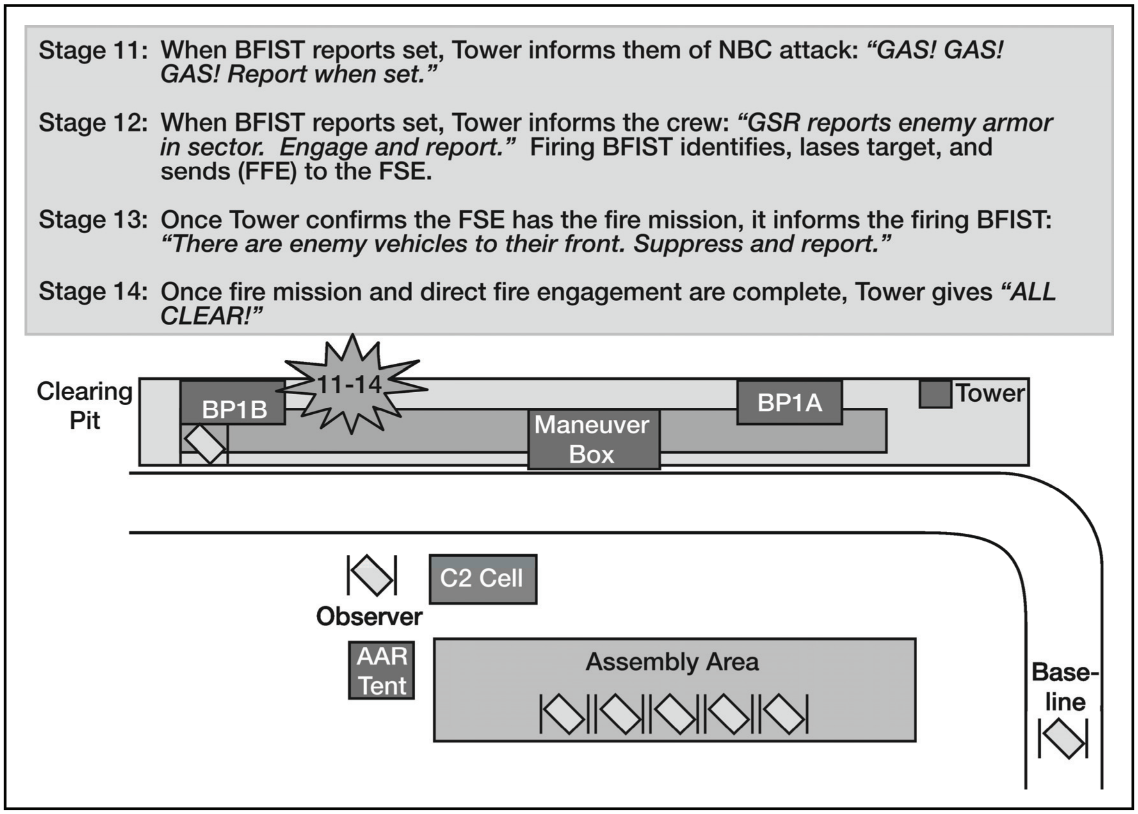


Figure 3-5. Illustration of BFIST Tables VIII.A and VIII.B, Stages 11-14.

AMMUNITION

3-53. Table 3-12 provides the required ammunition by quantity and type to conduct Tables VIII.A and B for each assigned BFIST.

Table 3-6. Ammunition for BFIST Tables VIII.A/B.

Ammunition for BFIST Tables VIII A/B		
Type	***DODIC***	***Quantity***
25-mm TPDS-T	A940	54
7.62 mm	A131	600
155 mm, HE	D544	36
Fuze, PD	N340	36
Prop Chg	DA12/DA13	36
120-mm Mortar	C623	36
Hoffman	LA06	30
Hoffman	LA07	30

3-54. The ammunition listed in Table 3-6 supports the engagements for Tables VIII.A/B as follows:

- BFIST Table VIII.A:
  - Three indirect-fire engagements (FA/120-mm mortar).
  - One 25-mm point engagement.
  - Two 7.62-mm coaxial engagements (one point and one area).

- BFIST Table VIII.B:
  - Three indirect-fire engagements.
  - Two 25-mm point engagements.
  - One 7.62-mm coaxial engagement (area).

PERSONNEL AND EQUIPMENT REQUIREMENTS FOR BFIST TABLES VIII.A/B

Personnel Support

3-55. The Command and Control cell consists of the brigade FSE with TF augmentation. The brigade FSO must coordinate with both the DS and FA Battalion and with the supported unit for artillery and mortar fire support. The FSO coordinates the range schedule to follow the Bradley Tables.

- OIC-Brigade FSO.
- NCOIC-Brigade FSNCO.
- RSO/OPS-2 X TF FSO.
- BFIST crew evaluators-3 X TF FSNCO.
- Bradley master gunner.

Equipment/Unit Support

- 155-mm Platoon.
- 1 X BFIST Observation Vehicle.
- 1 X Brigade FSE C2 Vehicle.
- 1 X 120-mm Platoon.

Minimum Standards

3-56. The crew must meet the following minimum standards:

- Engagement standards. Crews use the engagement standards from generic Bradley tasks for direct-fire targets. However, on indirect-fire missions, crews have 30 seconds to identify the target, give the proper fire command, lase the target, and send the fire mission. Scoring criteria follow:
  - T: Identify the target and send the fire mission within 20 seconds.
  - P: Identify the target and send the fire mission within 30 seconds.
  - U: Fail to identify the target or send the fire mission within 31 seconds.
- Task standards. Leaders use generic Bradley engagement task standards for BFIST direct-fire targets. Evaluators score the BFIST's proficiency in lasing, in using the proper fire command, and in transmitting the FR message during gunnery.
  - Target kill standards. During range setup, the master gunner records grid coordinates for all fire-mission targets. To receive target-kill credit, the crew must send the correct target grid (accurate to within 150 meters) to the FSE. For all fire missions, master gunners use the farthest targets on the range.
  - BFIST exposure matrixes. Leaders use generic Bradley exposure matrixes for BFIST direct-fire engagements. The BFIST crew engages indirect-fire targets from turret defilade. If the crew exposes the vehicle, then the BFV matrix standard applies in accordance with the conditions of the engagement and the threat vehicle's capability to engage the BFIST. Whether in the defense, the offense, or retrograde, the BFIST crew has 30 seconds to identify and engage indirect-fire targets.
  - Timing of the engagement. Time begins when the indirect-fire target is fully exposed (target locked). Evaluators time this engagement separately

from the self-defense engagement. For example, due to range and time limitations, all indirect targets have one condition—normal.

3-57. If the crew exposes the vehicle, leaders use the matrixes in chapter 8, FM 3-22.1. For example, target-exposure time for a stationary T-72 at 2,500 meters is 23 seconds.

- After the BFIST crew engages the indirect target, direct-fire targets are presented. Time target exposures separately for indirect-fire and direct-fire targets.
- Whether or not the BFIST crew engages the indirect-fire target, the direct-fire target(s) must appear as soon as the 30-second, indirect-fire period expires. Crew must pass all subtask standards in order to meet task standards.

Critical subtask standards

3-58. Evaluators use critical subtask standards to score the BFIST crew's ability to engage indirect-fire targets in less than normal operating conditions. Before the crew can meet a task's overall engagement standards, it must first meet the subtask standards. Until then, leaders consider the crew untrained on that task.

3-59. The crew engages all target(s) in the FIST mode.

- Gunner's engagement. The gunner uses his hand-station to identify and lase targets in the FIST mode. The gunner also operates the targeting-station control panel (TSCP).
- Commander's engagement. The commander uses his hand-station to identify and lase targets in the FIST mode.

Crew engagement

3-60. The crew switches to gun mode when presented with direct-fire targets. The gunner or the BC lases in FIST mode, switches to gun mode, and then reacquires the target for engagement.

Leader subtask standard

3-61. The leader subtask evaluates the BFIST commander's ability to control the crew, vehicle, MEP, and self-defense system. The BFIST commander must maintain control to synchronize reengagements and operate efficiently. He must also use the proper fire-mission commands for each indirect engagement and while engaging direct-fire targets.

FIST TABLE VIII.C

3-62. The final qualification table for all observer teams is the live-fire exercise. The tasks to be evaluated are identical to those in BFIST Table VII. Evaluation of fire missions will use the sample score sheets in appendix B and the grading procedures in appendix B. Units are resourced to live-fire 80 percent of their METL-related missions twice annually. The CATS and chapter 3, DA Pam 350-38 provide the commander with strategies and recommended events to train his unit. The commander must apply his METL and training assessment to determine a unit training plan that will best meet the needs of his training environment. The evaluation of FISTs during live-fire events must take advantage of multiple events. BFIST Table VIII.C. verifies BFIST Tables I-VII. The observer teams will have performed all tasks to standard prior to live-fire events. The live-fire evaluation is the run-level culmination of all previous training. In units with FIST elements assigned to maneuver commands, such as the Stryker Brigade and UA brigade combat teams (BCTs), the FSO must ensure that FISTs complete BFIST Tables I-VII prior to FA Battalion and Battery LFXs. The FSO will coordinate closely with the DS FA Battalion to integrate FISTs into all live-fire training and help coordinate supporting indirect fires for BFIST Tables VIII.A and B.

Chapter 4

Delivery Section Training

The artillery tables for field artillery delivery systems provide a methodology for training and evaluating individual and crew/section—tasks required to safely emplace; prepare for firing; fire; and displace all cannon, rocket, and missile systems.

INTRODUCTION

4-1. The methodology and format of the delivery section tables are identical to those presented in chapter 3, fire support tables. The tables provide a progressive, gated approach to conducting training to assist commanders in assessing and integrating training across the combined arms team. The tables also provide the means and tasks for C, W, R training for the section chief to use during sergeant's time training, as refresher training, or as a prelude to evaluating training. The contents of the ASPT and table I (page 4-52) provide the individual tasks and collective tasks to support routine training of sections and crews. This chapter includes the section/crew tasks from FM 6-50, FM 6-60, and FM 3-09.70 organized by howitzer delivery system and rocket/missile delivery system.

SECTION I. HOWITZER SECTION TABLES

ARTILLERY SKILLS PROFICIENCY TEST FOR HOWITZER SECTIONS

4-2. The ASPT evaluates the howitzer section member's ability to execute selected crew skills. The tasks listed in this chapter give the unit commander a means to evaluate the howitzer section member's basic proficiency prior to LFXs. The ASPT can also be used to assess section strengths and weaknesses. The commander, master gunner, and battery leaders should use ASPT results when structuring the unit's annual gunnery training program.

REQUIREMENTS

4-3. All MOS 13B personnel and any personnel assigned to a howitzer section (regardless of MOS) will be given the ASPT. (Howitzer section members are required to pass the ASPT prior to howitzer section qualification.) To pass the ASPT, a Soldier must receive a GO on all stations. If a Soldier fails a task, he must be retrained and retested on that station until he receives a GO. Appropriate manuals and other references listed for each station must be used to prepare, administer, and evaluate the ASPT.

Note. Evaluators must pass the ASPT within six months prior to testing.

4-4. Evaluation Procedures. Detailed procedures for setting up and conducting the evaluation and for conducting the AAR are in chapter 3, section I, of this manual.

4-5. Test Stations. Each test station consists of a test administrative guide and criterion-scoring checklist.

TEST STATIONS

TEST STATIONS
1. Disassemble the breech mechanism test station
2. Assemble the breech mechanism test station
3. Perform micrometer test on the gunner's quadrant test station
4. Conduct gunner's quadrant end-for-end test test station
5. Identify and prepare artillery ammunition test station
6. Prepare a howitzer range card test station
7. Conduct gunner's qualification test test station
8. Measure site-to-crest using an M2 compass test station

DISASSEMBLE THE BREECH MECHANISM TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 1 (ALL)

TASK: Disassemble the Breech Mechanism

CONDITIONS: Given an operational howitzer.

STANDARDS: Disassemble the breech, firing mechanism, and obturator group as outlined in the technical manual without error. Perform all actions in a safe manner without damage to equipment or injury to personnel.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of giving the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Assigned section howitzer.
- Technical manual for assigned howitzer.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 4-8 minutes
- Total time (per section): 9-13 minutes

INSTRUCTIONS TO THE CREWMAN: "*While conducting the before-operations checks on your howitzer, you noted a malfunction in the breech mechanism. To troubleshoot the exact cause, you decide that the breech mechanism must be disassembled. However, you may not physically perform any action. You have 1 minute to select the section member(s) to perform this task and to assemble all required tools and manuals.*

At the end of 1 minute, the evaluator gives the following instructions to the section member(s) performing the task.

INSTRUCTIONS TO THE SECTION MEMBER: ”*You are to disassemble the breech mechanism, to include removing the breech block and firing mechanism. Even though this is a timed event, perform all actions in the prescribed safe manner. Do you understand the requirements of this test? Do you have any questions? You may begin.*” (Start the time.)

M102/M119A1	***M198***	***M109 Series***	***Points***
0-3:45	0-3:30	0-3:45	49
3:01-3:25	3:31-4:00	3:46-4:05	36
3:26-3:40	4:01-4:20	4:06-4:20	24
3:41-8:00	4:21-10:00	4:21-8:00	12
Longer than 8:00	Longer than 10:00	Longer than 8:00	0

ASSEMBLE THE BREECH MECHANISM TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 2 (ALL)

TASK: Assemble the Breech Mechanism

CONDITIONS: Given the components of the breech-block assembly disassembled in the previous task.

STANDARDS: Reassemble breech, firing mechanism, and obturator group as outlined in the technical manual without error. Perform all actions in a safe manner without damage to equipment or injury to personnel.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Assigned howitzer with section equipment.
- Appropriate technical manual.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 5-12 minutes
- Total time (per vehicle): 10-17 minutes

INSTRUCTIONS TO THE SOLDIER: "*Assume that you have repaired the malfunction in the breech mechanism. At this time, you will be evaluated on your ability to reassemble the breech mechanism to its original configuration. Are you ready? Do you understand the requirements of this test? Do you have any questions? You may begin.*" (Start the time.)

Performance Measures	*GO*	*NO-GO*
1. The breech mechanism was properly assembled in accordance with the appropriate operator's manual and in a safe manner.		
Note. M119 SERIES: Failure to use retaining tool or to perform firing pin test is an automatic NO-GO.		

M102/M119A1	*M198*	*M109 Series*	*Points*
0-3:30	0-4:00	0-4:15	25
3:31-4:00	4:01-4:30	4:16-4:35	15
4:01-4:20	4:31-4:50	4:36-4:50	10
4:21-12:00	4:51-15:00	4:51-12:00	5
12:01-Longer	15:01-Longer	12:01-Longer	0

PERFORM MICROMETER TEST
ON THE GUNNER'S QUADRANT TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 3 (ALL)

TASK: Perform Micrometer Test on the Gunner's Quadrant

CONDITIONS: Given a howitzer with Basic Issue List Items (BILI).

STANDARDS: Perform micrometer test on the gunner's quadrant as outlined in the technical manual without error.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer with BILI.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 1 minute
- Total time (per Soldier): 6 minutes

INSTRUCTIONS TO THE SOLDIER: "*Because of recent firing inaccuracies, the platoon leader has told each howitzer section to perform the micrometer and end-for-end tests on its gunner's quadrants. You (or any member of your section) will perform the micrometer test and announce any error and corrective action. After the micrometer test, do not remove the gunner's quadrant from the breech until told to do so by the evaluator. Do you understand the requirements of this test? Do you have any questions? You may begin.*" (Start the time.)

Performance Measures		*GO*	*NO-GO*
1.	Inspected the gunner's quadrant and the quadrant seats, plates, and planes for dirt, nicks, or burrs.		
2.	Set index arm at +10 and micrometer knob at 0.		
3.	Pointed the line-of-fire arrow toward the muzzle end.		
4.	Elevated or depressed tube to center bubble.		
5.	Set index arm at 0 and micrometer knob at 10.		
6.	Pointed line-of-fire arrow toward muzzle end.		
7.	Determined if micrometer is in error or not and described/demonstrated action to be taken if it was in error.		
8.	Followed correct procedures in performing the micrometer test (per the -10 technical manual for the howitzer).		

SCORING: If all GO ratings are awarded, determine points for the task by the speed of execution as outlined in the table below. If a NO-GO rating is awarded, award 0 points for the entire task.

Time (Seconds)	*Points*
0-0:30	25
0:31-0:40	20
0:41-0:50	15
0:51-1:00	10
1:01 or Longer	0

CONDUCT GUNNER'S QUADRANT END-FOR-END TEST TEST STATION TEST ADMINISTRATIVE GUIDE STATION 4 (ALL)

TASK: Conduct Gunner's Quadrant End-for-End Test

CONDITIONS: Given a howitzer with Basic Issue List Items (BILI); Soldier has completed the gunner's quadrant micrometer test.

STANDARDS: Soldier will conduct the gunner's quadrant end-for-end test to determine serviceability/error per the appropriate technical manual.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer with BILI.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 2 minutes
- Total time (per Soldier): 7 minutes

INSTRUCTIONS TO THE CREWMAN: *"Now that the micrometer test has been done, you (or any member of your section) will perform the end-for-end test on your gunner's quadrant. At the conclusion of the test: Leave the gunner's quadrant on the breech. Announce the error to the evaluator. Announce to the evaluator if the gunner's quadrant is serviceable or unserviceable. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures		***GO***	***NO-GO***
1.	Followed the correct procedures in performing the end-for-end test.		
2.	Announced the correct quadrant error.		

Performance Measures		GO	NO-GO
3.	Declared the quadrant unserviceable if the error exceeded ±0.4 mils or declared the quadrant serviceable if the error was less than 0.4 mils.		

SCORING: If all GO ratings are awarded, determine points for the task by the speed of execution as outlined in the table below. If a NO-GO is awarded, award 0 points for the entire task.

Time (Minutes)	*Points*
0-1:00	25
1:01-1:20	20
1:21-1:30	15
1:31-1:40	10
1:41-1:50	5
1:51-2:00	2
2:01 or Higher	0

IDENTIFY AND PREPARE
ARTILLERY AMMUNITION TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 5 (ALL)

TASK: Identify and Prepare Artillery Ammunition

CONDITIONS: Given ammunition, section equipment, assistance, and firing data.

STANDARDS: Select the correct projectile and/or fuze combination, fuze the projectile, set the correct setting, and prepare the announced charge. Round must be prepared in accordance with the firing data provided.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).

TEST PLANNING TIME:

- Administrative time: 10 minutes
- Test time: 10 minutes
- Total time (per Soldier): 20 minutes

EVALUATION PREPARATION: Setup: Ensure that all the equipment is available and ready for use. Use the references and the evaluation guide to score the Soldier’s performance. To evaluate this task requires inert munitions, training aids, computer-based training, or written examination. Sample questions are available on the Fires Knowledge Network, Master Gunner Site.

CAUTION

Handle all inert training aids as if they were live ammunition. Some of the projectiles are heavy enough to cause injury, so use caution at all times. Ammunition needs protection from improper handling. Ammunition should not be carried or transported when fused. Do not drop or throw ammunition. Do not spin fuzes. Smoking is not allowed within 50 feet of artillery weapons and ammunition. Take care to protect ammunition from weather such as rain, snow, ice, and extreme heat.

Note. Semifixed ammunition is characterized by an adjustable propelling charge. This charge is divided into increments or charges contained in cloth bags that are tied together with acrylic cord in numerical sequence. These charges are stored in a canister, which is loosely fitted to the projectile. The projectile and the canister are loaded at the same time. The primer is an integrated part of the canister. Semifixed ammunition is used in the 105-mm howitzer and may be fused or unfused.

Note. Separate-loading ammunition has four separate components: primer, propellant, projectile, and fuse. The components are issued separately. Separate-loading ammunition components are used in 155-mm howitzers.

Note. The propelling charge explosive train consists of the primer, igniter, and propellant.

Performance Steps

1. Select the proper shell-fuse combination (assisted by the ammunition team chief [ATC]) when firing data is given.
    a. Identify ammunition by color code and markings stenciled on the projectile and/or containers.
    b. Inspect and clean the projectile. Inspection criteria for projectiles require you to check for rust, nicks, burrs, and so forth.
    c. Remove the grommet from the projectile.
    d. Inspect the rotating band.
    e. Open all ammunition containers safely.
2. Prepare the projectile.
    a. Remove the lifting plug and inspect the fuze well. Ensure that the fuze well is clean and the threads are not stripped. Ensure that the projectile filler is not seeping through the fuze well.
    b. Remove the supplementary charge when firing VT fuzes.
    c. Select the correct fuze for the projectile being used.
        (1) The MTSQ M582 is the same fuze as the M577 except for an additional booster. The fuze is authorized for HE and WP projectiles. It is mated with the M18 fuze wrench, and the time is set with the M35 fuze setter in a counterclockwise motion. The fuze is shipped on black triangle 93.5 to 95.5, and set on black triangle 98.0 for super-quick action. The fuze contains a timing mechanism that may be set to function at any time from 2 to 200 seconds.

Performance Steps
(2) The proximity fuze M728 (VT) is an adjustable delayed arming fuze used against surface targets and is authorized for HE projectiles. It is mated with the M18 fuze wrench, and the time setting is set only in whole increments with the M27 fuze setter. The M728 contains a radio transmitter and/or detector with antennas and a power supply that performs the target function. The M728 fuze is a long intrusion fuze that requires the removal of the supplementary charge before placing the fuze on the projectile fuze well. This fuze can also be set in the PD mode.
(3) The proximity fuze M732 is a short intrusion VT fuze that does not require the removal of the supplementary charge when placed on HE projectiles. Time settings of 5 to 150 seconds (in whole increments) are set off by using the M27 fuze setter. The M18 fuze wrench is used to mate the M732 fuze on HE projectiles.
(4) The PD fuze M739A1 is a selective super-quick or delay-impact fuse. The M739A1 fuze is authorized for HERA and WP projectiles. It is mated with the M18 fuze wrench. The M739A1 fuze has a rain-insensitive sleeve that allows firing in heavy rain with reduced probability of downrange premature functioning.
(5) The M78 CP fuze is constructed especially for spotting and destroying concrete targets. The M78 fuze is used on the HE projectile. The M78 fuze must be used with the M25 booster; if it is not used, the projectile will not detonate on impact (dud). The M78 fuze and booster are placed on the HE projectile with the M16 fuze wrench.
(6) The mechanical time fuze M563 is used with flechette-loaded 105-mm projectiles. The fuze is shipped set on muzzle action, but time settings of 0.5 second to 100 seconds can be set by using the M34 fuze wrench.
(7) The MTSQ M564 fuze is used when a choice of time or super-quick action is desired. The M564 fuze is authorized for HE and WP projectiles. It is mated with the M18 fuze wrench. The fuze setting is set with the M34 fuze wrench. Time setting can be achieved between 2 and 100 seconds, with a separate setting for super-quick action.
(8) The mechanical time fuze M565 is used on base-ejecting projectiles. The M565 is placed on illumination, hexachloroethane (HC) smoke, and ICM projectiles with the M18 fuze wrench, and the desired fuze setting is set with the M34 fuze setter.
(9) The MTSQ M577 fuze is used with base-ejecting projectiles carrying payloads that are expelled during flight. The fuze contains a timing mechanism that may be set to function from 2 to 200 seconds in increments of tenths of a second. Three digital rotating dials indicate the time setting. The fuze is authorized for area denial artillery munitions (ADAM), RAAMS, illumination, ICM, DPICM, and M825 felt WP. It is mated with the M18 fuze wrench, and the time is set by using the M35 fuze setter in a counterclockwise motion. The fuze is shipped on black triangle 93.5 to black triangle 98.0 for super-quick action.
d. Seat all fuses (except the M78 CP fuze) with the M18 fuze wrench. Use the M16 fuze wrench to seat the M78 fuse.
3. Set the fuze with the proper fuze setter.
a. Set impact fuses for super quick or delay with the M18 fuze wrench.
b. The M18 fuze wrench is used to mate all fuses to projectiles, except the M78-series CP fuse. Point-initiating and/or base-detonating fuses are installed at the manufacturer.
c. Set the mechanical time fuze to the nearest 0.1 second with the proper fuze setter.
d. Set the proximity fuze (VT) with the proper fuze setter to the nearest second.
e. The M762, M767 series, and M782 fuses are set with the new PIAFS.

Performance Steps
4. Inspect and prepare the propellant. a. Cut the charge as announced. Ensure that the igniter tube is not loose, bent, or broken; the holes are sealed to keep the filler inside the igniter tube; and only light brown oxidation is present. b. In separate-loading ammunition, the igniter is in a red bag sewn to the center of the base increment of the propellant. When ignited by the primer, the igniter sends hot flaming gases around the charge to ignite the propellant. c. In separate-loading ammunition, the inspection criteria for the igniter pad requires a check for rips and tears to ensure that it is properly sewn on the base charge and no lumps are caused by moisture. It should have a sandy, gritty feel. d. Semifixed ammunition propellant comes in seven increments that are numbered 1 through 7 and are connected by a thin acrylic cord. Each increment is a different size since each is a premeasured amount of propellant. e. Inspecting the propellant includes removing the seven increments to ensure that all are present and in numerical order. Check the increment for rips, tears, lumps, and discoloration caused by moisture. Charge 5 includes pieces of metal foil that act as a decoppering agent to prevent buildup of brass in the cannon tube during firing. Charge 5 for 105-mm propellant will have lumps due to the decoppering compound. f. In separate-loading ammunition, the propellant charges come as a separate unit of issue sealed in canisters to protect the propellant. g. The 155-mm GB propellant is designed with zones 1 through 5. The bags are fastened together with four cloth straps sewn to the base and hand tied to the top of increment 5. The 155-mm GB propellant canisters contain two complete charges. h. The 155-mm WB propellant is designed with zones 3 through 7. Its basic configuration is the same as the GB. i. Charge 8 WB, M119 series, is a single increment 155-mm WB charge with a perforated igniter core tube extending through the center of the propellant and a flash reducer sewn to the forward end. Charge M119 series can only be used in the M109A2/A3 and the M198 howitzers. j. Charge 7 RB, M119A2, is a single increment zone 7 RB for firing in the M109A2/A3 and M198 howitzers. The forward end of each charge has four pockets sewn longitudinally to the circumference. Each of the four pockets contains 4 ounces of potassium sulfate to act as a flash reducer. Charge 7 RB can be used interchangeably with charge 8 WB with only a minor difference in muzzle velocity. k. The M203 propellant is a zone 8 charge designed to provide extended range for the M198 howitzer. The M203 propellant charge is a single increment, RB charge, with a central ignition core extending through the center of the charge for almost its entire length and a donut-shaped flash reducer at the forward end of the charge. The M203 propellant is used only with the M549A1 (loaded with TNT) RAP for use in the M198 howitzer. l. In separate-loading ammunition, the primer comes as a separate item of issue. Some 155-mm propellant canisters come with the MK2A4 primer inside. m. The M82 primer is used on all M198 series and M109 series. Inspection criteria for the M82 include checking for rust, pits, and corrosion. Normal brown oxidation is acceptable. Check to ensure that the primer has not been previously fired and to ensure that the end is sealed to keep the black powder in the primer. 5. Give the prepared round to the designated cannoneer.

INSTRUCTIONS TO THE CREWMAN: *"You must select the proper shell-fuse combination from the fuses and shells present, set the fuze (if required), and cut the charge in accordance with the announced firing data without error. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	***GO***	***NO-GO***
1. Selected the proper shell-fuse combination assisted by the ATC when firing data was given.		
a. Identified the correct ammunition.		
b. Inspected and cleaned the projectile.		
c. Removed the grommet.		
d. Inspected the routing band.		
e. Opened all ammunition containers safely.		
2. Prepared the projectile(s).		
a. Removed lifting plug and inspected the fuze well.		
b. Selected the correct fuze for the projectile being used.		
c. Seated the fuze with the correct fuze wrench.		
3. Set the fuze using the proper fuze setter.		
a. Set impact fuze for super quick or delay with the M18 fuze wrench.		
b. Set mechanical time fuze to the nearest 0.1 second with the proper fuze setter.		
c. Set proximity fuze (VT) with the proper fuze setter to the nearest second.		
4. Inspected and prepared the announced propellant charge(s) assisted by the ATC.		
a. Cut the charge as announced.		
b. Inspected the propellant.		
5. At the appropriate time, gave the prepared round to the cannoneer responsible for loading the weapon.		

PREPARE A HOWITZER RANGE CARD TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 6 (ALL)

TASK: Prepare a Howitzer Range Card

CONDITIONS: Given a battery/platoon position area with howitzers emplaced.

STANDARDS: You will prepare a howitzer range card in accordance with the procedures in FM 6-50.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- DA Form 5699-R (*Howitzer Range Card*).

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time (per Soldier): 15 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will select an area with howitzers in position and have pencils and blank DA Forms 5699-R available.

INSTRUCTIONS TO THE CREWMAN: *"You have occupied a firing position, are laid and ready to fire, and your section has begun position improvements. The platoon sergeant/chief of firing battery has assigned a primary sector of fire and directed that a howitzer range card be prepared. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	*GO*	*NO-GO*
1. The Soldier began a sketch of the area.		
2. Left and right limits and potential targets and/or reference points were in the sector of fire section.		
3. Targets were identified and/or reference points in his sketch were numbered in the order from the most probable to the least probable.		
4. The section chief sited (along the bottom of the bore) and directed the gunner to traverse and elevate or depress until the weapon was sighted on the left limit.		
5. The gunner turned the head of the pantel without traversing the tube onto the collimator (or primary reference point) and read the deflection from the reset counter (or azimuth and azimuth micrometer scale).		
6. The Soldier recorded the deflections on the range card in the spaces marked right DF and left DF. (If the left/right deflection is also the target, record the deflection in the DF column on the appropriate line for the target number.)		
7. The quadrant was measured and recorded in the quadrant column for each target and the measured quadrant and range was given to the FDC to be converted into a true quadrant (the true quadrant will then be recorded on the range card in the QE column).		
8. A brief description was annotated for each target in the description column.		
9. The section chief determined the shell, fuse, and charge to be fired for the appropriate columns.		
10. The remarks column was used to record additional information needed to engage the target.		

CONDUCT GUNNER'S QUALIFICATION TEST TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 7 (ALL)

TASK: Conduct Gunner's Qualification Test

CONDITIONS: The gunner's qualification test will be administered to all personnel assigned to a howitzer section, regardless of grade or MOS, on a semiannual basis. The test will include the tasks in the gunner test tasks table and may include additional tasks.

SUPPORTING COLLECTIVE TASKS				
Task Number	***Subject***	***Elements***	***Points per Element***	***Maximum Credit***
1	Lay the cannon for initial direction of fire using the aiming circle	1	4	4
2	Lay the cannon for initial direction of fire using the M2 compass	1	4	4
3	Lay the cannon for initial direction of fire using a distant aiming point	1	4	4
4	Lay another cannon reciprocally	1	4	4
5	Refer the piece	1	4	4
6	Align the collimator	1	4	4
7	Align the aiming post	1	4	4
8	Boresight the howitzer	5	4	20
9	Verify boresight with the M140/M139	1	4	4
10	Conduct fire missions	5	4	20
11	Direct fire	4	4	16
12	Lay a howitzer for quadrant with the range quadrant	1	4	4
13	Measure the quadrant with the range quadrant	1	4	4
14	Initialize the automatic fire control system (AFCS)	1	4	4
15	Prepare to fire using the AFCS	1	4	4
16	Conduct fire missions using the AFCS	1	4	4
17	Perform direct fire using AFCS	1	4	4
	Total Points Possible: 112			

STANDARDS OF PRECISION:

The following standards apply to all tasks evaluated. Failure to meet these standards will result in the loss of four points on each task.

- Settings must be exact. Bubbles in leveling vials must be centered exactly.
- The vertical crosshairs of the pantel reticle pattern must be aligned exactly on the left edge of the aiming posts, the 0 line of the collimator, or on exactly the same part of the designated aiming point each time the piece is laid.
- The last motion of elevating handwheel must be in the direction that raises cannon tube or direction of the greater resistance.
- The last motion of all knobs should be from lower to higher readings. For all knobs not associated with scales, the last motion should be clockwise. The last motion of the traversing handwheel should cause the howitzer or sighting device to approach aiming point from left to right. The last motion of the pitch/elevation and cross level control knobs will be in a clockwise direction.
- The appropriate deflection correction must be set on the correction counter.
- Read backs must be done while looking at and reading from the azimuth counter.
- Correct terms and hand and arm signals must be used.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- An in-briefing station.
- A chief examiner.
- An examiner for each station and an assistant if required.
- Six howitzers in the firing position with BILI.
- An aiming circle with communications.
- Two direct fire targets, 600 meters in front of the test site and 50 meters apart.
- At least one distant aiming point.

Recommended Grading Sheet			
Gunner's Name		***Section***	***Unit***
Section Chief		***Date***	***Weapon System***
Task			***Points Achieved***
Task 1	Lay a howitzer for initial direction of fire using the aiming circle		NO-GO = 0 Points Time____=____Points
Task 2	Lay a howitzer for initial direction of fire using the M2 compass		NO-GO = 0 Points Time____=____Points
Task 3	Lay a howitzer for initial direction of fire using a distant aiming point		NO-GO = 0 Points Time____=____Points
Task 4	Lay another howitzer reciprocally		NO-GO = 0 Points Time____=____Points
Task 5	Refer the piece		NO-GO = 0 Points Time____=____Points
Task 6	Align the collimator		NO-GO = 0 Points Time____=____Points
Task 7	Align the aiming posts		NO-GO = 0 Points Time____=____Points
Task 8A	Boresight the howitzer (pantel) with the test target		NO-GO = 0 Points Time____=____Points
Task 8B	Boresight the howitzer (elbow telescope) with the test target		NO-GO = 0 Points Time____=____Points
Task 8C	Boresight the howitzer (pantel) using a distant aiming point		NO-GO = 0 Points Time____=____Points
Task 8D	Boresight the howitzer (elbow telescope) using a distant aiming point		NO-GO = 0 Points Time____=____Points
Task 9	Verify boresight with the M140/M139 alignment device		NO-GO = 0 Points Time____=____Points
Task 10A	Conduct fire mission		NO-GO = 0 Points Time____=____Points
Task 10B	Conduct fire mission		NO-GO = 0 Points Time____=____Points
Task 10C	Conduct fire mission		NO-GO = 0 Points Time____=____Points
Task 10D	Conduct fire mission		NO-GO = 0 Points Time____=____Points
Task 10E	Conduct fire mission		NO-GO = 0 Points Time____=____Points

Recommended Grading Sheet		
Gunner's Name	***Section***	***Unit***
Section Chief	***Date***	***Weapon System***

Task		***Points Achieved***
Task 11A	Perform direct fire	NO-GO = 0 Points Time____=____Points
Task 11B	Perform direct fire	NO-GO = 0 Points Time____=____Points
Task 11C	Perform direct fire	NO-GO = 0 Points Time____=____Points
Task 11D	Perform direct fire	NO-GO = 0 Points Time____=____Points
Task 12	Lay a howitzer for quadrant with the range quadrant	NO-GO = 0 Points Time____=____Points
Task 13	Measure the quadrant using the range quadrant	NO-GO = 0 Points Time____=____Points
Task 14	Initialize the AFCS	NO-GO = 0 Points Time____=____Points
Task 15	Prepare for firing using the AFCS	NO-GO = 0 Points Time____=____Points
Task 16	Conduct a fire missions using the AFCS	NO-GO = 0 Points Time____=____Points
Task 17	Perform direct fire using the AFCS	NO-GO = 0 Points Time____=____Points
	Total Points	

TEST PLANNING TIME: 4 hours

- Administrative time: 2 minutes per task
- Test time: 10 seconds to 120 seconds per task
- Total time (per Soldier): 68 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will—

- Determine the exact data setting to be used throughout that particular test. The values for deflections, quadrants, and setups (that is, within "so many" mils) presented in the gunner's test are guides. Plus or minus 10 mils is acceptable, but must be consistent for all examinees on that test.

Note. Successful administration of the test is enhanced by efficiently organizating the testing site. The specific approach will depend on the availability of equipment, space, and qualified personnel to administer the test. Whenever possible, use multiple stations in a "round-robin" setup. Such an approach uses equipment more efficiently, particularly in tasks requiring the aiming circle or a second weapon. Also, each Soldier is exposed to a given task on the same equipment and evaluated by the same examiner.

Note. The tasks in this test should be used as a training tool. The Soldier should practice each task under close supervision to acquire the proficiency required by the standards stated in this test.

Note. This test can bolster the esprit and motivation of the Soldier by recognizing individual proficiency. The artillery clasp for the marksmanship badge will be awarded upon completing this test (see AR 600-8-22).

TASK SCORING: Scoring will be per the standards for each task. A NO-GO will be given if any of the standards of precision (page 4-19) or the standards of a specific task are not met, and 0 points will be awarded. If the Soldier receives all GO ratings for the standards, points for the task will depend on the speed of execution.

QUALIFICATION SCORES: Scores determining the qualification status of the gunner are shown in the tables below.

	Weapon/Score				
Classification	***M102***	***M119A1***	***M198***	***M109A2-A5***	***M109A6***
Expert gunner	92-84	72-64	84-75	92-84	92-84
Gunner first class	83-76	63-57	74-67	83-76	83-76
Gunner second class	75-66	56-50	66-58	75-66	75-66
Unqualified	65-0	49-0	57-0	65-0	65-0

INSTRUCTIONS TO THE CREWMAN: *"Brief all personnel on the conduct and purpose of the training. Explain the scoring system and standards of precision. Explain the organization of the training area and general administrative and safety procedures. Ask if there are any questions pertaining to any portion of the test."*

TASK 1: Lay a howitzer for initial direction of fire using the aiming circle (061-266-2004)

CONDITIONS: Soldier will be given a howitzer in the firing position with the cannon tube 50 mils off the AOF and at loading elevation (unit SOP). Bubbles will be level and special corrections are 0. An assistant examiner will operate the aiming circle, which will be located 50 meters to the left front of the howitzer. Soldier positions himself as gunner and announces when ready. The assistant examiner commands NUMBER 1 ADJUST, AIMING POINT THIS INSTRUMENT, DEFLECTION (XXXX).

TIME: Time will start on the last digit of deflection of the initial command and will stop when the assistant examiner states that NUMBER 1 IS LAID.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-29	-29	-34	-29	4
30-34	30-34	35-39	30-34	3
35-39	35-39	40-45	35-39	2
40-50	40-50	45-50	40-50	1
51-	51-	51-	51-	0

SCORE EXAMPLE: (M102 howitzer) If the Soldier performs task 1 in 29.59 seconds, he scores 4 points. If the Soldier performs task 1 in 50.59 seconds, he scores 1 point.

TASK 2: Lay a howitzer for initial direction of fire using the M2 compass (061-266-2003)

CONDITIONS: The Soldier will be given a howitzer in the firing position. The cannon tube is 50 mils off the AOF and at loading elevation (unit SOP). Bubbles will be level and special corrections at 0. An assistant examiner will be at the M2 compass located 10 meters to the left front of the howitzer. The Soldier positions himself as the gunner and announces when ready. The assistant examiner commands NUMBER 1 ADJUST, AIMING POINT THIS INSTRUMENT, DEFLECTION (XXXX).

TIME: Time will start on the last digit of the deflection of the initial command and will stop when the assistant examiner announces that NUMBER 1 IS LAID.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-17	-17	-22	-17	4
18-20	18-20	23-25	18-20	3
21-23	21-23	26-28	21-23	2
24-25	24-25	29-30	24-25	1
26-	26-	31-	26-	0

TASK 3: Lay a howitzer for initial direction of fire using a distant aiming point (061-266-2003)

CONDITIONS: Soldier will be given a howitzer in firing position with the cannon tube 50 mils off the AOF and at loading elevation (unit SOP). Bubbles will be level and special corrections at 0. The Soldier positions himself as gunner and announces when ready. The examiner commands NUMBER 1 ADJUST, AIMING POINT (NAME OF OBJECT AND LOCATION), DEFLECTION (XXXX).

TIME: Time will start on the last digit of the deflection of the initial command and will stop when the examiner states that NUMBER 1 IS LAID.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-17	-17	-22	-17	4
18-20	18-20	23-25	18-20	3
21-23	21-23	26-28	21-23	2
24-25	24-25	29-30	24-25	1
26-	26-	31-	26-	0

TASK 4: Lay another howitzer reciprocally (061-266-2002)

CONDITIONS: The Soldier will be given a howitzer in the firing position and already laid for initial direction of fire. Bubbles will be level and special corrections at 0. The pantel will be 50 mils off the howitzer to be laid. An assistant examiner will act as the gunner of the howitzer to be laid. The Soldier positions himself as gunner and states when ready. The examiner will say BEGIN.

TIME: Time will start when the examiner says BEGIN and will stop when the gunner says NUMBER 2 IS LAID.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine points.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-12	-12	-12	-12	4
13-15	13-15	13-15	13-15	3
16-18	16-18	16-18	16-18	2
19-20	19-20	19-20	19-20	1
21-	21-	21-	21-	0

TASK 5: Refer the piece (061-266-2231)

CONDITIONS: The Soldier will be given a howitzer in the firing position that has already been laid for initial direction of fire. Bubbles will be level and special corrections at 0. The pantel will be oriented on the collimator. An assistant examiner will be operating the aiming circle 50 meters to the howitzer's left front. The Soldier positions himself as the gunner and announces when ready. The assistant examiner commands NUMBER 1 REFER, AIMING POINT THIS INSTRUMENT.

TIME: Time will start on the word REFER and will stop when the last digit of deflection is announced.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-12	-12	-12	-12	4
13-15	13-15	13-15	13-15	3
16-18	16-18	16-18	16-18	2
19-20	19-20	19-20	19-20	1
21-	21-	21-	21-	0

TASK 6: Align the collimator (061-266-2000, 061-266-2001)

CONDITIONS: The Soldier will be given a howitzer in the firing position that has already been laid on the initial direction of fire. Bubbles will be level and special corrections on 0. An assistant examiner will be posted at the collimator, 4-15 meters off the howitzer's left front. The collimator will be on the tripod but will not be sighted in on the pantel and will not have its legs sandbagged. The Soldier positions himself as gunner and announces when ready. The examiner will say BEGIN.

TIME: Time will start when the examiner says BEGIN and will stop when the gunner states that the collimator is set.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-17	-17	-22	-17	4
18-20	18-20	23-25	18-20	3
21-23	21-23	26-28	21-23	2
24-25	24-25	29-30	24-25	1
26-	26-	31-	26-	0

TASK 7: Align the aiming posts (061-266-2000, 061-266-2001)

CONDITIONS: The Soldier will be given a howitzer in the firing position that has already been laid on the initial direction of fire. Bubbles will be level and special corrections on 0. The pantel will be oriented on the collimator. Aiming posts will be emplaced in the ground at 50 and 100 meters from the howitzer, but will not be aligned. An assistant examiner will be posted at the far aiming post. The Soldier will position himself as gunner and announce when ready. The examiner will say BEGIN.

TIME: The time will start when the examiner says BEGIN and will stop when the gunner states that the aiming posts are set.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-17	-17	-22	-17	4
18-20	18-20	23-25	18-20	3
21-23	21-23	26-28	21-23	2
24-25	24-25	29-30	24-25	1
26-	26-	31-	26-	0

TASK 8: Boresight the howitzer

TASK 8A: Boresight the howitzer (pantel) with the test target

CONDITIONS: The Soldier will be given a howitzer in the firing position. Bubbles will be level and special corrections on 0. The pantel will be 10 mils off the test target, and the cover of the detent shaft will be on. The cannon tube will be aligned on the test target, which will be posted 50 meters in front of the howitzer. Boresight will be off by 5 mils and the Soldier will be given the tools needed to adjust the sight. The Soldier will position himself as gunner and will announce when ready. The examiner will say BEGIN.

TIME: The time will start when the examiner says BEGIN and will stop when the gunner states that the howitzer is boresighted.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M109s*	
Time in Seconds		*Points*
-45	-45	4
46-60	46-60	3
61-89	61-89	2
90-120	90-120	1
121-	121-	0

TASK 8B: Boresight the howitzer (elbow telescope) with the test target (061-266-2005)

CONDITIONS: The Soldier will be given a howitzer in the firing position. The cannon tube is aligned on the test target but the elbow telescope will not be aligned on the test target. The test target will be located 50 meters in front of the howitzer, and the Soldier will be given the tools needed to adjust the sight. The Soldier will position himself as the gunner and announce when ready. The examiner will say BEGIN.

TIME: The time will start when the examiner says BEGIN and will end when the gunner states that the howitzer is boresighted.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine points.		

M102	***M109s***	
Time in Seconds		***Points***
-45	-45	4
46-60	46-60	3
61-89	61-89	2
90-120	90-120	1
121-	121-	0

TASK 8C: Boresight the howitzer (pantel) using a distant aiming point (061-266-2005)

CONDITIONS: The Soldier will be given a howitzer in the firing position. Bubbles will be level and special corrections on 0. The cannon tube will be aligned on the DAP, but the pantel will be aligned 10 mils off the DAP. Boresight will be 5 mils off, and the cover will be on the detent shaft (if applicable). The Soldier will be given the tools needed to adjust the sight. The Soldier will position himself as the gunner and will announce when ready. The examiner will say BEGIN.

TIME: The time will start when the examiner says BEGIN and will stop when the gunner states that the howitzer is boresighted.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-45	-45	-45	-45	4
46-60	46-60	46-60	46-60	3
61-89	61-89	61-89	61-89	2
90-120	90-120	90-120	90-120	1
121-	121-	121-	121-	0

TASK 8D: Boresight the howitzer (elbow telescope) using a distant aiming point

CONDITIONS: The Soldier will be given a howitzer in the firing position. The cannon tube will be aligned on the DAP, but the elbow telescope will not be aligned on the DAP. The Soldier will be given the tools needed to adjust the sight. The Soldier will position himself as assistant gunner and will announce when ready. The examiner will say BEGIN.

TIME: The time will start when the examiner says BEGIN and will stop when the assistant gunner states that the howitzer is boresighted.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M198*	*M109s*	
Time in Seconds			*Points*
-45	-45	-45	4
46-60	46-60	46-60	3
61-89	61-89	61-89	2
90-120	90-120	90-120	1
121-	121-	121-	0

TASK 9: Verify boresight with the M140/M139 alignment device (061-266-2239)

CONDITIONS: The Soldier will be given a howitzer in the firing position with level bubbles and special corrections on 0. The cannon tube will be at 0 mils elevation, and the azimuth counter will be set at 1600. The Soldier will be given an M140/M139 alignment device. The Soldier will position himself as gunner and will announce when ready. The examiner will say BEGIN.

TIME: The time will start when the examiner says BEGIN and will stop when the gunner states that boresight is either verified or not verified.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-17	-17	-17	-17	4
18-20	18-20	18-20	18-20	3
21-23	21-23	21-23	21-23	2
24-25	24-25	24-25	24-25	1
26-	26-	26-	26-	0

TASK 10: Conduct fire missions

Note. The missions in task 10 are one continuous mission.)

TASK 10A:

CONDITIONS: The Soldier will be given a howitzer in the firing position. The howitzer will be laid and both the collimator and aiming posts will be emplaced. The pantel will be aligned on the collimator. Bubbles will be level and special corrections will be at 0. The cannon tube will be oriented on the primary direction of fire and elevated to 315 mils. The Soldier will position himself as gunner and will announce when ready. The examiner will command FIRE MISSION, PLATOON ADJUST, NUMBER 1, 1 ROUND, SHELL HE, CHARGE (XX), fuze QUICK, DEFLECTION 3225 (M101A1 USE DEFLECTION 2825), QUADRANT 315.

TIME: The time will start on the last digit of the deflection and will stop when the gunner says READY.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-10	-10	-10	-8	4
11-12	11-12	11-12	9-10	3
13-14	13-14	13-14	11-12	2
15-16	15-16	15-16	13-14	1
17-	17-	17-	15-	0

TASK 10B:

CONDITIONS: Continuation from task 10A. The Soldier will announce when ready. The examiner will command SPECIAL CORRECTIONS, RIGHT 4, DEFLECTION 3194, QUADRANT 315.

TIME: The time will start on the last digit of deflection and will stop when the gunner states READY.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-11	-11	-11	-9	4
12-13	12-13	12-13	10-11	3
14-15	14-15	14-15	12-13	2
16-17	16-17	16-17	14-15	1
18-	18-	18-	16-	0

TASK 10C:

CONDITIONS: Continuation from task 10B. The Soldier will announce when ready. The examiner will cancel special corrections, say that the collimator has fallen down and will direct the gunner to use the aiming posts. The examiner will command DEFLECTION 3180, QUADRANT 315.

TIME: The time will start on the last digit of deflection and will stop when the gunner states READY.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-12	-14	-14	-10	4
13-14	15-16	15-16	11-12	3
15-16	17-18	17-18	13-14	2
17-18	19-20	19-20	15-16	1
19-	21-	21-	17-	0

TASK 10D:

CONDITIONS Continuation from task 10C. The Soldier will announce when ready. The examiner will command DEFLECTION 3230, QUADRANT 315.

TIME: The time will start on the last digit of deflection and will stop when the gunner states READY.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-11	-11	-11	-9	4
12-13	12-13	12-13	10-11	3
14-15	14-15	14-15	12-13	2
16-17	16-17	16-17	14-15	1
18-	18-	18-	16-	0

TASK 10E:

CONDITIONS: Continuation from task 10D. The Soldier will announce when ready. The examiner will command GAS (waits for the Soldier to mask), DEFLECTION 3242, QUADRANT 315.

TIME: The time starts on the last digit of deflection and stops when the gunner states READY.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-11	-11	-11	-9	4
12-13	12-13	12-13	10-11	3
14-15	14-15	14-15	12-13	2
16-17	16-17	16-17	14-15	1
18-	18-	18-	16-	0

TASK 11: Perform direct fire (061-266-2235)

Note. The fire mission in task 11 is one continuous mission. The central or reticle method of sighting may be used. Only the one-man/one-sight technique of direct fire will be used.

TASK 11A

CONDITIONS: The Soldier will be given a howitzer in the firing position. The howitzer will be laid and the pantel will be oriented on the collimator. Bubbles will be level and special corrections at 0. The cannon tube will be at 0 mils elevation and oriented so that the trails will not have to be shifted during the mission to engage the direct fire target. The Soldier will be told which direct fire target he is to engage. The Soldier will position himself as gunner and will announce when ready. The examiner will command FIRE MISSION, TARGET THAT (XXX), (direction), SHELL HE, CHARGE (XX), fuze QUICK, LEAD RIGHT 15 MILS, RANGE 600, FIRE AT WILL.

TIME: The time will start when the examiner states FIRE AT WILL and will stop when the gunner says FIRE.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable)..		
b. Correct steps were followed to complete the task..		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-11	-11	-11	-9	4
12-13	12-13	12-13	10-11	3
14-15	14-15	14-15	12-13	2
16-17	16-17	16-17	14-15	1
18-	18-	18-	16-	0

TASK 11B:

CONDITIONS: Continuation from task 11A. The Soldier will announce when ready. The examiner will command RIGHT 5, ADD 100.

TIME: The time will start when the examiner states ADD 100 and will stop when the gunner says FIRE.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-6	-6	-6	-4	4
7-8	7-8	7-8	5-6	3
9-10	9-10	9-10	7-8	2
11-12	11-12	11-12	9-10	1
13-	13-	13-	11-	0

TASK 11C

CONDITIONS: Continuation of task 11 B. The Soldier will announce when ready. The examiner will command LEFT 10, ADD 100.

TIME: The time will start when the examiner states ADD 100 and will stop when the gunner states FIRE.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine points.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-6	-6	-6	-4	4
7-8	7-8	7-8	5-6	3
9-10	9-10	9-10	7-8	2
11-12	11-12	11-12	9-10	1
13-	13-	13-	11-	0

TASK 11D:

CONDITIONS: Continuation from task 11C. The Soldier will announce when ready. The examiner will command LEFT 15, DROP 100.

TIME: The time will start when the examiner states DROP 100 and will stop when the gunner states FIRE.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine points.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-6	-6	-6	-4	4
7-8	7-8	7-8	5-6	3
9-10	9-10	9-10	7-8	2
11-12	11-12	11-12	9-10	1
13-	13-	13-	11-	0

TASK 12: Lay a howitzer for quadrant with the range quadrant

CONDITIONS: The Soldier will be given a howitzer in the firing position with the cannon tube at 0 mils elevation. Bubbles will be level and special corrections at 0 mils. The Soldier will position himself as gunner/assistant gunner and will announce when ready. The examiner will command QUADRANT 215.

TIME: The time will start when the examiner states QUADRANT 215, and will stop when the gunner/assistant gunner states SET.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	***M119A1***	***M198***	***M109s***	
Time in Seconds				***Points***
-9	-9	-9	-8	4
10-11	10-11	10-11	9-10	3
12-13	12-13	12-13	11-12	2
14-15	14-15	14-15	13-14	1
16-	16-	16-	15-	0

TASK 13: Measure the quadrant using the range quadrant

CONDITIONS: The Soldier will be given a howitzer in the firing position with the cannon tube at 245 mils. The range quadrant will be at 0 mils and the cross level bubble will be centered. The Soldier will position himself as the gunner/assistant gunner and will announce when ready. The examiner will state BEGIN.

TIME: The time will start when the examiner states BEGIN and will stop when the gunner/assistant gunner states QUADRANT 245.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M102	*M119A1*	*M198*	*M109s*	
Time in Seconds				*Points*
-9	-9	-9	-8	4
10-11	10-11	10-11	9-10	3
12-13	12-13	12-13	11-12	2
14-15	14-15	14-15	13-14	1
16-	16-	16-	15-	0

TASK 14: Initialize the automatic fire control system (AFCS)

CONDITIONS: The Soldier will be given a howitzer parked within 1 meter of a SCP. The Soldier will receive data for the SCP and initialization data. The Soldier will position himself as section chief and will announce when ready. The examiner will state BEGIN.

TIME: The will time start when the examiner states BEGIN and will stop when the Soldier announces INITIALIZED.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M109A6	
Time in Minutes	*Points*
-7	4
8-13	3
14-15	2
16-17	1
18-	0

TASK 15: Prepare for firing using the automatic fire control system

CONDITIONS: The Soldier will be given a howitzer, aligned along the AOF, and in travel lock. The "emplace" screen is displayed on the AFCS. The Soldier will position himself as the section chief and will announce when ready. The examiner will state BEGIN.

TIME: The time will start when the examiner states BEGIN and will stop when the Soldier sends the updated piece status.

Scoring	***GO***	***NO-GO***
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M109A6	
Time in Minutes/ Seconds	***Points***
-1:30	4
1:31-1:45	3
1:46-1:55	2
1:56-2:10	1
2:11-	0

TASK 16: Conduct a fire mission using the automatic fire control system (AFCS)

CONDITIONS: The Soldier will be given a howitzer at loading elevation. The Soldier will position himself as the section chief and will announce when ready. The examiner will have a digital call-for-fire transmitted to the AFCS.

TIME: The time will start when the fire mission is received at the AFCS and will stop when the howitzer is laid on the target.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M109A6	
Time in Minutes/Seconds	*Points*
-15.0	4
15.1-16.0	3
16.1-20.0	2
20.1-22.0	1
22.1-	0

TASK 17: Perform direct fire using the automatic fire control system (AFCS)

CONDITIONS: The Soldier will be given a howitzer, aligned on the AOF, and out of travel lock. The Soldier will be shown which target he is to engage and an assistant examiner will be provided to lay for deflection. The Soldier will position himself as the section chief and will announce when ready. The examiner will state BEGIN.

TIME: The time will start when the examiner says BEGIN and will stop when the Soldier states SET.

Scoring	*GO*	*NO-GO*
a. Standards of precision were met (if applicable).		
b. Correct steps were followed to complete the task.		
c. If steps a and b were not followed, Soldier receives a NO-GO and 0 points. If Soldier received a GO on steps a and b, use the table below to determine score.		

M109A6	
Time in Minutes/Seconds	*Points*
-20.0	4
20.1-22.0	3
22.1-23.0	2
23.1-30.0	1
30.1-	0

MEASURE SITE-TO-CREST USING AN M2 COMPASS TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 8 (ALL)

TASK: Measure Site to Crest Using an M2 Compass

CONDITIONS: Given an M2 compass and designated position area for the howitzer.

STANDARDS: Sight on and measure the highest crest in the sector of fire and report the site to crest to the FDC.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M2 compass.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 2 minutes
- Total time (per Soldier): 7 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will measure site to crest with an aiming circle and will determine a primary sector of fire.

INSTRUCTIONS TO THE CREWMAN: *"You are the advanced party man for your howitzer. This position has been designated for your howitzer and you have been directed to measure the site to crest. Your primary sector of fire is _________. Do you have any questions? You may begin."* (Start the time.)

Performance Measures	*GO*	*NO-GO*
1. Held the compass on edge with both hands at eye level with arms braced against the body and with the rear sight nearest one's eyes.		
2. Placed the cover at an angle of approximately 45 degrees to the face of the compass so that the reflection can be seen in the mirror.		
3. Read the elevation in mils on the elevation scale.		
4. Measured the sight to crest two additional times and recorded average.		

EVALUATION CRITERIA: The Soldier achieved a GO on each of the performance measures and reported a sight to crest within ±20 mils.

HOWITZER TABLES

4-6. The howitzer tables listed in table 4-1 provide a standardized, tabular format to train and evaluate howitzer section tasks. These task-based tables include individual and collective tasks from STPs and MTPs and include equipment-specific tasks from system technical manuals.

Table 4-1. Howitzer tables

Table No.	*Description*	*Remarks*
I	Individual / leader tasks (includes safety certification)	Written exam
II	Crew/section special tasks	Section STX
III	Machine gun training	Training through qualification
IV	Direct fire procedures	LFX
V		
A & B	Deliberate occupation procedures (day/night)	STX
VI	Preparations to fire under unique conditions	Hip shoot, occupation of LZ, occupation of DZ, Paladin degraded operations
VII	Training	Evaluate using FSCATT as available
VIII	Section	LTX

HOWITZER TABLE I: INDIVIDUAL/LEADER TASKS

4-7. Howitzer Table I contains some of the critical individual tasks and knowledge required to safely operate and fire the howitzer. Table I is a gate for all other tables. The leader's safety certification exams and hands-on component in this table and chapter 2 of this manual may be required to be supplemented with local range safety procedures and requirements to meet the commander's safety certification program. Individual leader tasks to support the commander's safety certification program are available on the Fires Knowledge Network, Master Gunner Site. Tasks to support the hands-on component are in appendix C of this manual.

Howitzer Table I – Individual/leader tasks

Task Number	*Task Title*
061-266-5100	Measure site to crest using an M2 compass
061-266-1806	Lay and measure a howitzer for quadrant with the range quadrant (except M119)
061-266-1508	Prepare ammunition for firing
061-266-1501	Load and secure ammunition in preparation for transporting
061-266-1105	Emplace and recover close-in aiming points
061-266-1102	Record and maintain fire mission data on a DA Form 4513 (Record of Missions Fired)
061-266-1101	Prepare a position to receive/emplace a howitzer (advance party)
061-268-1507	Load and fire a prepared round (M102)
061-281-1543	Load a prepared round (M119)
061-271-1507	Load and fire a prepared round (M198)
061-270-1507	Load and fire a prepared round (M109A2-A5)

4-8. Soldier tasks in table I are those howitzer-related tasks typically trained during weekly sergeant's time training. (Sample questions for written examinations are available on the Fires Knowledge Network, Master Gunner Site.) Units should select questions from master gunner site and supplement with an equal number of questions on unit TSOP.

4-9. .Leader training and certification for table I supports the commander's safety certification program. Table I includes a hands-on component test for leaders assigned to the following type units:

- M102, M119 series, 105 mm.
- M198, M109A1-A5, 155 mm.

4-10. Sample written examinations for all cannon leaders are also available through the Fires Knowledge Network, Master Gunner Site. The commander must supplement the written examination to satisfy local range regulations and safety SOPs.

HOWITZER TABLE II: CREW/SECTION SPECIAL TASKS

4-11. Howitzer Table II includes basic crew/section-level tasks critical to the unit's ability to perform the overall mission but unique to certain types of units. Tasks in Table II include rigging procedures for airmobile operations. Specific rigging procedures must comply with unit TSOP and FM 10-450-4.

Howitzer Table II – Crew/section special tasks
Task Title
Rig the M119A1 howitzer for air movement
Rig the A-22 container for air movement
Tandem rigging procedures for M119A1 howitzer and a 1097 HMMWV
Rig the M119A1 howitzer with firing platform attached (A-frame rigging)

HOWITZER TABLE III: MACHINE GUN TRAINING

4-12. Field artillery units are currently equipped with the following types of machine guns:

- M249 LMG.
- M2 caliber .50 machine gun.
- MK-19 40-mm machine gun.

4-13. The M249 is for dismounted operations and assigned to light artillery units. The M2 caliber .50 machine gun and the MK-19 40-mm machine gun are heavy machine guns assigned to Stryker brigade combat teams (SBCTs) and M109-equipped units. The M2 and MK-19 are equipped with vehicular mounts or the RWS for Stryker vehicles to provide a unit defense against both ground and air threats during movement. The M2 and MK-19 machine guns are equipped with tripods and T&E mechanisms to assist in integrating the machine guns into the unit's perimeter defenses. Table III (table 4-4) is required for all FA units. The resourced training strategies for M249, M2, and MK19 training are found in the STRAC manual (DA Pam 350-38), tables 5-20, 5-23, and 5-25. These tables include transition firing for the gunner and assistant gunner or mounted qualification if a multipurpose range facility is available for both the M2 and MK-19. The commander must consider a number of factors to determine the optimal machine gun training for his unit. These factors include—

- METL.
- Previous experience and training of crews.
- Range availability.
- Training resources.

4-14. As a minimum, training should include firing from both the tripod with T&E mechanism and from the vehicle if equipped with a mount per procedures in FM 3-22.68, FM 3-22.27, and FM 3-22.65. Biannual training should be included for convoy live-fire operations or mounted firing on the multipurpose range. The following individual tasks are included in Howitzer Table III:

Howitzer Table III – Machine gun training

Task Number	*Task Title*
071-030-0011	Mount an MK-19 machine gun on an M3 tripod
071-030-0003	Zero an MK-19 machine gun
071-030-0004	Engage targets with an MK-19 machine gun
071-022-0012	Mount a caliber .50 M2 machine gun on a vehicle
071-030-0008	Correct malfunctions of an MK-19 machine gun
071-030-0009	Mount an MK-19 machine gun on a vehicle
071-022-0010	Mount a caliber .50 M2 machine gun on an M3 tripod
071-022-0001	Maintain a caliber .50 M2 machine gun
071-030-0005	Load an MK19 machine gun
071-030-0001	Maintain an MK19 machine gun
071-022-0003	Load a caliber .50 M2 machine gun
071-022-0013	Dismount a caliber .50 M2 machine gun from a vehicle
071-030-0006	Unload an MK19 machine gun
071-030-0012	Dismount an MK19 machine gun from an M3 tripod
071-030-0002	Prepare a range card for an MK-19 machine gun
071-313-3455	Set headspace and timing on a caliber .50 M2 machine gun
071-030-0007	Perform a function check on an MK-19 machine gun
071-022-0011	Dismount a caliber .50 M2 machine gun from an M3 tripod

M249 LMG Training

4-15. The M249 LMG is common to many sections and crews in FA units. Maintaining a high degree of proficiency on this weapon has never been more important. The asynchronous battlefield of the COE and the varied and complex missions assigned to FA organizations require that crews and sections be proficient on all assigned weapons. The M249 LMG is critical to the overall defense of the unit against both ground and air threats and integrated with other defenses to provide force protection against all threats. The unit training program should include preliminary marksmanship training and training on the assembly, disassembly, and maintenance of the weapon as described in FM 3-22.68. The training and qualification included in table 4-5 is the strategy recommended by STRAC and FM 3-22.68. This strategy has been expanded to include a convoy live-fire exercise.

Table 4-2. M249 light machine gun (LMG) training

Task	*Conditions*	*Ammunition*	*Reference*
10-meter zero practice and qualification	Integrated CBRN, 80 percent of assigned gunner and assistant gunner annually	108 rounds, ball/person	Table 5-1, FM 3-22.68; Table 5-26, DA Pam 350-38
Transition firing, practice, and qualification	Integrated CBRN	144 rounds, mix/person	Table 5-1, FM 3-22.68; Table 5-26, DA Pam 350-38
Night zero and instructional firing	With mounted AN/PVS-4	90 rounds, mix/person	Table 5-1, FM 3-22.68; Table 5-26, DA Pam 350-38
Convoy LFX		370 rounds, mixed	

M2 Caliber .50 Machine Gun Qualification

4-16. The following tables are extracts from FM 3-22.65. Table 4-6 is for tripod-mounted M2 gunner and assistant gunner transition fire tables for field zero and qualification. These tables require a caliber .50, transition fire range.

Table 4-3. Practice/qualification table, tripod mounted

Task No.	*Task*	*Conditions Target/Situation*	*Ammunition*	*Standard*
1.	Zero the M2 machine gun	Gunner is in the stationary tripod firing position and engages a 550-meter, double E-type silhouette. Gunner will use 5 to 7 round bursts.	28-round belt	Gunner must impact one burst on the 550–meter target.
2.	Engage a single, double E-type silhouette	Gunner is in the stationary tripod firing position and engages an 800-meter, double E-type silhouette. Gunner will use 5 to 7 round bursts.	14 rounds	Gunner must impact one burst on the 800–meter target in 20 seconds.
3.	Engage a single, double E-type silhouette	Gunner is in the stationary tripod firing position and engages a 400-meter, double E-type silhouette. Gunner will use 5 to 7 round bursts.	14 rounds	Gunner must impact one burst on the 400-meter target in 20 seconds.
4.	Engage a single, double E-type silhouette	Gunner is in the stationary tripod firing position and engages a 700-meter, double E-type silhouette. Gunner will use 5-7 round bursts.	14 rounds	Gunner must impact one burst on the 700-meter target in 25 seconds.
5.	Engage a single, double E-type silhouette	Gunner is in the stationary tripod firing position and engages a 1,000-meter, double E-type silhouette. Gunner will use 5 to 7 round bursts.	14 rounds	Gunner must impact one burst on the 1,000-meter target in 25 seconds.
6.	Engage multiple double E-type silhouettes	Gunner is in the stationary tripod firing position and engages 400-meter and 700-meter, double E-type silhouettes. Gunner will use 5 to 7 round bursts.	28 rounds	Gunner must impact one burst on each target within 35 seconds.
7.	Engage multiple double E-type silhouettes	Gunner is in the stationary tripod firing position and engages 550-meter and 800-meter, double E-type silhouettes. Gunner will use 5 to 7 round bursts.	28 rounds	Gunner must impact one burst on each target within 35 seconds.
8.	Engage multiple double E-type silhouettes	Gunner is in the stationary tripod firing position and engages 400-meter, 550-meter, and 1,000-meter double E-type silhouettes. Gunner will use 5 to 7 round bursts.	42 rounds	Gunner must impact one burst on each target within 45 seconds.

4-17. If multipurpose range facilities are available, and the commander chooses to conduct mounted M2 qualification, the following table (table 4-7) is provided.

Table 4-4. Mounted M2 qualification

Task No.	*Task*	*Conditions/Target/Situation*	*Ammunition*	*Standard*
1.	Conduct prefire inspection	Gunner is in a stationary position given a 450-meter stationary target, headspace and timing gauge, section organic vehicles, and M2 machine gun.	7-round belt	Conduct prefire inspections and fire 7 rounds to confirm operation of machine gun.
2.	Engage stationary target from stationary firing position	Gunner is in a mounted firing position in a stationary vehicle and engages a 450-meter stationary target. Gunner must use 5 to 7 round bursts.	14 rounds	Gunner must impact on target.
3.	Engage stationary target from stationary firing position	Gunner is in a mounted firing position in a stationary vehicle and engages an 850-meter stationary target. Gunner must use 5-7 round bursts.	14 rounds	Gunner must impact on target.
4.	Engage moving and stationary targets from a stationary firing position	Gunner is in a mounted firing position in a stationary vehicle and engages a moving vehicle at 800 meters and a stationary target at 1,000 meters. Gunner must use 5-7 round bursts.	28-round belt	Gunner must impact on target.
5.	Engage stationary targets while firing from a moving vehicle	While the gunner's vehicle is moving, the gunner engages stationary vehicles at 300 and 500 meters. Gunner must use 5-7 round bursts.	28-round belt	Gunner must impact on target.
6.	Engage moving and stationary targets from a stationary firing position	Gunner is in a mounted firing position in a stationary vehicle and engages a moving vehicle at 800 meters and a stationary personnel target at 600 meters. Gunner must use 5-7 round bursts.	28-round belt	Gunner must impact on target.
7.	Engage stationary target from stationary firing position while in an upgraded CBRN posture	Gunner in MOPP in a stationary firing position engages a 500-meter target. Gunner will use 5-7 round bursts.	14 rounds	Gunner must impact on target.

Table 4-4. Mounted M2 qualification

Task No.	*Task*	*Conditions/Target/Situation*	*Ammunition*	*Standard*
8.	Engage moving and stationary targets from stationary firing position while in an upgraded CBRN posture	Gunner in MOPP in a stationary firing position engages an 800-meter moving target and personnel targets at 1,000 meters. Gunner will use 5 to 7 round bursts.	28 rounds	Gunner must impact on target.
9.	Engage multiple stationary targets from stationary firing position while in an upgraded CBRN posture	Gunner in MOPP in a stationary firing position engages 300-meter personnel targets and 500- and 700-meter moving targets. Gunner will use 5 to 7 round bursts.	42 rounds	Gunner must impact on target.

MK-19 QUALIFICATION

4-18. The following tables extracted from FM 3-22.27 (table 4-8; table 4-9, page 4-58; and table 4-10, page 4-60) are the events resourced for the gunner and assistant gunner on the MK19. The first two tables are annual requirements for both the gunner and assistant gunner. Night record fire is a biannual requirement.

Table 4-5. Instructional fire exercise (zero/practice)

Task No.	*Task*	*Condition*	*Ammunition*	*Standard*
1.	Mount the MK19 on the M3 tripod	Given an MK-19, M3 tripod, T&E mechanism, MK 64 mount, and a selected firing position.	None	Crew must mount the MK-19 on its tripod in 1 minute.
2.	Prepare a range card	Given an MK-19, M3 tripod, T&E mechanism, and a selected firing position with a designated sector of fire, and targets at ranges of 400, 600, 1,100, and 1,500 meters.	None	Crew must prepare a completed MG range card in 15 minutes.
3.	Zero the MK-19 using a 400-meter target	Given an MK-19, M3 tripod, T&E mechanism, and 400-meter target and 4 rounds of 40-mm TP.	4 rounds	Gunner must impact on target with at least 2 rounds.
4.	Engage target at 1,100 meters using range card data (point target)	Given a tripod-mounted MK-19, completed range card, selected firing position, target at 1,100 meters, and 8 rounds of 40-mm TP.	8 rounds	Gunner must impact target with at least 2 rounds.
5.	Engage target at 1,500 meters using range card data	Given a tripod-mounted MK-19, completed range card, selected firing position, and target at 1500 meters, and 8 rounds of 40-mm TP.	8 rounds	Gunner must impact within 15 meters of target with at least 2 rounds.

Table 4-5. Instructional fire exercise (zero/practice)

Task No.	*Task*	*Condition*	*Ammunition*	*Standard*
6.	Engage personnel target at 600 meters using range card data (area target)	Given a tripod-mounted MK-19, completed range card, selected firing position, area target at 600 m, and 6 rounds of 40-mm TP.	6 rounds	Gunner must impact within 5 meters of target array with at least 2 rounds.
7.	Dismount the MK-19	Given a tripod-mounted MK-19 and selected firing position.	None	Crew must dismount the MK-19 from the M3 tripod in 1 minute.

Table 4-6. MK-19 qualification table

Task No.	*Task*	*Condition*	*Ammunition*	*Standard*
1.	Mount the MK 19 on the M3 tripod	Given an MK-19, M3 tripod, T&E mechanism, MK 64 mount, and a selected firing position.	None	Crew must mount the MK-19 on its tripod in 1 minute.
2.	Prepare a range card	Given an MK-19, M3 tripod, T&E mechanism, a selected firing position with a designated sector of fire, and targets at ranges of 400, 600, 1,100, and 1,500 meters.	None	Crew must prepare a completed MG range card in 15 minutes.
3.	Zero the MK-19 using a 400-meter target	Given an MK-19, M3 tripod, T&E mechanism, 400-meter target, and 4 rounds of 40-mm TP.	4 rounds	Gunner must impact on target with at least 2 rounds.
4.	Engage target at 600 meters using range card data (point target)	Given a tripod-mounted MK-19, completed range card, selected firing position, target at 600 meters, and 4 rounds of 40-mm TP.	4 rounds	Gunner must impact target with at least 2 rounds in 1 minute.
5.	Engage target at 1,100 meters using range card data (point target)	Given a tripod-mounted MK-19, completed range card, selected firing position, target at 1,100 meters, and 8 rounds of 40-mm TP.	8 rounds	Gunner must impact target with at least 2 rounds in 2 minutes.
6.	Engage personnel target at 600 meters using range card data (area target)	Given a tripod-mounted MK-19, completed range card, selected firing position, area target at 600 meters, and 6 rounds of 40-mm TP.	6 rounds	Gunner must impact within 5 meters of target array with at least 2 rounds in 1 minute 30 seconds.
7.	Engage target at 1,500 meters using range card data	Given a tripod-mounted MK-19, completed range card, selected firing position, target at 1,500 meters, and 8 rounds of 40-mm TP.	8 rounds	Gunner must impact within 15 meters of target with at least 2 rounds in 2 minutes.
8.	Engage point target at 1,100 meters and area target at 600 meters using range card data	Given a tripod-mounted MK-19, completed range card, selected firing position, targets at 1,100 and 600 meters, and 12 rounds of 40-mm TP.	12 rounds	Gunner must impact 2 out of 12 rounds on target at 1,100 meters and shift and place 2 rounds in target array in 3 minutes.
9.	Dismount the MK-19	Given a tripod-mounted MK-19 and selected firing position.	None	Crew must dismount the MK-19 from the M3 tripod in 1 minute.

Table 4-7. MK-19 night fire qualification

Task No.	*Task*	*Condition*	*Ammunition*	*Standard*
1.	Mount the AN/TVS-5 to the MK-19	Given the AN/TVS-5 complete, MK-19, M3 tripod, and T&E mechanism.	None	Gunner must mount the AN/TVS-5 on the MK-19 in 2 minutes.
2.	Engage a 400-meter point target	Given a zeroed MK-19 mounted on M3 tripod with AN/TVS-5 properly mounted, during the hours of darkness, and 6 rounds of 40-mm TP.	6 rounds	Gunner must impact 2 rounds on target at 400 meters in 1 minute.
3.	Engage point target at 600 meters	Given a zeroed MK-19 mounted on M3 tripod with AN/TVS-5 properly mounted, during the hours of darkness, and 8 rounds of 40-mm TP.	8 rounds	Gunner must impact 2 rounds on target at 400 meters in 2 minutes.
4.	Engage area target at 800 meters	Given a zeroed MK-19 mounted on M3 tripod with AN/TVS-5 properly mounted, during the hours of darkness, and 8 rounds of 40-mm TP.	8 rounds	Gunner must impact 2 rounds within 5 meters in 2 minutes.
5.	Dismount the AN/TVS-5 from the MK-19	Given an MK-19 with AN/TVS5 mounted.	None	Crew must dismount the AN/TVS-5 in 2 minutes.

HOWITZER TABLE IV: DIRECT FIRE PROCEDURES

Introduction

4-19. Howitzer Table IV includes the training and live-fire required to train howitzer sections in providing direct fire and indirect observed fire (killer junior). The asymmetrical battlefield of the COE has reinforced the need for focused training on force protection tasks. The cannon battery has historically provided a combat multiplier in situations requiring direct fires and must train to maintain that capability.

Direct Fire

4-20. The term “direct fire” always refers to using the maximum charge available. The advantages of direct fire are—

- Flat trajectory.
- Lower time of flight.
- Higher terminal velocity.

4-21. The direct fire mission training tasks are—

- Direct fire sighting – two man-two sight, two man-one sight, and one man-one sight.
- Direct fire laying methods – reticle laying, central laying.
- Direct fire commands.
- Estimation of range and lead.

Note. See FM 3-09.50 for detailed discussion on direct fire.

4-22. The individual supporting tasks for direct fire are included in Howitzer Table IV.

Howitzer Table IV – Individual tasks for direct fire

Task Number	*Task*	*Reference*
061-268-1214	Boresight the direct fire telescope (M102)	STP 6-13B14-SM-TG
061-268-1217	Sight on a target with the direct fire telescope (M102)	STP 6-13B14-SM-TG
061-271-1217	Sight on a target with the direct fire telescope (M198)	STP 6-13B14-SM-TG
061-271-1212	Boresight the direct fire telescope by using a distant aiming point (M198)	STP 6-13B14-SM-TG
061-270-1217	Sight on a target with the direct fire telescope (M109A2-A5)	STP 6-13B14-SM-TG
061-270-1214	Boresight the direct fire telescope (M109A2-A5)	STP 6-13B14-SM-TG
061-281-2233	Sight on a target during direct fire (M119)	STP 6-13B24-SM-TG
061-266-2235	Sight on a target during direct fire with the panoramic telescope	STP 6-13B24-SM-TG
061-281-1000	Verify boresight of the M90A2 direct fire telescope by using a distance aiming point (M119)	STP 6-13B24-SM-TG
061-307-3556	Perform direct fire using the automatic fire control system (M109A6)	STP 6-13B24-SM-TG

4-23. The section chief must ensure that his section is proficient at these individual tasks, techniques, and procedures prior to table IV live fire.

Indirect Observed Fire (Killer Junior)

4-24. Indirect observed fire is a technique using the lowest authorized charge with a mechanical time fuse with minimal fuze setting (see appendix I, FM 3-09.50). The advantages of using Killer Junior are—

- Higher trajectory allows firing over intermediate objects (parapets, front-line bunkers) that would be destroyed firing maximum charges with beehive ammunition.
- More effective against prone enemy personnel or enemy in defilade.
- Killer Junior procedures require quick-fire tables for the howitzer section. Refer to FM 3-09.50 for detailed discussion and safety procedures required to train.

Ammunition

4-25. The STRAC allocation for training direct fire/indirect fire observed live-fire missions is 36 rounds for 105-mm batteries and 18 rounds for 155-mm batteries.

HOWITZER TABLE V: DELIBERATE OCCUPATION PROCEDURES

4-26. Howitzer Table V will include the collective tasks required to perform a deliberate occupation by a howitzer section during both day and night conditions. The tasks will be trained as an STX as a gate prior to the abbreviated procedures trained in table VI (table 4-13, page 4-74) and may be included in the LTX for tables VII and VIII.

Howitzer Table V – Deliberate occupation tasks

Task	*Remarks*
Prepare position by the gun guide (M102, M119, M198, M109 A1-5)	Test administrative guide provided to assist in evaluating task may be supplemented with task steps including local TSOP requirements.

Howitzer Table V – Deliberate occupation tasks

Emplace the cannon (TLABSPAP) (M102, M119, M198, M109 A1-5)	Focus of evaluation should be on accuracy, precision, and correct procedures. Supporting MTP tasks (06-4-C012) (06-4-C004).
Conduct a tactical move to a firing position (Paladin)	
Conduct a deliberate occupation (Paladin)	Supporting MTP task (06-3-G004).
Conduct a survivability move (Paladin)	Supporting MTP task (06-4-G000).

TABLE V STATION 1 (M102, M119, M198, M109 A1-A5) TEST ADMINISTRATIVE GUIDE

TASK: Prepare Position by the Gun Guide (061-266-1101)

CONDITIONS: The gun guide will be required to prepare a position for a deliberate occupation. Upon his arrival in position, the gun guide will be given a detailed briefing.

STANDARDS: The gun guide will prepare the position for the arrival of the howitzer section, be prepared to brief his section chief on the required data to occupy the position and lay the howitzer, and will assist in securing the battery position area until the battery arrives.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of giving the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M2 compass.
- Marking stakes.
- TA-312.
- DR-8 with RL-39.
- Hammer.
- Panoramic telescope marker.
- Two flashlights with extra batteries.
- Additional items as required by TSOP.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 60 minutes
- Total time: 65 minutes

OTHER INFORMATION: Before the gun guide arrives in the selected position area, the evaluator will set up and orient an aiming circle and be prepared to brief the gun guide when he arrives.

INSTRUCTIONS TO THE GUN GUIDE: *"You are currently located at your new battery position area. This is where your howitzer will be emplaced with an AOF of ______ mils. The wire head will be located at _____________. After you have prepared your position for the arrival of your howitzer, you will be shown where the entrance to the position area will be and track plan or route you are to use during occupation. You will prepare for the arrival of your howitzer per the TSOP. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	***GO***	***NO-GO***
1. Was ready to depart with all necessary equipment at the prescribed time.		
2. Had all equipment required per TSOP (for example, M2 compass, DR-8, TA-312 or AN/GRA-39, flashlights, pen and paper, gun guide stakes, required tools, and MOPP gear).		
3. Performed a security sweep and maintained continuous security throughout the occupation, with weapon in his possession.		
4. Emplaced the pantel marking stakes in the location designated by the GSG.		
5. Emplaced the guide stakes on the AOF within 20 mils.		
6. Established wire communications with the aiming circle.		
7. Determined site to crest using the M2 compass and piece-to-crest range.		
8. Recorded and reported site-to-crest to the GSG.		
9. Established the track plan as directed by the GSG and walked the route to rehearse the occupation.		
10. Took up defensive position as directed by the GSG.		

TABLE V STATION 2 (M102, M119, M198, M109 A1-A5) TEST ADMINISTRATIVE GUIDE

TASK: Emplace the Cannon (Trails, Lay, Aiming Point Established, Boresight Verified, Safe, Prefire Checks Performed, Ammunition Prepared)

CONDITIONS: The section is occupying a new position prepared by the advance party.

STANDARDS: The section will complete the occupation and TLABSPAP procedures; will establish communication with the FDC; and will render critical elements of the section chief's report within 8 minutes.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of giving the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer section with BILI.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 20 minutes
- Total time (per howitzer section): 25 minutes

OTHER INFORMATION: Before the howitzer arrives in the selected position area, the evaluator will set up and orient an aiming circle and be prepared to lay the howitzer when the section chief announces "aiming point identified." A second means of verifying lay must also be established.

INSTRUCTIONS TO THE HOWITZER SECTION: *"You are currently located at your old battery position area. You have sent your gun guide with the advanced party and have been given the order-to-march order. You will move along the prescribed route and conduct a deliberate occupation of a new position area and complete TLABSPAP including the critical* *elements of the section chief per the TSOP. This is a timed event. Time begins when the howitzer stops in the position area and ends when you have completed TLABSPAP. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	***GO***	***NO-GO***
1. The driver followed the gun guide at a safe speed and distance.		
2. After stopping in position, the gun guide reported the AOF and the initial deflection to the section chief.		
3. Following the standards in the appropriate technical manual emplaced the weapon.		
4. The gunner used the initial deflection reported by the gun guide.		
5. Proper commands were used during laying.		
6. The bubbles were centered and correct settings were made during laying.		
7. The section chief verified the sight picture, laid deflection, and bubbles when the howitzer was laid.		
8. The howitzer was laid to an accuracy of 0 mils within the time prescribed by the appropriate evaluation standards.		
9. The collimator and aiming posts were prepared for use while the howitzer was being laid.		
10. The collimator was emplaced and ready for use as the primary aiming point within 2 minutes after the howitzer was laid for deflection.		
11. The aiming posts were properly emplaced within 2 minutes.		
12. A DAP was selected if applicable.		
13. The howitzer was boresighted by DAP or test target per the technical manual (or verified by the use of the appropriate alignment device).		
14. A second aiming circle verified the lay of the howitzer.		
15. Prefire checks were properly performed per the appropriate technical manual.		
16. Ammunition was handled and prepared per the technical manual.		
17. Angle of site and PCR were verified by the section chief.		
18. The section chief reported when his section was in order.		
19. Natural materials, when available, were used to help camouflage the section position.		
20. The range cards were prepared for both the howitzer and the secondary armament for primary and supplementary positions.		
21. The section gear was arranged according to the unit TSOP.		
22. Conditions existed which would make the howitzer unsafe during firing.		
23. The howitzer or prime mover driver followed the proper shutdown procedures per the appropriate technical manual.		

Performance Measures	*GO*	*NO-GO*
24. The section maintained track discipline and camouflage vehicles, to include all reflective surfaces.		
25. The section was in the proper uniform throughout the occupation.		
26. Each section member performed his duty with minimum orders.		

TABLE V STATION 1A (PALADIN)
TEST ADMINISTRATIVE GUIDE

TASK: Conduct a Tactical Move to a Firing Position (Paladin)

CONDITIONS: The section is conducting combat operations and receives an order that requires displacement.

STANDARDS: Section must be in position at the prescribed time to conduct fire mission.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of giving the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer section with BILI.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 15 minutes
- Total time (per howitzer section): 20 minutes

OTHER INFORMATION: The howitzer section will begin this task 3 to 5 kilometers from a position area/firing point. A movement order and briefing from the platoon leader must be prepared in advance. Communications representing the BOC/POC must be established. The section chief should be provided adequate time to conduct troop leading procedures before departure.

INSTRUCTIONS TO THE HOWITZER SECTION: "*You are currently located at your old position area. You have received the following movement order from your platoon leader, for example, move to grid _____. You will move along the prescribed route and conduct a deliberate occupation of a new position area including all reports required by your TSOP. Do you understand the requirements of this test? Do you have any questions? You may begin.*" (Start the time.)

Performance Measures	*GO*	*NO-GO*
1. Received movement briefing from platoon leadership and conducted troop leading procedures.		
2. Received movement order from POC. (Manual movement order and sectors of fire may be given.)		
3. Verified move order and sectors of fire with POC on the voice net.		
4. Recorded and plotted destination map and briefed section.		
5. Maintained communications with higher (POC/platoon leadership).		
6. Ensured that all equipment and ammunition were loaded and secured per load plans.		
7. Conducted move per movement brief.		
8. If NAV UPDATE was conducted while en route, recorded SCP data. COS told driver to record and track mileage after NAV UPDATE.		
9. Defended against ambush while moving. (This task is trained live-fire in table III and may be replaced with IED training task.)		

TABLE V STATION 2A (Paladin)
TEST ADMINISTRATIVE GUIDE

TASK: Conduct a Deliberate Occupation (Paladin)

CONDITIONS: The section has arrived at a new firing position that has been reconnoitered and set up by the GSG.

STANDARDS: Establish firing capability within 2 minutes without error per ARTEP 6-037-30-MTP and unit TSOP.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of giving the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer section with BILI.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 15 minutes
- Total time (per howitzer section): 20 minutes

OTHER INFORMATION: Howitzer section chief must be informed prior to task 3 (Conduct a tactical move to a firing position [Paladin]) that he is to continue to conduct a deliberate occupation upon arrival at his new position. If required to do a NAV UPDATE at the entrance to his position, it will not be included in his occupation time.

INSTRUCTIONS TO THE HOWITZER SECTION: SEE PREVIOUS TASK. (Start the time when the howitzer stops in the firing position and stop the time when the COS sends piece status – step 9.)

Performance Measures	*GO*	*NO-GO*
1. The COS may have to do NAV UPDATE at entrance point as per platoon leader instruction. SCP data will be recorded on DA Form 4446 (*Level, Transit, and General Survey Record Book*) (not part of 2-minute occupation time). COS told driver to record and track mileage after NAV UPDATE.		
2. COS directed driver to orient howitzer on center sector (±50 mils) (2-minute time starts when howitzer stops) and emplaced spades if needed.		
3. Howitzer may need to wait 30 seconds before conducting Step 5. (If NAV UPDATE has not been conducted within the last 5 miles, wait 30 seconds.)		
4. COS pressed the ARRIVED key on AFCS.		
5. COS directed driver to release travel lock.		
6. COS elevated tube to MAX TUBE ELEVATION and selected USE TUBE POSITION.		
7. COS and gunner conducted SITE DATA.		
8. COS updated POWDER TEMP in AFCS.		
9. COS sent PIECE STATUS to POC.		
10. Number 1 man prepared HE/PD in ready rack while steps 4 through 9 were conducted.		
11. COS directed crew to perform prefire checks.		
12. Gunner verified boresight with the M140.		
13. COS directed section to do position improvement.		
14. Established an aiming point. (DAP during daytime operations if one can be used. Collimator at night or during the day if no DAP is available.)		
15. Constructed range cards and established survivability movement plan as directed by PLT SGT.		
16. Conducted verification mission with POC (read back CHARGE, TI if time is set, DF, and QE) only if there is a significant database change.		
17. COS received, recorded, and read back to POC Safety T information. COS input maximum QE off the Safety T in MAX TUBE ELEVATION, TYPE NEW VALUE.		
18. COS input minimum QE as announced by POC and recorded charge to be fired as required.		

TABLE V STATION 3A (PALADIN)
TEST ADMINISTRATIVE GUIDE

TASK: Conduct a Survivability Move (Paladin)

CONDITIONS: The section is conducting tactical operations. The howitzer is required to displace per the TSOP or tactical guidance to provide fires in support of maneuver forces and increase survivability.

STANDARDS: Section will load all section equipment, maintain communications with the control element, and move to alternate firing position.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of giving the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer section with BILI.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 15 minutes
- Total time (per howitzer section): 20 minutes

OTHER INFORMATION: Movement criteria within a position area are generally dictated by the S3 in the FA support plan. It may also be based on the situation or the battery commander may direct a survivability move. Movement criteria should be addressed in the unit TSOP and firing sections should move accordingly. The evaluator must ensure that an alternate position is available for the section to move to and that the section is aware of the location.

INSTRUCTIONS TO THE HOWITZER SECTION: *"You are currently located at your old position area. You have received a directive to conduct a survivability move per your unit TSOP. Do you understand the requirements of this test? Do you have any questions? You may begin*."

Performance Measures	*GO*	*NO-GO*
1. When it had been determined to move, section ensured that all equipment and ammunition were loaded and secured.		
2. COS told section where they were moving.		
3. COS directed driver to put up travel lock, COS stored tube in travel lock, and driver locked travel lock. Stowed spades if emplaced.		
4. Section moved to new position.		
5. COS pushed ARRIVED key.		
6. COS and gunner did SITE DATA.		
7. COS directed section to perform prefire checks.		
8. COS updated POWDER TEMP if needed.		
9. COS sent PIECE STATUS to POC.		
10. COS directed section to establish an aiming reference point.		
11. Number 1 man prepared HE/PD in ready rack while steps 5 through 10 were conducted.		

HOWITZER TABLE VI: PREPARATIONS TO FIRE UNDER UNIQUE CONDITIONS

4-27. Howitzer Table VI includes the tasks and procedures to conduct hasty occupations or "hip-shoots" for all cannon units except M109A6, Paladin. All missions received by Paladin units that are moving are essentially emergency missions and are conducted in a similar manner to all other missions. All other cannon units require TTP and unit TSOP for hasty occupations and must be trained on the tasks that are unique to the hasty occupation. Paladin units, however, do require training on TTP and battle drills to conduct degraded operations in both the platoon operations center and on the howitzer should any of the automated systems fail. Airborne and airmobile units have unique requirements for drop zone operations and artillery raids that require special procedures and SOPs. This table includes various types of occupations under unique conditions. These occupations and operations depend on TSOPs and battle drills. The commander may elect to include more than one type of occupation based on his METL assessment.

Howitzer Table VI – Hasty occupations under unique conditions

Task Number	*Task Title*
06-3-C002	Conduct emergency missions
06-2-E001	Conduct airborne operations
06-2-E002	Conduct air assault operations
06-2-E003	Conduct an air assault raid
06-4-G005	Perform fire missions in degraded mode on the M109A6Paladin howitzer

Emergency Occupation

4-28. The emergency occupation mission for cannon batteries is task 06-3-C002, ARTEP 6-037-30-MTP. The time standards for the mission are included in task step 1. The time begins when the first howitzer stops in position and ends when the unit fires for effect. The unit must have effects on target for a successful mission.

TASK: Conduct Emergency Missions (06-3-C002) (FM 6-50) (FM 6-70)

CONDITIONS: The battery/platoon is en route to a new position area and has received a call for fire. Some iterations of this task should be performed in MOPP4.

STANDARDS: The battery/platoon selects and occupies a firing position and fires the mission in accordance with unit TSOP and FM 6-50.

Task Steps and Performance Measures	*GO*	*NO-GO*
1. XO/platoon leader directed the occupation and met the time standards set below:		
M102/M119 series – 11 minutes		
M198 – 12 minutes		
M109 – 11 minutes		
a. Selected a position area that facilitates timely completion of the mission.		
b. Notified all elements in the column in accordance with TSOP.		
c. Selected most expeditious method of lay for the mission and laid the howitzers.		
d. Notified the FDC as soon as one howitzer was laid and used first howitzer laid as the adjusting piece.		
2. The FDC/POC did the following:		
a. Verified tactical data.		
b. Determined AOF.		
c. Computed the firing data for the fire mission.		
d. Transmitted message to observer.		
3. The howitzer section chief did the following:		
a. The COS acknowledged receipt of the fire mission.		
b. Found suitable firing location (verified location if not GPS aided).		
c. Gunner verified direction (if required by SOP).		
d. COS and gunner verified that mission was clear of crest when the tube was at the lay deflection sent for the fire mission.		
e. COS ensured that proper crew drill was performed.		
4. The elements not required for fire mission established position security.		

SUPPORTING INDIVIDUAL TASKS		
Task Number	***Task Title***	***References***
061-266-2002	Lay a howitzer for initial direction of fire by reciprocal lay by using the panoramic telescope	STP 6-13B14-SM-TG

061-266-2004	Lay a howitzer for initial direction of fire by using the panoramic telescope	STP 6-13B14-SM-TG
061-266-2006	Lay a howitzer for deflection using the panoramic telescope	STP 6-13B14-SM-TG
061-266-2237	Supervise the preparation of ammunition for firing	STP 6-13B14-SM-TG
061-266-3305	Determine site and range to crest	STP 6-13B24-SM-TG
061-266-3315	Determine that howitzer data is safe to fire	STP 6-13B24-SM-TG
061-266-4007	Lay the battery/platoon using alternate methods of lay	STP 6-13B24-SM-TG
061-266-5302	Orient the M2 or M2A2 aiming circle	STP 6-13B24-SM-TG
061-268-1507	Load and fire a prepared round (M102)	STP 6-13B14-SM-TG
061-270-1507	Load and fire a prepared round (M109A2-A5)	STP 6-13B14-SM-TG
061-271-1507	Load and fire a prepared round (M198)	STP 6-13B14-SM-TG
061-281-1543	Load a prepared round (M119)	STP 6-13B14-SM-TG
061-281-2006	Fire a prepared round (M119)	STP 6-13B14-SM-TG

SUPPORTING COLLECTIVE TASKS		
Task Number	***Task Title***	***References***
06-3-A004	Command and control battery/platoon/section movement operations	ARTEP 6-037-30-MTP
06-3-B003	Conduct occupation of position area (non-Paladin units)	ARTEP 6-037-30-MTP
06-3-C001	Direct and control firing battery/platoon operations (cannon)	ARTEP 6-037-30-MTP ATREP 6-387-30-MTP
06-3-C011	Perform hasty survey	ARTEP 6-037-30-MTP ATREP 6-387-30-MTP

Conduct Airborne Operations

4-29. The conduct airborne operations task for cannon batteries is task 06-2-E001, ARTEP 6-037-30-MTP.

TASK: Conduct Airborne Operations (06-2-E001) (FM 90-26) (FM 6-50) (FM 90-4) (TM 9-1015-234-10) (TM 9-1015-252-10)

CONDITIONS: The battery has been ordered to conduct an airborne operation. Air Force aircraft are available. Date, time, and departure and arrival airfields are specified. The ground tactical, marshaling, loading, and landing plans are available. The battalion staff has planned the operation. Some iterations of this task should be performed in MOPP4.

STANDARDS: The battery conducts airborne operations to support the maneuver force OPORD in accordance with commander's guidance, TSOP, movement plan, load plan, and applicable field manuals and technical manuals.

Performance Measures	***GO***	***NO-GO***
1. The BC/1SG assembled and briefed personnel in accordance with TSOP.		
2. The BC/1SG maintained contact with the battalion staff to ensure complete coordination of the battery requirements in the following:		
a. Ground tactical plan.		
b. Fire support plans.		
c. Field artillery support plans.		
d. Loading priorities and cross loading with maneuver elements.		
e. Times for movement to HDRS, J/I, and loading into aircraft.		
f. Information concerning the DZ, such as enemy situation, hazards and obstacles, assembly areas, signals, and survey control.		
3. The battery conducted marshaling area activities. The BC/1SG ensured the following:		
a. Soldiers were assembled, organized, and marked.		
b. Soldiers were cross loaded.		
c. Sustained airborne training was conducted.		
d. Equipment to be heavy dropped was moved to the HDRS at the correct time.		
e. All equipment and correct ammunition were loaded on the platforms.		
f. Vehicles were sequenced in accordance with the movement plan and loaded in accordance with load plans.		
g. All equipment for combat was rigged correctly and loads were properly marked for ease of identification on the DZ.		
h. Personnel were briefed on tactical operations.		
i. Rehearsals were conducted.		
j. Final inspections of personnel and equipment were conducted.		

Performance Measures	*GO*	*NO-GO*
4. Battery conducted the operation. Leaders did the following:		
a. Ensured that beanbag lights and chemical lights were activated in the aircraft. Ensured that battery had backup signal(s) for heavy drop platforms.		
b. Ensured that jumpers exited on or near the HEPI.		
c. Ensured that battery immediately derigged equipment and personnel, conducted unit assembly procedures in accordance with TSOP, and moved off the DZ if required.		
Note. The tactical situation may require the unit to attain a firing capability on the DZ.		
5. The battery conducted drop zone mission.		
a. 105 mm: 15 minutes during the day and 25 minutes at night.		
b. 155 mm: 36 minutes during the day and 50 minutes at night.		
Note. Time starts when the last jumper, first pass, exits the aircraft. Time stops when the FDC receives call for fire, constructs and checks charts, plots targets, computes data, and sends to howitzer. The howitzer(s) is laid, prefire checks are complete, firing data is applied, and the round is prepared and positioned for the first howitzer and the howitzer reports "Ready."		
6. BC/1SG assembled all personnel and reported strength accountability to the battalion staff immediately upon occupation of position.		
7. Battery maintained noise and light discipline and security.		

SUPPORTING INDIVIDUAL TASKS		
Task Number	*Task Title*	*References*
071-326-5705	Establish an observation post	STP 21-24-SMCT
071-328-5301	Inspect personnel/equipment	STP 21-24-SMCT

Conduct Air Assault Operations

4-30. The conduct air assault operations for cannon batteries includes two collective tasks from ARTEP 6-037-30-MTP, tasks 06-2-E003 and 06-2-E002.

TASK: Conduct Air Assault Operations (06-2-E002)(FM 90-4).(FM 10-450-3).(FM 6-50)(TM 9-1015-234-10).(TM 9-1015-252-10)

CONDITIONS: The battery is conducting combat operations and has been ordered to conduct a planned air assault movement. The battery has been given guidance to include the location of the new position area, PZ/LZ, times, and coordinating instructions. The LZ is secure and the advance party has prepared the position. Some iterations of this task should be performed in MOPP4.

STANDARDS: The battery secures and rigs all equipment in accordance with field manuals, technical manuals, and pilot/crew chief directions. The battery occupies the LZ and establishes a firing capability per commander's guidance, OPORD, and TSOP.

Task Steps and Performance Measures	***GO***	***NO-GO***
1. The BC/XO conducted AMB with the air mission commander.		
2. The BC/platoon leader/platoon sergeant assembled and briefed personnel on the mission in accordance with TSOP.		
a. Briefed all personnel on the following:		
(1) Mission.		
(2) Method of movement.		
(3) General enemy situation.		
(4) Use of communications.		
(5) PZ and LZ operations and safety.		
b. Briefed key personnel on the following:		
(1) Route of movement to the LZ.		
(2) Location of PZ and LZ.		
(3) Time of displacement.		
(4) Azimuth of fire.		
(5) Tentative location of battery center.		
(6) Rehearsal times and location.		
3. The battery established communications with the lift unit. Primary and alternate frequencies were identified.		
4. The battery ensured that the PZ was marked and identified.		
5. The BC/1SG organized troops and equipment into chalks and assigned chalk leaders.		
6. The chalk leaders ensured the following:		
a. All personnel knew which aircraft and which position to load.		
b. All personnel wore or carried rucksack on the aircraft.		
c. Notified the crew chief when all personnel were on board.		
7. All sections prepared for airlift at PZ as follows: ***Note.*** When rigging the equipment, ensured that the proper steps were followed as outlined in		

Task Steps and Performance Measures	*GO*	*NO-GO*
FM 10-450-3 and/or the appropriate equipment manual.		
a. Howitzers, vehicles, A-22 bags, and cargo nets were rigged for internal or external loading.		
b. Loads were properly identified and marked.		
8. The battery ensured that hookup teams were properly equipped. Static probes and goggles or protective masks were required as a minimum.		
9. The battery maintained noise and light discipline in rear and forward areas and PZ and LZ.		
Note. For night air assaults, unit must use flashlights, beanbag and marking lights, IR strobes, or chemical lights (bright lights are not a viable operation when pilots are flying with the assistance of NODs). The decision of what light to use should be made by the pilots.		
10. The battery maintained security in rear and forward areas and PZ and LZ.		
11. The advance party secured LZ and position area and ensured that LZ was properly organized. Minimum personnel were used for the advance party.		
12. The battery conducted LZ operations as follows:		
a. The crews unloaded on order of aircraft crew chief.		
b. The individuals moved 15 to 20 meters out from the side of the aircraft and assumed the prone position facing away from the aircraft, weapons at the ready, until the aircraft departed the LZ.		
c. After aircraft depart, the LZ crews immediately derigged equipment.		
13. The battery attained firing capability.		
Note. Add 5 minutes for night occupation.		
a. 102/M119 series – battery 12 minutes		
b. M198 – battery 13 minutes, platoon 10 minutes		
14. The battery defended against ground attack during insertion as follows:		
a. Fired and maneuvered off the LZ to the closest side offering cover and concealment.		
b. Coordinated employment of all available fire support on enemy forces.		
c. Accounted for personnel and equipment once disengaged from the enemy.		

SUPPORTING COLLECTIVE TASKS		
Task Number	***Task Title***	***References***
06-1-E031	Support an air assault operation	ARTEP 6-115-MTP
06-2-E003	Conduct an air assault artillery raid	ARTEP 6-037-30-MTP

TASK: Conduct an Air Assault Artillery Raid (06-2-E003) (FM 90-4).(FM 6-50). (TM 9-1015-234-10)(TM 9-1015-252-10)

CONDITIONS: The battery is in position providing fires and has been ordered to conduct an air assault artillery raid. Required air assault equipment is on hand. The FA forward observers are available. The Army aviation assets are available. The advance party arrives at the LZ, 15 to 20 minutes before the main body. Some iterations of this task should be performed in MOPP4.

STANDARDS: The selected elements move to PZ at the prescribed time, rig equipment, and conduct the raid in accordance with commander's guidance, TSOP, and applicable field manuals and technical manuals.

Task Steps and Performance Measures	***GO***	***NO-GO***
1. The BC/XO planned air assault raid as follows:		
a. Planned mission using METT-TC.		
b. Used established TSOP.		
c. Ensured that minimum equipment was taken on raid.		
d. Specified correct ammunition for desired effect on target.		
e. Identified PZ and LZ locations.		
f. Coordinated with higher HQ for security element.		
g. Coordinated with higher HQ for attack helicopter support.		
h. Requested intelligence update from higher HQ.		
2. The BC/XO did the following:		
a. Coordinated with S3 air.		
b. Conducted an AMB with air mission commander.		
c. Designated raid personnel.		
d. Inspected raid personnel.		
e. Conducted troop safety briefing.		
3. The battery prepared to conduct air assault artillery raid to include the following:		
a. Raid participants conducted a rehearsal.		
b. Firing data was precomputed and distributed.		
c. PZ and security was established.		
Note. PZ is a minimum of 500 meters from the battery area.		
d. Howitzers and personnel were moved to PZ at appropriate time.		
e. Equipment was rigged and inspected.		

Task Steps and Performance Measures	*GO*	*NO-GO*
f. Prearranged signals or code words for extraction were distributed.		
4. Battery executed air assault artillery raid to include the following:		
a. Advance party and security elements secured the LZ.		
b. Advance party established communications with aircraft and observers.		
c. Loads were delivered to the correct LZ.		
d. Firing capability was established.		
e. Weapons were prepared for sling load extraction.		
f. Lift helicopters were recalled to LZ by BC/XO.		
g. Howitzers and personnel were extracted from LZ.		
h. Safety procedures were strictly adhered to.		

SUPPORTING INDIVIDUAL TASKS		
Task Number	*Task Title*	*References*
04-3302.01-0003	Conduct a reconnaissance	MOS O COM 0
04-3306.01-0008	Analyze terrain	MOS O COM 0
071-326-5626	Prepare an oral operation order	STP 21-24-SMCT
071-332-5000	Prepare an operation overlay	STP 21-24-SMCT

SUPPORTING COLLECTIVE TASKS		
Task Number	*Task Title*	*References*
06-1-E031	Support an air assault operation	ARTEP 6-115-MTP
06-2-E006	Prepare for air movement	ARTEP 6-037-30-MTP

Conduct Paladin Degraded Operations

4-31. The tasks to conduct degraded operations in a Paladin battery include actions at both the POC and on the howitzer. If the degradation should be on the howitzer, the following fire mission task from ARTEP 6-037-30-MTP is required. (Each howitzer section will be required to demonstrate their capability to operate at all levels of degradation.)

TASK: Perform Fire Missions in Degraded Mode on the M109A6 Paladin Howitzer (06-4-G005) (FM 3-09.70)

CONDITIONS: Given an M109A6 Paladin howitzer with a complete section and an inoperative subsystem. The subsystem could be the loss of communications, vehicle or AFCS power, some AFCS components, or anything that makes the vehicle less than 100 percent operational. Some iterations of this task should be performed in MOPP4.

STANDARDS: The section will complete all fire missions in degraded mode using alternate methods that are listed in TM 9-2350-314-10.

Task Steps and Performance Measures	***GO***	***NO-GO***
1. Section chief procedures for degraded fire missions, due to loss of electrical power:		
a. Immediately notified POC.		
b. Used limited electrical power available from the M992 FAASV APU.		
c. Manually rammed projectile.		
d. Manually laid using gunner's handwheels.		
Note. The APU provides enough power for AFCS operations only. APU output is not sufficient for operating the hydraulic system.		
2. Procedures for degraded fire missions, if the M992 FAASV is not available.		
a. Used reciprocal lay, aiming circle, or compass laying techniques.		
b. Ensured that spades were used.		
c. Manually elevated and traversed.		
d. Received firing data from adjacent howitzer.		
e. Operated travel lock manually.		
f. Used DAP or collimator.		
g. Hand-rammed projectile.		
3. Degraded fire missions procedures due to the loss of digital communications:		
a. Immediately notified POC.		
b. Collocated within 30 to 50 meters of operational gun and used data from operational gun.		
c. Used voice net for POC.		
d. Manually input data into AFCS.		
e. Section chief verified AFCS firing data with data received from POC, before firing round.		

Task Steps and Performance Measures	*GO*	*NO-GO*
f. If data matched, fired round upon voice command to fire from POC, then reported rounds complete back to the POC.		

SUPPORTING INDIVIDUAL TASKS		
Task Number	*Task Title*	*References*
061-266-1102	Record and maintain fire mission data on a DA Form 4513-R	STP 6-13B14-SM-TG
061-266-1105	Emplace and recover close-in aiming points	STP 6-13B14-SM-TG
061-266-1508	Prepare ammunition for firing	STP 6-13B14-SM-TG
061-266-1806	Lay and measure a howitzer for quadrant with the range quadrant (except M119)	STP 6-13B14-SM-TG
061-266-2001	Align close-in aiming points using the M100-series panoramic telescope	STP 6-13B14-SM-TG
061-266-2004	Lay a howitzer for initial direction of fire by using the panoramic telescope	STP 6-13B14-SM-TG
061-266-2231	Refer the piece	STP 6-13B14-SM-TG
061-266-2238	Establish a distant aiming point	STP 6-13B14-SM-TG
061-266-3305	Determine site and range to crest	STP 6-13B24-SM-TG
061-266-3315	Determine that howitzer data is safe to fire	STP 6-13B24-SM-TG
061-266-3323	Maintain DA Form 2408-4 (*Weapon Record Data*)	STP 6-13B24-SM-TG
061-266-4020	Determine and report the correct deflection	STP 6-13B24-SM-TG
061-266-4024	Monitor howitzer sections during firing	STP 6-13B24-SM-TG
061-307-3560	Conduct indirect fire missions using the automatic fire control system (M109A6)	STP 6-13B24-SM-TG
061-307-4557	Verify initialization data (M109A6)	STP 6-13B24-SM-TG

HOWITZER TABLE VII: TRAINING

4-32. Howitzer Table VII (table 4-14) will be conducted as an annual LTX and may include tables I through VII or selected tables as determined by the commander. This table will include all tasks to be performed during table VIII, qualification, and will be performed using the FSCATT simulator where available or using primers to simulate full-service ammunition. Howitzer Tables VII and VIII will include the following fire missions or substitute missions to satisfy the commander's METL assessment:

Howitzer Tables VII/VIII – fire missions

Fire Mission	*Table*	*Ammunition*
High angle, AF	VII, VIII	HE, 8 rounds
High angle, FFE	VII, VIII	HE, 1 round
Low angle, AF	VII, VIII	HE, 8 rounds
Priority target	VII, VIII	HE, 1 round
Out of sector mission	VII	0

TABLE VII/VIII STATION 1 (M102, M119, M198, M109 A1-A5) TEST ADMINISTRATIVE GUIDE

TASK: Conduct Fire Missions

CONDITIONS: You have completed the occupation of a new firing position and reported to the POC/BOC/FDC that you are ready to fire. You will conduct indirect fire missions as sent from the POC/BOC/FDC.

STANDARDS: The howitzer section is ready to fire within 30 seconds (45 seconds for high angle) after receiving and acknowledging the fire mission.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of giving the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer section with all assigned equipment.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 60 minutes
- Total time: 65 minutes

INSTRUCTIONS TO THE HOWITZER SECTION: *"You are conducting combat operations. You have arrived at your new position area and reported that you are laid and ready to fire. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time when the last digit in quadrant elevation is received.)

Performance Measures	*GO*	*NO-GO*
1. The section chief verified that fire mission data was safe.		
2. The crew selected announced projectile and fuze.		
3. The crew selected announced or standard ammunition lot.		
4. The crew cut and prepared announced charge.		
5. The crew assembled fuze and projectile.		
6. The crew placed announced fuze setting on fuze (if applicable).		
7. The crew prepared projectile for loading and ramming.		
8. The section chief checked ammunition lot, shell/fuse combination, and charge before loading.		
9. The crew laid howitzer for deflection and quadrant.		
10. The section chief verified lay.		
11. The crew loaded projectile when directed.		
12. The crew fired when directed in accordance with fire commands.		
13. The crew complied with any additional command (for example, cease fire).		
14. The crew made required entries on record of missions fired (DA Form 4513-R).		
15. The section chief ensured that the howitzer's ammunition status was updated in accordance with TSOP.		

TABLE VII/VIII STATION 2 (M102, M119)
TEST ADMINISTRATIVE GUIDE

TASK: Conduct out of Traverse Mission

CONDITIONS: The section is in position and fire missions are being conducted. The FDC sends a fire mission for a target about 1,600 mils off the AOL.

STANDARDS: The section traverses to the new AOF and conducts a fire mission in less than 3 minutes while maintaining standards of precision.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer section with all assigned equipment.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 5 minutes
- Total time: 10 minutes

OTHER INFORMATION: Time will begin when the last digit of quadrant is announced.

INSTRUCTIONS TO THE HOWITZER SECTION: *“You are conducting combat operations. You have arrived at your new position area and reported that you are laid and ready to fire. Do you understand the requirements of this test? Do you have any questions? You may begin.”*

Performance Measures	*GO*	*NO-GO*
1. Section traversed to the announced azimuth using the azimuth markers.		
2. COS verified that the howitzer was on the new azimuth using the compass or azimuth markers.		
3. Gunner disengaged deflection knob and set azimuth to the proper aiming reference on the azimuth scale.		
4. Section traversed howitzer onto the new AOF as the gunner sights through the pantel and told the section when to drop the trails.		
5. Gunner engaged the deflection knob and set the announced deflection for the fire mission.		
6. Section took all necessary action to place the howitzer in order and prepared for the fire mission.		
7. Section conducted fire mission and met all standards of precision.		

TABLE VII/VIII STATION 1 (PALADIN)
TEST ADMINISTRATIVE GUIDE

TASK: Conduct Fire Missions

CONDITIONS: You have completed the occupation of a new firing position and reported to the POC/BOC/FDC that you are ready to fire. You will conduct indirect fire missions as sent from the POC/BOC/FDC.

STANDARDS: The howitzer section is ready to fire within 30 seconds (45 seconds for high angle) after receiving and acknowledging the fire mission.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Howitzer section with all assigned equipment.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 60 minutes
- Total time: 65 minutes

INSTRUCTIONS TO THE HOWITZER SECTION: *"You are conducting combat operations. You have arrived at your new position area and reported that you are laid and ready to fire. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time when the AFCS displays quadrant elevation.)

Performance Measures	*GO*	*NO-GO*
1. The COS operated the AFCS and processed the fire mission.		
2. The COS responded and issued the fire commands.		

Performance Measures	*GO*	*NO-GO*
3. The driver raised the RPM of the howitzer from 1,000 to 1,200 RPM and recorded the fire mission on DA Form 4513-R.		
4. The COS activated servos and pushed LOAD KEY.		
5. The number 1 man prepared ammunition by lot and shell/fuse combination (set time if time fuze was used).		
6. The gunner prepared announced propellant.		
7. The COS checked setting, if time fuze was used, for proper time setting.		
8. The number 1 man rammed projectile (pushed manual control lever forward, holding lever for 4 seconds to allow full extension of rammer).		
9. The COS verified charge before gunner loaded it in the tube.		
a. The gunner placed the charge in the red ignitor pad facing the rear, announced "CLOSE," and lifted the breech-operating handle, causing the breech to close.		
b. The gunner ensured that witness marks were aligned and announced "WITNESS MARKS ALIGNED."		
10. The COS pressed the lay key and announced "LAY LIGHT IS BACK LIT."		
a. The actual and command deflection and quadrant matched within 1 mil of each other and no warning message was present.		
b. The gunner checked all three settings and announced, "VERIFIED." (If it was a high angle-fire mission, the command to prime was done before the lay key.)		
c. The gunner announced "CHECK FIRING" if a violation of the above steps occurred or if the data did not match.		
11. The COS commanded "PRIME" and the number 1 man emplaced the primer.		
12. The COS commanded "HOOK UP" and the number 1 man hooked up the lanyard.		
Note. If the method of fire control was "At My Command," the section chief waited until the command was given to fire over the AFCS.		
13. The COS commanded "FIRE" and the number 1 man fired.		

HOWITZER TABLE VIII: QUALIFICATION

4-33. Howitzer table VIII will be conducted as an annual live-fire LTX using full-service ammunition. Each howitzer section will have successfully completed table VII within the previous six months. It is recommended that Tables VII and VIII be incorporated into a single LTX. Howitzer Table VIII is a gate for all live-fire training conducted by battery or battalion.

SECTION II. MLRS SECTION TABLES

ARTILLERY SKILLS PROFICIENCY TEST FOR MLRS SECTION

4-34. The ASPT evaluates the MLRS section member's ability to execute selected crew skills. The tasks listed in this chapter provide the unit commander a means to evaluate the MLRS section member's basic proficiency prior to live-fire exercises. The ASPT can also be used as a guide for identifying section strengths and weaknesses. When structuring the unit's annual gunnery training program, the commander, master gunner, and battery leaders should use ASPT results.

REQUIREMENTS

4-35. All MOS 13M personnel and any personnel assigned to an MLRS section (regardless of MOS) will be given the ASPT. (MLRS section members are required to pass the ASPT before MLRS section qualification.) To pass the ASPT, a Soldier must receive a GO on all stations. If a Soldier fails a task, he must be retrained and retested on that station until he receives a GO. Appropriate manuals and other references listed for each station must be used to prepare, administer, and evaluate the ASPT.

Note. Evaluators must pass the ASPT within six months prior to testing.

EVALUATION PROCEDURES

4-36. Detailed procedures for setting up and conducting the evaluation and for conducting the AAR are in paragraph 3-2 of this manual.

TEST STATIONS

4-37. Each test station consists of a test administrative guide or criterion scoring checklist.

TEST STATIONS
1. Determine masking data test station
2. Perform hangfire procedures test station
3. Conduct launcher calibration test station (M270)
4A. Update weapon files test station (M270)
4B. Perform program load unit functions with the soldier's portable on-system repair tool test station
5. Perform fire control system startup test station
5A. Perform initialization/shutdown of the fire control system test station
6. Launcher reload procedures test station
7. Launcher reload operations test station
8. High mobility artillery rocket system test station

DETERMINE MASKING DATA TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 1 (ALL)

TASK: Determine Masking Data

CONDITIONS: Given a launcher, an M2 compass, a map of the area, a coordinate scale, and a briefing on the tactical situation and azimuth of fire (AOF).

STANDARDS: Measured masking data within 20 mils in elevation, 20 mils in azimuth, and 100 meters in distance. Entered masking data into the database for that firing point and sent the updated data to the BOC/POC.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Operational M270/M270A1/HIMARS launcher.
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Coordinate scale.
- Declinated M2 compass.
- Map.
- TM 9-1325-646-13&P, IETM 9-1055-647-13&P or IETM 9-2300-310-14&P.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time (per Soldier): 15 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will select an area with a panoramic view of surrounding terrain simulating a firing point and prepare a briefing on the tactical situation and the AOF.

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at a firing point. Your AOF is as follows: ____________________. You must successfully determine the azimuth to and measure the maximum immediate crest and determine the distance to the crest. You must also measure and report the azimuth to your left and right limits. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures	***GO***	***NO-GO***
1. Did NOT use the compass within 30 meters of the launcher.		
2. Measured the mask clearance.		
3. Inspected terrain and identified highest mask in his AOF.		
4. Measured and recorded mask to the closest 10 mils, within 20 mils of actual highest point.		
5. Measured mask azimuth.		
6. Used M2 compass to measure and record left azimuth to within 20 mils.		
7. Used M2 compass to measure and record right azimuth to within 20 mils.		
8. Measured distance to mask using a map, or had the driver pace the distance, or estimated the distance.		
9. Recorded the distance to within 100 meters distance.		
10. Section chief gave information to gunner; gunner correctly entered data into the FCS for the appropriate firing point and updated database.		
11. Gunner sent updated database to the BOC/POC.		

PERFORM HANGFIRE PROCEDURES TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 2 (ALL)

TASK: Perform Hangfire Procedures (061-310-8009)

CONDITIONS: Given a launcher with a simulated hangfire, crew, and appropriate technical manuals.

STANDARDS: The firing section performed all hangfire procedures without injury to personnel or damage to equipment.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M270/M270A1/HIMARS.
- TM 9-1325-646-13&P, IETM 9-1055-647-13&P or IETM 9-2300-310-14&P.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time (per Soldier): 15 minutes

OTHER INFORMATION: This task may be simulated at a firing point or in the local training area.

INSTRUCTIONS TO THE CREWMAN: *"You are currently located at a firing point. In the process of executing a fire mission, one or more rockets failed to fire. The hangfire indicator on the fire control panel is flashing. (Note. The continue option was selected during startup.)*

Do you understand the requirements of this test? Do you have any questions? You may begin."

Performance Measures	***GO***	***NO-GO***
Note. Crew stayed in position and double-checked the launcher cab.		
1. Made sure that vent fan was set to MED.		
2. Crew checked that differential pressure gauge read a minimum of 0.25. If the differential pressure gauge read less than 0.25, crew donned masks.		
3. Crew checked that vent fan control override was OFF.		
4. Crew checked that ventilation damper was in the firing position.		
5. Checked all doors, windows, hatches, and louvers to ensure that they were secured.		
6. Gunner set arm switch to SAFE after firing stopped.		
7. Ensured that mission fired message was sent to battery and platoon headquarters.		
8. Crew notified BOC/POC on voice radio of the hangfire condition.		
9. Waited 30 minutes. After 10 minutes, if cab became uncomfortably hot, directed driver to move the ventilation damper to normal and had all crewmembers don masks.		
10. After 30 minutes or when ordered, stowed the LLM and waited for further orders.		
Note. BOC will notify crew that they will download the pod with the hangfire at the nearest tree line. The crew will explain the following when questioned:		
11. Moved to tree line to download the LPC with the hangfire.		
a. Released SLO and drove the launcher with only the louvers open; needed to be able to see to drive the launcher.		
b. Drove the launcher slowly, avoiding rough ground and quick turns.		
c. Kept the LLM pointed in the AOF.		
d. Downloaded LPC and stowed LLM; ensured that the LPC shorting plug was connected.		
12. After unloading LPC, realigned SRP and updated PDS before continuing normal operations.		

CONDUCT LAUNCHER CALIBRATION TEST STATION (M270)
TEST ADMINISTRATIVE GUIDE
STATION 3

TASK: Conduct Launcher Calibration

CONDITIONS: Given an M270 launcher, a crew, calibration course data, FM 6-60, and TM 9-1325-646-13&P.

STANDARDS: Calibrated the M270 launcher within the PDS calibration limits listed in TM 9-1325-646-13&P.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational M270 launcher.
- Two survey control points.
- TM 9-1325-646-13&P.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 15 minutes
- Total time (per Soldier): 20 minutes

OTHER INFORMATION: Prior to this task being evaluated, two SCPs—an appropriate distance apart—must be surveyed and marked.

INSTRUCTIONS TO THE CREWMAN: *"You have initiated startup procedures and determined that the PDS requires calibration. Your POC/BOC has provided two survey control points. You must calibrate the PDS on your launcher per the procedures in the* *technical manual. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures	***GO***	***NO-GO***
1. The section chief directed the driver to park the SPLL with the rear edge of the left drive sprocket in line with and about 0.5 meters away from the SCP.		
2. When the vehicle was properly parked, the section chief directed the gunner to enter the calibration data into the CALIBRATE PDS MENU.		
3. The crew proceeded on calibration run 1 at a constant speed of 40 kilometers per hour.		
4. Upon arrival at the second SCP, the gunner entered the calibration data into the FCS in the CALIBRATE PDS MENU.		
5. Upon arrival back at the first SCP, the gunner entered the survey data into the FCS in the CALIBRATE PDS MENU.		
6. Upon completion of the calibration, the gunner entered the startup menu and recorded the odometer scale factor, azimuth crab angle, and the elevation crab angle. The gunner checked to ensure that the data are within the calibration parameters in TM 9-1325-646-13&P.		

UPDATE WEAPON FILES TEST STATION (M270)
TEST ADMINISTRATIVE GUIDE
STATION 4A

TASK: Update Weapon Files (061-310-8007)

CONDITIONS: Given an M270 launcher with startup completed, PLU with cassette, and TM 9-1325-646-13&P.

STANDARDS: Updated weapons files to receive the PIM EPROM PROGRAMMING COMPLETE prompt on the fire control panel.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational M270 launcher with startup completed.
- PLU with cassette.
- TM 9-1325-646-13&P.

TEST PLANNING TIME:

Administrative time: 5 minutes
Test time: 12 minutes
Total time (per Soldier): 17 minutes

INSTRUCTIONS TO THE CREWMAN: *"You have determined after startup that you must reprogram and update your weapon files. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures	*GO*	*NO-GO*
1. Entered PLU READ MENU.		
2. Pressed INIT key to begin deletion.		
3. Connected PLU.		
4. Pressed the INIT key.		
5. Received PIM EPROM PROGRAMMING COMPLETE prompt on the fire control panel.		
6. Disconnected PLU upon completion of weapons update.		

PERFORM PLU FUNCTIONS WITH THE SOLDIER'S PORTABLE ON-SYSTEM REPAIR TOOL (SPORT) TEST STATION TEST ADMINISTRATIVE GUIDE STATION 4B (M270A1, HIMARS)

TASK: Perform PLU Functions with the Soldier's Portable On-System Repair Tool (061-312-5107)

CONDITIONS: Given an M270A1 launcher, a SPORT, MSD, PLU (CD-ROM), W10P2 cable, BNC to MICRO adapter, "T" adapter, and BNC terminator.

STANDARDS: Performed successful transfer of files.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational M270A1/HIMARS launcher.
- SPORT with fully charged batteries.
- MSD.
- PLU (CD-ROM).
- W10P2 cable.
- BNC to MICRO adapter.
- "T" adapter and BNC terminator.
- IETM 9-1055-647-13&P or IETM 9-2300-310-14&P.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 30 minutes
- Total time (per Soldier): 35 minutes

OTHER INFORMATION:

1. Do not power down the system during initialization or the PLU will be damaged.
2. Reload the same version of software to avoid follow-on procedures wait time.

INSTRUCTIONS TO THE CREWMAN: *"You have determined after startup that you must reprogram and update your weapon files. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures	*GO*	*NO-GO*
1. Performed PLU functions using the SPORT.		
a. Connected the SPORT to FCS using the W10P2 cable, BNC to MICRO adapter, "T" adapter, or BNC terminator.		
b. Applied power to the SPORT using one of the four methods.		
c. Turned the SPORT on by pressing the OFF/ON key and allowed Microsoft Windows to completely boot up.		
d. Powered up the FCS by placing the FCP PWR SWITCH in the ON position.		
e. Activated the PLU software.		
f. Transferred files from the SPORT to the FCS.		
2. Performed PLU functions using the MSD.		
a. Connected power (W11) or NATO slave cable, and Ethernet (W10) between the MSD and launcher.		
b. Ensured that MSD batteries were installed.		
c. Turned on MSD and allowed to fully initialize.		
d. Double-clicked the PLU icon on the Windows 95 desktop screen on the MSD.		
e. Started the carrier engine and engaged the launcher interconnect switch and verified that both generators were working before continuing.		
f. Turned on FCS power switch.		
g. Pressed CONNECT on the PLU program.		
h. Transferred files from the MSD to the FCS by selecting one of the following options on the main PLU screen:		
(1) CONNECT/DISCONNECT: Used to establish or terminate a connection between the PLU and the FCS.		
(2) RELOAD MSD: Used to perform an entire rewrite of the mass storage device (MSD).		
(3) SELECTIVE FILE CONTROL: Used to send files back and forth between the PLU and MSD.		
(4) CLEAR STATUS: Clears the contents of the status window.		
(5) EXIT: Quits and exits the PLU program.		

PERFORM FIRE CONTROL SYSTEM STARTUP TEST STATION (M270) TEST ADMINISTRATIVE GUIDE STATION 5

TASK: Perform Fire Control System Startup

CONDITIONS: Given an M270 launcher, startup data, startup data card, TM 9-1325-646-13&P, and a program load unit (when required).

STANDARDS: Performed FCS startup to achieve hot status.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- An operational M270 launcher.
- ANCD.
- PLGR.
- OPORD, tactical situation.
- TM 9-1325-646-13&P, IETM 9-1055-647-13&P or IETM 9-2300-310-14&P, Startup Data Card, and PLU (when required).

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 13 minutes
- Total time (per Soldier): 18 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will prepare a form with all required startup data.

INSTRUCTIONS TO THE CREWMAN: *"Your section is conducting combat operations. You have been provided the tactical situation. You and your section are required to conduct launcher startup procedures to include establishing voice and digital communications with the POC/BOC. You will also be required to update the PDS and an SCP and be prepared to move to a hide area. You should complete all tasks in 8 minutes. Do you understand the requirements of the test? Do you have any questions? You may begin."* (Start the time when the crew is in the launcher.)

WARNING

Personnel working on and around equipment must wear ear protection. Noise levels could cause permanent hearing damage.

Performance Measures	***GO***	***NO-GO***
Note. Ensure that the MASTER POWER and LAUNCHER INTERCONNECT are in the ON position and the FCP SWITCHES are in the OFF and/or safe position before startup procedures begin. LLM must be stowed to perform startup.		
1. Checked to see if the launcher interconnect switch on the driver's console was on. (It connects the vehicle's alternators to the LLM batteries. The generators will not charge the batteries for the FCS if the switch is not on.) Checked to see that all switches on the FCP were in the down or safe position and all adjustment knobs were set to maximum.		
2. Turned on the radio equipment.		
3. Ran vehicle engine at fast idle (1,200 to 1,500 RPM). Checked the carrier volts gauge during normal operation. (The volts gauge should indicate in the upper 50 to 75 percent of the green zone.)		
4. Set the SYSTEM POWER SWITCH to ON and lowered cover.		
5. The first prompt that will appear on the screen will be BUBBLE MEMORY DOWNLOAD IN PROGRESS. The EU downloads the files required for operations from the storage memory of the EU to the operating memory of the EU. Once this action is complete, the FCP displays the LANGUAGE SELECTION field. Performed lamp tests at this time and adjusted the control knobs to the desired levels.		
6. Entered option 3 and pressed EXEC key (U.S. English).		
7. Entered BOOM CONTROL OPTION. Will show YES or NO. Selected NO.		
8. Selected the language-prompting mode and the TIME OF DAY field appeared. Enter time in the sequence of hours, minutes, and seconds. After the correct time of day was entered,, pressed the STORE key and the clock began keeping time.		
9. Performed system startup by purging the database. Selected option one to purge the database. (When purging the database, operational data will be removed from the memory that was saved when the fire control system was last shut down.)		
a. Pressed the index key, and the INDEX MENU displayed, showing a list of options which is the starting point for all menus and routines.		

Performance Measures	*GO*	*NO-GO*
b. Entered SYSTEM STARTUP using the information in the order it appeared on the startup data card.		
c. Selected option 0 in the startup menu.		
(1) Entered the easting information (that is, 000000) recorded on the startup data card.		
(2) Entered the northing information (that is, 00000000) recorded on the startup data card.		
(3) Entered the altitude information (that is, +0000) recorded on the startup data card. ***Note***. Valid entries can be either + positive or - negative. Positive entries represent altitudes above sea level and negative entries represent altitudes below sea level. (4) Pressed the STORE key to turn on the SRP/PDS.		
(5) Entered the grid zone information recorded on the startup data card. A grid zone is a large section of the earth's surface. Valid entries in this field can be either a + (positive) or - (negative) entry. A negative number would put your launcher below the equator, and a positive number puts your launcher above the equator.		
(6) Selected a valid entry for high QE. The high QE defaults to option zero or no entry. ***Note***. A "YES" entry (option 1) tells the EU to use a high angle to engage the target. A "NO" entry (option 0) tells the EU to find the lowest possible angle to engage the target during a fire mission. The only time the operator would enter 1 here is if a masking problem existed.		
(7) Selected a valid entry for LPC Malfunction. This field is used if there is some type of malfunction in LPC 1.		
(a) If a "YES" (option 1, default) is entered, and there are not enough rockets in LPC 1 to complete a mission due to a misfire, hangfire, or other malfunction, replacement rocket(s) will be automatically selected from LPC 2 and the assigned number of rockets will be fired.		
(b) If a "NO" (option 0) is entered, LPC 2 rockets will not be used to replace failed rockets.		
(8) Selected a valid entry for hangfire option. (This option allows the crewman to continue or stop if a hangfire occurs in any rocket during a fire mission.)		
(a) If "STOP" (option 0, default) is entered, and a rocket hangfires, the firing sequence will stop.		
(b) If "CONTINUE" (option 1) is selected and a hangfire occurs, the FCS will automatically select another weapon for firing.		
Note. The FCP displays the SRP aligning time to go after the last entry for system startup is made. Initial alignment of the SRP takes approximately 8 minutes. Do not wait for the SRP to complete alignment. d. Performed communication start up at this time. Pressed the index key; then selected option 5, Comms Startup menu.		
(1) Entered the numbers from the corresponding lines into the FCS. If there was no number in the first box next to the entry, looked to the right at the other boxes for the entry.		
(2) Pressed the EXEC key after making the final entry on line 25.		

Performance Measures	*GO*	*NO-GO*
e. Pressed the index key to proceed with startup.		
f. Entered the PDS data in section 4 of the SPLL startup data card. Selected option 3, MENUS MENU; then selected option 0, startup menu.		
(1) Selected option 1, PDS startup.		
(2) Entered the odometer scale factor information. ***Note.*** The odometer scale factor represents the distance traveled for each pulse sent from the encoder to the PDS.		
(3) Entered the azimuth crab angle information. ***Note***. The azimuth crab angle represents the difference in horizontal direction between the vehicle and the orientation of the SRP/PDS to the vehicle.		
(4) Entered the elevation crab angle information. ***Note.*** The elevation crab angle represents the difference in vertical direction between the vehicle and the orientation of the SRP/PDS to the vehicle.		

PERFORM INITIALIZATION/SHUTDOWN OF THE FIRE CONTROL SYSTEM TEST STATION (M270A1/HIMARS) TEST ADMINISTRATIVE GUIDE STATION 5A

TASK: Perform Initialization/Shutdown of the Fire Control System (M270A1)

CONDITIONS: Given a launcher (M270A1) with FCP and MSD, DTD, AN/CYZ-10, all communications equipment, startup data, SPORT, and IETM 9-1055-647-13&P for system initialization.

STANDARDS: Initialized FCS by powering up and downloading operational software to the FCS. Provided operational parameters to the FCS, which are used to initialize the PNU, GPS, and communications systems. Shut down FCS in a reverse logical order.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- An operational M270A1 launcher.
- MSD.
- Data transfer device, AN/CYZ-10.
- Startup data card.
- SPORT with fully charged batteries.
- TM 9-1325-646-13&P, IETM 9-1055-647-13&P or IETM 9-2300-310-14&P.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 13 minutes
- Total time (per Soldier): 18 minutes

OTHER INFORMATION: Before the Soldier arrives, the evaluator will prepare a form with all required startup data.

INSTRUCTIONS TO THE CREWMAN: *"Your section is conducting combat operations. You have been provided the tactical situation. You and your section are required to conduct launcher initialization procedures to include establishing voice and digital communications with the POC/BOC. You should complete all tasks in 8 minutes. Do you understand the requirements of the test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	*GO*	*NO-GO*
1. Performed system initialization.		
a. Initiated process by placing FCS SYSTEM PWR switch in ON position.		
b. Reviewed/entered data in system submode (time of day, launcher location data, communications initialization).		
c. Performed communications startup.		
d. Selected weapon data.		
e. Reviewed/selected operator options.		
f. Performed LDST.		
g. Loaded GPS keys.		
2. Performed FCS shutdown.		
a. Pressed menu bar.		
b. Selected SYSTEM option.		
c. Selected CONFIRM option.		
d. Monitored all CSCIs as they shut down on FCP display.		
e. Placed FCS POWER SWITCH in OFF position after the prompt POWER DOWN THE SYSTEM was displayed.		

MLRS TABLES

4-38. The MLRS tables for the SPLL are as outlined in table 4-15.

Table 4-8. MLRS launcher section tables

Table No.	*Description*	*Remarks*
I	Individual Soldier and leader tasks (includes safety certification)	Unit exam samples, FM 6-60
III	Machine gun training	
IV	Conduct MLRS firing section OPAREA occupation	06-4-M022 ARTEP 6-397-30-MTP
V	Reload procedures	
VI	Prepare HIMARS for air movement	

Table 4-8. MLRS launcher section tables

Table No.	*Description*	*Remarks*
VII	Crew training (fire missions)	Evaluate using FCP trainer
VIII	Section live-fire qualification	Multiechelon

MLRS TABLE I: INDIVIDUAL SOLDIER AND LEADER TASKS

4-39. The tasks for Table I include all individual and leader tasks required to accurately and safely fire MLRS/HIMARS munitions. Individual tasks are all tasks in STP 6-13M14-SM-TG. Leader task steps are included in the collective tasks in ARTEP 6-397-30-MTP. The training of these tasks is conducted during sergeant's time training and the results of this table will assist in planning and conducting that training. The leader's safety certification exams addressed in chapter 2 of this manual may require supplementation with local range safety procedures and requirements to meet the commander's safety certification program. Example examination questions may be found in appendix C and appendix D and should be supplemented with questions on unit TSOP and local regulations.

MLRS TABLE III: M249 LIGHT MACHINE GUN TRAINING

4-40. The M249 LMG is common to many sections and crews in FA units. Maintaining a high degree of proficiency on this weapon has never been more important. The asynchronous battlefield of the COE and the varied and complex missions assigned to FA organizations require that crews and sections be proficient on all assigned weapons. The M249 LMG is critical to the overall defense of the unit against both ground and air threats and integrated with other defenses to provide force protection against all threats. The unit training program should include preliminary marksmanship training and training on the assembly, disassembly, and maintenance of the weapon as described in FM 3-22.68. The training and qualification included in MLRS Table III is the strategy recommended by STRAC and FM 3-22.68. This strategy has been expanded to include a convoy live-fire exercise.

MLRS Table III – M249 LMG training

Task	*Conditions*	*Ammunition*	*Reference*
10-meter zero practice and qualification	Integrated CBRN, 80 percent of assigned gunner and assistant gunner annually	108 rounds, ball/person	Table 5-1, FM 3-22.68; Table 5-26, DA Pam 350-38
Transition firing, practice, and qualification	Integrated CBRN	144 rounds, mix/person	Table 5-1, FM 3-22.68; Table 5-26, DA Pam 350-38
Night zero and instructional firing	With mounted AN/PVS-4	90 rounds, mix/person	Table 5-1, FM 3-22.68; Table 5-26, DA Pam 350-38
Convoy live fire exercise		370 rounds, mixed	

MLRS TABLE IV: CONDUCT MLRS FIRING SECTION OPAREA OCCUPATION

4-41. Table IV is a critical task for MLRS/HIMARS sections that should be trained live, as an STX, on varying terrain.

TASK: Conduct MLRS Firing Section Operational Area Occupation (06-4-M022) (FM 6-60) (TM 9-1425-646-10-2)

CONDITIONS: The firing section is conducting combat operations. The section is in a platoon operations area and has received occupation and mission instructions from the platoon leader. Launcher is operational and calibrated, and all startup/PDS/FCS data is current and complete. Some iterations of this task should be performed in MOPP4.

STANDARDS: The section must move to the section's firing area, select hide and firing positions in accordance with FM 6-60, occupy an initial hide area, update the FCS data, transmit the updated database as required, and assume the designated launcher posture.

Task Steps and Performance Measures	***GO***	***NO-GO***
1. Section chief conducted a map reconnaissance of area to become familiar with the area and to spot potential hide/firing locations.		
2. Driver drove the launcher to the section firing area in accordance with FM 6-60, platoon instructions, terrain/weather conditions, and section chief's instructions.		
3. Section chief selected initial hide/firing locations and at least two additional hide/firing locations in accordance with FM 6-60. Unless special considerations apply, the locations should meet the following criteria:		
a. HAs are within 100 meters of FPs and offer good cover and concealment; however, longer distances are acceptable if response times can be kept short.		
b. FPs are at least 500 meters from other FPs (800 meters is preferred) and 800 meters from any other position or element except HAs.		
c. Slope of FPs is not greater than 89 mils.		
d. If a FP is located on a road, the road is perpendicular to the AOF for rocket missions or parallel to the AOF for missile missions.		
e. FPs do not have an immediate mask in the probable direction of fire that will interfere with firing.		
f. All locations afford good communications with POC and BOC.		
4. Section moved to and occupied initial HA in accordance with FM 6-60.		
a. Section conducted proper tactical movement to the HA. Section chief directed the driver using proper hand signals.		
b. Section chief directed camouflage and position preparation as appropriate.		
c. Section chief finalized position selections and verified all position data.		
5. Gunner updated all data in FCS as appropriate. Section chief verified correct data entry.		

Task Steps and Performance Measures	*GO*	*NO-GO*
6. Gunner transmitted updated FCS position data to the POC/BOC and verified receipt.		
7. Section assumed directed launcher response posture.		

SUPPORTING INDIVIDUAL TASKS		
Task Number	*Task Title*	*References*
061-310-2001	Perform stablization reference package//PDS operations	STP 6-13M14-SM-TG
061-310-2022	Edit/input fire control system data	STP 6-13M14-SM-TG
061-310-3011	Select a launcher firing position	STP 6-13M14-SM-TG
061-310-8004	Operate the M993	STP 6-13M14-SM-TG
061-310-8005	Perform fire control system startup	STP 6-13M14-SM-TG
061-310-8008	Enter operational area data into the fire control system	STP 6-13M14-SM-TG

SUPPORTING COLLECTIVE TASKS		
Task Number	*Task Title*	*References*
06-2-M017	Move an multiple launch rocket system firing platoon or battery	ARTEP 6-397-30-MTP
06-3-M001	Conduct occupation of position area (multiple launch rocket system battery/platoon)	ARTEP 6-397-30-MTP
06-3-M017	Conduct multiple launch rocket system firing platoon reconnaissance, selection, and occupation of position	ARTEP 6-397-30-MTP

MLRS Table V: Reload Procedures

4-42. The reload task in MLRS Table V may be trained as an STX or during the LTX for MLRS Tables VII/VIII. Table V is a gate for Table VIII.

LAUNCHER RELOAD PROCEDURES TEST STATION (M270)
TEST ADMINISTRATIVE GUIDE
STATION 6

TASK: Launcher Reload Procedures (M270)

CONDITIONS: The firing section is conducting combat operations and has completed a fire mission. The launcher requires resupply of rockets. The POC/BOC has directed that the launcher proceed to the reload point, re-arm, and move to an HA near the next firing point.

STANDARDS: The firing section must perform reload operations within 12 minutes and then prepare to assume a firing capability.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- An operational launcher.
- Two M68/M68A2 launch pod assembly trainers.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 12 minutes
- Total time (per Soldier): 17 minutes

OTHER INFORMATION:

1. Time starts when the launcher starts to move towards the LPCs and ends when the LLM is stowed.
2. Crew will download two training LPCs at the same time, move the hooks over to the expended pods representing the new live LPCs, and then pick up both LPCs (new LPCs would be loaded from the L/R rear corner of the SPLL).

3. Crew must pause briefly with hooks over the expended pods for the evaluator to verify that the hooks are over the bulkhead and the pods may be safely loaded without dragging the LPC more than one-half the width of the LPC.

INSTRUCTIONS TO THE CREWMAN: *"Your section is conducting combat operations. You have been given the tactical situation. You and your section have completed a mission and have been directed to move to a reload point, re-arm, and move to your next HA. The location of the LPCs is the reload point. Your time begins when you move to the LPCs and ends when the LLM is stowed. You should complete all tasks in 12 minutes. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures	*GO*	*NO-GO*
1. Section chief directed driver to reload point.		
2. As the LPCs to be loaded are approached, stopped SPLL and the section chief dismounted. Section chief checked for security and inspected pods for serviceability and correct weapon type.		
a. Checked type of LPCs to make sure they are the same type as specified in resupply order.		
b. Made sure an electrical shorting plug was connected to the wiring adapter for the LPCs.		
c. Checked LPC wiring for crimped, frayed, loose, or broken wiring.		
d. Checked for cracked, gouged, or shattered launch tubes.		
e. Checked launch tube end covers for cracks, dents, gouges, or looseness, indicating a break in the seal.		
f. Checked LPC rails, braces, and bulkheads for bends, breaks, gouges, and missing parts.		
g. Checked lifting bar for bends, breaks, and looseness.		
h. Checked condition of D-rings and their mountings; D-rings will lay flat against the top of the container.		
i. Checked missing components for other obvious damage.		
j. Checked bottom of LPC for damage or dirt that would prevent proper loading and firing.		
3. Section chief moved into position and directed launcher to proper position for loading using proper hand and arm signals.		
4. Driver parked SPLL with the rear edge of the launcher approximately 1/3 meter away at a 35-degree angle.		
5. Driver placed range selector in neutral, set hand brake, and engaged the SLO. Driver set throttle control to high idle (approximately 1,200 RPM). Driver observed voltmeter to ensure that it was reading in the high yellow or middle green.		
6. Driver exited the cab and moved to the rear left of the LLM.		
7. Gunner selected LLM LEFT/RIGHT from BOOM CONTROL menu; remained in cab until the BOOM CONTROL light was on.		

Performance Measures	***GO***	***NO-GO***
8. Gunner removed BC from storage and closed door. He moved to a position to unload LPCs.		
9. Section chief moved to rear of LLM and released both LPC hold-down latch handles.		
10. Section chief disconnected right umbilical cables; driver disconnected left umbilical cables and closed access door to cables.		
11. Driver moved to LPC to be loaded and disconnected quick release pins on skids.		
12. Section chief performed SNVT test, pressed button and adjusted lamp brightness so all lamps were visible, and waited for go lights on self-test and left and right cable.		
13. Section chief closed SNVT access door and moved into position for reloading operations.		
14. Gunner removed boom controller from storage door, closed the door, and moved into position for reloading.		
15. Gunner checked to ensure that boom enable light was functional; then moved toggle switch to select both LPCs and awaited further instructions.		
16. Section chief directed unloading procedure with hand and arm signals to ensure a safe unloading operation.		
17. Section chief moved to right LPC and driver to left LPC to disconnect hoist hooks from LPC.		
18. Section chief signaled gunner to raise hooks and moved LLM so it was positioned directly over LPC to be loaded.		
Note. At this point the evaluator will check to ensure that hoist hooks are over the lifting bar (within one-half the width of the LPC) and then the crew will move the hooks back over to their training pods and pick them up.		
19. Section chief ensured that hoist assembly was in the correct position to pick up the LPC to be loaded.		
20. Section chief signaled gunner with correct hand and arm signals to load launch pods in bay.		
21. Section chief inspected underside of LPC before giving the boom-in arm signal to gunner.		
22. Gunner moved booms in to limit switch stop and waited for the section chief to signal hoist down.		
23. Section chief checked position of pods to ensure that they were seated on positioning guide pins.		
24. Gunner moved the LLM to the right until section chief and driver could reach the LPC hold-down latches and umbilical cables if necessary.		
25. Section chief performed SNVT test.		
26. With section chief on right LPC and driver on left LPC, reconnected the umbilical cables to the LPC; moved hold-down latch handles to a position where the safety chain could be connected; then latched LPC hold-down handles.		
27. Gunner stowed LLM after LPCs were latched and watched panel for the weapon processing and fuze test. Entered proper JED pod identification.		

Performance Measures	***GO***	***NO-GO***
28. Section chief verified LLM stow by observing travel lock hooks.		
Note. TIME STOPS NOW.		
29. When LLM was stowed, driver released SLO toggle switch and observed that SLO light had gone out. He released the parking brake and put the selector in DRIVE to move the launcher.		

LAUNCHER RELOAD OPERATIONS TEST STATION (M270A1)
TEST ADMINISTRATIVE GUIDE
STATION 7

TASK: Conduct Launcher Reload Operations (M270A1) (06-4-M010.06-00A1)

CONDITIONS: The firing section is conducting combat operations and has completed a fire mission. The launcher requires resupply of weapons. The FDC has directed that the launcher proceed to the reload point, reload, and move to a hide area near the next firing point. Some iterations of this task should be performed in MOPP4.

STANDARDS: The firing section must perform reload operations within 10 minutes and then prepare to assume a firing capability. All safety procedures will be observed throughout the reload operation. Time standards do not apply to MOPP training. The crew will follow all safety guidelines in accordance with IETM. The time standard of 10 minutes assumes no damage to the LPC or that no unsafe conditions exist.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- An operational launcher.
- Two M68/M68A2 launch pod assembly trainers.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time (per Soldier): 15 minutes

OTHER INFORMATION: Time starts when the launcher is correctly positioned next to the LPCs per IETM and ends when the launcher begins to move off of the reload point.

INSTRUCTIONS TO THE CREWMAN: *"Your section is conducting combat operations. You have been given the tactical situation. You and your section have completed a mission and been directed to move to a reload point, re-arm, and move to your next HA. The location of the LPCs is the reload point. Time starts when the launcher is correctly positioned next to the LPCs in accordance with IETM and ends when the launcher begins to move off of the reload point. You should complete all tasks in 10 minutes. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Task Steps and Performance Measures	***GO***	***NO-GO***
1. When directed to move to a reload point, the firing section did the following:		
Note. Time starts when the launcher is correctly positioned next to the LPCs in accordance with IETM and ends when the launcher begins to move off of the reload point.		
a. Moved to the reload point when directed.		
b. Established or augmented security of reload point and reported status to FDC.		
c. Ensured that safety procedures were observed throughout the reload operation.		
Note. While the LM is moving, no one can be within the 3-meter safety zone around the LM, regardless of whether the LM is moving under BC control or from a selected reload position from the reload routine or if it is returning to STOW. This rule applies in both tactical and maintenance speeds.		
Note. The gunner must remove the BC from its storage bracket and hold it in his hand before anyone else steps into the 3-meter safety zone. The gunner must hold the BC in his hand during the entire reload operation even when there is no LM movement.		
2. The section chief guided the driver in positioning the launcher for reload as follows:		
a. Checked the LPCs to be loaded for damage or unsafe conditions that could prevent a safe resupply operation and recorded serial and lot numbers.		
b. Parked the launcher approximately 1 meter away from and at an approximate 35-degree angle to the side of the LPCs.		
c. Section chief verified that driver placed range selector in neutral, engaged hand brake and suspension lockout, suspension lockout indicator light came on, and the launcher interconnect switch was set to on.		
d. Driver checked that the carrier volts gauge was indicating in the upper 50 to 75 percent of the green zone.		
e. Gunner selected appropriate LM position when directed by section chief.		
3. The firing section unloaded LPCs as follows:		
a. Unlatched LPCs.		
b. Disconnected umbilical cables from LPCs and reconnected to launcher connectors.		
c. Tested umbilical cables (SNVT test).		
d. Unloaded expended LPCs.		
e. Disconnected hoist cables from expended LPCs.		

Task Steps and Performance Measures	*GO*	*NO-GO*
f. Positioned LM for reload.		
4. The firing section loaded LPCs as follows:		
a. Positioned LM boom over LPCs.		
b. Properly connected hoist locks to LPCs.		
c. Raised LPCs to the fully seated position against the hoist cradles.		
d. Section chief visually checked the bottom of the LPCs for damage or unsafe conditions that could prevent a safe resupply operation.		
e. Removed skids from LPCs.		
f. Loaded LPCs.		
g. Ensured that LPCs were seated properly.		
h. Positioned LM for safe crew access to umbilical cables.		
i. Tested umbilical cables (SNVT test).		
Note: If test results are NO-GO in any umbilical cables, stop operations and inform FDC. If test results are GO in all cables, continue sequence.		
j. Disconnected umbilical cables from launcher stowage connectors.		
k. Connected umbilical cables to LPCs.		
l. Latched LPs in position.		
m. Replaced and secured boom control.		
n. Stowed LM.		
o. Section chief visually verified the LM STOWED message, ensured that travel locks engaged, and listened for the LDS to power down.		
p. Driver released suspension lockout.		
q. Moved per instructions.		

MLRS TABLE VI: PREPARE HIMARS FOR AIR MOVEMENT

4-43. The strategic mobility of HIMARS and the resulting high probability of supporting the modular concept of force packaging require crew proficiency in the tasks of preparing the HIMARS for air transport. The actual air loading of HIMARS must be in accordance with the guidance and control of the USAF loadmaster supported by the HIMARS crew. This task should be trained as a crew-level STX using a simulated C-130 air load trainer before training on actual aircraft.

PREPARE HIMARS FOR AIR MOVEMENT TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 8

TASK: Prepare M142 High-Mobility Artillery Rocket Sustem for Internal Air Transport by C-130

CONDITIONS: Given a HIMARS crew, M142 HIMARS launcher, and C-130.

STANDARDS: The crew prepared the M142 HIMARS launcher for internal air transport.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (he may also occupy a test station).
- Station evaluator, SGT or above (one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- An operational M142 HIMARS launcher.
- C-130 air load trainer or C-130 aircraft.
- IETM 9-2300-310-14&P.

TEST PLANNING TIME:

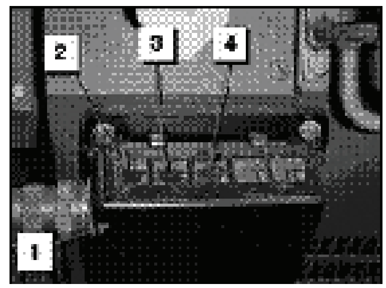
- Administrative time: 5 minutes
- Test time: 20 minutes
- Total time (per crew): 25 minutes

INSTRUCTIONS TO THE CREWMAN: *"Your section has been alerted for deployment using a C-130 aircraft. You must prepare your launcher for internal air transport. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

Section Chief	*Gunner*	*Driver*
1. POSITION VEHICLE FOR LOADING		
Guide driver to position vehicle as directed by aircraft loadmaster.		Follow signals from section chief and position vehicle.
		When in position, set the transmission selector to neutral and set the parking brake.
	Press the MENU BAR PF key.	
	Using the PREVIOUS/NEXT PF keys, highlight the SYSTEM heading.	
	Press the SELECT PF key to display the SYSTEM drop down menu.	
	Using the PREVIOUS/NEXT PF keys, highlight the PURGE heading.	
	Using the PREVIOUS/NEXT PF keys, highlight the CRYPTO heading.	
	Press the SELECT PF key.	
	Press the CONFIRM PF key.	
	When the crypto purge is complete, use the PREVIOUS/NEXT PF keys and highlight the SET SYSTEM PARAMETERS heading.	
	Press the SELECT PF key.	
	With the COORDINATE DISPLAY heading highlighted, press the SELECT PF key.	
	Enter the coordinates of the anticipated location at the FLS.	
	Press the RETURN PF key and the STORE PF key.	
	Press the MENU BAR key.	
	Using the PREVIOUS/NEXT PF keys, highlight the SHUTDOWN heading.	
	Press the SELECT PF key.	
	Press the CONFIRM PF key.	
	When prompted by the FCS, set the SYS PWR switch to OFF.	

Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

Section Chief	*Gunner*	*Driver*
2. DEFLATE REAR TIRES		
		Press the SAND Mode indicator (4) to set the CTIS in the soft terrain mode.
		The indicator illuminates steady when tire pressure is 22 PSI.
		Maximum speed at this setting is 12 MPH.
		 **Figure 4-1**

Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

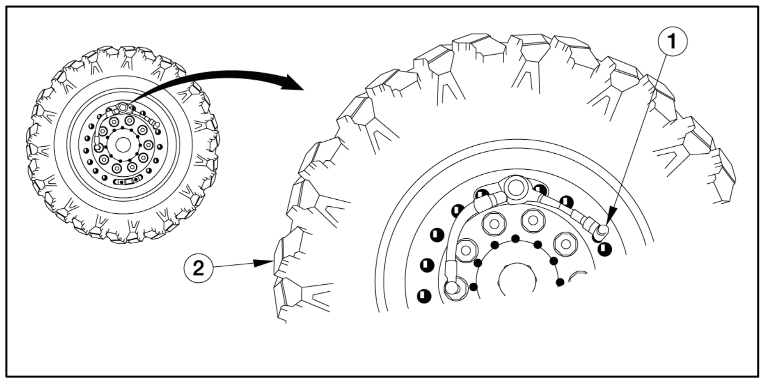
<table>
<tr><th>Section Chief</th><th>Gunner</th><th>Driver</th></tr>
<tr><td colspan="3">3. DEFLATE FRONT TIRES</td></tr>
<tr><td rowspan="4"></td><td colspan="2">Note. These steps are to be performed at the same time on both sides of the vehicle.</td></tr>
<tr><td>Turn the kneeling valve (1) on right front tire ½ turn counterclockwise to release air from the front tire (2).</td><td>Turn the kneeling valve (1) on left front tire ½ turn counterclockwise to release air from the front tire (2).</td></tr>
<tr><td>The tire deflates to 10 PSI.</td><td>The tire deflates to 10 PSI.</td></tr>
<tr><td>Keep kneeling valves in open position.</td><td>Keep kneeling valves in open position.</td></tr>
<tr><td></td><td colspan="2">

Figure 4-2</td></tr>
</table>

Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

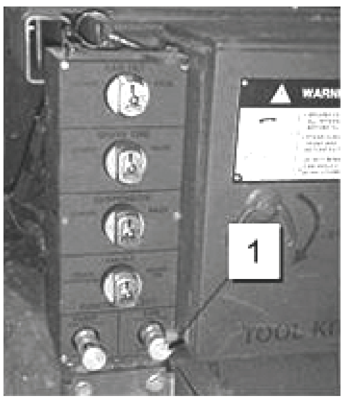
<table>
<tr><th>Section Chief</th><th>Gunner</th><th>Driver</th></tr>
<tr><td colspan="3">4. DEFLATE CAB AIR SPRINGS</td></tr>
<tr><td>Open the cover of the vehicle hydraulic manifold.</td><td colspan="2">Note These steps are to be performed at the same time on both sides of the vehicle.</td></tr>
<tr><td>Turn the cab knob (1) to the left and pull out.</td><td>Remove the quick release pin (2) from the cab air spring stowage bracket (3).</td><td>Remove the quick release pin (2) from the cab air spring stowage bracket (3).</td></tr>
<tr><td>Position cab tilt to RAISE.</td><td rowspan="2">Push down on the rear cab support and install the quick release pin (2) into the cab air spring bracket (4).</td><td rowspan="2">Push down on the rear cab support and install the quick release pin (2) into the cab air spring bracket (4).</td></tr>
<tr><td>Press and hold pump knob to raise cab.</td></tr>
<tr><td>

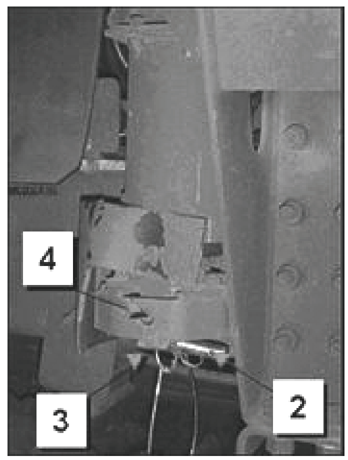
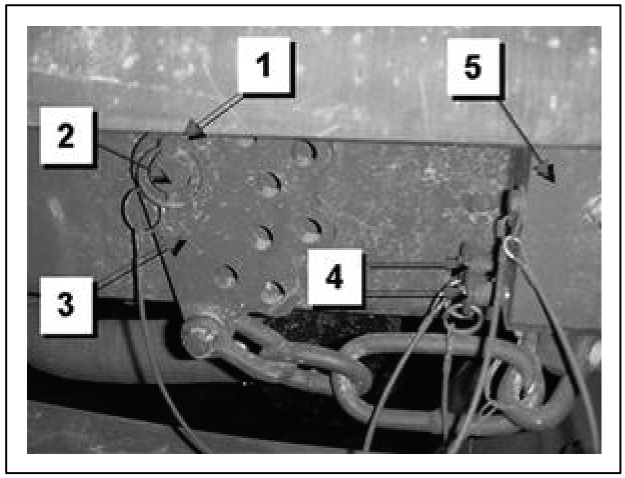
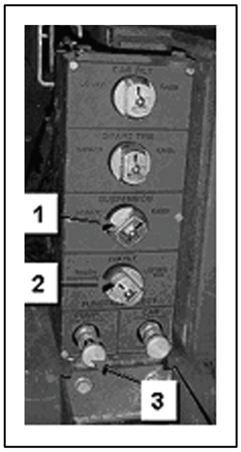
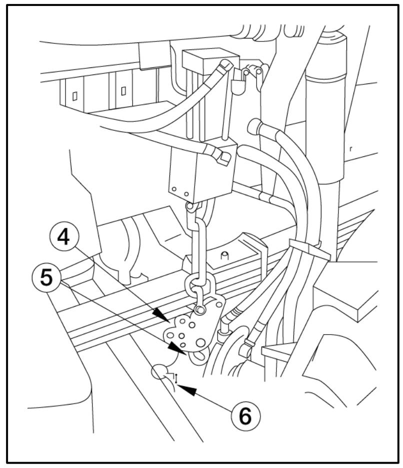
Figure 4-3</td><td colspan="2">

Figure 4-4</td></tr>
</table>

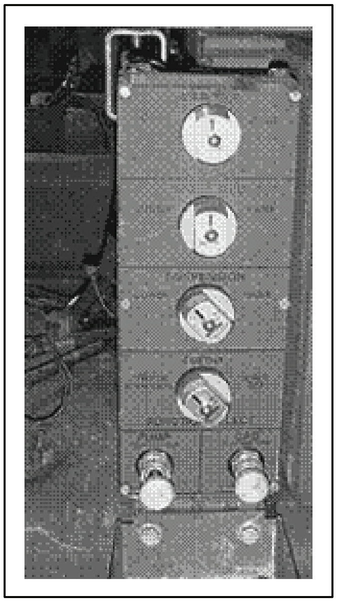
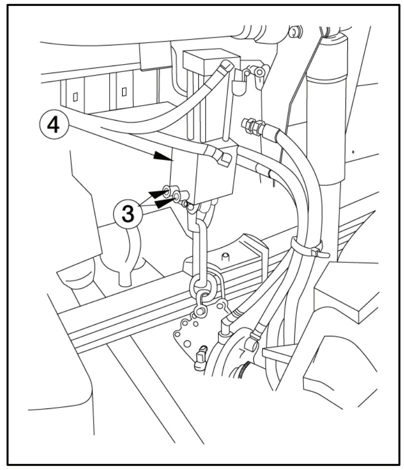
Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

Section Chief	*Gunner*	*Driver*
5. COMPRESS SUSPENSION		
	Note. These steps are to be performed at the same time on both sides of the vehicle.	
	Remove the retaining pin (1) from the stud (2).	Remove the retaining pin (1) from the stud (2).
	Remove the suspension compression plate (3) from the stud (2).	Remove the suspension compression plate (3) from the stud (2).
	Remove the two safety pins (4) from the compression cylinder (5).	Remove the two safety pins (4) from the compression cylinder (5).
	 Figure 4-5	
	Note To install the left (driver side) suspension compression plate on the axle stud, it may be necessary to turn the front wheels slightly to the left to allow adequate space between the vehicle frame and steering drag link	
Position the suspension knob (1) to RAISE.	***Note***. These steps are to be performed at the same time on both sides of the vehicle.	
Position the function select knob (2) to TRUCK SUSPENSION.	Install the suspension compression plate (4) on the axle stud (5).	Install the suspension compression plate (4) on the axle stud (5).

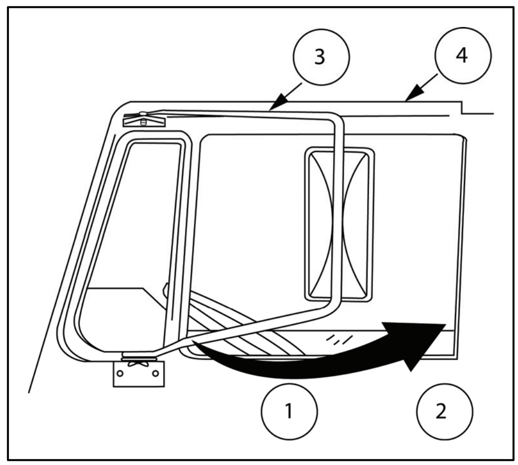
Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

<table>
<tr><th>Section Chief</th><th>Gunner</th><th>Driver</th></tr>
<tr><td>Press and hold the pump knob (3) until the suspension compression plate (4) can be installed on the axle stud (5).</td><td>Install the pin (6) in the axle stud (5).</td><td>Install the pin (6) in the axle stud (5).</td></tr>
<tr><td>
Figure 4-6</td><td colspan="2" rowspan="2">
Figure 4-7</td></tr>
<tr><td>Position the suspension knob (1) to LOWER.</td></tr>
</table>

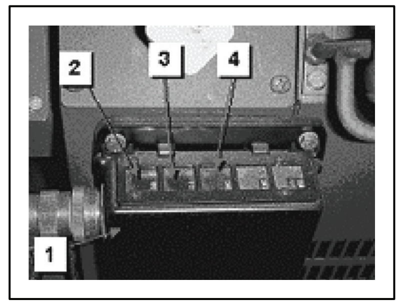
Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

Section Chief	***Gunner***	***Driver***
Press and hold the pump knob (2) until the suspension is fully compressed.	Install two safety pins (3) in the compression cylinder (4).	Install two safety pins (3) in the compression cylinder (4).
 **Figure 4-8**	 **Figure 4-9**	
Close the cover of the vehicle hydraulic manifold.		Straighten front wheels.

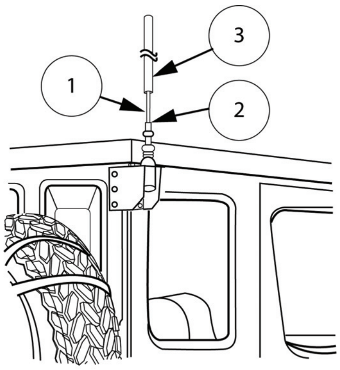
Preparation for Internal Air Transport
Preparing the M142 for Air Movement on C-130 Aircraft

Section Chief	***Gunner***	***Driver***
6. STOW MIRRORS AND REMOVE ANTENNAS		
	Note. These steps are to be performed at the same time on both sides of the vehicle.	
	Stow gunner side mirror.	Stow driver side mirror.
	Raise the windows (1) completely.	Raise the windows (1) completely.
	Raise the ballistic covers (2) completely.	Raise the ballistic covers (2) completely.
	Fold the mirror assemblies (3) in toward/against the vehicle doors (4).	Fold the mirror assemblies (3) in toward/against the vehicle doors (4).
	 **Figure 4-10**	
7. LOAD AND UNLOAD		
Note. Refer to MTMCTEA 99055024 for loading and unloading procedures.		

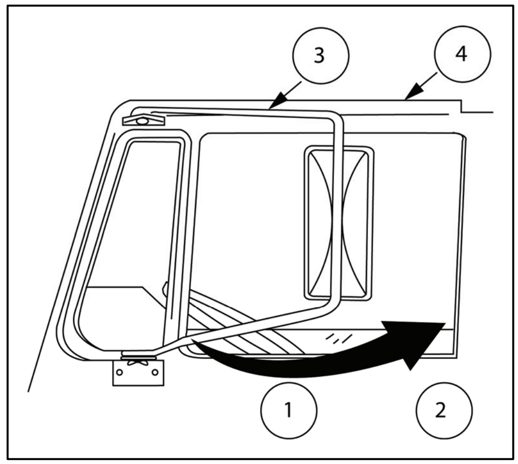
Recovery from Air Transport

Section Chief	***Gunner***	***Driver***
1. EXIT AIRCRAFT AND INFLATE TIRE		
Designate location to prepare the launcher for operations and tell the driver.		Start vehicle engine.
		Note. The vehicle may be driven while tires are inflating; however, it is restricted to first gear and on smooth surfaces until after 1 minute of tire inflation has occurred.
		Exit aircraft.
		When clear of the aircraft, stop and pick up section chief and gunner.
		 **Figure 4-11. Close kneeling valves**
		Ensure that air pressure is 120 PSI (827 kPa).
Initialize communications accordance with local SOP.	Set the SYS PWR switch to ON and adjust curbside mirror.	Adjust roadside mirror for driving.
Open commander's hatch and direct driver to proceed a safe distance from the aircraft to the survey control point or other point at which the FCS is to be initialized (at least 35 feet from aircraft).	Remain at the FCS until responding to the language prompt, and then exit the cab to begin cab recovery along with the driver.	Drive to location designated by section chief.
When the vehicle hasstopped, loosen the lock nut (1) on both antenna mount springs (2).		Park vehicle at designated location.
Position the antennas (1) in the antenna mount springs (2).		Turn wheel slightly to the left to allow removal of the suspension compression plate.

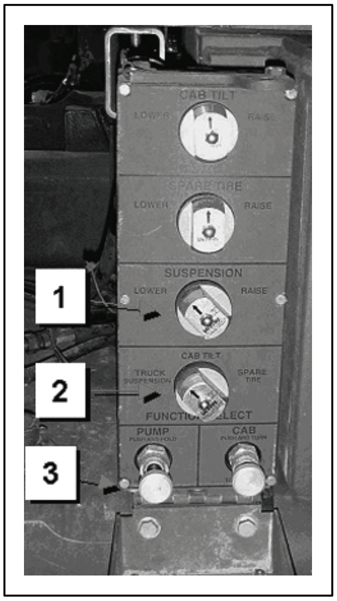
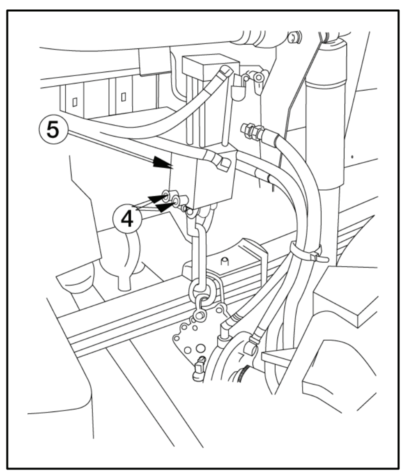
Recovery from Air Transport

Section Chief	*Gunner*	*Driver*
Tighten the lock nuts (1) on the antenna mount springs (2).  **Figure 4-12**		Press LO IDLE/HI IDLE switch (1) to engage HI IDLE.
Verify the radio setup and establish voice communications with the FDC if appropriate.		
Note. The SNVT result is only displayed for a few seconds and the chief must constantly observe the WIU until the result is displayed.		
Exit cab and open the WIU compartment door to observe the results of the automatic SNVT.		

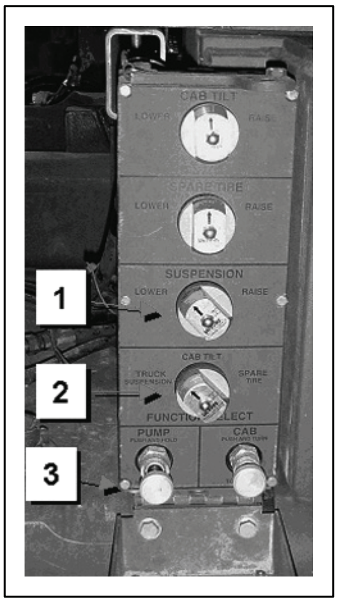
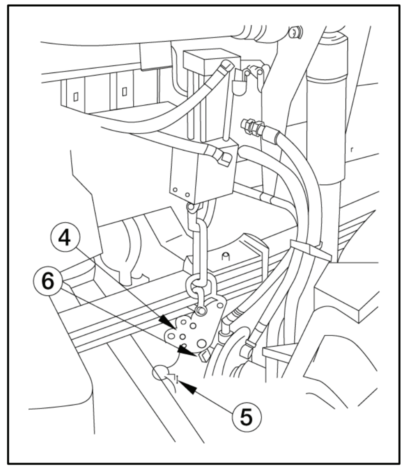
Recovery from Air Transport

Section Chief	*Gunner*	*Driver*
2. DEPLOY MIRRORS		
	Note. These steps are to be performed at the same time on both sides of the vehicle.	
	Lower the windows (1) completely.	Lower the windows (1) completely.
	Lower the ballistic covers (2) completely.	Lower the ballistic covers (2) completely.
	Deploy the mirror assemblies (3) and make adjustments.	Deploy the mirror assemblies (3) and make adjustments.
	 Figure 4-13	

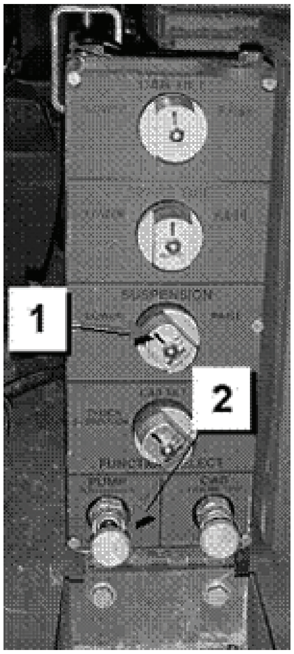
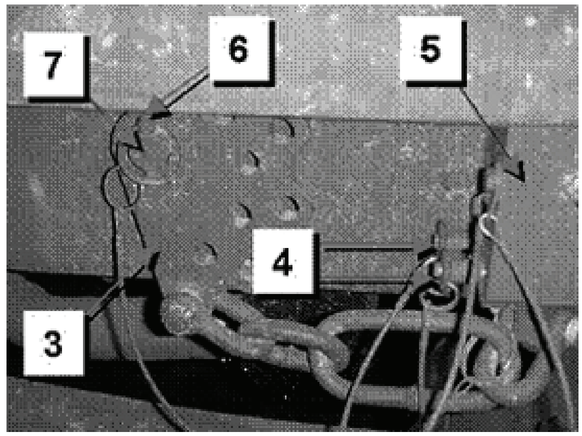
Recovery from Air Transport

Section Chief	*Gunner*	*Driver*
3. DECOMPRESS SUSPENSION		
Press and hold pump knob (3) until two safety pins (4) can be removed from compression cylinder (5).  **Figure 4-14**	Remove the two safety pins (4) from the compression cylinder (5).	Remove the two safety pins (4) from the compression cylinder (5).
	 **Figure 4-15**	
Position the suspension knob (1) to RAISE.		***Note***. To remove the left (driver side) suspension compression plate from the axle stud, it may be necessary to turn the front wheels slightly to the left to allow adequate space between the frame and steering drag link.
Position the function select knob (2) to TRUCK SUSPENSION.		

Recovery from Air Transport

Section Chief	***Gunner***	***Driver***
	Remove the pin (5) from the axle stud (6).	Remove the pin (5) from the axle stud (6).
	Remove the suspension compression plate (4) from the axle stud (6).	Remove the suspension compression plate (4) from the axle stud (6).
Press and hold the pump knob (3) until the vehicle returns to normal height and the suspension compression plate (4) is loose.  **Figure 4-16**	 **Figure 4-17**	
Position suspension knob (1) to LOWER.	Install two safety pins (4) in the compression cylinder (5).	Install two safety pins (4) in the compression cylinder (5).
Press and hold pump knob (2) until compression cylinder (5) is fully retracted and two safety pins (4) can be inserted in the compression cylinder (5).	Install suspension compression plate (3) on the stud (7).	Install suspension compression plate (3) on the stud (7).
	Install pin (6) in stud (7) and lower the cab.	Install pin (6) in stud (7) and lower the cab.

Recovery from Air Transport

Section Chief	*Gunner*	*Driver*
 Figure 4-18	 Figure 4-19	

Recovery from Air Transport

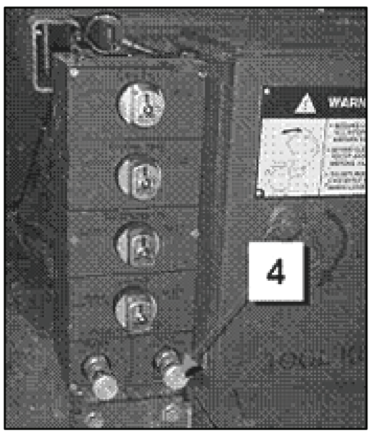
<table>
<tr><th>Section Chief</th><th>Gunner</th><th>Driver</th></tr>
<tr><td colspan="3">4. INFLATE CAB AIR SPRINGS</td></tr>
<tr><td>Open the cover of the vehicle hydraulic manifold.</td><td></td><td></td></tr>
<tr><td>Turn the cab knob (4) to the left and pull out.</td><td></td><td></td></tr>
<tr><td>Position cab tilt to RAISE.</td><td></td><td></td></tr>
<tr><td>Press and hold pump knob to raise cab.</td><td></td><td></td></tr>
<tr><td>Press and turn the cab knob (4) to the right.</td><td>Remove the quick release pin (1) from the air spring (2).</td><td>Remove the quick release pin (1) from the air spring (2).</td></tr>
<tr><td></td><td>Install the quick release pin (1) in the air spring stowage bracket (3).</td><td>Install the quick release pin (1) in the air spring stowage bracket (3).</td></tr>
<tr><td>


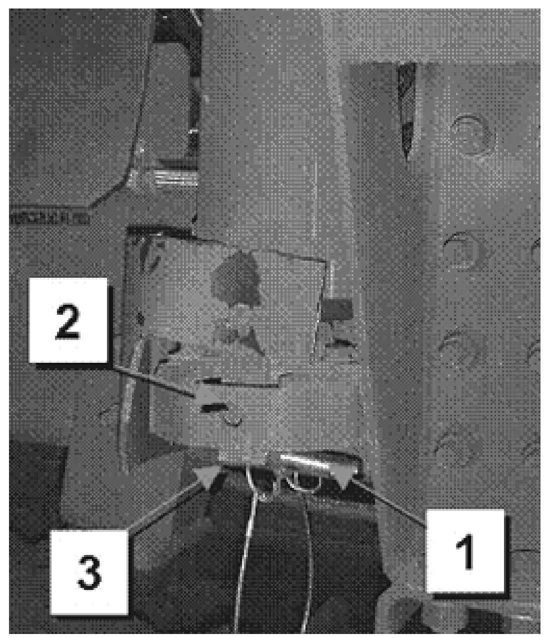
Figure 4-20
Close the cover of the vehicle hydraulic manifold.</td><td colspan="2">


Figure 4-21</td></tr>
</table>

Recovery from Air Transport

Section Chief	***Gunner***	***Driver***
5. CONTINUE INITIALIZATION		
Continue operations.	Complete FCS initialization using the SCP location. Press the OPERATIONAL PFK to command the FCS into the operational state.	Continue operations.
	Load GPS keys.	
	Transmit launcher status (LST) to verify digital communications and notify the FDC that the launcher is operational.	
	Note. If initialization was not at an SCP, the accuracy of the location must be determined to be within the accuracy requirements of the weapon to be fired. Otherwise, the GPS-aided mode must be achieved before firing.	
	Note. The keys cannot be verified until at least one satellite track is shown on the FCP.	
	Verify keys loaded into PNU and keys verified.	
Note. If the location stored on the MSD prior to air movement varies by more than 5 km from the location deter-mined by the PNU when it becomes GPS aided, the gunner will receive the following prompt on the FCP: "POSITIONING VIOLATION RECYCLE AND UPDATE SYSTEM PARAMETERS." To respond to this prompt, the gunner must shut the FCS completely down and reinitialize beginning with power on. This eliminates the possibility of heading errors that might be introduced by the first alignment that used the location stored on the MSD as its start point. This condition only exists when the stored location varies by more than 5 km from the GPS-corrected location. ***Note***. If the variance between stored and actual location is more than 50 meters but less than 5 km, the prompt: "POSITIONING ERROR' is posted to the FCP. No action is required in response to this prompt. ***Note***. If the weapon to be fired requires GPS keys, it must not be fired until the GPS keys have been verified.		

MLRS TABLE VII/VIII: CREW TRAINING (FIRE MISSIONS)/SECTION LIVE-FIRE QUALIFICATION

4-44. Tables VII and VIII are the tasks to train and qualify an MLRS section on their METL tasks to provide surface-to-surface fire support. Table VII is identical to Table VIII but is conducted in a dry-fire status. Table VII should be conducted as an evaluated lane training exercise using the PC-based fire control panel trainer. Table VIII is a live-fire exercise conducted as multiechelon training to maximize the training benefit of the limited ammunition available for training.

TASK: Execute a Multiple Launch Rocket System Fire Mission (06-4-M007) (TM 9-1425-646-10-2).(FM 6-60)

CONDITIONS: The platoon is conducting combat operations and launchers are occupying Hide areas with at least one launcher in a hot status. A fire mission has been sent to the hot launcher, which is located near a firing point. Terrain permitting, hot launchers should hide within 100 meters of their firing points. Some iterations of this task should be performed in MOPP4.

STANDARDS: The firing section fires the mission in accordance with FM 6-60 and the unit TSOP.

Performance Measures	***GO***	***NO- GO***
1. The firing section prepared to execute the fire mission. Moved to the firing position. Parked the SPLL within 150 meters of the firing point grid location in both northing and easting. (The SPLL may be parked at a heading within 240 mils of the parking heading shown on the display; however, a parking heading within 100 mils of the displayed heading is recommended.) Checked mask.		
2. The firing section fired the mission as follows:		
Note. The MLRS launcher receives the fire mission from the battery FDC. The POC monitors the fire mission. The method of fire control tells what method will be used to give the orders to fire. For AMC and when-ready missions, launcher time standard is 4 minutes. Time starts when the section acknowledges the mission and stops when the first rocket is fired or, for AMC, when the ready-to-fire message is sent. The time for the launcher to move to the firing point is included in the 4 minutes. The methods are— • At my command (AMC) • Fire when ready (FWR) • Time on target (TOT) • Time to fire (TTF) • Timed when ready (TWR) • Timed time on target (TTT) • On Call.		
a. Prepared carrier for firing:		
(1) Raised selector to neutral and set hand brake.		
(2) Ensured that the carrier launcher interconnect switch was set to ON.		
(3) Checked that the carrier volts gauge was indicating in the upper 50 to 75 percent of the green zone.		
(4) Set suspension lockout switch.		
(5) Engaged SLO, observed light.		
(6) Set the vent fan control override switch to OFF.		
(7) Ensured that all doors, hatches, windows, and louvers were closed.		
(8) Set the carrier vehicle damper to firing.		

Performance Measures	*GO*	*NO- GO*
(9) Set the carrier's vehicle vent fan switch to medium and checked differential pressure gauge for a positive pressure. If gauge did not indicate a minimum of 0.25, set the vent switch to HIGH. If gauge still did not indicate a minimum of 0.25, crew wore CBRN protective mask when firing.		
b. Pressed LCHR LAY key when directed.		
c. Section chief visually verified the launcher lay.		
d. For AMC, FWR, and On Call methods of fire, did the following:		
(1) When the LLM was moved to the first aiming point, set the ARM/SAFE switch to ARM. Checked to see if the ARM indicator light came on and the SAFE indicator light went out.		
(2) When the prompt FIRE ROCKETS was displayed, set the FIRE switch up. Held for 2 to 3 seconds. The rockets began to fire. Observed the FIRE light indicator; light went off after last rocket was fired on that mission. If the mission had more than one aiming point, LLM moved to the next aiming point and fired those rockets.		
e. For TOT and TTF fire missions, did the following:		
(1) Acknowledged call for fire (CFF) message.		
(2) Parked SPLL and pressed LCHR LAY key before countdown time reached zero.		
(3) Section chief visually verified the launcher lay.		
(4) Observed CNTDN = NET FOR FIRING message.		
(5) Set ARM/SAFE switch to ARM before countdown reached zero.		
(6) Fired rockets same as above when FIRE ROCKETS prompt was displayed.		
f. For TWR and TTT fire missions, did the following:		
(1) Acknowledged CFF message.		
(2) Observed CNTDN = NET FOR LCHR LAY message.		
(3) Parked the SPLL and pressed LCHR LAY key at appropriate time.		
(4) Section chief visually verified the launcher lay.		
(5) Observed CNTDN = NET FOR FIRING message.		
(6) When NET countdown reached 20 seconds, observed ARM ROCKET prompt.		
(7) Set ARM/SAFE switch to ARM before countdown reached zero.		
(8) Fired rockets same as above when FIRE prompt was displayed.		
g. After mission had been fired, set ARM/SAFE switch to SAFE.		
Note: Checked LPC tubes after firing for fire, whether LLM is stowed or unstowed.		
h. If remained at the site to conduct other operations, pressed INDEX key and selected the next operating routine.		
i. If left the site, pressed LLM STOW key and observed the LLM STOWED message on the display.		

Performance Measures	*GO*	*NO- GO*
j. Set carrier vehicle damper to normal.		
k. Disengaged suspension lockout.		
l. Moved per unit EOM instructions and continued the mission.		

SUPPORTING INDIVIDUAL TASKS		
Task Number	*Task Title*	*References*
061-275-8004	Operate single-channel ground and airborne radio system intercommunications with VIC-1	STP 6-13M14-SM-TG
061-310-2001	Perform stablization reference package/PDS operations	STP 6-13M14-SM-TG
061-310-2021	Perform a fire mission	STP 6-13M14-SM-TG
061-310-2022	Edit/Input fire control system data	STP 6-13M14-SM-TG
061-310-3011	Select a launcher firing position	STP 6-13M14-SM-TG
061-310-3024	Direct a fire mission	STP 6-13M14-SM-TG
061-310-8001	Perform launcher M270 reload	STP 6-13M14-SM-TG
061-310-8005	Perform fire control system startup	STP 6-13M14-SM-TG
061-310-8007	Update weapon files	STP 6-13M14-SM-TG
061-310-8008	Enter operational area data into the fire control system	STP 6-13M14-SM-TG
061-310-8010	Operate boom controls during launcher reload	STP 6-13M14-SM-TG
061-310-8015	Direct hangfire procedures on the M270	STP 6-13M14-SM-TG
061-310-8021	Operate the M993 during a fire mission	STP 6-13M14-SM-TG
061-310-8024	Perform maintenance on the fire control system/launcher loader module	STP 6-13M14-SM-TG
061-312-5104	Perform launcher reload (M270A1)	STP 6-13M14-SM-TG

SUPPORTING COLLECTIVE TASKS		
Task Number	*Task Title*	*References*
06-3-M001	Conduct occupation of position area (multiple launch rocket system fbattery/platoon)	ARTEP 6-397-30-MTP
06-4-M009	Perform hangfire procedures	ARTEP 6-397-30-MTP
06-4-M009.06-00A1	Perform hangfire procedures (M270A1)	ARTEP 6-397-30-MTP
06-4-M010	Conduct launcher reload operations	ARTEP 6-397-30-MTP
06-4-M010.06-00A1	Conduct launcher reload operations (M270A1)	ARTEP 6-397-30-MTP

TASK: Execute an M270A1 Multiple Launch Rocket System Fire Mission (06-4-M007.06-00A1)(FM 6-60).(IETM 9-1055-647-13&P)

CONDITIONS: The firing section is conducting combat operations and the launcher is in a hot status. A fire mission has been sent to the launcher, which is located within 100 meters of a firing point. Some iterations of this task should be performed in MOPP4.

STANDARDS: The firing section fires the mission in accordance with FM 6-60, IETM, and the unit TSOP. The time standard of 3 minutes starts when the launcher receives the mission and stops when the first rocket is fired for an FWR mission, or when the ready-to-fire message is sent for an AMC mission. Time standard applies to JED and JEH rockets only. The time standard will not apply to iterations of this task performed in MOPP. The time standard of 3 minutes assumes that only one mission is being processed at a time. The MLRS time standards elaborate the actual standard as listed here.

Performance Measures	***GO***	***NO-GO***
1. The firing section prepared to execute the fire mission. Moved to the firing position and parked the launcher within 150 meters of the firing point.		
Note. The launcher heading will be per the technical manual; however, some units have parking standards more rigorous than the IETM. Evaluation of this task will be per the technical manual if the unit TSOP does not address this issue.		
2. The firing section fired the mission as follows:		
Note. The method of fire control tells what method will be used to give the orders to fire. For AMC and FWR missions, the launcher time standard is 3 minutes, JED and JEH rockets only. Time starts when the section receives the mission and stops when the first rocket is fired for FWR mission or when the ready-to-fire message is sent for AMC mission. The time for the launcher to move to the firing point is included in the 3 minutes. The methods are— • At my command (AMC) • Fire when ready (FWR) • Time on target (TOT) • Time to fire (TTF) • Timed when ready (TWR) • Timed time on target (TTT) • On call. ***Note***. On call is a method of fire control stored in the database; however, amended data from FDC is required to perform fire mission.		
The driver, gunner, and section chief performed the following tasks simultaneously.		
a. Driver.		
(1) Raised selector to neutral and set hand brake.		
(2) Ensured that the carrier launcher interconnect switch was set to ON.		
(3) Checked that the carrier volts gauge was indicating in the upper 50 to 75 percent of the green zone.		
(4) Set suspension lockout switch.		

Performance Measures	*GO*	*NO-GO*
(5) Engaged SLO, observed light.		
(6) Set the vent fan control override switch to OFF.		
(7) Ensured that all doors, hatches, windows, and louvers were closed.		
(8) Set the carrier vehicle damper to firing.		
(9) Set the carrier's vehicle vent fan switch to medium and checked differential pressure gauge for a positive pressure of 0.25.		
(10) Set the carrier vehicle damper to normal after mission was fired and LM was stowed.		
b. Gunner.		
(1) Pressed launcher lay PF key when directed.		
(2) For AMC method of fire, did the following:		
(a) When the LM was moved to the first aiming point, and the ready to fire message had been sent to FDC, awaited CFF message from FDC containing fire command.		
(b) Upon receipt of fire command, armed and fired weapon when prompted.		
(3) For FWR method of fire, did the following:		
(a) When the LM was moved to the first aiming point, set the ARM/SAFE switch to ARM.		
(b) When the prompt FIRE WEAPONS was displayed, fired weapons.		
(4) For TOT and TTF methods of fire, did the following:		
(a) Pressed LCHR LAY PFK before countdown time reached zero on the NLT for launcher lay clock.		
(b) Observed CNTDN = NET FOR FIRING message.		
(c) Set ARM/SAFE switch to ARM when prompted.		
(d) Fired weapons when FIRE WEAPON prompt was displayed.		
(e) When NET countdown reached 20 seconds, observed ARM ROCKET prompt.		
(f) Set ARM/SAFE switch to ARM before countdown reached zero.		
(g) Fired rockets same as above when FIRE prompt was displayed.		
(5) For TWR and TTT methods of fire, did the following:		
(a) Observed CNTDN=NET FOR LCHR LAY and CNTDN=NLT FOR LCHR LAY clocks.		
(b) Pressed LCHR LAY PFK at appropriate time.		
(c) Observed CNTDN=NET FOR FIRING and CNTDN=NLT FIRING clocks.		
(d) When prompted, armed weapons.		

Performance Measures	*GO*	*NO-GO*
(e) Fired weapons when prompted.		
(6) After the mission had been fired, and END OF MISSION SAFE WEAPONS prompt had been displayed, set ARM/SAFE switch to SAFE.		
(7) Pressed STOW PFK and observed the LM STOWED message on the display screen.		
c. Section chief.		
(1) Section chief visually checked that LM lay in the direction of fire during launcher aiming process.		
(2) Checked for tube fires after weapons were safed and before stowing LM.		
(3) Verified that travel locks had engaged and listened to ensure that LDS powered down after LM was stowed.		
(4) Directed driver to move launcher off point per unit EOM instructions.		

SUPPORTING INDIVIDUAL TASKS		
Task Number	*Task Title*	*References*
061-310-3011	Select a launcher firing position	STP 6-13M14-SM-TG
061-310-3024	Direct a fire mission	STP 6-13M14-SM-TG
061-310-8010	Operate boom controls during launcher reload	STP 6-13M14-SM-TG
061-310-8015	Direct hangfire procedures on the M270	STP 6-13M14-SM-TG
061-310-8021	Operate the M993 during a fire mission	STP 6-13M14-SM-TG
061-312-5100	Operate the interactive electronic technical manual (M270A1)	STP 6-13M14-SM-TG
061-312-5101	Perform initialization/ menu navigation/ shutdown of the fire control system (M270A1)	STP 6-13M14-SM-TG
061-312-5103	Perform fire control system/LDS maintenance (M270A1)	STP 6-13M14-SM-TG
061-312-5104	Perform launcher reload (M270A1)	STP 6-13M14-SM-TG
061-312-5106	Perform a fire mission gunner's duties (M270A1)	STP 6-13M14-SM-TG

SUPPORTING COLLECTIVE TASKS		
Task Number	*Task Title*	*References*
06-3-M001	Conduct occupation of position area (multiple launch rocket system battery/platoon)	ARTEP 6-397-30-MTP
06-4-M009	Perform hangfire procedures	ARTEP 6-397-30-MTP
06-4-M009.06-00A1	Perform hangfire procedures (M270A1)	ARTEP 6-397-30-MTP

TASK: Execute a Launcher Fire When Ready Fire Mission – Manual Entry

CONDITIONS: The MLRS section is conducting combat operations and the launcher is occupying a hide area and is in hot status. The launcher is within 100 meters of the firing point. (This section is given a fire mission data card.)

STANDARDS: The firing section manually enters and executes the fire mission. The firing section will also acknowledge requests for status, and compute and confirm the fire mission on the FCP. The firing section fires the mission per the method of control of the fire mission. The firing section reports problems to the POC/BOC that prevent firing of missions or that require modification of data.

Note. Time starts when the section chief is given the fire mission data card and stops when the first rocket is fired or, for AMC, when the ready-to-fire message is sent. The time for the launcher to move to the firing point is included in the time.

Evaluation Checklist	*GO*	*NO-GO*
1. Gunner manually entered fire mission.		
2. A WILL COMPLY or CANNOT COMPLY was displayed automatically; gunner pressed XMIT key.		
3. The firing section prepared to execute the fire mission. Section chief directed crew to the firing position. Parked the SPLL within 150 meters of the firing point grid location in both northing and easting.		
4. SPLL was parked at a heading within 240 mils of the parking heading shown on the display. (A parking heading within 100 mils of the displayed heading is recommended.)		
5. The section chief checked mask.		
6. The firing section prepared the cab for firing by doing the following:		
a. Driver raised selector to neutral and set hand brake.		
b. Driver ensured that the carrier launcher interconnect switch was set to ON.		
c. Driver checked that the carrier volts gauge was indicating in the upper 50 to 75 percent of the green zone.		
d. Driver set suspension lockout switch.		
e. Driver engaged SLO, observed light.		
f. Driver set the vent fan control override switch to OFF.		
g. Crew ensured that all doors, hatches, windows, and louvers were closed.		
h. Driver set the carrier vehicle damper to firing.		
i. Driver set the carrier's vehicle vent fan switch to medium and checked differential pressure gauge for a positive pressure. If gauge did not indicate a minimum of 0.25, set the vent switch to HIGH. If gauge still		

Evaluation Checklist	*GO*	*NO-GO*
did not indicate a minimum of 0.25, crew wore CBRN protective mask when firing.		
7. Gunner pressed LCHR LAY key when directed.		
8. Section chief visually verified the launcher lay.		
9. When the LLM had moved to the first aiming point, gunner set the ARM/SAFE switch to ARM. Checked to see if the ARM indicator light came on and the SAFE indicator light went out.		
10. When the prompt FIRE ROCKETS was displayed, gunner set the FIRE switch up, and held for 2 to 3 seconds. The rockets began to fire. Observed the FIRE light indicator—the light went off after the last rocket was fired on that mission.		
11. After mission had been fired, gunner set ARM/SAFE switch to SAFE.		
12. Section chief and driver opened ballistic window covers on doors and checked launch tube containers for fires.		
13. Gunner pressed LLM stow key.		
14. Gunner checked for LLM stow prompt to appear on FCP and section chief visually checked travel lock hooks to ensure that LLM was stowed.		
15. Driver set ventilation damper to normal and disengaged SLO.		
16. Section chief immediately directed driver to exit firing point.		
17. Firing section met time standard of 4 minutes.		

Note. Time starts when the section chief is given the fire mission data card and stops when the first rocket is fired or, for AMC, when the ready-to-fire message is sent. The time for the launcher to move to the firing point is included in the time.

START TIME: ____________ STOP TIME: ____________

TASK: Execute a Launcher At My Command Fire Mission

CONDITIONS: The MLRS section is conducting combat operations and the launcher is occupying a hide area and is in hot status. A fire mission has been sent to the launcher, which is located within 100 meters of the firing point.

STANDARDS: The section acknowledges the fire mission on the FCP. The section will also acknowledge requests for status, and compute and confirm the fire mission on the FCP. The section fires the mission per the method of control of the fire mission. The firing section reports problems to the POC/BOC that prevent firing of missions or that require modification of data.

Note. For AMC and fire-when-ready missions, the launcher time standard is 4 minutes. Time starts when the section acknowledges the mission and stops when the first rocket is fired or, for AMC, when the ready-to-fire message is sent. The time for the launcher to move to the firing point is included in the 4 minutes.

Evaluation Checklist	***GO***	***NO-GO***
1. CFF was received, an alarm sounded, gunner pushed ALM ACK.		
2. A WILL COMPLY or CANNOT COMPLY was displayed automatically; gunner pressed XMIT key.		
3. The firing section prepared to execute the fire mission. Section chief directed crew to the firing position. Parked the SPLL within 150 meters of the firing point grid location in both northing and easting.		
4. SPLL was parked at a heading within 240 mils of the parking heading shown on the display. (A parking heading within 100 mils of the displayed heading is recommended.)		
5. Section chief checked mask.		
6. The firing section prepared the cab for firing by doing the following:		
a. Driver raised selector to neutral and set hand brake.		
b. Driver ensured that the carrier launcher interconnect switch was set to ON.		
c. Driver checked that the carrier volt gauge was indicating in the upper 50 to 75 percent of the green zone.		
d. Driver set suspension lockout switch.		
e. Driver engaged SLO, observed light.		
f. Driver set the vent fan control override switch to OFF.		
g. Crew ensured that all doors, hatches, windows, and louvers were closed.		
h. Driver set the carrier vehicle damper to firing.		
i. Driver set the carrier’s vehicle vent fan switch to medium and checked differential pressure gauge for a positive pressure. If gauge did not		

Evaluation Checklist	GO	NO-GO
indicate a minimum of 0.25, set the vent switch to HIGH. If gauge still did not indicate a minimum of 0.25, crew wore CBRN protective mask when firing.		
7. Gunner pressed LCHR LAY key when directed.		
8. Section chief visually verified the launcher lay.		
9. When the LLM had moved to the first aiming point, the READY TO FIRE message was automatically transmitted. When the CFF message containing the fire code was received and ALM ACK was pressed, gunner set the ARM/SAFE switch to ARM. Checked to see if the ARM indicator light came on and the SAFE indicator light went out.		
10. When the prompt FIRE ROCKETS was displayed, gunner set the FIRE switch up, and held for 2 to 3 seconds. The rockets began to fire. Observed the FIRE light indicator—the light went off after the last rocket was fired on that mission.		
11. After mission had been fired, gunner set ARM/SAFE switch to SAFE.		
12. Section chief and driver opened ballistic window covers on doors and checked launch tube containers for fires.		
13. Gunner pressed LLM stow key.		
14. Gunner checked for LLM stow prompt to appear on FCP and section chief visually checked travel lock hooks to ensure that LLM was stowed.		
15. Driver set ventilation damper to normal, disengaged SLO.		
16. Section chief immediately directed driver to exit firing point.		
17. Firing section met time standard of 4 minutes.		

Note. For AMC and FWR missions, the launcher time standard is 4 minutes. The time starts when the section acknowledges the mission and stops when the first rocket is fired or, for AMC, when the ready-to-fire message is sent. The time for the launcher to move to the firing point is included in the 4 minutes.

START TIME: ____________.STOP TIME: ____________

Chapter 5

Radar Section Tables

This chapter provides commanders and radar sections a standardized method of training and qualifying the Fire Finder Radar Sections assigned to their organizations. It includes training and qualification standards for all Weapon Location Radar Sections (WLRSs) (TPQ-36/TPQ-37).

INTRODUCTION

5-1. The methodology and format of the radar section tables (table 5-1) are identical to that presented in previous chapters. The tables provide a progressive, gated approach to training to assist commanders in the assessment of training and the horizontal integration of training across the combined arms team. The tables also provide the means and tasks for C, W, R training for the section chief to use during Sergeant's Time training, as refresher training, or as a prelude to the evaluation of training. The content of the ASPT and Radar Table I provide the individual and collective tasks to support the routine training of the radar section during Sergeant's Time training. Radar Table III is the required machine gun training on the M249 LMG for those sections with the M249 as an assigned weapon. Radar Tables IV-VI provide progressive training on tasks grouped as they are performed. Radar Tables VII/VIII are the training and qualification tables for the radar section.

Table 5-1. Contents of radar tables.

TABLE	*TABLE CONTENTS*	*REMARKS*
I	Individual tasks	Written test
III	Machine gun training	All sections equipped with M249 LMG
IV	Reconnaissance, selection, and occupation of position	
V	March order	
VI	Perform surveillance and locate targets	Focus on primary combat task
VII	Training	Use field exercise mode (FEM) embedded trainer to evaluate, a gate for Table VIII
VIII	Qualification	Live-fire observation in both friendly and hostile fire mode

SECTION I. ARTILLERY SKILLS PROFICIENCY TEST FOR RADAR SECTIONS

5-2. The ASPT evaluates the radar section member's ability to execute selected crew skills. The tasks listed in this chapter provide the unit commander a means to evaluate the radar section member's basic proficiency prior to live-fire exercises. The ASPT can also be used as a guide for identifying section strengths and weaknesses. ASPT results should be used by the commander, master gunner, and radar section leaders when structuring the unit's annual gunnery training program.

REQUIREMENTS

5-3. All MOS 13R personnel and any personnel assigned to a radar section (regardless of MOS) will be administered the ASPT. Radar section members are required to pass the ASPT prior to radar section qualification. To pass the ASPT, a Soldier must receive a GO on all stations. If a Soldier fails a task, he must be retrained and retested on that station until he receives a GO. Appropriate manuals and other references listed for each station must be used to prepare, administer, and evaluate the ASPT.

Note. Evaluators must pass the ASPT within 6 months prior to testing.

5-4. Evaluation Procedures. Detailed procedures for the setup and conduct of the evaluation and AAR are found in paragraph 3-2 of this manual.

5-5. Test Stations. Each station consists of a Test Administrative Guide and a criteria-scoring checklist.

TEST STATIONS

- Initialize the radar test station
- Establish communications test station
- Determine manual terrain-following data test station

STATION 1 – INITIALIZE THE RADAR

Task Order	*Task*	*Task No.*	*Remarks*
1	Determine Initialization Data	061-294-5300	
2	Initialize the Fire Finder Radar	061-294-1001	If Assigned to a Legacy Fire Finder Radar
2	Initialize the AN/TPQ-36 (V)8 Radar	061-294-5200	If Assigned to a Version 8 AN/TPQ-36 Radar
3	Initialize the AN/TPQ-37 (Digital Upgrade) Fire Finder Radar	061-294-1012	If Assigned to a Q-37 (Digital Upgrade) Radar
4	Evaluate the Initialization of the Fire Finder Radar	061-294-5200	This task will be performed by a supervisor for all initializations.

DETERMINE INITIALIZATION DATA TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 1A (ALL)

TASK: Determine Initialization Data (061-294-5300)

CONDITIONS: Given a fire finder radar position, a map, M2A2 aiming circle, a range pole, an initialization worksheet, and coordinates scale/protractor (Military GTA 5-2-12).

STANDARDS: Determine radar initialization data in accordance with FM 6-50 and applicable TMs.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M2A2 aiming circle.
- Range pole.
- Initialization worksheet.
- Coordinate scale/protractor (GTA 5-2-12).
- TMs 11-5840-355-10, 11-5840-378-10, and 11-5840-380-10.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 20 minutes
- Total time: 25 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE CREWMAN: *"You are currently located at your new radar position area. You must determine the radar initialization data and complete the initialization data worksheet. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures		***GO***	***NO-GO***
1.	Determined radar site coordinates.		
2.	Determined far stake data.		
3.	Measured and recorded manual terrain-following data.		
4.	Completed initialization worksheet.		

INITIALIZE THE FIRE FINDER RADAR TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 1B (ALL LEGACY FIRE FINDER RADAR SECTIONS)

TASK: Initialize the Fire Finder Radar (061-294-1001)

CONDITIONS: Given an emplaced fire finder radar legacy system with shelter prepared for operation and power applied.

STANDARDS: Initialize the radar so that all mission-essential data is correctly entered.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational radar with power generator.
- TMs 11-5840-355-10, 11-5840-378-10, and 11-5840-380-10.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 15 minutes
- Total time: 20 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE CREWMAN: *"You are currently located at your new radar position area. You must correctly initialize the radar by entering all essential data. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures		*GO*	*NO-GO*
1.	Performed antenna boresighting.		
2.	Loaded initialization program.		

Performance Measures		*GO*	*NO-GO*
3.	Entered date and time correctly.		
4.	Entered the adaptation constants (or read the constants from the tape) correctly.		
5.	Selected output device correctly.		
6.	Entered site data correctly.		
7.	Performed stabilization.		
8.	Entered the terrain-following data or loaded the digital map correctly.		
9.	Entered MET data correctly.		
10.	Entered site map data correctly.		
11.	Entered height correction data correctly.		
12.	Entered search data correctly.		
13.	Entered communications data correctly.		
14.	Checked and corrected initialization data.		

INITIALIZE THE AN/TPQ-36 RADAR TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 1C (ALL AN/TPQ-36 RADAR SECTIONS)

TASK: Initialize the AN/TPQ-36 Radar (061-294-5004)

CONDITIONS: Given an emplaced AN/TPQ-36 radar system with shelter prepared for operation and power applied.

STANDARDS: Initialize the radar so that all mission-essential data is correctly entered.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational radar with power generator.
- TMs 11-5840-355-10, 11-5840-378-10, and 11-5840-380-10.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 15 minutes
- Total time: 20 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE CREWMAN: *"You are currently located at your new radar position area. You must correctly initialize the radar by entering all essential data. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures		***GO***	***NO-GO***
1.	Loaded initialization data.		
	a. Correctly loaded existing initialization data.		
	b. Correctly input new initialization data.		
2.	Entered the correct date and time.		
3.	Entered the correct adaptation constants or loaded adaptation constants from the hard drive.		
	a. Enter the corrected constants.		
	b. Correctly loaded the constants from the hard drive.		
4.	Entered the correct site data.		
5.	Entered the correct terrain-following data.		
6.	Entered the correct MET data.		
7.	Entered the correct site map data.		
8.	Entered the correct search data.		
9.	Entered the correct communications net data.		
10.	Verified that boresighting and stabilization were successfully completed.		
11.	Verified the initialization printout.		

INITIALIZE THE AN/TPQ-37 FIRE FINDER RADAR TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 1C (ALL AN/TPQ-37 RADAR SECTIONS)

TASK: Initialize the AN/TPQ-37 Fire Finder Radar (061-294-1012)

CONDITIONS: Given an operational AN/TPQ-37 (digital upgrade) fire finder radar with operator PMCS completed and accurate site, weather, and mission data included.

STANDARDS: Initialize the radar so that all mission-essential data is correctly entered.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational radar with power generator.
- TMs 11-5840-355-10, 11-5840-378-10, and 11-5840-380-10.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 5 minutes
- Total time: 10 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at your new radar position area. The Radar has been emplaced and is operational. You must ensure that all essential data is correctly entered and that the radar has been initialized in accordance with the applicable TM. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures		*GO*	*NO-GO*
1.	Checked antenna boresighting.		
2.	Specified new data or loaded an existing file.		

Performance Measures		***GO***	***NO-GO***
3.	Entered or edited date and time correctly.		
4.	Entered the adaptation constants correctly.		
5.	Selected output device correctly.		
6.	Entered or edited site data correctly.		
7.	Performed stabilization.		
8.	Entered the terrain-following data or loaded the digital map.		
9.	Entered MET data correctly.		
10.	Entered site map data correctly.		
11.	Entered height correction data correctly.		
12.	Entered search data correctly.		
13.	Entered communications data correctly.		
14.	Checked and corrected initialization data.		

EVALUATE INITIALIZATION OF THE FIRE FINDER RADARS TEST STATION TEST ADMINISTRATIVE GUIDE STATION 1D (ALL AN/TPQ-36 RADAR SECTIONS)

TASK: Evaluate Initialization of the Fire Finder Radars (061-294-5200)

CONDITIONS: Given an initialized fire finder radar system, a radar operator, and initialization data worksheet.

STANDARDS: Ensure that all mission-required initialization data is displayed and correctly entered on the initialization printout in accordance with applicable TM without error.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational radar with power generator.
- TM 11-5840-355-10, TM 11-5840-378-10, and TM 11-5840-380-10.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 5 minutes
- Total time: 10 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at your new radar position area. The Radar has been emplaced and initialized. You must ensure that all essential data is correctly entered and that the radar has been initialized in accordance with the applicable*

TM. Do you understand the requirements of this test? Do you have any questions? You may begin." (Start the time.)

Performance Measures		***GO***	***NO-GO***
1.	Obtained and inspected the initialization data printout.		
2.	Ensured that all mission-required initialization data were displayed and correctly entered.		
3.	Directed corrections to any errors or deficiencies found during evaluation and informed section chief of initialization status.		

STATION 2 – ESTABLISH COMMUNICATIONS

Task Order	*Task*	*Reference*	*Remarks*
1	Install/Operate/Maintain a Single Channel Ground and Airborne Radio System (SINCGARS) FH Net (11-5-1102.06-A001)	ARTEP 6-303-30-MTP	
2	Install Antenna Group OE-254/GRC (061-276-1012)	STP 6-13R14-SM-TG	

INSTALL/OPERATE/MAINTAIN A SINCGARS FH NET TEST STATION TEST ADMINISTRATIVE GUIDE
STATION 2 (ALL RADAR SECTIONS)

TASK: Install/Operate/Maintain a Single-Channel Ground and Airborne Radio System FH Net (11-5-1102.06-A001)

CONDITIONS: The radar section has been briefed and has SOI/signal supplemental instructions (SSI) extracts, appropriate loading devices with keys, radio net diagram, maps, and grid coordinates.

STANDARDS: The SINCGARS radio sets are operational in accordance with the TSOP, applicable supporting products, and the operation plan/operation order.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational SINCGARS radio.
- SOI/SSI.
- Loading device w/keys.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time: 15 minutes

OTHER INFORMATION: Evaluator must ensure that a distant station is operational.

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at your new radar position area. You must correctly initialize the radar by entering all essential data. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures		***GO***	***NO-GO***
1.	Supervisor checked radios for completeness and operability.		
	a. Checked that vehicular and/or manpack systems were assembled correctly.		
	WARNING: High voltages exist at connector J1 on the mounting adapter. Be sure J1 is covered or capped when not in use.		
	b. Checked to ensure that preoperational PMCS are completed.		
	CAUTION: RF energy is present near the antenna during transmissions. Maintain at least 30 inches between vehicular antenna and personnel during transmission. An antenna tip cap must be in place on the antenna. Tie down the antenna so the distance from the ground to the tip cap is 7 feet or more.		
2.	The supervisor selected the site.		
	a. Selected primary and alternate locations within the general site.		
	b. Established/maintained camouflage discipline.		
	c. Checked that location provides effective use of terrain in an electronic warfare environment.		
	d. Checked that location avoids interference from power lines and other friendly sources of frequency interference.		
3.	Network Members performed permission checks for SINCGARS frequency hopping (FH) cold start network opening.		
	a. Performed before-operation PMCS.		
	b. Loaded transmission security key (TSK) using MX-10579 or MX-18290 (non-ICOM) only.		
	c. Loaded hopset using MX-18290 (ICOM only).		
	d. Loaded traffic encryption key (TEK) using KYK-13.		
4.	NCS opened net.		
	a. Issued net call in the secure mode on the MAN channel.		
	b. Issued electronic remote fill (ERF) counter-countermeasures instructions and sent ERF.		
	c. Set channel switch to hopset channel and issued network call.		
	d. Opened network.		
	e. Reset channel switch to MAN and called missing network members.		
	f. Repeated cold start.		
	g. Set FCTN switch to SQ ON.		

Performance Measures		*GO*	*NO-GO*
5.	Network members entered the network.		
	a. Responded in correct sequence to network call.		
	b. Stored ERF and set channel switch to hopset channel and FCTN switch to SQ ON.		
	c. Responded in correct sequence to network call.		
	d. If missed ERF, or heard no communications on hopset channel, reset channel switch to MAN and FCTN switch to LO.		
	e. Responded in sequence to NCS call.		
6.	The team members extended the range of the radio station.		
	a. Inspected OE-254 antenna for serviceability.		
	b. Installed OE-254 antenna (team method).		
	c. Accomplished the transaction from the whip to OE-254 antenna without unnecessary interruption of service.		

DETERMINE MANUAL TERRAIN-FOLLOWING DATA TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 3 (ALL)

TASK: Determine Manual Terrain-Following Data (061-294-1014)

CONDITIONS: Given a declinated aiming circle, you have been directed to determine manual terrain-following data.

STANDARDS: Azimuths and vertical mask angles measured to within 0.5 mils. Accurate to within 2.0 mils.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the primary evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M2A2 aiming circle.
- TM 11-5840-355-10, TM 11-5840-378-10, and TM 11-5840-380-10.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time: 15 minutes

OTHER INFORMATION: Prior to the Soldier arriving, the evaluator must measure and record the azimuths and vertical mask angles and confirm that the measurements are correct.

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at your new radar position area. You have been directed to set up the aiming circle and determine manual terrain-following data. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

	Performance Measures	*GO*	*NO-GO*
1.	Leveled aiming circle over near stake.		
2.	Measured horizontal angles and elevations of screening crest to the nearest 0.5 mils, accurate to within 2.0 mils.		
3.	Recorded data without error.		
4.	Provided manual terrain-following data to section chief.		

SECTION II. RADAR TABLES

5-6. The radar tables provide a standardized, tabular format for training and evaluating radar section tasks. These task-based tables include individual and collective tasks from STPs and MTPs and equipment-specific tasks from system TMs. Table 5-2 includes all critical collective and individual tasks and the table or event in which they are trained. The ASPT and Radar Tables I-VIII may be integrated into an LTX or conducted as standalone evaluated STXs.

Table 5-2. Collective/individual radar task matrix.

Task Number	*Task*	*Where Trained*
061-294-5300	Determine Initialization Data	ASPT, Table IV, VI, VII, VIII
061-294-1024	Direct Operator Maintenance of FA Target Acquisition Radar Systems and Associated Equipment	Table I, Sgt's Time
061-294-1023	Direct Displacement of FA Radars	Table V
061-294-1022	Direct the Emplacement of FA Target Acquisition Radars	Table IV
061-294-1021	Select a Site for the FA Target Acquisition Radars	Table IV
061-294-1020	Evaluate Mission Operations Data for FA Target Acquisition Radars	Table IV
061-294-1019	Evaluate Initialization of the FA Target Acquisition Radars	ASPT, Table IV, VI, VII, VIII
113-573-6001	Recognize Electronic Countermeasures (ECM) and Implement Electronic Counter-Countermeasures(ECCM)	Table I, Sgt's Time
061-276-1012	Install Antenna Group OE-254/GRC	ASPT, Table I, Sgt's Time
061-276-1011	Use SOI Extract	ASPT, Table I, Sgt's Time
061-275-8003	Operate SINCGARS ICOM	ASPT, Table I, Sgt's Time
071-329-1004	Determine the Elevation of a Point on the Ground Using a Map	Table I, Sgt's Time
071-329-1002	Determine the Grid Coordinates of a Point on a Military Map	Table I, Sgt's Time
061-294-1014	Determine Manual Terrain-Following Data	ASPT
061-294-5112	March Order the MEP-115A/816A 60-kW Generator	Table V
061-294-1011	March Order the Fire Finder Radar Shelter	Table V
061-294-1007	March Order the Generator Set (MEP-112A/813A 10 kW)	Table V
061-294-1003	March Order the AN/TPQ-37 Radar Trailer	Table V
061-294-1002	March Order the AN/TPQ-36 Radar Trailer	Table V
061-294-5120	Operate the AN/TPQ-36 (V)8 Radar Using the Remote	Table VI

Table 5-2. Collective/individual radar task matrix.

Task Number	Task	Where Trained
	Control Display Terminal (CDT)	
061-294-1012	Initialize the AN/TPQ-37 (Digital Upgrade) Fire Finder Radar	ASPT, Table IV, VI, VII, VIII
061-294-1009	Operate the Fire Finder Radar Set in the Hostile Mode (AN/TPQ-36 (V)8 or AN/TPQ-37 Digital Upgrade)	Table VI
061-294-1005	Operate the Fire Finder Radar in the Hostile Mode (Legacy Systems)	Table VI
061-294-1004	Operate the Fire Finder Radar Set in the Friendly Mode (Legacy System)	Table VII/VIII
061-294-1000	Operate the Fire Finder Radar Set in the Friendly Mode (AN/TPQ-36 (V)8 or AN/TPQ-37 Digital Upgrade)	Table VII/VIII
061-294-5123	Start the Main Power Source (MEP-115A/816A 60 kW)	Table IV, VI, VII, VIII
061-294-5122	Start the Main Power Source (MEP-112A/813A 10 kW)	Table IV, VI, VII, VIII
061-294-5116	Operate Modular Azimuth Positioning System (MAPS)	Table IV/V
061-294-5108	Perform Operator PMCS on the AN/TPQ-37 Radar System	Table I
061-294-5106	Emplace the MEP-115A/816A 60-kW Generator	Table IV
061-294-5105	Emplace the AN/TPQ-37 Radar Trailer	Table IV
061-294-5100	Emplace the AN/TPQ-36 Radar Trailer	Table IV
061-294-5004	Initialize the AN/TPQ-36 (V)8 Radar Set	ASPT, Table IV, VI, VII, VIII
061-294-5001	Prepare the AN/TPQ-36 (V)8 Shelter for Operation	Table IV, VI, VII, VIII
061-294-1013	Prepare the Fire Finder Radar Shelter (Digital Upgrade) for Operation	Table IV, VI, VII, VIII
061-294-1010	Emplace the Fire Finder Radar Shelter	Table IV, VI, VII, VIII
061-294-1008	Emplace the Generator Set (MEP-112A/813A 10 kW)	Table IV, VI, VII, VIII
061-294-1001	Initialize the Fire Finder Radars (Legacy Systems)	ASPT, Table IV, VI, VII, VIII
06-4-Q002	March Order Radar Equipment	Table V
06-4-Q003	Emplace and Prepare Radar Equipment for Operations	Table IV
06-4-Q009	Occupy a Radar Site	Table IV
06-4-Q010	Reconnoiter a Radar Position	Table IV
06-4-Q011	Perform Unit Maintenance on Radar Equipment	Table I
06-4-Q035	Observe Friendly Indirect Fires (Radar)	Table I, VII, VIII
06-4-Q045	Perform Surveillance and Locate Targets	Table VI, VII, VIII

RADAR TABLE I: INDIVIDUAL TASKS

5-7. Radar Table I includes the individual tasks and skills and common tasks that all Soldiers must master to survive on the battlefield. These tasks are trained during Sergeant's Time training and are the basic building blocks for all collective training. The evaluation of the Soldier on Radar Table I tasks is a routine part of Sergeant's Time training and should also be evaluated using a written examination as a gate prior to all other tables. A list of test questions is provided on the Fires Knowledge Network, Master Gunner Site. The unit should select questions from the Master Gunner Site and add an equal number of questions, including questions concerning unit TSOP, local regulations, and items of command interest.

RADAR TABLE III: M249 LMG TRAINING

5-8. The M249 LMG is common to many sections and crews in FA units. The requirement to maintain a high degree of proficiency on this weapon has never been more important. The asynchronous battlefield of the COE and the varied and complex missions assigned to FA organizations require that crews and sections be proficient on all assigned weapons. The M249 LMG is critical to the overall defense of the unit against both ground and air threats and is integrated with other defenses to provide force protection against all threats. The unit-training program should include preliminary marksmanship training and training on the assembly, disassembly, and maintenance of the weapon as described in FM 3-22.68. The training and qualification included in Radar Table III is the strategy recommended by STRAC and FM 3-22.68. This strategy has been expanded to include a convoy live-fire exercise.

Radar Table III – M249 LMG

Task	Conditions	Ammunition	Reference
10-m Zero Practice and Qualification	Integrated CBRN, 80 percent of Assigned Gunner and Assistant Gunner Annually	108 rounds Ball/Person	Table 5-1, FM 3-22.68; Table 5-26, DA Pam 350-38
Transition Firing, Practice, and Qualification	Integrated CBRN	144 rounds, Mix/Person	Table 5-1, FM 3-22.68 Table 5-26, DA Pam 350-38
Night Zero and Instructional Firing	With Mounted AN/PVS-4	90 rounds, Mix/Person	Table 5-1, FM 3-22.68 Table 5-26, DA Pam 350-38
Convoy LFX		370 rounds Mixed	

RADAR TABLE IV: RSOP

5-9. Table IV includes the collective and supporting individual tasks as shown in Table 5-4. This table should include tasks based on unit TSOP such as precombat checks and inspections, load plans, PMCS checks, and driver certification.

Radar Table IV – RSOP tasks

Task Number	Task	Where Trained
06-4-Q003	Emplace and Prepare Radar Equipment for Operations	Table IV
06-4-Q009	Occupy a Radar Site	Table IV
06-4-Q010	Reconnoiter a Radar Position	Table IV
061-294-1022	Direct the Emplacement of FA Target Acquisition Radars	Table IV
061-294-1021	Select a Site for the FA Target Acquisition Radars	Table IV
061-294-1020	Evaluate Mission Operations Data for FA Target Acquisition Radars	Table IV
061-294-5123	Start the Main Power Source (MEP-115A/816A 60 kW)	Table IV, VI, VII, VIII
061-294-5122	Start the Main Power Source (MEP-112A/813A 10 kW)	Table IV, VI, VII, VIII
061-294-5116	Operate MAPS	Table IV/V
061-294-5106	Emplace the MEP-115A/816A 60-kW Generator	Table IV
061-294-5105	Emplace the AN/TPQ-37 Radar Trailer	Table IV
061-294-5100	Emplace the AN/TPQ-36 Radar Trailer	Table IV
061-294-5001	Prepare the AN/TPQ-36 (V)8 Shelter for Operation	Table IV, VI, VII, VIII
061-294-1013	Prepare the Fire Finder Radar Shelter (Digital Upgrade) for Operation	Table IV, VI, VII, VIII
061-294-1010	Emplace the Fire Finder Radar Shelter	Table IV, VI, VII, VIII
061-294-1008	Emplace the Generator Set (MEP-112A/813A 10 kW)	Table IV, VI, VII, VIII
06-4-Q003	Emplace And Prepare Radar Equipment For Operations	Table IV, Table VII/VIII
06-4-Q009	Occupy a Radar Site	Table IV, Table VII/VIII
06-4-Q010	Reconnoiter a Radar Position	Table IV, Table VII/VIII

RADAR TABLE V: MARCH ORDER

5-10. Radar Table V includes the collective task and supporting individual tasks shown in table 5-5.

Radar Table V – March order tasks.

Task Number	Task	Where Trained
06-4-Q002	March Order Radar Equipment	Table V
061-294-1023	Direct Displacement of FA Radars	Table V
061-294-5112	March Order the MEP-115A/816A 60-kW Generator	Table V
061-294-1011	March Order the Fire Finder Radar Shelter	Table V
061-294-1007	March Order the Generator Set (MEP-112A/813A 10 kW)	Table V
061-294-1003	March Order the AN/TPQ-37 Radar Trailer	Table V
061-294-1002	March Order the AN/TPQ-36 Radar Trailer	Table V
06-4-Q002	March-Order Radar Equipment	Table V, Table VII/VIII

RADAR TABLE VI: PERFORM SURVEILLANCE AND LOCATE TARGETS

5-11. Radar Table VI contains the core combat task of radar sections for locating targets in the hostile fire mode.

Radar Table VI – Perform surveillance and locate targets.

Task Number	Task
06-4-Q045	Perform Surveillance and Locate Targets
061-294-5120	Operate the AN/TPQ-36 (V)8 Radar Using the Remote Control Display Terminal
061-294-1012	Initialize the AN/TPQ-37 (Digital Upgrade) Fire Finder Radar
061-294-1009	Operate the Fire Finder Radar Set in the Hostile Mode (AN/TPQ-36 (V)8 or AN/TPQ-37 Digital Upgrade)
061-294-1005	Operate the Fire Finder Radar in the Hostile Mode (Legacy Systems)
061-294-5001	Prepare the AN/TPQ-36 (V)8 Shelter for Operation
061-294-1013	Prepare the Fire Finder Radar Shelter (Digital Upgrade) for Operation
061-294-1010	Emplace the Fire Finder Radar Shelter
061-294-1008	Emplace the Generator Set (MEP-112A/813A 10 kW)
061-294-1001	Initialize the Fire Finder Radars (Legacy Systems)
06-4-Q035	Observe Friendly Indirect Fires (Radar)
06-4-Q045	Perform Surveillance and Locate Targets

RADAR TABLES VII/VIII: TRAINING AND QUALIFICATION

5-12. Radar Tables VII and VIII, Section Training and Qualification Tables , are semiannual requirements for radar sections. Table VII is identical to Table VIII but will be evaluated using the embedded training capability FEM on the radar and is a gate preceding live-fire evaluation during Table VIII. Radar Table VIII, Qualification, should evaluate the radar section in both the friendly fire and hostile fire modes during artillery and/or mortar live-fire. Radar Table VIII must be integrated with LFX training conducted by the Mortar Platoon of the supported unit for AN/TPQ-36 sections or by Field Artillery Live Fire Training for the AN/TPQ-37 section.

Radar Tables VII/VIII – Training and qualification tasks.

Task Number	Task	Where Trained
06-4-Q035	Observe Friendly Indirect Fires (Radar)	Table I, VII, VIII
06-4-Q045	Perform Surveillance and Locate Targets	Table VI, VII, VIII
061-294-5001	Prepare the AN/TPQ-36 (V)8 Shelter for Operation	Table IV, VI, VII, VIII
061-294-1013	Prepare the Fire Finder Radar Shelter (Digital Upgrade) for Operation	Table IV, VI, VII, VIII
061-294-1010	Emplace the Fire Finder Radar Shelter	Table IV, VI, VII, VIII
061-294-1008	Emplace the Generator Set (MEP-112A/813A 10 kW)	Table IV, VI, VII, VIII
061-294-1001	Initialize the Fire Finder Radars (Legacy Systems)	ASPT, Table IV, VI, VII, VIII
061-294-5004	Initialize the AN/TPQ-36 (V)8 Radar Set	ASPT, Table IV, VI, VII, VIII
061-294-1004	Operate the Fire Finder Radar Set in the Friendly Mode (Legacy System)	Table VII/VIII
061-294-1000	Operate the Fire Finder Radar Set in the Friendly Mode (AN/TPQ-36 (V)8 or AN/TPQ-37 Digital Upgrade)	Table VII/VIII
061-294-5123	Start the Main Power Source (MEP-115A/816A 60 kW)	Table IV, VI, VII, VIII
061-294-5122	Start the Main Power Source (MEP-112A/813A 10 kW)	Table IV, VI, VII, VIII
061-294-1019	Evaluate Initialization of the FA Target Acquisition Radars	ASPT, Table IV, VI, VII, VIII
061-294-5300	Determine Initialization Data	ASPT, Table IV, VI, VII, VIII
06-4-Q003	Emplace and Prepare Radar Equipment for Operations	Table IV, Table VII/VIII
06-4-Q002	March-Order Radar Equipment	Table V, Table VII/VIII
06-4-Q009	Occupy Radar Site	Table IV, Table VII/VIII
06-4-Q010	Reconnoiter Radar Position	Table IV, Table VII/VIII
06-4-Q035	Observe Friendly Indirect Fires (Radar)	Table VII/VIII
06-4-Q045	Perform Surveillance and Locate Targets	Table VII/VIII

This page intentionally left blank.

Chapter 6

FDC/BOC/POC Section Tables

The artillery tables for FDCs, BOCs, and POCs provide a methodology for training and evaluating individual and crew/section core tasks required to establish and operate the battery/platoon operations and fire direction center and to ensure the safe, timely, and accurate delivery of fires.

INTRODUCTION

6-1. The methodology and format of the FDC section tables are identical to those of tables presented in previous chapters. The tables provide a progressive, gated approach to training to assist commanders in the assessment of training and the horizontal integration of training across the combined arms team. The tables also provide the means and tasks for C, W, and R training for the section chief to use during sergeant's time training, as refresher training, or as a prelude to training evaluation. The evaluation of FDC/BOC/POC personnel on selected critical tasks of the mission precedes the actual tables. These tasks include both individual and collective tasks that all Soldiers in the section must master. The content of the ASPT and Table I provides individual and collective tasks to support the routine training of sections and crews. This chapter includes the section/crew tasks from FM 6-40/MCWP 3-16.4, FM 6-60, and FM 3-09.70, organized by cannon FDCs and rocket/missile BOC/POC.

FDC CRITICAL FUNCTIONS

6-2. The FDC/BOC/POC in all units perform three very critical functions:

- The first critical function is to ensure that the solution to the gunnery problem is accurate, timely, and satisfies the requirements of the supported force. The technical solution of the gunnery problem may be embedded in the delivery platform (as in Paladin and MLRS launchers) or produced by automated—or in some cases manual—systems in the FDC/BOC/POC. The FDC is responsible for ensuring that all data used in the solution is the most accurate available.
- The second critical function of equal importance is to ensure the safety of the data fired by eliminating human error from the gunnery problem. Establishing procedures that provide an independent check of each element of data used in the firing solution can accomplish this.
- The third critical function is to act as the Tactical Operations Center for the battery or platoon. This requires situational awareness of the common operating picture of the battlefield (including all FSCMs) and the ability to anticipate and react quickly to the tactical situation in accordance with the field artillery support plan, ensuring that firing elements are always in support position.

SECTION I. ARTILLERY SKILLS PROFICIENCY TEST FOR FDC SECTIONS

6-3. The ASPT evaluates the FDC section member's ability to execute selected crew skills. The tasks listed in this section provide the unit commander a means to evaluate the FDC section member's basic proficiency prior to live-fire exercises. The ASPT can also be used as a guide for identifying section strengths and weaknesses. ASPT results should be used by the commander, master gunner, and battery leaders when structuring the unit's annual gunnery training program.

REQUIREMENTS

6-4. All MOS 13D (13C and 13E until converted), 13P personnel, and any personnel assigned to an FDC/BOC/POC (regardless of MOS) will be administered the ASPT. Soldiers must pass the ASPT prior to FDC/BOC/POC qualification. To pass the ASPT, a Soldier must receive a GO on all stations. If a Soldier fails a task, he must be retrained and retested on that station until he receives a GO. Appropriate manuals and other references listed for each station must be used to prepare, administer, and evaluate the ASPT.

Note. Evaluators must have passed the ASPT within 6 the months prior to testing.

6-5. a. Evaluation Procedures. Detailed procedures for the setup and conduct of the evaluation and AAR are in paragraph 3-2 of this manual.

b. Test Stations. Each station consists of a test administrative guide and criterion-scoring checklist.

TEST STATIONS

TEST STATIONS	
1.	Initialize the AFATDS test station
2.	Establish and maintain communications test station
3A.	Compute MLRS safety test station
3B.	Perform manual safety procedures test station
4.	MET message checking procedures test station
5.	Compute muzzle velocity information (manual) test station

INITIALIZE THE AFATDS TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 1

TASK: Initialize the Advanced Artillery Tactical Data System (061-300-5033)

CONDITIONS: In a field environment given an AFATDS, login information, and TM 11-7025-297-10.

STANDARDS: Initialize the AFATDS following the sequence outlined in TM 11-7025-297-10, entering the correct unit role and identification in accordance with current situation.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational AFATDS.
- SOI.
- Unit TACSOP.
- Operation order/field artillery support plan.
- Operational distant station representing battalion FDC with digital and voice communications.
- TM 11-7025-297-10.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 30 minutes
- Total time: 35 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at your new battery position area. You have been directed to initialize the AFATDS, establish digital communications with your headquarters, and be prepared to fire. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures		*GO*	*NO- GO*
1.	Applied power to all devices in sequence.		
2.	Successfully logged into the system.		
3.	Started the AFATDS.		
4.	Restored the database, if required.		
5.	Set the unit ID and unit role.		
6.	Set the system time.		
7.	Activated the system.		

ESTABLISH AND MAINTAIN COMMUNICATIONS TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 2 (ALL)

TASK: Establish and Maintain Communications (06-2-A000.06-C000, 06-2-A000.06-M000)

CONDITIONS: The FDC/BOC/POC has radios, extracts of the SOI, and COMSEC materiel. All systems are operational.

STANDARDS: The section establishes voice and digital communications with its controlling HQ in accordance with TSOP, SOI, and applicable FMs.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Operational SINCGARS radio.
- SOI/SSI.
- Loading device with keys.
- Initialized AFC/DS, FDS, and LCU.
- Simulated jamming station.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time: 15 minutes

OTHER INFORMATION: Evaluator must ensure that a distant station is operational and prepared to send and receive voice and digital traffic.

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at your new battery/platoon position area. You must correctly install the SINCGARS radio and establish communications with your controlling headquarters. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures		*GO*	*NO- GO*
1.	Radio operators prepared radios for operation as follows:		
	a. Secured radio in mount.		
	b. Connected audio accessories.		
	c. Installed antenna.		
	d. Performed operational checks of radio.		
2.	Radio operators made initial entry into net as follows:		
	a. Obtained appropriate call signs, suffixes, and frequency from SOI.		
	b. Entered radio net.		
	c. Authenticated when challenged by net control station (NCS).		
3.	Radio operators recognized frequency interference.		
	a. Determined if electronic countermeasures were being employed.		
	b. Checked for accidental or unintentional interference.		
	c. Checked for intentional interference.		
4.	Radio operators initiated prescribed electronic protection (EP) procedures.		
	a. Disconnected the antenna.		
	b. Identified the type of noise.		
	Note. SINCGARS cannot be tuned above or below the normal frequency, if properly used.		
	c. Tuned the receiver above or below the normal frequency.		
	d. Identified jamming signals.		
	e. Reported interference received to the leader.		
	f. Employed anti-jamming measures.		
5.	Radio operators recognized and prevented imitative electronic deception.		
	a. Identified intentional insertion of electromagnetic energy into transmission paths with objective of deceiving operators.		
	b. Used properly authenticated aids to ensure that the enemy could not enter their net.		
	c. Challenged reception when suspected enemy were in the net.		
6.	Radio operators employed EP.		
	a. Used COMSEC secure equipment, if available.		
	b. Set COMSEC equipment for proper code.		
	c. Safeguarded COMSEC equipment and materiel when COMSEC was used.		
	d. Used only approved radiotelephone procedures.		
	e. Used challenge and reply authentication, as required by SOI.		
	f. Used approved codes and brevity list. Encrypted and decrypted grid coordinates using SOI (optional if on a secure net).		
	g. Kept length and number of transmissions to a minimum with an objective of no more than 20 seconds per transmission.		
	h. Used the lowest power setting required to communicate with desired stations.		
	i. Used correct call signs and procedures.		
	j. Observed periods of radio listening silence.		
	k. Adhered to net discipline.		

Performance Measures		*GO*	*NO- GO*
	l. Used terrain to mask signal when possible.		
7.	The operations center made initial entry into the internal/external nets and did the following:		
	a. Established communications in low power with higher HQ and subordinate elements. Went to medium/high power, only if necessary.		
	b. Acted as NCS on internal nets.		
	c. Entered external nets (replied to authentication challenge from NCS).		
	d. Used challenge and reply authentication to ensure valid response before acting on orders or information (optional if on a secure net).		
	e. Requested permission from NCS to leave the net, as required.		
	f. Used RETRANS frequency, if necessary, to communicate with controlling HQ. (The RETRANS must be operational and established by controlling HQ.)		
	g. Conducted mobile subscriber equipment (MSE) voice and digital communications check with higher HQ.		
8.	The unit made initial entry into the appropriate nets in accordance with TSOP.		
9.	The unit improved electronic line of sight by installing range-enhancing antennas and/or directional antennas, if necessary, and did the following:		
	a. Selected antenna site away from power lines and power-generating equipment; used terrain masking.		
	b. Installed range-enhancing antennas.		
	c. Ensured that antennas did not touch tree limbs or other surrounding objects.		
	d. Accomplished the transition from whip antenna to range-enhancing antennas without communication interruptions.		
	e. Conducted frequency and COMSEC variable change in accordance with SOI or as higher HQ directed.		
10.	The FDC/BOC/POC conducted a digital communications check to confirm digital communications with the distant station.		

SUPPORTING INDIVIDUAL TASKS	
Task Number	*Task Title*
061-275-8004	Operate SINCGARS ICOM with VIC-1
061-275-8006	Operate as a Net Control Station (NCS)
061-275-8008	Operate Improved High Frequency Radio (IHFR) Sets
061-275-8009	Operate Mobile Subscriber Radio Telephone Terminals
061-275-8013	Construct Field Expedient Antennas
061-275-8014	Supervise the Operations of SINCGARS
061-275-8015	Supervise SINCGARS Net Control Station (NCS) Procedures
061-275-8016	Supervise the Operation of Improved High Frequency Radio (IHFR) Sets
061-275-8020	Supervise Field Artillery (FA) Automation/Communications System Operation
061-276-1012	Install Antenna Group OE-254/GRC
061-288-5111	Install Antenna Group OE-303 (Version 11)
061-300-5009	Perform Troubleshooting Procedures on the TAFCS (AFATDS Units)

SUPPORTING INDIVIDUAL TASKS	
Task Number	***Task Title***
061-300-5018	Supervise Preparation of the TAFCS
061-300-5019	Supervise Operation of the TAFCS
061-300-5022	Update the Master unit List (AFATDS Units)
061-300-5023	Direct TAFCS Operations (AFATDS Units)
061-C01-1028	Direct the Employment of Antenna Group OE-254/GRC
113-572-4008	Transmit a Voice United States Message Text Format (USMTF) Message
113-572-5005	Receive a Voice United States Message Text Format (USMTF) Message
113-572-6005	Write a United States Message Text Format (USMTF) Message
113-572-6006	Read a United States Message Text Format (USMTF) Message
113-573-0002	Conduct Operations Security (OPSEC) Procedures
113-573-8006	Use an Automated Signal Operation Instruction (SOI)
113-596-1017	Construct a Field Expedient Antenna for Tactical FM Radio

COMPUTE MLRS SAFETY TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 3A (MLRS)

TASK: Compute Multiple Launch Rocket System Safety

CONDITIONS: Given a launcher firing point, range safety card, rocket crest clearance tables, SDC or check launcher FCS, and a current MET message.

STANDARDS: Compute and construct a safety T, safety hazard areas, and check downrange/intervening crest clearance without error in accordance with procedures outlined in Chapter 2 of this manual.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Safety data calculator or check launcher FCS.
- Current MET message.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 30 minutes
- Total time: 35 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE SOLDIER: *"You are preparing to -fire live ammunition and have been provided range safety card data and a current MET message. You have been directed to compute safety data, determine safety hazard areas, construct a safety T, and check clearance of intervening crests. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures		*GO*	*NO- GO*
1.	Identified computational procedures (OPAREA, point-to point, or firing point).		
2.	Determined surface danger zone.		
3.	Determined firing data.		
4.	Constructed the basic safety T diagram.		
5.	Computed the launcher danger areas.		
6.	Determined down-range masking data.		

PERFORM MANUAL SAFETY PROCEDURES TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 3B (CANNON)

TASK: Perform Manual Safety Procedures (061-280-5005)

CONDITIONS: Given an XO's report, range safety card, appropriate tabular firing table (TFT), graphical firing table (GFT), graphical site table (GST), Chapter 2 of this manual, and a current MET message.

STANDARDS: Compute manual safety, XO's minimum QE, and intervening crest without error in accordance with procedures outlined in FM 6-40/MCWP 3-1.6.19 with current changes and Chapter 2 of this manual.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- XO's report.
- Range safety card.
- GFT.
- TFT.
- GST.
- Current MET message.
- Pencil and paper.
- AFATDS.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 30 minutes
- Total time: 35 minutes

OTHER INFORMATION:

INSTRUCTIONS TO THE SOLDIER: *"You are preparing to -fire live ammunition and have been provided range safety card data and a current MET message. You have been directed to compute low angle, high angle, and illumination safety data, construct a safety T, and check clearance of intervening crests. Do you understand the requirements of this test? Do you have any questions? You may begin."*

Performance Measures		***GO***	***NO- GO***
1.	Identified manual computational procedures.		
2.	Constructed the basic safety diagram.		
3.	Computed low angle safety data.		
4.	Updated safety data after determining a GFT setting.		
5.	Computed high-angle safety.		
6.	Determined the maximum effective illumination area.		
7.	Identified the elements of computation of minimum QE.		
8.	Computed manual minimum QE.		
9.	Computed minimum QE using the RFTs.		
10.	Determined intervening crest.		

MET MESSAGE CHECKING PROCEDURES TEST STATION
TEST ADMINISTRATIVE GUIDE
STATION 4 (ALL)

TASK: MET Message Checking Procedures

CONDITIONS: Given a computer MET message.

STANDARDS: Check the message for possible errors in accordance with procedures in FM 6.40/MCWP 3-1.6.19.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- Computer MET messages.
- 1:50,000 scale map.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 10 minutes
- Total time: 15 minutes

OTHER INFORMATION: Ballistic and computer MET messages should be developed with representative errors for each performance measure to be evaluated.

INSTRUCTIONS TO THE SOLDIER: *"Your current location is __________. You are preparing to fire and have received the current MET messages that I am providing. You are to check the messages for validity in accordance with the procedures in FM 6-40/MCWP 3-1.6.19 and FM 6-60. You are to inform the evaluator of any element of data that may require action and what your action would be. Do you understand the requirements of this test? Do you have any questions? You may begin."* (Start the time.)

Performance Measures		*GO*	*NO-GO*
1.	Checked message type, octant, and location entries for correctness. (MET messages for artillery are considered valid up to 20 kilometers from the balloon release point [MET section].)		
2.	Checked date andtime entries to ensure that data were current. If the MET message was more than 4 hours old, consulted with the MET section to determine message validity.		
	Note. Date and time entries are expressed in Zulu time.		
3.	Checked MET station height.		
4.	Checked that the identification line pressure and surface (line 00) pressure were the same.		
5.	Wind speeds and directions should be uniform with proportional changes in altitude. Questioned drastic changes (1,000 mils or greater) or sudden reverses of wind direction from line to line, particularly if wind speeds were more than 10 knots. (Direction changes greater than 1,000 mils are common when wind speeds are 10 knots or less.)		
6.	Questioned severe increases or decreases (10 knots or greater) in wind speed from line to line.		
	Note. Ballistic temperatures and densities normally show an inverse relationship; that is, as temperature increases, density should decrease.		
7.	Checked for erratic changes in temperature (for example, ±20 Kelvin).		
8.	Checked for drastic changes (2 percent or more) in density or temperature.		
	Note. Atmospheric pressures always decrease consistently from line to line. Pressure will never increase with height.		

COMPUTE MUZZLE VELOCITY INFORMATION (MANUAL) TEST STATION TEST ADMINISTRATIVE GUIDE STATION 5 (CANNON)

TASK: Compute Muzzle Velocity Information (Manual) (061-280-5006)

CONDITIONS: Given M93/M94 velocimeter readings, tabular firing table (TFT), MVCT-1, partially completed DA Form 4982-1-R (*M90 Velocimeter Worksheet*), partially completed DA Form 4982-R (*Muzzle Velocity Record*), calibration information, and FM 6-40/MWCP 3-1.6.19.

STANDARDS: Compute muzzle velocity information without error in accordance with procedures outlined in FM 6-40/MCWP 3-1.6.19.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Primary evaluator (SSG or above) in charge of administering the test (the evaluator may also occupy a test station).
- Station evaluator (SGT or above; one per test station).
- Classroom or training area.
- Stopwatch (one per evaluator).
- Criterion-scoring checklist (one per Soldier).
- Desk and chair or clipboard (one per Soldier).
- Pencils (one per Soldier).
- FM 3-09.8 (one per station).
- M93/M94 velocimeter readings.
- TFT.
- MVCT-1.
- DA Form 4982-1.
- DA Form 4982-R.
- Calibration data.
- FM 6-40/MCWP 3-1.6.19.

TEST PLANNING TIME:

- Administrative time: 5 minutes
- Test time: 15 minutes
- Total time: 20 minutes

OTHER INFORMATION: The evaluator must ensure that velocimeter worksheets and muzzle velocity records with weapon data, powder temperatures, and records of muzzle velocities are prepared in advance.

INSTRUCTIONS TO THE SOLDIER: *"You are currently located at a firing position. The howitzers have recorded MV readings and calibration data on the forms provided. You are to compute muzzle velocity information without error in accordance with the procedures in FM 6-40/MCWP 3-1.6.19. Do you understand the requirements of this test? Do you have any questions?"* You may begin."

Performance Measures		***GO***	***NO- GO***
1.	Verified the administrative data.		
2.	Verified the weapon information.		
3.	Verified the starting and ending powder temperature for each weapon.		
4.	Calculated the average powder temperature for each weapon.		
5.	Recorded the average powder temperature for each weapon.		
6.	Verified the M93/M94 velocimeter readout by round for each weapon.		
7.	Averaged all the usable measured muzzle velocities for each weapon.		
8.	Compared the average with each usable muzzle velocity.		
9.	Discarded any measured muzzle velocity if more than ±3 mps.		
10.	Recalculated the average, if any muzzle velocity was discarded.		
11.	Recorded the readout average for each howitzer.		
12.	Determined the MVCT correction data.		
13.	Determined the calibrated muzzle velocity.		
14.	Recorded the calibrated muzzle velocity.		
15.	Completed the muzzle velocity record (DA Form 4982-R).		

SECTION II. FDC/BOC/POC TABLES

6-6. The FDC/BOC/POC Tables listed in Table 6-1 provide a standardized, tabular format to train and evaluate FDC/BOC/POC section tasks. These task-based tables include individual and collective tasks from STPs and MTPs and the equipment-specific tasks from system TMs. Tables II and III do not exist for these sections.

Table 6-1. FDC/BOC/POC Tables.

Table No.	*Description*	*Remarks*
I	Individual Soldier and Leader Tasks (Includes Safety Certification)	Unit exam samples available on FKN and master gunner site.
IV	Occupation and Setup	
V	Compute Firing Data	
VI	Provide Command and Control	
VII	Section Dry-Fire Training	
VIII	Section Live-Fire Qualification	

FDC TABLE I. INDIVIDUAL LEADER AND SOLDIER TASKS

6-7. The tables provide a standardized and tabular format to train and evaluate FDC section tasks. These task-based tables include individual and collective tasks from STPs and MTPs and include equipment-specific tasks from system TMs. The tasks to be trained in Table I for FDC/BOC/POC personnel depend on many factors, such as—

- The automated fire control system and version software assigned to the organization.
- The backup system or procedures required (includes degraded mode procedures).
- The unit METL.
- The unit TACSOP.

6-8. The example task selection in Table 6-2 represents selected tasks that could be trained during sergeant's time training or weekly digital sustainment training. This is not a recommended task selection. Actual tasks would be selected as a result of METL, training assessment, and type of automated fire control from the complete task list in the appropriate STP. All tasks in Table 6-2 are found in STP 6-13D1-SM-TG and STP 6-13P14-SM-TG.

Table 6-2. Example of task selection.

Task No.	*Task*
061-275-8004	Operate SINCGARS ICOM with VIC-1
061-276-1011	Use SOI Extract
061-300-5003	Incorporate the Printer into the TAFCS
061-300-5010	Configure Received Message Types
061-300-5011	Process Messages for Transmission
061-300-5014	Prepare the TAFCS for Fire Mission Processing
061-300-5015	Process Target Information
061-300-5035	Manage Map Functions
061-300-5045	Run Munitions Calculator
061-300-5046	Initiate a Target List Search
061-300-5047	Process a Received Fire Support Munitions Restriction Guidance Using an AFATDS
061-300-5147	Input Trigger Events for the Current Situation
061-300-5181	Load Digital Maps
061-300-5183	Process Survey Control Points
061-300-5184	Process Met Data
071-332-5021	Prepare a Situation Map
061-266-5000	Operate the Command Post Vehicle
061-280-5000	Prepare to Process Fire Mission in Degraded Mode (Manual)
061-280-5001	Process Fire Mission in Degraded Mode (Manual)
061-275-8008	Operate Improved High Frequency Radio (IHFR) Sets
061-275-8009	Operate Mobile Subscriber Radio Telephone Terminals
061-275-8010	Use Field Wire Laying Techniques
061-300-5000	Prepare the TAFCS for Operations
061-300-5012	Disseminate Information Via Data Distribution
061-300-5186	Process Movement Data
071-329-1004	Determine Elevation of a Point on the Ground Using a Map
071-329-1009	Convert Azimuths
071-329-1014	Locate and Unknown Point on the Ground Using Intersection
071-329-1015	Locate and Unknown Point on the Ground Using Resection
061-300-5001	Configure the TAFCS Database
061-300-5002	Establish TAFCS Communication Configurations
061-300-5006	Process Geometry Data in the TAFCS
061-300-5007	Update Unit Data in TAFCS
061-300-5013	Enter Commander's Guidance into the TAFCS
061-300-5033	Initialize the AFATDS
061-300-5034	Shutdown the AFATDS Workstation
061-300-5072	Process Muzzle Velocity Information Using AFATDS
061-300-5135	Verify Computed Muzzle Velocities Using AFATDS

Table 6-2. Example of task selection.

Task No.	*Task*
061-300-5137	Perform Functions of the System Administrator
061-300-5400	Determine Commander's Guidance
061-300-5401	Process Fire Support Plans
061-288-5102	Maintain Operational Graphics on a Map
061-288-5201	Verify Operational Graphics on a Map
061-275-8020	Supervise FA Automation/Communication System Operation
061-300-5124	Determine Allocation of Attack System to Attack Requirements
061-288-5305	Advise Supported Unit of MLRS Capabilities and Limitations

6-9. The evaluation of tasks in FDC Table I is an ongoing process that will routinely be accomplished during sergeant's time training. The proficiency on Table I tasks is included in the semiannual testing of FDC personnel as part of the commander's safety certification process. Example questions are available on the fires knowledge network master gunner site to assist the commander in developing a written exam. The safety certification must include other questions concerning local range regulations and unit TACSOP. The commander should select questions from this manual and add questions from local/unit sources.

FDC TABLE IV: OCCUPATION AND SETUP

6-10. FDC Table IV includes the collective task Establish and Maintain Battery/Platoon Operations and Fire Direction Centers, 06-2-W109.

FDC Table IV—Occupation and setup

Task No.	*Task*	*Reference*
06-2-W109	Establish and Maintain Battery/Platoon Operations and Fire Direction Centers	ARTEP 6-037-30-MTP
	Precombat Checks and Inspections	Unit TACSOP
	Inspect Load Plans	Unit TACSOP
06-3-C002	Conduct Emergency Occupation, Step 2	ARTEP 6-037-30-MTP
06-3-G004	Establish Firing Capability at the Firing Position (Paladin Units), Task Steps 2 and 6	ARTEP 6-037-30-MTP

6-11. The tasks in the ASPT are gates for this table. FDC Table V should include the precombat checks and inspections, load plans, and CP setup drills in accordance with unit TACSOP. The following task steps of the emergency occupation task Conduct Emergency Missions 06-3-C002, Task Step 2 for cannon units—

The FDC/POC does the following:

a. Verifies tactical data.
b. Determines AOF.
c. Computes the firing data for the fire mission.
d. Transmits message to observer.

and the following task Establish Firing Capability at the Firing Position (Paladin Units) 06-3-G004, Task Steps 2 and 6—

2. Fire direction officer: In addition to those listed in FM 6-50, the FDO has the following responsibilities in a Paladin Unit: Verifies POC and gun databases by conducting a verification mission (dry fire or AMC) after initialization, when either the AFCS and LCU is powered up, or when a significant change occurs to the LCU/howitzer's database (MET, MVV, registration corrections).

Note. Location is not a significant change to a howitzer database.

6. POC: The platoon operation center conducts a verification mission every time there is a significant change in the database, MVVs, MET, and registration data. The POC verifies that targets do not violate fire support coordination measures and that the targets plot within the prescribed target area. It is imperative that the FDO or chief computer verifies the plot of the target and the target location that is input into LCU.

a. Ensure voice and digital communications with BN, FDC, and howitzers have been established.

b. Receive piece status (HOW;UPDATE) from howitzers and verify center sector.

c. Verify howitzer location plots inside the firing area by plotting on howitzer tracking chart.

d. Verify database. If database information changes occur, the POC directs a verification mission (that is, check/change MVVs, registrations, ammunition, and MET). At this time, the firing unit is ready to fire.

e. Verify and announce XO's minimum QE to the guns.

f. Ensure fire support measures are posted.

should also be included as tasks in the STX to train FDC Table V.

FDC TABLE V: COMPUTE FIRING DATA

6-12. FDC Table V includes the core tasks for the FDC/BOC/POC to initialize, communicate, and compute firing data. This table requires the response and input from launcher/howitzers and battalion FDC or an active simulation such as SISTIM. The focus of the tasks in this table is on the firing data computation and includes all types of fire missions and methods of control, adherence to time standards, and computation accuracies.

FDC Table V – Tasks for computing firing data

Task	*Task Number*	*Remarks*
Control and Coordinate MLRS Fire Missions (Battery)	06-2-W111	MLRS BOC/POC
Determine Firing Data	06-4-C002	All Cannon FDC/BOC/POC
Establish and Maintain Battery/Platoon Operations and Fire Direction Centers	06-2-W109	All
Establish and Maintain Communications	06-2-A000.06-C000	All Cannon FDC/BOC/POC
Establish and Maintain Communications	06-2-A000.06-M000	MLRS BOC/POC
Perform Initialization of the AFC/DS Database	061-279-5002	M109A6 Unit
Initialize the Fire Direction System (FDS) (Version 11)	061-288-5105	MLRS BOC/POL
Initialize the AFATDS	061-300-5033	All AFATDS Equipped Units

FDC TABLE VI: PROVIDE COMMAND AND CONTROL

6-13. FDC Table VI includes all tasks in Table V in addition to the planning, command, and control tasks that the FDC/BOC/POC must also performed . FDC Table VI also requires the cues and responses of live or simulated howitzers/launchers and higher echelon FDCs. This table should be evaluated in a CPX type of event that requires the element to conduct tactical moves under day and night conditions. In addition to FDC Table V, the following tasks are also included in FDC Table VI:

FDC Table VI – Provide command and control

Task	*Task Number*	*Remarks*
Command and Control Delivery of Fires	06-1-W103	All
Control and Coordinate MLRS Battery Operations	06-2-W110	MLRS
Direct and Control Firing Battery/Platoon Operations (Cannon)	06-3-C001	Cannon
Control and Coordinate MLRS Battery Operations	06-2-W110	MLRS
Prepare For Combat	06-2-A098	All
Develop and Communicate a Plan	06-2-A099	All
Move a Cannon Battery or Platoon	06-3-C013	Cannon
Coordinate MLRS Firing Platoon Ammunition Resupply	06-3-M014	MLRS

6-14. The execution of this table requires an operations order, FA support plan, maps, a scenario, and a driver for the automated systems. A TSP has been developed with the required materials to support this training and is available on the USAFAS Training and Doctrine Web Site (http://sill-www.army.mil/).

FDC TABLES VII/VIII: TRAINING AND QUALIFICATION

6-15. FDC Tables VII/VIII include all of the individual and collective tasks in the ASPT and in Tables I-VI. The live-fire qualification is conducted semiannually during the battery/platoon EXEVAL or during battalion FTX EXEVAL or both. The FDC/BOC/POC evaluation requires all of the support materials discussed in paragraph 6-14.The howitzer/launcher sections provide cues and responses and a higher level FDC to act as a "white cell" for the evaluation.

Appendix A
Minimum QE Rapid Fire Tables

This appendix provides minimum QE Rapid Fire Tables.

A-1. Use rapid fire tables only when ∠1 + ∠2 is less than or equal to 300 mils. ∠1 is the greatest site to crest as reported by the COS. Use the following table (Table A-1) to extract ∠2 for a given PCR:*

Table A-1. Extracting ∠2 for a given PCR

*Range (meters)_*	*∠2*
100	51
200	26
300	17
400	13
500	11
600	9
700	8
800	7
900-1,000	6
1,100-1,200	5
1,300-1,600	4
1,700-2,500	3
2,600-5,000	2
5,100-	1

*∠2 is determined with the formula.

$$\angle 2 = \frac{5 \text{ Meters}}{\text{PCR (in thousands)}}$$

where 5 meters is the appropriate vertical clearance for firing fuzes other than armed VT.

Note. All M557, M564 tables are used for unarmed VT fuzes. Use EL on VT tables only when firing less than minimum safe time.

Table A-2. Rapid Fire Table I

FUZE: M557, M564			*PROPELLANT: M67*			*WEAPON: M102/M119*	
Piece-to- Crest Range	**CHG 1**	**CHG 2**	**CHG 3**	**CHG 4**	**CHG 5**	**CHG 6**	**CHG 7**
100	67	65	63	61	59	58	57
200	54	50	46	42	39	36	34

Table A-2. Rapid Fire Table I

FUZE: M557, M564			*PROPELLANT: M67*			*WEAPON: M102/M119*	
Piece-to- Crest Range	**CHG 1**	**CHG 2**	**CHG 3**	**CHG 4**	**CHG 5**	**CHG 6**	**CHG 7**
300	58	51	45	40	35	30	27
400	68	57	50	43	36	30	25
500	78	68	56	47	39	31	25
600	91	79	65	53	42	33	25
700	105	89	74	59	46	36	27
800	116	98	82	64	50	38	28
900	128	110	89	70	54	41	29
1000	143	121	98	77	59	45	31
1100	162	136	109	86	64	49	36
1200	177	147	118	93	69	53	36
1300	190	159	128	99	74	56	37
1400	205	170	137	106	79	60	40
1500	219	182	146	113	84	64	43
1600	248	203	159	124	91	69	45
1700	262	214	170	130	95	72	50
1800	278	226	179	137	101	76	50
1900	293	240	189	147	106	81	53
2000	310	252	199	154	112	85	56
2100	349	280	218	166	119	92	60
2200	367	293	228	173	125	97	63
2300	385	308	238	181	131	101	66
2400	404	321	249	189	136	106	69
2500	424	337	261	199	144	111	72
2600	493	372	282	212	152	115	75
2700	514	389	292	220	158	119	78
2800	536	403	305	228	164	124	81
2900	558	421	316	236	170	129	85
3000	584	438	328	245	176	134	88
3100		503	359	263	185	142	94
3200		522	371	270	191	148	98
3300		541	385	281	198	155	102
3400		562	398	289	204	160	105
3500		583	413	300	210	165	109
3600			457	322	221	171	113
3700			472	331	227	176	117
3800			488	340	234	181	123
3900			502	352	240	187	128
4000			519	362	247	192	132
4500			690	436	290	227	157

Table A-2. Rapid Fire Table I

FUZE: M557, M564			*PROPELLANT: M67*			*WEAPON: M102/M119*	
Piece-to- Crest Range	**CHG 1**	**CHG 2**	**CHG 3**	**CHG 4**	**CHG 5**	**CHG 6**	**CHG 7**
5000				531	337	257	180
5500				670	387	298	208
6000					450	334	234
6500					527	389	270
7000					633	430	299
7500						516	340
8000						565	375
8500							431
9000							471
9500							561
10000							609

Rapid Fire Table I

FUZE: M513					PROPELLANT: M67						WEAPON: M102/M119			
Piece-to-Crest Range	CHG 1		CHG 2		CHG 3		CHG 4		CHG 5		CHG 6		CHG 7	
	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI
100	67	8.0	65	8.0	63	8.0	61	8.0	59	8.0	58	8.0	57	**8.0**
200	54	8.0	50	8.0	46	8.0	42	8.0	39	8.0	36	8.0	34	**8.0**
300	58	8.0	51	8.0	45	8.0	40	8.0	35	8.0	30	8.0	27	**8.0**
400	259	8.0	57	8.0	50	8.0	43	8.0	36	8.0	30	8.0	25	**8.0**
500	230	8.0	220	8.0	208	8.0	47	8.0	39	8.0	31	8.0	25	**8.0**
600	218	9.0	206	9.0	194	8.0	180	8.0	42	8.0	33	8.0	25	8.0
700	241	9.0	198	9.0	183	9.0	168	9.0	155	8.0	36	8.0	108	8.0
800	211	10.0	193	10.0	177	9.0	159	9.0	145	8.0	133	8.0	108	8.0
900	213	10.0	195	10.0	174	10.0	155	9.0	139	9.0	126	8.0	108	8.0
1000	219	11.0	197	11.0	174	10.0	153	10.0	135	9.0	121	9.0	108	8.0
1100	232	11.0	206	11.0	179	11.0	156	10.0	134	9.0	119	9.0	103	8.0
1200	240	12.0	210	12.0	181	11.0	156	10.0	132	10.0	116	9.0	99	9.0
1300	249	13.0	218	12.0	187	11.0	158	11.0	133	10.0	115	10.0	96	9.0
1400	260	13.0	225	12.0	192	12.0	161	11.0	133	10.0	115	10.0	95	9.0
1500	270	14.0	233	13.0	197	12.0	164	12.0	135	11.0	115	10.0	94	9.0
1600	295	14.0	250	13.0	206	13.0	171	12.0	138	11.0	115	10.0	92	10.0
1700	307	15.0	259	14.0	215	13.0	175	12.0	140	11.0	116	11.0	92	10.0
1800	321	15.0	269	15.0	222	14.0	180	13.0	144	12.0	119	11.0	93	10.0
1900	333	16.0	280	15.0	229	14.0	187	13.0	146	12.0	120	11.0	93	10.0
2000	348	16.0	290	16.0	237	15.0	192	14.0	150	12.0	123	12.0	94	11.0
2100	385	17.0	316	16.0	254	15.0	202	14.0	155	13.0	127	12.0	96	11.0
2200	402	18.0	328	17.0	263	15.0	208	14.0	160	13.0	131	12.0	98	11.0
2300	418	18.0	341	17.0	271	16.0	214	15.0	164	14.0	134	13.0	99	11.0
2400	435	19.0	352	18.0	280	16.0	220	15.0	167	14.0	136	13.0	100	12.0
2500	454	20.0	367	18.0	291	17.0	229	16.0	174	14.0	140	13.0	102	12.0
2600	523	20.0	402	19.0	312	17.0	242	16.0	182	15.0	144	14.0	105	12.0
2700	543	21.0	418	19.0	321	18.0	249	16.0	187	15.0	148	14.0	107	13.0
2800	564	22.0	431	20.0	333	18.0	256	17.0	192	15.0	152	14.0	109	13.0
2900	585	22.0	448	21.0	343	19.0	263	17.0	197	16.0	156	15.0	112	13.0
3000	610	23.0	464	21.0	354	19.0	271	18.0	202	16.0	160	15.0	114	13.0
3100			528	22.0	384	20.0	288	18.0	210	16.0	167	15.0	119	14.0
3200			546	23.0	395	20.0	296	19.0	215	17.0	171	16.0	122	14.0
3300			564	23.0	408	21.0	304	19.0	221	17.0	177	16.0	125	14.0
3400			584	24.0	420	22.0	312	20.0	226	18.0	182	16.0	127	15.0
3500			605	25.0	435	22.0	322	20.0	232	18.0	187	17.0	131	15.0
3600			793	25.0	478	23.0	343	20.0	242	18.0	191	17.0	134	15.0
3700					493	23.0	352	21.0	248	19.0	197	17.0	138	16.0
3800					508	24.0	360	21.0	254	19.0	201	18.0	143	16.0

Rapid Fire Table I

FUZE: M513			***PROPELLANT: M67***						***WEAPON: M102/M119***					
Piece-to-Crest Range	**CHG 1**	**CHG 2**	**CHG 3**		**CHG 4**		**CHG 5**		**CHG 6**		**CHG 7**			
3900			521	25.0	371	22.0	259	20.0	206	18.0	147	16.0		
4000			538	25.0	381	22.0	266	20.0	211	19.0	151	17.0		
4500			707	29.0	453	25.0	307	22.0	243	20.0	174	18.0		
5000					546	28.0	352	24.0	271	22.0	195	20.0		
5500					684	31.0	401	26.0	312	24.0	222	22.0		
6000							463	29.0	346	26.0	247	24.0		
6500							539	31.0	401	28.0	282	25.0		
7000							644	34.0	440	31.0	310	27.0		
7500									526	33.0	350	26.0		
8000									575	36.0	385	32.0		
8500											440	34.0		
9000											480	36.0		
9500											569	39.0		
10000											617	42.0		

Rapid Fire Table I

FUZE: M728, M732 ***PROPELLANT: M67*** ***WEAPON: M102/M119***

Piece- to- Crest Range	CHG 1		CHG 2		CHG 3		CHG 4		CHG 5		CHG 6		CHG 7	
	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI
100	67	8.0	65	8.0	63	8.0	61	8.0	59	8.0	58	8.0	57	8.0
200	54	8.0	50	8.0	46	8.0	42	8.0	39	8.0	36	8.0	34	8.0
300	58	8.0	51	8.0	45	8.0	40	8.0	35	8.0	30	8.0	27	8.0
400	183	8.0	57	8.0	50	8.0	43	8.0	36	8.0	30	8.0	25	8.0
500	169	8.0	159	8.0	147	8.0	47	8.0	39	8.0	31	8.0	25	8.0
600	167	9.0	155	9.0	143	8.0	129	8.0	42	8.0	33	8.0	25	8.0
700	170	9.0	154	9.0	139	9.0	124	9.0	111	8.0	36	8.0	27	8.0
800	173	10.0	155	10.0	139	9.0	121	9.0	107	8.0	95	8.0	28	8.0
900	180	10.0	162	10.0	141	10.0	122	9.0	106	9.0	93	8.0	29	8.0
1000	189	11.0	167	11.0	144	10.0	123	10.0	105	9.0	91	9.0	78	8.0
1100	204	11.0	178	11.0	151	11.0	128	10.0	106	9.0	91	9.0	75	8.0
1200	215	12.0	185	12.0	156	11.0	131	10.0	107	10.0	91	9.0	74	9.0
1300	225	13.0	194	12.0	163	11.0	134	11.0	109	10.0	91	10.0	74	9.0
1400	238	13.0	203	12.0	170	12.0	139	11.0	111	10.0	93	10.0	74	9.0
1500	250	14.0	213	13.0	177	12.0	144	12.0	115	11.0	95	10.0	74	9.0
1600	276	14.0	231	13.0	187	13.0	152	12.0	119	11.0	96	10.0	74	10.0
1700	289	15.0	241	14.0	197	13.0	157	12.0	122	11.0	98	11.0	74	10.0
1800	304	15.0	252	15.0	205	14.0	163	13.0	127	12.0	102	11.0	76	10.0
1900	317	16.0	264	15.0	213	14.0	171	13.0	130	12.0	104	11.0	77	10.0
2000	335	16.0	275	16.0	222	15.0	177	14.0	135	12.0	108	12.0	79	11.0
2100	370	17.0	301	16.0	239	15.0	187	14.0	140	13.0	112	12.0	81	11.0
2200	388	18.0	314	17.0	249	15.0	194	14.0	146	13.0	117	12.0	84	11.0
2300	405	18.0	328	17.0	258	16.0	201	15.0	151	14.0	121	13.0	86	11.0
2400	422	19.0	339	18.0	267	16.0	207	15.0	154	14.0	123	13.0	87	12.0
2500	442	20.0	355	18.0	279	17.0	217	16.0	162	14.0	128	13.0	90	12.0
2600	511	20.0	390	19.0	300	17.0	230	16.0	170	15.0	132	14.0	93r	12.0
2700	532	21.0	407	19.0	310	18.0	238	16.0	176	15.0	137	14.0	96	13.0
2800	553	22.0	420	20.0	322	18.0	245	17.0	191	15.0	141	14.0	98	13.0
2900	574	22.0	437	21.0	332	19.0	252	17.0	186	16.0	145	15.0	101	13.0
3000	600	23.0	454	21.0	344	19.0	261	18.0	192	16.0	150	15.0	104	13.0
3100			519	22.0	375	20.0	279	18.0	201	16.0	158	15.0	111	14.0
3200			537	23.0	386	20.0	287	19.0	205	17.0	162	16.0	113	14.0
3300			555	23.0	399	21.0	295	19.0	212	17.0	168	16.0	116	14.0
3400			575	24.0	411	22.0	303	20.0	217	18.0	173	16.0	118	15.0
3500			596	25.0	426	22.0	313	20.0	223	18.0	178	17.0	122	15.0
3600			784	25.0	469	23.0	334	20.0	233	18.0	182	17.0	125	15.0
3700					485	23.0	344	21.0	240	19.0	189	17.0	130	16.0
3800					500	24.0	352	21.0	246	19.0	193	18.0	135	16.0
3900					513	25.0	363	22.0	251	20.0	196	18.0	141	16.0
4000					530	25.0	373	22.0	258	20.0	203	19.0	143	17.0
4500					700	29.0	446	25.0	300	22.0	236	20.0	167	18.0
5000							540	28.0	346	24.0	265	22.0	189	20.0
5500							678	31.0	395	26.0	306	24.0	216	22.0
6000									458	29.0	341	26.0	242	24.0
6500									534	31.0	396	28.0	277	25.0
7000									640	34.0	436	31.0	306	27.0
7500											522	33.0	346	29.0
8000											571	36.0	381	32.0
8500													437	34.0
9000													477	36.0
9500													566	39.0
10000													614	42.0

Table A-3. Rapid Fire Table II

FUZE*: *M557, M564	***PROPELLANT*: *GREEN BAG M3A1***		***WEAPON*: *M109A2-A6/M198***		
Piece- to- Crest Range	**CHG 1**	**CHG 2**	**CHG 3**	**CHG 4**	**CHG 5**
100	67	64	62	61	59
200	53	47	43	40	37
300	57	48	40	36	31
400	65	53	43	37	31
500	77	62	48	40	33
600	87	69	52	43	35
700	98	77	58	45	37
800	111	86	64	52	40
900	125	96	72	56	43
1000	137	108	80	61	47
1100	151	116	86	66	50
1200	167	126	93	76	58
1300	181	137	99	76	58
1400	194	147	106	81	62
1500	210	160	116	87	66
1600	231	172	123	95	71
1700	244	181	129	99	75
1800	260	192	137	105	79
1900	276	204	144	111	84
2000	303	221	155	117	89
2100	317	232	164	123	93
2200	335	245	170	129	100
2300	352	256	179	135	105
2400	370	269	187	141	110
2500	407	290	199	150	115
2600	427	303	208	155	119
2700	447	315	216	161	124
2800	467	329	224	167	129
2900	490	341	232	175	134
3000	551	370	247	183	140
3100	576	385	256	189	145
3200	602	398	264	196	150
3300	631	414	273	202	155
3400	664	430	284	208	160
3500	813	469	300	219	168
3600		486	309	225	173
3700		504	320	232	178
3800		522	330	241	183
3900		541	330	247	189
4000		607	362	259	197
4500			432	302	228
5000			521	350	262
5500			644	403	297
6000				466	335
6500				549	379
7000				659	427
7500					483
8000					554
8500					646

Note. CHG 1 restriction due to possibility of a “sticker” (see TM 9-2350-217-10N)

Rapid Fire Table II

FUZE: *M557, M564*	***PROPELLANT***: *WHITE BAG M4A1 (CHG 3-7), M119 (CHG 8)*			***WEAPON***: *M109A2-A6/M198*	
Piece- to-Crest Range	**CHG 3**	**CHG 4**	**CHG 5**	**CHG 6**	**CHG 7**	**CHG 8**
100	60	59	58	56	55	55
200	41	37	35	32	31	30
300	38	33	29	25	23	22
400	39	33	28	24	21	19
500	43	36	30	24	20	18
600	47	39	32	24	20	17
700	54	42	35	26	21	17
800	59	46	37	27	21	17
900	64	50	40	29	22	17
1000	70	55	43	32	24	19
1100	75	60	46	34	26	19
1200	81	67	50	36	27	20
1300	88	71	53	38	28	20
1400	94	76	56	40	30	21
1500	100	82	60	43	32	23
1600	108	87	67	46	34	24
1700	114	91	70	48	34	24
1800	121	96	74	50	36	25
1900	128	101	79	53	38	27
2000	137	108	83	56	40	28
2100	143	113	88	59	42	30
2200	152	118	92	62	44	32
2300	158	124	97	65	46	33
2400	165	129	101	68	48	34
2500	174	138	105	71	50	36
2600	181	142	110	73	51	36
2700	188	148	115	76	54	38
2800	195	153	119	80	56	39
2900	202	159	126	84	58	40
3000	215	166	131	89	60	42
3100	222	172	136	93	63	43
3200	229	178	141	96	66	45
3300	236	184	146	100	68	46
3400	246	190	151	103	70	48
3500	258	199	156	107	73	50
3600	266	207	163	110	76	51
3700	275	213	168	114	78	53
3800	283	219	173	118	80	54
3900	291	225	178	122	83	56
4000	308	234	183	128	85	58
4500	362	272	213	149	101	66
5000	423	312	244	173	116	77
5500	500	356	277	195	133	85
6000	596	410	312	224	149	95
6500		468	352	249	172	109
7000		542	392	282	191	121
7500		642	442	310	215	135

Rapid Fire Table II

***FUZE*: M557, M564**	***PROPELLANT*: WHITE BAG M4A1 (CHG 3-7), M119 (CHG 8)**			***WEAPON*: M109A2-A6/M198**		
Piece- to- Crest Range	**CHG 3**	**CHG 4**	**CHG 5**	**CHG 6**	**CHG 7**	**CHG 8**
8000			499	348	238	149
8500			569	394	266	167
9000			660	428	291	183
9500				492	325	203
10000				531	352	222
10500				648	393	244
11000				697	423	266
11500					478	291
12000					513	315
12500					597	347
13000					639	372
13500						409
14000						438
14500						484
15000						516
15500						585
16000						622

Rapid Fire Table II

***FUZE*: M514**		***PROPELLANT*: GREEN BAG M3A1**					***WEAPON: M109A2-A6/M198***			
Piece- to- Crest Range	**CHG 1**		**CHG 2**		**CHG 3**		**CHG 4**		**CHG 5**	
	EL	**TI**	**EL**	**TI**	**EL**	**TI**	**EL**	**TI**	**EL**	**TI**
100	67	8.0	64	8.0	62	8.0	61	8.0	58	8.0
200	53	8.0	47	8.0	43	8.0	40	8.0	36	8.0
300	57	8.0	48	8.0	40	8.0	36	8.0	30	8.0
400	254	8.0	53	8.0	43	8.0	37	8.0	30	8.0
500	268	8.0	253	8.0	48	8.0	40	8.0	32	8.0
600	251	9.0	231	9.0	213	8.0	43	8.0	35	8.0
700	239	9.0	216	9.0	196	9.0	184	8.0	37	8.0
800	235	9.0	208	9.0	185	9.0	172	9.0	160	8.0
900	236	10.0	205	10.0	180	9.0	163	9.0	150	8.0
1000	237	10.0	204	10.0	176	10.0	157	9.0	143	9.0
1100	249	11.0	207	11.0	175	10.0	155	10.0	138	9.0
1200	253	11.0	209	11.0	174	10.0	152	10.0	135	9.0
1300	262	12.0	215	12.0	175	11.0	151	10.0	133	10.0
1400	269	12.0	220	12.0	176	11.0	151	11.0	131	10.0
1500	280	13.0	224	13.0	182	12.0	151	11.0	130	10.0
1600	301	13.0	238	13.0	186	12.0	156	11.0	132	11.0
1700	311	14.0	244	14.0	189	12.0	157	12.0	132	11.0
1800	324	14.0	252	14.0	194	13.0	160	12.0	134	11.0
1900	337	14.0	261	14.0	198	13.0	163	12.0	135	12.0
2000	351	15.0	269	15.0	203	14.0	165	13.0	137	12.0
2100	381	15.0	286	15.0	213	14.0	171	13.0	139	12.0
2200	398	16.0	298	16.0	220	14.0	176	13.0	145	12.0
2300	413	16.0	307	16.0	225	15.0	180	14.0	148	13.0
2400	429	17.0	318	17.0	231	15.0	184	14.0	151	13.0
2500	445	19.0	328	17.0	237	16.0	188	14.0	153	13.0
2600	502	20.0	354	18.0	250	16.0	194	15.0	157	14.0
2700	521	21.0	365	19.0	257	16.0	199	15.0	161	14.0
2800	540	21.0	378	19.0	264	17.0	204	15.0	165	14.0
2900	561	22.0	388	20.0	270	17.0	210	16.0	168	15.0
3000	583	23.0	402	20.0	279	18.0	215	16.0	172	15.0
3100	720	24.0	439	21.0	295	18.0	224	17.0	178	15.0
3200	746	24.0	451	21.0	302	19.0	230	17.0	182	16.0
3300	773	25.0	466	22.0	310	19.0	235	17.0	186	16.0
3400	805	26.0	481	22.0	320	19.0	240	18.0	191	16.0
3500	842	27.0	496	23.0	327	20.0	246	18.0	195	17.0
3600			558	24.0	347	20.0	257	18.0	202	17.0
3700			575	24.0	358	21.0	263	19.0	206	18.0
3800			592	25.0	366	21.0	271	19.0	211	18.0
3900			610	26.0	374	22.0	276	20.0	215	18.0
4000			630	26.0	385	22.0	282	20.0	220	19.0
4500					453	25.0	323	22.0	249	20.0
5000					514	28.0	369	24.0	281	22.0
5500					589	31.0	421	27.0	315	24.0
6000							482	29.0	351	26.0
6500							564	32.0	395	28.0
7000							673	35.0	441	30.0
7500									497	33.0

Rapid Fire Table II

FUZE*: *M514		***PROPELLANT*: *GREEN BAG M3A1***					***WEAPON: M109A2-A6/M198***			
Piece- to-Crest Range	**CHG 1**		**CHG 2**		**CHG 3**		**CHG 4**		**CHG 5**	
	EL	**TI**	**EL**	**TI**	**EL**	**TI**	**EL**	**TI**	**EL**	**TI**
8000									566	35.0
8500									657	38.0

Rapid Fire Table II

***FUZE*: M514** ***PROPELLANT*: WHITE BAG M4A1 (CHG 3-7), M119 (CHG 8)** ***WEAPON*: M109A2-A6/M198**

Piece- to- Crest Range	CHG 3		CHG 4		CHG 5		CHG 6		CHG 7		CHG 8	
	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI
100	61	8.0	59	8.0	58	8.0	58	8.0	56	8.0	56	8.0
200	41	8.0	37	8.0	35	8.0	34	8.0	32	8.0	31	8.0
300	38	8.0	33	8.0	29	8.0	27	8.0	24	8.0	23	8.0
400	39	8.0	33	8.0	28	8.0	26	8.0	22	8.0	20	8.0
500	234	8.0	36	8.0	30	8.0	26	8.0	21	8.0	19	8.0
600	207	8.0	40	8.0	32	8.0	26	8.0	21	8.0	18	8.0
700	191	8.0	180	8.0	35	8.0	28	8.0	22	8.0	18	8.0
800	179	9.0	167	8.0	157	8.0	29	8.0	22	8.0	18	8.0
900	171	9.0	158	9.0	147	8.0	138	8.0	23	8.0	18	8.0
1000	166	9.0	152	9.0	139	9.0	129	8.0	25	8.0	20	8.0
1100	165	10.0	149	9.0	134	9.0	123	8.0	115	8.0	21	8.0
1200	163	10.0	148	10.0	130	9.0	117	9.0	108	8.0	22	8.0
1300	165	10.0	147	10.0	128	9.0	114	9.0	104	8.0	97	8.0
1400	165	11.0	146	10.0	125	10.0	110	9.0	100	9.0	92	8.0
1500	166	11.0	146	11.0	124	10.0	108	9.0	97	9.0	89	8.0
1600	170	12.0	148	11.0	127	10.0	107	9.0	95	9.0	86	8.0
1700	173	12.0	149	11.0	127	11.0	106	10.0	92	9.0	83	9.0
1800	178	12.0	151	12.0	128	11.0	105	10.0	91	9.0	81	9.0
1900	181	13.0	153	12.0	130	11.0	105	10.0	90	10.0	80	9.0
2000	185	13.0	156	12.0	131	12.0	105	11.0	89	10.0	78	9.0
2100	190	13.0	159	13.0	133	12.0	107	11.0	88	10.0	76	9.0
2200	198	14.0	163	13.0	136	12.0	109	11.0	89	10.0	77	9.0
2300	202	14.0	167	13.0	139	12.0	110	11.0	89	10.0	76	10.0
2400	207	15.0	170	14.0	141	13.0	111	12.0	89	11.0	75	10.0
2500	212	15.0	176	14.0	143	13.0	112	12.0	89	11.0	75	10.0
2600	222	15.0	181	14.0	147	13.0	113	12.0	89	11.0	74	10.0
2700	228	16.0	186	15.0	151	14.0	115	12.0	91	11.0	75	10.0
2800	234	16.0	190	15.0	154	14.0	118	13.0	92	12.0	75	11.0
2900	239	16.0	194	15.0	159	14.0	121	13.0	92	12.0	74	11.0
3000	247	17.0	198	16.0	163	14.0	123	13.0	93	12.0	75	11.0
3100	258	17.0	206	16.0	167	15.0	128	14.0	95	12.0	75	11.0
3200	264	18.0	211	17.0	171	15.0	130	14.0	97	13.0	76	11.0
3300	270	18.0	216	17.0	175	16.0	133	14.0	98	13.0	76	11.0
3400	279	18.0	221	17.0	179	16.0	135	15.0	99	13.0	77	12.0
3500	285	19.0	226	18.0	183	16.0	138	15.0	101	13.0	78	12.0
3600	300	19.0	237	18.0	190	17.0	141	15.0	103	13.0	79	12.0
3700	308	20.0	242	18.0	194	17.0	144	15.0	105	14.0	80	12.0
3800	315	20.0	247	19.0	198	17.0	147	16.0	106	14.0	80	12.0
3900	322	21.0	252	19.0	202	18.0	150	16.0	108	14.0	81	13.0
4000	331	21.0	257	19.0	206	18.0	153	16.0	109	15.0	82	13.0
4500	383	23.0	293	21.0	234	20.0	176	18.0	123	16.0	88	14.0
5000	442	26.0	331	23.0	263	22.0	195	20.0	137	17.0	97	15.0
5500	517	28.0	374	26.0	295	24.0	220	21.0	153	19.0	106	16.0
6000	614	31.0	426	28.0	328	25.0	244	23.0	167	20.0	115	17.0
6500			556	33.0	367	27.0	273	25.0	190	22.0	126	19.0
7000			655	36.0	406	30.0	301	27.0	208	24.0	137	20.0
7500					455	32.0	337	29.0	231	25.0	151	21.0

Rapid Fire Table II

FUZE: M514 ***PROPELLANT: WHITE BAG M4A1 (CHG 3-7), M119 (CHG 8)*** ***WEAPON: M109A2-A6/M198***

Piece- to- Crest Range	CHG 3		CHG 4		CHG 5		CHG 6		CHG 7		CHG 8	
	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI
8000					511	34.0	365	31.0	254	27.0	164	23.0
8500					580	37.0	411	33.0	281	29.0	182	25.0
9000					671	39.0	446	35.0	307	31.0	198	26.0
9500							623	40.0	368	35.0	237	30.0
10000							667	42.0	408	37.0	258	31.0
10500							718	45.0	439	39.0	281	33.0
11000									493	41.0	305	35.0
11500									529	43.0	330	37.0
12000									614	46.0	363	39.0
12500									657	49.0	387	41.0
13000											425	43.0
13500											455	45.0
14000											501	47.0
14500											533	50.0
15000											605	52.0
15500											643	55.0

Rapid Fire Table II

***FUZE*: M728, M732** ***PROPELLANT*: GREEN BAG M3A1** ***WEAPON*: M109A2-A6/M198**

Piece- to-Crest Range	CHG 1		CHG 2		CHG 3		CHG 4		CHG 5	
	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI
100	67	8.0	64	8.0	62	8.0	61	8.0	58	8.0
200	53	8.0	47	8.0	43	8.0	40	8.0	36	8.0
300	57	8.0	48	8.0	40	8.0	36	8.0	30	8.0
400	65	8.0	53	8.0	43	8.0	37	8.0	30	8.0
500	209	8.0	194	8.0	48	8.0	40	8.0	32	8.0
600	201	9.0	181	9.0	163	8.0	43	8.0	35	8.0
700	196	9.0	173	9.0	153	9.0	141	8.0	37	8.0
800	198	10.0	171	9.0	148	9.0	135	9.0	123	8.0
900	203	10.0	172	10.0	147	9.0	130	9.0	117	8.0
1000	207	11.0	174	10.0	146	10.0	127	9.0	113	9.0
1100	221	11.0	179	11.0	147	10.0	127	10.0	110	9.0
1200	228	12.0	184	11.0	149	10.0	127	10.0	110	9.0
1300	238	12.0	191	12.0	151	11.0	127	10.0	109	10.0
1400	147	13.0	197	12.0	154	11.0	129	11.0	109	10.0
1500	260	14.0	204	13.0	160	12.0	131	11.0	110	10.0
1600	282	14.0	219	13.0	167	12.0	137	11.0	113	11.0
1700	293	15.0	226	14.0	171	12.0	139	12.0	114	11.0
1800	307	15.0	235	14.0	177	13.0	143	12.0	117	11.0
1900	321	16.0	245	14.0	182	13.0	147	12.0	119	12.0
2000	336	16.0	254	15.0	188	14.0	150	13.0	122	12.0
2100	367	17.0	272	15.0	199	14.0	157	13.0	125	12.0
2200	384	17.0	284	16.0	206	14.0	162	13.0	131	12.0
2300	400	18.0	294	16.0	212	15.0	167	14.0	135	13.0
2400	416	19.0	305	17.0	218	15.0	171	14.0	138	13.0
2500	433	19.0	316	17.0	225	16.0	176	14.0	141	13.0
2600	491	20.0	343	18.0	239	16.0	183	15.0	146	14.0
2700	510	21.0	354	19.0	246	16.0	188	15.0	150	14.0
2800	529	21.0	367	19.0	253	17.0	193	15.0	154	14.0
2900	551	22.0	378	20.0	260	17.0	200	16.0	158	15.0
3000	573	23.0	392	20.0	269	18.0	205	16.0	162	15.0
3100	711	24.0	430	21.0	286	18.0	215	17.0	169	15.0
3200	736	24.0	442	21.0	293	19.0	221	17.0	173	16.0
3300	764	25.0	457	22.0	301	19.0	226	17.0	177	16.0
3400	796	26.0	472	22.0	311	19.0	231	18.0	182	16.0
3500	834	27.0	488	23.0	319	20.0	238	18.0	187	17.0
3600			549	24.0	338	20.0	248	18.0	194	17.0
3700			567	24.0	349	21.0	255	19.0	198	18.0
3800			584	25.0	358	21.0	263	19.0	204	18.0
3900			602	26.0	367	22.0	269	20.0	208	18.0
4000			623	26.0	378	22.0	275	22.0	213	19.0
4500					446	25.0	316	22.0	242	20.0
5000					534	28.0	363	24.0	275	22.0
5500					656	31.0	415	27.0	309	24.0

Rapid Fire Table II

***FUZE*: M728, M732** ***PROPELLANT*: GREEN BAG M3A1** ***WEAPON*: M109A2-A6/M198**

Piece- to- Crest Range	CHG 1		CHG 2		CHG 3		CHG 4		CHG 5	
6000							477	29.0	346	26.0
6500							559	32.0	390	28.0
7000							669	35.0	437	30.0
7500									493	33.0
8000									562	35.0
8500									654	38.0

Rapid Fire Table II

FUZE*: *M728, M732 ***PROPELLANT*: *WHITE BAG M4A1 (CHG 3-7), M119 (CHG 8)*** ***WEAPON*: *M109A2-A6/M198***

Piece- to- Crest Range	CHG 3		CHG 4		CHG 5		CHG 6		CHG 7		CHG 8	
	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI
100	61	8.0	59	8.0	58	8.0	57	8.0	56	8.0	56	8.0
200	41	8.0	37	8.0	35	8.0	33	8.0	32	8.0	31	8.0
300	38	8.0	33	8.0	29	8.0	26	8.0	24	8.0	23	8.0
400	39	8.0	33	8.0	28	8.0	25	8.0	22	8.0	20	8.0
500	43	8.0	36	8.0	30	8.0	25	8.0	21	8.0	19	8.0
600	181	8.0	40	8.0	32	8.0	25	8.0	21	8.0	18	8.0
700	148	8.0	137	8.0	35	8.0	27	8.0	22	8.0	18	8.0
800	132	9.0	130	8.0	120	8.0	28	8.0	22	8.0	18	8.0
900	138	9.0	125	9.0	113	8.0	105	8.0	23	8.0	18	8.0
1000	136	9.0	122	9.0	108	9.0	99	8.0	25	8.0	20	8.0
1100	137	10.0	121	9.0	106	9.0	95	8.0	87	8.0	21	8.0
1200	138	10.0	123	10.0	105	9.0	92	9.0	83	8.0	21	8.0
1300	141	10.0	123	10.0	104	9.0	90	9.0	80	8.0	72	8.0
1400	143	11.0	124	10.0	103	10.0	88	9.0	78	9.0	69	8.0
1500	146	11.0	126	11.0	104	10.0	88	9.0	77	9.0	68	8.0
1600	151	12.0	129	11.0	108	10.0	88	10.0	76	9.0	67	8.0
1700	155	12.0	131	11.0	109	11.0	88	10.0	74	9.0	65	9.0
1800	161	12.0	134	12.0	111	11.0	88	10.0	74	9.0	64	9.0
1900	165	13.0	137	12.0	114	11.0	89	10.0	74	10.0	64	9.0
2000	170	13.0	141	12.0	116	12.0	90	11.0	74	10.0	63	9.0
2100	176	13.0	145	13.0	119	12.0	93	11.0	74	10.0	62	9.0
2200	184	14.0	149	13.0	122	12.0	95	11.0	75	10.0	63	9.0
2300	189	14.0	154	13.0	126	13.0	97	11.0	76	10.0	63	10.0
2400	194	15.0	157	14.0	128	13.0	98	12.0	76	11.0	62	10.0
2500	200	15.0	164	14.0	131	13.0	100	12.0	77	11.0	63	10.0
2600	211	15.0	170	14.0	136	13.0	102	12.0	78	11.0	63	10.0
2700	217	16.0	175	15.0	140	14.0	104	12.0	80	11.0	64	10.0
2800	223	16.0	179	15.0	143	14.0	107	13.0	81	12.0	64	11.0
2900	229	16.0	184	15.0	149	14.0	111	13.0	82	12.0	64	11.0
3000	237	17.0	188	16.0	153	15.0	113	13.0	83	12.0	65	11.0
3100	249	17.0	197	16.0	158	15.0	119	14.0	86	12.0	66	11.0
3200	255	18.0	202	17.0	162	15.0	121	14.0	88	12.0	67	11.0
3300	262	18.0	207	17.0	166	16.0	124	14.0	89	13.0	67	11.0
3400	270	18.0	212	17.0	170	16.0	126	15.0	90	13.0	68	12.0
3500	277	19.0	218	18.0	175	16.0	130	15.0	93	13.0	70	12.0
3600	291	19.0	228	18.0	181	17.0	132	15.0	94	13.0	70	12.0
3700	300	20.0	234	18.0	186	17.0	136	15.0	97	14.0	72	12.0
3800	307	20.0	239	19.0	190	17.0	139	16.0	98	14.0	72	12.0
3900	315	21.0	245	19.0	195	18.0	143	16.0	101	14.0	74	13.0
4000	324	21.0	250	19.0	199	18.0	146	16.0	102	14.0	75	13.0
4500	376	21.0	286	21.0	227	20.0	169	17.0	116	16.0	81	14.0
5000	436	26.0	325	23.0	257	22.0	189	20.0	131	17.0	91	15.0
5500	511	28.0	368	26.0	289	24.0	214	21.0	147	19.0	100	16.0

Rapid Fire Table II

***FUZE*: M728, M732** ***PROPELLANT*: WHITE BAG M4A1 (CHG 3-7), M119 (CHG 8)** ***WEAPON*: M109A2-A6/M198**

Piece- to- Crest Range	CHG 3		CHG 4		CHG 5		CHG 6		CHG 7		CHG 8	
	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI	EL	TI
6000	609	31.0	421	28.0	323	26.0	239	23.0	162	20.0	110	17.0
6500			479	30.0	362	28.0	268	25.0	185	22.0	121	19.0
7000			552	33.0	402	30.0	297	27.0	204	24.0	133	20.0
7500			651	36.0	451	32.0	343	29.0	227	25.0	147	21.0
8000					507	34.0	361	31.0	250	27.0	160	23.0
8500					577	37.0	408	33.0	278	29.0	179	25.0
9000					667	40.0	442	35.0	303	31.0	194	26.0
9500							546	40.0	365	35.0	234	30.0
10000							664	42.0	405	37.0	255	31.0
10500									436	39.0	278	33.0
11000									41	41.0	303	35.0
11500									526	43.0	327	37.0
12000									611	46.0	360	39.0
12500									655	49.0	385	41.0
13000											423	43.0
13500											453	45.0
14000											498	47.0
14500											531	50.0
15000											603	52.0
15500											641	55.0

Rapid Fire Table II			
***FUZE*: M557, M564**	***SHELL RAP***	***ROCKET ON ONLY***	***WEAPON*: M109A2-A6/M198**
Piece- to- Crest Range	**CHG 7RB**	**CHG 8WB**	**CHG M203**
100	55	55	54
200	32	31	30
300	24	23	22
400	22	20	18
500	21	19	17
600	21	18	16
700	22	18	16
800	22	18	15
900	23	19	15
1000	25	20	16
1100	26	20	16
1200	28	21	17
1300	29	21	16
1400	31	23	17
1500	32	24	18
1600	34	25	19
1700	35	25	19
1800	37	27	19
1900	39	28	20
2000	41	29	21
2100	43	31	22
2200	44	33	23
2300	46	34	24
2400	48	35	25
2500	50	37	25
2600	51	37	25
2700	53	39	26
2800	55	40	27
2900	57	41	28
3000	60	43	29
3100	63	44	30
3200	66	46	31
3300	67	47	32
3400	69	49	33
3500	71	50	34
3600	74	52	35
3700	76	53	36
3800	78	55	37
3900	80	56	38
4000	83	58	39
4500	94	66	44
5000	107	73	49
5500	117	82	54
6000	128	90	60
6500	141	97	65

Rapid Fire Table II

FUZE: M557, M564	*SHELL RAP*	*ROCKET ON ONLY*	*WEAPON: M109A2-A6/M198*
Piece- to- Crest Range	**CHG 7RB**	**CHG 8WB**	**CHG M203**
7000	152	105	71
7500	165	113	77
8000	177	123	85
8500	192	132	91
9000	206	141	97
9500	221	151	103
10000	238	161	109
10500	256	170	114
11000	273	184	121
11500	295	196	129
12000	313	208	138
12500	339	223	143
13000	360	237	152
13500	389	251	160
14000	412	268	170
14500	447	85	175
15000	474	302	187
15500	515	324	198
16000	545	343	209
16500	601	366	214
17000	636	387	229
17500	728	416	242
18000	771	440	256
18500	1173	471	266
19000	1241	498	281
19500		538	297
20000		567	315
20500		622	328
21000		657	347
21500		745	365
22000		789	383
22500			404
23000			425
23500			445
24000			468
24500			500
25000			525
25500			550
26000			577
26500			648
27000			577
27500			648
28000			525
28500			550
29000			577
29500			648

Rapid Fire Table II

SHELL DPICM ***WEAPON: M109A2-A6/M198***

Piece-to-Crest Range	CHG 3GB	CHG 3WB	CHG 4GB	CHG 4WB	CHG 5GB	CHG 5WB	CHG 6WB	CHG 7RB	CHG 7WB
100	62	61	59	58	58	57	56	55	55
200	44	42	41	38	37	35	33	31	32
300	43	39	37	34	32	30	27	23	25
400	46	41	39	35	32	30	25	20	22
500	51	45	43	38	34	31	26	19	22
600	50	50	47	41	37	34	28	10	22
700	65	55	51	45	40	37	29	19	23
800	71	62	56	49	44	39	31	19	24
900	78	68	61	54	47	42	32	19	24
1000	88	74	67	59	52	46	35	20	26
1100	96	81	72	64	56	49	37	22	28
1200	104	87	80	69	61	53	40	23	30
1300	111	92	85	73	64	56	42	23	31
1400	119	99	91	78	69	60	44	25	33
1500	127	108	97	86	73	65	47	26	35
1600	140	117	104	92	79	70	50	27	37
1700	149	123	111	96	83	73	52	28	38
1800	157	130	117	102	88	77	5	29	40
1900	165	137	123	107	92	82	58	30	42
2000	174	145	130	113	97	86	62	32	44
2100	188	155	138	120	103	92	66	33	47
2200	196	162	147	126	108	96	69	34	50
2300	207	169	153	132	113	103	72	36	52
2400	216	177	160	137	118	107	76	37	54
2500	224	186	167	143	123	112	79	39	56
2600	241	196	172	150	129	117	82	39	58
2700	250	203	183	156	134	121	86	41	60
2800	262	211	190	164	139	126	89	42	62
2900	271	218	197	170	144	131	93	44	65
3000	281	228	204	176	150	136	96	45	67
3100	303	243	211	185	157	143	101	47	70
3200	313	251	224	191	162	148	105	48	73
3300	325	258	232	197	168	153	109	50	75
3400	335	268	241	203	173	158	112	52	78
3500	346	277	248	209	181	163	116	53	0
3600	376	294	256	221	190	170	121	55	83
3700	307	302	271	227	195	175	127	57	86
3800	390	313	278	236	201	181	131	58	88
3900	411	321	286	242	207	186	135	60	91
4000	423	330	294	249	212	191	139	62	94
4500	523	392	338	289	246	224	163	72	109
5000	671	468	394	335	282	256	186	81	125
5500	1068	563	460	386	323	289	211	93	145
6000		709		447	367	329	241	104	163
6500		1087		521	420	371	270	117	185
7000				622	479	420	300	129	205
7500				783	556	478	336	145	232
8000					661	548	372	160	254

Rapid Fire Table II

SHELL DPICM *WEAPON: M109A2-A6/M198*

Piece-to-Crest Range	CHG 3GB	CHG 3WB	CHG 4GB	CHG 4WB	CHG 5GB	CHG 5WB	CHG 6WB	CHG 7RB	CHG 7WB
8500					854	642	413	177	284
9000						796	461	195	302
9500							516	214	346
10000							585	232	374
10500							676	374	420
11000							829	278	451
11500								307	514
12000								329	550
12500								363	661
13000								388	709
13500								429	
14000								459	
14500								509	
15000								542	
15500								619	
16000								660	
16500								845	
17000								902	

Rapid Fire Table II

SHELL COPPERHEAD			*WEAPON: M109A2-A6/M198*		
Piece-to-Crest Range	**CHG 4GB**	**CHG 5GB**	**CHG 6WB**	**CHG 7WB**	**CHG 8WB**
100	99	97	95	94	93
200	82	78	75	73	71
300	82	76	70	67	65
400	86	79	71	67	63
500	93	83	73	68	64
600	100	88	76	70	65
700	107	93	79	72	67
800	115	99	83	75	68
900	123	105	87	78	70
1000	132	112	92	81	73
1100	141	118	96	84	75
1200	150	125	101	88	77
1300	159	132	105	91	79
1400	169	139	110	95	82
1500	179	147	116	99	85
1600	189	154	121	103	88
1700	198	161	126	106	90
1800	209	169	131	110	93
1900	220	177	137	115	96
2000	231	185	143	119	100
2100	242	194	149	124	103
2200	253	202	155	128	106
2300	265	211	161	133	109
2400	277	219	167	138	113
2500	289	228	174	142	116
2600	301	236	179	146	119
2700	314	245	185	151	122
2800	327	255	192	156	126
2900	341	264	199	162	130
3000	356	274	206	167	133

Appendix B
Fire Mission Grading

This appendix provides detailed instructions to assist an evaluator in grading fire missions to support the Conduct of Fire Support Tables VII and VIII.C.

FIRE MISSION GRADING TABLE VII AND TABLE VIII.C

B-1. The following procedures provide a standardized approach to grading observers on Conduct of Fire procedures.

TARGET LOCATION

B-2. **Target Location Error (TLE).** There are three methods that an evaluator may use to determine an observer's TLE: total range and deviation corrections or evaluator spotting.

(1) Total range and deviation corrections. If the guns are firing accurately, the observer's range and deviation corrections are summed to determine the TLE.

EXAMPLE:

R100, +400; R40, -200; L30, +100; +50 FFE =Total correction of R110, +350

(2) Evaluator spotting**.** If the guns are firing erratically, then the evaluator must subjectively spot the student's initial round and compute TLE.

(3) Survey target list. The evaluator compares the observer's target location with the actual survey location from a known target survey list.

Note. Simulation software generates TLE.

PROCEDURAL ERRORS

B-3. **Procedural Errors (PE).** A cut of 5 points is assessed for each PE that is not corrected by the observer on his own initiative. PEs consist of data being sent in an untimely manner or omitted, sent in the wrong sequence, or sent to the wrong accuracy.

B-4. **Major Procedural Error**. A cut of 10 points is assessed for each major PE that is not corrected by the observer on his own initiative.

PERFORMANCE GOALS

B-5. In the Area Adjust Fire Mission, the observer must enter fire for effect (FFE) using no more than five adjusting rounds (this does not include the initial round). The FFE must have effects on target (impact or burst within 50 meters of the target). The observer must formulate and transmit a call for fire within 120 seconds or less.

GRADING STANDARDS

B-6. The observer must meet all performance objectives and maintain a score of 70 or above to satisfactorily pass the mission.

B-7. If the observer fails to achieve all performance goals, the maximum grade awarded is either 69 or 100 minus the total number of cuts, whichever is less.

MISSION TIME REQUIREMENTS

B-8. **For all missions except FPF, Priority Target, Immediate Suppression, and Immediate Smoke**. All three transmissions of the elements of the initial call for fire must be completed within 45 seconds after the mission is initiated in order to not lose points against their shoot score. An observer has a total of 120 seconds to complete the entire call for fire or receive 69 points for failing a performance goal.

B-9. **For FPF, Priority Target, Immediate Suppression, and Immediate Smoke**. All three transmissions of the elements of the initial CFF must be completed within 25 seconds after the target is identified in order to not lose points against their shoot score.

B-10. **For Subsequent Round Adjustments**. Each adjustment must be transmitted within 10 seconds in order not to lose points.

CUT SHEET

B-11. **Target Location Error Deductions, Area Adjust Fire Mission**. After 250 meters, the observer will lose points based on the following distance brackets:

- 251-400 meters = -5.
- 401-550 meters = -10.
- >551 meters = -15.

B-12. **Target Location Error Deductions, FFE Mission**. After 150 meters, the observer will lose points based on the following distance brackets:

- 151-300 meters = -5.
- 301-550 meters = -10.
- >551 meters = -15.

B-13. **For Initial CFF for all missions except Fire FPF, Immediate Suppression, Priority Target, or Immediate Smoke**. After 45 seconds, the observer will lose points based on the following time brackets:

- 46-60 seconds = -5.
- 61-90 seconds = -10.
- 91-120 seconds = -15.

B-14. **For Initial CFF to Fire FPF, Immediate Suppression, Priority Target, or Immediate Smoke**. After 25 seconds, the observer will lose points based on the following time brackets:

- 26-30 seconds = -5.
- 31-45 seconds = -10.
- 46-60 seconds = -15.

B-15. **For Subsequent Adjustments**. After 10 seconds, the students will lose points based on the following time brackets:

- 11-15 seconds = -5.
- 16-25 seconds = -10.
- 26-40 seconds = -15.

B-16. **Procedural Error (-5).**

- Sequence, omission, or format error.
- Wrong or no target description or sh/fz requested.
- No direction sent.
- No refinement, EOM, or surveillance.
- Incorrect sequence of subsequent corrections.

- Direction error greater than 100 mils.
- Deviation correction of less than 30 meters.
- Deviation correction sent to the nearest meter.
- Fail to correct range during subsequent adjustments (obvious + or -).
- Creeping fires (three or more subsequent adjustments in the same direction which either fail to establish a bracket, or have effects on target), except during danger close missions.
- Incorrect application of OT factor.
- Failure to request/cancel Danger Close or Cancel Danger Close.
- Initial direction not within ±60 mils.
- Correction direction of less than 100 mils given.

B-17. **Major PE (ALL-10)**

- Wrong adjusting point.
- Observer loses visible round.
- Correction wrong way during subsequent adjustments (Dev or Rg).
- Wasted round (includes two rounds fired at the same range).
- Evaluator help required.

Note. If an observer fails to have effects within 50 meters of the target or complete the entire call for fire within 120 seconds, he can receive no higher than a 69 on his fire mission. The observer may score lower based on the cumulative deductions for his mission.

MISSION: REQUEST AND ADJUST AREA FIRE

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, a laser range finder (LRF) (an LRF will not be replicated in TSFO or GUARDFIST), binoculars, night vision goggles (during hours of limited visibility), and an enemy target.

STANDARDS: Engage a target of opportunity by initially locating it within 250 meters and completing the CFF within 45 seconds of target identification. Enter FFE within 50 meters of the target. Follow all procedures specified in FM 6-30.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer has established communications with the FDC during the previous task.
2. Locate and identify a suitable target for an adjust fire mission.
3. Be able to determine if the observer's target location and subsequent adjustment are correct.
4. Ensure that a stopwatch is available to time the mission.

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	***Deductions***
1	**Transmits the observer ID and "ADJUST FIRE OVER" as the first transmission**. *The observer must include a warning order if intending to use any method of target location other than grid in the first transmission. Sequence is graded.*	
2	**Transmits target coordinates (six or eight) as the second transmission of the call for fire.**	
2A	**Transmits polar plot data as the second transmission of the call for fire**. *The observer sends OT direction to nearest 10 mils (±60 mils), distance to the target to the nearest 100 meters (10 meters is acceptable if the observer is using a laser range finder), and a vertical shift when it is greater than 35 meters to the nearest 5 meters. The observer must send OT direction to nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*	
2B	**Transmits shift from a known point data as the second transmission of the CFF**. *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. Sequence is graded.*	
3	**Determines the target location within 250 meters of the actual location**. *The grader must be able to confirm or deny that the observer has met the 250-meter standard.*	
4	**Completes the third transmission of the CFF within 45 seconds of target identification**. *At a minimum, the observer must include target description in his third transmission and danger close when applicable. Sequence is graded.*	
5	**Correctly determines the OT factor**. *Grader must ask for the OT factor.*	

EVALUATION GUIDE

Step	**Performance Measures**/*Grader Instructions*	*Deductions*
6	**Transmits OT direction to the nearest 10 mils (±60 mils) prior to the first adjustment when applicable**.	
7	**Transmits subsequent corrections within 10 seconds of HE burst and each adjustment moves the round(s) closer to the target or maintains successive bracketing**. *Sequence is graded.*	
8	**Utilizes no more than five adjusting rounds to include the initial round to enter FFE.**	
9	**Enters FFE when the HE rounds will impact within 50 meters of the target**.	
10	**Transmits refinement data, records as target or known point, "END OF MISSION," and surveillance**. *The observer must transmit refinement, but does not necessarily have to record the target unless directed by the grader. Sequence is graded.*	

Evaluation Guidance: If an observer fails to have effects within 50 meters of the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on the fire mission. The observer may score lower based on the cumulative deductions for the mission.

References: FM 6-30, STP 6-13F14-SM-TG, Task Numbers 061-283-1011, 061-283-1002, 061-283-1003, and 061-283-1004

MISSION: CONDUCT A FIRE FOR EFFECT MISSION

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF (an LRF will not be replicated in TSFO or GUARDFIST), binoculars, night vision goggles (during hours of limited visibility), and an enemy target.

STANDARDS: Engage a target of opportunity with an FFE mission within 150 meters of actual target location and complete the CFF within 45 seconds of target identification. Follow all procedures specified in FM 6-30.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer has established communications with the FDC during the previous task.
2. Locate and identify a suitable target for an FFE mission.
3. Be able to determine if the observer's target location is correct.
4. Ensure that a stopwatch is available to time the mission.

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	***Deductions***
1	**Transmits the observer ID and "FIRE FOR EFFECT OVER" as the first transmission**. *The observer must include a warning order if he intends to use any method of target location other than grid in his first transmission. Sequence is graded.*	
2	**Transmits target coordinates (six or eight) as the second transmission of the call for fire.**	
2A	**Transmits polar plot data as the second transmission of the call for fire**. *The observer sends OT direction to the nearest 10 mils (±60 mils), distance to the target to the nearest 10 or 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. The observer must send OT direction to nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*	
2B	**Transmits shift from a known point data as the second transmission of the CFF**. *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. Sequence is graded.*	
3	**Determines the target location within 150 meters of the actual location**. *The grader must be able to confirm or deny that the observer has met the 150-meter standard.*	
4	**Completes the third transmission of the CFF within 45 seconds of target**. *At a minimum, the observer must include target description and danger close when applicable. Sequence is graded.*	
5	**Transmits refinement data, "END OF MISSION," and surveillance.** *Sequence is graded*.	

Evaluation Guidance: If an observer fails to have effects within 50 meters of the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on the fire mission. The observer may score lower based on the cumulative deductions for the mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Numbers 061-283-1015, 061-283-1002, 061-283-1003, and 061-283-1004

MISSION: REQUEST AND ADJUST FPF

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF (an LRF will not be replicated in TSFO or GUARDFIST), binoculars, night vision goggles (during hours of limited visibility), and a location for a Final Protective Fire (FPF).

STANDARDS: Adjust an FPF so that all rounds impact within 50 meters of either side of an FPF line. This is in accordance with the procedures in FM 6-30 as outlined in the Evaluation Guide.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a suitable location for the FPF.
3. Be able to determine if the observer's target location and subsequent adjustments are correct.
4. Specify what target block the observer will use to record the FPF.

EVALUATION GUIDE

Step	**Performance Measures/**Grader Instructions	***Deductions***
1	**Transmits the observer ID and "ADJUST FIRE OVER" as the first transmission**.	
2	**Transmits an eight-digit grid that plots 200-400 meters beyond the center of the FPF line**. *The grader will clearly identify the left and right limits on the linear line that forms the FPF*.	
3	**Includes FPF, Attitude (between 0000-3100), Danger Close, and Delay in the third transmission of the CFF**. *The tolerance for attitude is graded in Step 12. Sequence is graded.*	
4	**Transmits OT direction to the nearest 10 mils (±60 mils) to the center of the FPF line prior to the first adjustment**.	
5	**Initial round impacts at least 200 meters beyond the FPF line**.	
6	**Correctly determines the OT factor.** *Grader must ask for the OT factor*.	
7	**Uses creeping fires for all range corrections**. *Corrections between 60 and 100 meters to the nearest 10 meters.*	
8	**Transmits deviation or range corrections of 50 meters or less in the form on refinement data only**. *Deviation refinement must precede range refinement*.	
9	**Determines and transmits corrections so that the HE bursts will impact within 50 meters of the FPF line when the FPF is fired**. *Only the center gun will fire if the FDC is equipped with a battery computer system (BCS) or similar device. Once the center gun is adjusted to the center of the FPF (within 50 meters), the mission is ended. All other guns are computed from data fired by the FDC. If manual computation is required, all guns/tubes will fire in adjustment. The firing unit will fire one volley centered on the initial grid sent by the observer. The observer begins adjustment with the flank piece closest to the FPF line. Once the first gun is adjusted, the observer announces, "NUMBER (refinement), NUMBER __ IS ADJUSTED, NUMBER __, REPEAT OVER." This process continues until the last gun/tube is adjusted.*	

EVALUATION GUIDE

Step	**Performance Measures/**Grader Instructions	*Deductions*
10	**Rounds are adjusted to equally space (±10 m) them along the FPF line**. *Normally, the FDC determines the lateral separation; however, during a manual adjustment the observer must correct for deviation to ensure that there is a lateral separation.*	
11	**Transmits refinement for the final correction, records the FPF as a target number, and ends the mission.** *Sequence is graded*.	
12	**All rounds impact within ±50 meters of either side of the FPF line when the FPF is fired.**	

Evaluation Guidance: If an observer fails to have effects within 50 meters of the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on the fire mission. The observer may score lower based on the cumulative deductions for the mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Number 061-283-2002

MISSION: CONDUCT AN IMMEDIATE SMOKE MISSION

CONDITIONS: Given a 1:50,000 map; an OF fan; a compass; a terrain sketch (drawn by the observer); communications with an FDC; a GPS; an LRF (an LRF will not be replicated in TSFO or GUARDFIST); binoculars; night vision goggles (during hours of limited visibility); a cross, head, or tailwind; and an enemy target.

STANDARDS: Obscures a target of opportunity with an immediate smoke mission. This is in accordance with the procedures in FM 6-30 as outlined in the Evaluation Guide.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a suitable target for an immediate smoke mission.
3. Review the procedures for obscuring targets listed in FM 6-30 prior to evaluating the task.
4. Ensure that a stopwatch is available to time the mission.

EVALUATION GUIDE

Step	**Performance Measures/**Grader Instructions	***Deductions***
1	**Transmits the observer ID and "IMMEDIATE SMOKE."** *The observer must include a warning order if intending to use any method of target location other than grid. Sequence is graded.*	
2	**Transmits target coordinates (six or eight) after the warning order in the first transmission of the call for fire.**	
2A	**Transmits polar plot data after the warning order in the first transmission of the call for fire.** *The observer sends OT direction to the nearest 10 mils (±60 mils), distance to the target to the nearest 10 or 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. The observer must send OT direction to the nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*	
2B	**Transmits shift from a known point data after the warning order in the first transmission of the CFF.** *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. Sequence is graded.*	
3	**Completes the CFF within 25 seconds of target identification.** *The observer may send a second transmission to include a target description, but it is not necessary. Time will stop when the observer transmits target location data unless danger close is required. Danger close must be included, when applicable, at the conclusion of the first transmission or as a separate transmission. Sequence is graded.*	

EVALUATION GUIDE

Step	**Performance Measures/**Grader Instructions	***Deductions***
4	**Obscures the target**. *In order to obscure the target without adjustments, the observer will have to use a placement point for the target location. Placement points are approximate and are designed to obscure the target. Placement points are as follows: a crosswind is 100 meters upwind and 100 meters short of the target, a tailwind is 200 meters short of the target, and a headwind is 100 meters short of the target.*	
5	**Transmits refinement data, "END OF MISSION," and surveillance.** *Sequence is graded.*	

Evaluation Guidance: If an observer fails to obscure the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on the fire mission. The observer may score lower based on the cumulative deductions for his mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Numbers 061-283-1014, 061-283-1002, 061-283-1003, 061-283-1004

MISSION: CONDUCT A QUICK SMOKE MISSION

CONDUCTIONS:

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF (an LRF will not be replicated in TSFO or GUARDFIST), binoculars, night vision goggles (during hours of limited visibility), and an enemy target.

STANDARDS: Locates the center of the smoke screen or the adjusting point within 250 meters of the actual target location. Requests shell smoke when the 200-meter bracket is split. Completely obscures the target. Follows all procedures specified in FM 6-30.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a suitable target for a quick fire mission.

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	***Deductions***
1	**Transmits the observer ID and "ADJUST FIRE OVER" as the first transmission**. *The observer must include a warning order if he intends to use any method of target location other than grid in his first transmission. Sequence is graded.*	
2	**Transmits target coordinates (six or eight) as the second transmission of the call for fire**.	
2A	**Transmits polar plot data as the second transmission of the call for fire**. *The observer sends OT direction to nearest 10 mils (±60 mils), distance to the target to the nearest 10 or 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. The observer must send OT direction to nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*	
2B	**Transmits shift from a known point data as the second transmission of the CFF**. *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. Sequence is graded.*	
3	**Determines the location to the center of the smoke screen or the adjusting point within 250 m of the actual center of the smoke screen or the adjusting point**. *The observer must ensure that the smoke screen is 200 meters short of the target for a crosswind, 100 meters short for a headwind, 400 meters short for a tailwind, for HC/M825 smoke; when an artillery unit is firing the smoke the FDC will determine the amount of the lateral offset. When mortars provide the smoke, the observer will use an adjusting point; the adjusting point should be 100 meters short and 100 meters upwind for a crosswind, 100 meters short for a headwind, and 200 meters short for a tailwind.*	

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	***Deductions***
4	**Transmits target description, length (nearest 10 m); maneuver target direction; direction for the wind (left or right cross-, head-, or tailwind); duration (to the nearest 1 minute); "SMOKE IN EFFECT OVER."**	
4A	**Transmits target description, length (to the nearest 10 meters), attitude (0000-3100); direction for the wind (left or right, cross-, head-, or tailwind); duration (to the nearest 1 minute); "SMOKE IN EFFECT OVER."** *The observer must use Step 4A for mortars and may use 4A when it is more accurate to determine attitude verses maneuver target direction.*	
5	**Correctly determines the OT factor.** *Grader must ask for the OT factor.*	
6	**Transmits OT direction to the nearest 10 mils (±60 mils) prior to the first adjustment when applicable.**	
7	**Transmits subsequent corrections within 10 seconds of HE burst and each adjustment moves the round(s) closer to the center of the smoke screen or the adjusting point.** *Sequence is graded.*	
8	**When a 200-m bracket is split, the observer requests smoke and adjusts the smoke prior to FFE.** *Based on the accuracy of the offset, the observer may not have to adjust the smoke. Splitting the 200-meter bracket is defined as any correction less than 200 meter. Sequence is graded.*	
9	**Enters FFE when the smoke rounds will obscure the target.**	
10	**Completely obscures the target.**	
11	**Transmits "END OF MISSION" and surveillance.** *Sequence is graded*.	

Evaluation Guidance: If an observer fails to obscure the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on the fire mission. The observer may score lower based on the cumulative deductions for his mission.

References: FM 6-30, STP 6-13F14-SM-TG Task #s 061-283-2023, 1002-283-2023, 1003-283-2023, and 1004-283-2023

MISSION: REQUEST FIRE ON AN IRREGULARLY SHAPED TARGET

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF (an LRF will not be replicated in TSFO or GUARDFIST), binoculars, night vision goggles (during hours of limited visibility), and an irregularly shaped enemy target.

STANDARDS: Engages an irregularly shaped target of opportunity by providing the FDC with target location and an accurate target description within 45 seconds of target identification. Enters FFE within 50 meters of the target. Follows all procedures for engaging irregularly shaped targets in FM 6-30.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a target that could not be engaged without specifying the target size as a part of the target description.
3. Ensure that a stopwatch is available to time the mission.
4. Be able to determine if the observer's target location and subsequent adjustments are correct.

EVALUATION GUIDE

Step	**Performance Measures**/*Grader Instructions*	*Deductions*	
1	**Transmits the observer ID and "ADJUST FIRE OVER" as the first transmission**. *The observer may initially FFE; however, this changes the initial target location standard to 150 meters. The observer must include a warning order if he intends to use any method of target location other than grid in his first transmission. Sequence is graded.*		
2	**Transmits target center coordinates (six or eight) as the second transmission of the call for fire.**		
2A	**Transmits polar plot data to the center of the target as the second transmission of the call for fire.** *The observer sends OT direction to nearest 10 mils (±60 mils), distance to the target to the nearest 10 or 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. The observer must send OT direction to nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*		
2B	**Transmits shift from a known point data to the center of the target as the second transmission of the CFF**. *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. Sequence is graded.*		

EVALUATION GUIDE

Step	**Performance Measures**/*Grader Instructions*	*Deductions*	
3	**Determines the target location within 250 meters of the actual location based on an AF mission**. *The grader must be able to confirm or deny that the observer has met the 250-meter standard.*		
3A	**Determines the target location within 150 meters of the actual location based on an FFE mission**. *The grader must be able to confirm or deny that the observer has met the 250-meter standard.*		
4	**For a linear target (greater than 150 meters in length and less than 50 meters width), transmits a length to the nearest 10 meters and an attitude (0000-3100) after the target description.** *The accuracy of this data is evaluated based on the effects on target. Sequence is graded.*		
4A	**For a rectangular target (greater than 150 meters and greater than 50 m in width), transmits a length to the nearest 10 meters, width to the nearest 10 meters, and an attitude (0000-3100) after the target description**. *The accuracy of this data is evaluated based on the effects on target. Sequence is graded*.		
4B	**For a circular target, transmits radius to the nearest 10 meters after the target description.** *The accuracy of this data is evaluated based on the effects on target. Sequence is graded.*		
4C	**For other shapes, transmits grid-to-grid-to-grid coordinates as the second transmission.** *The accuracy of this data is evaluated based on the effects on target. Sequence is graded.*		
4D	**Polar plot data may be transmitted to multiple points as a laser draw.** *The FDC must be equipped with a BCS or similar device in order to compute target location data sent in this format. The accuracy of this data is evaluated based on the effects on target. Sequence is graded.*		
5	**Completes the third transmission of the CFF within 45 seconds of target identification.** *At a minimum, the observer must include target description in his third transmission and danger close when applicable. Sequence is graded.*		
6	**Correctly determines the OT factor.** *Grader must ask for the OT factor.*		
7	**Transmits OT direction to the nearest 10 mils (±60 mils) prior to sending the first adjustment when applicable.**		
8	**Transmits subsequent corrections within 10 seconds of HE burst.**		
9	**Each adjustment moves the round(s) closer to the target.**		
10	**Enters FFE when the HE rounds will impact within 50 meters of the target.**		
11	**Transmits refinement data, "END OF MISSION," and surveillance.** *Sequence is graded.*		

Evaluation Guidance: If an observer fails to have effects within 50 meters of the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on his fire mission. He may score lower based on the cumulative deductions for his mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Numbers 061-283-2206, 061-283-1002, 061-283-1003, 061-283-1004

MISSION: CONDUCT AN IMMEDIATE SUPPRESSION MISSION

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF (an LRF will not be replicated in TSFO or GUARDFIST), binoculars, night vision goggles (during hours of limited visibility), and an enemy target.

STANDARDS: Engage a target of opportunity with an immediate suppression mission within 150 meters of actual target location and **complete** the call for fire within 25 seconds of target identification. Follow all procedures specified in FM 6-30, as outlined in the Evaluation Guide.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a suitable target for an immediate suppression mission.
3. Be able to determine if the observer's target location is correct.
4. Ensure that a stopwatch is available to time the mission.

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	***Deductions***
1	**Transmits the observer ID and "IMMEDIATE SUPPRESSION" as the warning order.** *The observer must include a warning order if he intends to use any method of target location other than grid. Sequence is graded.*	
2	**Transmits target coordinates (six or eight) after the warning order in the first transmission of the call for fire.**	
2A	**Transmits polar plot data after the warning order in the first transmission of the call for fire.** *The observer sends OT direction to the nearest 10 mils (±60 mils), distance to the target to the nearest 10 or 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. The observer must send OT direction to the nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*	
2B	**Transmits shift from a known point data after the warning order in the first transmission of the CFF.** *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 meters, and a vertical shift when it is greater than 35 meters to the nearest 5 meters. Sequence is graded.*	
3	**Determines the target location within 150 meters of the actual location**. *The grader must be able to confirm or deny that the observer has met the 150-meter standard.*	
4	**Completes the CFF within 25 seconds of target identification**. *The observer may send a second transmission to include a target description, but it is not necessary. Time will stop when the observer transmits target location data unless danger close is required. Danger close must be included, when applicable, at the conclusion of the first transmission or as a separate transmission. Sequence is graded.*	
5	**Transmits refinement data, "END OF MISSION," and surveillance**. *Sequence is graded*.	

Evaluation Guidance: If an observer fails to have effects within 50 meters of the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on his fire mission. He may score lower based on the cumulative deductions for his mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Numbers 061-283-1014, 061-283-1002, 061-283-1003, 061-283-1004

MISSION: CONDUCT AN IMPACT AND TIME REGISTRATION

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF, binoculars, night vision goggles (during hours of limited visibility), DA Form 5429-R (*Conduct of Fire*) or a field reproduction of this form, and a location for a Registration Point (RP). (When it is impossible to replicate an LRF, the grader will provide the distance to the RP [nearest 10 meters] and then offset the grid no more than 200 meters in order to replicate a firing unit's failure to meet the requirements for accurate fires.)

STANDARDS: Accurately locate a registration point and adjust both HE and time rounds to meet the objective of both the impact and time portion without error. This is in accordance with the procedures in FM 6-30 as outlined in the Evaluation Guide.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a suitable location for the registration point.
3. Be able to determine if the observer's RP location and subsequent adjustments are correct.
4. Direct the FDC to begin the mission utilizing a vicinity grid format for the MTO.

	EVALUATION GUIDE	
Step	**Performance Measures/***Grader Instructions*	***Deductions***
1	**Selects an RP that is on level terrain, semipermanent, and in the center of the zone of fire**. *The grader may have to ask the observer if he knows what the requirements for an RP are in accordance with FM 6-30.*	
2	**Transmits an eight-digit grid (±10 meters on either the easting, northing, or both of the actual RP location), an altitude to the nearest 5 meters (±10 meters), and the OT direction to the nearest 10 mils (±60 mils) after he reads back the MTO.**	
3	**Records spottings (to the nearest 1 mil) and corrections on both the sketch and table portion of DA Form 5429-R or a field reproduction of this form.**	
4	**Correctly determines the OT factor.** *Grader must ask for the OT factor.*	
5	**Corrects each subsequent round to move it closer to the RP.**	
6	**Corrects for deviation only when a round is spotted a range doubtful**. *The grader will use the observer's spotting(s) when determining pass or fail for this measure.*	
7	**Brings the round online before splitting the 200-meter bracket.**	
8	**Requests repeat when a round is spotted as target or range correct.** *A target or range correct spotting counts as both an over and short; therefore, the impact portion of the mission could be finished if the observer spotted two rounds as target or range correct.* ***Note.*** Deviation refinement may still be necessary and must be correctly determined.	
9	**Requests two rounds add or drop 25 meters after the 50 meters is fired.**	

	EVALUATION GUIDE	
Step	**Performance Measures**/*Grader Instructions*	***Deductions***
10	**Changes to a volume of one round or repeats the two-round volume based on the spotting of the last round(s).** *The grader will use the observer's spotting(s) when determining pass or fail for this measure*.	
11	**Transmits deviation refinement to the nearest 10 meters based on the spottings of two, three, or four rounds.** *The observer's computation procedures must be without error.*	
12	**Transmits range refinement to the nearest 10 meters based on the standard range refinement corrections in FM 6-30.**	
13	**Transmits deviation followed by range refinement, records the registration as an RP number or a target number, and requests "TIME REPEAT OVER" when appropriate.** *Sequence is graded.*	
14	**Corrects to a measurable airburst using the automatic correction of "UP40" when the time round is spotted as a graze burst.**	
15	**Transmit "3 ROUNDS REPEAT OVER" once a measurable airburst has been spotted.**	
16	**Determines the correct refinement to achieve a 20-meter HOB utilizing the automatic refinement corrections when appropriate or adds the four airbursts, divides by 4, multiplies by the OT factor, and corrects (to the nearest 5 meter) to achieve a 20-m HOB.** *Computation procedures must be without error.*	
17	**Transmits time refinement, records as "TIME RP (same number)," and ends the mission.** *Sequence is graded*.	

Evaluation Guidance: This is not a timed mission. If the observer fails to provide accurate target location (see step 2), he can receive no higher than 69 on this mission. The observer may score lower based on the cumulative deductions for his mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Number 061-283-2102

MISSION: CONDUCT A MORTAR REGISTRATION

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF, binoculars, night vision goggles (during hours of limited visibility), DA Form 5429-R or a field reproduction of the form, and a location for an RP. (When it is impossible to replicate an LRF, the grader will provide the distance to the RP [to the nearest 10 meters] and then offset the grid no more than 200 meters in order to replicate a firing unit's failure to meet the requirements for accurate fires).

STANDARDS: Accurately locate a registration point, adjust HE rounds to meet the objective of a mortar registration, and adjust the sheaf without error. This is in accordance with the procedures in FM 6-30 as outlined in the Evaluation Guide.

EVALUATION PREPARATION:

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a suitable location for the registration point.
3. Be able to determine if the observer's RP location and subsequent adjustments are correct.
4. Review the procedures for conducting a mortar registration in FM 6-30 prior to evaluating the task.
5. Direct the FDC to begin the mission utilizing a vicinity grid format for the MTO.

EVALUATION GUIDE

Step	**Performance Measures**/*Grader Instructions*	***Deductions***
1	**Selects an RP that is on level terrain, semipermanent, and in the center of the zone of fire**. *The grader may have to ask the observer if he knows what the requirements for an RP are in accordance with FM 6-30.*	
2	**Transmits an eight-digit grid (±10 meters of the actual RP location), an altitude to the nearest 5 meters (±10 meters), and the OT direction to the nearest 10 mils (±60 mils) after he reads back the MTO.** *The observer may use a known point to communicate the RP location.*	
3	**Records spottings (to the nearest 1 mil) and corrections on both the sketch and table portion of DA Form 5429-R or a field reproduction of this form.**	
4	**Correctly determines the OT factor.** *Grader must ask for the OT factor.*	
5	**Corrects each subsequent round to move it closer to the RP.**	
6	**Corrects for deviation only when a round is spotted as range doubtful**. *The grader will use the observer's spotting(s) when determining pass or fail for this measure*.	
7	**Brings the round online before splitting the 200-meter bracket.**	
8	**Utilizes successive bracketing to ensure that the last round fired is within 50 meters of the RP**. *This step may not be necessary if the observer spots a round as target or range correct.*	
9	**Determines deviation refinement to the nearest 10 meters or no deviation refinement to move the last round closer to the RP.**	

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	***Deductions***
10	**Determines ADD or DROP 25 or no range refinement to move the round closer to the RP.**	
11	**Transmits deviation followed by range refinement, records the registration as an RP number or a target number, and ends the mission**. *Sequence is graded*.	
12	**Determines section left or right based on the type of wind when the FDC requests that the sheaf be adjusted.**	
13	**Reads back the fire order from the FDC and transmits "SECTION LEFT/RIGHT REPEAT OVER."**	
14	**Determines deviation (lateral) refinement or corrections to the nearest 10meters, but transmits corrections of less than 50 meters as refinement data only.**	
15	**Ignores range corrections for rounds impacting within 50 meters of the sheaf.**	
16	**Transmits corrections before refinement and transmits refinement data in the order the tubes fired**. *Sequence is graded*.	
17	**Adjusts all rounds online at approximately the same range (within 50 meters) and with a 40-meter lateral spread between rounds**. *If angle T is greater than 500 mils, each piece is adjusted onto the registration point and the FDC computes data for the sheaf.*	
18	**Transmits refinement, "SHEAF IS ADJUSTED," and ends the mission**. *Sequence is graded*.	

Evaluation Guidance: This is not a timed mission. If the observer fails to provide accurate target location (see Step 2), he can receive no higher than 69 on this mission. The observer may score lower based on the cumulative deductions for the mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Number 061-283-2104

MISSION: REQUEST AND ADJUST COORDINATED ILLUMINATION

CONDITIONS: Given a 1:50,000 map, an OF fan, a compass, a terrain sketch (drawn by the observer), communications with an FDC, a GPS, an LRF (an LRF will not be replicated in TSFO or GUARDFIST), binoculars, night vision goggles (during hours of limited visibility), and an enemy target.

STANDARDS: Transmit a request for illumination by completing the CFF within 45 seconds of target identification. Adjust the illumination so it best illuminates the target of opportunity when HE rounds impact. Transmit a request for HE fires by completing a second call for fire within 45 seconds of marking the illumination. Establish a bracket to ensure the FFE is within 50 meters of the target. Follow all procedures specified in FM 6-30 as outlined in the Evaluation Guide.

EVALUATION PREPARATION

The evaluator must—

1. Ensure that the observer is able to communicate with the FDC.
2. Locate and identify a suitable target for a coordinated illumination mission.
3. Determine if the observer's target location and subsequent adjustment are correct.
4. Ensure that a stopwatch is available to time the mission.

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	**Deductions**
1	**Transmits the observer ID and "ADJUST FIRE OVER" as the first transmission**. *The observer must include a warning order if he intends to use any method of target location other than grid in his first transmission. Sequence is graded.*	
2	**Transmits target coordinates (six or eight) as the second transmission of the call for fire.**	
2A	**Transmits polar plot data as the second transmission of the call for fire**. *The observer sends OT direction to nearest 10 mils (±60 mils), distance to the target to the nearest 10 or 100 m, and a vertical shift when it is greater than 30 meters to the nearest 5 meters. The observer must send OT direction to the nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*	
2B	**Transmits shift from a known point data as the second transmission of the CFF**. *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 m, and a vertical shift when it is greater than 30 meters to the nearest 5 meters. Sequence is graded.*	
3	**Transmits suspected enemy activity and a request for illumination in the third transmission**. *Sequence is graded*.	
4	**Completes the third transmission of the CFF within 45 seconds of hearing noises that prompt a need for illumination.**	
5	**Transmits OT direction to the nearest 10 mils prior to the first adjustment when applicable.**	

EVALUATION GUIDE

Step	**Performance Measures/***Grader Instructions*	Deductions
6	**Adjusts the illumination to identify the location of the enemy target.** *Sequence is graded.*	
7	**Transmits "ILLUMINATION…MARK OVER" when it best illuminates the target.**	
8	**Transmits "COORDINATED ILLUMINATION OVER."**	
9	**Transmits the observer ID and "ADJUST FIRE OVER" as the first transmission**. *The observer must include a warning order if he intends to use any method of target location other than grid in his first transmission. Sequence is graded.*	
10	**Transmits target coordinates (6 or 8) as the second transmission of the call for fire.**	
10A	**Transmits polar plot data as the second transmission of the call for fire**. *The observer sends OT direction to the nearest 10 mils (±60 mils), distance to the target to the nearest 10 or 100 meters, and a vertical shift when it is greater than 30 meters to the nearest 5 meters. The observer must send OT direction to the nearest 1 mil, distance to the nearest 10 meters, and a vertical angle to the nearest 1 mil when equipped with a G/VLLD or similar device. Sequence is graded.*	
10B	**Transmits shift from a known point data as the second transmission of the CFF**. *The observer sends an OT direction to the nearest 10 mils (±60 mils), a lateral shift to the nearest 10 meters, a range shift to the nearest 100 meters, and a vertical shift when it is greater than 30 meters to the nearest 5 meters. Sequence is graded.*	
11	**Completes the third transmission of the CFF within 45 seconds of "ILLUMINATION…MARK OVER."** *The grader should begin timing the mission when the observer transmits "OVER." At a minimum, the observer must include target description and danger close when applicable. Sequence is graded.*	
12	**Transmits OT direction to the nearest 10 mils (±60 mils) prior to the first adjustment when applicable.**	
13	**Transmits subsequent corrections within 10 seconds of HE burst and each adjustment moves the round(s) closer to the target**. *Sequence is graded.*	
14	**Utilizes no more than four adjusting rounds to include the initial round to enter FFE.**	
15	**Enters FFE when the HE rounds will impact within 50 meters of the target.**	
16	**Transmits refinement data, "END OF MISSION," and surveillance**. *Sequence is graded*.	

Evaluation Guidance: If an observer fails to have effects within 50 meters of the target or complete the entire CFF within 120 seconds, he can receive no higher than a 69 on his fire mission. He may score lower based on the cumulative deductions for his mission.

References: FM 6-30, STP 6-13F14-SM-TG Task Numbers 061-283-1021, 061-283-1011, 061-283-1002, 061-283-1003, 061-283-1004.

This page intentionally left blank.

Appendix C

Sample Leader Exams

TABLE I (HOWITZER) SAFETY HANDS-ON COMPONENT

PHASE I:

Task 1: Perform prefire checks on an applicable weapon.

Conditions: The Soldier is given an emplaced weapon in operational condition, ready for low-angle firing.

Standards: Conduct the prefire checks, state what is a safe and unsafe condition, and specify what necessary corrective action is to be taken.

Reference: Appropriate -10 manual, FM 6-50, and DA Pam 385-63

Task 2: Verify emplacement of aiming points and recording of deflection.

Conditions: Given an operational emplaced howitzer with the aiming posts, safety and lay circles, and collimator emplaced; all deflections recorded on a gunner's reference card are correct.

Standards: Determine and announce if the aiming posts are properly emplaced to within 1 mil of the recorded deflections. Announce any error found and what must be done to correct them. All bubbles must be leveled and the scales zeroed out.

Reference: Appropriate -10 Manual

Task 3: Verify boresight.

Conditions: Given an emplaced weapon that has been correctly boresighted. The fire control equipment and a gunner's quadrant is available. An assistant is available to help traverse or elevate the tube.

Standards: Correctly demonstrate the procedures to verify that the weapon is properly boresighted. Announce to the tester whether or not the weapon is properly boresighted. If any error was found, indicate what corrective action should be taken.

Reference: Appropriate -10 Manual

Task 4: Emplacement of safety aids (stakes or tape).

Conditions: Given an emplaced weapon with a standard reference point (collimator or aiming posts), fire control equipment, safety aids, a Safety T with the right and left deflection limits, and a crewmember to assist in the emplacement of the safety aids.
Standards: Correctly emplace the safety aids at the proper deflection limits to within 10 mils accuracy.

Reference: FM 6-50

Task 5: Determine site to crest.

Conditions: Given an emplaced weapon, assistant, assigned sector of fire, and visible crest less than 1,000 meters away.

Standards: Determine and report the site to crest, within 10 mils, to the tester.

Reference: FM 6-50

Task 6: Perform end for end, gunner's quadrant test.

Conditions: Given a weapon and a gunner's quadrant.

Standards: Correctly perform the end-for-end test to within 0.1 mil accuracy and report the result to the tester. State the criteria for determining the quadrant's serviceability.

Reference: Appropriate -10 Manual

Task 7: Perform micrometer test for the gunner's quadrant.

Conditions: Given a weapon and an accurate gunner's quadrant.

Standards: Correctly perform the micrometer test procedures and announce the result to within 0 mils tolerance to the tester. State the criteria for determining if the gunner's quadrant is serviceable.

Reference: Appropriate -10 Manual

Task 8: Set the cannon for deflection using a distant aiming point.

Conditions: Given an emplaced weapon with sights, the gunner's reference card with the recorded deflection to the collimator and DAP; collimator and aiming posts are not available for use.

Standards: Correctly set the cannon for the deflection of the fire mission using the DAP, aligning the tube and sight to within 1 mil accuracy. All bubbles must be leveled.

Reference: FM 6-50

Task 9: Determine that the weapon is safe to fire (10 missions).

Conditions: Given an emplaced weapon with crew, correctly boresighted, the prefire checks completed, Safety T and a gunner's quadrant available, and ammunition and charge increments available. Fire commands will be verbally issued by the tester, and the weapon data will be set off by the crew.

Standards: Verify that the commands are safe; confirm the crew set off the data correctly to 1 mil accuracy, and prepare the ammunition properly (correct and complete charge and time fuzes set to 0.1 sec accuracy). If an unsafe condition or error greater than 1 mil exists, "check firing" is announced, along with the reason why. After the condition is corrected, continue to safe the weapon and then fire the weapon.

Reference: FM 6-50, TM 43-0001-28, and appropriate -10 Manual

Task 10: Set up and orient an M2 aiming circle by the grid azimuth method.

Conditions: Given a declinated aiming circle in march order configuration and an AOF.

Standards: Correctly set up and level the circle, determine and place the instrument reading on the circle to 0 mil accuracy, and correctly orient the circle to within 0 mil accuracy.

> ***Note.*** Leveling the circle can be accomplished by either the circular leveling vial (fish-eye bubble) or the tubular leveling vial. The orientation of the circle will be checked by a reciprocal reading from another circle by the tester.

Reference: FM 6-50

Task 11: Set up and orient an M2 aiming circle by the orienting angle method.

Conditions: Given an unleveled, declinated aiming circle on a tripod, an AOF, an orienting station (OS), a clearly marked end of the orienting line (EOL), and azimuth to the EOL.

Standards: Correctly level the circle, determine and place the instrument reading on the circle to 0 mil accuracy, and correctly orient the circle to 0 mil accuracy.

> ***Note.*** Leveling the circle can be accomplished by either the circular leveling vial (fish-eye bubble) or the tubular leveling vial. The orientation of the circle will be checked by reciprocal reading by another circle. The circle should initially be positioned near, but not over, the OS.

Reference: FM 6-50

Task 12: Determine the orientation of the lay circle as safe or unsafe.

Conditions: Given leveled, declinated, aiming circles on a tripod that have been oriented.

Standards: Verify the orientation of the lay circle with the safety circle. If safe, correctly zero-out the safety circle to 0 mil accuracy. If unsafe, announce the error, recheck the lay circle after it has been reoriented, and then zero out the safety circle. Record the deflections on paper.

> ***Note.*** The circles must check within 10 mils. After zeroing, the circles must check within 0 mil. The initial deflection on the test should be unsafe. An immediate second reading will be given that is safe.

Reference: FM 6-50 and USAFAS Battery Executive Officer's Handbook

Task 13: Set up and level the GLPS.

Conditions: Given an M67 Gun Laying Positioning System in the stowed configuration.

Standard: Set up and level the GLPS in accordance with TM 9-6675-347-13&P.

Task 14: Position and orientation using the M67 GLPS.

Conditions: Given an M67 GLPS set up and leveled in a field location; known azimuths to two azimuth markers; an AoF, a howitzer in a firing position, necessary assistants, and communication with the howitzer.

Standard: Perform positioning and orientation in accordance with TM 9-6675-347-13&P.

Appendix D

The Contemporary Operating Environment

The global war on terror (GWOT) has changed the COE for U.S. Army artillery units. The impact of the changes resulting from COE prompted a reexamination of the current missions of the artillery force, which will be reflected in other training literature and materials. The execution of the training tables provided in FM 3-09.8 must address COE conditions.

BACKGROUND

D-1. The expanded missions capture the tasks being performed in the field by artillery units as required by emerging operational doctrine. FM 3-09.08 is a tool that supports realigned mission/task training. The current mission set for the field artillery force includes—

- Command and Control.
- Develop Intelligence.
- Communicate.
- Detect and Locate Surface Targets.
- Coordinate Fires and Effects.
- Conduct Tactical Deployment/Redeployment Activities.
- Conduct Surface-to-Surface Attack.
- Conduct Tactical Maneuver.
- Provide Combat Service Support.
- Provide Force Protection.
- SOSO (Stability Operations and Support Operations).

D-2. **Command and Control.** The C2 mission provides the collective tasks that support a properly designated commander exercising authority and direction over assigned and available forces in accomplishing the mission. For the FA battery, C2 directly addresses the arrangement of personnel, information management, procedures, and equipment and facilities essential to the commander to conduct (plan, prepare, execute, and continuously assess) operations. COE settings for executing the Field Artillery Tables can focus on scenarios consistent with scheduled deployments, assigned theater of operations, or variants, depending on the experience, continuity, and task mastery of the section in training. An example is provided in Section D-3 to illustrate how the conditions may be adjusted to train differing aspects of C2 using FDC/BOC/POC Table VI.

D-3. **Develop Intelligence**. The development of intelligence is a continuous process that is fundamental to FA operations and integrated into battle command. The mission focuses on providing information and intelligence to the commander that assist in achieving a clear understanding of the force's current state with relation to the enemy and the environment. Intelligence supports the FA commander's ability to make sound decisions. Intelligence functions are performed during all phases of operations, including predeployment, deployment, HIC, SOSO, and redeployment. The Artillery Tables affected by COE changes to conditions for the Intelligence mission include the ROC-V portion of the ASPT for FIST/COLT/Knight and FS Table IV; Occupation of the OP; and the inclusive task of reporting intelligence information. FDC/BOC/POC Table VI (C2) must integrate intelligence from all available sensors and platforms, including observers, UAVs, and radars.

D-4. **Communicate.** This is a critical task in COE that poses challenges because of the limitations of TO&E communications means. The range of current fire mission communications provides challenges to using AFATDS in a noncontiguous battlefield. The ability to communicate is imperative to accomplish C2, distribute intelligence, deliver fires, sustain a COP, provide security, and logistically sustain the force. Communications tasks—individual and collective—are included in the APST, and as a part of the tables, and are integrated functionally in Tables VII and VIII. The impact of COE is the increased demand on redundant, long-range communications; linked sensors and networked fires; and training on alternative/backup means of controlling fires (for example, transferring C2 to another POC/BOC).

D-5. **Detect and Locate Surface Targets.** The mission is to perceive an object of possible military interest without confirming it by recognition (detect). The mission includes determining the placement of a target on the battlefield (locate). This is the primary mission for FIST/COLT/Knight and radar sections.

D-6. **Coordinate Fires and Effects.** Fire support coordination is the primary means of synchronizing fire support. It involves the tactical and technical considerations necessary to deliver effects on target. Fire support coordination is the continual process of coordinating fire support plans and managing the fire support assets that are available to a maneuver force. The FA commander serves as the force commander's FSCOORD and speaks for the force commander on all matters pertaining to fire support. The tasks in COE address coordinating, integrating, and synchronizing fires and effects, emphasizing joint fires. The COE places a premium on fire support personnel at all levels being trained to coordinate all effects, lethal and nonlethal. The ever-expanding role of information operations (IO) under COE has placed increasing demands on fire supporters at every level to assist the commanders in planning and integrating IO. The addition of IO tasks to FS Table VI (Lethal and Nonlethal Fire Planning) would be a means of training FS sections on this critical task.

D-7. **Conduct Tactical Deployment/Redeployment Activities.** The deployment mission is composed of activities required to prepare and move forces, sustainment equipment, and supplies to an area of operations (AO). The force organizes, echelons, and tailors itself for movement based on the mission, concept of operations, available lift, and other resources. Redeployment involves transferring forces and materiel to support another joint force commander's operational requirements or returning personnel, equipment, and materiel to the home and/or demobilization stations for reintegration and/or outprocessing. Redeployment optimizes readiness of forces and materiel to meet new contingencies or crises.

D-8. **Conduct Surface-to-Surface Attack.** These missions use ground-based, indirect-fire weapons systems to destroy, suppress, or neutralize enemy equipment, materiel, personnel, fortifications, and facilities. This remains the single most important mission or core competency for all sections.

D-9. **Conduct Tactical Maneuver**. Maneuver is the movement of field artillery forces on the battlefield using terrain and combat formations to accomplish the mission. Commanders take full advantage of maneuvers to achieve a position of advantage over the enemy to deliver fires and yet sustain the unit in COE. Each type of section includes a task table designed to train the tasks associated with the mission Conduct Tactical Maneuver (for example, Occupation of OP, Deliberate Occupation, Occupation under Special Conditions, and Occupation and Setup). The conditions of the COE and the asymmetric battlefield have generated a new emphasis on "old" tasks, such as reaction to ambush, dealing with civilians on the battlefield, and increasing focus on individual and crew-served weapons. Tables have been provided to assist with the training and qualification of assigned machine guns.

D-10. **Provide Combat Service Support (CSS).** This support provides all classes of supplies necessary to equip, maintain, and operate the unit. CSS tasks also encompass conducting PMCS to quickly identify potential problems, including quick turnaround repairs by component replacement, minor repairs, and performing scheduled services at the operator, crew, battery, and battalion/task force levels. FA units coordinate maintenance operations among the various activities and maintain maintenance/equipment records. CSS tasks include planning and coordinating the transportation and movement of personnel, equipment, and supplies; managing strength accounting data and readiness; administering essential personnel services to maintain Soldier readiness; and sustaining the human dimension of the unit, including coordinating combat casualty care.

D-11. **Provide Force Protection.** This COE mission requires emphasis on basic Soldier tasks including—

- Protect against enemy hazards within the AO.
- Conduct CBRN defense.

- Tactical dispersion and protection of unit.
- Conduct security operations.
- Combat terrorism in an AO.
- Employ combined arms for air defense.
- Engage threat with direct fire weapons of the unit, including small arms, antitank weapons, automatic weapons, attached weapons systems, and direct fire with howitzers.
- Conduct counter ambush actions.

D-12. **Conduct Stability Operations and Support Operations (SOSO)**. Stability operations employ FA units outside the United States and U.S. territories to promote and protect U.S. national interests by influencing threat, political, and information dimensions of the operational environment. The two types of support operations are domestic and foreign humanitarian assistance. SOSO support is a combination of peacetime developmental, cooperative activities and coercive actions in response to crisis.

FA units conduct support operations forces to assist civil authorities, foreign or domestic, as they prepare for or respond to crises and relieve suffering. In support operations, units provide essential services, assets, or specialized resources to help civil authorities deal with situations beyond their capabilities. Recent experience has resulted in the FA units being among the first selected when indirect fires are no longer a priority.

COE FOCUS ON FA MISSIONS AND TRAINING TO STANDARD WITH GUNNERY TABLES

D-13. METT-TC analysis in the COE is an ongoing process to accommodate dynamic (concurrent) input of data and the broadest spectrum of conflict. This includes artillery operations against enemy states with sophisticated capabilities (high-intensity conflict) to stability operations coping with events associated with terrorist organizations, as identified in the GWOT. FM 3-09.08 provides a means to train to standard with the flexibility needed to deal with tactical/operational issues posed in worldwide contingencies.

D-14. FM 3-09.08 also focuses on section-level training. Units train with COE as a condition—not to be confused with a condition statement. Units provide leader and Soldier training designed to build adaptive leaders in the expert trades of FA. Leader and Soldier mastery of basic tasks are tested against a dynamic, intelligent threat in challenging environments. Adaptations to training prescriptions in executing a tabular training strategy are required to prepare qualified sections/units for a multitude of circumstances.

FDC TABLE VI: PROVIDE COMMAND AND CONTROL

D-15. Units that execute FDC Table VI train BOC/POC either in preparation for deployment certification or postdeployment readiness train-up for section qualification. The preliminary tables, which emphasize individual and team skills, have been trained to standard as the "crawl" level of training for this "walk" level of training in preparation for Table VIII "run" qualification (C, W, R).

D-16. Table VI (shown in table D-1) should be evaluated in a CPX type of event that requires the element to provide security, conduct tactical moves under day and night conditions, process all types of data, and execute the tasks included in Table VI in a simulated environment with appropriate threat.

FDC Table VI – Provide command and control.

Task	Task Number	Remarks
Command and Control Delivery of Fires	06-1-W103	All
Control and Coordinate MLRS Battery Operations	06-2-W110	MLRS
Direct and Control Firing Battery/Platoon Operations (Cannon)	06-3-C001	Cannon
Control and Coordinate MLRS Battery Operations	06-2-W110	MLRS
Prepare For Combat	06-2-A098	All
Develop and Communicate a Plan	06-2-A099	All

Task	Task Number	Remarks
Move a Cannon Battery or Platoon	06-3-C013	Cannon
Coordinate MLRS Firing Platoon Ammunition Resupply	06-3-M014	MLRS

D-17. The COE integration should—

- Allow performance of FA operational missions as outlined in mission capability statements.
- Assign additional nonstandard missions aligned with extended SOSO.
- Direct performance of IO (for example, integration of "lethal and nonlethal effects" function as a part of the "Targeting Process").
- Focus on basic combat tasks aligned with Force Protection under both combat and SOSO conditions (for example, Conduct of Convoy Operations, Response to Ambush, and Perform Security Techniques).
- Conduct of Autonomous Battery Operations, the leaders execute tasks like Develop and Communicate a Plan, 06-2-A099, supplemented by applicable task steps of Tasks 06-1-5450 and 06-1-A040.

D-18. This example illustrates how a unit commander and leaders utilize a prescriptive gunnery training table to address the training progression required to certify training readiness at section level. Field artillery units require all sections to be qualified. Maintenance of the mastery of section tasks is required to sustain readiness at the qualified section level under predeployment and postdeployment environments that are a part of today's COE. Unit commanders that integrate and structure their use of FM 3-09.08 as a training tool sustain leader, Soldier, and unit training readiness.

Glossary

SECTION I – ACRONYMS AND ABBREVIATIONS

Acronym/Term	Definition
AAR	after action review
ACTD	advanced concept technology demonstration
ADAM	area denial artillery munitions
AFATDS	Advanced Field Artillery Tactical Data System
AFC	automated fire control
AFC/DS	Automated Fire Control/Direction System
AFCS	automatic fire control system
ALT	altitude
AMB	air mission brief
AMC	at my command
AN/CYZ	data transfer device
AN/GRA-39	radio set control group (remote device)
AN/PSG-7	forward entry device
AN/PVS	night vision goggle
AN/TPQ-36	firefinder radar
AN/TPQ-37	mobile phased array artillery locating radar system
AN/TVS	night vision sight
ANCD	air net control device
AO	area of operations
AOF	azimuth of fire
AOL	azimuth of lay
APU	auxiliary power unit
ARTEP	Army Training and Evaluation Program
ASPT	Artillery Skills Proficiency Test
ATC	ammunition team chief
AZ	Azimuth
BC/1SG	Brigade Commander/1st Sergeant
BCS	Battery Computer System
BCT	brigade combat team
BDE	Brigade
BFIST	Bradley Fire Support Team
BFV	Bradley fighting vehicle
BILI	basic issue list items
BIT	Built-in test
BMP	Bronevaya Maschina Piekhota – Soviet Armored Troop Carrier

BOC	battery operations center
C, W, R	Crawl, Walk, Run
C/VAM	compass/vertical angle measurement
C2	command and control
CATS	combined arms training strategy
CBRN	chemical, biological, radiological, nuclear
CDT	control display terminal
CFB	chief of firing battery
CFF	call for fire
CFFT	call for fire trainer
CFL	coordinated fire line
CHG	charge
CLGP	cannon-launched guided projectile
CMD	command
COE	contemporary operational environment
COLT	combat observation and lasing team
COMP	Complementary
COMSEC	communications security
CORR	Correction
COS	chief of section
CP	concrete-piercing
CPX	command post exercise
CRP	center reference point
CSM	command sergeant major
DA	department of the army
DAP	distant aiming point
DF	deflection
DFT	drift
DODIC	department of defense identification code
DPICM	dual purpose improved conventional munitions
DS	direct support
DTD	data transfer device
DTG	date time group
DZ	drop zone
ECCM	electronic counter-countermeasures
ECM	electronic countermeasures
EFAT	essential field artillery tasks
EFST	essential fire support task
EL	elevation
EOM	end of mission

EP	electronic protection
EPROM	erasable programmable read-only memory
ERF	electronic counter-countermeasures remote fill
ETAC	emergency tactical air control
ETI	elevation-to-impact
EXEVAL	external evaluation
FA	field artillery
FAASV	field artillery ammunition supply vehicle
FASCAM	family of scatterable mines
FCE	fire control element
FCP	fire control party
FCS	fire control system
FCTN	function
FDC	fire direction center
FDO	fire direction officer
FDS	fire direction system
FED	forward entry device
FEM	field exercise mode
FFE	fire for effect
FH	frequency hopping
FIST	fire support team
FIST-V	fire support team-Vehicle
FLOT	forward line of own troops
FM	Field Manual
FO	forward observer
FORTRAN	formula translation (computer programing language)
FOS	forward observer system
FP	firing point
FPF	final protective fire
FS	fire support
FSCATT	fire support combined arms tactical trainer
FSCM	fire support coordinating measure
FSE	fire support element
FSNCO	fire support noncommissioned officer
FSO	fire support officer
FTX	field training exercise
FWR	fire when ready
G/VLLD	ground/vehicular laser locator designator
GB	green bag
GFT	graphical firing table

GN	grid north
GPS	global positioning system
GSG	general support group
GSPT	Gunnery Skills Proficiency Test
GST	graphical site table
HA	hide area
HB	high burst
HC	hexachloroethane
HCO	horizontal control operator
HDRS	heavy drop rigging site
HE	high explosive
HE/WP/SMK	high explosive/white phosphorous/smoke
HEPI	heavy equipment point of impact
HERA	high explosive rocket-assisted
HIMARS	High-mobility artillery rocket system
HMMWV	High-mobility multipurpose wheeled vehicle
HOB	height of burst
HQ	Headquarters
HT	height
ICM	improved conventional munitions
ICOM	intercommunications
ID	idenitfication
IED	improvised explosive device
IETM	interactive electronic technical manual
IHFR	improved high frequency radio
ILA	illumination
ILLUM	Illumination
INIT	initialize
INS	inertial navigation system
IPDS	improved position determining system
JED	Joint Educational Doctrine
JI	joint inspection
KM	Kilometer
kPa	
LARS	LEFT ADD RIGHT SUBTRACT (memory aid)
LCHR	launcher
LCU	lightweight computer unit
LDS	launcher drive system
LDST	launcher drive system test
LFX	live fire exercise

LLDR	lightweight laser designator/rangefinder
LLM	launcher loader module
LM	Launcher Module
LMG	light machine gun
LO	low
LP	load plan
LPC	launch pod containers
LRF	laser range finder
LRSO	laser range safety officer
LST	launcher status
LTX	Lane Training Exercise
LZ	landing zone
M2	.50 Cal Machine Gun, compass
M2A2	Bradley Fighting Vehicle
MAPS	modular azimuth positioning system
MCWP	Marine Corps Warfighting Publication
MEP	mission equipment package
MET	meteorology
METL	mission essential task list
METT-TC	mission, enemy, terrain, and weather, troops and suport available, time available, civilian considerations
MG	machine gun
MHL	manufacturer's hair-line
MLRF	Melios Laser Range Finder
MLRS	Multiple Launch Rocket System
MOPP	Mission-oriented protective posture
MOS	military occupational specialty
MPI	mean-point-of-impact
MSD	maintenance support device
MSE	mobile subscriber equipment
MTP	mission training plan, MOS training plan
MTSQ	mechanical time, super quick
MUL	Master Unit List
NA	table 2-4 not applicable
NATO	North Atlantic Treaty Organization (set of standards)
NCS	net control station
NHA	noise hazard area
NOD	night observation device
OIC	officer in charge
OP	observation post

OPAREA	operational area
OPORD	operation order
OPSEC	operations security
PA	performance assessment
PADS	Performance Assessment Data System
PCR	piece-to-crest range
PD	point detonating
PDS	position determining system
PDU	power distribution unit
PE	probable error
PFK	programmable function key
PIAFS	portable induction artillery fuze setter
PL	phase line
PLGR	precise lightweight global positioning system receiver
PLT	platoon
PLU	Program Load Unit
PMCS	preventive maintenance checks and services
PNU	Position Navigational Unit
POC	Platoon Operations Center
POI	program of instruction
PROJ	projectile
PSI	pounds per square inch
PWR	power
PZ/LZ	pickup zone/landing zone
QE	quadrant elevation
RAAMS	remote antiarmor mine system
RAP	rocket-assisted projectile
RB	red bag
RCO	range control officer
RDP	range-deflection protractor
REF	reference
RFT	Rapid-fire table
RG	range
RL	range limits
ROC-V	recognition of combat vehicles
RP	registration point, reference point, release point
RPG	rocket propelled grenade
RPM	revolutions per minute
RSO	range safety officer
RSOP	reconnaissance, selection, and occupation of position

RTI	range-to-impact
RWS	remote weapon station
SADARM	sense and destroy armor
SBCT	Stryker brigade combat team
SCP	survey control point
SDC	safety data calculator
SDZ	surface danger zone
SEC	sector
SGT	Sergeant
SI	site
SI FAC	site factor
SINCGARS	single-channel ground and airborne radio system
SISTIM	simulation/simulation system
SN	serial number
SLO	suspension lock out
SNVT	short no voltage test
SOI	signal operating instructions
SOI/SSI	signal operating instructions/signal supplemental instructions
SOP	standing operating procedure
SOSO	stability operations and support operations
SPLL	self-propelled launcher loader
SPORT	Soldier's portable on-system repair tool
SRP	stabilization reference package
SRP/PDS	Stabilization Reference Package/Position Determining System
SSG	staff sergeant, strategic studies group
SSI	signal supplemental instructions
STP	Soldier training publication
STR	standard training requirment
STRAC	Standards in Training Commission
STX	situational training exercise
SWPQ	stryker weapons proficiency qualification
TA	Target acquistion
T&E	traversing and elevation
TADSS	training aids, devices, simulators, and simulations
TAFCS	Tactical Automated Fire Control System
TC	tank commander, track commander
TEK	traffic encryption key
TF	task force
TFT	tabular firing table
TI	time

TLABSPAP	trails, lay, aimpoint established, boresight verified, safe, prefire checks performed, ammunition prepared
TLE	target location error
TM	technical manual
TNT	trinitrotoluene
TO&E	table of organization and equipment
TOF	time of flight
TOT	time on target
TP	transfer point
TRADOC	Training and doctrine command
TS	test support
TSCP	targeting station control panel
TSFO	training set forward observation
TSK	transmission security key
TSOP	tactical standing operating procedure
TSP	training support package
TTF	time to fire
TTP	tactics, techniques, and procedures
TTT	timed time on target
TWR	timed when ready
UA	unit of action
USAF	United States Air Force
USMTF	United States message text format
VCO	vertical control operator
VE	velocity error
VI	vertical interval
VIC-1	vehicle intercom system
VMS	vehicle motion sensor
VT	Variable time (fuze)
WB	white bag
WIU	weapon interface unit
WLRS	Weapon Location Radar Section
WP	white phosphorous
XO	executive officer
XMT	transmit
ZUPT	zero velocity update

SECTION II – TERMS

mil	A unit of angular measurement equal to 1/6400 of 360 degrees and used especially in artillery.

Area F	The area immediately to the rear of the launcher that is directly exposed to blast and debris (launcher danger area).
complementary angle of site	The complementary site factor for the appropriate charge at the piece-to-crest range multiplied by the sum of angles 1 and 2.
conversion formula	To convert feet to meters feet ÷ 3.28 = meters
crab angle	?
distance W	A distance to either side of the target wide enough to include all debris (payload, warhead skin, and rocket motor) from normally functioning rounds. Distance W is the maximum lateral distance a projectile will ricochet after impacting within the dispersion area. Distance W defines the maximum lateral edge of the ricochet area.
distance X	A distance beyond the target adequate to contain rockets when the fuze fails to function (M26/A1/A2/M28). Distance X is further defined as the maximum distance a rocket will travel when fired or launched at a given quadrant with a given propulsion system (M28A1/A2).
distance Y	A distance short of the target sufficient to include all debris (payload, warhead skin, and rocket motor) from normally functioning rounds.
entry range	Total range multiplied by Range K expressed to the nearest 10 meters.
H	Height of the launcher above mean sea level.
"left least, right most" rule	The lowest (least) drift is applied to all left deflection limits, and the highest (greatest) drift is applied to all right deflection limits.
MET + VE technique	?
mini-max rule	The rule for determining the correct altitude for safety purposes—at the minimum range, maximum altitude is selected; at the maximum range, the minimum range is selected.
quadrant elevation	The sum of elevation and site and express to the nearest whole mil. Also known as QE.
Range K	The total range correction from the graphical firing table setting expressed as a percentage.
Safety T	Convenient method of arranging safety data and used to verify the safety of fire commands.
total range	The sum of the diagram range and the range correction expressed to the nearest 10 meters.
vertical interval	Determined by subtracting the unit altitude from the altitude corresponding to the diagram range and expressed to the nearest whole meter. Also known as VI.
W_{max}	The maximum possible value of W. For OPAREAs, this is the value of W at a range from the rear edge of the OPAREA to the geographic center of the usable portion of the installation impact area.
X_{max}	The maximum possible value of X. For OPAREAs, this is the value of X at a range from the forward edge of the OPAREA to the geographic center of the usable portion of the installation impact area.
Y_{max}	The maximum possible value of Y. For OPAREAs, this is the value of Y at a range from the forward edge of the OPAREA to the geographic center of the usable portion of the installation impact area.

This page intentionally left blank.

References

SOURCES USED

These are the sources quoted or paraphrased in this publication.

AR 220-1, *Unit Status Reporting,* 10 June 2003.

AR 385-63/MCO P3570.1B*, Range Safety,* 19 May 2003.

AR 600-8-22, *Military Awards,* 25 February 1995.

ARTEP 6-037-30-MTP, *Mission Training Plan for the Consolidated Cannon Battery, M102, M119, M198, M109A5, M109A6,* 1 April 2000.

ARTEP 6-115-MTP, *Mission Training Plan for the Field Artillery Cannon Battalion Command and Staff Section, Headquarters and Headquarters Battery, and Service Battery,* 1 April 2000.

ARTEP 6-303-30-MTP, Mission Training Plan for the Target Acquisition Battery and the Corps Target Acquisition Detachment, 1 April 2000.

ARTEP 6-395-MTP, *Mission Training Plan for the Field Artillery Multiple Launch Rocket System Battalion Command and Staff Section and Headquarters and Service Battery*. 1 April 2000.

ARTEP 6-397-30-MTP*, Mission Training Plan for the Multiple Launch Rocket System Battery*. 1 April 2000.

DA Form 581, *Request for Issue and Turn-In of Ammunition*.

DA Form 2028, *Recommended Changes to Publications and Blank Forms*.

DA Form 2404, *Equipment Inspection and Maintenance Worksheet*.

DA Form 2408-4, *Weapon Record Data*.

DA Form 4446, *Level, Transit, and General Survey Record Book*.

DA Form 4513, *Record of Missions Fired*.

DA Form 4982-R, *Muzzle Velocity Record*.

DA Form 4982-1-R, M90 *Velocimeter Work Sheet*.

DA Form 5429-R, *Conduct of Fire*.

DA Form 5699-R, *Howitzer Range Card*.

DA Form 7232-R, *MLRS FDC Fire Mission Log*. DA Form 7233-R, *MLRS Launcher Fire Mission Log (LRA)*.

DA Form 7353-R, *Universal Safety* T.

DA Pam 350-38, *Standards in Training Commission (STRAC).*

DA Pam 385-63, *Range Safety*.

FM 3-09.70 (6-70), *Tactics, Techniques, and Procedures for M109A6 Howitzer (Paladin) Operations*. 1 August 2000.

FM 3-22.1, *Bradley Gunnery*. 28 November 2003.

FM 3-22.68 (FM 23-14), M249 *Crew-Served Machine Guns, 5-56 mm and 7.62 mm*. 31 January 2003.

FM 3-22.27 (FM 23-27), *MK 19, 40-mm Grenade Machine Gun, Mod 3.* 28 November 2003.

FM 3-22.65 (FM 23-65), *Browning Machine Gun Caliber .50 HB, M2*. . 3 March 2005.

FM 6-15, *Tactics, Techniques, and Procedures for Field Artillery Meteorology*. 13 August 1997.

FM 6-30, *Tactics, Techniques, and Procedures for Observed Fire Procedures*. 16 July 1991. (Will be revised as FM 3-09.3)

FM 6-40/MCWP 3-1.6.19, *Tactics, Techniques, and Procedures for Field Artillery Manual Cannon Gunnery* . 1 October 1999.

FM 6-50, *Tactics, Techniques, and Procedures for the Field Artillery Cannon Battery*. 23 December 1996. (Will be revised as FM 3-09.50)

FM 6-60, *Tactics, Techniques, and Procedures for Multiple Launch Rocket System (MLRS) Operations*. 23 April 1996. (Will be revised as FM 3-09.60)

FM 7-0. *Training the Force*. 22 October 2002.

FM 7-1. *Battle-Focused Training*. 15 September 2003.

FM 10-450-3, *Multiservice Helicopter Sling Load: Basic Operations and Equipment*. 10 April 1997.

FM 10-450-5, *Multiservice Helicopter Sling Load: Dual-Point Rigging Procedures*. 30 August 1999.

FM 10-450-4 (FM 55-450-4) *Multiservice Helicopter Slingload: Single-Point Load Rigging Procedures*. 30 May 1998.

FM 90-4, *Air Assault Operations*. 16 March 1987.

FM 90-26*, Airborne Operations*. 18 December 1990.

ST 6-50-20, *Battery Executive Officer's/Platoon Leader's Handbook*. 20 February 1998.

STP 6-13B14-SM-TG, *Soldier's Manual and Trainer's Guide, MOS 13B, Cannon Crewmember Skill Levels 1/2/3/4. 15 August 1989*.

STP 6-13F14-SM-TG, *Soldier's Manual, Skill Levels 1234, and Trainer's Guide, MOS 13F Fire Support Specialist*. 24 September 1993.

STP 6-13P14-SM-TG, *Soldier's Manual*, *Skill Levels 1/2/3/4 and Trainer's Guide, MOS 13P Multiple Launch Rocket System (MLRS) Fire Direction Specialist*. 28 December 1994.

STP 6-13R14-SM-TG, *Soldier's Manual, Skill Levels 1234, and Trainer's Guide, MOS 13R, FA Firefinder Radar Operator*. 21 May 1993.

STP 21-1-SMCT, *Soldier's Manual of Common Tasks, Skill Level 1*. 31 August 2003.

STP 21-24-SMCT, *Soldier's Manual of Common Tasks, Skill Levels 2 to 4*. 31 August 2003.

IETM 9-1055-647-13&P, *Interactive Electronic Manual for the Multiple Launch Rocket System* (MLRS) M270A1 Launcher and M993/M993A1 Carrier. 31 March 2005.

TM 9-1015-234-10, *Operator's Maintenance Manual For Howitzer, Light, Towed*: *105-mm, M102*. 18 August 1985.

TM 9-1015-252-10, *Operator's Manual for Howitzer, Light, Towed 105mm, M119A2*. 12 August 1999.

TM 9-1425-646-10-1, *Operator's Manual for Launcher, Rocket, Armored Vehicle Mounted: M270 (Multiple Launch Rocket System)*. 30 April 1998.

TM 9-1425-646-10-*2,Operator's Manual for Volume 2 Launcher, Rocket, Armored Vehicle Mounted: M270 Part No. 13029700-202 (NSN 1055-01-251-9756) (EIC: QBJ) Part No. 1302700-203 (1055-01-329-6826) (EIC: QBU) (Multiple Launch Rocket System).* 30 April 1998.

TM 9-2350-314-10, *Operator's Manual Howitzer, Medium, Self-Propelled 155 Millimeter M109A6*. 8 February 1999.

TM 9-2350-362-10, *Operator's Manual for Striker Fire Support Vehicle M707 (NSN 2350-01-455-3174) (EIC: 3RH).* 21 March 2003.

TM 9-6675-347-13&P, *Operator, Organizational and Direct Support Maintenance Manual Including Repair Parts and Special Tools List for Gun Laying and Positioning System (GLPS): M67 (NSN 6675-01-430-1965) (EIC: CJ2).* 31 October 2000.

TM 11-5820-890-10-1*, Operator's Manual – SINCGARS Ground Combat Net Radio, ICOM*. 1 September 1992.

TM 11-5840-355-10, *Operator's Manual for Radar Set, AN/TPQ-37(V)1 (NSN 5840-01-043-4258) (EIC: IYB) and AN/TPQ-37(V)2 (5840-01-084-5374) (EIC: IYD) AN/TPQ-37(V)5 (5840-01-270-5101) (EIC: IYG) and AN/TPQ-37(V)6 (5840-01-270-5100) (EIC: IYF).*. 1 April 2002.

TM 11-5840-378-10, *Operator's Manual for Radar Sets AN/TPQ-36(V) (NSN 5840-01-185-4244) (EIC: N/A) and AN/TPQ-36(V)5 (5840-01-229-1276) (EIC: IYE) and AN/TPQ-36(V)7 (NSN 5840-01-229-1278) (EIC: IT6).* 1 July 2000.

TM 11-5840-380-10, *Operator's Manual for Radar Set AN/TPQ-36(V)8, (NSN 5840-01-390-0529) (EIC: Q68).* 1 February 2000.

TM 11-7025-275-10, *Operator's Manual for Fed Forward Observer/Fire Support Team (FO/FIST) (AN/PSG-7 softward)*15 January 1992.

TM 11-7025-297-10, *Operator's Manual, Advanced Field Artillery Tactical Data System (AFATDS).* 15 April 2000.

TM 43-0001-28, *Army Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers and Artillery Fuses (FSC 1310, 1315, 1320, 1390).* Reprinted with Basic Incl C1. 28 April 1994.

DOCUMENTS NEEDED

These documents must be available to the intended users of this publication.

IETM 9-2300-310-14&P, *Interactive Electronic Technical Manual Operator's Instruction: Operator, Unit, Direct Support and General Support Maintenance: and Repair Parts and Special Tools List HIMARS Launcher Chassis: HIMARS XM1140 (2320-01-491-3436) (UOC:MRS)*

TM 9-1055-647-13&P, *The Multiple Launch Rocket System (MLRS) M270A1 Launcher & M993/M993A1 Carrier*. 30 July 2004.

TM 9-1325-646-13&P, *Operator's Manual for Launcher, Rocket, Armored Vehicle Mounted*: M270 (Multiple Launch Rocket System). 17 May 2004.

TM 9-1325-646-13&P, *Operator's Manual for Volume 2 Launcher, Rocket, Armored Vehicle Mounted: M270 Part No. 13029700-202 (NSN 1055-01-251-9756) (EIC: QBJ) Part No. 1302700-203 (1055-01-329-6826) (EIC: QBU) (Multiple Launch Rocket System).* 17 May 2004.

TM 9-2350-314-10, *Operator's Manual for Howitzer, Medium, Self-Propelled 155-mm M109A6.* (NSN 2350-01-305-0028) 8 February 1999.

TM 11-5820-890-10-1, *Operator's Manual for SINCGARS Ground Combat Net Radio, ICOM Manpack Radio AN/PRC-119A (NSN 5820-01-267-9482) (EIC: L2Q) Short Range Vehicular Radio AN/VRC-87A (5820-01-267-9480) (EIC: L22) Short Range Vehicular Radio With Single Radio Mount AN/VRC-87C* (5820-01-304-2045) (EIC: GDC). 1 September 1992.

INTERNET WEB SITES (current at printing)

Program of Instruction (POI) for ROC-V Train-The-Trainer, ROC-V (Visible), ROC-V (1st Gen), ROC-V (2nd Gen)

http://rocv.army.mil/rocv/ROCV_desc.php

USAFAS Training and Doctrine Web Site

http://sill-www.army.mil/

This page intentionally left blank.

FM 3-09.8
31 July 2006

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0612801

DISTRIBUTION:
Active Army, Army National Guard, and U. S. Army Reserve: To be distributed in accordance with the initial distribution number 110772, requirements for FM 6-20.

This page intentionally left blank.

PIN: 083279-000