FM 3-09.70

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FM 3-09.70

Tactics, Techniques, and Procedures for M109A6 Howitzer (Paladin) Operations

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Preface

Field manual (FM) 3-09.70 (6-70) is focused on Paladin-unique battalion, battery, platoon and section operations. It sets forth the doctrine pertaining to organization, equipment, command and control (C2), operations, and tactics, techniques, and procedures (TTP) for Paladin units. It establishes the duties and responsibilities of key Paladin battery personnel for field operations. FM 3-09.70 is written for the Paladin battery and platoon, as well as for the battalion commander and staff.

It is designed to be used in conjunction with the appropriate FM 6-series, FM 71-3, equipment technical manuals (TMs), Army training and evaluation program (ARTEP) mission training plans (MTPs), and soldiers' manuals.

This FM supplements doctrine and TTP outlined in FM 6-50, *TTP for the Field Artillery Cannon Battery* and FM 6-20-1, *TTP for the Field Artillery Battalion*. As applicable, those TTPs for Paladin operations which do not differ significantly from those described in FM 6-50 or FM 6-20-1 are not repeated in this manual.

FM 3-09.70 ties the doctrinal approach with the training strategies outlined in the associated ARTEP 6-037-30-MTP, *Mission Training Plan for the Consolidated Cannon Battery, M102, M119, M198, M109A5, M109A6*. Refer to ARTEP 6-037-30-MTP for specific time standards regarding Paladin operations and fire missions.

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

Chapter 1

Mission, Organization, and System Description

This chapter provides an overview of the M109A6 howitzer (Paladin) battalion mission, organization, and description of key system components. The Paladin battalion exhibits the agility, initiative, and flexibility to provide timely and accurate fires in support of maneuver forces. The organization of the battalion and the tactics employed reinforce the principles of war and the tenants of Army operations as set forth in FM 100-5, *Operations*. Compared to earlier M109 series howitzers, the Paladin howitzer operates over more widely dispersed areas, processes on board technical firing data, and demonstrates the ability to shoot and scoot without relying on aiming circles and wire lines.

MISSION

1-1. The Paladin battalion strikes throughout the depth of enemy formations to suppress, neutralize, and destroy ground forces, direct fire weapons, indirect fires systems, and air defense systems. The battalion is organized and equipped to perform any of the four standard tactical missions (direct support (DS), general support (GS), general support reinforcing (GSR), and reinforcing (R)) or any nonstandard missions as described in FM 6-20-1, Chapter 1.

BASIC TASKS

1-2. The Paladin battalion performs tasks under the Army universal task list (AUTL) for the tactical level of war as defined for field artillery battalions in FM 6-20-1. The six major task areas for the tactical level AUTL are:

- Deploy/conduct maneuver.
- Develop intelligence.
- Employ fires.
- Perform combat service support (CSS) and sustainment.
- Exercise C2.
- Protect the force.

ORGANIZATION

1-3. The Paladin battalion is organized with a headquarters and headquarters battery (HHB), three firing batteries each with six howitzer sections (3 X 6), and a service battery (Figure 1-1). The HHB and service battery provide command, control, administrative, and service support for organic and attached elements. See FM 6-20-1 for further details on HHB and service battery configurations and functions.

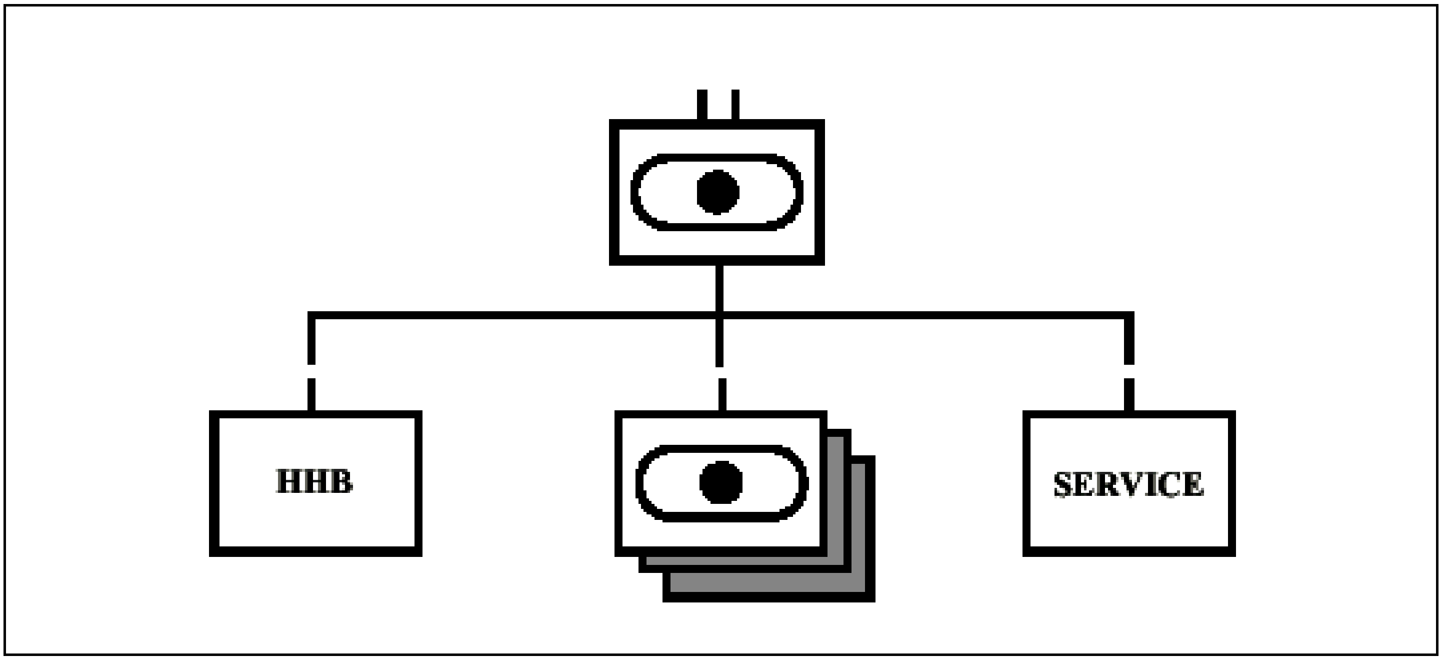


Figure 1-1. Paladin Battalion Organization

1-4. The Paladin firing battery (Figure 1-2) consists of a battery headquarters and two firing platoons. Each firing platoon consists of a platoon headquarters section, a platoon operations center (POC) comprised of fire direction center (FDC) section personnel, three firing sections, and an ammunition section.

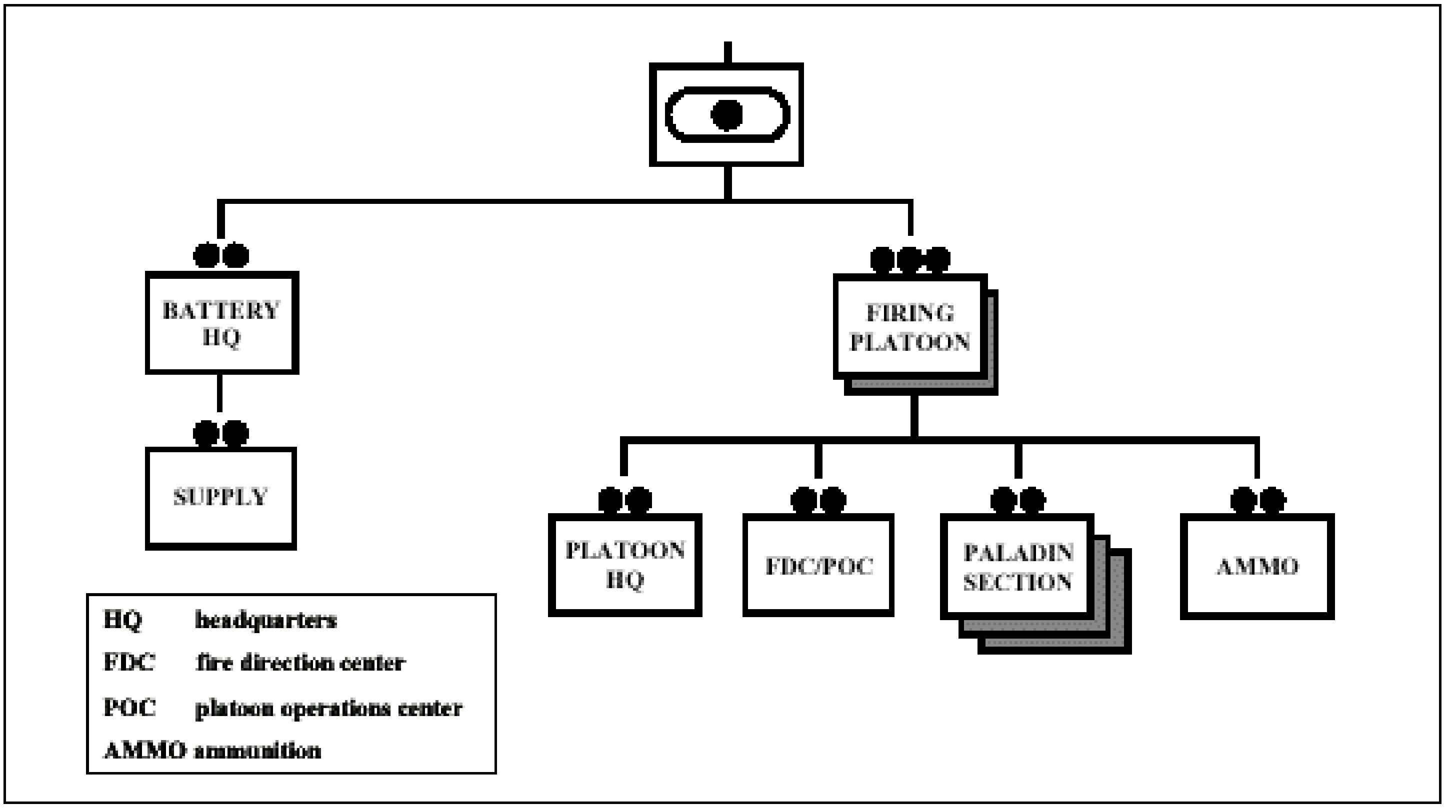


Figure 1-2. Paladin Firing Battery Organization

FORCE XXI ORGANIZATION

1-5. Paladin battalions organized under the Force XXI series table of organization and equipment transition to a four battery per battalion configuration. The battalion consists of a headquarters, headquarters and service (HHS) battery and three firing batteries (Figure 1-3).

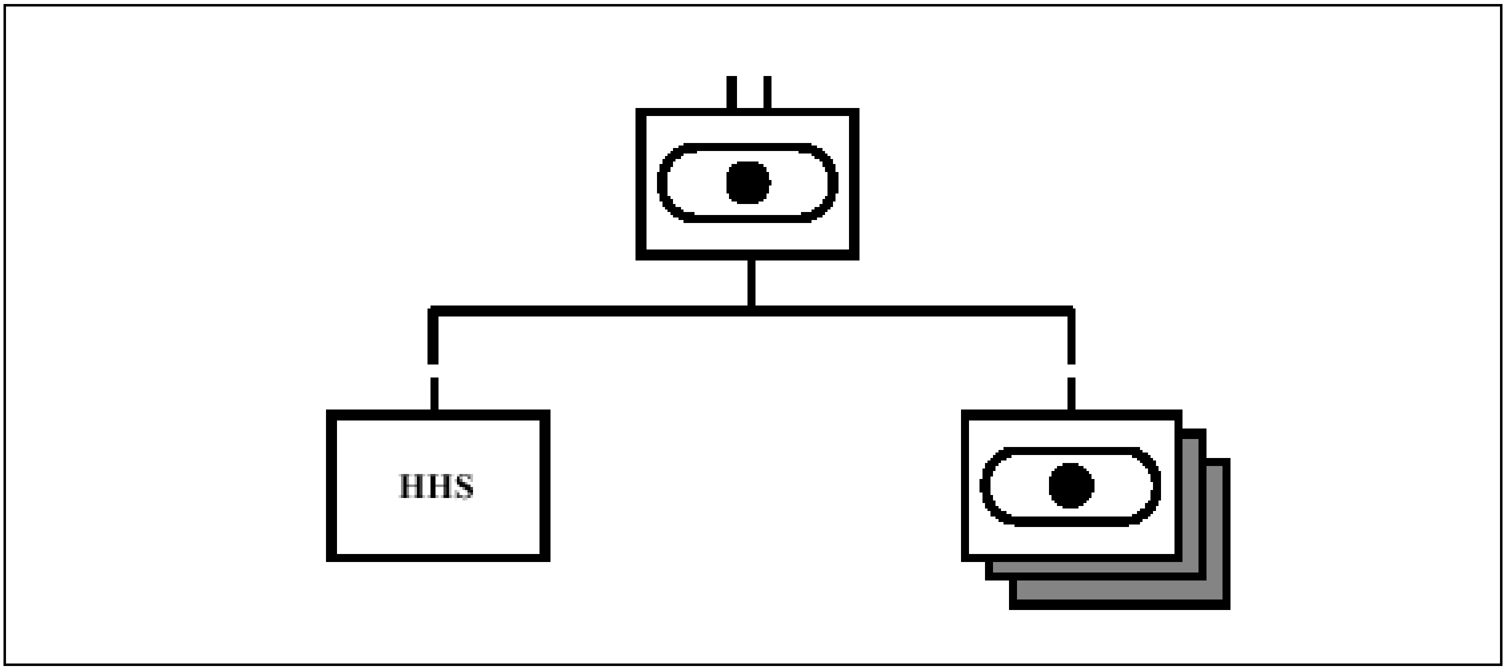


Figure 1-3. Force XXI Paladin Battalion Organization

1-6. The Force XXI Paladin firing battery consists of a battery headquarters, two firing platoons (each with three firing sections) and a support platoon (Figure 1-4). In the Force XXI battery, a battery operations center (BOC) with FDC takes the place of the two POC elements. The support platoon is comprised of a platoon headquarters, two ammunition sections, a supply section, maintenance section and a food service section. Elements of the support platoon may be consolidated at the battalion level under the HHS, or remain decentralized at battery level.

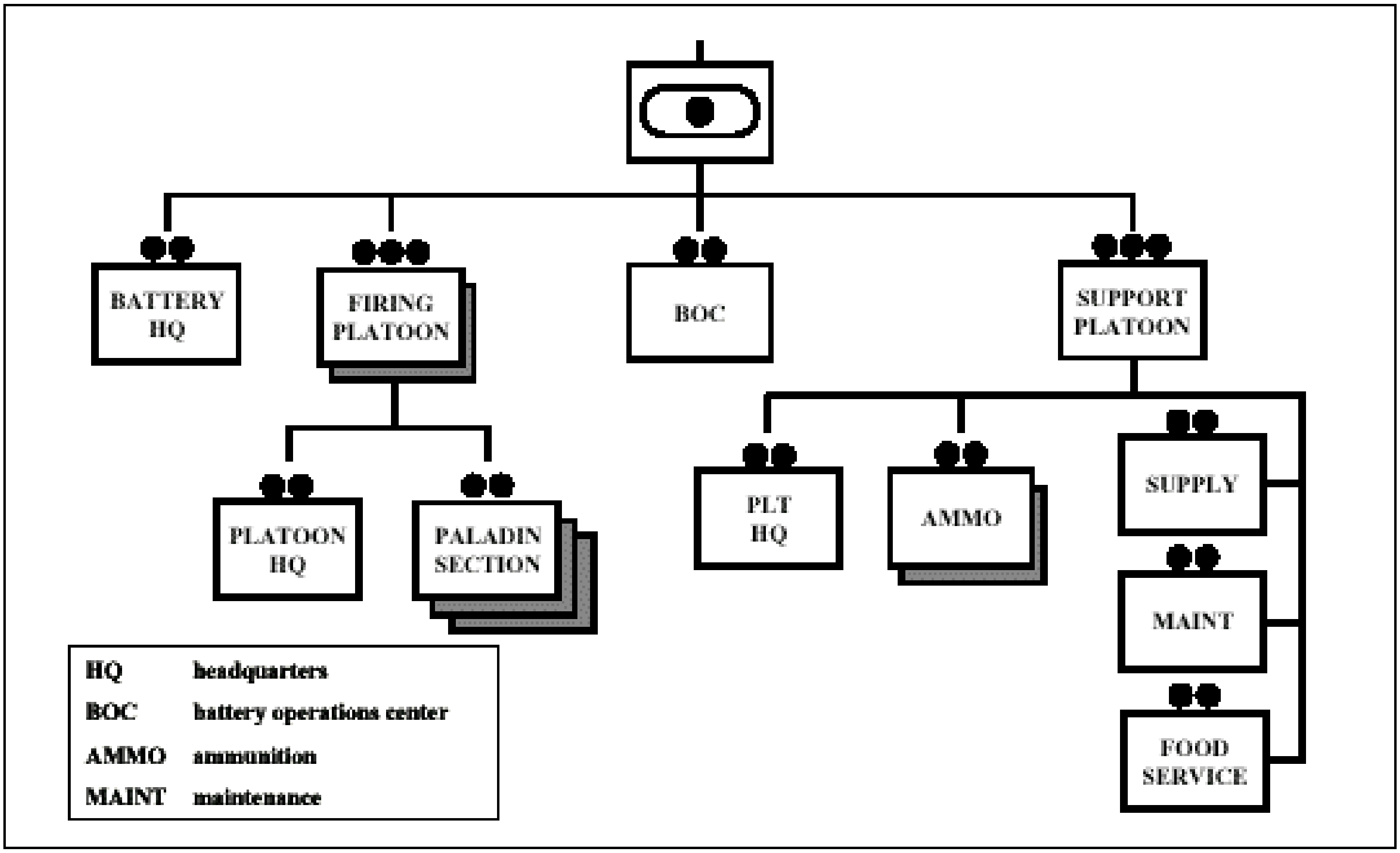


Figure 1-4. Force XXI Paladin Firing Battery Organization

1-7. The Force XXI Paladin organizational structure is currently undergoing testing. Emerging TTP for Force XXI Paladin organizations may be found in Experimental Forces Special Text 6-70, *Tactics, Techniques, and Procedures for Paladin Operations in the Army XXI Division*.

SYSTEM DESCRIPTION

OVERVIEW

1-8. The combination of M109A6 system capabilities and tactics results in more responsive and sustained fires for the maneuver commander compared to earlier M109 series howitzers. The most significant operational differences between the M109A6 and prior M109 series howitzers are the Paladin's ability to operate over a widely dispersed area and to move and emplace using the Paladin technology. Technology advances allow the Paladin to move and position within an assigned area, process technical firing data with the automatic fire control system (AFCS) and single-channel ground and airborne radio system (SINCGARS), and fire a mission without relying on surveyed firing points, aiming circles and wire lines. Howitzers can occupy in more widely varying terrain positions and can repeatedly displace, move, and quickly emplace with faster "ready to fire" times.

1-9. Paladin system responsiveness is enhanced through:

- On-board position navigation.
- On-board technical fire direction.
- Radio communications.
- Freedom from wire.

1-10. Paladin survivability is enhanced through:

- Built-in hardening.
- Dispersion techniques.
- 300-500 meter survivability moves.

1-11. Chapter 3 provides more in depth discussion on Paladin tactical operations. The following paragraphs highlight Paladin system features.

M109A6 PALADIN HOWITZER FEATURES

1-12. The M109A6 Paladin howitzer is the latest product improvement to the original M109 155-millimeter self-propelled (SP) howitzer. The Paladin features improvements in the areas of survivability; reliability, availability, and maintainability (RAM); responsiveness; and terminal effects. Features include an on-board ballistic computer, secure communications, enhanced position and navigation system, an integrated muzzle velocity system (MVS), new turret, improved cannon and mount, improved ballistic and nuclear, chemical, and biological protection, automotive improvements, built-in test equipment (BITE), and driver's night vision capability (Figure 1-5).

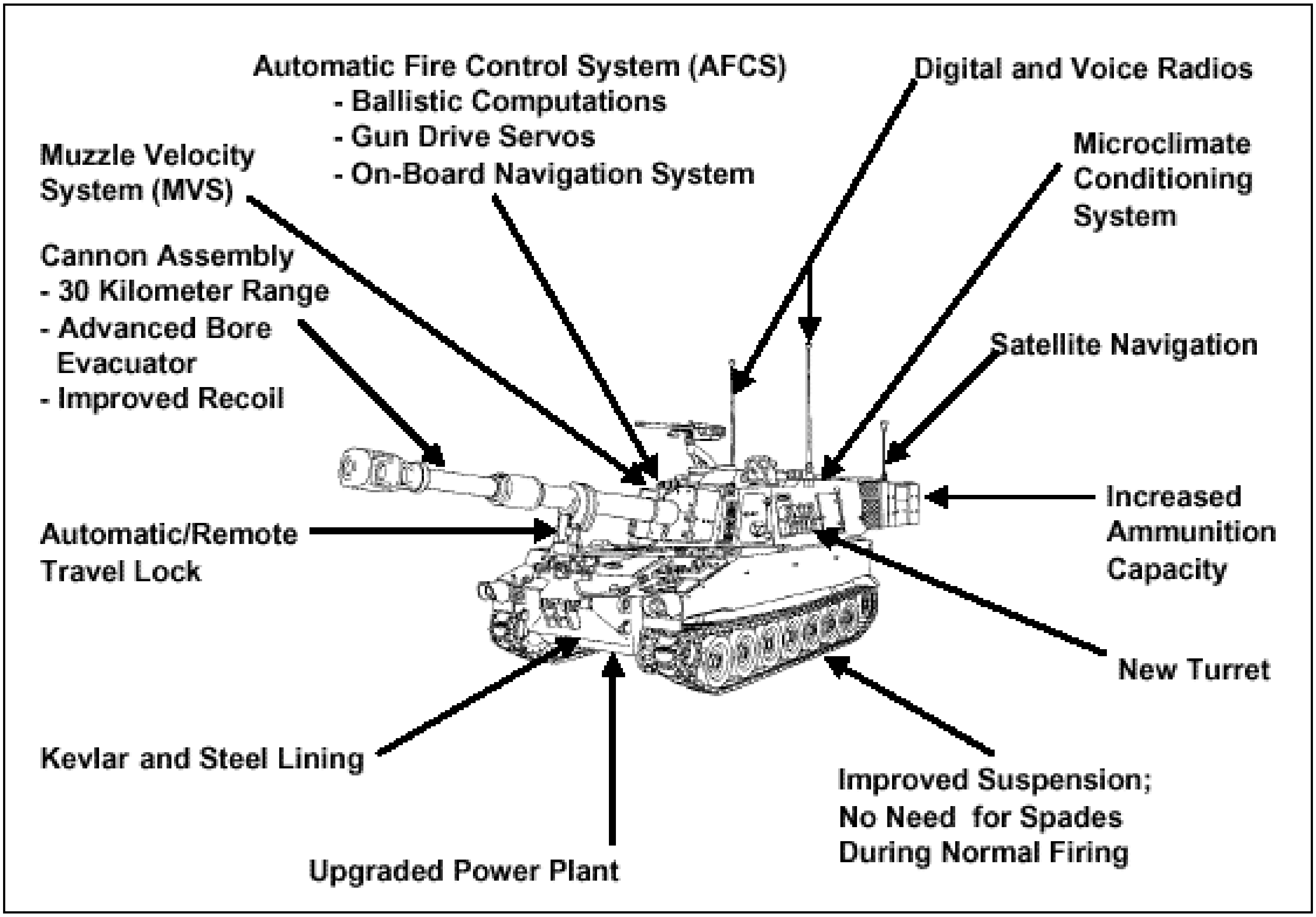


Figure 1-5. Paladin Howitzer Features

1-13. The M109A6 is an armored full-tracked howitzer capable of carrying 37 complete conventional rounds and two Copperhead rounds. A crew of four personnel operates the howitzer. The Paladin's 155 millimeter M284 cannon assembly, fitted with the M182A1 mount, has a maximum range of 30 kilometers (km) when firing a rocket assisted projectile (RAP) using the M203 series charge (24 km when firing an unassisted projectile). The howitzer has a maximum rate of fire of four rounds per minute for three minutes and a sustained rate of fire of one round per minute. The M109A6 travels at speeds up to 38 miles per hour, has a maximum cruising range of 186 miles, and a fuel capacity of 133 gallons. The Paladin weighs approximately 32 tons combat loaded.

1-14. Survivability improvements include:

- Hull and turret structure with composite spall suppression liners and supplemental armor.
- Remote travel lock allows crew to emplace or displace without dismounting from the howitzer.

- Relocated projectiles.
- Segregated hydraulic components.
- Microclimate conditioning system provides filtered and conditioned air to crew's protective masks and vests.
- A fixed carbon dioxide fire suppression system for the engine compartment and portable units for the crew and driver's compartments.

1-15. RAM improvements include:

- Engine cooling package.
- Sealed starter and protective circuitry.
- New alternator.
- Final drive quick disconnects.
- Upgraded suspension, hydraulic, and electrical systems.
- Added the prognostic/diagnostic interface unit (PDIU), a maintenance diagnostic and limited prognostic testing unit.

1-16. Armament improvements to the cannon include:

- Redesigned interior profile of the gun tube assembly.
- Improved breech and recoil system designed to enhance component life.
- Strengthened muzzle break.
- An advanced bore evacuator.

Automatic Fire Control System (AFCS)

1-17. The AFCS provides position location and directional reference, a ballistic computer for on-board technical fire direction, a muzzle velocity (MV) measuring system, and gun-drive servos, which automatically orient the tube for deflection and quadrant. The AFCS enhancements improve responsiveness and survivability by permitting frequent movement through semi-autonomous operations. Additionally, the AFCS has an embedded training feature, which allows the crew to practice mission scenarios.

1-18. The major components that make up the AFCS include:

- AFCS computer unit (ACU) (includes ballistic computation, weapons control, and communications processing circuit cards).
- Display unit (DU).
- Hydraulic components (manifolds, servo valves, solenoid valve, and pilot check valves).
- System interconnect cabling (military standard 1553 data bus).
- Power conditioner unit (PCU).

- Navigation system with modular azimuth positioning system (MAPS) components.

1-19. The MAPS is made up of modular components combined in different configurations to provide survey and orientation information needs of a particular system. In the Paladin application, major components of MAPS consist of the dynamic reference unit-hybrid (DRU-H), vehicle motion sensor (VMS), and the global positioning system (GPS)/precision lightweight GPS receiver (PLGR).

1-20. The DRU-H is mounted on the right trunnion of the Paladin armament system. Operating in conjunction with PLGR, the DRU-H contains all necessary sensor electronics, processing, and input-output circuitry to perform survey and orientation functions and interface with other MAPS components. The DRU-H performs the following functions:

- Provides vehicle position from a known starting point in terms of universal transverse mercator coordinates of easting, northing, and altitude.
- Provides vehicle orientation in terms of azimuth from grid north.
- Compensates for weapon pitch and cant.
- Supplies angular velocity rates.
- Provides weapon elevation, grid azimuth, azimuth rate, elevation rate, travel local grid azimuth reference, and travel local elevation reference.

1-21. The VMS is a mechanical drive that converts vehicle odometer outputs to electrical signals as a measure of weapon displacement. The VMS, located in the engine compartment, is driven directly from the transmission output drive for the odometer cable. The VMS supplies the electronic information to the VMS modem.

1-22. Note: The M117/M117A2 panoramic telescope (pantel), M145/M145A1 telescope mount, and the M1A1 collimator remain on board the howitzer as backup optical fire control instrumentation.

M992A2 FIELD ARTILLERY AMMUNITION SUPPORT VEHICLE (FAASV) FEATURES

1-23. The M992A2 FAASV accompanies the M109A6 and completes the howitzer section. The FAASV has a crew of five. The M992A2 is a full-tracked, aluminum armored ammunition resupply vehicle with a hydraulic powered conveyor for single-round transfer of ammunition. The M992A2 is comparable to the M109A6 in terms of speed, mobility, and survivability. In addition to ammunition handling equipment, the FAASV features projectile rack assemblies and storage compartments with the capacity to hold 90 complete conventional rounds and 3 copperhead rounds; a diesel powered auxiliary power unit used to drive the hydraulic system and recharge vehicle batteries; and an automatic fire extinguisher system (AFES).

THE PLATOON OPERATIONS CENTER (POC)

1-24. The POC provides battle command for the Paladin platoon. The POC is contained in an M577/M1068 command post vehicle configured to support M109A6 Paladin operations. The lightweight computer unit (LCU) with battery computer system (BCS) software is the primary digital interface between the advanced field artillery tactical data system (AFATDS)/initial fire support automation system (IFSAS) and the howitzers.

Chapter 2

Duties of Key Personnel

The duties and responsibilities of key personnel assigned to the Paladin firing battery are discussed in this chapter. These duties and responsibilities are in addition to those listed in FM 6-50, Chapter 1. The duties and responsibilities of the battalion commander and his staff have not changed significantly as covered in FM 6-20-1.

BATTERY COMMANDER

GENERAL DUTIES

2-1. The battery commander (BC) commands and controls the Paladin battery and directs its employment in accordance with assigned missions. He is responsible for battery training, combat readiness, morale, welfare, and all aspects of operations. He establishes standards for the battery and ensures that those standards are achieved and sustained. As the senior battery trainer he is responsible for the professional development of the platoon leaders and fire direction officers.

SPECIFIC DUTIES

- Plans and conducts reconnaissance of the unit headquarters position and selects a series of position areas (PAs) for each platoon.
- Ensures proper terrain coordination with higher headquarters, maneuver elements, and adjacent units to facilitate timely position occupations by battery vehicles and personnel.
- Supervises platoon leaders' operations. To the maximum extent possible, maintains a presence in the PA and in the POCs teaching, supervising, and ensuring adherence to standards.
- Coordinates with the battalion S3 and reconnaissance and survey officer for survey requirements to include navigation update points.
- Obtains survivability move criteria from the battalion operations section and provides to platoon leaders. These criteria are based primarily on the anticipated level of threat and the terrain available in accordance with (IAW) the factors of

mission, enemy, terrain and weather, troops, time available, and civil considerations (METT-TC) and the unit's tactical standing operating procedures (TSOP).

EQUIPMENT REQUIREMENTS

2-2. The BC must continue to be mobile on the battlefield. Paladin tactics require the BC to have a combat vehicle, driver, secure GPS/PLGR, and two long-range radios.

FIRST SERGEANT

GENERAL DUTIES

2-3. The firing battery first sergeant (1SG) assists the BC in the command and control of the battery in an expanded battlespace. He provides leadership and guidance for the battery's enlisted personnel. He is the primary trainer for enlisted personnel. Additionally, he supervises all administrative and logistical support requirements. His principal assistants include the battery supply sergeant and the maintenance contact team chief.

SPECIFIC DUTIES

- Coordinates battery supply, maintenance, and food service operations.
- Maintains a presence in the PAs supervising the platoon sergeants, gunnery sergeants, and Paladin section chiefs.
- Ensures platoon sergeants establish adequate security for their elements.
- Develops, integrates, and supervises the security plan as appropriate.

EQUIPMENT REQUIREMENTS

2-4. A Paladin battery 1SG must have a high-mobility multipurpose wheeled vehicle (HMMWV), driver, secure GPS/PLGR, and two long-range radios to accomplish his duties.

FIRING PLATOON LEADER

GENERAL DUTIES

2-5. The firing platoon leader commands and controls the Paladin platoon. He is responsible for all actions of the platoon to include tactical movement, continuous day/night and degraded operations, defense, communications, individual training, and enforcement of battery standards.

2-6. During tactical operations, he positions himself to facilitate command and control of the platoon. For example, during a movement to contact, the platoon leader could be at a critical terrain choke point and may need to coordinate with maneuver elements to facilitate passage through a minefield. In the defense, he could be located in an overwatch position monitoring survivability moves or key avenues of approach.

2-7. The firing platoon leader relies heavily on the platoon sergeant to supervise the firing elements and on the gunnery sergeant (GSG) to conduct reconnaissance, selection, and occupation of the position (RSOP).

SPECIFIC DUTIES

- Plans, coordinates, supervises, and directs Paladin platoon operations to include:
  - Plans and issues platoon operations/movement orders.
  - Conducts in-depth platoon rehearsals.
  - Updates platoon on tactical situation and survivability movement criteria.
  - Plans and supervises platoon tactical moves.
- Verifies database in AFCS during initialization or as required.
- Manages and tracks platoon ammunition status.
- Ensures AFCS and LCU databases are input correctly and that independent secondary checks are made of all entries.
- Ensures an independent secondary check is performed for all survey data.
- Ensures verification of howitzer location as required.

EQUIPMENT REQUIREMENT

2-8. The firing platoon leader must have a dedicated vehicle in order to accomplish his duties and execute battle command of his platoon. A combat vehicle is required for the platoon leader to include a driver, two radios, and a secure GPS.

PLATOON FIRE DIRECTION OFFICER

GENERAL DUTIES

2-9. The platoon fire direction officer (FDO) is responsible for the training and supervision of the POC personnel. He supervises the establishment, verification, and maintenance of the platoon computer database, ensuring that all reports are received, recorded, and processed, as required by the unit TSOP. He must also be familiar with the duties of the platoon leader, as he may be called upon to assume these duties in addition to his own.

- If required, verifies database in AFCS during initialization.
- Provides tactical fire direction.

- Supervises the overall conduct of fires.
- Reviews fire mission: call for fire (FM:CFF) as necessary. Selects the shell-fuze and propelling charge for each howitzer in order to decrease the fire mission processing time at the howitzer and to achieve optimum effects on target commensurate with ammunition on hand.
- Tracks ammunition count and usage; recommends ammunition distribution plan to the platoon leader.
- Informs section chiefs of the overall tactical situation and provides guidance on positioning. Ensures howitzers do not emplace in areas just vacated and susceptible to counterfire.
- Reports platoon logistical and administrative requirements to the 1SG as appropriate.
- Controls the fires of the other Paladin platoon in the battery as required.
- Exchanges key POC database information with the other POC.
- Maintains capability of computing the technical firing solution for any degraded howitzers.

SPECIFIC DUTIES

- Primary duty to compute executive officer's (XO's) minimum quadrant elevation (min QE) based on worst case site to crest data provided by the GSG.
- Verifies the technical databases for AFATDS, BCS, and AFCS, specifically:
  - Howitzer location, azimuth of fire (AOF), and powder temperature.
  - MV files, target files, ammunition files.
  - Verification mission to validate initial database and changes to database.
  - Application of registration corrections, and current meteorological (met) data.
- Ensures secondary check is made of all entries into the AFATDS/LCU.
- Verifies target plots before processing fire missions and ensures the target location does not violate fire support coordinating measures (FSCMs).
- Ensures the dissemination of the following:
  - Required TSOP reports to higher headquarters.
  - Required database information to the battalion tactical fire direction system and the other platoon's BCS.
  - Tactical and technical fire control measures based upon commander's guidance, including howitzer movement.
- Controls howitzer movement and positioning, and maintains howitzer tracking charts (HTCs).
- Verifies situation map is updated.

FIRE DIRECTION CHIEF

GENERAL DUTIES

2-10. The fire direction chief is the technical expert on technical/tactical fire direction and operation of the AFATDS/LCU. He is the platoon FDO's principal enlisted assistant and performs the duties of the FDO in his absence.

SPECIFIC DUTIES

- Verifies AFATDS/LCU initialization information.
- Ensures secondary check is made of all entries into the AFATDS/LCU.
- Ensures the current met, muzzle velocity variations (MVVs), and registration data are entered into the BCS database. Ensures this information is transmitted to the Paladins, using a howitzer (HOW);REQUEST message (see Chapter 3 and Appendix B).
- Verifies database information for each howitzer.
- Ensures all information received is properly posted and verified on situation overlays, status charts, and the HTC.
- Shift supervisor during continuous operations of the POC.

FIRE DIRECTION COMPUTER

2-11. The fire direction computer operates and maintains the LCU. He inputs, updates, and deletes database information as directed. He relays information reported by the howitzers to the FDO or fire direction chief for verification.

FIRE DIRECTION SPECIALIST

2-12. The fire direction specialist posts the situation maps and maintains the HTCs, database charts, and files as directed (i.e., howitzer locations, ammunition status, met data, and MVVs). He maintains and operates AFATDS, radio equipment, command post carrier, and ancillary equipment.

PLATOON SERGEANT

GENERAL DUTIES

2-13. The platoon sergeant is the primary enlisted assistant to the platoon leader and must be prepared to assume the platoon leader's duties. Normally, he is the senior noncommissioned officer (NCO) in the platoon area during firing, moving between the howitzers and the POC to perform his duties.

SPECIFIC DUTIES

- Trains and supervises the howitzer section chiefs.
- Verifies database in AFCS during initialization or as required.
- Plans, coordinates, and conducts Paladin platoon occupations and displacements. Ensures section chiefs know alternate positions throughout the platoon area.
- Conducts independent secondary check of all survey data.
- Ensures verification of howitzer locations (see Chapter 3).
- Coordinates and supervises ammunition distribution plans.
- Verifies howitzer calibration and ensures MV readings are provided to the POC.
- Determines platoon requirements and coordinates with the platoon leader and 1SG for all logistical activities for the platoon.
- Plans and supervises the security of all elements within the platoon, and coordinates with the battery 1SG.
- Enforces navigation updates as required.
- Verifies the confidence test on the howitzer as required. (Refer to TM 9-2350-314-10, *Operator's Manual Howitzer, Medium, Self-Propelled 155 Millimeter M109A6*.)

EQUIPMENT REQUIREMENTS

2-14. A platoon sergeant must have a dedicated vehicle and driver, secure GPS/PLGR, and a long-range radio in order to accomplish his duties.

GUNNERY SERGEANT

GENERAL DUTIES

2-15. The GSG is the primary reconnaissance expert for the platoon. Additionally, he assists the platoon sergeant and must be prepared to assume his duties.

SPECIFIC DUTIES

- Performs in-depth reconnaissance of route and platoon PAs selecting multiple howitzer or pair locations for possible use. This is made easier by use of the GPS. As a minimum he:
    - Verifies the PA location and transmits the location (easting (E), northing (N), and altitude (alt)) and radius per pair (if operating in paired howitzers) to the POC.
    - Coordinates with the BC and survey team for emplacement of survey control points (SCPs).
    - Selects location of SCPs, release points, and rally points as required.

    - Verifies that SCPs are properly marked and conducts independent secondary check of all survey data.
- Assists and advises the BC during battery RSOP planning.
- Selects the location for the POC and makes a radio check with battalion to ensure radio communications capability.
- Provides FDO worst case site to crest data for computation of XO's min QE.
- As required, reconnoiters possible logistics release point (LRP) locations within or close to the PAs ensuring areas selected do not compromise platoon positions.
- Initiates the platoon security plan as a part of his detailed RSOP.
- Identifies the location of any friendly elements within or adjacent to the area of operation.

EQUIPMENT REQUIREMENT

2-16. The GSG is the primary reconnaissance expert for the platoon and spends the majority of his time away from the platoon. He must have his own combat vehicle with a driver, long-range radio, and secure GPS/PLGR.

PALADIN CHIEF OF SECTION

GENERAL DUTIES

2-17. The Paladin chief of section (COS) is responsible for all operations of the Paladin section. He normally positions himself at the DU during firing and movement.

SPECIFIC DUTIES

- Initializes and operates the AFCS while ensuring that independent secondary checks are conducted for procedures.
- Monitors AFCS during navigation.
- Selects firing positions within assigned fire area.
- Selects hasty occupation firing positions for the Paladin while conducting tactical movement.
- Ensures that no more than 16 miles (27 km) is traveled between each navigation update when not GPS/PLGR aided.
- Performs zero-velocity updates (ZUPTs) when prompted unless otherwise directed.
- Ensures digital and voice communications are established and maintained.
- Plans and coordinates for the security of the howitzer section as designated by the platoon sergeant. (Note: The senior COS is responsible for security in multi-howitzer operations).
- Directs personnel rotations between the howitzer and the FAASV. Cross-trains crewmen in all section duties. Special emphasis will be placed on training the

gunner and ammunition team chief in the operation of the AFCS.
- Ensures that all required reports are submitted to the POC in an accurate and timely manner.
- Coordinates logistical support and maintenance requirements with the FDO, platoon sergeant, GSG, or platoon leader.
- Supervises preventive maintenance checks and services (PMCS) and other maintenance as directed by applicable technical manuals on assigned equipment.
- Maintains ammunition accountability for both his howitzer and FAASV.

DUTIES BEFORE FIRING

- Ensures the AFCS is properly initialized/updated/checked at an established SCP.
- Operates or supervises the operation of the AFCS in both operational and degraded modes. Monitors and verifies all data input into the AFCS.
- Selects a suitable firing position.
- Designates the position for the FAASV.
- Operates the AFCS, radios, and hydraulic control box.
- Directs the driver to orient the howitzer on the general direction of the AOF provided by the POC.
- Commands "PREPARE FOR ACTION."
- Supervises the conduct of prefire checks.
- Assists the driver with the travel lock by elevating the cannon tube with the COS hydraulic control handle.
- Verifies the position location by use of a GPS/PLGR aiding, independent GPS/PLGR, a SCP, adjacent howitzer with good location, or map spot. Map spot is the least reliable but most readily available method when not GPS/PLGR aiding.
- Records position data.
- Determines maximum tube elevation.
- Determines site data.
- Sends piece status. (At this point, the howitzer is considered "ready to fire".)
- Establishes a distant aiming point (DAP) if available.
- Ensures the ammunition data for the howitzer and FAASV are correct, accurately input into the AFCS, and updated after each fire mission.
- Ensures an accurate powder temperature is input in the AFCS and is updated as required.
- Ensures the gunner verifies boresight.

DUTIES UPON RECEIPT OF FIRE MISSION

- IAW TM 9-2350-314-10, Chapter 2-15.

PREPARATION FOR MOVEMENT

- Commands "MARCH ORDER."
- Gives movement instructions to the ammunition team chief (ATC).
- Normally, the section moves on its own (for survivability moves) based on guidance received from the POC and under the direction of the senior COS.
- Transmits a piece status upon completion of the move.

GUNNER

2-18. The gunner must be aware of the status of the section and prepared to assume the duties of the COS or the ATC to facilitate 24-hour operations. He operates the AFCS as directed by the COS.

DUTIES BEFORE FIRING

- Unlocks turret lock, secures ballistic shield, and releases spade pins as required.
- Assists with determining mask data by sighting through the bore and directing the COS's movement of the tube.
- Conducts prefire checks as directed by the chief.
- Establishes an alternate aiming point using a DAP (if available) or emplaces the collimator (as required). Records data to the alternate aiming point.
- Reports the temperature of the propellant being fired (on-board howitzer, FAASV, or outside cache) to the COS every two hours or as required by TSOP/POC.

DUTIES UPON RECEIPT OF FIRE MISSION

- Assists the COS in conducting safe howitzer operations.
- Announces the propellant and charge, prepares charge, loads charge, closes breech, and ensures unused increments are stowed in propellant canister.
- Verifies firing data on DU by checking for the following: lay key is backlit, actual and commanded QE and deflection (df) match, and the prompt, "warning tube is not in laid position" is not displayed. If data is correct, the gunner announces "VERIFIED." If data is not verified or data is incorrect, he announces "CHECK FIRING."

PREPARATION FOR MOVEMENT

- Locks the turret lock and secures the ballistic shield.
- Notifies the COS that the howitzer is ready to move.
- Monitors and reports AFCS data to COS during movement.

NUMBER 1 CANNONEER

DUTIES BEFORE FIRING

- IAW TM 9-2350-314-10, Chapter 2-15.

DUTIES UPON RECEIPT OF FIRE MISSION

- IAW TM 9-2350-314-10, Chapter 2-15.

PREPARATION FOR MOVEMENT

- IAW TM 9-2350-314-10, Chapter 2-15.

HOWITZER DRIVER

DUTIES BEFORE FIRING

- Records mileage after last navigation update. Reports to COS when howitzer approaches 16 miles (27 km) since last update.
- Conducts prefire checks.
- Closes the driver's hatch.
- Sets the throttle to 1000-1200 revolutions per minute (RPM) while operating the hydraulic system.
- Operates the remote travel lock and commands "ELEVATE".
- Scans his sector defined by the chief and reports any unusual activity.

DUTIES UPON RECEIPT OF FIRE MISSION

- Ensures driver’s hatch is closed, and remains in the driver's compartment and monitors instruments.
- Sets the throttle to 1000-1200 RPM.
- Records firing data on Department of the Army (DA) Form 4513, *Record of Missions Fired*.
- Scans his immediate front and reports any unusual activity.

PREPARATION FOR MOVEMENT

- Maintains DA Form 4513 IAW FM 6-50.
- Operates the travel lock.

AMMUNITION TEAM CHIEF

2-19. The ATC must be proficient in mounted land navigation. He must be prepared to assume the duties of the gunner or COS during 24-hour operations. He supervises the cannoneers assigned to the FAASV and must be capable of operating the AFCS.

DUTIES BEFORE FIRING

- Positions the FAASV as directed.
- Commands "PREPARE FOR ACTION."
- Starts the auxiliary power unit (APU) and positions conveyor.
- Reports the current ammunition inventory and powder temperature to COS as needed.

DUTIES UPON RECEIPT OF FIRE MISSION

- Maintains DA Form 5969-R, *Section Chief's Report*.
- Verifies shell, charge, fuze setting (when in the mated position), and reports powder temperature as required.

PREPARATION FOR MOVEMENT

- Secures the conveyor and shuts down the APU.

AMMUNITION VEHICLE DRIVER

DUTIES BEFORE FIRING

- Positions the FAASV as directed by the ATC.
- Sets the brakes.
- Remains in the driver's compartment, monitors the instruments as required, and scans his sector as defined by the ATC.

DUTIES DURING FIRING

- The driver performs duties as directed by the ATC.

PREPARATION FOR MOVEMENT

- Releases the brakes and prepares to move.

NUMBER 2 CANNONEER

2-20. The number 2 cannoneer is normally the second senior soldier on the FAASV. He must be prepared to assume the duties of the ATC during continuous operations.

DUTIES BEFORE FIRING

- Opens the lower rear door and extends the conveyor for operation, assisted by the number 4 cannoneer.
- Connects (if mated) communications between the FAASV and the howitzer as required.
- Places the powder thermometer in the powder charge, prepares powder charges for firing and reports powder temperature to the ATC.
- As directed by the CS, helps the gunner emplace the collimator (for mated operations).

DUTIES DURING FIRING

- Prepares powder charges.
- Carries ammunition to the howitzer if required.

PREPARATION FOR MOVEMENT

- Disconnects (if mated) communications between the howitzer and the FAASV as required.
- Retracts the conveyor and closes the rear door.

NUMBER 3 CANNONEER

DUTIES BEFORE FIRING

- Prepares the conveyor for operation.
- Prepares ammunition for firing.

DUTIES DURING FIRING

- Places the projectile on the conveyor dead-end section.
- Operates the conveyor controls.

PREPARATION FOR MOVEMENT

- Assists the number 2 cannoneer in retracting the conveyor.

NUMBER 4 CANNONEER

DUTIES BEFORE FIRING

- Prepares the conveyor for operation, assisted by the number 2 cannoneer.

DUTIES DURING FIRING

- Prepares ammunition for firing.
- Carries ammunition to the howitzer as directed.

DUTIES AFTER FIRING

- Returns ammunition to the stowed configuration.

Chapter 3

Operations

This chapter addresses Paladin battalion, battery, platoon, and section level operations. Additionally, it provides TTP for Paladin unique occupation procedures and insights on CSS for Paladin units.

SECTION I — BATTALION OPERATIONS

BATTLE COMMAND

3-1. Battle command is the art of decision making and leading. It includes controlling operations and motivating soldiers and their organizations into action to accomplish missions. The battle command process of a Paladin battalion is impacted by four methods of employment available for the three firing batteries. Firing batteries can be employed using battery, platoon, paired, and single howitzer methods. Effective battle command relies upon well-trained subordinate units because each of the three batteries may employ various methods as dictated by METT-TC. The battle command process with each method must be rigorously rehearsed to enable rapid delivery of fires in support of the maneuver commander.

TACTICAL OPERATIONS CENTER (TOC)

3-2. Within the battalion command post (CP) the operations, intelligence, and fire direction sections make up the TOC. The TOC provides C2 for current and future operations. The battalion S3 is responsible for TOC operations. Its composition is the same as all cannon field artillery battalions. TOC operations are discussed in FM 6-20-1.

Jump TOC

3-3. The jump TOC is an element of the main TOC specifically designed to facilitate the movement of the main TOC. It is normally characterized as a vehicle(s) and personnel capable of reconnaissance of the TOC's planned route and future position. It establishes local security and communications until the main TOC's arrival. The jump TOC may have to assume C2 of the battalion during the movement of the main TOC.

Designated POC

3-4. The S3 or battalion FDO may designate one POC to assume tactical fire control of the battalion based on the ability to communicate with battalion FDC and all other POCs. This method is most effective when the S3 or his designated representative is positioned at the designated POC prior to the battle handover.

MUTUAL SUPPORTED UNIT (MSU) OPERATIONS

3-5. MSU operations, while highly effective, require rehearsals and a great deal of coordination. Unit TSOPs must address the details of battle handover with the reinforcing field artillery battalion and the brigade fire support element (FSE). Tactical fire control will be simplified with a similar reinforcing battalion (i.e., cannon artillery). However, it is possible for a multiple launch rocket system (MLRS) battalion to assume control provided the reinforcing artillery commander clearly understands the tactical maneuver plan and all assigned essential field artillery tasks (EFATs).

DISPLACEMENT

3-6. The Paladin battalion uses the same displacement options as other platoon-based units. Under normal conditions, the smallest unit for tactical displacement is the platoon. This facilitates command, control, and logistical operations. The platoons move as individual march elements.

POSITIONING

3-7. The Paladin battalion is positioned to accomplish its assigned tactical mission. Considerations during PA coordination include the following:

- The ability to accomplish the battalion's essential fire support tasks (EFSTs) and EFATs. EFSTs/EFATs are the primary tools used by the battalion S3, the staff, and battery commanders to focus Paladin fires and prioritize tasks. EFSTs are discussed in FM 6-20-40. EFATs are discussed in FM 6-20-1.
- Maximum range requirements and available ammunition to support EFSTs/EFATs.
- Terrain suitability.
- Communications with higher, lower, and adjacent units.
- Survivability.
- Future operations.

TERRAIN MANAGEMENT AND COORDINATION

3-8. The S3 manages and coordinates terrain use with maneuver units. Land management considerations include using larger platoon areas of operation (compared to earlier M109 series howitzers) and sharing the same land with other units.

3-9. When an M109A6 battalion is assigned a DS mission, the fire support coordinator (FSCOORD) and his S3 anticipate the requirement to move the batteries and coordinate with the maneuver commander or S3 through the FSE. The commander, S3, and fire support officer (FSO) perform an initial map reconnaissance to identify possible PAs. These areas must allow the battalion to support the scheme of maneuver. The field artillery (FA) battalion reconnaissance survey officer (RSO) and/or the firing BCs and GSGs confirm suitability of positions by reconnaissance, as the situation permits.

3-10. At battalion level, the Paladin adds flexibility to the planning and coordination process. Because the traditional line of metal no longer exists, the Paladin platoon can occupy places unsuitable for conventional artillery. A Paladin unit can occupy wooded areas, urban areas, or areas with dense undergrowth. If an area is open enough for individual howitzers to establish an AOF (considering site to crest) and the ground is firm enough to allow one or more howitzers to move around, the area is suitable for M109A6 operations. Since there is no need to lay with an aiming circle, intervisibility between the Paladins is not absolutely required. However, it should be a consideration, as it allows for mutual defense and facilitates reciprocal lay in degraded operations.

3-11. A Paladin platoon PA may require an area on the order of 1,500 by 3,000 meters. There may be more than one firing area within a platoon PA. The greater the threat of counterfire, the more the Paladin conducts survivability moves within a given firing area. However, Paladin does not require sole use of this terrain. With proper coordination, maneuver units can pass through a Paladin PA without disrupting operations.

3-12. The Paladin battery normally operates in a band of terrain 1 to 8 km behind the forward maneuver units, competing with other friendly units for PAs. Maneuver commanders may resist sharing space with Paladin units because of the potential for enemy counterfire. This is particularly true for less mobile units. However, wide dispersion of Paladin across a brigade front minimizes the effectiveness of enemy counterfire. Since Paladin does not require sole use of terrain, land management is facilitated by the ability to co-use PAs.

3-13. Coordination of terrain with the supported maneuver unit must be continuous. The FSE at the maneuver CP is the focal point for this coordination. The emphasis at this level should be on "NO-GO" areas for the artillery, rather than attempting to allocate individual

PAs. The locations of friendly elements must be known in the battalion TOC, the battalion FDC, and the POCs. BCs and GSGs must keep the FA battalion S3 constantly apprised of problems encountered with friendly elements during reconnaissance and occupation of PAs. The battery commander should coordinate face-to-face with commanders in close proximity to his planned PA. This coordination may take place during brigade-level combined arms rehearsals.

SURVEY OPERATIONS

3-14. Survey operations must be carefully planned and controlled to maximize accuracy by minimizing circular error probable (CEP). As with traditional cannon artillery, all survey control should originate from a common source. Limited survey assets (two position azimuth determining systems (PADS) and one conventional survey party for six platoons), dispersed firing elements, and greater survey requirements demand a well-coordinated plan. If not GPS aided, the navigation subsystem (DRU-H) will require navigation updates. SCPs are necessary to ensure each howitzer maintains the following accuracy:

- Position - 18 meters CEP.
- Elevation - 10 meters probable error (PE).

3-15. If ZUPTs are not performed when prompted, the 18-meter CEP may be exceeded.

3-16. Survey planning and coordination are a critical aspect of survey operations. The planning process begins with guidance (priority of survey) from the battalion S3 and continues for the duration of the operation. Execution of the survey plan requires continuous coordination among the firing battery commanders, the S3, and the RSO.

COMMUNICATIONS

3-17. Survey information can be transmitted in a number of ways. These include face-to-face meetings, voice or digital radio communications, and written tags left at marked SCPs. Normally, survey information is transmitted to individual batteries by voice on the battery command net.

SURVEY CONTROL POINTS

General

3-18. SCPs are used to establish positional control. The locations of SCPs are prioritized based on time available and accuracy of the system. A confidence check point (CCP) is a SCP with an established end of the orienting line (EOL). When a howitzer's navigation system is experiencing failures it uses the CCP to conduct a confidence test. Confidence test procedures are found in TM 9-2350-314-10.

Navigation Update Points

3-19. A navigation update point is simply a surveyed point on the ground where the howitzer can update its location in the AFCS (E, N, and alt). As part of position improvement, a SCP should be established in the PA. Specific placement of the SCP is the responsibility of the BC or GSG and is based on their reconnaissance of the PA.

3-20. If there is no rearm, refuel, resupply, and survey point (R3SP) planned, the battalion should establish three SCPs along the route of march, spaced 50 - 100 meters apart. The SCPs should be easily identifiable, accessible, and within a reasonable distance of the release point of the tactical road march. Their use permits the entire platoon to update simultaneously, without holding up the rest of the battalion.

3-21. If the battalion has established a R3SP, there should be a SCP established at each heavy expanded-mobility tactical truck (HEMTT) tanker, permitting the howitzers to perform a navigation update while refueling.

Global Positioning Systems

3-22. A secure GPS can be used to establish SCPs that the howitzers can use for navigation update points. The use of secure GPS provides the PADS team the time and flexibility to accomplish other survey missions (i.e., task force mortars, target acquisition (TA) radars, and fire support teams (FISTs)). An independent, secondary check must be performed to validate the grid location determined by the secure GPS. Refer to FM 6-50, Chapter 4 for guidelines in using GPS.

Position Marking

3-23. SCPs are usually marked with a short wooden stake or a .50 caliber shell casing. The stake must be positioned where it can be seen from a distance. They are normally tagged with a distinctive survey marker and are positioned to allow the howitzer to navigate its front hub in close proximity to the marker. Each SCP requires the following minimum information: E, N, alt, spheroid, datum, and grid zone. The information should be legible and the letters large enough for the driver to read from his seat as he positions the gun's left front sprocket within one meter of the SCP. The information should be written in indelible ink on the conventional shoe tag, 3 x 5 card, or a small placard affixed to the stake facing the driver. All survey data must be verified using an independent, secondary check.

SECTION II — BATTERY OPERATIONS

BATTLE COMMAND

3-24. Battery operations are defined as one POC controlling all six howitzers in an area that is approximately 3,000 X 3,000 meters. The Paladin firing battery normally operates with two firing platoons. However, the BC may designate one POC to control all six howitzers to meet mission requirements. A typical example where this may occur would be fast moving operations where the BC designates a controlling POC and positions the other POC at a point to facilitate continuous operations. Battery operations are also used when one POC is degraded and not capable of fire direction.

EMPLOYMENT OF HOWITZERS

3-25. The controlling POC can employ the howitzers as one battery element, two platoons, in pairs, or as single howitzers. Employment is based on the commander's assessment of METT-TC (see Figure 3-1). Employment advantages using battery operations include standardization of crew drills for fire direction personnel, continuous operations, centralized battle command and logistical support, and enhanced security.

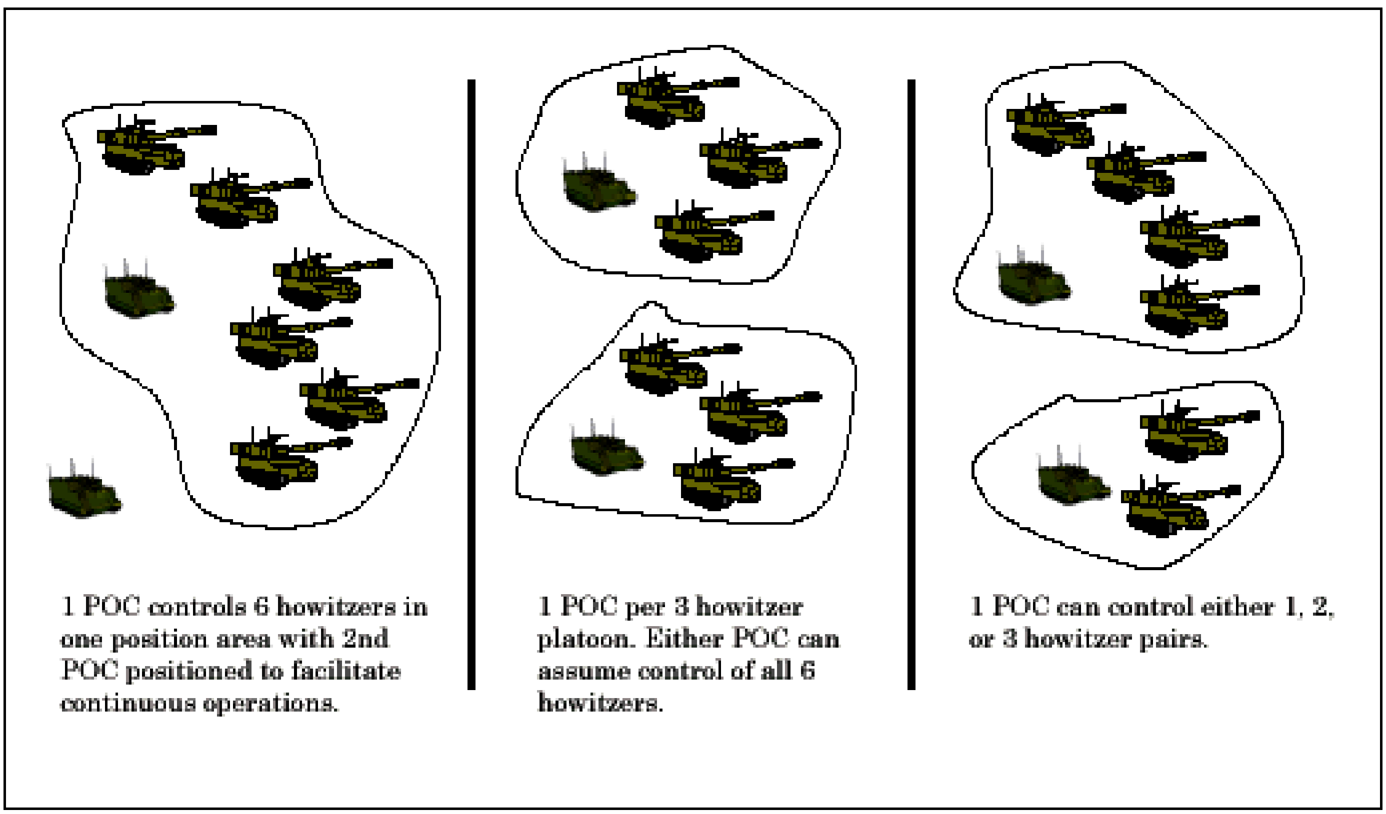


Figure 3-1. Employment Options

RECONNAISSANCE, SELECTION, AND OCCUPATION OF POSITION

(RSOP)

3-26. The battery commander must issue clear guidance and task organize to effectively reconnoiter battery positions. If the displacing elements move at the same time and are not greatly separated, one POC can control movement. If the elements move separately, either by time or route, movement reverts to platoon control. Separation of the platoons increases the difficulty of command, control, and logistics.

RECONNAISSANCE

3-27. The BC receives a warning order to relocate the battery. He is given general locations to reconnoiter for suitability. He assembles the reconnaissance elements of one or both platoons and rendezvous with a battalion survey team if one is available. The platoon reconnaissance element is normally the platoon GSG and his driver augmented with additional personnel to meet mission requirements. The following tasks must be accomplished during reconnaissance:

- Reconnoiter routes to the new PAs. Emplace SCPs along the route to perform navigation updates as required.
- Reconnoiter the planned platoon PAs and report their suitability to the battalion CP. Key concerns are the track plan, obstacles, site to crest, cant, and communications (i.e., POC to battalion FDC, POC to guns).
- Conduct face-to-face coordination with any friendly elements that may be in the vicinity. For a detailed discussion of conventional RSOP procedures, see FM 6-50, Chapter 2.

DISPLACEMENT

3-28. The Paladin battery can displace the same as all other platoon-based units (battery, platoon, pairs, sections).

Rapid Movement Option

3-29. Move rapidly to the new position. Disregard ZUPTs and navigation updates. Understand accurate firing unit location has been compromised and some method of registration is required. Establish firing unit location using hasty survey techniques. Conduct a navigation update using 5th order survey as soon as possible.

Survey Not Available

3-30. If survey is not available in the new position, the commander can expect the errors noted in the following graph (Figure 3-2):

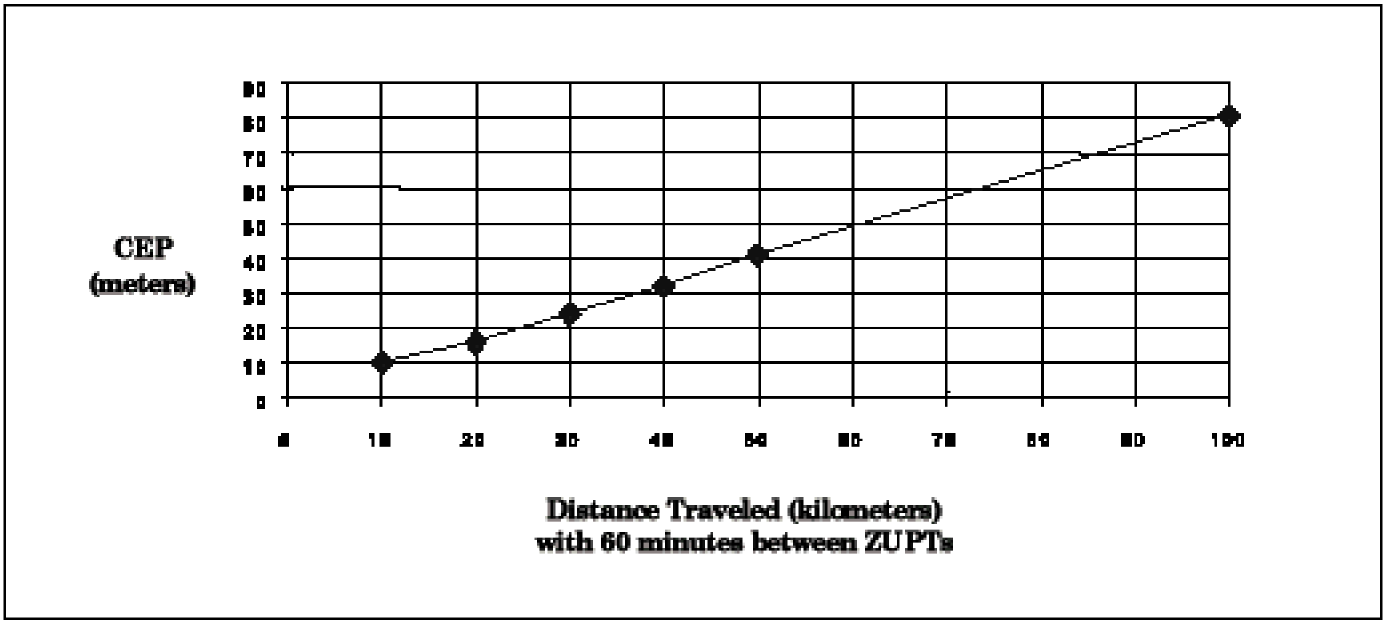


Figure 3-2. Circular Error Probable versus Distance Traveled

3-31. DRU-H data should be verified with a map spot or a GPS with particular attention given to altitude, as it is the most sensitive to traveling without an update.

POSITIONING SUPPORT ASSETS

3-32. The important consideration for positioning the battery support elements is that they must be able to respond quickly to platoon elements without encumbering operations. There are three options referenced in FM 6-50 for positioning battery support elements:

- Heavy-heavy.
- Heavy-light.
- Light-light.

3-33. The heavy-heavy option divides the support elements in half and assigns them to each platoon. The heavy-light option positions all of the support elements in one platoon PA. The light-light option positions all of the battery support elements in a separate location away from both platoon areas.

MOVEMENT CONSIDERATIONS IN THE OFFENSE

3-34. Paladin offensive operations are often non-stop and characterized by firing high volumes of missions. Positioning options in the offense are tied to movement methods designed to provide continuous fire support.

3-35. During a movement to contact/hasty attack, the battery may move in separate platoon formations and move the battery headquarters as a separate element. If the wedge formation is used, the platoons may travel in their own wedge or a battery consolidated wedge with the controlling POC and headquarters elements located inside the formation for protection. The other POC can be repositioned to assume control in a fast moving scenario. If the terrain is restrictive, the BC may move in columns to keep pace with the battle. Areas that must be addressed are the locations of the key leaders, maneuver graphics, terrain, and the scheme of maneuver.

3-36. The BC must consider the following during offensive operations:

- Navigation update points along the route of march.
- Rearm, refuel, and resupply operations.
- Hipshoot procedures.
- Location of the POC in the formation.
- Location of the platoon leader during movement.
- Distance between vehicles and positive identification of the trail vehicle in the maneuver formation.
- Situational awareness at the section level (i.e., changing maneuver graphics, minefield locations, chemical strikes, and location of enemy reconnaissance units).

ARTILLERY TROOP LEADING PROCEDURES

3-37. Troop leading procedures (TLPs) provide a mental framework to ensure complete preparation, dissemination, and execution of the battery mission. The process provides a checklist for all leaders from receipt of the mission to execution (FM 6-50, Chapter 2). The steps may occur out of order or simultaneously after receipt of the mission. It is imperative that leaders understand that TLPs will be tailored for Paladin specific tasks. For example, EFATs will dictate turret load, FAASV load, movement options, resupply options, and other tactical considerations.

SECTION III — PLATOON OPERATIONS

BATTLE COMMAND

3-38. Platoon operations are defined as a POC controlling three howitzers in a PA that is approximately 1,500 X 3,000 meters (see Figure 3-3). The numbers of howitzers in each platoon may be altered and various employment techniques can be used to meet mission requirements. C2 is critical to maintaining responsiveness and survivability of the platoons. TLPs reinforce and expedite dissemination of information to the section chief.

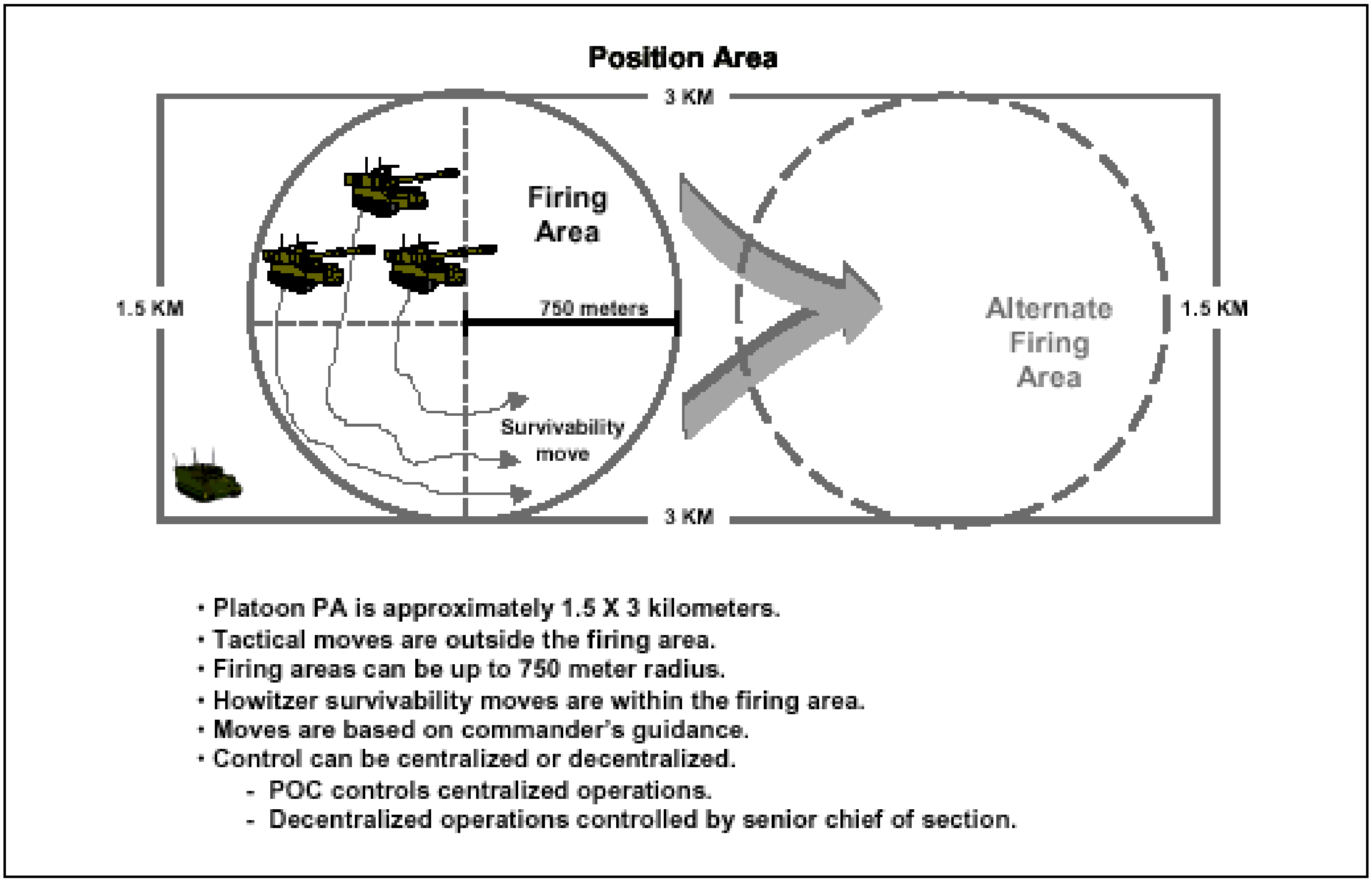


Figure 3-3. Platoon Operations

3-39. Issuance of orders is a critical link in fire mission processing. The POCs must be positioned to receive C2 from battalion and to issue C2 to the sections. To ensure this, the GSG must make communications checks with battalion as part of the RSOP procedures. He must assess the ability of the POC to communicate with all of the howitzers in each firing position.

RSOP

RECONNAISSANCE

3-40. The BC and GSG must determine the suitability of the position for Paladin operations and determine whether enemy ground forces, mines, or chemical hazards are present. Since there is no need to establish individual howitzer positions or determine initial deflections the advance party will usually consist of only the GSG and his driver. However, it may include any other personnel specified by the unit TSOP or required by the tactical situation. The primary function of the advance party is to determine what general areas or zones that his unit can operate within as a battery or platoon of howitzers. Mine sweeping and chemical monitoring are performed consistent with the threat.

3-41. Enroute to the new platoon PA, the GSG coordinates with the BC or RSO for the locations of the SCPs required for updating the howitzers while enroute. The GSG verifies the SCPs, establishes a track plan, and reports any problems to the BC or platoon leader to include locations of friendly and enemy elements. RSOP operations are facilitated with the GSG's card. An example card is shown at Figure 3-4.

Task	Planned	Actual
Center Grid (only refine if necessary	E: N: Alt:	E: N: Alt:
Radius (meters)		
Min QE of Immediate Crest		
Range		
Sight		
Object		
Radio Check with Battalion FDC	Yes/No	
Entry Point		
Grid	E: N:	E: N:
Description		
POC Location	E: N:	E: N:
Terrain Restrictions		
Route Restrictions		
Firing Area Restrictions		
Visible Distant Aiming Point	Yes/No Description:	
Travel Time		
Rally Point		
Additional Information		
Note: Send the ready to fire information as soon as it is determined. Send as much of the report as is completed before platoon departs from start point.		

Figure 3-4. Example Gunnery Sergeant's Card

3-42. The GSG identifies the POC location, potential target reference points (TRPs), and enemy avenues of approach. This information is graphically displayed on the initial PA/defensive diagram and given to the platoon sergeant/platoon leader upon his arrival (time permitting). After the platoon sergeant/platoon leader refine and approve the defense diagram/firing area map, the POC will use it to overlay the HTC (see Chapter 4).

3-43. Note: If the platoon is operating in a fully degraded mode, the platoon leader can use M109A5 tactics. FM 6-50 explains conventional RSOP procedures. Consider restrictions in TM 9-2350-314-10.

DISPLACEMENT-SURVIVABILITY MOVES

3-44. In a mid- to high-intensity threat environment, the COS must assume that the enemy's TA assets acquire the first round fired from any position. In this case, the enemy may respond in as little as 5 to 12 minutes. The Paladin survives with the combination of movement and dispersion. A survivability move of 300 to 500 meters removes the platoon or howitzers from the target footprint of most threat artillery systems. The FSCOORD, S3, and BC evaluate the available intelligence preparation of the battlefield (IPB) and issue guidance to the platoons concerning survivability measures. Managing survivability moves requires teamwork between the howitzers and the POC.

METHOD OF CONTROL

3-45. The POC must coordinate movement of the howitzers within the platoon area. The BC can move his vehicles within the firing area by either a decentralized or centralized method. With the decentralized concept, the POC provides movement criteria and the senior COS of the platoon directs movement of the howitzers to the new firing positions within the firing area. Centralized movement requires the POC to tell the howitzers when and/or where to move. See Chapter 4 for more details on control of howitzer movement.

METHODS OF POSITIONING THE POC

3-46. To avoid enemy counterfire, the POC should be positioned outside the firing area. It must be located to effectively communicate with battalion FDC and its guns. Once positioned, the POC does not routinely move within the platoon area but relies on cover and concealment to survive.

METHODS OF EMPLOYING HOWITZERS

Platoon

3-47. Within a platoon PA, three howitzers are normally positioned individually and work together under the supervision of the senior COS. The three section chiefs coordinate movement and move as a team. The sections maximize dispersion based on the factors of METT-TC. The method of employment depends on the tactical situation. As an example, a platoon may operate as single sections to maximize dispersion during a high air threat. The number of howitzers in each platoon may be changed to execute multiple missions or special missions. The normal platoon configuration is one POC controlling three howitzers. The advantages to positioning Paladins as a platoon versus a battery are as follows:

- Provides dual mission capability (multiple missions).
- Better leader ratio (gunnery and platoon sergeants, platoon leaders).
- Increased survivability (more dispersed).
- Facilitates communications (more dispersed with two POCs).

Paired

3-48. This concept requires two howitzers to operate in a firing area with a radius up to 750 meters. A senior COS is designated and he acts as the team leader. During paired operations, the two howitzers move together and should stay visible to one another. Survivability is enhanced by maintaining a distance of at least 100 meters between the howitzers in the pair. When METT-TC allows, chiefs of section should maximize separation. Howitzers can be much closer than 100 meters in built-up or heavily wooded areas. They can be farther apart in more open terrain, such as the desert, but must be vigilant to stay in their assigned area. BCs and platoon leaders should consider paired howitzer operations when the enemy counterfire threat is high and the threat from a dismounted ground attack is low. The advantages of paired operations over single howitzers are:

- Allows for mutual ground and air defense.
- Provides an independent check of position and azimuth.
- Gives ability to perform degraded operations (see Appendix A).

Single Howitzer

3-49. Single howitzer operations are one section operating autonomously in an exclusive firing area. The POC controls the section and it is placed on the HTC (see Chapter 4) as a separate firing area. This is the most difficult operational mode to battle command, as it requires the highest degree of crew training and provides no means for mutual support against ground or air threats.

TERRAIN MANAGEMENT AND COORDINATION

3-50. The M109A6 howitzers operate in a dispersed manner. They make survivability moves of 300-500 meters within a firing area and operate in a 1.5 X 3 kilometer platoon PA. This is about the same amount of space currently used by a prior M109 series platoon in establishing its two (primary and alternate) PAs. The key differences are discussed below:

3-51. Non-M109A6 units must select new PAs for survivability moves. Paladin units make all survivability moves within the same firing area.

3-52. Non-M109A6 units must have prepared alternate positions, while Paladin units do not. If a firing position becomes untenable, a Paladin can move to another firing position within its firing area to continue its mission (survivability move).

3-53. The Paladin can use areas not suitable for other cannon units. An area that prior M109 series platoons could not occupy may provide several single/pair M109A6 positions.

3-54. Paladin units do not need to be sole users of a platoon PA. Sharing land must be coordinated through the FA battalion S3. BCs must conduct face-to-face coordination with the unit commander sharing common ground.

SECTION IV — SECTION OPERATIONS

BATTLE COMMAND

3-55. A section, consisting of a howitzer and a FAASV, normally operates as one of three sections in a platoon, but may operate alone in a firing area under the control of the POC. Normally, the COS is responsible for both vehicles, although there may be times (such as during periods of intense high volume indirect fires) when the FAASVs will fall under the control of the platoon sergeant. Section operations are the least preferred option because the section is isolated and must provide its own defense. The COS relies on the ATC to overwatch the howitzer, particularly during firing.

RSOP

DISPLACEMENT

3-56. The section performs survivability moves to new firing positions within a firing area assigned by the POC. The COS coordinates movement with the ATC on the FAASV. The new position is improved as time permits.

Centralized

3-57. Sections operating under purely centralized control move as directed by the POC. This method of control may be dictated by the tactical situation, or may be used by units with inexperienced crews. The S3 may impose centralized control prior to executing scatterable mine (SCATMINE) minefields, preparations, or counter-preparations to ensure that the battalion can mass.

Decentralized

3-58. Normally, the platoon will operate in a decentralized mode. The COS must be able to choose a specific firing position within a firing area. As a minimum, he should keep in mind the following items:

- Center sector of fire.
- Obstacles to firing within the sector (site to crest).
- Communications with the POC.
- Any natural or man-made objects that provide protection or deter detection from the enemy.
- Any friendly elements sharing the firing area which may be endangered if the Paladin is targeted.

POSITIONING OPTIONS

3-59. The platoon sergeant can use the following methods:

Mated

3-60. When mated, the gun must be on spades and the FAASV conveyor extended into the back door of the howitzer. The FAASV top rear door must be closed to avoid blast overpressure problems for the M992.

3-61. **Advantages.**

- Crew endurance is increased because personnel handle the ammunition less than in any other FAASV configuration.
- All rounds can be fired from the ammunition carried on the FAASV instead of firing on-board ammunition from the howitzer ammunition racks.
- Crew rotation for sleep and section defense is enhanced by close proximity of all crew members.
- The howitzer can draw electrical power from the FAASV for degraded operations.

3-62. **Disadvantages.**

- The howitzer rear door must be open to allow the ammunition feed path from the FAASV to operate effectively.
- The crew compartment of the howitzer is susceptible to nuclear, biological, and chemical (NBC) contamination.
- Exposes the crew to blast over pressure when firing M203 and M119-series charges.
- Counterfire survivability of the section is reduced because of the proximity of the howitzer to the FAASV.
- Using spades increases emplacement and displacement time and exposes crew to small arms fires.

Separated

3-63. When separated the FAASV conveyor is not extended into the howitzer. The FAASV should be positioned far enough away from the Paladin to minimize the effects of enemy artillery, but near enough to supply the howitzer ammunition. The distance from the FAASV to the howitzer is METT-TC dependent. Intervisibility between the howitzer and the FAASV must be maintained.

3-64. **Advantages.**

- FAASV ammunition resupply simplified.
- Less susceptible to enemy artillery fire.
- Blast protection maximized.

3-65. **Disadvantages.**

- Ammunition resupply to howitzer is more manpower-intensive.
- Crew rotation is reduced.
- Sleep plan more difficult.

Overwatch

3-66. The FAASV is positioned to provide early warning to the howitzers. It is positioned on terrain to cover danger areas or high-speed avenues of approach. Separation between the two vehicles may allow occupation of areas unsuitable for mated vehicles. There is no blast over pressure problem. The FAASV is normally positioned in the platoon PA but is not tied to howitzer location or movement. Emphasis is on concealing the FAASV, particularly from air observation.

3-67. **Advantages.**

- Enhanced defensive capability.
- FAASV is less susceptible to counterfire directed at the gun.
- Reduced visual signature.

3-68. **Disadvantages.**

- Ammunition resupply takes longer.
- Crew is separated and not immediately available.
- Sleep plan more difficult.
- Must fire only from ammunition on the gun.

SECTION IV — OCCUPATION

PROCEDURES

3-69. This section outlines standard occupation procedures for Paladin units. These procedures provide reasonable assurances that all rounds fired will impact accurately and safely.

3-70. The Paladin occupation procedures are designed to maximize the system capabilities and allow the Paladin unit to train as it will fight.

3-71. The procedures outlined in this section describe a system of independent checks for both the POC and howitzer databases and related firing data. Independent checks are necessary to ensure that someone other than the person who performs the action verifies all actions that affect firing data. Though most independent checks take place before missions are received, performing secondary independent checks is a continuous process, and must be rigidly enforced to ensure fires are timely, accurate, and safe.

3-72. The employment of the Paladin howitzer is divided into four phases: initialization, conducting the tactical move, occupation of the position, and during firing.

PHASE I: INITIALIZATION

Howitzer

3-73. Initialization/database checks occur either in the motor pool or whenever the AFCS has been shut down (IAW procedures found in TM 9-2350-314-10, Chapter 2). Unit

TSOPs should list explicitly those settings to be made at the howitzer. Upon completion of initialization, the howitzer will conduct a verification mission with the POC to ensure accuracy of the ballistic solution. The platoon leader, assisted by the platoon sergeant and GSG will verify each howitzer's initialization database. At a minimum, they will verify the initialization grid (E, N, and alt).

POC

3-74. The POC initializes the LCU IAW procedures found in the applicable technical bulletin and their battalion TSOP. The Paladin weapons dependent program has five unique formats, two of which need to be completed during initialization (the HOW;SBT and HOW;UPDATE). The FDO/chief computer verifies that all entries made by the LCU operator are correct. Once communications with the guns are established, the POC will transmit the subscriber table, map modification (MAP MOD), met, and other pertinent ballistics data to the guns. This information flow is transparent to the guns.

3-75. **Verification Mission.** Once the guns have initialized, the POC will initiate a verification mission, specifying a converged sheaf, charge, shell-fuze combination, and lot using BCS (SYS;SETUP, GUNORD;X). This will produce firing data at the LCU which the POC records. Next, the POC removes X from the GUNORD field and re-executes the mission to all howitzers. The AFCS at each howitzer will compute firing data. The chiefs report charge, deflection, quadrant, and fuze time (if applicable) to the POC. The POC will compare the data computed by the AFCS to the data computed by the LCU. The data must agree within the following tolerances:

Table 3-1. Verification Mission Tolerances

Data Item	Version 10 or Higher
Fuze Time	0.1 second
Fuze Variable Time (VT)	1 second
Deflection	2 mils
Quadrant	2 mils

3-76. Verification missions must be conducted after initialization, or when an AFCS or LCU has powered down and powered back up again, or when a significant change to the database occurs. A significant change is one or more of the following: change in met, MVVs, or registration corrections. A howitzer's location is not considered a change, if the howitzer's location was properly verified by an independent means. Comparison between the AFCS data and the LCU data highlights gross inaccuracies in MVs, ammunition, fire unit, met, registration corrections, and powder temperature.

PHASE II: CONDUCT TACTICAL MOVEMENT

Howitzer

3-77. After initialization is complete, the guns are given movement orders by the POC. The movement order includes the guns proposed location, center sector AOF, start point (SP) time, and movement radius. The POC will use the location and radius provided by the GSG for use with the HTC.

3-78. If the tactical move is less than 27 kms, ZUPTs are performed and no faults detected, the howitzers begin occupation procedures. If faults are detected, acknowledge fault and perform appropriate level of degraded operations IAW Appendix A. If movement is greater than 27 kms or ZUPTs not performed, conduct navigation update at a SCP prior to arrival. Along the route of march close to the battalion release point or at an R3SP there will be one to four SCPs set up as described in Section I. The platoon arrives at the SCP and performs a navigation update. Upon completion of the navigation update, the section completes the movement.

3-79. If the DRU-H is GPS aided, units are not required to perform navigation updates and the AFCS normally will not prompt the operator to perform ZUPTs.

POC

3-80. The POC transmits movement orders to the guns, sending them to a platoon PA. Included in the movement order is the center sector, left and right sector limits (if necessary), grid coordinates, SP time, and radius. Other instructions should be sent to the howitzer using a plain text message or voice communications.

PHASE III - OCCUPATION OF POSITION

One Howitzer

3-81. Once the howitzer stops, the COS records his position from the DU. Concurrent with this action, the howitzer's location is independently verified by the COS if not GPS aided. Next, the COS presses the arrive key which automatically transmits the piece status to the POC. Simultaneously, the driver releases the travel lock and the other members of the section conduct pre-fire checks.

3-82. The COS actions the maximum (max) tube elevation screen, and determines/inputs a one-line site entry between his left and right sectors of fire. It is recommended that the COS sweep 400 mils left and right of his center sector of fire to determine his one line site data. As part of position improvement, the COS will establish 6,400 mil site data. These entries will cause a warning message to be displayed on the DU if the firing limits are violated, except for load elevation. Occupation of position procedures are illustrated in the flow chart in Figure 3-5.

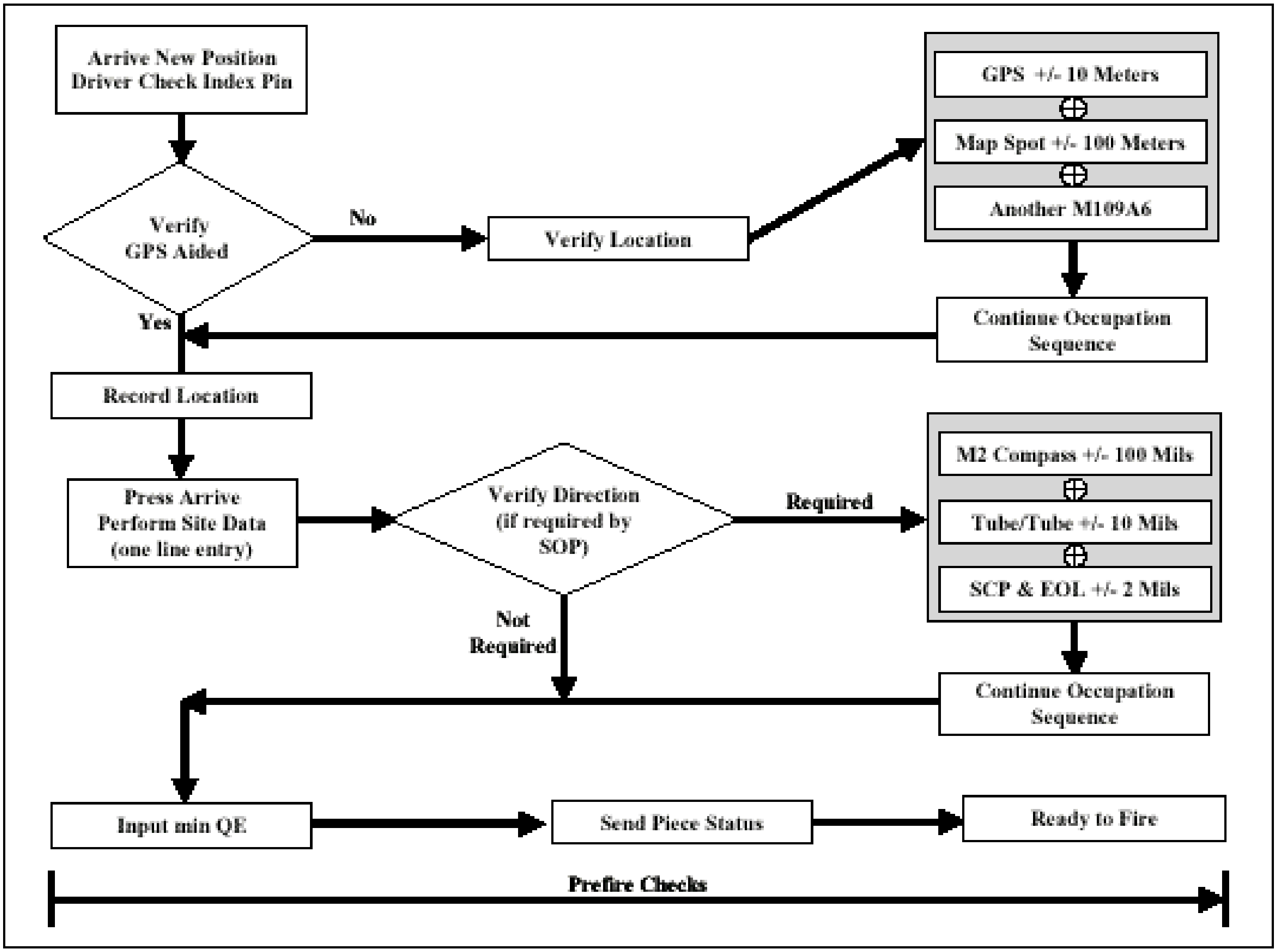


Figure 3-5. Occupation of Position Flow Chart

3-83. Once these checks are completed, the gun is considered safe and ready to fire (RTF). The RTF times are found in ARTEP 6-037-30 MTP, Appendix A (Table A-7 for normal occupations and Table A-7.1 for emergency/hipshoot missions). Next, the COS directs position improvements. These actions include but are not limited to: verifying boresight; establishing alternate aiming points; establishing 6,400 mil site data; visually identifying TRPs; establishing sectors of fire for crew served weapons; and transmitting updated piece status to the POC.

POC

3-84. Refer to Chapter 4 for POC occupation drill.

PHASE IV - DURING FIRING

Howitzer Crew

- Section chief announces fire commands.
- Driver will record commands on the DA Form 4513.
- Chief verifies that fire commands are applied as announced (projectile, charge, and fuze).
- While laying the howitzer, the chief will verify the following to ensure the howitzer is properly laid: lay key is backlit, commanded and actual deflection/quadrant match, and the warning prompt, "warning tube is not in lay position" is not displayed.
- The gunner verifies the lay data and announces "verified." (If gunner does not announce "verified", or data is not correct, "CHECK FIRING!" is announced, reason(s) why the command is unsafe are given, and corrective action taken)
- The chief then commands the number 1 man to prime, hook-up, and fire.

3-85. The POC is responsible to conduct a verification mission every time there is a significant change in the database, MVVs, met, and registration data. The POC is responsible for verifying that targets do not violate FSCMs 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 the LCU.

SURVIVABILITY MOVES

3-86. After completing a survivability move, if the howitzer remains within the prescribed radius, the requirement exists to determine site data, verify min QE, and transmit piece status (see Figure 3-6). For position improvement the howitzer section would input max QE, refine site data, send new piece status, and establish alternate aiming points.

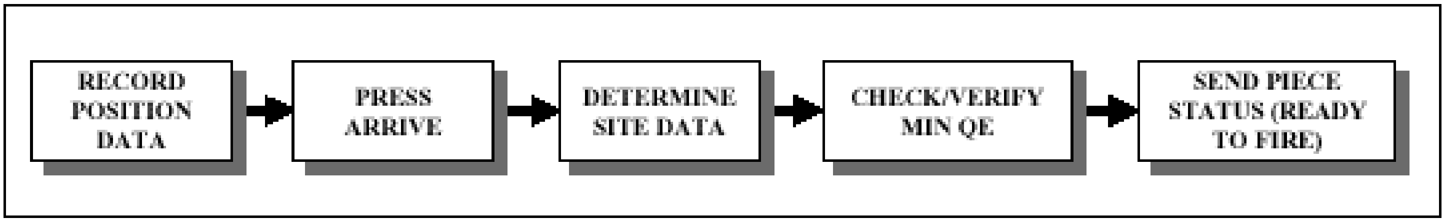


Figure 3-6. Occupation from Survivability Move

EMERGENCY MISSIONS INSIDE FIRING AREA

3-87. These procedures apply when conducting survivability moves inside an assigned radius and the howitzer receives a fire mission. The COS takes the following actions: find a suitable location; press arrive key, press use all, and press enter on min QE screen; verify immediate crest along the commanded deflection and quadrant; and execute the fire mission (see Figure 3-7). There is no requirement to recompute firing limits since the howitzer is within its assigned radius.

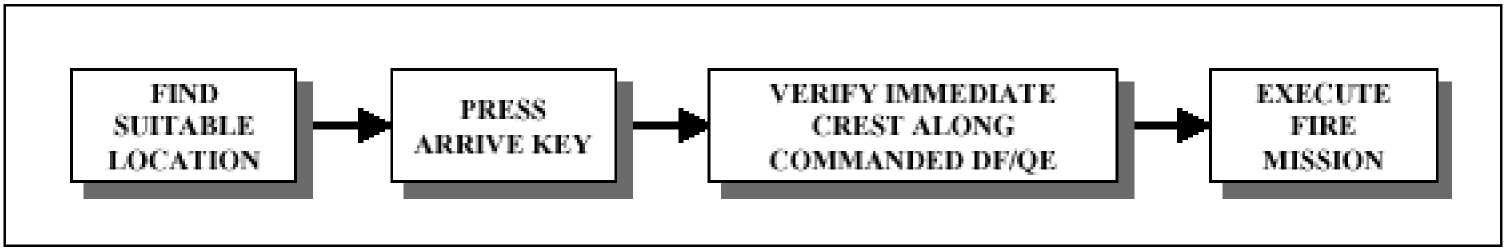


Figure 3-7. Emergency Mission Inside Firing Area

EMERGENCY MISSIONS OUTSIDE FIRING AREA (HIPSHOOT)

3-88. The procedures for emergency missions outside the firing area (see Figure 3-8) are identical to emergency mission procedures inside a PA. The COS must verify his immediate crest along his commanded deflection. The POC announcing "fire mission" over the voice net enables the COS to reference his movement screen in verifying location.

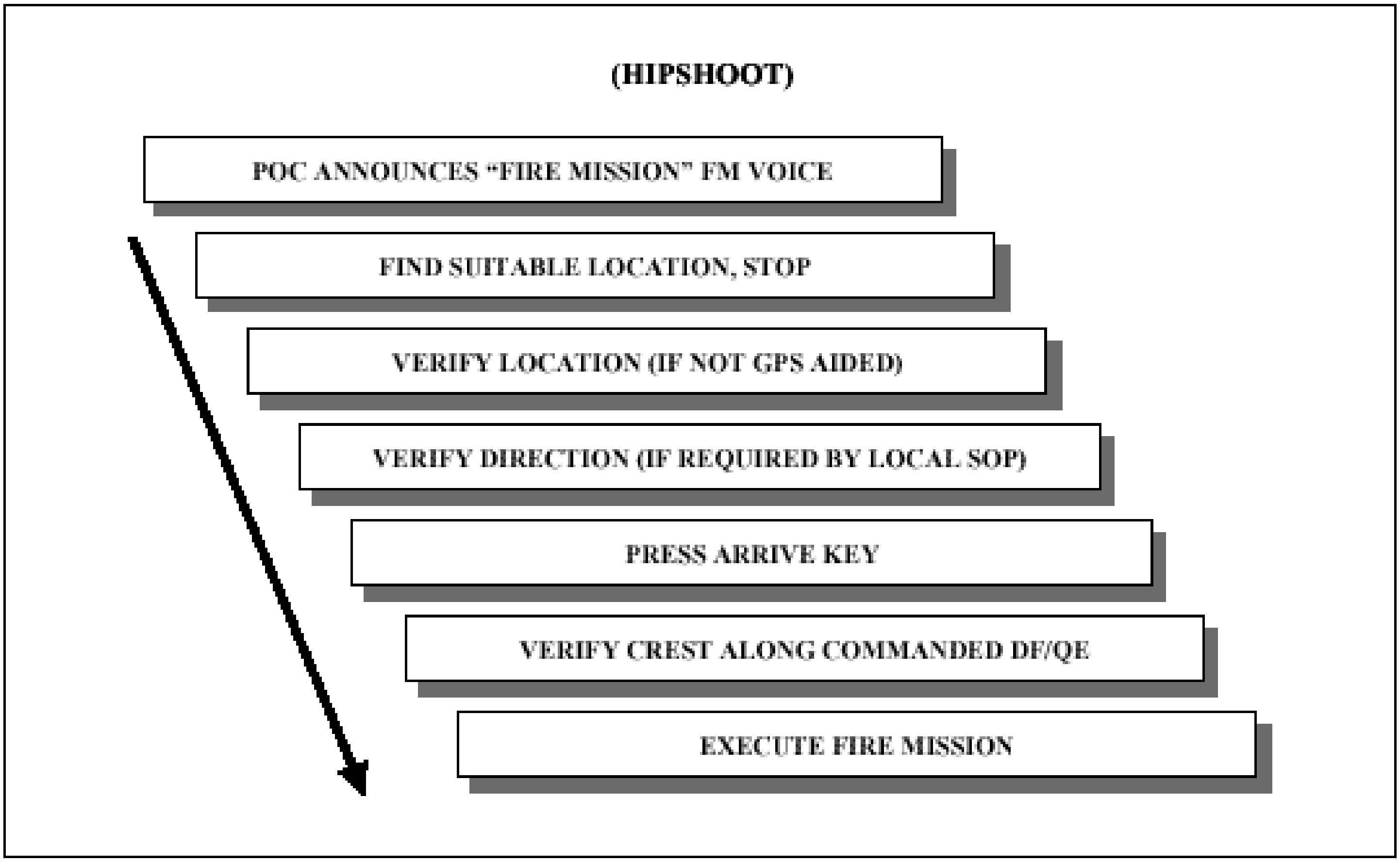


Figure 3-8. Emergency Mission Outside Firing Area (Hipshoot)

3-89. Once the howitzer has stopped moving, if it is not GPS aided, the position is checked by a secure GPS and the COS verifies location.

3-90. The POC will ensure there are no intervening crests and the target does not violate any FSCMs.

VERIFYING DIRECTION

3-91. The DRU-H is extremely accurate and dependable in maintaining directional control for the Paladin system. There is no requirement for the operator to check the Paladin for directional control during normal operations. However; some units may require operators conduct verification of direction of the system. If verification of direction is used, the following proven techniques will give leaders a reasonable assurance that directional control of the Paladin is operational. The COS must always be aware of the AOF as it relates to the tactical situation. This is particularly important when traveling or conducting survivability moves, as the section chief can position to shoot emergency missions and resolve mask problems during occupation much faster. During occupation, the COS should ensure the howitzer hull and gun tube is oriented along the AOF. This will ensure faster mission times when attacking targets along the AOF. Before he takes the tube from travel lock, he may conduct verification of direction to ensure the system is reporting proper direction. He can verify direction using the M2 compass method, tube to tube method, or any of the methods listed in FM 6-50. The method used is determined by METT-TC. The M2 compass method is normally faster than the tube to tube method, but the latter method allows all section members to remain in the howitzer.

The M2 Compass Method

3-92. The gunner exits the howitzer and moves to the rear of the piece not less than 10 meters to get an accurate reading from the compass. He orients the compass by siting along the side of the turret or along the length of the tube. The compass reading must be within 100 mils of the azimuth displayed on the AFCS.

The Tube to Tube Method

3-93. The gunner sites through the bore of the cannon and aligns his gun tube on the gun tube of a second howitzer. Both gun tubes are pointed directly at each other and the subordinate chief/wingman reads his azimuth of lay to the senior chief. The senior chief then reads his AFCS azimuth and compares the two (adding or subtracting 3,200 mils as required). If the wingman is positioned to the left of the team leader, the senior chief adds 3,200, and if to the right, he subtracts 3,200. The two readings must be within 10 mils to be valid. If performing the tube to tube method during platoon operations, the procedure is faster if the senior chief flanks his wingmen. The two wingmen orient on the senior chief and the senior chief sequentially verifies direction with each of his wingmen.

SECTION VI — COMBAT SERVICE SUPPORT

3-94. The principles for CSS do not differ significantly from FM 6-20-1. The primary responsibility for CSS rests with the battalion. The battery leadership must be prepared to execute with sound TSOPs and TLPs. The decentralized nature of Paladin CSS operations demands development of coordinated and standardized procedures. The following concepts ensure logistics requirements are met effectively and efficiently. These concepts are guides that can be tailored to meet the needs of any type of Paladin organization to include separate howitzer batteries in the armored cavalry regiment (ACR). The organization of the "battalion trains" varies with METT-TC. For a Paladin battalion, the trains are organized for combat as dual trains: the field trains and combat trains. This type of organization provides immediate responsive forward support, flexible resource usage, and increased resource survivability.

COMBAT TRAINS

3-95. The combat trains should be close enough to the forward line of own troops (FLOT) to be responsive to the forward units. If possible, it should not be within range of enemy direct fire. In less fluid operations, it is normally located about 5-8 km behind the battery or platoon firing positions and 2-3 km from the TOC. It is organized to provide immediate critical CSS and to support multiple LRPs. In highly mobile operations, it may be necessary to position CSS elements forward to facilitate rapid R3SP operations.

COMPOSITION

3-96. Listed below is an example of a combat trains. Actual composition will be based on the mission of the battalion and METT-TC.

- Recovery assets (up to three M88A1s and one HEMTT wrecker).
- One-third of the ammunition palletized load system (PLS) vehicles.
- Battalion aid station (BAS).
- Administrative logistics operations center (ALOC) (include enough S1/S4 personnel to man two shifts).
- One-half of the petroleum, oils, and lubricants (POL) section.
- Unit maintenance collection point (UMCP) includes required maintenance personnel and assets.
- SCP/CCP (situation permitting).
- DS maintenance contact team (-).

RESPONSIBILITIES

HHB Commander

3-97. The HHB commander is responsible for combat trains operations to include: RSOP; movement; internal operations; and the preparation of R3SPs. He coordinates litter team support for the BAS and conducts TLPs necessary to meet mission requirements for all elements of the combat trains.

HHB 1SG

3-98. The 1SG's primary responsibility is administering the personnel and logistical matters of the combat trains and the TOC. He assists the HHB commander in conducting reconnaissance and coordinating perimeter defense. He further coordinates with the battalion ammunition officer (BAO) for locating and securing flat rack transfer points (FRTPs).

S4

3-99. The S4 supervises the ALOC, maintains the situation map, and tracks the battle to ensure execution of CSS triggers. He is further responsible, during the battalion orders process, for coordinating with the XO, S3, HHB commander, and service BC in selecting potential trains, LRP, and R3SP locations.

Battalion Ammunition Officer (BAO)

3-100. The BAO coordinates with the S3, XO, and S4 in planning and executing the ammunition distribution plan. He monitors the command and administration and logistics (A/L) nets for ammunition requirements. Additionally, he coordinates with the HHB commander and the XO in the reconnaissance and preparation of R3SP sites.

Personnel Services NCO (PSNCO)

3-101. The PSNCO is the NCOIC of the ALOC. He monitors nets and ensures logistics and personnel reports are received and forwarded to the battalion support operations center (BSOC). Additionally, he assists the S4 with battle tracking.

Battalion Maintenance Technician (BMT)

3-102. The BMT supervises the UMCP; assesses deadlined and damaged equipment; and recommends when, where, and how to best make repairs based on guidance from the BMO, XO, and the factors of METT-TC.

CONCEPT OF OPERATIONS

3-103. The ALOC provides C2 for all CSS functions of the combat trains. As a forward deployed logistical unit, the combat trains provides firing platoons with immediate resupply (Class III, V, VIII) and mass casualty support. The combat trains must maintain the capability to rearm and refuel the platoons. Combat trains personnel exchange empty fuel trucks and PLS flat racks for full fuel trucks and PLS combat configured loads (CCLs) as they are pushed forward from the field trains. The UMCP is established to provide forward maintenance support to the battalion. The combat trains also provides medical support to the battalion through the BAS and supporting litter teams. Litter teams are special teams and are assembled from non-medical personnel assigned to the combat trains. Medical personnel must not be distracted from treating the wounded to carry litters and send routine radio traffic.

FIELD TRAINS

3-104. The field trains is organized of elements not included in the combat trains and not required for immediate support of the batteries. It is normally located 15-20 km behind the FLOT (METT-TC driven) in an area providing easy access to main supply routes (MSRs), the brigade support area (BSA), and forward units.

COMPOSITION

3-105. The field trains consists of the following elements:

- BSOC (S1/S4 sections minus those assigned to the combat trains).
- Remaining ammunition PLS vehicles (those not forward).
- Consolidated food service sections.
- Battalion maintenance section (-).
- DS maintenance contact team (-).
- Remaining POL assets (those not forward).
- Battery supply sections.

RESPONSIBILITIES

Battalion XO

3-106. The XO oversees all the logistical resupply functions of the battalion. He coordinates with the S3 concerning resupply and tactical operations. The XO operates where he can best influence the battalion's CSS effort.

Service BC

3-107. The service BC serves as the field trains commander and is responsible for the RSOP, movement, and internal operations. He performs troop leading procedures and time management to ensure Class I, ammunition, fuel, and repair parts are pushed forward to meet mission requirements.

Service 1SG

3-108. The service 1SG assists the service BC and coordinates with BSA personnel for local security of the trains and soldier support activities.

S1

3-109. The S1 supervises the BSOC with the primary duty of personnel management. He maintains the situation map, tracks the battle to ensure execution of CSS triggers, and coordinates with the forward support battalion (FSB) medical company commander for planning medical support.

S4 NCOIC

3-110. The S4 NCOIC monitors nets and ensures logistics and personnel reports are received from the ALOC and forwarded to the FSB. He oversees the logistics package (LOGPAC) to ensure requests for supplies are received from the FSB and assembled onto the trucks for delivery with the LOGPAC. Additionally, he assists the S1 with battle tracking.

Battalion Ammunition NCO

3-111. The battalion ammunition NCO assists the BAO with resupply operations, manages ammunition vehicles, supervises driver's schedules, and resupply operations to the brigade ammunition transfer point (ATP).

Battalion Maintenance Officer (BMO)

3-112. The BMO advises the BSOC of the battalion’s maintenance status. He manages the battalion maintenance area, overseeing the operations of the DS maintenance contact team. He coordinates with the BMT and maintenance sergeant for Class IX resupply and major assemblies replacement.

CONCEPT OF OPERATIONS

3-113. The field trains continuously anticipates, requests, coordinates, and conducts CSS operations. As required by the tactical mission, the field trains pulls supplies from the BSA, pushing them forward to the combat trains, LRP, and R3SP. The BSOC serves as the coordination and control center for the battalion S4 section, personnel and administration center, maintenance elements not forward located, and the battalion supply section.

BATTALION RESUPPLY

3-114. The battalion resupply system functions are described in FM 6-20-1 and FM 6-50, Chapter 12.

CLASS I OPERATIONS

3-115. The battalion is the lowest level that should prepare and issue rations.

3-116. The battery 1SGs oversee Class I operations through the use of the battery supply sergeants located in the field trains. The battery supply sergeants will receive the Class I items and deliver them through the battalion LOGPAC to the batteries. Units should develop TSOPs addressing Class I operations that are characterized by dispersion and high operating tempo (Paladin tactics).

CLASS III OPERATIONS

3-117. Battalion Class III operations are managed and controlled by the C2 elements of the trains. The fuel consumption of the M109A6 is greater than previous M109 series howitzers due to increased mobility and the requirement to run the engine during the conduct of fire missions. The increased demand for fuel requires detailed planning during mission analysis. Units will resupply at scheduled intervals, for normal operations, and push fuel forward as required during periods of increased optempo. Units should consider the following when developing TSOPs:

- The battalion's tankers receive fuel from the FSB in the BSA and are positioned in the field trains and combat trains.
- During normal operations, a platoon is refueled at the R3SP site or through LRP operations. However, the platoon/battery can coordinate with the ALOC for emergency POL support. The HEMTT tanker links up with the platoon/battery at the predesignated refuel point, conducts the refuel, and then returns to its base of operation or refuel location.
- As the combat trains runs low on Class III, fuel can be transloaded to one tanker and the ALOC coordinates with the BSOC for replacement tankers.

CLASS V OPERATIONS

3-118. The Paladin battalion must organize the ammunition platoon to operate efficiently and routinely. The battery ammunition PLSs are managed at the battalion level. A section of three PLSs remain habitually dedicated to each battery to facilitate command and control. The same section should resupply the same battery as often as possible. This practice allows each ammunition section chief and his BC to exercise established battery internal resupply operations, troop leading procedures, and simplifies navigation to/from that battery during static operations. The PLS supports this technique with quick and easy flat rack exchange. Ammunition section chiefs must control battery ammunition resupply IAW battalion/battery directives. The S3, S4, and XO coordinate priorities and issue guidance to the BAO. The BAO or S4 issues the distribution plan to commanders at the field artillery support plan (FASP) briefing. BCs include ammunition resupply in their battery orders, rehearsals, and TLPs. Resupply may routinely be accomplished by the double loop, the single loop, R3SP, or any combination of these methods.

Double Loop Method

3-119. The double loop method is the quickest, most efficient, and normally the preferred method of resupply. The ammunition platoon must operate across the entire brigade zone. The battalion must organize the ammunition platoon to facilitate command and control of the double loop method. A preferred technique is to position three PLSs with each firing battery and position the remaining nine between the combat trains and field trains. This organization, based on METT-TC, establishes a basis for routine operations. The double loop method utilizes the PLS's flat rack swapping capabilities with ammunition uploaded on flat racks in the ATP, and pushed forward to a FRTP. Trucks carrying empty flat racks from a battery resupply point, exchange their empty for a full flat rack at the FRTP. Trucks with loaded flat racks return to their battery, a resupply point, or the combat trains. Trucks with empty flat racks return to the ATP. When possible, establish the FRTP in the vicinity of the combat trains.

Single Loop Method

3-120. In the single loop method, operators draw ammunition from the ATP and deliver to the battery position. This method may be required for emergencies such as late ammunition shipments to the ATP or last minute changes to the resupply plan. Success depends on the ability of each driver to navigate between the ATP and the battery location. This requires detailed movement briefings or a leader to personally guide the convoy. Empty flatracks are returned as directed.

3-121. Regardless of the method of resupply, the battalion must maintain strict ammunition accountability and lot management. This ensures adequate amounts of a single propellant and projectile lot are on hand. The S4, S3, and BAO develop several flat rack load plans for the TSOP. Flat rack load plans may be CCLs based on the battalion's basic load, controlled supply rate (CSR), unit mission, and EFATs. Flat rack load plans may include trucks loaded by type (i.e., all dual-purpose improved conventional munitions (DPICM)) or trucks with a mixture of munitions supporting EFATs (i.e., area denial artillery munitions (ADAM)/remote antiarmor mine systems (RAAMSs) for a medium density minefield).

REARM, REFUEL, RESUPPLY, AND SURVEY POINTS (R3SP)

3-122. The battalion staff must consider the advantages and disadvantages of the R3SP. The R3SP is the most expedient method to resupply. It is the most convenient means for the battery leadership, as their involvement is minimized. The R3SP may be used at the battery level when distance and location prevent the use of a battalion R3SP. R3SPs are established along the route the platoon travels as it makes a tactical move. This is a "get in and get out" operation. The goal is to refuel, rearm, and resupply in less than 30 minutes. When possible the Paladin will be rearmed by their FAASVs prior to a tactical move. This simplifies the R3SP, allowing the howitzers to bypass the rearm area and move directly to the refuel area. Actions performed at the R3SP include: refueling; rearming of the

FAASVs; updating navigation systems; issuing POL products; and the distribution of rations, mail, sundries, and other items.

3-123. In concert with the XO and S3, the S4 identifies the location of the R3SP. The HHB commander/BAO/RSO reconnoiters the site, and coordinates for POL, ammunition, other classes of supplies, and survey to establish SCPs. A technique is to establish SCPs next to the tankers so that the howitzers can update their navigation systems as they receive fuel.

3-124. The rearm and refuel operations are separated by 300-600 meters. The rearm operation requires a 500-800 meter area with approximately 100 meters between flat racks. The refuel operations require a 200-400 meter area with 50-100 meters between the HEMTT tankers. The actual size of the R3SP will be terrain dependent. Once refueled, the howitzers continue on to their next position. The POC and FAASVs complete rearm and refuel operations and continue their tactical moves.

LOGISTICS PACKAGE (LOGPAC) OPERATIONS

3-125. The most efficient method of resupply is accomplished through LOGPACs. FM 6-20-1 discusses LOGPAC operations. Class I, III, and IX are routinely delivered via the LOGPAC. Additional classes of supply may be included in the LOGPAC based on unit requirements. Units may submit daily personnel, logistics, and maintenance reports (hard copy reports that supplement and clarify FM feeder reports) with the LOGPAC.

3-126. The LOGPAC is assembled in the field trains. LOGPACs are organized for each battery and separate elements in the battalion. Once assembled, the vehicles move to the LRP under the control of an OIC or NCOIC. At the LRP a battery representative receives his LOGPAC and conducts unit level resupply. Following resupply, the trucks assemble at the LRP and return to the field trains.

3-127. The ideal place for the battalion's logisticians to meet and coordinate logistics requirements is the LRP. Here they rehearse future logistics operations, discuss changes to plans, and review personnel, logistics, and maintenance reports.

3-128. The LOGPAC offers many advantages. The most significant is increased C2 for moving supplies over the long distances. It provides the framework for safely moving supplies without stifling the initiative of individual supply sergeants. Effective LOGPAC operations reduce the number of trips between the field trains and forward deployed units. Finally, LOGPAC operations provide the proper setting to exchange information.

3-129. The battalion S4 plans and coordinates LOGPAC operations to ensure they fully support the commander's tactical plan. Planning must begin early, be METT-TC dependent, and updated continuously to ensure subordinate units are properly supported.

BATTERY RESUPPLY

CLASS I OPERATIONS

3-130. The battery 1SGs oversee the Class I operations through the battery supply sergeants located in the field trains. The battery supply sergeants will receive the Class I items and deliver them through the battalion LOGPAC. Batteries will normally maintain a 3-day supply of water and rations.

CLASS III OPERATIONS

3-131. The fuel consumption of the M109A6 is greater than previous M109 series howitzers due to increased mobility and the requirement to run the engine during the conduct of fire missions. The increased demand for fuel requires detailed planning during mission analysis. Battery Class III resupply is normally provided through LOGPAC or R3SP operations.

CLASS V OPERATIONS

3-132. Frequent movement complicates ammunition resupply. The BC must ensure the orderly flow of ammunition from the battalion to the battery. He must be proactive, including ammunition resupply in his TLPs. Platoon leaders, platoon sergeants, section chiefs, ammunition section chiefs, and ATCs must ensure that operators of FAASVs and PLS vehicles are aware of pickup points, routes, and when they can anticipate resupply to occur. Ammunition resupply is accomplished from either a battery or a platoon rearm point.

Battery Rearm Point

3-133. The battery rearm point is normally established on the movement route and centrally located between the two platoons. Rearm can then be accomplished as the unit moves to the next location. This site can easily be converted to a battery R3SP by coordinating for survey and with the combat trains for additional classes of supply. A typical battery rearm point would have two flat racks, capable of simultaneously servicing six FAASVs. Each section would take 58 rounds, from the two flat racks (each flat rack carries a standard 176-round CCL). Another setup might have one flat rack on the ground and require sections from each platoon rotate through the rearm point. Each section would take 29 rounds from the 176-round CCL flat rack. It is important to empty flat racks as soon as possible so they can be returned to the ATP and continue the battalion's ammunition push.

Platoon Rearm Point

3-134. The platoon rearm point is similar to that of the battery. However, establishing one per platoon facilitates autonomous operations. When the platoons are widely separated, this is the preferred method. The platoon rearm point is centrally located outside of each firing area. While this method reduces turnaround time for the FAASVs, it is more difficult for the ammunition section chief to control and may slow the turnaround time for the PLSs. A typical platoon rearm point would have one flat rack with a 176 CCL positioned on the ground and three sections would rearm 58 rounds each. As is the case with a battery rearm point, the platoon rearm site can be positioned for rearm enroute to the next location and, if necessary, can be converted to a battery R3SP.

PLATOON RESUPPLY

CLASS I & III OPERATIONS

3-135. Platoon Class I and III operations are managed by the platoon leader/platoon sergeant and are coordinated through the battery 1SG.

CLASS V OPERATIONS

3-136. There are two options available to the platoon leader for delivery of Class V to the individual sections. The method used depends upon the required mix, the rate of ammunition expenditure, and expected enemy threat.

One FAASV- One Howitzer

3-137. One approach is to permanently assign one FAASV per howitzer section. The assigned FAASV resupplies Class V to the howitzer section. After resupplying, the FAASV crew provides the COS a properly completed DA Form 5969-R (reference FM 6-50). This form will facilitate the update of the section ammunition inventory in the AFCS. The COS adds this ammunition to his on-board totals and transmits the overall total to the POC. The inventory must reflect the ammunition status of the howitzer and the FAASV. This facilitates the automated management of ammunition.

FAASVs in Support of a Platoon

3-138. Using this method, FAASVs are controlled by the platoon sergeant. Two FAASVs will resupply the howitzers, while the third is conducting rearm or performing overwatch. When two FAASVs have depleted their Class V supply, they are dispatched to the battery or platoon rearm point and the third takes over resupply of the howitzers. This method ensures availability of ammunition. However, it complicates ammunition accountability. The chief will not be able to input all of the "on-site" ammunition into the AFCS. The unit must have written procedures to account for the ammunition in the FAASVs.

3-139. When the expenditure rate is extremely high, "FAASVs in support of a platoon" better facilitates Class V resupply. During periods of minimal ground threat, "one FAASV – one howitzer" enhances the task of ammunition accountability. Regardless of the method of resupply, the POC is ultimately responsible to accurately report ammunition accountability. Consider the following information when planning ammunition resupply operations:

- The M109A6 basic load is 37 complete conventional rounds and two Copperhead rounds.
- The FAASV basic load is 90 conventional rounds and three Copperhead rounds.
- The FAASV may average from one to five rearming moves per day in addition to tactical and survivability moves.
- Ensure M109A6 has 100% of its basic load (Consider ammunition required for EFATs) prior to FAASV departing for resupply operations.
- When establishing resupply triggers, consider multiples of 8 to facilitate flat rack (155mm pallet) operations. Additionally, at the howitzer section level, it is recommended to establish numeric resupply triggers in lieu of "red, amber, green" status.

UNIT MAINTENANCE

OPERATOR/CREW MAINTENANCE

3-140. The Paladin crew performs PMCS, visual inspection, cleaning, and maintenance tasks authorized in applicable operator level technical manuals.

3-141. BITE allows for failure isolation to component and or line replaceable unit (LRU) as appropriate. The PDIU monitors M109A6 systems and provides feedback to the crew.

3-142. The platoon must set aside time to allow the Paladin sections to perform routine scheduled maintenance without greatly degrading the ability of the platoon to fire. This should be accomplished as part of the overall continuous operations plan in effect at any given time.

ORGANIZATIONAL MAINTENANCE

3-143. The battalion’s organizational maintenance assets provide timely maintenance and recovery support. They are located in battery PAs, combat trains (UMCP), field trains (battalion maintenance area), and in remote element locations to facilitate rapid response to the Paladin battalion.

DIRECT SUPPORT MAINTENTANCE

3-144. DS maintenance is mobile, deployed forward, and designed for "repair by replacement" operations. DS contact teams from the FSBs perform maintenance. Normally, these teams are positioned in the battalion field trains. The platoon leaders coordinate DS maintenance support through the BC and the ALOC as required. Contact teams can repair most non-operational equipment at the platoon PA. Items beyond the repair capabilities of the contact team (such as communications, electronics, or NBC equipment) are replaced with a serviceable part, and the faulty part is evacuated for repair.

RECOVERY

3-145. The Paladin battalion's tracked recovery vehicles (M88A1s) are positioned to facilitate any required recovery missions. They may be located in the combat trains or forward in the battery PAs. If the contact team or the DS maintenance team cannot repair the equipment on site, the recovery vehicle evacuates it to the UMCP or the field trains. The recovery vehicle may remain with the equipment to assist in repairs or move it if displacement is required. Once the vehicle is repaired, the recovery vehicle returns to the combat trains or PAs IAW unit TSOP. Guidelines for determining whether to repair on site or evacuate are found in FM 6-20-1. The tactical situation and the anticipated length of time to complete the repair are primary factors in determining if evacuation is necessary.

CASUALTY EVACUATION

3-146. Special consideration must be given to casualty evacuation in a Paladin battalion to reinforce responsiveness and dispersion. For a battalion to administer proper care to its wounded, the following medical assets are needed for routine evacuation.

MEDICAL TREATMENT TEAM

3-147. This team includes an emergency treatment NCO and two medical specialists. Equipment includes two HMMWVs, one secure FM radio, two chemically and biologically protected shelter systems, and medical equipment sets for field trauma, sick call, chemical agent decontamination, and chemical agent treatment.

AMBULANCE TEAMS

3-148. This team consists of one evacuation NCO and an ambulance driver per ambulance.

It supports the medical treatment team in the firing batteries and battalion in medical evacuation. Equipment includes four HMMWV ambulances with FM radios, and secure GPSs.

COMBAT MEDIC SQUAD

3-149. This squad consists of six combat medical specialists. One combat medic is allocated per firing platoon. Each medic carries a surgical kit.

MASS CASUALTIES

3-150. For mass casualty evacuation, the battalion must rely on its combat lifesavers and organic transport capabilities in addition to its medical section personnel and medical transport capabilities. For planning purposes, a cargo HMMWV can transport up to five litter casualties and a 2 1/2-ton truck or 5- ton truck can transport up to 12 casualties (see FM 8-10-6, *Medical Evacuation in a Theater of Operations TTP*). Battalion or battery TSOPs should address a standard layout for a casualty collection point at the BAS and battery or platoon. Litter teams need to be identified and trained at every separate element within the battalion. Combat medics, combat lifesavers, and litter teams must conduct rehearsals to ensure they can effectively collect, provide aid, and transport casualties.

3-151. The battalion addresses, in the FASP, those actions to be taken in the event of mass casualties. If only one battery or platoon is hit, the closest battery provides combat lifesavers and evacuation vehicles. If two batteries are hit, the surviving battery and the combat trains provide assistance. When two or three batteries are hit, mass casualty assistance will likely have to come from brigade or task force assets. In any mass causality event, the battalion must resist diverting medical personnel from the BSA. The limited number of medical personnel should remain at the combat trains providing C2, through the combat trains/ALOC, and casualty assistance in a protected environment.

Chapter 4

Delivery of Fires

The POC is the C2 center for the Paladin howitzer platoon. Battery and platoon operations are similar in many ways to those in platoon-based M109A5 battalions. However, the primary focus of the Paladin POC is significantly different. Where the first priority of the M109A5 FDC is technical fire direction, the single most critical function of the M109A6 POC is database management.

POC RESPONSIBILITIES

4-1. Platoon-based operations and the ability of the Paladin to compute its own technical firing data have caused the traditional FDC to assume a broader role, performing tactical as well as technical fire direction. The Paladin POC's key responsibilities are:

- Perform database management.
- Provide survivability move criteria for the howitzers within the firing area and for tactical moves from one firing area to another.
- Perform tactical fire direction to ensure that the firing data is safe and does not violate maneuver boundaries, restrictive FSCMs, and intervening crests.
- Perform technical fire direction for special fire missions assigned by the battalion to the platoon.
- During some degraded operations, assume direct control of the technical fire direction and send firing data to the howitzers.
- Assume control of all six howitzers and act as the BOC if directed by the BC.

DATABASE MANAGEMENT

AFCS Input

4-2. During normal operations of the Paladin platoon, the on-board AFCS in each howitzer performs technical fire direction. After receipt of the initialization data (HOW;SBT, SPRT;MAP, MET;CM, AFU;REG) from the POC, the AFCS operator must input specific information regarding the howitzer. This information constitutes the database that the

AFCS must continuously maintain if the Paladin is to be able to provide accurate predicted fires. The database information input at the AFCS includes current location, propellant temperature, load elevation and maximum tube elevation, site data, MVVs, and ammunition status.

AFCS/LCU Databases

4-3. Much of the data above is maintained in the nonvolatile memory of the AFCS, thus facilitating reinitialization following a normal shutdown. In case of a Paladin system failure, after the system is restored to operational status, the AFCS can and should request database information from the LCU. It is critical that database information is received, stored, updated, and maintained in the LCU at the POC as well as in the AFCS. Just as the AFCS can request database information from the LCU, the LCU operator can request the information from the AFCS for verification of the data the computer is maintaining for each individual howitzer. This duplicate database ensures that the Paladin can request accurate data to reinitialize quickly. Also, it allows the LCU to compute accurate firing data with the AFCS database, if required.

4-4. Whenever the AFCS or LCU resumes operations after a non-operational period, the LCU and the AFCS should exchange database information and conduct a verification mission to ensure consistency between the two elements. No matter how brief the shutdown period, the POC should assume that changes occurred.

Information Management Requirements

4-5. The capabilities of the on-board ballistic computer (AFCS) of the M109A6 generate a substantial increase in information management requirements for the POC. Each howitzer section has its own unique set of database information (such as location and AOF). The LCU database receives input from each howitzer AFCS. Likewise, the AFCS receives certain LCU information. Accurate and timely information management between systems is a must. Organization and training of the POC is necessary to properly manage database information.

Database Information

4-6. All database information should be readily available in the LCU. Obtaining this information from the LCU during fire mission processing may be inconvenient however. Therefore, a system of charts, checklists and overlays are necessary to show the FDO howitzer status, database information, and each howitzer's current location. Examples of status charts are as follows: POC LCU Checklist (Figure 4-1); Database Management Chart (Figure 4-2); and Example Platoon Ammunition Status Chart (Figures 4-3 and 4-4).

INITIALIZATION:		YES	NO
1. Load weapon-dependent program or restore database recording.			
2. SYSTEM SETUP	Verify initialization information.		
3. SYS;COMM	Verify communications characteristics.		
4. SYS;SBT	Verify subscriber table.		
5. HOW;SBT	Verify computer-generated entries.		
6. SPRT;MAP	Verify area of operations.		
7. AFU;UPDATE	Verify platoon data to be stored in the database.		
DATABASE:			
1. HOW;UPDATE	Verify Paladin locations and status.		
2. HOW;AMOUP	Verify ammunition status.		
3. AFU;MASK	Verify Paladin mask data.		
4. MET;CM	Verify meteorological data.		
5. FM;OBCO	Verify observer files.		
6. SPRT;GEOM	Verify support geometry.		
7. BCS;MVV	Verify MV data for the Paladins.		
8. AFU;REG	Verify registration file by charge and firing position.		
9. Conduct verification mission.			
OPERATIONS:			
1. Verify powder temperature at least every two hours.			
2. Verify target locations before transmitting fire missions to the Paladins.			
3. Measure and compensate for intervening crests.			
4. Control and verify positioning of Paladins during survivability moves.			
5. Transmit tactical information by use of the AFU;UPDATE message using the SYS;PTM to battalion.			

Figure 4-1. POC LCU Checklist

Max E: Max N: Min E: Min N: MAPMOD:			Grid Zone:				Sphere: Datum:	
SYS:PTM Data:								
Move Order Grid:	Left Sector:	Center Sector:	Right Sector:	Max Elev	Load Elev	Powder Temp	Status	Remarks
1/1								
1/2								
1/3								
2/1								
2/2								
2/3								
Date Time Group (DTG) of Current Met Message:								
Other Information:								

Figure 4-2. Database Management Chart

PROJECTILE	BCS CODE	LOT	GUN #1	GUN #2	GUN #3	TOTAL
HE M107	HEA	A B				
RAP M549A1	HER	A B				
ICM M449A1	HEE	A B				
Illumination M485	ILA	A B				
DPICM M483A1	HEF	A B				
DPICM M864DB	HEF	A B				
ADAM Long M731	APL	A B				
ADAM Short	APS	A B				
Smoke M825	SMC	A B				
RAAMS Long M718A1	AML	A B				
RAAMS Short M741A1	AMS	A B				
Copperhead M712	CPH	A B				
OTHER		A B				

Figure 4-3. Example Platoon Ammunition Status Chart

PROPELLANTS	BCS CODE	LOT	GUN #1	GUN #2	GUN #3	EXTENDED LOT #	TOTAL
Charge 3-7 M4A2							
Charge 8 M119A1							
Charge 7(Red) M119A2							
Charge 8 Super M203							
Charge 8 Super M203A1							
FUZES							
Proximity M732	VTB						
Proximity M728	VTE						
MTSQ M564	TIA						
MTSQ M582	TID						
MTSQ M767	TIG						
PDSQ/D M557	PDA						
PDSQ/D M739	PDB						
Mech Time M565	TIF						
Mech Time M577	TIB						
Mech Time M762	TIH						
CP MK 399	PDE						

Figure 4-4. Example Platoon Ammunition Status Chart Continued

HOWITZER MOVEMENT AND LAND MANAGEMENT

Survivability Movement Control

4-7. One of the POC's key responsibilities is to control survivability movement of the howitzers within the firing area. The two methods the POC can use for this movement are centralized control and decentralized control.

4-8. **Centralized Control.** When using this method of control, the POC directly controls all howitzer movement. The POC designates the new location as a grid location, direction and distance, or quadrant. In the quadrant method a radius is drawn oriented to the AOF to facilitate the layout of quadrants (upper left-quadrant 1, lower left-quadrant 2, upper right-quadrant 3, and lower right-quadrant 4). The howitzers move on the specific order of the POC via a plain text message (PTM) or a voice command over the battery/platoon command net. Centralized control is best used under the following conditions: when deploying on limited terrain; when one or more howitzers have experienced system failures; when the commander wants to exercise maximum control; or the battery has inexperienced crews. This method of control increases the likelihood of accomplishment of supporting EFATs and allows the platoon leader and/or FDO to position assets based on the other friendly elements collocated in the platoon PA.

4-9. **Decentralized Control.** This method of control takes full advantage of the Paladin's capabilities. Each howitzer is deployed to its own assigned area of operation. Howitzer sections are allowed to move within the firing area at the discretion of the senior COS. Commander's guidance, the unit TSOP, the threat (for example, counterfire or ground attack), or METT-TC dictate movement of the howitzers (movement criteria). The disadvantages of this method are as follows:

- The POC must wait for the howitzer to arrive in its new position and report piece status (digital or voice) in order to post the howitzer location on the HTC.
- If there are problems with the new position (i.e., if it is too close to another Paladin's radius or friendly element), the POC must immediately initiate another move. Radii cannot overlap.
- The difficulty of coordinating platoon security is increased.
- The probability of two or more howitzers locating too close together or occupying a position recently vacated by another section is increased.

4-10. Whether centralized or decentralized, the platoon leader exercises the option of specifying a grid or a quadrant within the firing area radius or allows the platoon sergeants to move howitzers the minimum and maximum distances (METT-TC dependent).

Position Area Movement and the Howitzer Tracking Chart

4-11. Tracking the movement of three (and possibly as many as six) howitzers is a full-time job for one person in the POC. He must plot the locations on the HTC, post the current information on the database management chart, and provide a recommendation to the platoon leader and/or FDO regarding the proposed location for the howitzer's next move within the firing area.

4-12. The HTC is normally prepared on a piece of preprinted chart paper with each grid square representing 200 meters. The HTC is overlaid on a large-scale (normally 1:10,000) map and used to track the movement of the individual howitzers. It is prepared for each platoon PA and is used to manage the movement of the howitzers within the firing area and the PA so that they do not endanger themselves or other friendly elements.

4-13. **Plotting Procedure.** The HTC operator monitors howitzer movement on the tracking chart using color-coded tic marks. The upper right quadrant of the tic mark is labeled as follows: Platoon # Gun #. A black tic mark represents a howitzer's current location. A red tic mark represents the past location of the howitzer. A blue tic mark represents a howitzer's future location (used only during centralized operations). In decentralized operations, only black and red tick marks are used. When a new HOW;UPDATE message is received, the grid will be verified on the HTC and updated as necessary.

4-14. **Chart Use.** The platoon leader and/or FDO uses the HTC in one of two ways. If the platoon is operating under centralized control (Figure 4-5), the platoon leader/FDO looks at the chart and determines a new location that ensures mission accomplishment and will not endanger the howitzers or other friendly elements. He then directs movement via digital or voice radio. The message is given either as a new position grid, as a direction and distance for displacement, or by telling the senior COS which quadrant to go to.

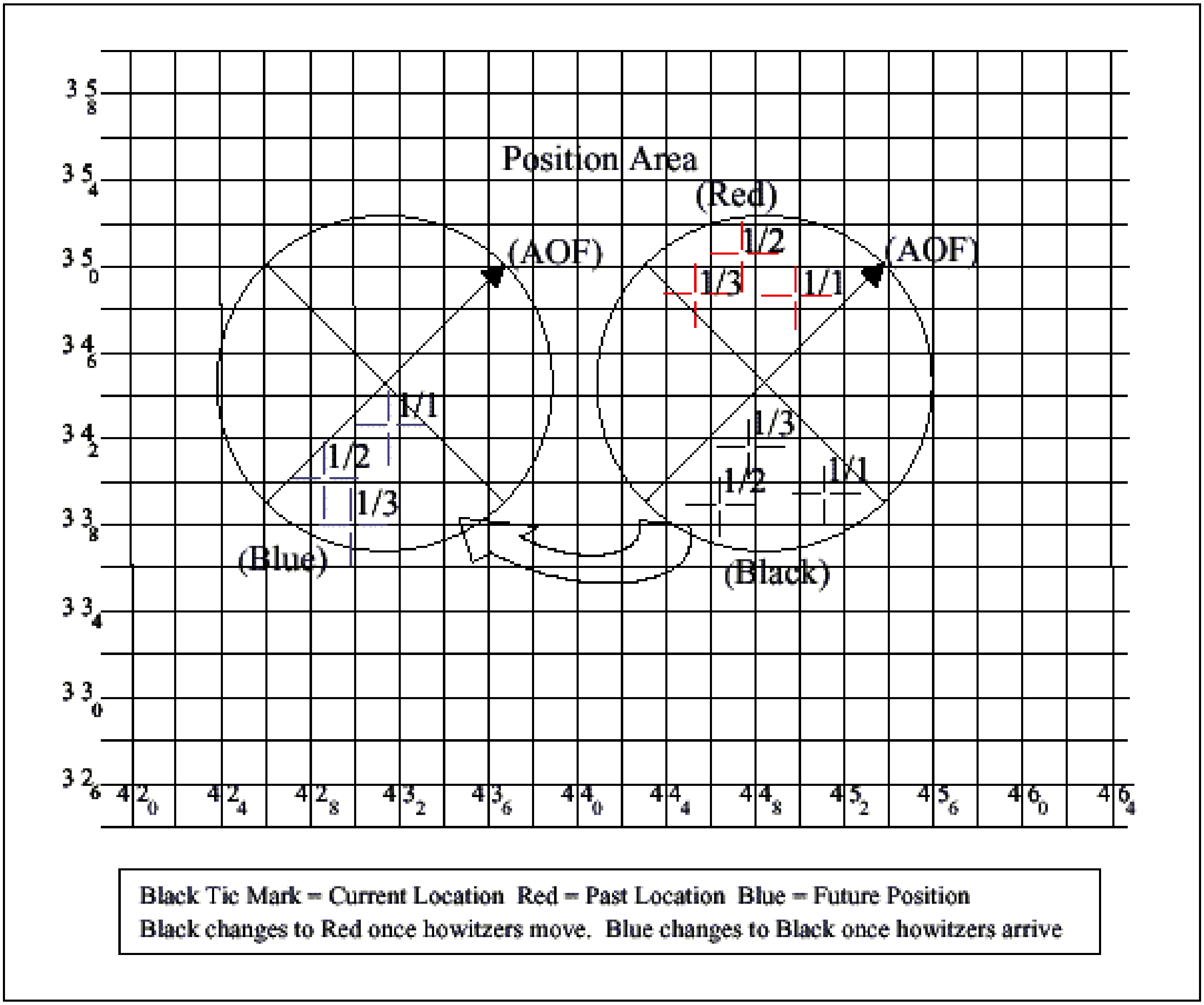


Figure 4-5. Example Howitzer Tracking Chart (Centralized Control)

4-15. If the platoon is operating under decentralized control, the platoon leader/FDO monitors the firing positions as reported by the sections as they occupy. He ensures that the howitzers remain within their assigned firing area and that they do not threaten friendly elements by positioning too closely to them. In the decentralized mode, the POC intercedes only if there is a problem. The platoon sergeants are normally in the best position to select positions based upon guidance received from the platoon leader.

4-16. Use of the HTC is mission and METT-TC dependent. For example, the HTC is very useful while fighting a deliberate defense. However, if conducting a movement to contact or a hasty attack it would be counterproductive to use the HTC until the platoon/battery has stopped and emplaced.

TACTICAL AND TECHNICAL FIRE DIRECTION

4-17. The POC performs tactical/technical fire direction for fire missions assigned by the battalion to the platoon. This tactical fire direction includes howitzer selection for missions that do not require the entire platoon; for example, smoke, illumination, and precision registration missions. The FDO and FDC chief retain responsibility for tactical/technical fire direction while the platoon leader and his designated representative monitor the tactical situation. While tactical fire direction is primarily accomplished at the DS battalion CP, the POC should ensure that the fire orders received from the battalion are executed properly.

4-18. Technical fire direction during normal operations is accomplished by the AFCS at each individual howitzer. The leaders at the POC quickly review each mission as it is received to ensure that it is safe to fire and does not violate maneuver boundaries, restrictive FSCMs, or intervening crests. After these checks are conducted, the mission is transmitted to the howitzers for processing of individual firing data by the howitzer's on-board computer. This procedure may be modified to accommodate special circumstances. As an example, precision registration missions are computed and controlled by the LCU at the POC.

DIRECT CONTROL BY THE POC

4-19. During some types of degraded howitzer operations, the POC may assume direct control of technical fire direction and send firing data to the howitzer as in a M109A5 unit. For example, if the AFCS of an individual howitzer section is degraded or inoperative, the POC may compute technical firing data for that section. (Note: The preferred method requires an operational howitzer to locate next to the degraded howitzer, and the degraded howitzer uses the operational howitzer’s firing data.) Degraded operations TTP are discussed in detail in Appendix A.

4-20. In those cases when the POC is providing technical data down to one or more howitzers, secondary checks by independent means must be used. The secondary independent check for the LCU computing data for the degraded howitzer(s) will be by verifying howitzer location (i.e., GSG, platoon sergeant, platoon leader) and target location (i.e., fire support team, battalion FDC, POC). Once data is verified and correctly input into the LCU and no major database change has occurred, then data is good. Safety will be applied to the degraded howitzer the same as on operational howitzers.

POC CONTROL OF ALL BATTERY HOWITZERS

4-21. In addition to the functions listed above, each Paladin POC must be prepared to control all six of the battery's Paladins simultaneously. POCs must develop charts and procedures that let them C2 the entire battery. The battery commander may designate one of the POCs as the BOC. The functions of the BOC are outlined in FM 6-50, Chapter 1. To achieve mission requirements, the BC may augment the BOC with personnel from the battery headquarters.

Situation Map

4-22. The situation map is one of the most important tools in the POC to track operations. It should consist of the following overlays:

- Maneuver graphics for the force being supported. Friendly and enemy unit locations, FLOTs, and observer locations. (The battalion operations and intelligence (O&I) section should provide this information. The FDO must be proactive in ensuring that the information is current.)
- Platoon/battery operations overlay. This overlay includes the current PA of both platoons in the battery.
- Anticipated future PAs and the locations of the battery headquarters, the other battery POC, and the battery trains should also be posted. All of this information usually should not be posted on a single overlay. It may be necessary to use separate overlays, one for current and anticipated platoon PAs and one for battery trains and headquarters locations.
- Survey control information.

FIRE DIRECTION

4-23. The following paragraphs address those fire direction operational capabilities unique to the LCU and AFCS. Specific "how to" fire direction procedures are addressed in Appendix B.

HOWITZER STATUS REPORT

4-24. Each howitzer is managed as an individual firing unit and is, therefore, required to report its operational status in the same manner as the POC reports the status of the platoon to the battalion TOC. In reporting the howitzer's operational status, the following information is transmitted digitally to the POC:

- Specific location, AOF, maximum tube elevation, and powder temperature.
- Mask data.
- Ammunition on hand.
- MV information.

DATA TRANSMITTED TO HOWITZERS

4-25. The POC manually transmits the following via FM digital to each howitzer:

- Movement order.
- Ammunition information.
- MV information.
- Initialization data.
- Met data.

NOTE: The AFCS can digitally request all of the above information at any time. Howitzer subscriber information and met data cannot be requested from the howitzer.

Meteorological Data

4-26. When a computer met (MET;CM) is received at the POC from the battalion FDC or the meteorological measuring system (MMS), it is placed in the input queue of the LCU for operator review. Once validated, the message is executed. This process updates the met file as specified in the MET TO UPDATE field of the SYSTEM SETUP message. Once MET IN USE is updated, if AUTO XMIT DATABASE messages is NO, the MET;CM message is automatically generated and placed in the input queue for transmission to the Paladin. If AUTO XMIT DATABASE messages is YES the MET;CM message will be sent directly to the howitzer. This MET;CM message contains a total of 32 lines of met data. The first message contains lines 00 through 15, and the second contains lines 16 through 31. The met file is automatically updated after the AFCS has received both messages. The LCU operator must ensure that the message is acknowledged by all of the platoon's howitzers. Note: The met must have a "9" in the OCTANT field or the Paladin will not accept it. If both messages (pages) of the met are not acknowledged by the AFCS, the AFCS will not use the new met.

4-27. Once the met data are successfully updated in the POC and at the Paladin, previous met data must be deleted from the LCU database. Using the SYSTEM SETUP message, enter the previous MET IN USE value in the MET TO DELETE field and execute the message. No transmission to the Paladins is required.

AFCS CAPABILITIES

4-28. The AFCS has unique capabilities that give the POC great flexibility. These capabilities are discussed below.

- Each AFCS can store nine targets and one priority target. These targets may be planned targets, FPF, Copperhead priority targets, TOT missions, or any type of target deemed necessary by the POC.
- The priority mission buffer allows each howitzer to store one final protective fire

(FPF) or one priority Copperhead mission. The POC designates priority missions.
- Each AFCS has a single active target buffer for mission processing.
- It is possible for the POC to link a TA asset or "sensor" with a single or multiple howitzers " shooter". (Note: There is a loss of tactical control by the POC when this is done.) The sensor may be a hand-held terminal unit (HTU), forward entry device (FED), a Firefinder radar (AN/TPQ-36 or Q-37), or the airborne target handover system (ATHS) aboard an OH-58D. For Copperhead missions, a single howitzer may be linked to the observer's HTU or FED. Additionally, the POC may allow a TA system the capability to access stored targets, adjust fires, and fire for effect (FFE) with a single howitzer. The "sensor-to-shooter" or "linked observer" mode is a special situation used only at the specific direction of the FSCOORD.

MISSION PROCESSING

CAPABILITIES AND RESPONSIBILITIES

4-29. The capabilities of the Paladin howitzer do not change the basic procedures for fire mission processing. However, they do change the location at which technical firing data are computed. Because the M109A6 has the capability to compute technical firing data, the POC assumes the role of providing tactical fire direction. After making whatever tactical fire direction decisions are necessary to meet the requirements, the POC transmits the fire order digitally to each howitzer for the computation of technical firing data. This is the normal method of processing calls for adjust fire and fire-for-effect missions. However, the POC is responsible for the computation of firing data for special missions.

REGISTRATIONS

4-30. The AFCS is capable of computing a ballistic solution, however, it cannot generate an AFU-REG message and the POC is not capable of requesting the AFU-REG. Therefore, all registrations (precision, radar, high-burst (HB), or mean point of impact (MPI)) are processed by the POC. When conducting a registration, the POC should direct the registering howitzer to emplace spades thereby minimizing displacement.

SPECIAL MISSIONS

4-31. The following special missions require specific input of data or unique handling by the POC before transmission to the howitzers:

- All illumination missions except one gun illumination.
- Destruction missions.
- SCATMINE.
- "Sensor-to-shooter" and emergency observer mission.

- Laser draw. Note: Laser draw is the procedure used to have aim points identified within an irregularly shaped target and transmitted to the LCU. The LCU then computes firing data to each aimpoint.

BATTALION UNIT OF FIRE

4-32. The unit of fire at battalion FDC is a three-gun platoon; however, it must be remembered that firing unit data at the battalion FDC reflects an average of three gun locations and azimuths of fire for all guns in a platoon.

ARTILLERY TECHNICAL REHEARSALS

4-33. FA technical rehearsals are critical to the success of the FA battalion. The technical rehearsal should include all elements in the FS chain down to the howitzer. The technical rehearsal allows the FA battalion to practice and verify the technical execution of EFATs. All elements in the chain must understand their EFATs and the commander's intent. For further explanation, refer to FM 6-20-1.

POC OCCUPATION PROCEDURES

4-34. Step 1: Find a suitable location (if not already done). Questions to ask are:

- Will I have good communication?
- Will I be concealed?
- Am I off high-speed avenues of approach?
- Is there an escape route?

Note: If the platoon is enroute to a position and the howitzers occupy, the POC should emplace and establish a firing capability. After the platoon is RTF, the POC can move as necessary to improve its location.

4-35. Step 2: Ensure voice and digital communications with battalion FDC and howitzers are established.

4-36. Step 3: Receive piece status (HOW;UPDATE) from howitzers and verify AOF.

4-37. Step 4: Verify database. If database information changes occur, the POC will direct a verification mission (i.e., check/change MVVs, registrations, ammunition, and met). At this time, the firing unit is RTF.

POC POST-OCCUPATION IMPROVEMENT

4-38. Once the occupation is completed and the unit is ready to answer calls for fire, sustaining actions begin. Refer to FM 6-50, Chapter 2 for post occupation sustaining actions.

Chapter 5

Communications

The Paladin's ability to provide highly responsive fires and effects is dependent on reliable, flexible, secure, responsive, and long-range communications. The introduction of radios on-board the howitzer and FAASV offers tremendous flexibility over wire-based gunlines.

BATTALION COMMUNICATIONS

5-1. The communications systems and procedures at the M109A6 battalion level do not differ significantly from those in other M109A5 battalions. FM 6-20-1 outlines communications procedures and nets any cannon battalion uses as it executes its mission of providing fire support to the maneuver force. In a Paladin battalion however, greater emphasis is placed on the use of radio systems at the battery level and below.

BATTERY COMMUNICATIONS

5-2. The increased number of radios, along with a reduction in personnel and equipment available to install and service wire, requires changes in the traditional way the communications section, as well as the battery as a whole, approaches its mission. The dispersion of communications assets within the unit increases the need for mobility and map reading skills among the members of the communications section. If wire is used, especially if the battery wishes or is directed to enter the mobile subscriber equipment (MSE) system, the BC must plan and coordinate with the battalion signal officer for whatever external support is required. If a unit's modified table of organization and equipment does not provide for a 31U (radio repairer), the battalion SOP must address the shortage and provide a solution.

RADIO NETS

5-3. The firing battery normally operates on three secure external radio nets:

- Battalion command net (very high frequency (VHF)-frequency modulated (FM)-voice (V)).
- One of three battalion fire direction (FD) nets (VHF-FM-digital (D)).
- Battalion A/L net (VHF-FM-V).

5-4. The battery also operates five secure internal radio nets:

- Battery command (VHF-FM-V).
- Platoon command (VHF-FM-V) X 2.
- Platoon FD (VHF-FM-D) X 2. Each platoon operates on its own assigned FD net to facilitate automated C2.

Battery Command Net (VHF-FM-V)

5-5. This net enables battery personnel to pass operational and admin/log traffic. The battery commander may designate full time subscribers for this net.

Platoon Command Net (VHF-FM-V)

5-6. This net enables platoon personnel to pass operational and admin/log traffic. Only mission essential traffic should be passed on this net. The POC operates as the net control station (NCS). Failure to practice net discipline diminishes the effectiveness of the battery's command and control.

Platoon Fire Direction Net (VHF-FM-D)

5-7. This net enables each POC (BCS) to communicate digitally with its howitzers. As a matter of SOP, the net frequency and BCS address of the alternate POC should be provided to each COS with instructions to establish digital communications with his alternate POC if his primary POC becomes inoperative or mutual support is required. The operational POC acts as the NCS in this situation. Howitzer section chiefs must avoid masking their radio communications with terrain features or man-made objects as they select firing positions or make survivability moves.

RADIO NET STRUCTURE

5-8. Figure 5-1 illustrates the radio net structure and SINCGARS equipment for a firing battery in a Paladin battalion. Table 5-1 provides an example Paladin firing battery combat net radio matrix.

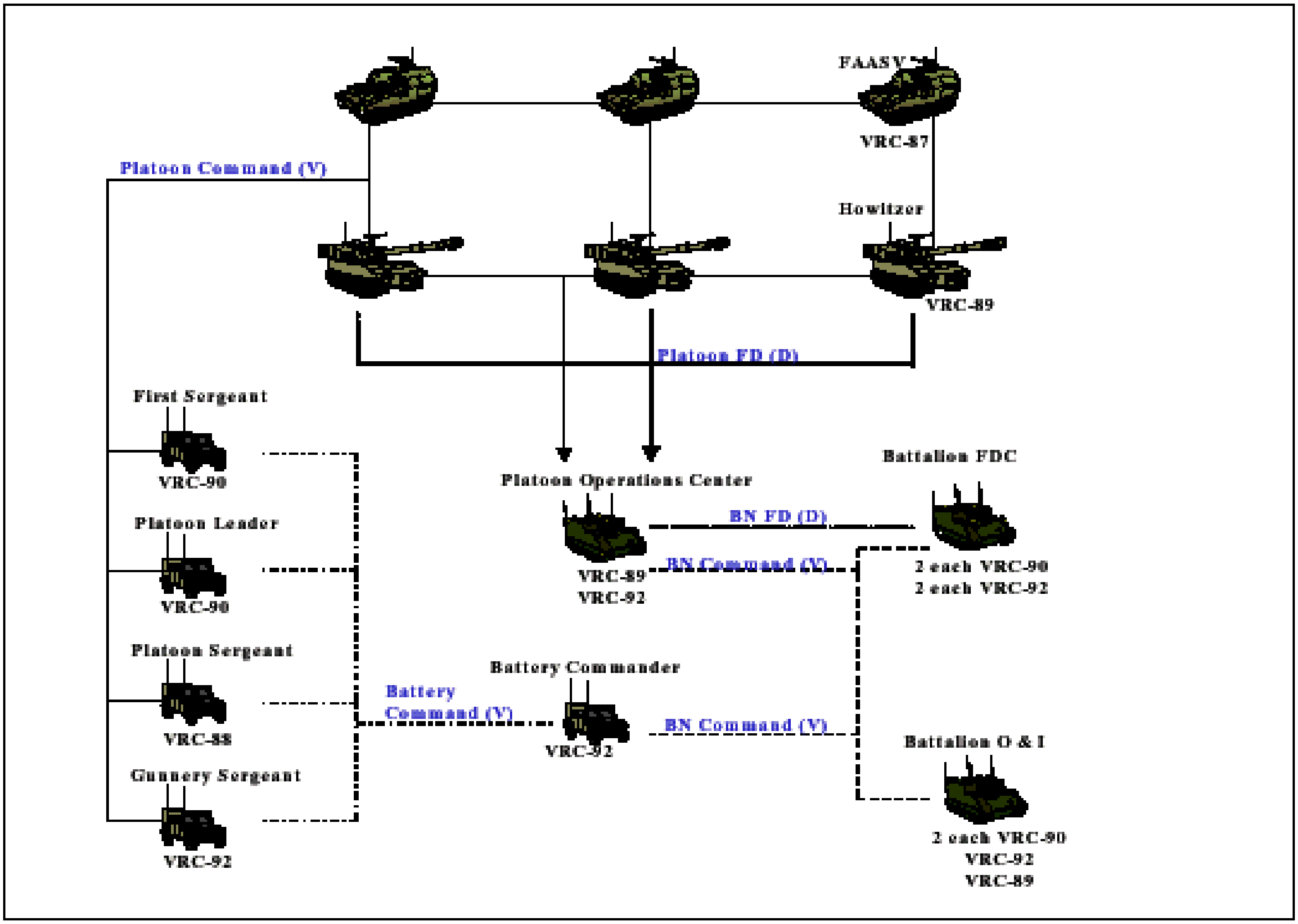


Figure 5-1. Paladin Battery Combat Net Radio (CNR) Structure

Table 5-1. Example Paladin Battery CNR Matrix

FIRING BATTERY CNR MATRIX	BC	1SG	PLT LDR	PLT SGT	POC	HOW	FAASV	GSG
EXTERNAL NETS:								
BN COMMAND (V)	X	A	A	A	A			A
COMMAND FIRE (V)					X			
BN FD 1/2/3 (D)					X			
BN A/L (V)	A	A	A	A	A			
FORCE FA SURVEY (V)	A		A	A				A

INTERNAL NETS:								
BATTERY COMMAND (V)	A	A	A	A	A			A
PLATOON FD (D)					X	X		
PLATOON COMMAND (V)	A	A	X	X	X	X	X	X
LEGEND: X = FULL TIME SUBSCRIBER D = DIGITAL V = VOICE A = AS REQUIRED								

PLANNING CONSIDERATIONS

SETTINGS AND RANGES

5-9. Power output and planning ranges for SINCGARS are shown in Table 5-2.

Table 5-2. SINCGARS Power Output and Range

Power Output	Range
Low	300 meters
Medium	.3 to 4 km
High - Manpack	8 km (voice) 4 km (digital)
High - Vehicular	8 km (voice) 8 km (digital)
Power Amplifier	35 km (voice) 20 km (digital)

MINIMUM COMMUNICATION POWER LEVELS

5-10. The electronic warfare (EW) threat must always be taken into account. Each element of the battery must operate on the minimum power needed to communicate effectively

COMMUNICATIONS PARAMETERS

5-11. Before communicating digitally, personnel must make various software settings in the AFCS and LCU. Many of these settings should be part of the unit TSOP.

NET ACCESS DELAY TIME

5-12. The values set for this function allows each howitzer access to the battery internal FD net. When the LCU transmits data to all howitzers, it is a single broadcast message. If the net access delay time were the same for all howitzers, each would be competing for the same space in time to return an acknowledgment to the LCU. If this were to happen, no AFCS would be able to access the net. By staggering the time for net access, each AFCS has its own space in time to respond to LCU messages.

Communications Sequencing

5-16. Table 5-3 provides an example of communications sequencing used to manage the platoon FD digital net (referred to as net access delay time) in order to maintain communications between the POC and the howitzers' AFCS.

Table 5-3. Net Access Delay Times (POC Only)

Howitzer Logical Number (1st Platoon)	1/1	2/1	3/1
Net Access Delay Time	1.0	1.5	2.0
Howitzer Logical Number (2nd Platoon)	1/2	2/2	3/2
Net Access Delay Time	1.0	1.5	2.0
Note: The net access delay is the same for each platoon as long as each POC is controlling their own guns. If one POC is controlling all six howitzers, then the delay times for those additional howitzers would be as follows: 2.5, 3.0, 3.5 (these are also used as the backup access delay times if POC changeovers occur). In the event the battery acquires additional howitzers, then delay times would need to be modified accordingly.			
1st & 2nd Platoon BCS Net Access Delay	.5		

Note: The BCS has a smaller net access delay time and therefore has the highest priority on the net.

GUN KEY TIME

5-13. Gun key time is a software setting in the AFCS which allows the radio to key up to full power before digital traffic is transmitted.

BROADCAST ADDRESS

5-14. The LCU can transmit to all howitzers with a single transmission. Each howitzer must have the same address as found in the SYS;SBT. This address is valid only for the LCU. Any attempt to use it otherwise causes an error at the LCU, or the AFCS responds with an unable to execute (UTE) message.

PHYSICAL ADDRESS

5-15. This address is used when linking a single howitzer with a TA asset capable of digital communications (i.e., HTU, FED, OH-58D, or radar). This address must be different for each howitzer if more than one howitzer is going to be linked. (Note: AFCS will not allow duplication of the physical address.)

COMMUNICATIONS PARAMETERS CARD

5-17. Shown below (Figures 5-2 and 5-3) are examples of the communications parameter card used to establish both voice and digital communications between the POC and the howitzers during initialization, as well as provide them with backup information in the event that the primary BCS becomes inoperable. This information is included in the unit SOPs and is given to the howitzers prior to starting operations.

NET ACCESS		NET ADDRESS	
NET TYPE:	14	GUN PLTN/SECT:	2/3
NET ACCESS DELAY TIME (SEC):	1.0	BROADCAST ADRS:	B
GUN KEY TIME (SEC):	1.4	PHYSICAL ADRS:	Z
BLOCK MODE SELECTION:	SINGLE	PRIMARY BCS ADRS:	A
NET BUSY SENSE OVERRIDE:	OFF	BACKUP BCS ADRS	C
*NETWORK PROTOCOL:	AFCS	AFCS URN:	16245010
*BAUD RATE:	1200	PRIMARY BCS URN:	12345678
*MODULATION:	1200-2400	BACKUP BCS URN:	143
*WIRE-RADIO LINK:	RADIO	CONTROLLING BCS:	PRIMARY
HOWITZER CALL SIGN:	PAPA 10	DIGITAL NET:	________
POC CALL SIGN:	PAPA 13	VOICE NET:	________
BACKUP POC CALL SIGN:	PAPA 20	BACKUP DIGITAL NET:	________
BACKUP NET ACCESS DELAY TIME (SEC):	3.5	BACKUP VOICE NET:	________
		DATUM:	
LEGEND: SEC = SECOND PLTN = PLATOON SECT = SECTION ADRS = ADDRESS URN = UNIT REFERENCE NUMBER * = OPERATOR PROTECTED FIELD			

Figure 5-2. Example Communications Parameter Card (AFCS Protocol)

NET ACCESS		NET ADDRESS	
NET TYPE:	31	GUN PLTN/SECT:	1/1
		AFCS URN:	12123234
		PRIMARY BCS URN:	8123215
		BACKUP BCS URN:	123
		AFCS IP:	127. 0. 1. 10
NETWORK PROTOCOL:	188-220A	PRIMARY BCS IP:	127. 0. 2. 20
BAUD RATE:	16000	BACKUP BCS IP:	127. 0. 3. 30
MODULATION:	NRZ	CONTROLLING BCS:	PRIMARY
WIRE RADIO LINK:	RADIO		
HOWITZER CALL SIGN:	PAPA 10	DIGITAL NET:	________
POC CALL SIGN:	PAPA 13	VOICE NET:	________
BACKUP POC CALL SIGN:	PAPA 20	BACKUP DIGITAL NET:	________
		BACKUP VOICE NET:	________
		DATUM:	
LEGEND: SEC = SECOND IP = INTERNET PROTOCOL PLTN = PLATOON SECT = SECTION URN = UNIT REFERENCE NUMBER * = OPERATOR PROTECTED FIELD			

Figure 5-3. Example Communications Parameter Card (188-220A Protocol)

BATTERY WIRE SYSTEM

WIRE COMMUNICATIONS

5-18. Use of wire in a Paladin battery is usually limited to those periods when a howitzer's radio communication is degraded and it must connect with another howitzer, FAASV, or the POC in order to continue operating or when radio listening silence is imposed by the higher headquarters. Connecting by wire to another howitzer or a FAASV allows voice intercom communications (AN/VIS-3). Connecting to the POC provides both voice and digital communications (if two wire lines are laid). Priority in establishing communications is digital followed by voice.

SINGULAR DATA LINK

5-19. Only one method may be used to establish the digital link over land line. For each howitzer, this is done by connecting one end of the DR-8 wire to the howitzer digital binding post and the other end to the POC LCU wire line adapter binding post. The limitations associated with this method are the amount of available wire and the time it takes to install, maintain, and recover the wire line. Wire cannot be hot looped.

ALTERNATIVE COMMUNICATIONS

5-20. If radio listening silence is imposed, an alternate means of communications (such as wire, messenger, or signals) must be used. Given the constraints on wire, personnel, visibility, mission, time, and the requirement to maintain digital communications between the guns and the POC, the procedures below should be considered when developing the unit TSOP:

- If required, move howitzers to within 1/4 mile (or less) of the POC or platoon terminal board (TM-184) and use DR-8 wire lines.
- Establish a battery wirehead as a connection point for the POCs.
- Consider use of wire line adapter (HYX-57/TSEC for wire line security and remoting.
- Mark lines or provide line route maps for wire repair or recovery operations, if they are used.
- Use other available means (messenger, visual signals) to facilitate communication needs.
- Establish communications with adjacent units, left to right or higher to lower, as applicable.

Chapter 6

Unit Defense

The techniques and procedures employed by the Paladin unit to establish the defense are similar to those in FM 6-50, Chapter 3. The Paladin is extremely flexible and allows for many employment options to optimize its defense. A detailed threat and terrain analysis will dictate how commanders will employ Paladin to ensure its survivability.

RESPONSIBILITIES OF KEY PERSONNEL

6-1. Leaders create a defensive plan that is flexible enough to accommodate the movement and dispersion of howitzers within a PA. The BC and platoon leaders identify the critical elements of the defense and convey that information to subordinates. Key terrain features, high-speed avenues of approach, and danger areas must be known and understood to develop an effective defense.

6-2. The GSG works with the BC during RSOP to initiate and develop the defense plan. The GSG sketches the plan on the firing area map/defensive diagram. When the unit arrives in a new position, the platoon sergeant and platoon leader refine the plan. The section chief executes the plan and provides feedback to the platoon sergeant.

BATTERY COMMANDER

- Responsible for the overall defense of the battery.
- Responsible for identifying the primary threat to the battery and possible enemy avenues of approach.
- Responsible for coordinating mutual supporting defense with adjacent units.
- Responsible for relaying any change to the tactical situation which may affect the battery.
- Based on threat capabilities or limitations and time available, identify possible areas in unit defense to accept/assume risk in order to ensure mission accomplishment.
- Establish priority of work for defense.

FIRST SERGEANT

- Responsible for the overall execution of the battery defense.
- Integrates platoon defensive plans into an overall battery defensive plan and forwards to battalion.
- Responsible for organizing and positioning the defense for the battery support (trains) elements.

PLATOON LEADER

- Responsible for the overall defense of the platoon.
- Coordinates with the platoon sergeant on the defensive plan IAW FM 6-50, Chapter 3.

PLATOON SERGEANT

- Responsible for the development of the platoon defensive plan IAW FM 6-50, Chapter 3.

GUNNERY SERGEANT

- Initiates firing area defense diagram (FADD) during RSOP.
- Identifies potential TRPs and enemy avenues of approach in conjunction with the battery commander.
- Establishes initial security of firing area as required.

SECTION CHIEF

- Executes the platoon defensive plan.
- Monitors assigned sectors.
- Develops section defensive plan IAW guidance/TSOPs.

AMMUNITION TEAM CHIEF

- Executes the platoon/section defensive plan.
- Monitors assigned sectors.

CONDUCT OF THE DEFENSE

DEFENSE AGAINST COUNTERFIRE

6-3. The best defense in a high counterfire threat environment is for Paladin howitzers to execute survivability moves after firing and maximize dispersion between sections.

DEFENSE AGAINST AIR ATTACK

6-4. Concealment without movement is the best defense in a high air threat environment. If Paladin is detected and attacked, the key to survival is dispersion and engaging attacking aircraft with a large volume of fire. Immediate actions against air attack include using organic direct fire weapons (or air defense assets if attached) to return fire.

DEFENSE AGAINST ARMORED OR MECHANIZED ATTACK

6-5. The best defense against an armored or mechanized ground attack is for the Paladin unit to move to a position from which it can continue the mission without a direct confrontation with the enemy. The section chief moves out of the danger area, notifies the POC, and continues the mission. However in some circumstances fighting an enemy force may be unavoidable. The unit TSOP should address immediate action drills to include direct fire engagement criteria.

DEFENSE AGAINST DISMOUNTED ATTACK

6-6. The best defense against a ground threat is avoiding detection through concealment. When the counterfire threat is low, protection from ground attack is enhanced with the establishment of pair, platoon or battery defensive positions. An additional defensive measure against a ground attack is for the Paladin unit to displace to an alternate position.

DEFENSIVE CONCEALMENT

6-7. The Paladin's best defense is to avoid enemy detection. Firing positions should be selected that allow the howitzer sections the maximum ability to hide while continuing to operate. Tree lines, the bed or valley of a stream, and built-up areas provide excellent means of concealment. When the battle becomes static, camouflage discipline should be rigorously enforced and camouflage nets may be used to effectively conceal the unit.

AVAILABLE DEFENSIVE WEAPONS

6-8. A formidable defense calls for sound tactics and the proper employment of the unit’s organic weapons. Defensive weapons available to the Paladin battery include direct fire by the howitzers (see TM 9-2350-314-10, Chapter 2), .50 caliber machine guns, M60 machine guns, MK 19 grenade launchers, M18-series mines, light antitank weapons, and 5.56-mm rifles. Artillery fires are a key element of battery’s defensive planning. The BC coordinates his defensive plan through the battalion S3. Mutual defensive support with adjacent friendly units is coordinated face to face by the commander or NCO in charge (NCOIC) with the nearby unit.

TSOP RESPONSIBILITIES

6-9. Unit TSOPs and checklists are important tools in the development and execution of a strong defense. Figure 6-1 provides an example checklist for the development of an effective battery defense.

H-HOUR	ACTIONS	COMPLETE
	Accurate RSOP Prepare Positions/Pickup Point Assign Sectors of Fire/Establish Timeline Coordinate with POC for HOW;UPDATE Test/Emplace M-8 Alarms Complete Range Cards Assign Time Line/Priority of Work Complete Position Map/Defense Diagram Clear Fields of Fire Camouflage Vehicles Hasty Fighting Positions/Rollover Pits Mass Casualty Plan Established Communications to All Perimeter Positions Ammunition Redistributed As Needed Defense Diagram to Battalion Wire Staked and Buried Sleep Plan Established PMCS Completed/2404s Turned In Rehearse Reaction Plan, NBC Teams, Casualty Evacuation and Crater Analysis Teams Test/Reposition NBC Equipment Reconnoiter Route to Aid Station All Mines (M18A1) Emplaced Fighting Positions Completed/Camouflaged Inspect/Preposition MOPP Gear Update Unit on Tactical Situation as Necessary Personal/Crew Served Weapons Cleaned Rehearse Direct Fire/Tank Killer Teams Technical Rehearsal of Fire Plan Establish Rally Points	

Figure 6-1. Example of Defensive Checklist

6-10. The BC must ensure that battery TSOPs address all aspects of unit operations, to include procedures for dealing with NBC attacks. TSOPs should cover protective measures, immediate action, decontamination, and reporting. Guidance for the commander is in FM 3-100, *NBC Operations*.

DEFENSIVE METHODS

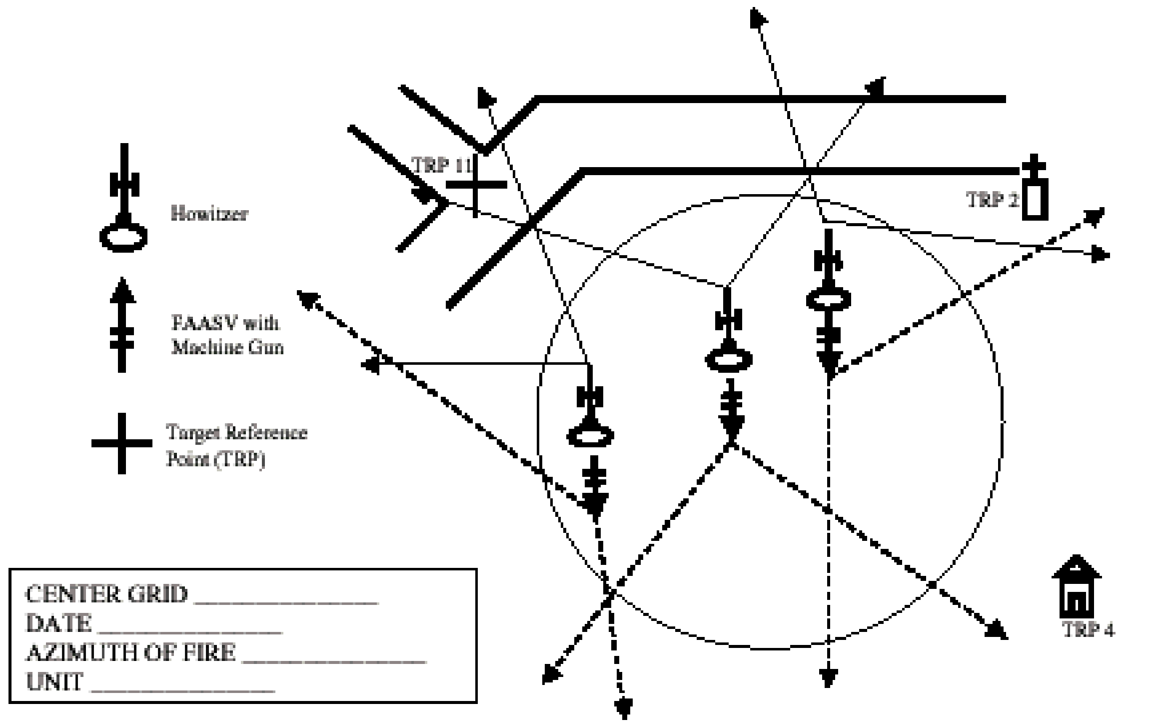
DEFENSE WHILE MOVING AND IN POSITION

6-11. Employing one of the following three methods during operations enhances Paladin defense:

- Clock method.
- TRP method.
- Static method.

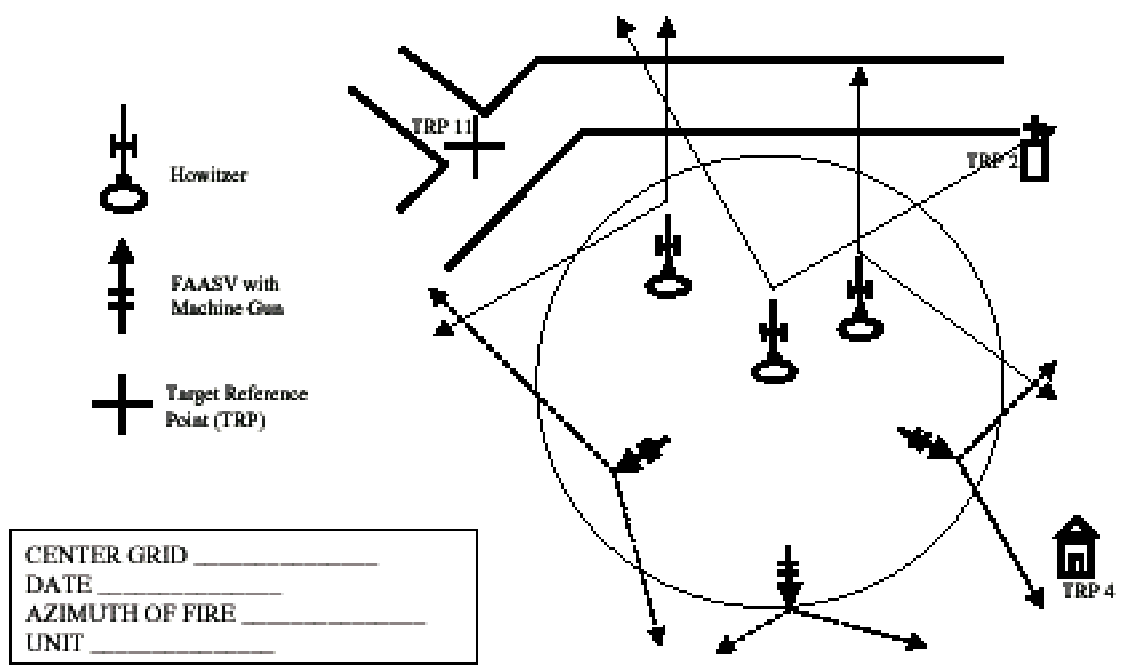
6-12. The clock method is recommended while moving and upon occupations. Vehicles are assigned sectors of fire in relation to a clock, with 1200 hours (hrs) as the direction of travel while moving and 1200 hrs along the azimuth of fire during and after occupations. Adopting the standardized clock method provides the means to assign areas of responsibility to gun sections and facilitates rapid occupation and emplacement of security. Further, this method enhances the section's ability to move and quickly refocus its primary and secondary weapon systems on assigned areas of responsibility. This has been referred to as a "floating" or "flexible" defense. The clock method may be employed while moving in various formations and upon initial occupation until a suitable TRP method can be established.

6-13. After the completion of occupation, the platoon senior COS/platoon sergeant/GSG executes the TRP method by replacing "clock" sectors of fire with identifiable TRP sectors of fire ensuring all sectors interlock. Figures 6-2 and 6-3 depict examples of a platoon defensive diagram during mated/separated operations and during overwatch operations using TRPs.



TRP #	Shell	CHG	FZ	TI	DF	QE	RG	Description	Grid/ALT

Figure 6-2. Example Defensive Diagram--Mated/Separated



TRP #	Shell	CHG	FZ	TI	DF	QE	RG	Description	Grid/ALT

Figure 6-3. Example Defensive Diagram--Overwatch

6-14. Static defense is an improvement on the TRP method during periods of less frequent movement (i.e., low threat of counterfire). Sections maximize cover/concealment and improve their positions to include individual fighting positions and survivability positions. Units position listening posts/observation posts (LPs/OPs) to provide early warning and limited security. Static defense includes but is not limited to the techniques described in FM 6-50, Chapter 3.

6-15. During all three methods, units designate known rally points before/during movement and when emplaced to facilitate defensive operations upon attack.

BATTERY AND PLATOON DEFENSE

6-16. Battery and platoon level defensive operations are effective when the ground threat is greater than the counterfire threat. Conventional battery and platoon defensive operations differ little from those described in FM 6-50, Chapter 3 and FM 6-20-1. Consolidating the howitzers into a battery or platoon formation increases the unit's defensive capability against ground attack. Battery trains and POCs may be collocated with the firing elements to provide additional security particularly at night. Survivability moves are driven by the tactical situation.

Advantages

- Security within the battery is maximized.
- Available firepower for defense against ground and air attack is increased.
- C2, supply distribution, feeding, and sleep rotations are easier to manage in platoon and battery-level operations.
- Wire communications, if used, reduce radio signatures in the platoon and battery area.

Disadvantages

- Easier to locate.
- Provides larger target array for threat forces.
- More vulnerable to counterfire.

PAIRED HOWITZERS

6-17. This mode enhances howitzer section defense, especially during degraded operations and hours of limited visibility. The Paladins and their FAASVs provide mutual security through interlocking fires with crew-served weapons. Paired howitzers coordinate survivability moves with each other to ensure continued mutual defense. FAASVs assist in the security of the entire position, regardless if they are used in the paired configuration or in the overwatch position.

Advantages

- Complicates enemy's targeting and attack decision process
    - Firing areas are better protected against ground and air attack over single howitzers.
    - The increased number of soldiers in the area reduces the psychological factors of isolation compared to single howitzer operations.

Disadvantages

- More difficult to C2 and resupply over platoon operations.
- More vulnerable to ground attack over battery and platoon defense.

SINGLE HOWITZERS

6-18. This mode of operation is least preferred. However, it is very effective when the counterfire or air threat is much greater than the ground threat. Defense against ground threat suffers because of crew and firepower limitations. Mission and crew rest requirements make it difficult to provide LPs and OPs.

6-19. The dispersion and isolation of single howitzer operations place the immediate responsibility of making defensive decisions on the section chief. To effectively employ this method of operation, the section chief must understand the commander's guidance, be skilled in applying the defensive procedures in FM 6-50, and be capable of establishing a local defense. He must make an initial plan to displace or fight from his position and develop the plan with the platoon sergeant.

6-20. The COS and the ATC work together to establish an effective defense. The ATC bears a large responsibility to defend the howitzer, particularly when the howitzer is occupying or firing. The COS and ATC must make effective use of cover and concealment. Entering a position, they must sweep and clear the immediate area, identify danger areas, avenues of approach, and an egress to an alternate position or rally point. BCs must maximize coordination with adjacent and surrounding units when employing single howitzers.

ADVANTAGES

- Less vulnerable to counterfire.
- The smaller signature makes detection of individual howitzer difficult.

DISADVANTAGES

- Most difficult to C2.
- Does not provide for mutual support against ground threats.

Appendix A

Degraded Operations

This appendix presents guidelines and actions to ensure Paladin firing capability should the LCU at the POC fail to function or communicate, or should various elements of the Paladin system fail during combat operations.

DEGRADED PLATOON OPERATIONS CENTER

PROCEDURES FOR DEGRADED POC OPERATIONS

A-1. The POC is the "brain" of the Paladin platoon. If the LCU becomes inoperative, that POC can no longer control the fires of the platoon. If the digital communications system fails, the AFCS cannot receive and compute fire missions, and firing data must be externally supplied. Table A-1 outlines procedures to be followed if POC operations become degraded.

Table A-1. Degraded POC Operations

Failure	Battle Drill/Options
Lightweight Computer Unit	Degraded POC: - Notify adjacent platoon to assume control of howitzers. - Inform the battalion CP of the situation. - Inform BC of nature of equipment failure and request necessary external support. - Repair or replace faulty equipment.
	Immediate Action/Options
	- Notify howitzers to go backup BCS and backup frequency on the net address screen.
	Adjacent POC: - Display SYS;SBT. Enter Y in the T-field of the degraded platoon Paladins, if necessary. - Request HOW;UPDATE from each Paladin. - Execute upon receipt. - Request HOW;AMOUP from each Paladin. - Execute upon receipt. - Request AFU;MASK from each Paladin. - Execute upon receipt. - Request BCS;MVV from each Paladin. - Request AFU;REG from each Paladin. - Execute upon receipt. - Conduct verification mission (after this step, the platoon is RTF. - Request targets stored at the AFCS of each Paladin. - Update/transmit AFU; UPDATE to battalion. - Update/transmit AFU; AMMO to battalion.
Digital Communications	Degraded POC: - Keep Paladins in current position or move them into a platoon formation. - Establish an internal wire system, if feasible. - Use LCU to compute technical fire commands. - Verify AOF. - Send fire commands to Paladins by voice over FM radio or wire.

A-2. Consideration must be given to FPFs and Copperhead. Only one FPF and one Copperhead, or two Copperhead targets may be stored in a LCU. Missions with the highest priority should be stored on the Paladins. All other missions should be recorded and deleted.

AFCS COMMAND INPUT

A-3. The AFCS can only receive fire missions digitally. The COS can only input fire commands manually at the AFCS. When digital communications with the Paladin are lost for any reason, collocate degraded howitzer within 30-50 meters of an operational howitzer and use the data computed by the operational howitzer. The COS of the degraded howitzer manually inputs the data into the AFCS and allows the system to operate normally.

BACKUP FIRE DIRECTION CAPABILITY

A-4. The primary backup technical fire direction capability for the Paladin platoon is the LCU from the second POC in the battery. Should both battery LCUs become inoperative, the BC may direct several options:

- Option 1. Platoons may be attached to other batteries of the battalion.
- Option 2. The POCs manually compute firing data. (The POCs retain the plotting board, plotting set, and fire direction set necessary for manual operations.) However, the Paladins must set up as a platoon.

ALTERNATE FIRING MODE

A-5. If the AFCS or navigation system of a Paladin howitzer becomes non-operational, the easiest way to maintain fire capability is to reciprocally lay using an operational Paladin. If both systems are down, the non-operational howitzer will co-locate and use the firing data from an operational howitzer which is located 30-50 meters from the degraded howitzer. The POC may also compute firing data.

DEGRADED SUBSYSTEM BATTLE DRILLS

A-6. The Paladin is a "system of systems," all of which must be working for the M109A6 to achieve its full combat potential. Loss of one or several subsystems does not completely negate the overall capability of the Paladin. Most subsystem failures can be overcome by working around the faulty subsystem with alternate procedures.

Table A-2. Degraded Subsystem Operations

Failure	Battle Drill/Options
Electrical Power	- Notify POC. - Use limited electrical power available from M992A2 FAASV APU. - Manually ram projectile. - Manually lay using gunner's hand wheels. - Note: The APU provides enough power for AFCS operations only. APU output is not sufficient for operating the hydraulic system.
	If M992A2 is not available: - Use reciprocal lay, aiming circle, or compass laying techniques. Refer to this appendix for reciprocal laying procedures. - Use spades. - Manually elevate and traverse. - Receive firing data from adjacent howitzer. - Operate travel lock manually. - Use DAP or collimator. - Hand ram.
Digital Communications	- Notify POC. - Collocate within 30-50 meters of operational gun and use operational gun's data or determine firing data in the POC (this method is slower than collocation with an operational gun, but more accurate). - Use voice net for fire direction. - Manually input data into AFCS. - Verify AOF (voice) with POC. - Report rounds complete.
Navigation System (DRU-H)	- Notify POC. - If in position use DAP (preferred) or collimator and continue mission using manual/optical fire control and move operational howitzer within 30-50 meters and use its firing data. - If moving, manually navigate to destination. Use another howitzer to provide location and reciprocal lay or use hasty survey and other laying techniques, move operational howitzer within 30-50 meters and use its firing data. - POC provides firing data (this method is slower than the above methods, but more accurate). -Use spades if needed.
VMS	- ZUPTs will be required more often. Howitzer is still fully operational.
Hydraulic Power	- Notify POC. - Load, traverse, and elevate manually according to the procedures in the current -10 series TM.
Gun Drive Servos	- Notify POC. - Lay with chief of section or gunner's control handle. - Lay manually using the gunner's elevating and traversing hand wheel.

Table A-2. Degraded Subsystem Operations (continued)

AFCS	- Notify POC. - Have operational howitzer collocate within 30-50 meters and fire operational gun's data. - Use DAP or collimator. - Lay manually using gunner's/section chief's hydraulic control handle or hand wheels. - Use spades. - If moving, navigate manually to destination. Use another howitzer to provide location and for reciprocal lay.
Voice Communications	- Notify POC. - Use wire to an adjacent howitzer. - Remove radio from FAASV and place in howitzer.
Intercom	- Notify POC. - Remove combat vehicle crewman (CVC) helmets and replace with Kevlar helmet. If firing M119 or M203 charges, the CVC helmet must still be worn with earplugs to ensure overpressure does not damage hearing. - Do not move howitzer until communications are restored between the track commander and the driver.
Transmission and/or Final Drive	- Notify POC. - Tow to subsequent position by using the FAASV. Use APU to power the AFCS.
Engine	- Notify POC. - Use limited electrical power available from FAASV APU. - Continue firing until engine is repaired or replaced. - Tow to subsequent position.

RECIPROCAL LAYING PROCEDURES

A-7. The procedures for reciprocal laying are somewhat different than those for reciprocal laying of previous M109 series howitzers. The turret configuration of the M109A6 requires the howitzer being laid to be positioned to the left front of the operational howitzer. Also, location can be transferred in addition to direction. The procedures are as follows:

A-8. The driver positions the degraded howitzer as required and emplaces using spades. The M2 compass is used to approximate the azimuth of fire. The selected position must allow a second howitzer to pull up along the left (driver) side of the howitzer.

A-9. The driver pulls the operational howitzer alongside the degraded howitzer hub to hub, with the left front sprockets parallel and not more than 1 meter apart as shown in Figure A-1.

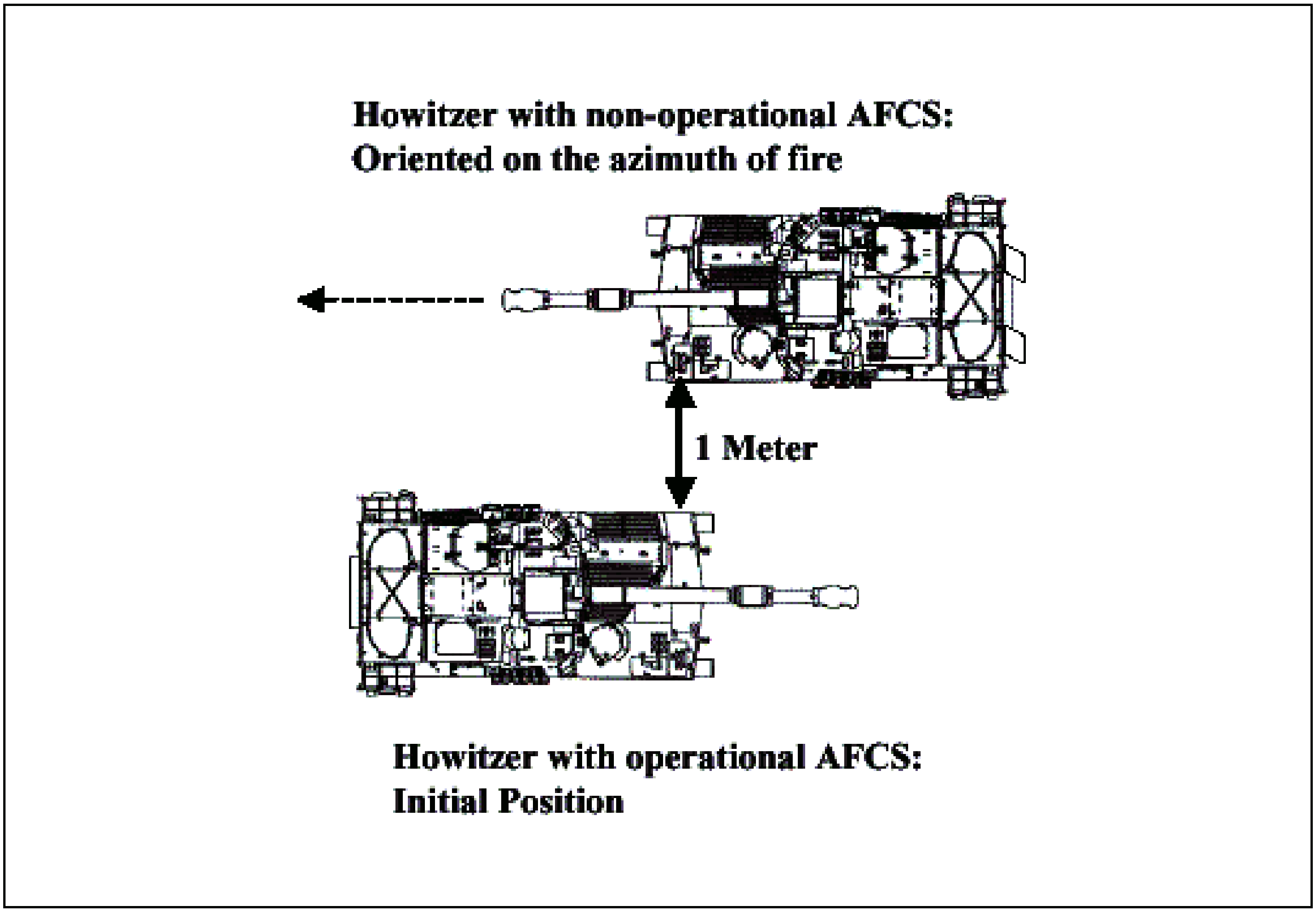


Figure A-1. Hub to Hub Positioning for Location

A-10. The COS on the operational howitzer reads its location from the AFCS and reports that location to the COS on the degraded howitzer. The COS of the degraded Paladin records the location and reports it to the POC as his location.

A-11. Note: Another possibility is to use two PLGRs to determine howitzer location. The degraded howitzer has a PLGR on board, so only one additional PLGR would be needed. This allows the operational howitzer to obtain firing capability before reciprocally laying the degraded howitzer.

A-12. The driver then moves the operational howitzer to its firing point. This point must be clearly visible, to the left of and within a 45-degree cone forward of the degraded howitzer as shown in Figure A-2. This limitation is due to the limited traverse of the pantel ballistic shield of the Paladin.

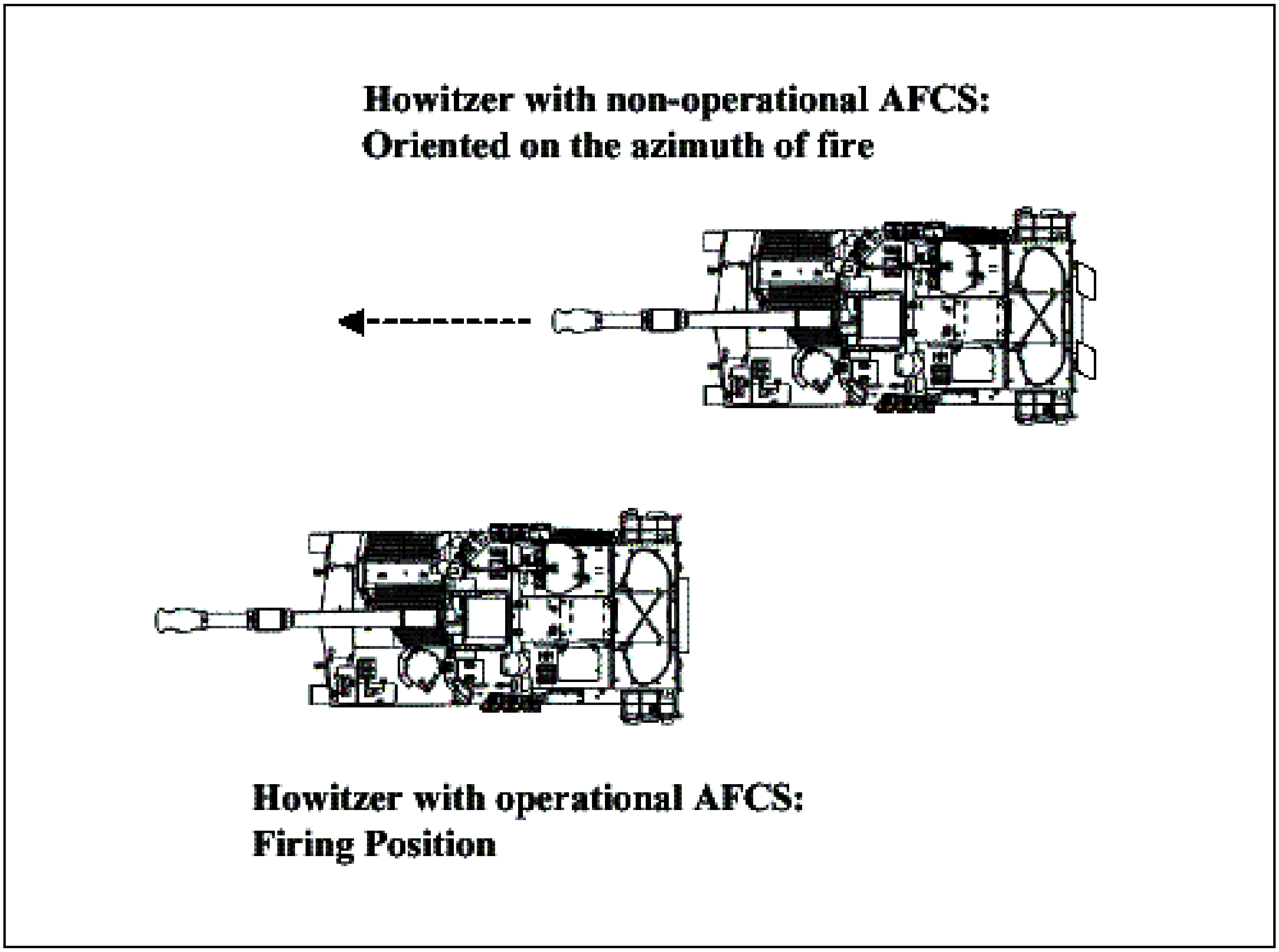


Figure A-2. Positioning the Operational Howitzer

A-13. Once the operational howitzer is in position and laid on the desired azimuth of fire, the gunners on both howitzers check the boresight of their pantel with the M140 boresighting device or standard angle method.

A-14. Using the AFCS, the COS traverses the turret 3200 mils, placing the operational howitzer on the back azimuth of fire. This gives the two gunner's sights clear fields of view off the left sides of the respective howitzers (Figure A-3).

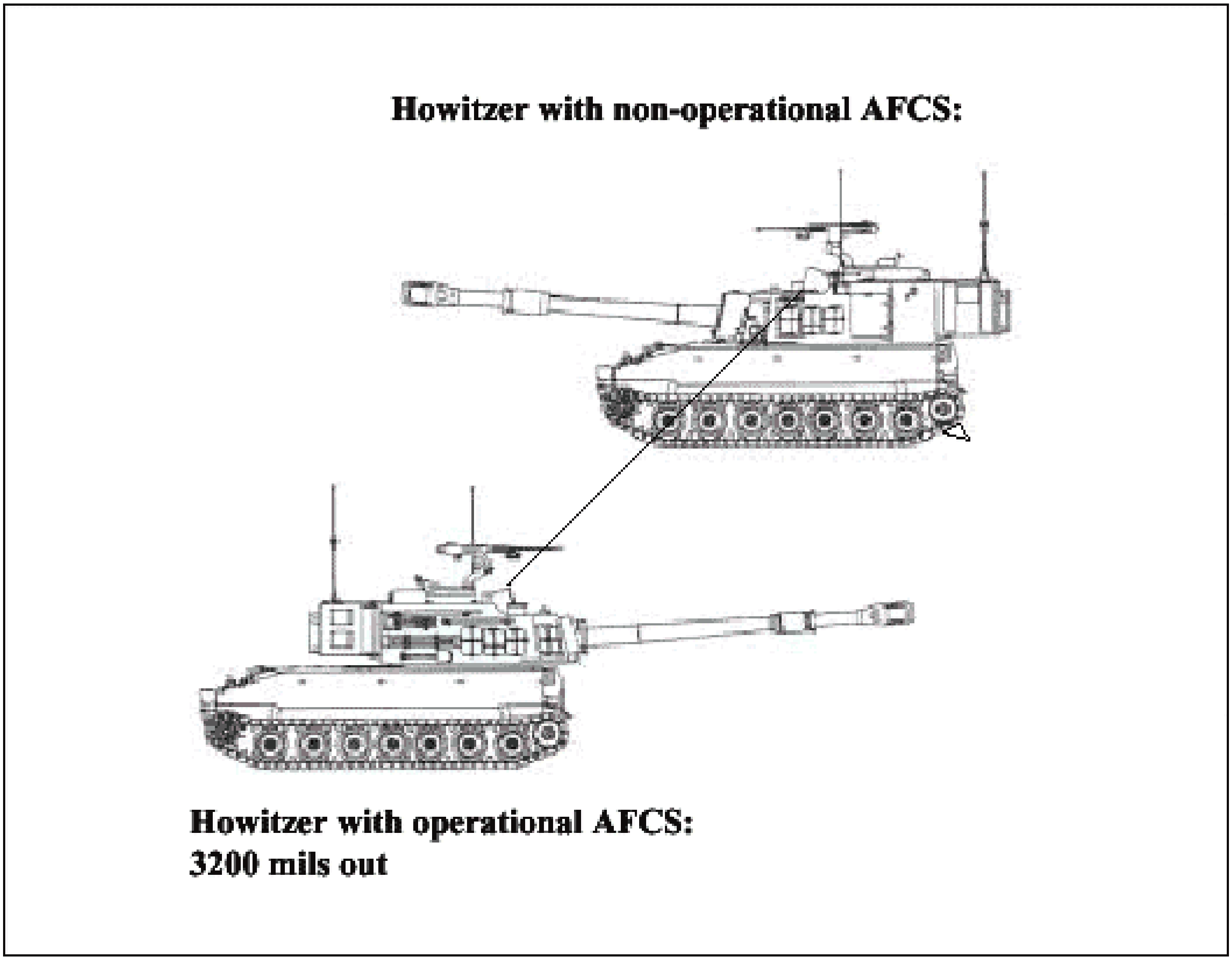


Figure A-3. Laying the Degraded Howitzer

A-15. The gunner of the operational howitzer sights on the pantel of the degraded howitzer. Reading the upper scale, he reports NUMBER (so-and-so), DEFLECTION (so much). The COS reports the referred deflection to the degraded howitzer by radio (using the battery/platoon command voice net) or by voice relay.

A-16. Note: The operational howitzer is already on the back azimuth of lay. The gunner is not required to add or subtract 3200 mils from the referred deflection as in conventional reciprocal lay procedures.

A-17. The gunner of the degraded howitzer sets the reported deflection on the upper scale of the pantel, traverses the tube until he sights the pantel of the operational howitzer, and reports READY FOR RECHECK.

A-18. The gunner of the operational howitzer again sights on the pantel of the degraded howitzer and reports the referred deflection. The procedure is repeated until the degraded howitzer reports ZERO MILS. The azimuth of fire for the degraded howitzer is then reported to the POC.

A-19. Then, as with any howitzer laid by conventional means, aiming points for the degraded howitzer are established and recorded IAW FM 6-50.

A-20. If the degraded howitzer uses the operational howitzers firing data, the operational howitzer must remain within 30-50 meters.

A-21. Independent verification of reciprocal lay must be conducted.

ALTERNATIVE PROCEDURE

A-22. An alternative method to establishing direction is to lay the degraded howitzer using conventional methods IAW FM 6-50.

Appendix B

Automated Command and Control

The capabilities of the Paladin howitzer have substantially changed the role of the POC. The emphasis at the POC shifts from providing technical fire direction to tactical fire direction and the C2 of three semiautonomous howitzers. The Paladin unit has a number of unique capabilities as well as some unique challenges to operate at its fullest capacity. Increasing automation means that information flow is accelerated and the demand for information, both into and out of the POC, is increased. This appendix provides information on AFCS capabilities, initialization procedures, and message traffic to assist in controlling the automation process.

COMMANDER'S CRITERIA

B-1. Commander's criteria are the supported maneuver commander's guidance for fire support translated into language usable by the battalion FDC computer. The FSCOORD, artillery battalion S3, and battalion FDO meet and develop commander's criteria for each maneuver mission or phase of a mission. The FA support plan or the battalion FDC tab to the FA support plan must contain commander's criteria. When AFATDS/IFSAS is controlling the battalion fires, this information is automatically part of the tactical fire control solution developed by the computer. However, this information must also be disseminated to each POC so that the maneuver commander's guidance for fire support and attack guidance are adhered to in case battalion FDC is not available. The battalion O&I section provides this information, and should be regularly queried to ensure this information is passed initially and updated as changes in the tactical situation occur.

AUTOMATIC FIRE CONTROL SYSTEM

B-2. To C2 the Paladin, it is important that personnel understand what the AFCS can and cannot do. It is not a stand-alone device but is an extension of the LCU. The howitzer COS cannot receive voice calls for fire and input grid coordinates to compute fire missions. The items discussed below are those the COS must input into the AFCS and report to the LCU.

PIECE STATUS

B-3. The piece status is reported to the POC in the form of the HOW;UPDATE report. The actual status in the HOW;UPDATE depends on directions given by the POC. The HOW;UPDATE received by LCU contains the howitzer grid location and altitude, date and time of arrival at the firing position, operational status, AOF, maximum elevation, and powder temperature. Status codes used are as follows:

- Y = Operational in a fire area. This means the howitzer is given more authority within a POC-specified radius.
- O = Out of action. Determined automatically by the AFCS.
- M = Moving. Determined automatically by the AFCS.
- S = Stationary at a firing point.
- L = Linked with a TA asset.
- R = Relay linked with a TA asset.

AMMUNITION

B-4. The howitzer ammunition status is reported to the POC by use of the HOW;AMOUP report. This information is maintained in the LCU by howitzer and is consolidated for AFATDS/IFSAS reporting purposes on the AFU;AMMO report. Ammunition reported includes both on-board howitzer ammunition and ammunition available on the FAASV if the FAASV is in the PA.

MASK DATA

B-5. The gunner or section chief traverses the tube, elevating and/or depressing to measure site to crest. He then measures piece-crest range by using an AN/GVS-5 hand-held laser range finder or one of the methods described in FM 6-50, Chapter 6. The mask information is determined for each howitzer and is reported to the POC on the AFU;MASK report, where it is also maintained by howitzer. Each howitzer can report up to eight masks with a maximum of 24 masks stored at the LCU. It is not necessary for each howitzer to report eight masks. If the adjacent POC is not available and one POC must control six howitzers, the mask data may have to be redefined by the howitzer COS as directed by the POC. For example, the COS may be directed to report the three highest masks within his primary sector of fire.

MUZZLE VELOCITY

B-6. Each howitzer maintains its own MVV data. This information is also maintained by howitzer in the LCU database at the POC. The POC can request the current MVV data by using the HOW;REQUEST message format. This process is transparent to the Paladin. All calibration data entered into the AFCS are corrected for nonstandard conditions (projectile weight and propellant temperature) and appear at the POC as variations requiring no further processing. (Also refer to Appendix K.)

MISSION PROCESSING

B-7. The AFCS can process only one fire mission at a time. However, a stored priority Copperhead or FPF mission can be fired anytime it is requested. The AFCS can store up to ten targets, including one priority target.

B-8. Except for priority targets (FPF or priority Copperhead), the gunner or COS can review only stored targets for the purpose of preparing ammunition. The AFCS can process fire missions where the LCU has computed the firing data (firing data sent by FM;COMMDS message), or it may compute its own data (HOW;MSN sent from LCU). In the normal mode of operation, the AFCS computes its own data based on tactical fire control information sent from the POC via the LCU.

B-9. If for any reason the AFCS should be unable to process information transmitted from the LCU, the AFCS automatically transmits a "be advised that" (BAT) or an "unable to execute" (UTE) plain text message to the LCU. The BAT or UTE PTM states the warning or reason for failure to process. Section II lists BAT and UTE messages.

INITIALIZATION

B-10. It is imperative that platoon and battery personnel be thoroughly briefed on the tactical situation and the role the unit is to play in accomplishing the commander's guidance for fire support. This information has a direct influence on the operational employment of the Paladin battery and its platoons. Information critical for howitzer sections is discussed below.

CALL SIGNS AND FREQUENCIES

B-11. Call signs and frequencies to be used by the howitzers must be known.

SURVEY CONTROL AND LOGISTICS POINTS

B-12. Location of SCPs and logistic points must be known.

PRIORITY SHELL-FUZE COMBINATIONS

B-13. This information is part of commander's criteria found in the FA support plan. It aids the howitzer COS in managing ammunition on the howitzer and FAASV to best support the operation.

COMMUNICATIONS PARAMETERS

B-14. (See Chapter 5 for communications parameters information.)

DATABASE INFORMATION

B-15. There are several ways to approach building the database. However, digital communications must first be established. Each howitzer and POC must input enough initial database information to enable digital communications between elements. Each howitzer must notify the POC when it is prepared to establish digital communications.

LCU Database

B-16. There are two options in constructing a database at the LCU:

- Build a complete database by selecting the weapon-dependent program and receiving all of the information directly from the individual Paladins.
- Modify an existing database, using database recording (DBR) DATABASE1 or DATABASE2 or FLEXIBLE DISC UNIT.

B-17. Selection of a database previously recorded normally is the option selected. Corrections are made and transmitted to the howitzer as needed. As a matter of SOP, the AUTO XMIT DATABASE messages should be YES (selected). This allows automatic transmission of the HOW;SBT, MET;CM, AFU;REG, and SPRT;MAP anytime the format is executed or a HOW;REQUEST is executed. Otherwise, changes to the LCU database are placed in the input queue and require operator action for transmission to the howitzer(s). The LCU operator should enter all six howitzers (both platoons) in the SYS;SBT. These should be the first six entries. The adjacent platoon howitzers should have an entry of N in the T field. This eliminates the need to enter them in case the POC has to assume control of the adjacent platoon howitzers. However, do not enter the adjacent platoon howitzers (HOW;UPDATE) and ammunition (HOW;AMOUP) into the database. This results in incorrect platoon location and ammunition count reports to battalion.

AFCS Database

B-18. Each howitzer COS constructs his database on the basis of known data. Some of this information is provided by the POC:

- Net access (See Chapter 5).
- Net address (See Chapter 5).
    - Radio frequencies and call signs.

- Date and time.

B-19. The remaining information for the AFCS is available at howitzer level (such as ammunition, load elevation, and time on target (TOT) response time). At the onset of operations, there may be no more than one or two SCPs where the howitzer(s) may initialize the navigation system. (This does not preclude other database information from being entered.) The POC may need only to tell the COS at which SCP to initialize. It is important to note that once the navigation system is initialized, it need not be done again unless a catastrophic failure or loss of survey control occurs.

ESTABLISH THE NET CONTROL STATION (INTRA-PLATOON)

B-20. Each POC is responsible to establish voice and digital communications within its platoon. Strict net discipline is essential because of the increase in radios. Unit TSOPs should specify procedures to establish voice and digital communications.

B-21. Voice communications checks should be made first on both voice and digital nets. If voice communications cannot be established, then digital cannot be established. Once each howitzer has completed initial database input, digital communications should be established. The POC should first send a time hack, after which the COS should request initialization. The LCU receives this as a HOW;REQUEST, which the LCU operator executes. If AUTO XMIT DATABASE messages is YES, then the HOW;SBT, AFU;REG, SPRT;MAP and MET;CM automatically transmit. It is important to note that this database information is not accessible to the howitzer COS and is controlled exclusively by the POC. If the POC is uncertain whether the AFCS has this information, it should be retransmitted. There are two reasons for transmitting the HOW;SBT before any other message: first, to check digital communications from LCU to AFCS: and second, so the howitzer knows its fire unit name (as found in BCS SYS;SBT). This keeps the LCU operator from having to correct the fire unit name when a HOW;REQUEST is received from a howitzer.

B-22. Unlike digital transmissions to other subscribers, the POC, when transmitting to howitzers, may transmit to a single gun or make a single broadcast transmission to all guns. For example:

- SB:*/1/2/ / ; Transmission to guns 1 and 2 only.
- SB:*/ / / / ; Broadcast transmission to all guns.
- SB:*/1/ / / ; Transmission to gun 1 only.

HOWITZER SUBSCRIBER TABLE (HOW;SBT)

B-23. The HOW;SBT is used to establish legal digital subscribers for each howitzer. The controlling POC should enter the backup POC in each HOW;SBT. This allows the backup

POC to assume control of adjacent howitzers should the need arise.

HOWITZER MOVEMENT (HOW;MOVE)

HOW;MOVE FORMAT

B-24. The HOW;MOVE format is used to direct howitzer movement. This message gives the howitzer authority to move. When this format is used, it is important to understand the type of control the POC is granting the howitzer. If the POC intends the howitzer to occupy a single firing point, the radius given should be zero. If a firing area is desired, thereby allowing the howitzer freedom to select its own position, a radius greater than zero is specified. Whenever a radius greater than zero is specified, the howitzer is automatically granted move authority. In all cases, the POC should enter X in REPORT. When the howitzer arrives at the firing position, the AFCS automatically reports the arrival to the POC. If the howitzer is directed to a firing point (no move authority) and the howitzer moves more than 18 meters, the AFCS warns the operator and reports the movement to the POC. If the POC wants the howitzer to lay on a specific azimuth, the desired azimuth is placed in the center sector (CSECT) field. The left sector (LSECT) and right sector (RSECT) fields are used to orient the howitzer in a specific zone of support. Note: Prior to entering a manual move order into the AFCS, the new location sectors of fire, if known, should be applied, otherwise the sectors will remain unchanged from previous data entered.

HOWITZER UPDATE (HOW;UPDATE)

B-25. The HOW;UPDATE, when transmitted to the LCU, displays the howitzer location and other firing-related information. The status reported in this format is also displayed in the LCU middle plasma display. The HOW;UPDATE should be compared to the platoon operations and survey overlays when received. If the LCU operator placed an X in REPORT on the HOW;MOVE format, the howitzer automatically reports its location when the COS selects ARRIVE on the AFCS. This is done upon arrival at a survey point (INITAL on the HOW;MOVE), logistic point, or firing area. If the howitzer is moving to a firing point, the reported location should be within 50 meters (E and N) of the firing point. If the howitzer is sent to a firing area, it should be within the specified radius from the grid sent in the HOW;MOVE. If not, the situation should be investigated, since there may be a problem with the AFCS. Note: After a survivability move within a firing area the HOW;UPDATE is not automatically transmitted when the COS presses the arrive key.

HOWITZER AMMUNITION (HOW;AMOUP)

B-26. The HOW;AMOUP contains the ammunition file for each howitzer. As previously stated, this includes ammunition on the FAASV. If ammunition requires more than one page in the file, the first page when received will have AMOH: X and subsequent pages will have AMOR: X. Upon receipt of each howitzer's ammunition file, the file should be compared to the ammunition breakdown specified by the POC.

AMMUNITION AND FIRE UNIT UPDATE MESSAGE (AFU;UPDATE)

IFSAS

B-27. This format reports platoon location and other tactical information to the battalion IFSAS. If received from IFSAS or another LCU, this format cannot be executed. It is for information purposes only. It is part of the initial setup sequencing and must be executed at that time. Failure to execute this format during setup causes the MAXRNG entries to default to 0. This keeps the LCU from computing ballistic solutions, since the maximum range for each shell type is 0. The CORD and AZ fields reflect averages based on the number of HOW;UPDATEs on file.

HOW;UPDATE AVERAGES

B-28. Each POC must avoid executing the adjacent platoon's HOW;UPDATEs if received, because the CORD and AZ fields reflect averages based on the number of HOW;UPDATES on file. Executing the adjacent platoon's updates can cause gross errors at the battalion AFATDS/IFSAS when the AFU;UPDATE is sent. This does not apply when one LCU must control all six howitzers.

FIRE UNIT AMMUNITION UPDATE MESSAGE (AFU;AMMO)

B-29. The AFU;AMMO reports platoon ammunition to AFATDS/IFSAS. Just as with the AFU;UPDATE, the AFU;AMMO cannot be executed when received from AFATDS/IFSAS or another LCU. The AFU;AMMO reflects the total platoon ammunition based on the number of HOW;AMOUPs on file. Do not execute the adjacent platoon HOW;AMOUPs, as this transmits an incorrect AFU;AMMO file to battalion FDC.

REQUEST FOR DATA MESSAGE (HOW;REQUEST)

B-30. This format requests database information from AFCS to LCU or from LCU to AFCS. When received from AFCS, the LCU operator has only to execute the request and the requested information is automatically addressed for transmission. A unique capability of this format is that it allows the LCU operator to request HOW;UPDATEs while the howitzer is moving. When received by the AFCS, the current howitzer location is transmitted back to the LCU. This allows the POC to track howitzer movement while en route to the next directed location or during survivability moves when in a position area.

SENSOR-TO-SHOOTER OPERATIONS (LINKED)

TARGET ACQUISITION LINKS (HOW;OBSERVER)

B-31. This message links a Paladin howitzer with a TA system. The link allows the howitzer and observer to communicate through the LCU. The observer, the howitzer, and the POC must be on the same frequency.

PRIOR COORDINATION

B-32. Anytime a howitzer is to be linked, prior coordination is essential. This is necessary to determine the amount of control and/or support the observer needs. The following items must be coordinated with the FSO, FIST, FO, or other TA agency:

- Duration of link.
- Requirement to store targets, to include priority targets.
- Target number block to be used. Note: This should be the observer's assigned target number block. Do not use the platoon LCU block unless absolutely necessary.
- Type of ammunition required and number of rounds for adjust phase and FFE phase of all fire mission processing.

COPPERHEAD FIRING

B-33. The most likely situation requiring linked operations is the firing of Copperhead. The FIST, combat observation lasing team (COLT), or Striker may be linked directly to the howitzer. A direct link also may be used for maneuver forces in movement to contact when suppressive fires are needed. Priority targets may be established along the axis of attack and then be deleted and new ones established as the supported unit moves.

LINK SUSPENSION/BREAKAGE

B-34. The POC, using the HOW;OBSR format, establishes as much control as needed during the link and terminates the link by transmitting an updated HOW;SBT. Otherwise, the link is automatically broken upon expiration of the time established in the HOW;OBSR. If the linked observer is processing a fire mission, the termination is suspended until the mission is ended. If the AFCS has a stored priority target (FPF or priority Copperhead), the linked observer cannot establish a priority target until the POC deletes the one previously established. The POC may use the howitzer for fire missions, even if linked, as long as the howitzer is not processing a mission for the linked observer. In all cases, a priority mission (FPF or priority Copperhead) which has been established on the howitzer will override any other mission.

FIRE DIRECTION PROCEDURES

B-35. It is important to understand that Paladin fire mission processing differs from that for cannon artillery units such as the M109A5, M198, and M119. The AFCS is the primary means of technical fire direction except in special situations. If it becomes necessary for the LCU to perform technical fire direction, the operator must first ensure that he has the current howitzer location and ammunition file. The operator must then place an X in the GUNORD field, and an S in the STATUS field of the HOW;UPDATE message format. Once a howitzer is placed in a fire mission status and firing information is transmitted, only a priority mission (FPF or priority Copperhead) will override a mission. If the FDO wishes to override a mission in process, he must direct the LCU operator to end the mission in process or order the AFCS operator to abort the mission if in a degraded mode of operation.

FM;CFF PROCESSING

B-36. The LCU unique fields (data elements which follow the EDT indicator) are very important. Unlike conventional cannon systems, operator input into the LCU reformats the FM;CFF into a HOW;MSN format. This format is for transmission only and cannot be found in the message skeletons. Upon execution of the FM;CFF, the operator sees an FM;CFF addressed to the howitzers specified in the PTF: or SHTF: displayed on the LCU lower display. The LCU is not computing technical firing data, so the RG: field and the MAXORD: field are not filled out. The RPT: field is also very important. Placing an X in this field causes each howitzer to generate a message to observer (MTO), shot, splash, and round complete or ready reports to update the LCU middle display. The decision to place an X in this field causes an increased communications burden on the internal fire direction net because each howitzer is reporting.

FM;CFF:O PROCESSING

B-37. This format is received from IFSAS or another LCU. It differs from the FM;CFF in that the tactical fire control information (such as shell-fuze and number or volleys) is present upon display. Otherwise, operator information is input the same as the FM;CFF.

FM;COMNDS

B-38. This format is produced when the LCU is performing technical fire control. When displayed, this format is automatically addressed for transmission to the howitzer which has GUNORD: X in the HOW;UPDATE. If the LCU database has a combination of GUNORD: X and GUNORD: BLANK in the HOW;UPDATEs, the HOW;MSN will always be prepared for transmission first.

BE ADVISED THAT (BAT) MESSAGES

B-39. The BAT message is used to inform a subscriber of information concerning some action by the AFCS. All messages of this type begin with the text: "BAT-DD:HH:MM (day:hour:minute) - ".

HOW;MOVE

B-40. "BAT-DD:HH:MM- MOVE ORDER "LOCATION OF KNOWN POINT DATA" PENDING DUE TO NAVIGATION ALIGNMENT IN PROGRESS."
HOW;MOVE sent while MAPS is in an alignment mode. Upon completion of alignment, move will be activated.

B-41. "BAT-DD:HH:MM - MOVE ORDER "LOCATION OF KNOWN POINT DATA" PENDING DUE TO ACTIVE MISSION TARGET ID "TARGET NUMBER"."
HOW;MOVE sent while AFCS is in a fire mission. Upon end of mission (EOM), move will be activated.

B-42. "BAT-DD:HH:MM - MOVING TO LOCATION "LOCATION OF NEW POINT" WHICH IS OUTSIDE OF CURRENT MAP."
HOW;MOVE sent with spheroid code which differs from that in the MAP MOD.

B-43. "BAT-DD:HH:MM - BCS COMPUTED PRIORITY TARGET ID "TARGET NUMBER" HAS BEEN DELETED."
BCS computed data for a priority target and stored the data in AFCS. Once the howitzer moves, this data is no longer valid.

HOW;OBSR

B-44. "BAT-DD:HH:MM - OBSERVER "LOGICAL NAME OF OBSERVER" HAS BEEN DELINKED UPON RECEIPT OF RESTRICTIONS FOR OBSERVER."
If HOW;OBSR sent and the logical name of the observer does not match that of the HOW;SBT, then a delink occurs.

B-45. "BAT-DD:HH:MM - OBSERVER "LOGICAL NAME OF OBSERVER" HAS BEEN DELINKED UPON EXPIRATION OF LINK TIME."
HOW;OBSR sent which specified an ending data and time group. A delink has occurred due to expiration of the specified data and time.

HOW;SBT

B-46. "BAT-DD:HH:MM- SUBSCRIBER FILE UPDATE PENDING DUE TO ACTIVE MISSION TARGET ID "TARGET NUMBER "."

HOW;SBT sent during a fire mission. Upon EOM HOW;SBT will be processed.

B-47. "BAT-DD:HH:MM - SUBSCRIBER FILE UPDATED WITH AFCS UNDER CHECKFIRE ID "TARGET NUMBER"."
HOW;SBT sent while AFCS is in a checkfire status.

FM;SUBS (EOM & SURV FOR DIGITAL DEVICE)

B-48. "BAT-DD:HH:MM - EOM "TARGET NUMBER" BDA IS "BDA GIVEN BY OBSERVER"."
EOM sent by linked observer and observer has given battle damage assessment (BDA).

FM;CFF(HOW;MSN)

B-49. "BAT-DD:HH:MM - STORED TOT TARGET "STORED TARGET NUMBER" ACTIVATED."
Activation by the AFCS of a stored time on target mission.

B-50. "BAT-DD:HH:MM - UNEXPECTED SHOT OUT DETECTED."
The AFCS operator has not followed the firing sequence prompted by the AFCS.

CHECKFIRE OR CANCEL CHECKFIRE

B-51. "BAT-DD:HH:MM - ALREADY UNDER CHECKFIRE WITH ID "TARGET NUMBER"."
A checkfire has been sent to AFCS which is already under checkfire.

B-52. "BAT-DD:HH:MM - ENTERED CHECKFIRE STATUS WITH ID "TARGET NUMBER" WHEN NO ACTIVE MISSION."
A checkfire has been sent to AFCS, which is not in a mission, referencing a target number.

B-53. "BAT-DD:HH:MM - ENTERED CHECKFIRE STATUS WITH ID "TARGET NUMBER" WHEN ACTIVE TARGET ID "ACTIVE TARGET NUMBER"."
A checkfire by target number has been sent to AFCS with an active mission and the target numbers do not match.

B-54. "BAT-DD:HH:MM - ENTERED CHECKFIRE STATUS WITH ID "TARGET NUMBER"."
A checkfire by target number has been sent to AFCS and processed.

STORE TO AFCS TARGET FILE

B-55. "BAT-DD:HH:MM - TARGET ID "TARGET NUMBER" STORED."
PTM sent to digital device which has target write permission from HOW;OBSR message.

B-56. "BAT-DD:HH:MM - A NON PRIORITY TARGET WAS DELETED WHICH MATCHED THE STORE PRIORITY TARGET ID "TARGET NUMBER"."
A request to delete a target from the AFCS target storage file.

B-57. "BAT-DD:HH:MM - PRI TARGET "TARGET NUMBER" STORED."
PTM sent to digital device which has target write permission from HOW;OBSR message.

DELETE FROM AFCS TARGET FILE

B-58. "BAT-DD:HH:MM - TARGET ID "TARGET NUMBER" DELETED."
PTM sent to a digital device, requesting deletion of a stored target. Device has been given target write permission from HOW;OBSR message.

B-59. "BAT-DD:HH:MM - ALL NON PRI TGTS DELETED."
PTM sent to a digital device, requesting deletion of all stored targets. Device has been given target write permission from HOW;OBSR message.

MAP MOD

B-60. "BAT-DD:HH:MM - BCS COMPUTED STORED PRIORITY TARGET ID "STORED PRI TARGET NUMBER" WAS DELETED DUE TO CHANGE IN MAP ZONE OR SPHEROID."
BCS transmitted a MAP MOD which changes the zone or spheroid code of AFCS stored priority target computed by BCS.

B-61. "BAT-DD:HH:MM - MAP MODIFICATION COMPLETE."
BCS transmitted a MAP MOD to AFCS.

UNABLE TO EXECUTE (UTE) MESSAGES

B-62. All messages of this type begin with the text: "UTE-DD:HH:MM (day:hour:minute) - ".

CEASE LOAD REQUEST

B-63. "UTE-DD:HH:MM - CEASE LOAD "TARGET NUMBER" DUE TO AFCS UNDER CHECKFIRE."
Command to cease load sent to AFCS which is under checkfire.

B-64. "UTE-DD:HH:MM - CEASE LOAD "TARGET NUMBER" DUE TO NO ACTIVE MISSION."
Command to cease load sent while AFCS is not in an active mission.

B-65. "UTE-DD:HH:MM - CEASE LOAD "TARGET NUMBER" DUE TO ACTIVE MISSION TARGET ID "TARGET NUMBER"."
Command to cease load sent with target number different from active mission in AFCS.

FIRE ON TARGET REQUEST (FIRE)

B-66. "UTE-DD:HH:MM - FIRE REQUEST "TARGET NUMBER" DUE TO AFCS UNDER CHECKFIRE "TARGET NUMBER"."
Request for fire on target sent while AFCS under checkfire.

B-67. "UTE-DD:HH:MM - FIRE REQUEST "TARGET NUMBER" DUE TO ACTIVE MISSION "TARGET NUMBER" NOT AMC."
Request to fire sent when method of control is not at my command (AMC).

B-68. "UTE-DD:HH:MM - FIRE REQUEST "TARGET NUMBER" DUE TO PRIORITY ACTIVE MISSION TARGET ID "TARGET NUMBER."
Request to fire on target number while AFCS is processing a priority fire mission (FPF, Copperhead).

B-69. "UTE-DD:HH:MM - FIRE REQUEST OF STORED TARGET ID "TARGET NUMBER" DUE TO ACTIVE MISSION TARGET ID "TARGET NUMBER."
Request to fire a non priority stored target while AFCS is processing a fire mission and the request to fire does not match active mission nor priority stored target.

FIRE MISSION (HOW;MSN)

B-70. "UTE-DD:HH:MM - FIRE REQUEST "TARGET NUMBER" DUE TO TARGET NOT STORED IN AFCS."
Request to fire on target number which is not stored in AFCS files.

B-71. "UTE-DD:HH:MM - HOW;MSN REQUEST TARGET ID "TARGET NUMBER" DUE TO AFCS UNDER CHECKFIRE - ID "TARGET NUMBER"."
Request to fire sent while AFCS under checkfire.

B-72. "UTE-DD:HH:MM - HOW;MSN REQUEST TARGET ID "TARGET NUMBER" DUE TO ACTIVE PRIORITY MISSION TARGET ID "TARGET NUMBER"."
Request to fire sent while AFCS processing priority mission.

B-73. "UTE-DD:HH:MM - HOW;MSN REQUEST TARGET ID "TARGET NUMBER" DUE TO ACTIVE MISSION TARGET ID "TARGET NUMBER"."
Request to fire sent, which is not a priority mission and target number sent does not match active mission.

B-74. "UTE-DD:HH:MM - HOW;MSN REQUEST TARGET ID "TARGET NUMBER" DUE TO LAST MISSION REQUEST FOR THAT TARGET NOT COMPLETE."
If the AFCS is not awaiting EOM or continuation of mission (as in subsequent corrections then above UTE is sent. An example would be if the AFCS is waiting for the howitzer COS to depress the shot key.

HOWITZER MASK DATA (AFU;MASK)

B-75. "UTE-DD:HH:MM - MASK UPDATE DUE TO OVERLAPPING SEGMENTS IN DEFINITION."
The AFCS has requested its last reported mask data from the BCS and the left and right azimuth limits overlap.

REQUEST FOR DATA (HOW;REQUEST)

B-76. "UTE-DD:HH:MM - SEND TARGET ID "TARGET NUMBER" DUE TO NOT STORED IN AFCS - TARGETS IN AFCS "PRIORITY TARGET NUMBER", "STORED TARGET NUMBER(S)"."
A HOW;REQUEST sent requesting a specific target number but that target number is not stored in the AFCS. The last portion of the UTE message will list the targets stored in the AFCS.

B-77. "UTE-DD:HH:MM - SEND ALL TARGETS DUE TO NO TARGETS ARE STORED IN AFCS."
A HOW;REQUEST sent requesting all targets in AFCS target file because there are none in the AFCS target file.

FIRE COMMANDS (FM;COMNDS)

B-78. "UTE-DD:HH:MM - FM;COMNDS TARGET ID "TARGET NUMBER" AFCS HAS NOT REPORTED STATIONARY STATUS."
BCS has computed data to send to AFCS however, the AFCS has not reported its current location.

B-79. "UTE-DD:HH:MM - FM;COMNDS TARGET ID "TARGET NUMBER" HAS INSUFFICIENT DATA IN THE REQUEST."
BCS has computed data and transmitted it to AFCS however, the howitzer has not been

identified in the FU field of the FM:COMNDS message.

B-80. "UTE-DD:HH:MM - FM;COMNDS TARGET ID "TARGET NUMBER" DUE TO ACTIVE PRIORITY MISSION TARGET ID "TARGET NUMBER" IN PROGRESS."
BCS has computed data and transmitted it to AFCS which is currently processing a priority target.

B-81. "UTE-DD:HH:MM - FM;COMNDS TARGET ID "TARGET NUMBER" DUE TO LAST MISSION REQUEST FOR THAT TARGET NOT COMPLETE."
BCS has sent FM:COMNDS requesting that AFCS process mission however, the AFCS is not in a state with which it can process the mission. The howitzer COS has not depressed the "SHOT" and "ROUNDS COMPLETE" when prompted. The AFCS must be at awaiting EOM or continuation of mission to process anything other than a priority mission.

END OF MISSION COMMAND (FM;EOM):

B-82. "UTE-DD:HH:MM - EOM "TARGET NUMBER" DUE TO ACTIVE MISSION TARGET ID "TARGET NUMBER"."
An EOM request is sent to an AFCS and the requested EOM target number does not match the active mission.

B-83. "UTE-DD:HH:MM - EOM "TARGET NUMBER" DUE TO NO ACTIVE MISSION."
An EOM request is sent to an AFCS that has no active mission.

FORWARD OBSERVER COMMAND MESSAGE (FOCMD)

Fire

B-84. "UTE-DD:HH:MM - FIRE TGT IS IN CHECKFIRE."
A request to fire target number is sent to AFCS and AFCS is in a checkfire status.

B-85. "UTE-DD:HH:MM - FIRE TGT IS NOT AMC MISSION."
A request to fire target number is sent to AFCS however, the active mission is not an "at my command" method of control.

B-86. "UTE-DD:HH:MM - FIRE TARGET IS BUSY PRI MSN."
A request to fire target number is sent to AFCS however, the AFCS is processing a priority fire mission.

B-87. "UTE-DD:HH:MM - FIRE BUSY WITH OTHER MSN."
A request to fire target number is sent to AFCS however, the target number does not match

the current active mission.

B-88. "UTE-DD:HH:MM - FIRE TGT NOT IN TGT FILE."
A request to fire target number is not in the AFCS target file.

Delete Target

B-89. BCS Version - "UTE-DD:HH:MM - DELETE TARGET ID "TARGET NUMBER" DUE TO NO WRITE TARGET FILE PERMISSION."
Digital Device Version - "UTE-DD:HH:MM - NO TGT DELETE PERMISSION."
A request to delete a target from AFCS target storage file is received however, the HOW;OBSR did not allow target storage permission.

B-90. BCS Version - "UTE-DD:HH:MM - DELETE TARGET ID "TARGET NUMBER" DUE TO NOT STORED IN AFCS - TARGET IN AFCS - "STORED PRIORITY TARGET NUMBER AND STORED TARGET NUMBER(S)."
Digital Device Version - "UTE-DD:HH:MM - DELETE "TARGET NUMBER" NOT STORED."
A request to delete target from AFCS target storage file is received however, the target number does not match target number(s) in file.

LINKED OBSERVER MESSAGES (HOW;OBSR)

B-91. "UTE-DD:HH:MM - ILLEGAL PROJECTILE / FUZE COMBINATION IN "PHASE" OF THE HOW;OBSR RESTRICTIONS."
HOW;OBSR sent with illegal projectile / fuze combination in SHAJ: or SHEF:.

FIRE REQUEST (FR;GRID)

B-92. "UTE-DD:HH:MM - COORD EXPANSION FAILURE."
A request for fire has been sent in short coordinates and either the observer failed to specify the use of grid zone or the MAP MOD does not cover the requested area.

B-93. "UTE-DD:HH:MM - NO TARGET ID "TARGET NUMBER" AVAILABLE."
The AFCS cannot process the fire request due to all target numbers assigned by the HOW;OBSR message have been exhausted.

B-94. "UTE-DD:HH:MM - NOT ADJ PHASE PERMISSION."
The linked observer was not given adjust fire authority on the HOW:OBSR.

B-95. "UTE-DD:HH:MM - ALLOWED SH/FZ VIOLATION."
Linked observer requested an unauthorized shell / fuze combination.

B-96. "UTE-DD:HH:MM - FR;GRID IS IN CHECKFIRE."
A fire mission is sent while the AFCS in under checkfire.

B-97. "UTE-DD:HH:MM - TARGET ID "TARGET NUMBER" MUST BE GIVEN."
If the AFCS is in an active mission then the target number for that mission must be sent before any further processing.

B-98. "UTE-DD:HH:MM - BUSY WITH OTHER MISSION."
A request for fire is received, with a target number, however, the target number does not match the current active mission.

B-99. "UTE-DD:HH:MM - BUSY LAST REQ FOR "TARGET NUMBER"."
If the AFCS is not at the awaiting continuation of mission or end of mission state, then it will not process any other mission except priority.

B-100. "UTE-DD:HH:MM - NO ASSIGN PRI MISSION."
The linked observer does not have target storage permission.

B-101. "UTE-DD:HH:MM - PRI TGT ALREADY ASSIGNED."
A priority target already exists at the AFCS. This may have been assigned by the BCS or previously assigned by the linked observer. In any case the AFCS may only have one priority target.

SUBSEQUENT ADJUSTMENT (SUBQ ADJ)

B-102. "UTE-DD:HH:MM - SA EOM / EOM RAT NOT VALID."
The linked observer has attempted to request EOM or EOM record as target (RAT) with a subsequent adjust (SA) format.

B-103. "UTE-DD:HH:MM - SA IS IN CHECKFIRE."
The AFCS is in a checkfire state and any subsequent adjustment will not be processed.

B-104. "UTE-DD:HH:MM - SA "TARGET NUMBER" DUE TO NO MSN."
The linked observer has attempted subsequent adjustment on a non-active mission.

B-105. "UTE-DD:HH:MM - SA BUSY WITH ANOTHER MISSION."
The linked observer has attempted subsequent adjustment with a target number which matches the current active mission however, the AFCS is not at an awaiting continuation of mission or EOM state.

END OF MISSION AND SURVEILLANCE (EOM&SURV)

B-106. "UTE-DD:HH:MM - EOM TARGET ID REQUIRED."
The linked observer has attempted to end a mission without the active target number.

B-107. "UTE-DD:HH:MM - EOM "TARGET NUMBER" HAS NO ACTIVE MISSION."
The linked observer has requested EOM on a target which is not active in the AFCS.

B-108. "UTE-DD:HH:MM - EOM "TARGET NUMBER" AS WRONG MISSION."
The linked observer has requested EOM with the incorrect target number.

QUICK RESPONSE FIRE REQUEST (FR;QUICK)

Delete

B-109. "UTE-DD:HH:MM - DELETE TARGET ID NEEDED:"
The linked observer has requested the deletion of a target, but no target number is given.

Fire

B-110. "UTE-DD:HH:MM - FIRE TGT IS IN CHECKFIRE."
A request to fire target number is received however, the AFCS is in a checkfire status.

B-111. "UTE-DD:HH:MM - FIRE TGT AS BUSY LAST REQ."
A request to fire target number is received and the AFCS is not at an AMC status.

B-112. "UTE-DD:HH:MM - FIRE TGT AS BUSY PRI MSN."
A priority mission is currently active and a request to fire stored target is received.

B-113. "UTE-DD:HH:MM - FIRE BUSY WITH OTHER MSN."
The request to fire target number does not match the current mission.

B-114. "UTE-DD:HH:MM - FIRE TGT NOT IN TGT FILE."
The requested target is not in target file.

OPERATOR ABORTED FIRE REQUEST

B-115. BCS Version: "UTE-DD:HH:MM - AFCS OPERATOR ABORTED ACTIVE MISSION TARGET ID "TARGET NUMBER"."
The howitzer COS aborted fire mission. This message is sent only to BCS.

B-116. Digital Device Version: "UTE-DD:HH:MM - OPERATOR ABORT ID "TARGET NUMBER"."

The howitzer COS aborted fire mission. This message is sent to digital devices.

TIME ON TARGET (TOT) MISSIONS

B-117. "UTE-DD:HH:MM - STORED TOT REQUEST TARGET ID "TARGET NUMBER" DUE TO AFCS UNDER CHECKFIRE - ID "TARGET NUMBER"."
A stored TOT mission was activated automatically by AFCS however, the AFCS is under checkfire.

B-118. "UTE-DD:HH:MM - STORED TOT REQUEST TARGET ID "TARGET NUMBER" DUE TO ACTIVE PRIORITY MISSION TARGET ID "TARGET NUMBER"."
A stored TOT mission was activated automatically by AFCS however, the AFCS is processing a priority mission (i.e., Copperhead or FPF).

B-119. "UTE-DD:HH:MM - STORED TOT REQUEST TARGET ID "TARGET ID "TARGET NUMBER" DUE TO ACTIVE MISSION TARGET ID "TARGET NUMBER"."
A stored TOT mission was activated automatically by AFCS however, the AFCS is processing a previously requested fire mission.

B-120. "UTE-DD:HH:MM - STORED TOT REQUEST TARGET ID "TARGET NUMBER" DUE TO LAST MISSION REQUEST FOR THAT TARGET NOT COMPLETE."
A stored TOT mission was activated automatically by AFCS and the TOT target number matched the current active mission. If the mission is not awaiting EOM or continuation of mission then it will be unable to be executed.

CHECKFIRE OR CANCEL CHECKFIRE

B-121. "UTE-DD:HH:MM - CANCEL CHECKFIRE ID "TARGET NUMBER" SINCE NO CHECKFIRE EXISTS."
A cancel checkfire by target number was sent to AFCS which was not in checkfire.

B-122. "UTE-DD:HH:MM - CANCEL CHECKFIRE ID "TARGET NUMBER" DUE TO NO MATCH WITH CHECKFIRE ID "TARGET NUMBER"."
A cancel checkfire by target number was sent to AFCS however, the target number did not match. NOTE: A CANALL request will always match. Caution should be used when using CANALL as an undesired cancel checkfire may be sent.

B-123. "UTE-DD:HH:MM - CHECKFIRE REQUEST "TARGET NUMBER" DUE TO AFCS UNDER CHECKFIRE - ID "TARGET NUMBER"."

A request to checkfire by target number is sent to AFCS however, AFCS is already in checkfire.

TARGET FILE STORAGE AND DELETION

B-124. The following messages apply to BCS and digital devices when a link has occurred. (Note: Only one subscriber may have target storage permission, either the BCS or digital device.)

B-125. BCS Version: "UTE-DD:HH:MM - STORE TARGET ID "TARGET NUMBER" DUE TO NOT STORE TARGET FILE PERMISSION."
Digital Device Version: "UTE-DD:HH:MM - NO TARGET STORE PERMISSION."
An attempt is made to store a target in the AFCS file however, target storage permission was not given in the HOW;OBSR.

B-126. BCS Version: "UTE-DD:HH:MM - STORE TARGET ID "TARGET NUMBER" DUE TO CONFLICT WITH STORED PRIORITY TARGET ID "STORED TARGET NUMBER"."
Digital Device Version: "UTE-DD:HH:MM - TARGET ASSIGNED AS PRI."
An attempt is made to store a priority target by target number and the request matches the priority target already in file.

B-127. BCS Version: "UTE-DD:HH:MM - STORE TARGET ID "TARGET NUMBER" DUE TO TARGET LIST FULL."
Digital Device Version: "UTE-DD:HH:MM - TARGET LIST ALREADY FULL."
An attempt is made to store a target however, the AFCS target file is full.

B-128. BCS Version: "UTE-DD:HH:MM - STORE PRIORITY TARGET ID "TARGET NUMBER" DUE TO NO WRITE TARGET FILE PERMISSION."
Digital Device Version: "UTE-DD:HH:MM - NO ASSIGN PRI PERMISSION."
An attempt is made to store a priority target however, target storage permission was not given in the HOW;OBSR.

B-129. BCS Version: "UTE-DD:HH:MM - STORE PRIORITY TARGET IS "TARGET NUMBER" DUE TO EXISTING STORED PRIORITY TARGET ID "TARGET NUMBER"."
Digital Device Version: "UTE-DD:HH:MM - PRI TARGET ALREADY ASSIGNED."
An attempt is made to store a priority target however, a priority target already exists.

Delete All (DELALL)

B-130. BCS Version: "UTE-DD:HH:MM - DELETE ALL TARGETS DUE TO NO

WRITE TARGET FILE PERMISSION."
Digital Device Version: "UTE-DD:HH:MM - NO TGT DELETE PERMISSION."
A request to delete all targets from AFCS target storage file is received however, the HOW;OBSR did not allow target storage permission.

MAP MODIFICATION INFLUENCE ON STORED TARGETS

B-131. "UTE-DD:HH:MM - STORED TARGET CANNOT BE CONVERTED TO THE CURRENT MAP MOD."
A request to fire a target from the AFCS target storage file is received however, the target cannot be converted based on current MAP MOD in database.

AMMUNITION SELECTION

B-132. "UTE-DD:HH:MM - SPECIFIED PROJECTILE LOT "PROJECTILE LOT" NOT IN AFCS INVENTORY."
A fire mission message is sent to AFCS and the specified projectile is not in file.

B-133. "UTE-DD:HH:MM - SPECIFIED PROPELLANT LOT "PROPELLANT LOT" NOT IN AFCS INVENTORY."
A fire mission message is sent to AFCS and the specified propellant is not in file.

B-134. "UTE-DD:HH:MM - SPECIFIED FUZE "FUZE MODEL" NOT IN AFCS INVENTORY."
A fire mission message is sent to AFCS and the requested elements do not match what is in the AFCS ammunition inventory.

B-135. "UTE-DD:HH:MM - ILLEGAL PROJECTILE, PROPELLANT, FUZE COMBINATION."
A fire mission message is sent to the AFCS and the request contains illegal combinations for ammunition, propellant, and fuze.

B-136. "UTE-DD:HH:MM - INSUFFICIENT AMMUNITION."
A fire mission message is sent to the AFCS and the howitzer COS was prompted that the requested quantity of ammunition is not on hand. If the COS denies the mission for the above reason, then the above UTE is sent to the BCS.

B-137. When the AFCS receives a fire mission message and more than one of the specified elements is not in file, one of the following UTE messages is sent:

B-138. "UTE-DD:HH:MM - SPECIFIED PROJECTILE LOT "PROJECTILE LOT" PROPELLANT LOT "PROPELLANT LOT" AND FUZE MODEL "FUZE MODEL"

NOT IN AFCS INVENTORY."

B-139. "UTE-DD:HH:MM - SPECIFIED PROJECTILE LOT "PROJECTILE LOT" AND PROPELLANT LOT "PROPELLANT LOT" NOT IN AFCS INVENTORY."

B-140. "UTE-DD:HH:MM - SPECIFIED PROJECTILE LOT "PROJECTILE LOT" AND FUZE MODEL "FUZE MODEL" NOT IN AFCS INVENTORY."

B-141. "UTE-DD:HH:MM - SPECIFIED PROPELLANT LOT "PROPELLANT LOT" AND FUZE MODEL "FUZE MODEL" NOT IN AFCS INVENTORY."

PROPELLANT SECTION

B-142. "UTE-DD:HH:MM - PROPELLANT INSUFFICIENT."
A fire mission message is sent to the AFCS and the maximum range of the propellant is compared to the range to the target. If the target range exceeds 85% of that for the propellant (90% for high angle fire) the above UTE is sent to the BCS.

FUZE SELECTION

B-143. "UTE-DD:HH:MM - BECAUSE "FUZE TYPE" NOT IN INVENTORY."
A fire mission message is sent to the AFCS however, no legal fuze is found.

B-144. "UTE-DD:HH:MM - NO LEGAL AMMUNITION COMBINATIONS INVENTORY."
A fire mission message is sent to the AFCS however, the AFCS found no legal combinations for projectile, powder, and fuze.

CHARGE SELECTION

B-145. "UTE-DD:HH:MM - EXCESSIVE RANGE TO TARGET."
A fire mission message is sent to AFCS and the target range exceeded 85% of the range of the powder model (90% for high angle fire).

Appendix C

Sample Safety Qualification Checklists

Sample Safety Qualification ChecklistsThis appendix provides sample safety qualification checklists designed to be used by the commander as a guide to develop a program that fully qualifies personnel involved in firing.

QUALIFICATION TASKS

TASK 1

C-1. Initialize AFCS.

Conditions

C-2. Direct the establishment of digital and voice communications between the M109A6 howitzer and the POC and/or a paired M109A6 howitzer section.

Performance Measures

Performance Measures	Go	No Go
1. Ensure the left drive sprocket is within 1 meter of survey control point.		
2. Ensure the tube is in travel lock and turret is locked.		
3. Ensure M93 chronograph antenna is mounted and connected.		
4. Ensure PLGR is connected.		
5. Ensure vehicle master switch is "ON"; powers up radios.		

6. Turn on DU and observe system status (Explains OK, degraded, or out subsystems).		
7. Enter NET ACCESS.		
8. Enter NET ADDRESS.		
9. Enter DATE TIME GROUP and conduct FM voice radio check with POC.		
10. Get initialization data from POC BCS.		
11. Select NAV RESTART.		
12. Enter EASTING.		
13. Enter NORTHING.		
14. Enter ALTITUDE.		
15. Enter GRID ZONE.		
16. Enter SPHEROID.		
17. Enter AMMO INVENTORY (shell, propellants, and fuzes).		
18. Enter PROPELLANT TEMPERATURE.		
19. Enter MVV ROUNDS		
20. Enter TOT RESPONSE TIME.		
21. Enter LOAD ELEVATION.		
22. Enter SECTOR OF FIRE.		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

TASK 2

C-3. Navigate from one point to another using the AFCS.

Conditions

C-4. M109A6 howitzer with an operational AFCS, operating during day and night, digital communications with the POC, a move order, section personnel, and TM 9-2350-314-10.

Performance Measures

Performance Measures	Go	No Go
Manually Entered:		
1. Plot destination on map.		
2. Plan route of march on map and inform ATC.		
3. Select manual move order menu.		
4. Enter destination (easting, northing, altitude, grid zone, and spheroid).		
5. Manually input the sectors of fire that are provided by POC.		
6. Verify azimuth of fire (voice) with POC.		
7. Navigate howitzer to destination using navigation aid and map.		
8. If move orders are to a firing point, howitzers must be within 50 meters of destination.		
BCS Provided:		
1. Plot destination on map.		
2. Plan route of march on map and inform ATC.		
3. Navigate howitzer to destination.		

4. If move orders are to a firing point, howitzers must be within 50 meters of destination.		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

TASK 3

C-5. Prepare a howitzer for firing with the AFCS.

Conditions

C-6. M109A6 howitzer in a firing position, a sector of fire and initialized AFCS, section personnel, and TM 9-2350-314-10.

Performance Measures

Performance Measures	Go	No Go
1. Orient the howitzer onto the general direction of the center of fire.		
2. Conduct prefire checks (see Task 4).		
3. Verify and record location.		
4. Verify direction (if required by TSOP).		
5. Press ARRIVED key on DU.		
6. Determine site data.		
7. Input min QE.		
8. Send piece status.		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

TASK 4

C-7. Perform prefire checks.

Conditions

C-8. M109A6 in a firing area or point, conducting occupation procedures, day or night.

Performance Measures

Performance Measures	Go	No Go
1. Check tube- must be clean and dry with no visible damage or foreign matter present.		
2. Low voltage checks. Check battery generator indicator for low battery voltage.		
3. Breech Mechanism.		
a. Witness mark must align when breech is closed.		
b. Firing mechanism, block assembly, and firing pin must be serviceable.		
c. Primer vent must be clear.		
d. Breech operating handle is securely latched forward.		
4. Perform rammer reliability check.		
5. Recoil system.		
a. Check index pins (1/8 inch to 3/4 inch).		
b. Check recuperator locking nut and cotter pin.		

c. Check recoil locking nut.		
d. Check replenisher pressure gauge (17 - 24 pounds per square inch (psi)).		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

TASK 5

C-9. Conduct indirect fire missions using AFCS.

Conditions

C-10. M109A6 howitzer moving or emplaced at a firing area or point, an operational AFCS, digital communications with the POC, section equipment and personnel, TM 9-2350-314-10.

Performance Measures

Performance Measures	Go	No Go
1. Confirm receipt of fire mission.		
2. Turn on hydraulic control box.		
3. Turn on gun drive servos.		
4. Announce fire mission data (number) or rounds, shell, propellant, and fuze information.		
5. Press LOAD key and load ammunition.		

6. Press LAY key. Verify that LAY light on DU is lit, actual and command deflection and quadrant are within tolerance (+/- 0.9 mils), and the prompt WARNING THE TUBE IS NOT IN THE LAY POSITION is no longer displayed. (If it is a high angle mission the command to PRIME will be given before pressing the LAY key.)		
7. COS commands PRIME.		
8. COS commands HOOK UP.		
9. COS command FIRE.		
10. Verify expended ammunition.		
11. Turn off servos and hydraulics.		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

TASK 6

C-11. Manually input data in the AFCS to lay a howitzer for deflection and quadrant.

Conditions

C-12. M109A6 has lost digital communications after being emplaced at a firing point.

Performance Measures

Performance Measures	Go	No Go
1. Select FIRE COMMANDS menu.		
2. Enter commanded deflection and quadrant.		
3. Press LOAD key to load ammunition.		

4. Press LAY key, lay tube on commanded deflection and quadrant on DU.		
5. Command end of mission using DU.		
6. Verify ammunition inventory.		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

TASK 7

C-13. Operate/explain the components of the hydraulic system.

Conditions

C-14. M109A6 howitzer, occupation procedures completed and prepared to accept fire missions, section equipment and personnel, and TM 9-2350-314-10.

Performance Measures

Performance Measures	Go	No Go
1. Turn master switch to "ON".		
2. Set engine to run at 1000 - 1200 RPM.		
3. Ensure cooling fan switch is in automatic position.		
4. Ensure hydraulic warm-up switch is in the automatic position.		
5. Turn hydraulic power switch to "ON".		
6. Check hydraulic pressure gauge for correct operating pressure (shuts system down if incorrect pressure reading).		
7. Select proper operation of controls as directed by the instructor.		

8. Use override switch to return to within traverse limits.		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

TASK 8

C-15. Perform AFCS confidence test.

Conditions

C-16. M109A6 howitzer with initialized AFCS, a movement order to a survey control point, and a survey control point with known data to a distant aiming point.

Performance Measures

Performance Measures	Go	No Go
1. Position howitzer within 1 meter of survey control point toward distant aiming point.		
2. With the STEER TO FIRE AREA screen displayed read and record AFCS position data under POSN (easting, northing and altitude) and the range to destination (RNG) in the upper right corner of the screen. Subtract the POSN altitude from the DESTN altitude. Compare the data obtained with the following tolerances: RNG 26 meters or less Altitude Difference +/- 26 meters Note: If the data is within tolerance but not exact, do a position navigation update.		
3. Press ARRIVED key.		
4. Check boresight of the pantel with M140 alignment device.		

5. Using the azimuth deflection knob align the vertical hair line of the pantel on the distant aiming point, level the pitch and cross level bubbles, and check alignment.		
6. Rotate counter reset knob on pantel until 3200 appears on the reset counter.		
7. Remove tube from the stowed position, install breech boresighting disc, and muzzle cross hairs on tube.		
8. Using the boresighting disc, align the tube on the distant aiming point. Note: Primer vent hole may be used if boresighting disc is missing.		
9. Level pitch and cross level bubbles on pantel mount and realign vertical hair line on pantel using the azimuth deflection knob.		
10. Using the auxiliary quadrant, level the elevation vial.		
11. If fire mission screen is not already displayed select fire commands menu from the setup and information menu to display fire mission screen.		
12. Read the actual deflection and quadrant on the AFCS and compare them with the deflection and quadrant obtained in steps 9 and 10. The tolerance between the readings should be +/- 2 mils. Note: Quadrant should also be checked with a pretested gunner's quadrant. Reading should compare to +/- 2 mils.		
13. Select display format from the setup and information menu.		
14. Change display from deflection to azimuth and return to the fire mission menu. Read the actual azimuth.		
15. Compare the azimuth displayed on the AFCS with the measured azimuth to the distant aiming point. Azimuth should compare to +/- 2 mils.		

If the soldier scored "no go", tell him and write a brief explanation in the space below.

Check one: Go_____ No Go _____ Instructor's Initials ________

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Appendix D

Example Platoon Operations Center Configuration

INTRODUCTION

D-1. The POC of the Paladin platoon is in an M577/M1068 command post carrier. The additional equipment associated with the Paladin system requires revision of the POC layout outlined in FM 6-40 for M109A5 units. Figure D-1 shows a top view of the inside of the M577/M1068 while Figure D-2, shows a top view from the outside.

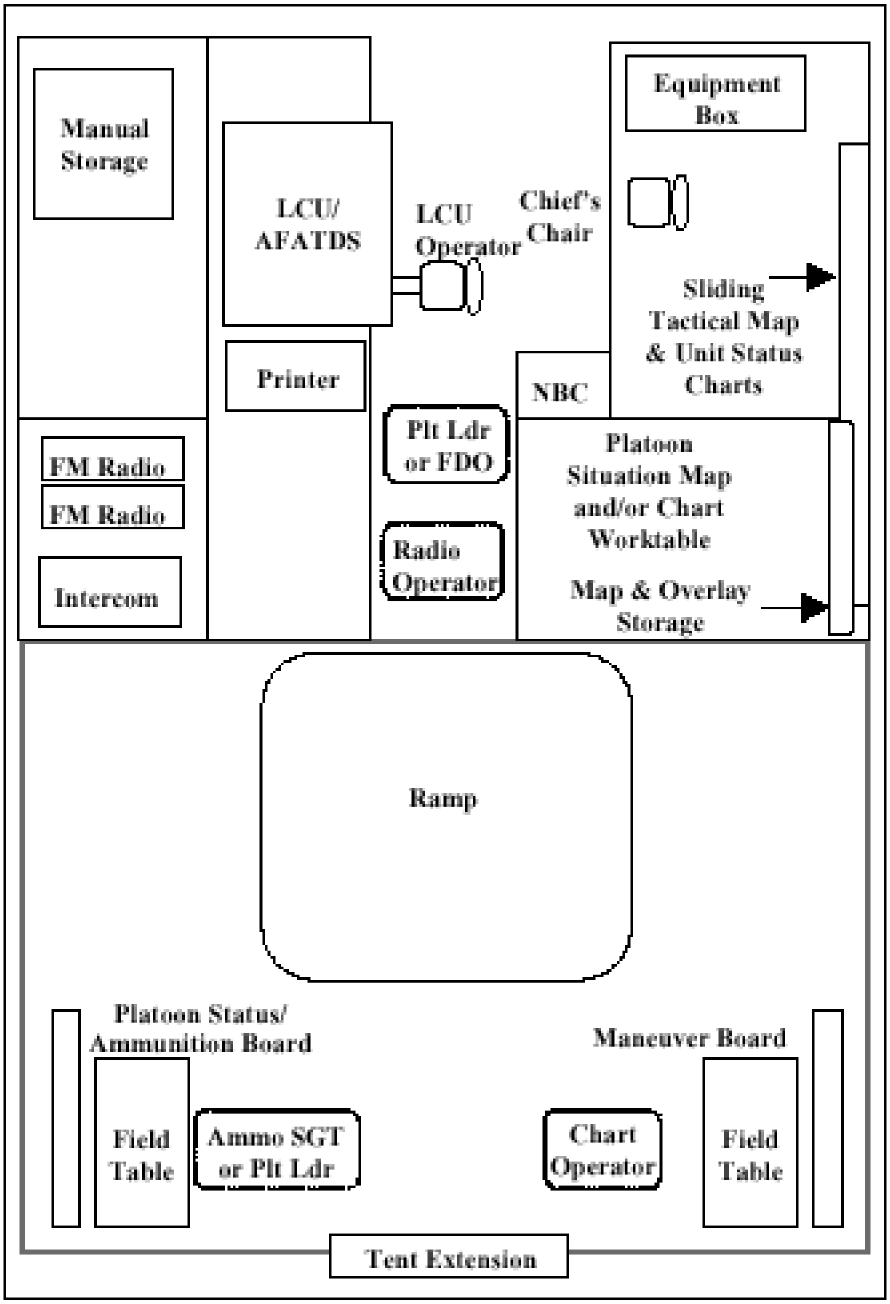


Figure D-1. Top View, Inside M577/M1068 Example

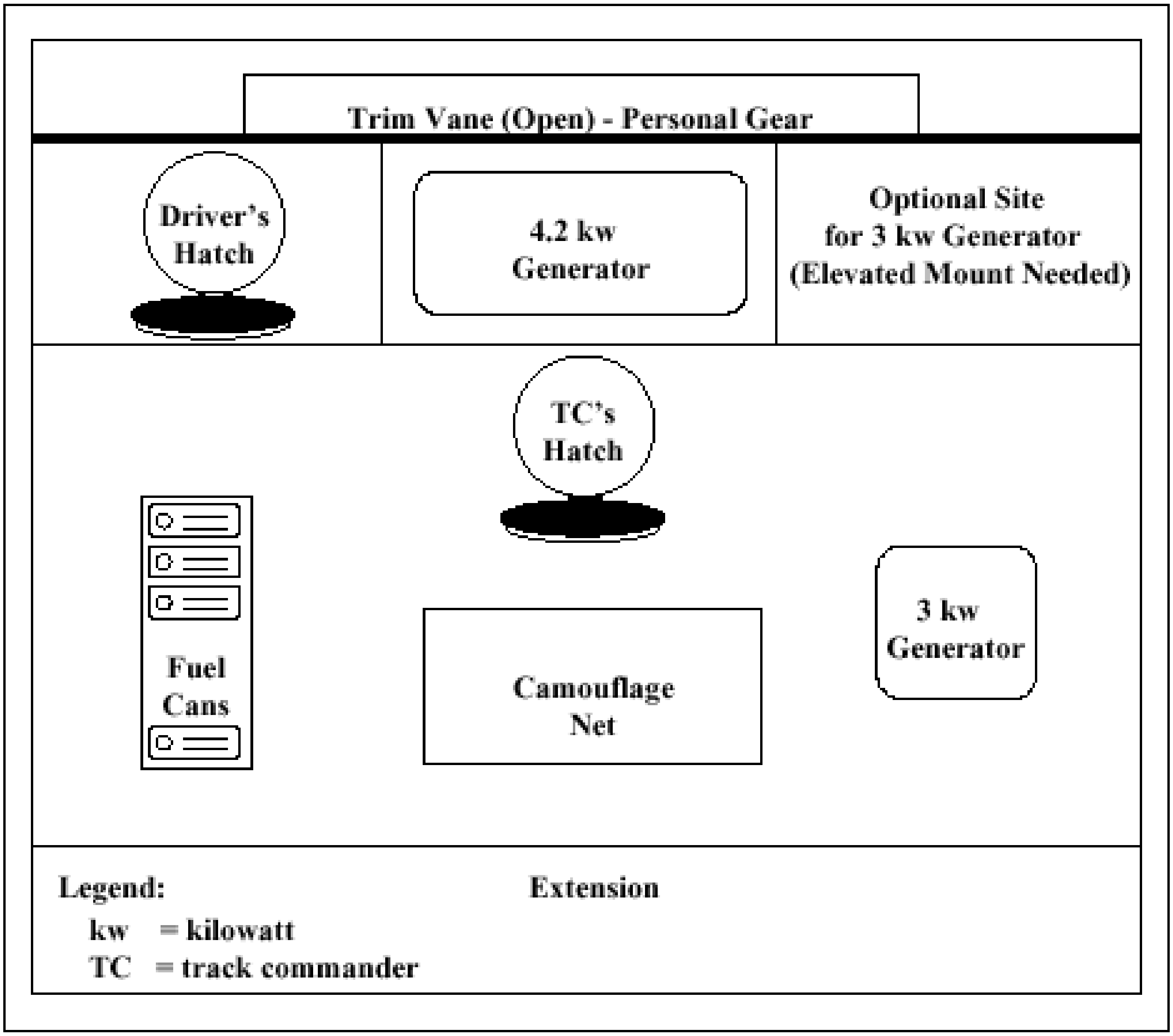


Figure D-2. Top View, Outside M577/M1068 Example

D-2. An additional way to configure the inside of the M577/M1068 is illustrated in Figure D-3.

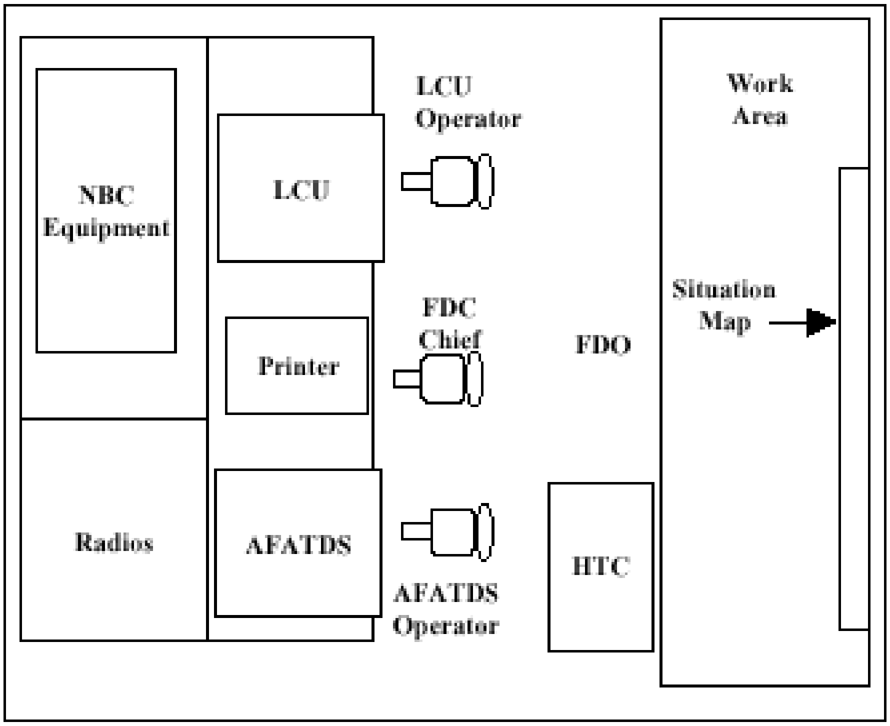


Figure D-3. Top View, Inside M577/M1068 Example

INSIDE VIEW, M577/M1068

INTERNAL RIGHT SIDE CONFIGURATION

D-3. The internal right side configuration may include the modifications discussed below.

CVC Helmet Hanger

D-4. A storage cabinet with CVC helmet hanger may be fabricated from sheet metal or wood. The recommended dimensions are 19 1/2 inches high x 17 1/2 inches wide x 21 3/4 inches deep.

Map/Overlay Storage

D-5. A map and overlay storage container may be made with 3-inch plastic pipe and joining collars.

Map Boards

D-6. By securing a track along the top right side, a unit may secure sliding Plexiglas map boards for easy use by the crew. After mounting the maps, the crew may transfer tactical overlays to the Plexiglas. The crew may then attach the unit status boards to the side of the M577.

Fire Direction Chief's Chair

D-7. For the fire direction chief's chair, the unit can secure a swivel chair, minus legs, to the shelf. To maintain access to the battery compartment, an easy or quick disconnect is required.

INTERNAL LEFT SIDE CONFIGURATION

D-8. The internal left side configuration may include the modifications discussed below.

Intercom Box Mounts

D-9. Intercom boxes are mounted on a mounting plate that may be fabricated by the unit. Thus, the intercom boxes can be moved out of the way to the top shelf with the radios.

Radio Mounts

D-10. The SINCGARS are mounted in "doghouses". Mounting the radios in the protective housing lets the crew stack the radios effectively.

Storage Shelf Height

D-11. The shelf above the LCU is raised 3.5 inches. Fabricate metal mounting straps to raise the shelf above the LCU. This eliminates the need to cut the shelf.

Manual Storage Cabinet

D-12. A manual storage cabinet can be made from metal or wood and used to store reference manuals and other required papers. The recommended dimensions are 11 inches high x 32 inches wide x 12 inches deep.

Swivel Stool

D-13. The unit could use a swivel stool with back or order the swivel seat from the variable format message entry device installation kit for the M577.

OTHER IMPROVEMENTS, M577/M1068

D-14. Other considerations for overall improvement of the POC include the following:

- Install 24-volt fans along the ceiling by the work stations to aid in cooling and ventilation.
- Install encased fluorescent light fixtures to increase lighting and decrease heat generated by incandescent lighting.
- Install heavy-duty rubber floor matting.
- Remove table or work extensions except at the situation map center.
- Attach corkboard to the wall of the M577/M1068 at the radio operator's station for charts, notes, and a call-sign board.
- Consider using Velcro strips or Velcro-backed boards for quick removal and updating. This is especially useful if multiple boards are maintained and various setups can be used (e.g., tent extension or a modified trailer).
- Consider installing a map display with the materials listed in Figure D-4.

  (Reference: FM 1-111, *Aviation Brigades*, Chapter 2).

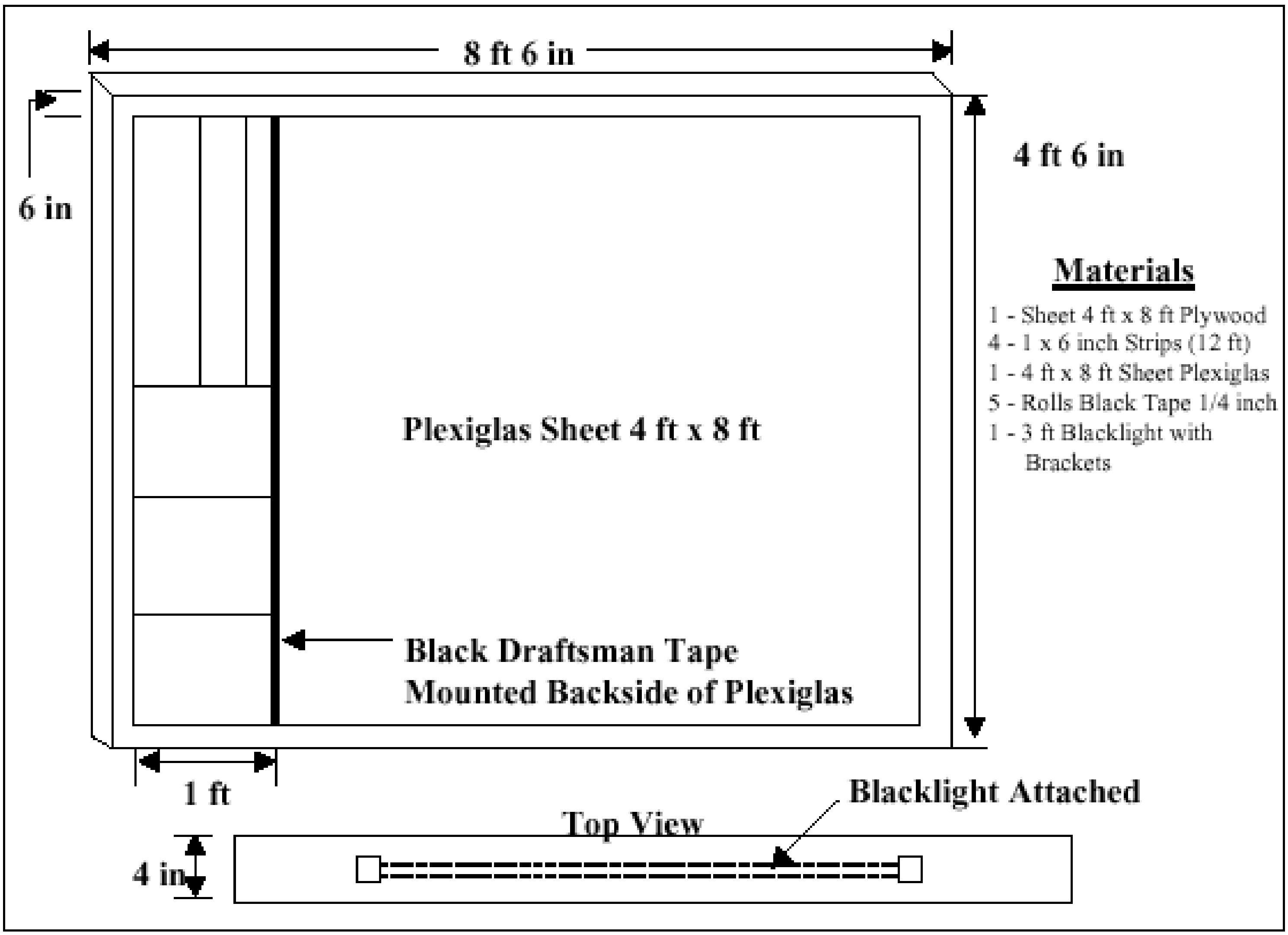


Figure D-4. Example Map Display

INSIDE VIEW, TENT EXTENSION

INTERNAL RIGHT SIDE CONFIGURATION

D-15. The internal right side configuration (Figure D-5) may include the modifications discussed below.

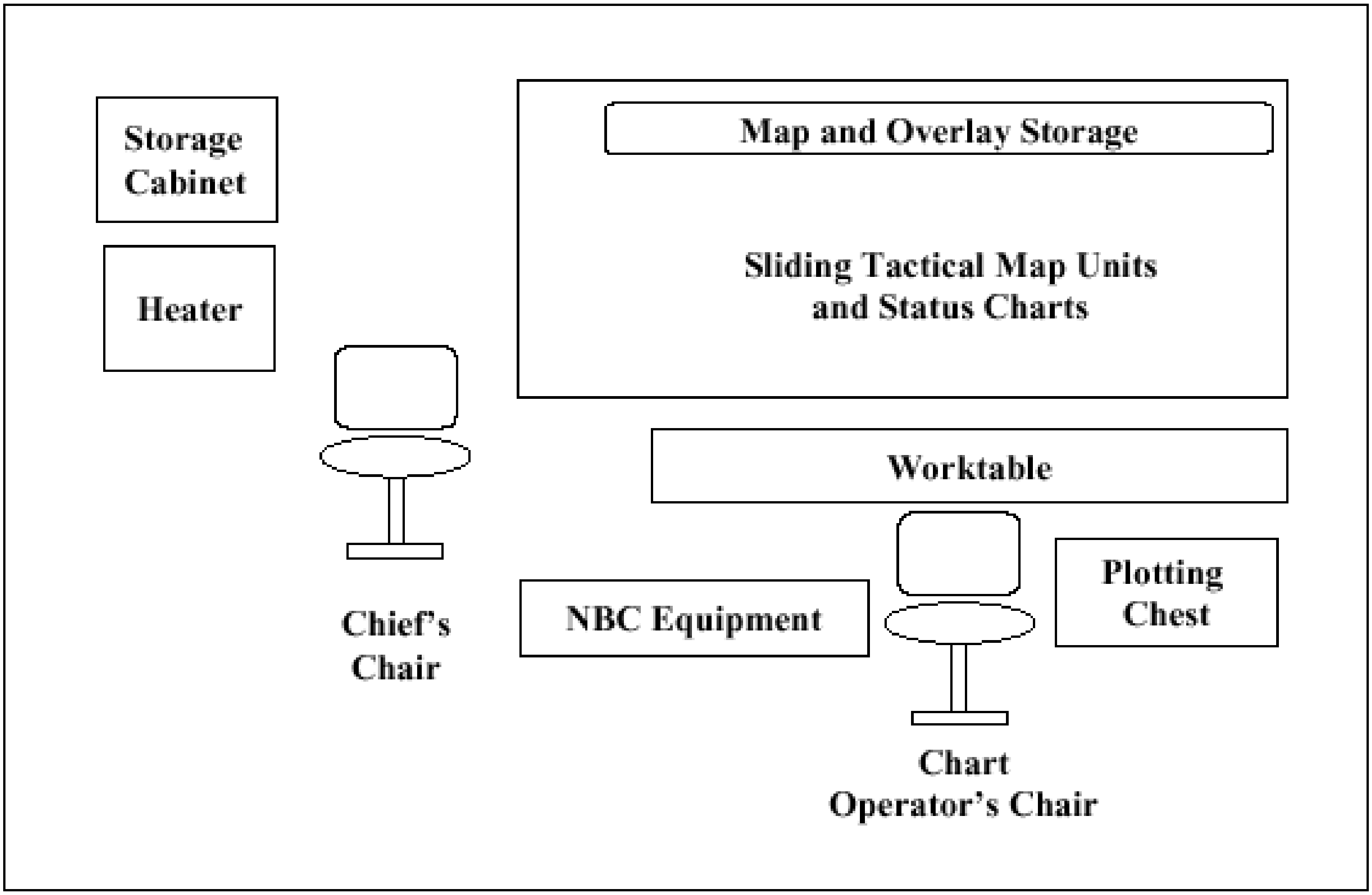


Figure D-5. Tent Extension Inside View, Right Side Example

Tactical Map

D-16. The platoon leader uses the tactical map to track the maneuver situation and plan tactical moves.

Worktable

D-17. The worktable is used to develop movement instructions or the chart operator can work here instead of inside the M577/M1068.

Status/Ammunition Board

D-18. The platoon leader monitors the status/ammunition board to track Class III, Class V, Class IX, and howitzer status. This takes the administrative/logistics activities out of the M577/M1068 and allows the crew to concentrate on tactical fire direction.

Platoon Leader's Battlebook

D-19. This book is an easily transportable binder used by the platoon leader when he is away from the POC. The book should contain all the information maintained on the POC's status charts and all reports. It is maintained by the platoon leader and provides a redundant record of important data regarding platoon operations.

Appendix E

Environmental Awareness

Commanders, unit leaders, and soldiers have specific duties and responsibilities concerning protection of the environment. Soldiers are expected to do what is right in the absence of specific guidance. Unit leaders and commanders must be competent and confident in the area of environmental stewardship. Not all leaders are required to be environmental experts; however, they must be aware and responsive to compliance and prevention issues required during the execution of their duties. The information contained herein is considered an overview of expected duties and responsibilities in order to build a foundation of basic environmental awareness. Throughout is reference to material for further reading; research of these documents provides a complete explanation of legal and ethical responsibilities.

SECTION I — ARMY ENVIRONMENTAL AWARENESS

GENERAL POLICY STATEMENTS

E-1. The Army's environmental vision states: "The Army will be a national leader in environmental and natural resource stewardship for present and future generations as an integral part of our mission". To achieve this vision, the Army's environmental strategy places a high priority on sustained compliance with all environmental laws; takes into account the restoration of previously contaminated sites; focuses on pollution prevention; and accounts for the conservation and preservation of natural resources.

E-2. The Army environmental ethic calls for the chain of command to establish and support a stewardship climate which supports *compliance*, obeying the law; *prevention*, the concept of reduce, reuse, recycle; *conservation*, control and protection of natural resources; and *restoration*, the cleanup of contaminated areas. This ethic supports caring for the environment while conducting realistic training.

E-3. Army personnel should become familiar with these policy statements; they are established so that our natural environment will be available for present and future generations. Complete information regarding these polices can be obtained in Section II of *The Field Artillery Guide to Environmental Considerations*.

SECTION II — PALADIN SPECIFIC ENVIRONMENTAL CONSIDERATIONS

FIELD ACTIVITIES

E-4. The M109A6 Howitzer (Paladin) is a powerful, highly mobile, and very lethal weapon system capable of providing devastating fire support from multiple locations. Because of this power and mobility, the Paladin provides tremendous tactical advantage. These same attributes that contribute to their lethality and tactical value make them a threat to our environment unless they are employed prudently and in consideration of environmental preservation. This section will identify and address the various preventive measures that can be utilized in order to decrease possible environmental damage while conducting realistic training from the Paladin, associated vehicles, and support personnel involved in training and operations.

E-5. Key field environmental considerations include, but are not limited to, the following:

- Wheeled and tracked combat vehicles should stay on established roads, trails, firing points, and firebreaks, unless conducting specific cross-country maneuver exercises. Additionally, confine pivot turns and neutral steers to the middle of the roadway.
- Follow land contours rather than driving up and down hills or along creeks.
- In order to minimize siltation of streams; use bridges or low water crossings when crossing permanent streams. If crossing through a stream becomes necessary, then do so by the most direct route (90-degree angle).
- Establish refueling and maintenance areas away from wetlands, drainage areas, and near or over water sources.
- Federal law prohibits the removal of artifacts from federal property. Do not excavate, remove, damage, or otherwise alter or deface any archaeological resource located on a military reservation.
- Avoid and mark off-limit areas for known archaeological sites during military training exercises. Penalties can be up to $250,000 for knowingly disturbing a site.
- Be aware of and avoid nesting, bedding, and habitats of all species of birds and animals. Mark as off-limits, designated threatened or endangered species areas.
- Use camouflage netting instead of live vegetation.
- When planning training activities, conform to installation and community noise-abatement regulations. Identify and mark the off-limit boundaries.
- Open fires, such as burning of garbage, refuse, and rubbish is not allowed on range

areas. For burning excess powder increments, use only designated powder burn sites.

- Conform to field sanitation and medical standards when using soakage pits for wash water, liquid kitchen wastes, and grease traps per FM 21-10, *Field Hygiene and Sanitation*.
- Establish field satellite-accumulation site and procedures.
- Police field locations and establish field trash-collection point and procedures. Remove materials packed into training area on departure from the training area.
- When the training exercise is complete, repair any field damage such as ruts from vehicles, foxholes, and other emplacements.
- Conduct all training with a concern for conservation and future use of range training areas.

MUNITIONS

E-6. Munitions and ordnance are not considered wastes as long as they are in their life cycle of use and may still be used for their intended purpose. Resource Conservation Recovery Act (RCRA) hazardous waste management requirements do not apply to:

- Explosive ordnance disposal (EOD) sites that are used solely for training, emergency, and range clearance operations.
- Open burning/open detonation training activities on training ranges, impact ranges, firing ranges, or the equivalent.
- Burning excess propellant bags/increments incidental to the training mission. All excess powder will be burned at designated powder burn areas.
- Installation range clearance operations of conventional ordnance.

HAZARDOUS MATERIAL AND HARZARDOUS WASTE

E-7. The RCRA of 1976 is the framework for managing hazardous waste and has established standards for identifying, classifying, and storing of these wastes. RCRA regulations require those involved in managing hazardous substances to be properly trained, and the training to be properly documented.

E-8. Key hazardous material and hazardous waste environmental considerations include, but are not limited to, the following items:

- Personnel dealing with hazardous materials should be trained in proper handling, containment, cleanup, and reporting procedures.
- A material safety data sheet (MSDS) must be on file, and made available to all personnel regarding hazardous material.
- Bore cleaner waste. Is a chlorinated hydrocarbon product used? If so, how is the

waste disposed?

- Battery electrolyte (acid) from damaged batteries should be drained and disposed of through turn-in via installation policy and maintenance SOP. Refer to TB 43-0134, *Battery Disposition and Disposal,* for complete procedures regarding battery handling and disposal.
- Never allow the accumulation of more than 55 gallons of a hazardous waste, or 1 quart of acutely hazardous waste, at the satellite accumulation point. Process all hazardous waste in a timely manner.
- Hazardous waste containers should be kept closed when not in use, kept free of rust and leaks, and stored separately from incompatible wastes.
- Incompatible wastes must never be transported on the same vehicle.
- Ensure that all Department of Transportation (DOT) and hazardous waste transportation requirements are met prior to transporting hazardous material or hazardous waste on public highways.
- Check with the local environmental office for transportation procedures within the installation boundary.
- For complete information regarding storing and handling of hazardous materials refer to TM 38-410, *Storage and Handling of Hazardous Materials*.

MATERIAL SAFETY DATA SHEET

E-9. A MSDS is a summary of information on a given chemical identifying material, health and physical hazards, exposure limits, and precautions. A MSDS describes the hazards of a material and provides information on how the material can be safely handled, used, and stored. Insist on receiving a copy of a MSDS when receiving a hazardous chemical from supply, and retain it for when or if you turn in the material. As time permits, periodically review each MSDS pertaining to your unit. This will assure a quick response when identifying symptoms and handling emergencies.

E-10. Unfortunately, there is no specified format for a MSDS, and it doesn't contain all known data of a chemical, but there are typical components. These are outlined in 29 Code of Federal Regulations (CFR) 1910.1200. Use the following information (Figure E-1) as a guide toward what to expect on most MSDS forms.

Section/Topic	Contents
Section 1 - General Information	Manufacturers' name and address Trade or common name of product
Section 2 - Hazardous Components	NIOSH and/or chemical abstract system number Chemical name and percentage

Section 3 - Physical Properties	Boiling point, freezing point, water solubility, etc. Appearance and odor under normal conditions
Section 4 - Fire & Explosion Hazard	Fire-fighting equipment Any unusual fire and explosion hazards
Section 5 - Health Hazard	Routes of entry into the body Emergency and first aid procedures
Section 6 - Reactivity Data	Conditions to avoid Incompatibility with other materials
Section 8 - Control Measures	Recommended respiratory and ventilation Personal protective equipment, if needed
Section 9 - Special Precautions	Handling and storing precautions
Section 10 - Transportation	Applicable regulations Hazards class and required labeling

Figure E-1. Material Safety Data Sheet

MAINTENANCE

E-11. The maintenance officer acts as the hazardous material/hazardous waste (HM/HW) spill coordinator. He/she ensures the accountability, proper storage, and disposal of all HM/HW, and ensures that HM/HW spills are immediately contained and reported. Additionally, the maintenance officer reports nonfunctional/inoperative treatment/collection facilities (such as oil/grease interceptors, floor drains, or catch basins) to the installation environmental office through the unit environmental compliance officer (ECO).

E-12. Key maintenance environmental considerations include, but are not limited to, the following:

- Motor maintenance areas require SOPs and close monitoring; this operation is a continuous source of minor pollution to storm drainage systems due to the constant threat of a spill of fuel or oil. SOPs for prevention or cleanup of spills should be posted in motor maintenance areas, and should be understood by all personnel involved in maintenance activities.
- Refueling operation SOPs should address practices to minimize spills.

- Implement preventive maintenance on all heavy equipment to ensure petroleum products will not be released from the belly pan.
- Ensure pollutants are not discharged into storm or washrack drains or poured on the ground or along fence lines. Some common pollutants are oil, solvents, soap, diesel, gasoline, battery acid, chemicals, waste antifreeze, paint, and grease.
- Asbestos containing parts such as brake shoes, clutch plates, and equipment insulation should be removed, collected, and disposed according to installation policy.
- The least hazardous or preferably, non-hazardous material to perform a function should be used, unless previous research of options clearly indicates otherwise. The Defense Logistics Agency produces a manual, *Environmental Products,* to assist in this process.
- Do not mix fuel, oil, or antifreeze together. This is considered a mixed waste.

SUPPLY

E-13. The supply sergeant is required to have a complete inventory of HM/HW generated by the unit. He/she must also know what chemicals the unit requires, where and how they are stored, how much hazardous waste is generated, and necessary spill response procedures. The supply sergeant should coordinate with the unit S3 or ECO to ensure this information is incorporated into the unit SOP.

E-14. Key supply environmental considerations include, but are not limited to, the following items:

- Requisition only supplies needed and authorized, avoid excessive stockpiling of materials.
- Maintain an accurate inventory in unit SOP of hazardous waste used by the generating unit. This listing should include waste by volume, type, generating process, and location.
- Use of used oil tanks for disposal of solvents, antifreeze, or other HM/HW is against regulation. Storage of hazardous material must be in clearly marked DOT-approved containers.
- Actively support a unit-recycling program.
- Ensure tires and batteries are properly turned in for recycling.
- Ensure used batteries are turned in on a one-for-one basis.

SPILL RESPONSE

E-15. Generally, only persons specifically trained to respond to a spill should handle unit spills. However, all personnel should, at a minimum, report the spill, and be aware of the following four basic steps to spill response:

- Protect yourself. Use personal protective equipment specified in the MSDS.
- Stop the flow. This may be as simple as placing the container upright or closing a valve.
- Contain the spill. Place absorbent material around the spill, and protect drains and ditches.
- Report the spill. Notify supervisor, and other key personnel.

E-16. Each unit is responsible for the cleanup of their own spills, as long as no personnel are put in danger. After the above four steps are completed, take the necessary steps to cleanup the spill. Information on cleanup procedures can be found on the MSDS, unit SOP, or contact installation environmental staff for guidance. Turn in the spilled material and absorbent to the Defense Reutilization Marketing Office (DRMO), or another designated point if a DRMO is not available. Also, ensure there are adequate spill supplies on-hand for future use.

E-17. Key spill prevention, response, and cleanup considerations include, but are not limited to, the following items:

- A spill prevention and response section should be included in the unit SOP outlining installation spill plan requirements.
- Each unit should make available and maintain a spill cleanup kit near any satellite-accumulation area, or where a potential for spill exists. The kit should contain, at a minimum, absorbent material, shovel, brooms, gloves, and appropriate containers. Units who have a potential for release or spill that may impact streams should also maintain brooms for containment.
- Drip pans should be used under vehicles and equipment where spills are likely to occur.
- Spills of oil, fuel, or other hazardous pollutants over 5 gallons in volume, 100 square feet in area, or in any waterway should be reported immediately to the chain of command.
- All topsoil contaminated with oil should be removed, properly disposed, and replaced by the unit. While awaiting disposal, keep the excavated soil covered to prevent runoff in case of rain.

SECTION III — REGULATORY REQUIREMENTS

LAWS AND REGULATIONS

E-18. Military facilities are subject to federal, state, local, and host nation environmental laws; when the requirements differ, the most stringent applies. Ignorance of environmental laws is not an excuse for non-compliance, and it will not protect commanders, soldiers, or the military services from civil and criminal liability. Figure E-2 lists the federal and military laws and regulations that are frequently encountered by Army personnel; however, it is not inclusive of all requirements.

Army Regulations

AR 200-1. Environmental Protection and Enhancement
AR 200-2. Environmental Effects of Army Actions
AR 200-3. Natural Resources
AR 200-4. Historic Preservation
AR 420-49. Solid and Hazardous Waste Management
AR 420-76. Pest Management

Executive Orders

EO 11989. Use of off-road vehicles on public land
EO 11990. Wetland protection
EO 12114. Effects of federal actions abroad
EO 12196. OSHA Compliance for federal employees
EO 12580. CERCLA duties and powers
EO 13101. Pollution prevention and recycling

Federal Laws

Archaeological Protection Act of 1979

Clean Air Act of 1970
Clean Water Act of 1972
CERCLA of 1980
EPCRA of 1986
Endangered Species Act of 1973
Federal Facilities Compliance Act of 1992
Hazardous Materials Transportation Act of 1975
National Environmental Policy Act of 1969
National Historic Preservation Act of 1966
Noise Control Act of 1972
Oil Pollution Act of 1990
RCRA of 1976
Toxic Substances Control Act of 1976

Figure E-2. Environmental Laws and Regulations

E-19. Additionally, environmental law varies with differing countries, states, and cities. What is legal in one area may be illegal in another. Each installation environmental office knows the laws for that locality, and should be consulted on environmental considerations during the planning and execution of training.

E-20. Army units outside the continental United States (OCONUS) that are not subject to federal environmental regulations decreed by the Environmental Protection Agency (EPA) should comply with the final governing standards of the host nation. In areas where a host nation has minimal or no environmental laws and regulations, comply with the *Overseas Environmental Baseline Guidance Document (OEBGD)* provided by the Department of Defense, AR 200-1, *Environmental Protection and Enhancement*, and AR 200-2, *Environmental Effects of Army Actions*.

REGULATORY RAINING REQUIREMENTS

E-21. Regulatory agencies exist which require environmental training. This training may be at the awareness level for all personnel or at a more specialized level designed for specific personnel. The installation environmental and safety offices can best assist in determining your training requirements and who to contact for additional information.

Table E-1 is provided as a reference of possible training requirements for Paladin operations.

Table E-1. Regulatory Training Requirements

NOTE: The depth or level of training will vary between target audiences. For example, K and E will need in-depth training, while A will only require broad overviews. The letters K, E, N, or A denotes target audience, and are listed below.

Knowledge	Personnel who administer, implement, or comply with contents of regulations such as program manager and technicians in the environmental field. Also includes organizations that need in-depth knowledge of the environmental laws/regulations/programs, such as staff judge advocate.
Executors	All personnel who supervise or actually handle responsibilities dealing with environmental programs, to include ECOs, technicians, and workers. Also includes unit personnel required to execute responsibilities with environmental ramifications as part of their mission.
Need to Know	Personnel who may encounter environmental issues as part of their mission. This may include personnel within the following activities: engineers; designers; emergency personnel; safety; reserve components; first-line supervisors; crew chiefs; NCOs; and various unit personnel as identified by the installation environmental office and their supervisors
Awareness	Public affairs office, reserve components, other unit personnel.

Table E-1. Regulatory Training Requirements (Continued)

Training Topic	Regulatory Reference	K	E	N	A
Hazardous Materials/Waste Compliance Training	29 CFR 1200; 40 CFR 262.34, 264.16, 265.16; 49 CFR 172	*	*	*	*
Hazardous Waste Operations for Installation Restoration	29 CFR 1910.120	*	*		
Hazardous Waste Operations for Treatment Storage and Disposal Facilities	29 CFR 1910.120	*	*		

Emergency Response to Hazardous Materials Incidents/Hazardous Material Technician	29 CFR 1910.120	*	*	*	
National Environmental Policy Act (NEPA)	NEPA of 1969	*			*
National Historic Preservation Act (NHPA)	36 CFR part 800, 36 CFR part 63, NHPA of 1966	*			*
Archaeological Resources Protection Act (ARPA)	43 CFR 7.7 (4) ARPA of 1979	*			
Native American Graves Protection and Repatriation Act (NAGPRA)	NAGPRA of 1990	*			
Emergency Planning and Community Right-to-Know (EPCRA)	EPCRA/SARA 1986 Title 3, Executive Order 12856	*	*	*	*
Lead Based Paint	Lead Based Paint Exposure Reduction Act of 1992, 24 CFR 35	*	*	*	*
Asbestos	40 CFR part 763, 40 CFR 61 part M	*	*	*	*
Endangered Species Act (ESA)	ESA 1973 as amended, 50 CFR par 402	*			*
Clean Water Act (CWA)	CWA S 311	*	*		*
Storm Water Pollution Prevention Planning	CWA S 319	*	*	*	
CFC/Halon Refrigerants	EO 11051, 40 CFR 82.40, 40 CFR 282, 58 FR 92 (p. 28660)		*	*	*
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	FIFRA of 1972, 40 CFR 265.16, SARA of 1986		*		
Solid Waste Management	40 CFR 240-257/RCRA Subtitle D	*			*

Underground Storage Tanks	40 CFR part 280, RCRA Subtitle I	*			
National Pollutant Discharge Elimination System (NPDES)	CWA of 1990, 40 CFR 122-129	*	*		*
Confined Space Entry	29 CFR 1910.146	*	*	*	*
Occupational Respiratory Protection	29 CFR 1926.58, 29 CFR 1910.134	*	*		
Occupational Exposures to Bloodborne Pathogens	29 CFR 1910.1030	*	*	*	*
Storm Water Compliance	40 CFR 122-129, WPCA S 319	*	*		
Hazard Communication Standard	29 CFR 1910.1200	*	*	*	*
Department of Transportation	49 CFR172.704	*	*	*	*

ENVIRONMENTAL COMPLIANCE OFFICER RESPONSIBILITIES

E-22. It is the unit commander's duty to appoint an ECO and a hazardous waste coordinator; the same person can serve in both positions, per AR 200-1. These appointments are made to ensure that environmental compliance occurs at the unit level. Appointed personnel:

- Should receive formal training and act as an advisor on environmental regulatory compliance during training, operations, and logistics functions.
- Will be the commander's eyes and ears for environmental matters, as the safety officer/NCO is for safety matters.
- Should function as the liaison between the unit and higher headquarters regarding environmental matters such as training requirements, equipment, or supplies that unit personnel need.
- Should inspect HM/HW accumulation sites, and ensures that soldiers handling these materials are properly trained.
- Ensure the unit's SOP covers environmental considerations, conservation, natural resources, pollution prevention, HM/HW, and spill procedures.
- Support the Army's pollution prevention/recycling program.
- Report hazardous material and waste spills immediately.
- Conduct environmental self-assessments or internal environmental compliance

assessments, and meet with key installation environmental points of contact, as necessary, to remain updated on any regulatory changes.

SECTION IV — ENVIRONMENTAL RISK MANAGEMENT

SECTION IV — ENVIRONMENTAL RISK MANAGEMENT

E-23. Leaders at all levels are required to make timely and appropriate decisions regarding the environment. The failure to do so may negatively impact the training environment, which could then lead to personal liability of individuals directly involved, the chain of command, and the US Army. Therefore, leaders must have a method of managing, assessing, and reducing environmental risks.

THE FIVE-STEP PROCESS

E-24. Risk management is a five-step process designed to provide leaders a methodology for the identification, assessment, control, and evaluation of environmental risks. The following is a summary of these steps from FM 20-400, *Military Environmental Protection*, and FM 100-14, *Risk Management*. (Refer to these FMs for detailed information.)

E-25. Step 1. Identify Hazards - Environmental hazards include all activities that may pollute, create negative noise-related effects, degrade archeological/cultural resources, or negatively effect threatened or endangered species habitats. A select listing of common environmental hazards is located in Figure E-3.

Media Area	Common Environmental Hazards
Air	Equipment exhaust, convoy dust, range fires, open-air burning, pyrotechnics/smoke pots/smoke grenades, part-washer emissions, paint emissions, air-conditioner/refrigeration CFCs, HM/HW release, pesticides, other toxic industrial chemicals or material.
Archeological and cultural	Maneuvering and digging in sensitive areas, disturbing or removing artifacts, demolition/munitions effects, HM/HW spills.

Noise	Low-flying aircraft (helicopters), demolition/munitions effects, nighttime operations, operations near post/camp boundaries and civilian populations, vehicle convoys/maneuvers, large-scale exercises.
Threatened and/or endangered species	Maneuvering in sensitive areas, demolition/munitions effects, especially during breeding seasons, disturbing habitat or individual species, HM/HW spills or releases, poor field sanitation, improper cutting of vegetation, damage to coral reefs,
Soil (terrain)	Over use of maneuver areas, demolition/munitions effects, range fires, poor field sanitation, poor maneuver-damage control, erosion, troop construction effect, refueling operations, HM/HW spills, maneuver in ecologically sensitive areas such as wetlands and tundra, industrial waste runoff, pesticide accumulation in soil, vegetation, and terrestrial organisms.
Water	Refueling operations near water sources, HM/HW spills, erosion and unchecked drainage, amphibious/water-crossing operations, troop construction effects, poor field sanitation, washing vehicles at unapproved sites.

Figure E-3. Common Environmental Hazards

E-26. Step 2. Assess Environmental Hazards to Determine Risk - A risk assessment is a tool used for evaluating the most pressing or most hazardous potential environmental damage. It considers two factors; probability, how often a hazard is likely to occur; and severity, the effect in degrees a hazard will have on personnel, equipment, environment, and mission. Unit leaders should conduct risk assessments before conducting any training, operations, or logistical activities that are not previously addressed in the SOP, or when conditions differ significantly from the SOP. Complete information on risk assessments can be obtained from FM 20-400 for procedures on how to perform an environmental risk assessment.

E-27. Step 3. Develop Controls and Make a Decision - This step is designed to reduce the probability or severity of each hazard, which in turn lowers the overall risk. Control types fall in the categories of educational, physical, or avoidance. Figure E-4 outlines examples of environmental controls, and Section II contains the specifics pertinent to the Paladin.

Control Type	Environmental-Related Examples
Educational	• Conducting unit environmental-awareness training • Conducting an environmental briefing before deployment • Performing tasks to environmental standards • Reviewing environmental considerations in AARs • Reading unit's environmental SOPs and policies
Physical	• Providing spill-prevention equipment • Establishing field satellite-accumulation site and procedures • Policing field locations • Practicing good field sanitation • Posting signs and warnings for off-limit areas
Avoidance	• Maneuvering around historical/cultural sites • Establishing refueling and maintenance areas away from wetlands and drainage areas • Crossing streams at approved sites • Preventing pollution • Limiting noise in endangered and threatened species habitats

Figure E-4. Environmental-related Controls

E-28. Step 4. Implement Controls - Leaders must inform subordinates of risk-control measures, state how each control is to be implemented, and assign responsibilities. They must also ensure these controls are in place prior to the operation. This is accomplished by using the *before*, *during*, and *after* checklists and the environmental risk-assessment process. Examples of checklists can be obtained from Training Circular (TC) 5-400, *Unit Leaders' Handbook for Environmental Stewardship*, or from the field artillery environmental handbook referenced in Section I, in order to determine the environmental considerations that may affect Paladin training and operations.

E-29. Step 5. Supervise and Evaluate - Leaders should monitor controls to ensure effectiveness and whether controls require modification. They should ensure the after action review (AAR) process includes an evaluation of environmental-related hazards, controls, soldier performance, and leader supervision.

Appendix F

Movement Techniques

Movement TechniquesThe Paladin howitzer gains its increase in survivability by making frequent moves. To make the best use of this ability, soldiers in a Paladin platoon must be well trained in various movement techniques in different types of terrain.

PLATOON MOVEMENT

F-1. The POC controls three howitzer sections in a platoon position that is approximately 1,500 X 3,000 meters in area. Operating as a platoon of three sections requires a great deal of coordination between the section chiefs and the POC. C2 is maximized if a team leader is designated among howitzer sections. The senior chief or team leader directs the movement of the other sections based on guidance from the platoon leader, platoon sergeant or the POC. When the POC sends movement orders to the platoon, the team leader is responsible to execute the movement. Although all three howitzers in the platoon receive the same movement order, the team leader is responsible for leading the way to the new position.

"WINGMEN" CONCEPT

F-2. Two Paladin sections or "wingmen" maneuver by orienting off the team leader's location. The wingmen orient and disperse from the team leader as set forth by unit TSOP or as directed by the team leader. The team leader maneuvers and changes the platoon formation based on the factors of METT-TC. Orientation data may be designated by a direction; front, rear, left or right from the team leader, or in relation to the face of a clock. For instance, in desert terrain one wingman might be positioned 200 meters to the left and 300 meters to the rear, and the second wingman positioned 200 meters to the right and 300 meters to the rear of the team leader relative to the AOF (see Figure F-1). In more restrictive terrain, the distance might be 100 meters with one wingman at the 4 o'clock position and the second at the 8 o'clock position (see Figure F-2).

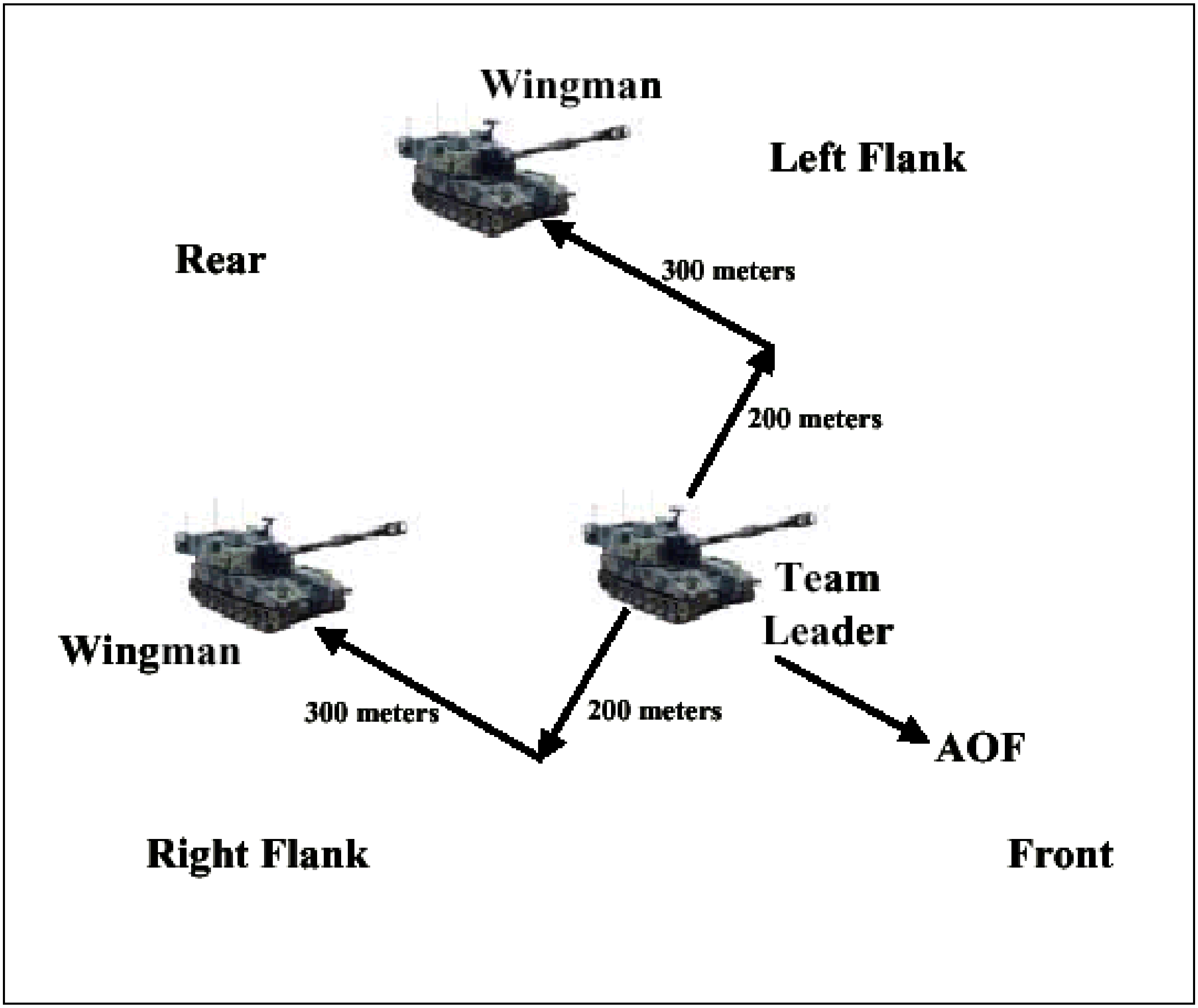


Figure F-1. Wingmen Positioned at Left and Right Rear

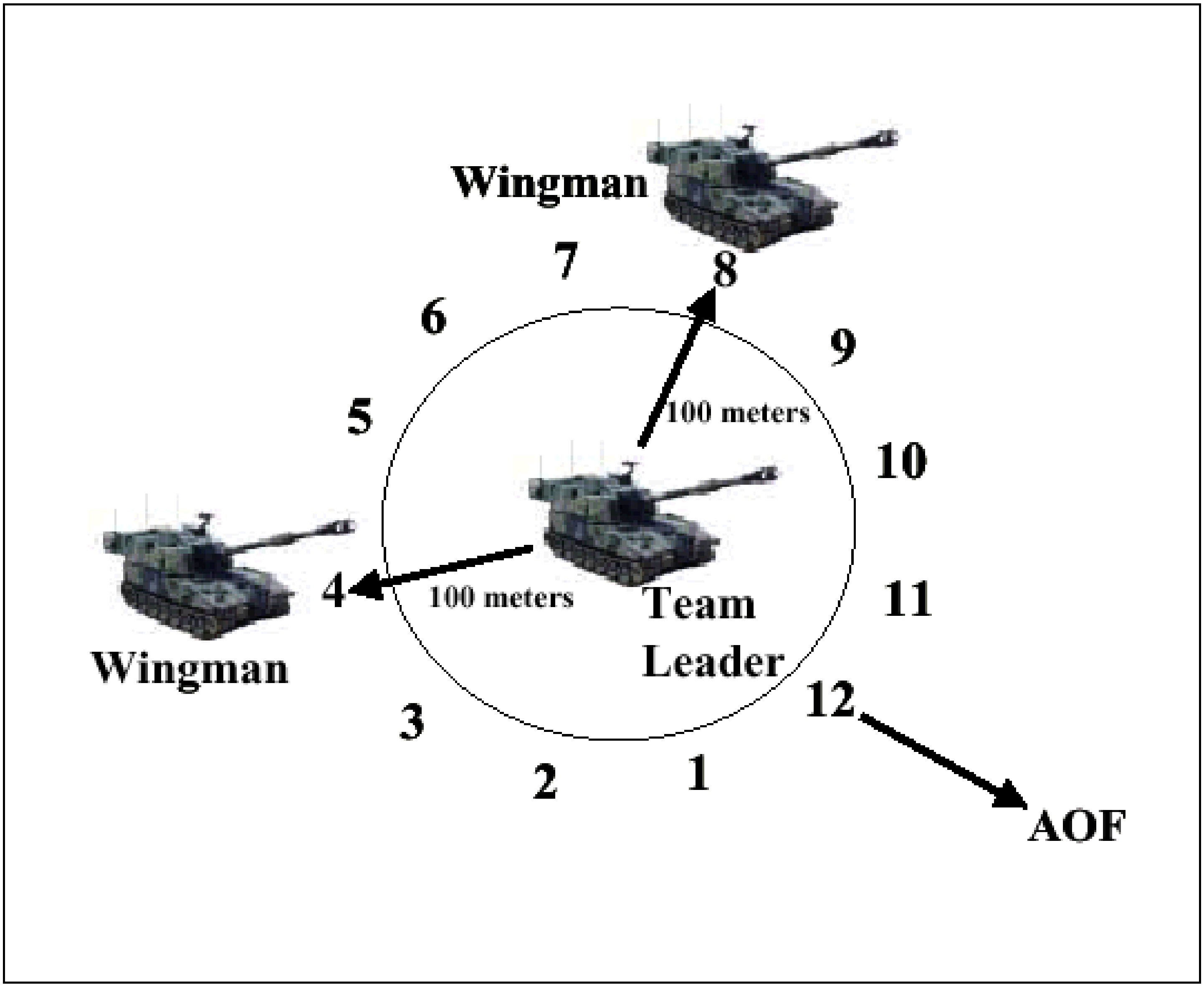


Figure F-2. Wingmen Positioned at 4 and 8 O'clock

PAIRED MOVEMENT

F-3. The battery commander may decide to move his battery in pairs of howitzers. With this technique, one POC assumes control of two pair and the other POC controls one pair. The paired concept is similar to the platoon movement except only two sections are moving together. As with platoon movement, it is advantageous to assign a team leader to control each pair. This concept simplifies the C2 and ensures that proper separation is maintained within a pair. As with platoon operations, both howitzers in the pair receive the same movement order and the team leader leads the way to the new position. The single wingman maneuvers and orients off the team leader's location as in platoon operations.

MOVEMENT METHODS

F-4. The factors of METT-TC call for different types of movement techniques, tied to different levels of centralized versus decentralized control of the howitzers by the POC. The following techniques can be altered as the tactical situation and level of training within the unit dictate.

DESERT/TUNDRA

F-5. The unobstructed open spaces of a desert environment offer the easiest methods of conducting survivability movement. Any method can be used in conjunction with decentralized control to maximize dispersion and use of the terrain. The team leader, followed by his wingmen, can disperse in the firing area (Figure F-3A), they can move from firing area to firing area as in the quadrant method (Figure F-3B), or they can displace to a new firing area within the PA. The movement should be varied so actions do not become predictable.

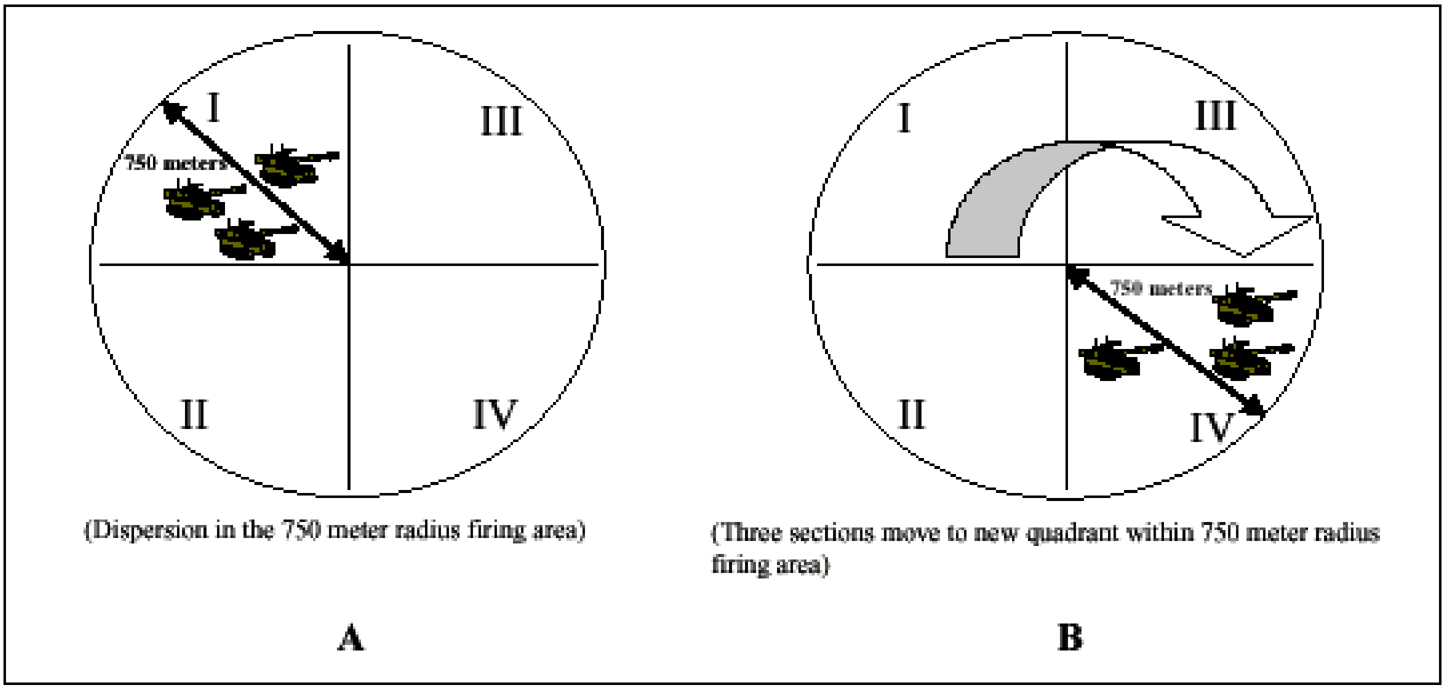


Figure F-3. Survivability Movement

TEMPERATE/FORESTED

F-6. The temperate/lightly forested environment, such as is found in most of Western Europe and much of the United States, calls for an intermediate level of centralization. As terrain features may subdivide platoon areas, the senior COS can find locations for his wingmen within his area, based on guidance from the GSG or platoon sergeant. The wingmen concept can be used here also, but since the COS will want to use all available cover and concealment, the orientation may have to be more flexible. For example, guidance from the team leader to his wingmen might be: "Follow me to the next tree line, and take a positions 200 meters left and right of me in the tree line."

URBAN

F-7. The urban environment calls for the most centralized control of any environment. Since maneuverability may be limited, the GSG should reconnoiter individual howitzer positions, and brief his chiefs on where they are. As time permits, the GSG can take the chiefs to each of their firing positions in the PA in the GSG's HMMWV. The GSG should report to the POC and point out on the PA diagram where all of the individual howitzer positions are located.

MOVEMENT TO CONTACT

F-8. In a fast moving situation such as a movement to contact, movement may not fit neatly into the categories of "tactical" or "survivability" moves. Units should establish TSOPs for how to deploy in these situations. Those TSOPs should allow for swift emplacement from the column march. The wingmen concept can be useful here also.

MOVEMENT TTP

F-9. This section provides a short description of movement options and associated TTPs. The list of options is not all-inclusive. FM 71-123, *Tactics and Techniques for Combined Arms Heavy Forces: Armored Brigade, Battalion/Task Force, and Company/Team*, Appendix A; FM 17-98-1, *Scout Leader's Handbook*; and FM 17-15, *Tank Platoon* provide additional assistance and reference for movement and survivability in combat. They also discuss TTPs for navigation, TLPs, and C2 during movement.

F-10. When selecting movement options leaders must consider METT-TC:

- Mission. What are the battalion, battery, and platoon missions? What is the task force commander's intent? What are the essential tasks for this mission?
- Enemy. Where is the enemy and what size force does he have? What are his intentions? Will he attack, defend, or delay? What are his strengths and weaknesses?
- Terrain and Weather. Where can we observe and fire at the enemy? Where are covered and concealed routes and positions? Where are the obstacles and what kind are they? How are they bypassed? Where is the key terrain, and how can it be used to support the mission? Where are the avenues of approach? How fast can we move, and how much space does terrain and other unit formations give us?
- Troops (and other assets). What are the conditions of personnel and vehicles? What is the status of ammunition, fuel, and supplies? How much sleep can we get? Who

is best able to do a specific task? What other assets are available to support our mission? What are other batteries and platoons doing?

- Time Available. What was the SP time? What was the line of departure time? How much time is available for planning, preparation, and movement?
- Civil considerations. Are there any restrictions or hindrances to movement?

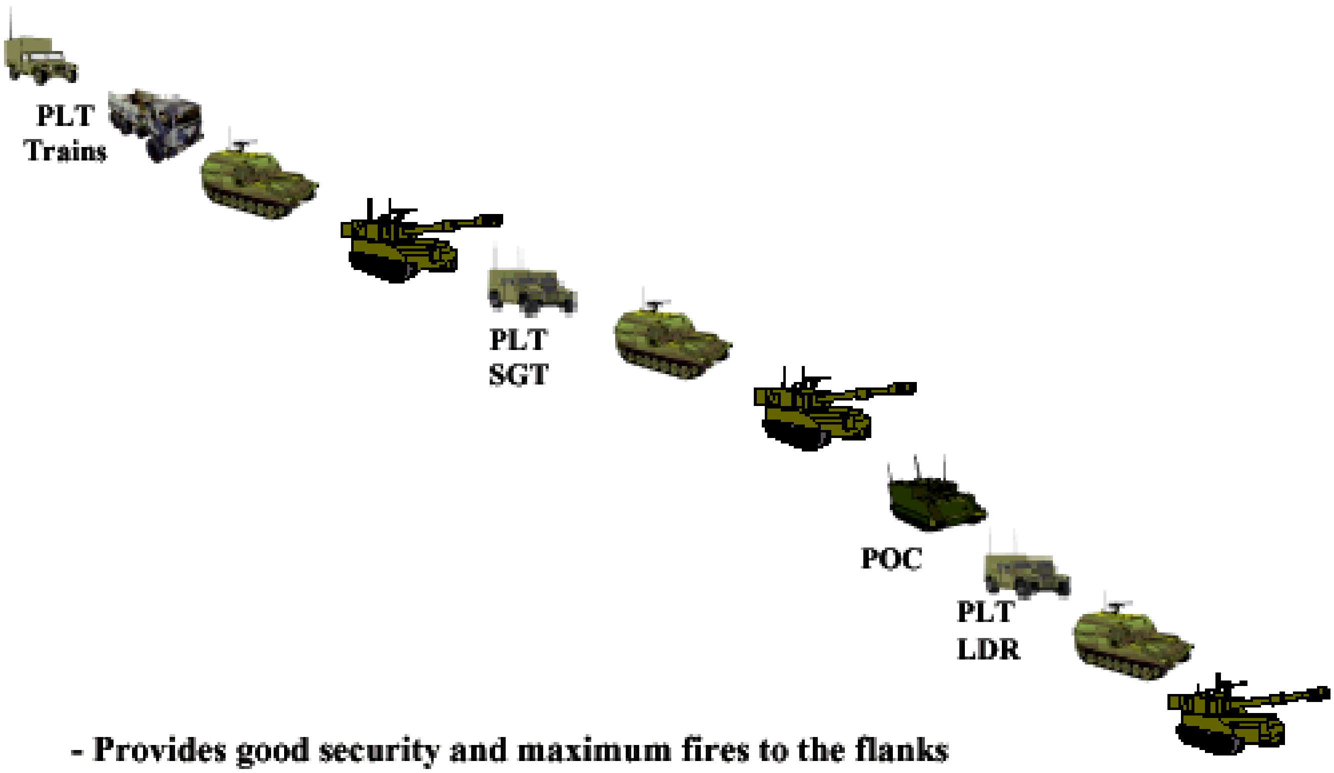
F-11. In addition to the factors of METT-TC, the movement options selected must take the following into account:

- The battalion displacement options (the organization and sequencing of moves) discussed in FM 6-20-1:
  - By unit- the battalion displaces with all elements moving at once.
  - By echelon- the battalion displaces in 2-3 groupings.
  - By battery- each firing battery moves only after the preceding battery has completed its move and is in place.
  - By element- the battalion displaces by individual elements as recommended by the battery commanders.
- In some cases, battalion may influence movement to maintain control of fires especially for employment of special munitions or mass missions.
- Maintaining the communications flow (electronic line of sight) from battalion TOC/FDC to the platoons to the guns. Extended ranges between battalion and platoons may require the use of battalion retransmission capability.
- Need to maintain survey/navigation accuracy on board the howitzer.
- Survivability/Defensibility

FORMATIONS

F-12. The unit can use, but is not restricted to four basic formations: column, wedge, box, and line. Leaders should select the formations most appropriate for the situation unless directed otherwise. Formations are not rigid. Terrain and common sense will frequently dictate needed changes. There is no set location for leaders. Key personnel must be tactically positioned in locations to best provide C2. Typically, the GSG is positioned forward to reconnoiter and provide early warning to the unit. The position of vehicles and support elements are dictated by METT-TC.

F-13. Consider the following formations (see Figure F-4 through F-7) as a general guide:



- Provides good security and maximum fires to the flanks
- Facilitates control
- Facilitates deployment into other formations
- Facilitates rapid movement

Figure F-4. Column

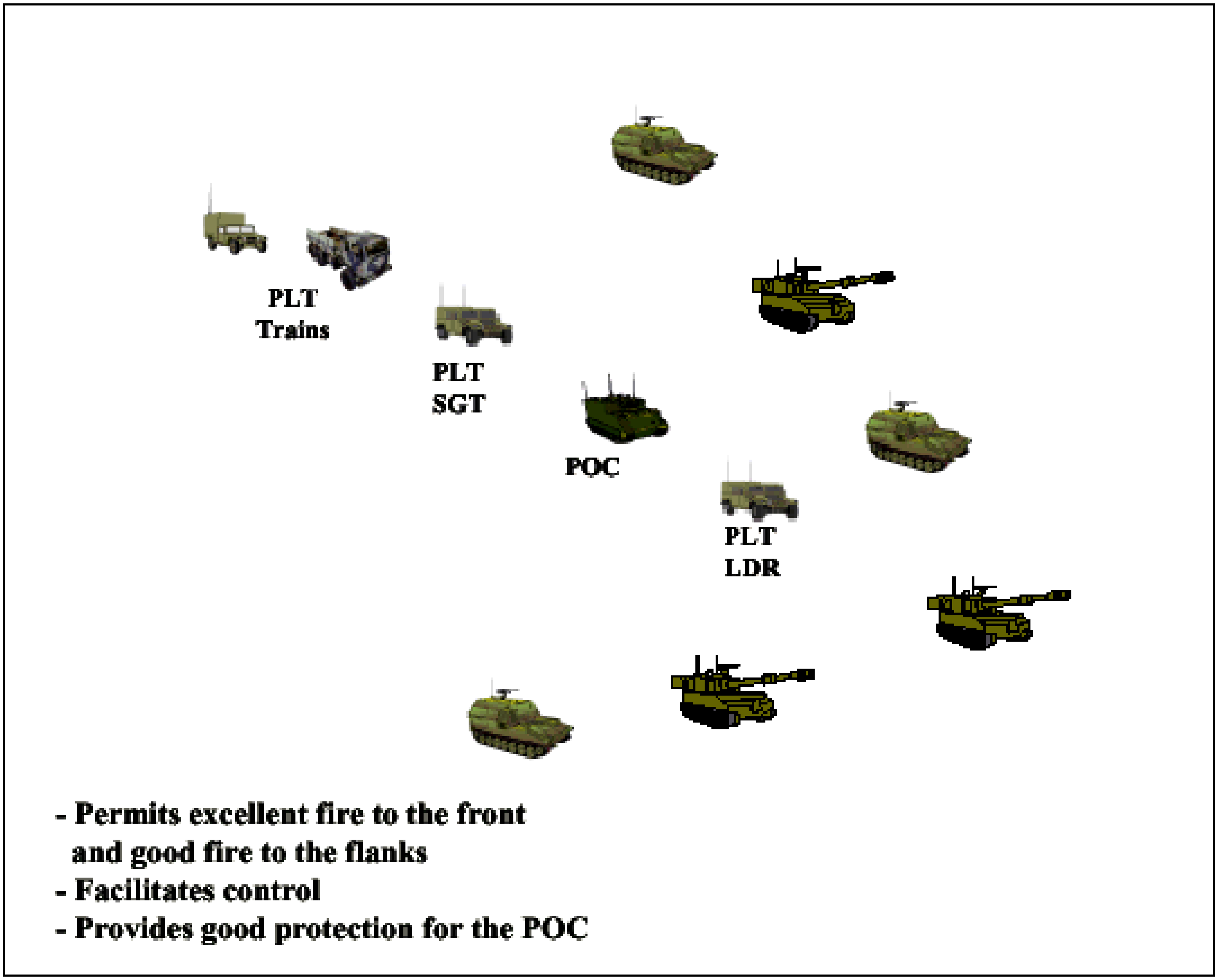


Figure F-5. Wedge

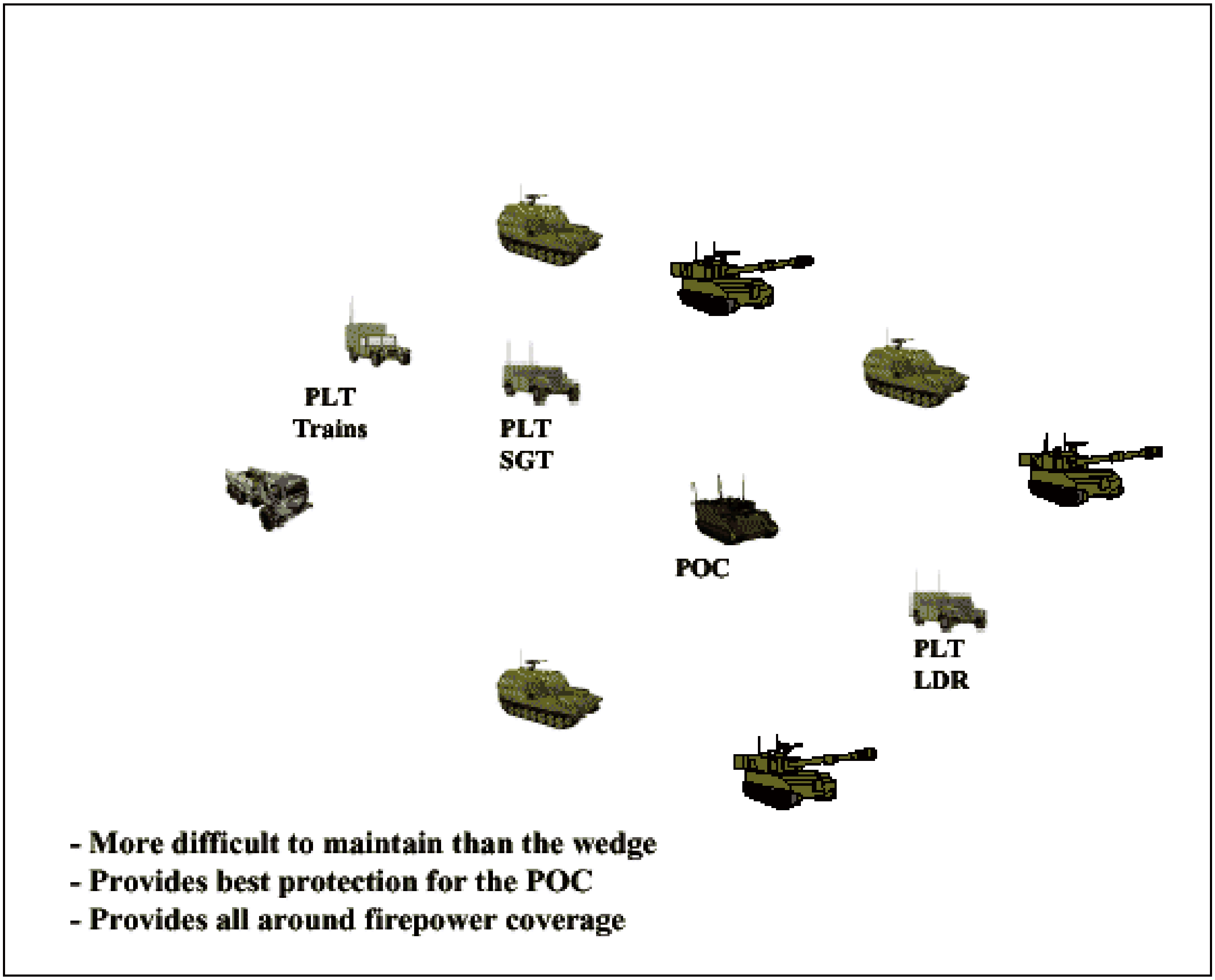


Figure F-6. Box

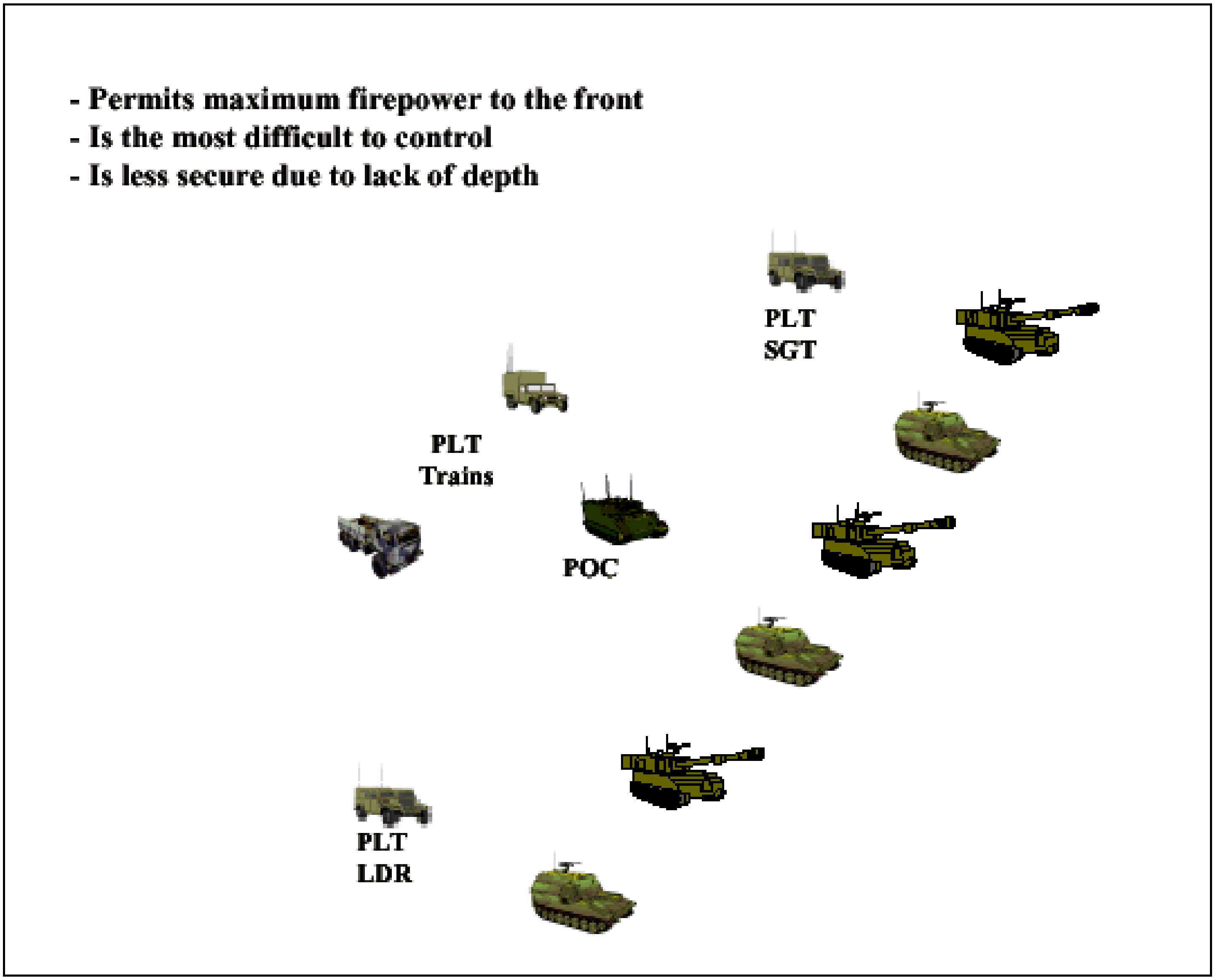


Figure F-7. Line

Appendix G

Paladin Firing Safety

GENERAL

G-1. Firing safety is paramount and every secondary independent check (verification) is designed to ensure rounds fired 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) - the leadership must be proactive under degraded operations.
- Charge error.

Target location and verification of target location are important segments in fire mission processing as well. The POC has the responsibility to verify target location at the battery level. Targets must be physically plotted and checked to ensure 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

G-2. Safety is computed IAW the standards of FM 6-40 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 on the move order message format. The FDO determines minimum and maximum quadrants. The minimum and maximum quadrants and charge specific are sent to the howitzers by digital means on a SYS;PTM. The section chief enters the data into the AFCS. Min 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 G-1.)

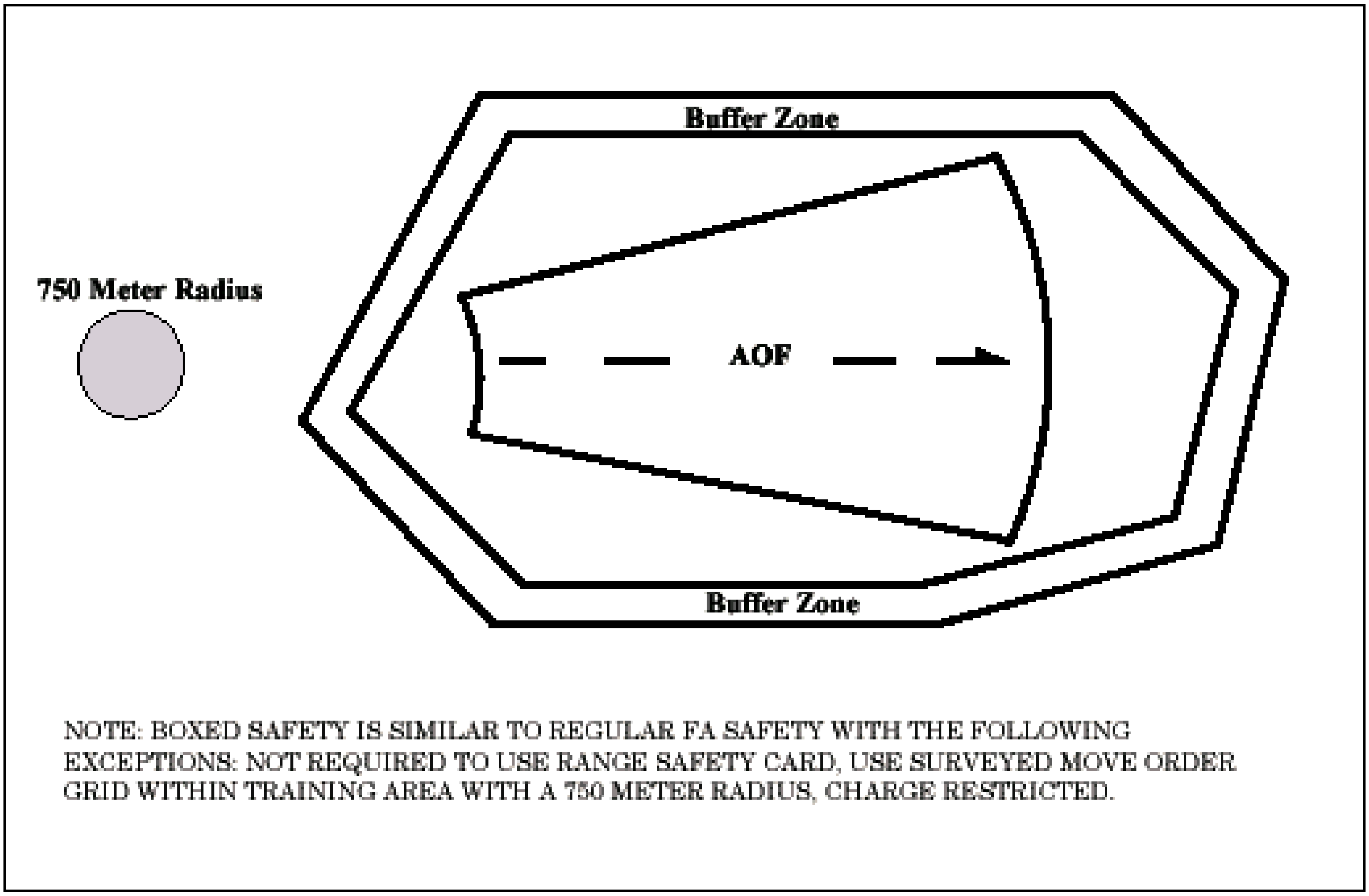


Figure G-1. Boxed Safety

UNBOXED SAFETY

G-3. This technique requires the FDO to shrink the perimeter of the selected impact area 300 meters or IAW local range safety regulations (which ever 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. The POC transmits min QE to the howitzer using the SYS;PTM format, and the COS inputs min 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 G-2.) The following are key points in unboxed safety:

- Min 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 IAW local range safety regulations (which ever is safest) to allow for probable errors.
- Howitzer pairs work within a 750 meter radius.

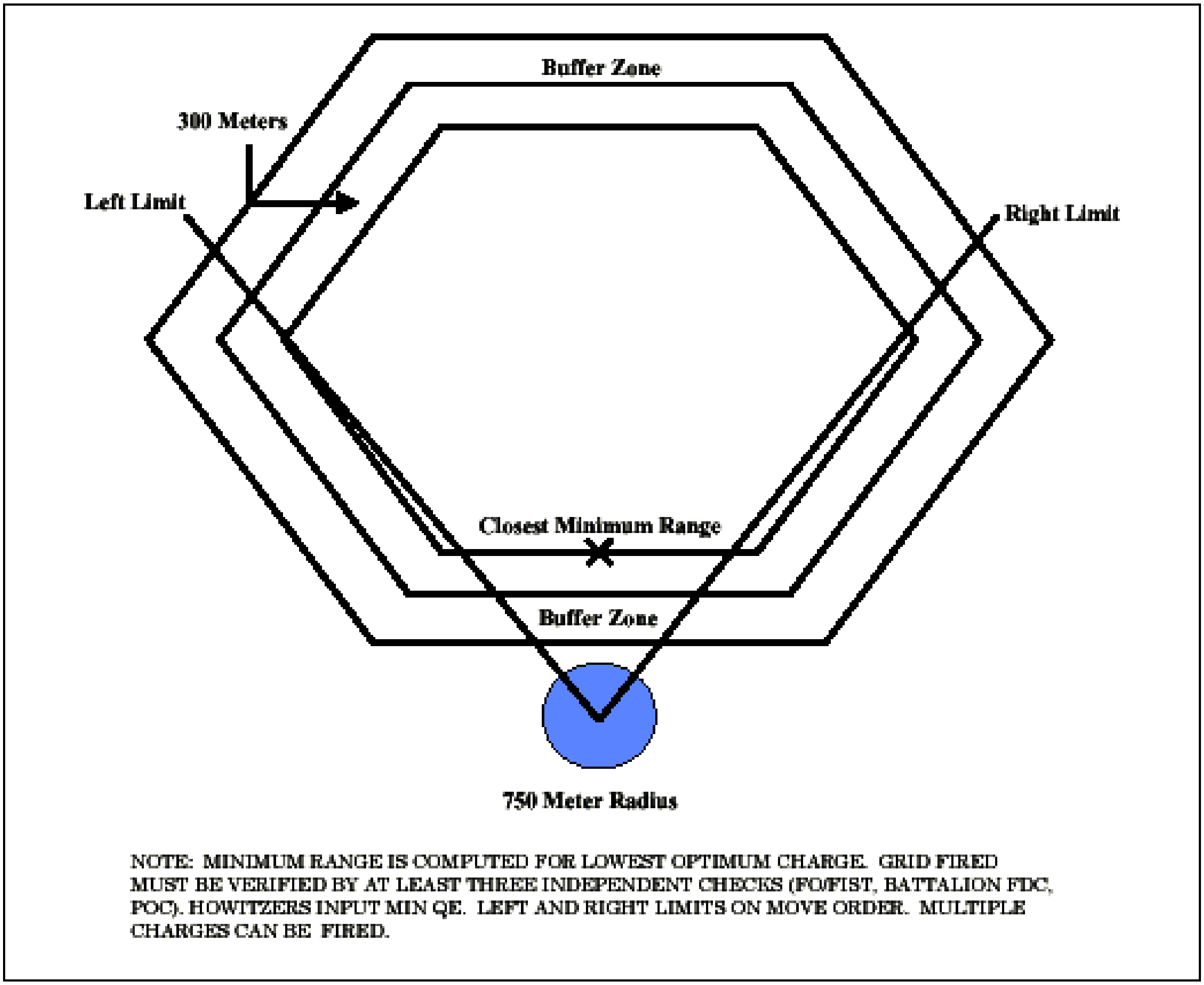


Figure G-2. Unboxed Safety

COMBAT SAFETY

G-4. Combat safety (see Figure G-3) is similar to unboxed safety with the following exceptions:

- The min QE is computed to the minimum range line (i.e., FLOT/brigade coordinated fire line (CFL)).

- Left and right limits are computed to the brigade boundaries and sent in the move order.
- The POC must check intervening crests.

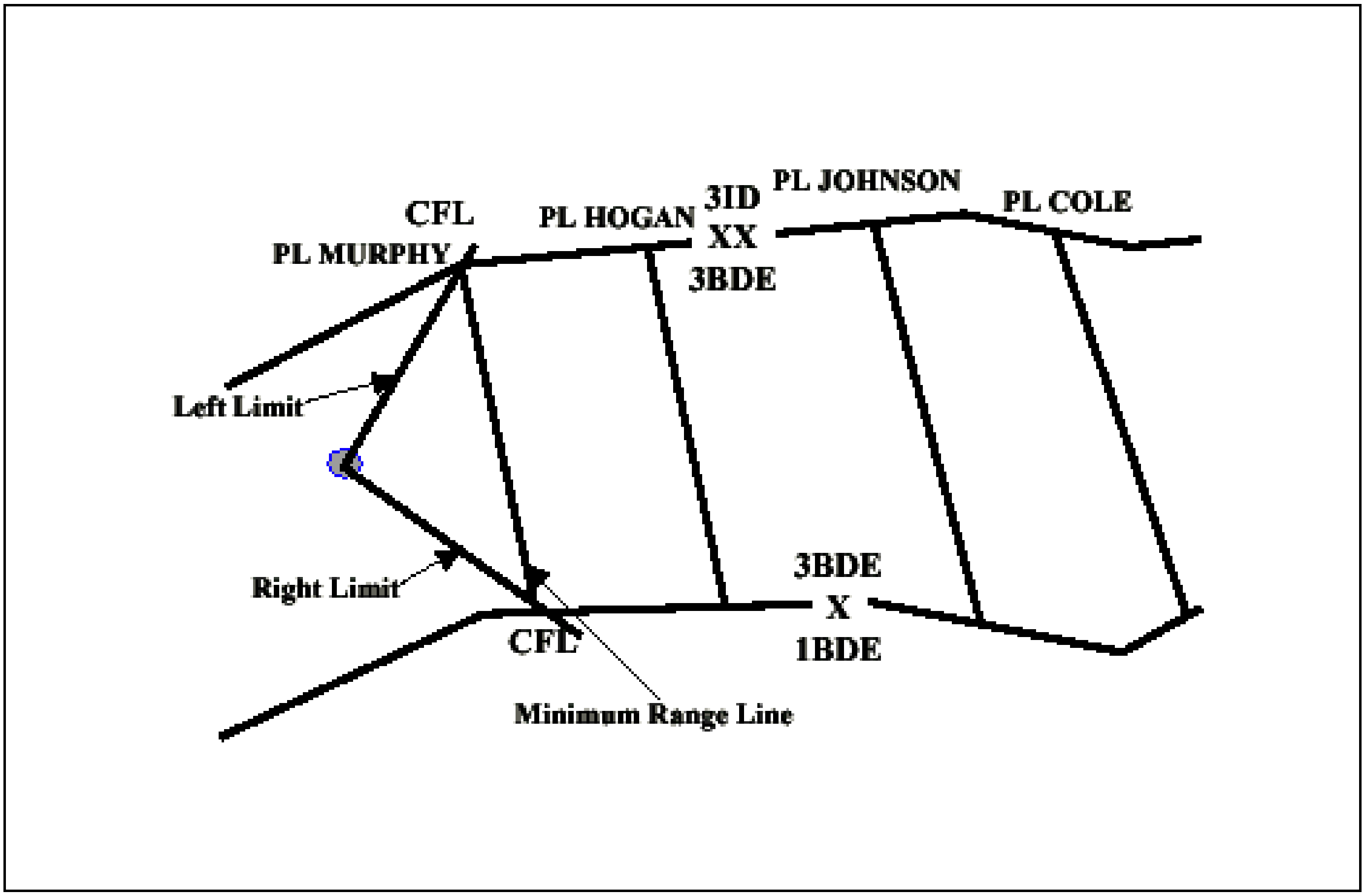


Figure G-3. Combat Safety

ILLUMINATION SAFETY

G-5. Illumination safety (see Figure G-4) is similar to boxed safety and is computed using an approved safety box in an impact area. Computations are made in accordance with the procedures in FM 6-40. 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.
- Howitzer section chief does not enter Safety "T" data into AFCS, but records the data.

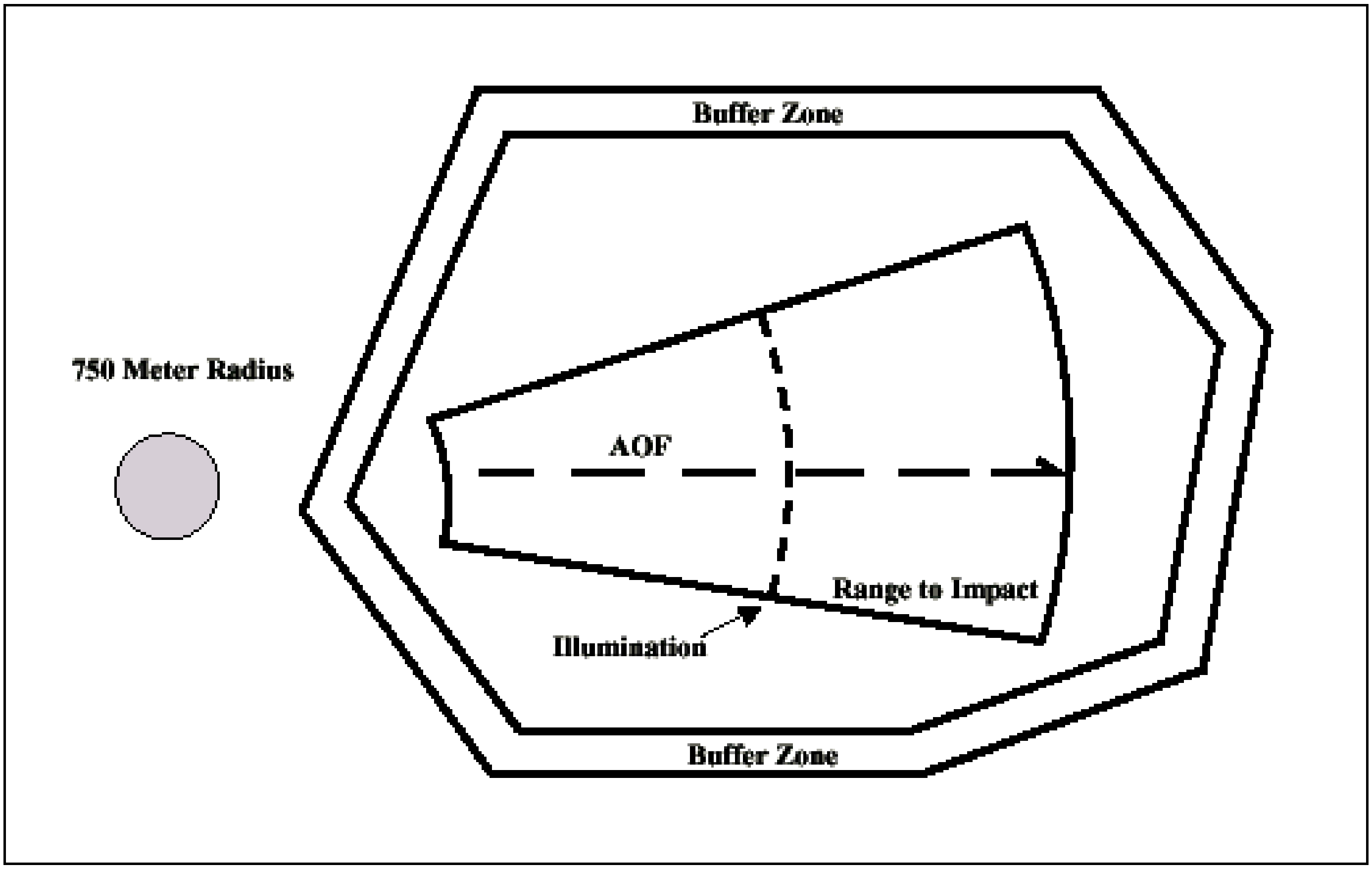


Figure G-4. Illumination Safety

Appendix H

Sample Gunner's Qualification Test

This gunner's qualification test is offered as a guide. Paladin units can modify it to fit specific training needs. It is a modification to the gunner's test in FM 6-50 (minus standard angle & elbow telescope) to make it Paladin specific.

USE OF TEST

H-1. This appendix presents a test that evaluates the 13B soldier in the performance of the principal duties of the gunner. This test applies to the M109A6 Paladin weapon system and has the following purposes:

- The tasks in this test should be used as a training tool. The soldier should practice each task under close supervision to acquire the degree of proficiency required by the standards stated in this test.
- This test can bolster the esprit and motivation of the soldier through recognition of individual proficiency. The artillery clasp for the marksmanship badge will be awarded upon successful completion of this test (see Army regulation (AR) 672-5-1, *Military Awards*).

This test will be given IAW unit training requirements.

STANDARDS OF PRECISION

H-2. The soldier will be required to perform the tasks IAW the following standards:

- Settings must be exact.
- Bubbles in leveling vials must be centered exactly.
- The cross hair of the reticle pattern on the pantel must be aligned exactly on the 0 line of the collimator (or offset correctly to counter the effects of displacement), center mass of the compass or reflector of the aiming circle, or on the top left edge of the DAP.

- The final motion of the elevating handwheel must always be in the direction that raises the cannon tube.
- Azimuth knobs must be rotated so as to approach the aiming point from left to right.
- The appropriate deflection correction must be set on the gunner's aid.
- Correct terms must be used.
- Correct hand and arm signals must be used.
- If any questions arise, refer to the appropriate TM and then to FM 6-50.

ASSISTANCE

H-3. The soldier will not receive assistance on the individual tasks except as specified for those tasks that require it. If the soldier fails any task because of the fault of the assistant, that task will be retested.

TASK SCORING

H-4. Scoring will be in accordance with the standards for each task. A "no go" will be given if any of the standards of precision 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 subtasks, the score for the task will depend on the speed of execution.

QUALIFICATION SCORES

H-5. Scores determining the qualification status of the gunner are shown in Table H-1.

Table H-1. Paladin Gunner Qualification Scores

Classification	Score
Expert Gunner	92-87
Gunner First Class	86-77
Gunner Second Class	76-67
Unqualified	66- 0

EQUIPMENT, PERSONNEL, AND SITE REQUIREMENTS

H-6. Successful administration of the test is enhanced by efficient organization of the test site. The test site will consist of the following:

- An in-briefing station.
- A chief examiner.
- An examiner for each station and an assistant if required.
- Six howitzers in the firing position with basic issue items (BIIs).
- An aiming circle with communications.
- Two direct fire targets, 600 meters in front of the test site and 50 meters apart.
- At least one DAP.

H-7. Soldiers will use the round-robin method to move from station to station. The examiner will remain at his station. Each examiner will have a clip board and stop watch.

H-8. The chief examiner will brief each soldier on the test site and what tasks are on each howitzer. He will explain the scoring system and answer any questions.

H-9. A test outline is shown in Table H-2. A sample grading sheet is shown in Table H-3.

Task Number	Subject	Elements	Points per Element	Maximum Credit
1	Lay the Howitzer for Initial Direction of Fire using the Aiming Circle	1	4	4
2	Lay the Howitzer for Initial Direction of Fire using the M2 Compass	1	4	4
3	Lay the Howitzer for Initial Direction of Fire using a DAP	1	4	4
4	Lay Another Howitzer Reciprocally	1	4	4
5	Refer the Piece	1	4	4
6	Align the Collimator	1	4	4
7	Check the Boresight of the Pantel with the M140 Alignment Device	1	4	4
8	Boresight the Howitzer (Pantel) using a DAP	1	4	4
9	Fire Mission	5	4	20
10	Direct Fire	4	4	16
11	Lay the Howitzer for Quadrant with the Range Quadrant	1	4	4
12	Measure the Quadrant with the Range Quadrant	1	4	4
13	Initialize the AFCS	1	4	4
14	Prepare to Fire using the AFCS	1	4	4
15	Conduct a Fire Mission using the AFCS	1	4	4
16	Perform Direct Fire using the AFCS	1	4	4
		Total Points Possible:		92

Table H-2. Test Outline

Gunner's Name		Section	Unit
Section Chief		Date	Weapon: M109A6
Task			Points Achieved
Task 1	Lay the Howitzer for Initial Direction of Fire using the Aiming Circle		No Go = 0 Points/Time____=____Points
Task 2	Lay the Howitzer for Initial Direction of Fire using the M2 Compass		No Go = 0 Points/Time____=____Points
Task 3	Lay the howitzer for Initial Direction of Fire using a DAP		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	Check the Boresight of the Pantel with the M140 Alignment Device		No Go = 0 Points/Time____=____Points
Task 8	Boresight the Howitzer (Pantel) using a DAP		No Go = 0 Points/Time____=____Points
Task 9A	Fire Mission		No Go = 0 Points/Time____=____Points
Task 9B	Fire Mission		No Go = 0 Points/Time____=____Points
Task 9C	Fire Mission		No Go = 0 Points/Time____=____Points
Task 9D	Fire Mission		No Go = 0 Points/Time____=____Points
Task 9E	Fire Mission		No Go = 0 Points/Time____=____Points
Task 10A	Direct Fire		No Go = 0 Points/Time____=____Points
Task 10B	Direct Fire		No Go = 0 Points/Time____=____Points
Task 10C	Direct Fire		No Go = 0 Points/Time____=____Points
Task 10D	Direct Fire		No Go = 0 Points/Time____=____Points
Task 11	Lay the Howitzer for Quadrant with the Range Quadrant		No Go = 0 Points/Time____=____Points
Task 12	Measure the Quadrant with the Range Quadrant		No Go = 0 Points/Time____=____Points
Task 13	Initialize the AFCS		No Go = 0 Points, Go = 4 Points____ =____Points
Task 14	Prepare for Firing Using the AFCS		No Go = 0 Points/Time____=____Points
Task 15	Conduct a Fire Mission using the AFCS		No Go = 0 Points/Time____=____Points
Task 16	Perform Direct Fire using the AFCS		No Go = 0 Points/Time____=____Points
	Total Points		__________

Table H-3. Sample Grading Sheet

TASKS

TASK 1

H-10. Lay the howitzer for initial direction of fire using the aiming circle.

Conditions

H-11. Soldier is given a howitzer in the firing position with the cannon tube 50 mils off the AOF and at loading elevation (unit TSOP). Bubbles will be level, and special corrections at 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

H-12. Time will start on the last digit of deflection of the initial command. Time will stop when the assistant examiner states that number 1 is laid.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B soldier's training publication (STP) (soldier's manual).		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points

-29	4
30-34	3
35-39	2
40-50	1
51+	0

H-13. Score Example: 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

H-14. Lay the howitzer for initial direction of fire using the M2 compass.

Conditions

H-15. The soldier is 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

H-16. Time will start on the last digit of the deflection of the initial command. Time will stop when the assistant examiner announces that number 1 is laid.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		

Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-17	4
18-20	3
21-23	2
24-25	1
26+	0

TASK 3

H-17. Lay the howitzer for initial direction of fire using a DAP.

Conditions

H-18. Soldier is 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

H-19. Time will start on the last digit of the deflection of the initial command. Time will stop when the examiner states that number 1 is laid.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-17	4
18-20	3
21-23	2
24-25	1
26+	0

TASK 4

H-20. Lay another howitzer reciprocally.

Conditions

H-21. The soldier is 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

H-22. Time will start when the examiner says, "BEGIN". The time will stop when the gunner says, "NUMBER 2 IS LAID".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-12	4
13-15	3
16-18	2
19-20	1
21+	0

TASK 5

H-23. Refer the piece.

Conditions

H-24. The soldier is 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

H-25. Time will start on the word refer. Time will stop when the last digit of deflection is announced.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-12	4
13-15	3
16-18	2

19-20	1
21+	0

TASK 6

H-26. Align the collimator.

Conditions

H-27. The soldier is 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 at 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

H-28. Time will start when the examiner says "BEGIN". Time will stop when the gunner states that the collimator is set.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-17	4
18-20	3
21-23	2
24-25	1
26+	0

TASK 7

H-29. Check the boresight of the pantel with the M140 alignment device.

Conditions

H-30. The soldier will be given a howitzer in the firing position, with level bubbles and special corrections at 0. The cannon tube will be at 0 mils elevation, and the azimuth counter will be set at 1600. The soldier will be provided with an M140 alignment device. The soldier positions himself as gunner and announces when ready. The examiner will say "BEGIN".

Time

H-31. 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
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		

If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-17	4
18-20	3
21-23	2
24-25	1
26+	0

TASK 8

H-32. Boresight the howitzer (pantel) using a DAP.

Conditions

H-33. The soldier will be given a howitzer in the firing position. Bubbles will level and special corrections at 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. The soldier will be provided with the tools needed to adjust the sight. The soldier positions himself and announces when ready. The examiner will say "BEGIN".

Time

H-34. Time will start when the examiner says "BEGIN" and will stop when the gunner states that the howitzer is boresighted.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-45	4
46-60	3
61-89	2
90-120	1
121+	0

TASK 9A

H-35. Fire Mission. (Note: Tasks 9A through 9E involve one continuous fire mission).

Conditions

H-36. The soldier will be given a howitzer in the firing position. The howitzer is laid, DAP is identified, and the collimator is emplaced. The pantel is aligned on the collimator, bubbles are level, and special corrections at 0. The cannon tube is oriented on the primary direction of fire elevated to 315 mils. The soldier positions himself as gunner and announces when ready. The examiner commands, "FIRE MISSION, PLATOON ADJUST,NUMBER 1, 1 ROUND, SHELL HE, CHARGE(XX), FUZE QUICK,

DEFLECTION 3225, QUADRANT 315".

Time

H-37. Time will start on the last digit of quadrant and will stop when the gunner says "READY".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-8	4
9-10	3
11-12	2
13-14	1
15+	0

TASK 9B

H-38. Fire Mission. (Note: Tasks 9A through 9E involve one continuous fire mission).

Conditions

H-39. Continuation from 9A. Soldier announces when ready. The examiner commands, "SPECIAL CORRECTIONS, RIGHT 4, DEFLECTION 3194, QUADRANT 315".

Time

H-40. Time will start on the last digit of quadrant and will stop when the gunner says "READY".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-9	4
10-11	3
12-13	2
14-15	1

16+	0

TASK 9C

H-41. Fire Mission. (Note: Tasks 9A through 9E involve one continuous fire mission).

Conditions

H-42. Continuation from 9B. Soldier announces when ready. The examiner cancels special corrections, says that the collimater has fallen down, and directs the gunner to use the aiming posts. The examiner commands, "DEFLECTION 3180, QUADRANT 315".

Time

H-43. Time will start on the last digit of quadrant and will stop when the gunner says "READY".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-10	4

11-12	3
13-14	2
15-16	1
17+	0

TASK 9D

H-44. Fire Mission. (Note: Tasks 9A through 9E involve one continuous fire mission).

Conditions

H-45. Continuation from 9C. Soldier announces when ready. The examiner commands, "DEFLECTION 3230, QUADRANT 315".

Time

H-46. Time will start on the last digit of quadrant and will stop when the gunner says "READY".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-9	4
10-11	3
12-13	2
14-15	1
16+	0

TASK 9E

H-47. Fire Mission. (Note: Tasks 9A through 9E involve one continuous fire mission).

Conditions

H-48. Continuation from 9D. Soldier announces when ready. The examiner commands, "GAS (waits for the soldier to mask), DEFLECTION 3242, QUADRANT 315".

Time

H-49. Time will start on the last digit of quadrant and will stop when the gunner says "READY".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		

If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-9	4
10-11	3
12-13	2
14-15	1
16+	0

TASK 10A

H-50. Direct Fire. (Note: Tasks 10A through 10D involve one continuous fire mission). The central or reticle method of sighting may be used. Only the one man/one sight technique of direct fire will be used.

Conditions

H-51. The soldier is given a howitzer in the firing position. The howitzer is laid and the pantel is oriented on the collimator. Bubbles are level and special corrections at 0. The cannon tube is at 0 mils elevation. The soldier will be told which direct fire target he is to engage. The soldier positions himself as gunner and announces when ready. The examiner commands, "FIRE MISSION, TARGET THAT (XXX), (direction), SHELL HE, CHARGE (XX), FUZE QUICK, LEAD RIGHT 15 MILS, RANGE 600, FIRE AT WILL".

Time

H-52. Time will start when the examiner states "FIRE AT WILL" and will stop when the gunner says "FIRE".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-9	4
10-11	3
12-13	2
14-15	1
16+	0

TASK 10B

H-53. Direct Fire. (Note: Tasks 10A through 10D involve one continuous fire mission). The central or reticle method of sighting may be used. Only the one man/one sight technique of direct fire will be used.

Conditions

H-54. Continuation from 10A. Soldier announces when ready. The examiner commands, "RIGHT 5, ADD 100".

Time

H-55. Time will start when the examiner states "ADD 100" and will stop when the gunner says "FIRE".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-4	4
5-6	3
7-8	2
9-10	1
11+	0

TASK 10C

H-56. Direct Fire. (Note: Tasks 10A through 10D involve one continuous fire mission). The central or reticle method of sighting may be used. Only the one man/one sight technique of direct fire will be used.

Conditions

H-57. Continuation from 10B. Soldier announces when ready. The examiner commands, "LEFT 10, ADD 100".

Time

H-58. Time will start when the examiner states "ADD 100" and will stop when the gunner says "FIRE".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-4	4
5-6	3
7-8	2

9-10	1
11+	0

TASK 10D

H-59. Direct Fire. (Note: Tasks 10A through 10D involve one continuous fire mission). The central or reticle method of sighting may be used. Only the one man/one sight technique of direct fire will be used.

Conditions

H-60. Continuation from 10C. Soldier announces when ready. The examiner commands, "LEFT 15, DROP 100".

Time

H-61. Time will start when the examiner states "DROP 100" and will stop when the gunner says "FIRE".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-4	4
5-6	3
7-8	2
9-10	1
11+	0

TASK 11

H-62. Lay the howitzer for quadrant with the range quadrant.

Conditions

H-63. The soldier is given a howitzer in the firing position with the cannon tube at 0 mils elevation. Bubbles will be level and special corrections at 0. The soldier positions himself as the gunner and announces when ready. The examiner commands, "QUADRANT 215".

Time

H-64. Time will start when the examiner states "QUADRANT 215" and will stop when the gunner states "SET".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		

If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-8	4
9-10	3
11-12	2
13-14	1
15+	0

TASK 12

H-65. Measure the quadrant with a range quadrant.

Conditions

H-66. The soldier is given a howitzer in the firing position with the cannon tube at 245 mils. The range quadrant is at 0 mils and the cross level bubble is centered. The soldier positions himself as gunner and announces when ready. The examiner states, "BEGIN".

Time

H-67. Time will start when the examiner states "BEGIN" and will stop when the gunner states "QUADRANT 245".

Scoring

	Go	No Go

Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-8	4
9-10	3
11-12	2
13-14	1
15+	0

TASK 13

H-68. Initialize the AFCS.

Conditions

H-69. The soldier is given a howitzer parked within 1 meter of a SCP. The soldier will receive data for the SCP and initialization data. The soldier positions himself as COS and announces when ready. The examiner will state "BEGIN".

Standards

H-70. In order to receive a "go" the soldier must perform the initialization IAW TM 9-

2350-314-10.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

TASK 14

H-71. Prepare for firing using the AFCS.

Conditions

H-72. The soldier is given a howitzer, aligned along the AOF, and in travel lock. The "Emplace" screen is displayed on the AFCS. The soldier positions himself as COS and announces when ready. The examiner will state "BEGIN".

Time

H-73. Time will start when the examiner states "BEGIN" and stops when the soldier sends the updated piece status.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		

Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-1:30	4
1:31-1:40	3
1:41-1:50	2
1:51-2:00	1
2:01+	0

TASK 15

H-74. Conduct a fire mission using the AFCS.

Conditions

H-75. The soldier is given a howitzer at loading elevation. The soldier positions himself as COS and announces when ready. The examiner has a digital call for fire transmitted to the AFCS.

Time

H-76. Time will start when the when the fire mission is received at the AFCS and stops when the howitzer is laid on the target.

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-15	4
15.1-16.0	3
16.1-20.0	2
20.1-22.0	1
22.1+	0

TASK 16

H-77. Perform direct fire using the AFCS.

Conditions

H-78. The soldier is given a howitzer, aligned on the azimuth of fire and out of travel lock. The soldier is shown which target he is to engage and an assistant examiner will be provided to lay for deflection. The soldier positions himself as COS and announces when ready. The examiner will state "BEGIN".

Time

H-79. Time will start when the examiner says "BEGIN" and stops when the soldier states "SET".

Scoring

	Go	No Go
Standards of precision (Paragraph H-2) were met. (If applicable.)		
Correct steps were followed to complete the task in accordance with 13B STP.		
If steps above were not followed, soldier recieves a "no go" and 0 points. If soldier recieved a "go" on steps above, use the chart below to determine score.		

Time in seconds	Points
-20	4
20.1-22.0	3
22.1-23.0	2
23.1-30.0	1
30.1	0

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Appendix I

Paladin Howitzer Section Evaluation

This section evaluation is offered as a guide. Paladin units can modify it to fit specific training needs.

SECTION EVALUATION SCORE SHEET

Section/Battery ____________________
Date ____________________
Chief of Section ____________________
Score ____________________

Phase	Task Description	Maximum Allowable Points	Points Awarded
I	Written Test (30 questions at 2 points each, developed by the unit. Responsibility of the master gunner. See sample in Phase I)	(60)	______
II	Preparation for Firing Operations (Tactical Assembly Area Operations)	(225)	
	1. PMCS/PCI	80	______
	2. Disassemble Breech	25	______
	3. Assemble Breech	25	______
	4. Micrometer Test	25	______
	5. End for End Test	25	______
	6. Weapons	15	______
	7. AFCS Initialization	30	______
	Total Points Awarded for Phase II		______
III	Occupation	(456)	
	8. Tactical Move	20	______
	9. Emergency Mission	51	______
	10. Deliberate Occupation	100	______
	11. Fire Missions	200	______
	12. Misfire Procedures	30	______

	11. Fire Missions	200	_______
	12. Misfire Procedures	30	_______
	13. Survivability Move	55	_______
	Total Points Awarded for Phase III		_______

Continued

SECTION EVALUATION SCORE SHEET (CONTINUED)

Phase	Task Description	Maximum Allowable Points	Points
IV	Degraded Operations	(230)	_______
	14. Occupation	80	_______
	15. Use of Conveyor	10	_______
	16. Fire Missions	100	_______
	17. Direct Fire	40	_______
	Total Points Awarded for Phase IV		_______
V	NBC Operations	(55)	_______
	18. Assume MOPP4	10	_______
	19. Occupation	20	_______
	20. Fire Mission	15	_______
	21. M256 Kit	10	
	Total Points Awarded for Phase V		_______
VI	Night Operations	(130)	
	22. Occupation	30	_______
	23. Night Operations	100	_______
	Maximum Point Total	(1156)	
	Section Total		_______

PHASE I: SAMPLE WRITTEN TEST

I-1. The test consists of 30 multiple choice and true/false questions worth 2 points each for a maximum score of 60 points.

1. WHAT IS THE NUMBER 1 MAN'S FIRST ACTION WHEN CHECKFIRE IS CALLED, AND A ROUND IS IN THE TUBE?

A. ATTEMPT TO FIRE TWO ADDITIONAL TIMES
B. CEASE ALL ACTIONS AND ANNOUNCE CHECKFIRE
C. CALL HIMSELF OUT OF THE MISSION

D. ALL OF THE ABOVE

2. DURING FIRE MISSIONS, PRIOR TO FIRING, WHAT MUST BE DONE WITH UNUSED POWDER INCREMENTS?

A. THEY MUST BE STORED IN THE POWDER PIT
B. THEY ARE STORED IN THE PROPELLANT CANISTER WITH THE LID SECURED
C. INCREMENTS ARE HANDED OUT THE SIDE WINDOW AND STORED IN THE AMMUNITION VEHICLE
D. ALL OF THE ABOVE

3. THE COS KNOWS HIS NAVIGATION SUBSYSTEM IS BEING PLGR AIDED WHEN__________________.

A. THE "A" IS DISPLAYED IN FIELD # 7 ON THE DISPLAY
B. THE "A" IS NOT DISPLAYED IN FIELD # 7 ON THE DISPLAY
C. FIELD # 7 DISPLAYS "CMD"
D. NONE OF THE ABOVE

4. THE LEAD FILTER INTAKE SYSTEM MUST BE USED____________.

A. WHILE FIRING SMOKE ROUNDS
B. WHEN FIRING THE M203 CHARGE
C. NOT NECESSARY TO USE AT TEMPERATURES LESS THAN 60 DEGREES
D. DURING ALL FIRING

5. DURING A "FIRE WHEN READY" FIRE MISSION, THE ONLY WHITE SOFT KEY LABELS THAT WILL BE AVAILABLE ARE__________,___________AND___________.

A. READY, INVENTORY, AND ABORT
B. SHOT, CLEAR, AND EOM
C. SHOT, CHECK, AND ABORT
D. NONE OF THE ABOVE

6. _______________MUST BE ENTERED INTO THE AFCS AS THE LOADING ELEVATION.

A. MAX QE ON THE SAFETY-T
B. MIN QE ON THE SAFETY-T
C. 299 MILS
D. NONE OF THE ABOVE

7. THE "MAX ELEVATION MENU" HAS THREE AVAILABLE ENTRY OPTIONS. WHICH

OPTION IS USED TO INPUT THE MAX QE FROM THE SAFETY-T?

A. USE TUBE POSITION
B. TYPE NEW VALUE
C. MAX QE ENTRY
D. USE DEFAULT VALUE (1333)

8. THE TOLERANCE FOR DIRECTION VERIFICATION WITH THE M2 COMPASS IS__________MILS.

A. 50 MILS
B. 10 MILS
C. 100 MILS
D. 20 MILS

9. WHEN SHOULD THE PROPELLANT TEMPERATURE BE UPDATED INTO THE AFCS?

A. AT LEAST EVERY 2 HOURS
B. ONLY DURING INITIALIZATION
C. EVERY 20 MINUTES
D. ONLY WHEN DIRECTED BY POC

10. WHEN CONDUCTING DIRECTION VERIFICATION WITH THE M2 COMPASS, THE MEASURED AZIMUTH SHOULD BE COMPARED TO___________ON THE DISPLAY.

A. THE "AOF"
B. THE "GUN TARGET LINE"
C. THE "HEADING" ON THE DISPLAY
D. NONE OF THE ABOVE

11. THE M577A1 FUZE MAY BE USED ON THE M107 HE PROJECTILE, SET AT PD ACTION.

A. TRUE B. FALSE

12. IAW FM 3-09.70, A VERIFICATION MISSION MUST BE CONDUCTED WHEN___________.

A. AFTER INITIALIZATION
B. DURING LIVE FIRE
C. WHEN THERE IS A SIGNIFICANT CHANGE IN THE DATABASE
D. BOTH A. AND C.
E. NONE OF THE ABOVE

13. DURING A HIPSHOOT THE COS MUST VERIFY HIS IMMEDIATE CREST BY PRESSING THE________KEY ON THE DISPLAY.

A. "ARRIVE" KEY
B. "ACK" KEY
C. "LOAD" KEY
D. "LAY" KEY

14. DURING AFCS FIRE MISSIONS, PRIOR TO ANNOUNCING THE COMMAND TO FIRE, THE COS MUST VERIFY THAT THE ACTUAL AND COMMANDED DF AND QE ARE WITHIN TOLERANCE, THE LAY KEY IS BACKLIT, AND_________________.

A. THE TRAVEL LOCK IS UP
B. THE GUN-DRIVE SERVO LIGHT IS LIT
C. THE PROMPT "WARNING TUBE IS NOT IN LAY POSITION" IS NOT DISPLAYED
D. ALL OF THE ABOVE

15. YOU ARE THE NUMBER 1 MAN FOR 3RD SECTION FIRING A TWO ROUND WHEN READY FIRE MISSION. ON THE SECOND ROUND BEING FIRED, THE PRIMER DID NOT FIRE. YOU HAVE ANNOUNCED MISFIRE TO THE COS. HOW LONG DOES THE SECTION HAVE TO FIRE THE ROUND AFTER THE ROUND WAS CHAMBERED? (THE TUBE IS WARM.)

16. THE ALERT "OK TO SHOOT OR MOVE" INDICATES NAVIGATION ALIGNMENT HAS REACHED_________________.

A. 0 MILS ACCURACY
B. A FULL 15 MINUTE ALIGNMENT
C. 1 MIL ACCURACY
D. 10 METER ACCURACY

17. IN FIELD # 2, "MISSION STATUS" WHICH OF THE FOLLOWING MAY APPEAR?

A. ALN______S
B. MOVE ORDER
C. FIRE MISSION
D. ALL OF THE ABOVE

18. THE MAXIMUM ALLOWABLE RADIUS IN A FIRING AREA IS 250 METERS.

A. TRUE B. FALSE

19. THERE ARE ________ OPERATIONAL MODES FOR THE AFCS "AUTOMATIC FIRE CONTROL SYSTEM.

A. NORMAL
B. 2
C. 3
D. 1

20. THE GPS/PLGR BATTERY MUST BE REMOVED PRIOR TO______________.

A. CONDUCTING FIRE MISSIONS
B. CONNECTING TO VEHICLE POWER
C. LAYING THE GUN
D. PERFORMING A ZUPT

21. THE DOTTED LINE ON THE "EMPLACE FIRE AREA/POINT" SCREEN REPRESENTS_____________.

A. CURRENT HEADING
B. FAULTY PIXELS ON THE DISPLAY
C. DESIRED HEADING
D. GUN-TARGET LINE FOR FPF/PRI

22. ANYONE THAT SEES AN UNSAFE ACT SHOULD CALL CHECK-FIRE.

A. TRUE B. FALSE

23. WHAT DATA MUST BE ENTERED INTO THE AFCS "DIRECT FIRE SCREEN", FOR CONDUCTING DIRECT FIRE.

A. DEFLECTION/QUADRANT
B. RANGE/QUADRANT
C. ELEVATION/RANGE
D. RANGE/ UP/DOWN

24. WHEN THE COS PRESSES THE LOAD KEY ON THE DISPLAY, THE HOWITZER TUBE WILL_______________________.

A. AUTOMATICALLY MOVE TO THE AOF (BASE DEFLECTION) AND THE PREDETERMINED ELEVATION.
B. MOVE TO THE LOAD ELEVATION ONLY.
C. MOVE TO THE PREDETERMINED LOAD ELEVATION, THE AOF (BASE DEFLECTION),

AND/OR THE COMMANDED DEFLECTION
D. NONE OF THE ABOVE

25. THE CHIEF OF SECTION'S FIRST ACTION WHEN HIS HOWITZER BECOMES DEGRADED IS TO_______________.

A. CALL HIMSELF OUT
B. GO TO AN SCP POINT
C. NOTIFY POC
D. DISREGUARD AND CONTINUE

26. A BCS DATA XFER, "PIECE STATUS" MUST BE SENT TO THE POC ON ALL OCCUPATIONS.

A. TRUE B. FALSE

27. WHICH OF THE BELOW LISTED ARE THE PREFIRE CHECKS THAT MUST BE DONE PRIOR TO FIRING.

A. LOW VOLTAGE, RAMMER, TUBE, BREECH ASSEMBLY, RECUPERATOR, AND REPLINISHER.
B. LOW VOLTAGE, TUBE, BREECH, AND RECUPERATOR.
C. LOW VOLTAGE, RAMMER, TUBE, BREECH ASSEMBLY, RECUPERATOR, REPLINISHER, AND THE DA FORM 4513.
D. NONE OF THE ABOVE

28. THE FOLLOWING FUZES ARE FIRED WITH THE M107 DEEP CAVITY HE PROJECTILE.

A. M557, M739, M564, M582, M577, M732
B. M557, M379, M564, M582, M565, M728
C. M557, M739, M565, M577, M728, M732
D. M557, M739, M564, M582, M728, M732

29. YOUR PLATOON SERGEANT HAS DIRECTED YOU TO CONDUCT HOWITZER CONFIDENCE TEST FOR DIRECTION VERIFICATION WITH SURVEY CONTROL AND AN AZIMUTH TO A KNOWN POINT. WHAT IS THE TOLERANCE FOR THIS TEST IN MILS?

A. 0 MILS
B. 2 MILS
C. 1 MIL
D. 5 MILS

30. EXPLAIN THE PROPER WAY TO MATE AND TIGHTEN A FUZE TO A PROJECTILE.

PHASE II: PREPARATION FOR FIRING OPERATIONS

TASK 1: PREPARATION FOR DELIBERATE OCCUPATION OF FIRING POSITION

Conditions

I-2. The section is in the tactical assembly area (TAA). The evaluator will read the following: Your section is preparing to leave the TAA for a deliberate occupation. The advance party will depart in 15 minutes. Your platoon sergeant has informed you that the main body will depart in 45 minutes and that your section should make all necessary preparations for movement to include before operations checks and services on the howitzer and FAASV.

Standards

I-3. Perform before operations checks and services on howitzer and FAASV. Load and stow equipment, and check personnel and equipment as outlined in TM or according to unit SOP as applicable. NOTE: 1SG will check blocks 1 and 2 during the section competition.

Evaluation

Evaluation Check List	Go	No Go
1. Did the section have all section equipment installed or stowed IAW applicable manuals and unit load plans, and did section members have all required individual clothing and equipment?		
2. Were all necessary items on hand for performing PMCS on the howitzer and the FAASV (i.e., BII, operator's manuals, lubrication order, DA Form 5988-E *Equipment Inspection and Maintenance Worksheet*, log books, and cleaning materials?		
3. Were the headings of the DA Form 5988-Es properly completed for the conduct of before PMCS?		
4. Did the COS use all members present to conduct the inspection?		
5. Did the section inspect each item in the before column of the PMCS table in the operator's manual?		
6. Did the section members perform PMCS in an orderly manner with a minimum of supervision?		
7. Did the section use the DA Form 5988-E to list all faults that were not already listed under uncorrected faults that they could not correct?		
8. Was the section ready to depart the TAA within the time briefed by the PLT SGT?		

Scoring

I-4. 25 points each will be awarded for a "go" rating in blocks 1 and 2. 5 points each will be awarded for a "go" in blocks 3 through 8. For each "no go" rating, 0 points will be awarded.

TASK 2: DISASSEMBLY OF BREECH MECHANISM

Conditions

I-5. After giving the howitzer section approximately 45 minutes to complete Task 1, the evaluator reads the following situation to the COS:

I-6. During the conduct of the before operation checks and services on your cannon, you noted a malfunction in the breech mechanism. To troubleshoot the exact cause, you decide that you must disassemble the breech mechanism. You may select any member(s) of your section to perform this task. However, you may not physically perform any action. You have 1 minute to select the section member(s) to perform this task and 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:

Standards

I-7. Disassemble breech, firing mechanism and obturator group as outlined in TM without error. Perform all actions in a safe manner without damage to equipment or injury to personnel. "ARE YOU READY?…GO".

Evaluation

Evaluation Check List	Go	No Go
1. Was the breechblock, obturator group, and firing mechanism disassembled IAW the appropriate operator's manual?		
2. Was the operation performed in the prescribed safe manner?		

Scoring

I-8. If a "go" rating is awarded, the disassembly will be graded according to speed of execution as outlined in the table below. If a "no go" rating is awarded, 0 points will be awarded for the entire task.

Time In Minutes	Points
0-3:45	25
3:46-4:05	15
4:06-4:20	10
4:21-8:00	5
8:01 or above	0

TASK 3: ASSEMBLY OF BREECH MECHANISM

Conditions

I-9. After evaluating Task 2, the evaluator reads the following to the COS and the section members previously selected for disassembly of the breech:

Standards

I-10. Reassemble breech, firing mechanism and obturator group as outlined in TM without error. Perform all actions in a safe manner without damage to equipment or injury to personnel. "ARE YOU READY?…GO".

Evaluation Check List	Go	No Go
1. Was the breech mechanism properly assembled IAW the appropriate operator's manual?		
2. Was the operation performed in the prescribed safe manner?		

Scoring

I-11. If a "go" rating is awarded, the assembly will be graded according to speed of execution as outlined in the table below. If a "no go" rating is awarded, 0 points will be awarded for the entire task.

Time In Minutes	Points
0-4:15	25
4:16-4:35	15
4:36-4:50	10
4:51-12:00	5
12:01 or above	0

TASK 4: PERFORMANCE OF MICROMETER TEST ON THE GUNNER'S QUADRANT

Conditions

I-12. After evaluating Task 3, the evaluator reads the following to the howitzer COS:

I-13. 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.

Standards

I-14. Perform micrometer test on the gunner's quadrant as outlined in the TM without error. "ARE YOU READY?…GO".

Evaluation Check List	Go	No Go
1. Did the soldiers follow the correct procedures in performing the micrometer test?		
2. Was the soldier able to determine if the micrometer knob was or was not in error and the action to be taken if it was in error?		

Scoring

I-15. If all "go" ratings are awarded, the score will be determined by the speed of execution as outlined in the table below. If a "no go" rating is awarded, 0 points will be awarded for the entire task.

Time In Seconds	Points
0-30	25
31-40	15
41-50	10
51-60	5
61 or above	0

TASK 5: PERFORMANCE OF THE END-FOR-END TEST

Conditions

I-16. After evaluating Task 4, the evaluator reads the following to the COS:

I-17. 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

Standards

I-18. Perform end-for-end test on the gunner's quadrant as outlined in the TM without error. "ARE YOU READY?…GO".

Evaluation

Evaluation Check List	Go	No Go
1. Did the soldier follow the correct procedures in performing the end-for-end test?		
2. Was the correct quadrant error announced?		
3. Was the quadrant declared unserviceable if the error exceeded + or - 0.4 mil, or declared serviceable if the error was 0.4 mil or less?		

Scoring

I-19. If all "go" ratings were awarded, the score for the task will be determined by the speed of execution as outlined in the table below. If a "no go" is awarded, 0 points will be awarded for the entire task.

Time In Minutes	Points
0:00-1:00	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 above	0

TASK 6: CREW SERVED AND INDIVIDUAL WEAPONS

Conditions

I-20. Prior to departing the TAA, the platoon leader informs the chiefs to check all crew and individual weapons for proper functioning.

Standards

I-21. Perform functions check of individual and crew served weapons without error IAW applicable TMs. Perform head space and timing check on M2 machine guns without error IAW applicable TM.

Evaluation

Evaluation Check List	Go	No Go
1. Was the head space properly set on both M2 machine guns?		
2. Was the timing properly set on both M2 machine guns?		
3. Did the section members properly conduct a functions check on the individual weapons, M2 machine guns, and MK-19?		

Scoring

I-22. For each "go" rating, 5 points will be awarded, for a maximum 15 points. For each "no go" rating, 0 points will be awarded.

TASK 7: AFCS INITIALIZATION

Conditions

I-23. Given a fully operational M109A6 howitzer, a SCP location, and an operational POC under field conditions, the section will conduct AFCS initialization.

Standards

I-24. Initialize the AFCS in order without error. Chief of section, gunner, or ATC must initialize the AFCS. AFCS must be checked by a second person who is safety certified.

Evaluation

Evaluation Check List	Go	No Go
1. Enter NET ACCESS DATA and NET ADDRESS DATA IAW battery SOP. This information will be standard within the battery and should not change.		
2. Enter SET DATE/TIME; time will be requested from the POC. POC will give "mark".		
3. Request initialization in BCS DATA TRANSFER.		
4. Enter MAP/DATUM.		
5. Execute NAV UPDATE. Two individuals must verify data before USE ALL key is used. Sections will record easting, northing, and altitude.		
6. Select AMMO INVENTORY, EDIT CURRENT AFCS if you are going to input ammunition on hand. Select EDIT BCS PROVIDED if you are going to use ammunition inventory which POC has sent to AFCS. If ammunition is not present at the time of initialization select FINISHED. When inputting ammunition, physically look at the square weights. When inputting lot, use the battalion standard lot outlined in the TSOP.		
7. Enter PROP TEMP using powder temperature gauge which has been placed in a propellant charge for 10 minutes. If propellant has not been received use tube temperature in SETUP AND INFORMATION screen. ALERT TIME will be set at 1 hour. When one of the following exists, powder temperature will be updated:		
a. Initial occupation and before PIECE STATUS is sent to the POC.	___	___
b. Whenever PROP TEMP ALERT displays.	___	___
c. As directed by the POC.	___	___
d. If type propellant is changed, section will put powder temperature gauge in the propellant which is to be shot. Wait 5 minutes before updating and then send PIECE STATUS to POC.	___	___
e. If powder temperature changes when updating powder temperature, PIECE STATUS will be sent to POC.	___	___
8. Enter MVV ROUNDS (1-9).		
9. Enter 2 minutes for TOT RESPONSE		
10. Enter 300 mils for LOAD ELEVATION. (This is only until safety "T" is received.)		

Evaluation Task 7: AFCS Initialization (Continued)

11. Enter SECTOR OF FIRE, left limit sector of fire, center sector of fire, and right limit sector of fire. This information will be given to the POC.		
12. Select CANCEL to display SECTION IN ORDER screen.		

Scoring

I-25. If all "go" ratings were awarded, the score for the task is 30 points. For a "no go" rating, 0 points will be awarded for this entire task.

PHASE III: OCCUPATION

TASK 8: CONDUCT A TACTICAL MOVE TO A FIRING POSITION

Conditions

I-26. The section is conducting combat operations and receives an order that requires displacement.

Standards

I-27. Section must be in position at the prescribed time in order to conduct fire mission.

Evaluation

Evaluation Check List	Go	No Go
1. Receive movement brief from platoon leadership.		
2. Receive movement order from POC. (Manual movement order and sectors of fire may be given.)		
3. Verify move order and sectors of fire with POC on the voice net.		
4. Record and plot destination map and brief section.		
5. Maintain communications with higher (POC/platoon leadership).		
6. Ensure all equipment and ammunition are loaded and secured IAW load plans.		
7. Conduct move IAW movement brief.		
8. If NAV UPDATE is conducted while enroute, SCP data will be recorded. COS tells driver to record and track mileage after NAV UPDATE.		
9. Defend against ground attack while moving.		
10. Defend against air attack while moving.		

Scoring

I-28. For each "go" rating, 2 points will be awarded, for a maximum of 20 points. For each "no go" rating, 0 points will be awarded.

TASK 9: EMERGENCY MISSION

Conditions

I-29. During movement to another PA, you receive a call for fire (fire mission). Your section must conduct an emergency fire mission. (You have departed your original PA.)

Standards

I-30. Section fires the mission IAW ARTEP 6-037-30-MTP.

Evaluation

Evaluation Check List	Go	No Go
1. COS receives mission, finds suitable location, stops, verifies location, and emplaces howitzer on the azimuth which is displayed on the AFCS screen.		
2. Gunner verifies direction using M2 compass (IAW TSOP).		
3. COS presses the ARRIVED key on AFCS.		
4. COS directs driver to release travel lock.		
5. Driver will raise the RPMs of the howitzer to 1,000 to 1,200 RPM and will record the fire mission on DA Form 4513-R.		
6. COS will activate servos and push LOAD key.		
7. COS and gunner will verify immediate crest along commanded deflection.		
8. COS responds and issues the fire commands.		
9. Number 1 man prepares ammunition by lot and shell/fuze combination. (Sets time if time fuze is used.)		
10. Gunner prepares announced propellant for fire mission.		
11. COS checks fuze for tightness and if time fuze is used checks time setting.		
12. Number 1 man will ram projectile (pushes manual control lever forward, holding lever for 4 seconds to allow full extension of rammer cylinder rod and proper seating).		
13. COS will verify charge before gunner loads in tube. Gunner will place charge in tube (red igniter pad facing the rear) and announce "CHARGE, I SEE RED." Gunner will then announce "CLOSING" and lift the breech operating handle causing the breech to close. Gunner will then ensure witness marks align and announce "WITNESS MARKS ALIGNED".		
14. COS will press LAY key and announce "LAY LIGHT IS LIT, ACTUAL AND COMMAND DEFLECTION AND QUADRANT ARE WITHIN TOLERANCE (+/- 0.9 mils), AND NO WARNING MESSAGE IS PRESENT". Gunner will check all three things and announce VERIFIED. (If it is a high angle fire mission, the		

0.9 mils), AND NO WARNING MESSAGE IS PRESENT". Gunner will check all three things and announce VERIFIED. (If it is a high angle fire mission, the command to PRIME will be given before pressing the LAY key.) Gunner will announce "CHECK FIRING" if a violation of the above step occurs or data does not match.		
15. COS will command "PRIME". Number 1 man will prime.		
16. COS will command "HOOK UP". Number 1 man will hook up.		

Evaluation Task 9: Emergency Mission (Continued)

17. COS will command "FIRE" and Number 1 man will fire (if it is AMC, COS waits until the command is given to fire over the AFCS).		

Scoring

I-31. For each "go" rating, 3 points will be awarded, for a maximum of 51 points. For each "no go" rating, 0 points will be awarded.

TASK 10: DELIBERATE OCCUPATION

Conditions

I-32. The section is occupying a new firing position that has been reconnoitered and set up by the GSG.

Standards

I-33. Establish firing capability without error IAW ARTEP 6-037-30-MTP.

Evaluation

Evaluation Check List	Go	No Go
1. COS may have to do NAV UPDATE at entrance point as per platoon leader instruction. SCP data will be recorded on DA Form 4446 (not part of 2 minute occupation time). COS tells driver to record and track mileage after NAV UPDATE.		
2. Platoon occupies position area, wingmen insure intervisibility with center howitzer (IAW TSOP).		
3. COS directs driver to orient howitzer on center sector (+/-50 mils) (2 minute time starts when first howitzer stops) and emplace spades if needed.		
4. Howitzer may need to wait 30 seconds before doing step 5 (if NAV UPDATE has not been conducted within the last 5 miles wait the 30 seconds).		
5. COS presses the ARRIVED key on AFCS.		
6. COS directs driver to release travel lock.		
7. COS elevates tube to MAX TUBE ELEVATION and selects USE TUBE POSITION.		
8. COS and gunner conduct SITE DATA.		
9. COS updates POWDER TEMP in AFCS.		
10. COS sends PIECE STATUS to POC.		
11. Number 1 man prepares HE/PD in ready rack while steps 4 through 9 are being conducted.		
12. COS directs crew to perform prefire checks.		
13. Gunner verifies boresight with the M140.		
14. COS directs section to do position improvement.		
15. Establish an aiming point. (DAP during day time operations if one can be used. Collimator at night or during the day if no DAP is available).		
16. Construct range cards and establish survivability movement plan as directed by PLT SGT.		
17. Conduct verification mission with POC (read back CHARGE, TI if time is set, DF, and QE). (Only if there is a significant database change.)		
18. COS will receive, record, and read back to POC safety T information. COS will input MAX QE off the safety T in MAX TUBE ELEVATION, TYPE NEW VALUE.		

Evaluation Task 10: Deliberate Occupation (Continued)

20. COS will input MIN QE as announced by POC and record charge to be fired as required.		

Scoring

I-34. For each "go" rating, 5 points will be awarded, for a maximum of 100 points. For each "no go" rating, 0 points will be awarded.

TASK 11: FIRE MISSIONS

Conditions

I-35. You have completed the occupation of a new firing position and reported to the POC that you are RTF. You will conduct indirect fire missions as sent from the POC.

Standards

I-36. The howitzer section is ready to fire within 30 seconds (45 seconds for high angle, 1 minute for Copperhead inspection of the round) after receipt and acknowledgement of the fire mission.

Evaluation

Evaluation Check List-Four Missions: High Angle Fire For Effect (FFE), Low Angle FFE, Priority Target, and Low Angle Adjust	Go	No Go
1. COS operates the AFCS and processes the fire mission.		
2. COS responds and issues the fire commands.		
3. Driver will raise the RPMs of the howitzer to 1,000 to 1,200 RPM and will record the fire mission on DA Form 4513-R.		
4. COS will activate servos and push LOAD KEY.		
5. Number 1 man prepares ammunition by lot and shell/fuze combination (sets time if time fuze is used).		
6. Gunner prepares announced propellant.		
7. COS checks fuze for tightness and if time fuze is used checks time setting.		
8. Number 1 man will ram projectile (pushes manual control lever forward, holding lever for 4 seconds to allow full extension of rammer cylinder rod and proper seating).		
9. COS will verify charge before gunner loads in tube. Gunner will place charge in tube red igniter pad facing the rear and announce "CHARGE, I SEE RED". Gunner will then announce "CLOSING" and lift the breech operating handle causing the breech to close. Gunner will ensure witness marks align and announce "WITNESS MARKS ALIGNED".		
10. COS will press LAY key and announce "LAY LIGHT IS LIT, ACTUAL AND COMMAND DEFLECTION AND QUADRANT ARE WITHIN TOLERANCE (+/-0.9 mils) AND NO WARNING MESSAGE IS PRESENT". Gunner will check all three things and announce VERIFIED. (If it is a high angle fire mission, the command to PRIME will be given before pressing the LAY key.) Gunner will announce "CHECK FIRING" if a violation of the above steps occurs or if data does not match.		
11. COS will command "PRIME". Number 1 man will prime.		
12. COS will command "HOOK UP". Number 1 man will hook up.		
13. COS will command "FIRE" and Number 1 man will fire. (If it is AMC, COS waits until the command is given to fire over the AFCS.		

Scoring

I-37. If all steps are graded as a "go", the section will receive 50 points for each mission (High Angle FFE, Low Angle FFE, Priority Target, and Low Angle Adjust). For a "no go" rating, 0 points will be awarded for the mission. Note: If any unsafe data is fired, the section will receive 0 points for the entire mission.

TASK 12: MISFIRE PROCEDURES

Conditions

I-38. During firing, your section experienced a misfire. You have only fired 2 rounds prior to the misfire so you have a cold tube.

Standards

I-39. Perform misfire procedures IAW the TM without error, observing all warnings listed for cold tube weapon.

Evaluation

Evaluation Check List	Go	No Go
1. Did the number 1 cannoneer announce misfire?		
2. Did the number 1 man wait 2 minutes prior to removing the primer?		
3. Was the primer replaced if needed?		
4. Was the firing mechanism repaired or replaced as needed?		
5. Was the weapon fired after corrective action was taken?		
6. Were all warnings listed in the TM followed?		

Scoring

I-40. For each "go" rating, 5 points will be awarded, for a maximum of 30 points. For each "no go" rating, 0 points will be awarded.

TASK 13: SURVIVABILITY MOVE

Conditions

I-41. The section is conducting tactical operations. One, a pair, or a platoon of howitzers is required to displace IAW the TSOP or tactical guidance to provide fires in support of maneuver forces and increase survivability.

Standards

I-42. Sections will load all section equipment, maintain communications with the control element, and move to another firing position within the PA.

Evaluation

Evaluation Check List	Go	No Go
1. When it has been determined to move, section will ensure all equipment and ammunition are loaded and secured.		
2. Senior COS will tell wingmen where they are moving.		
3. COS directs driver to put up travel lock, COS stores tube in travel lock, and driver locks travel lock. Stows spades if emplaced.		
4. Sections move to new position.		
5. COS pushes ARRIVED key.		
6. COS and gunner will do SITE DATA.		
7. COS will direct section to perform prefire checks.		
8. COS will update POWDER TEMP if needed.		
9. COS will send PIECE STATUS to POC.		
10. COS directs section to establish an aiming reference point.		
11. Number 1 man prepares HE/PD in ready rack while steps 5 through 10 are being conducted.		

Scoring

I-43. For each "go" rating, 5 points will be awarded, for a maximum of 55 points. For each "no go" rating, 0 points will be awarded.

PHASE IV: DEGRADED OPERATIONS

I-44. Note for evaluator to read to the COS: During movement to your next position your AFCS has gone out. You will have to occupy using degraded operations. Do not shut down your AFCS.

TASK 14: OCCUPATION

Conditions

I-45. During your movement to this location your AFCS has gone out (don't shut the AFCS down). You will have to occupy and fire missions in a degraded operations mode.

Standards

I-46. The section establishes a firing capability and prepares to accept fire missions and deliver fires.

Evaluation

Evaluation Check List	Go	No Go
1. The howitzer has lost electrical power.		
a. Notify the POC.	___	___
b. Limited electrical power from the M992A1 APU provides enough power for AFCS operation only (if FAASV is not available, you must use step e through j).	___	___
c. Manually elevate and traverse the tube.	___	___
d. Manually ram projectile.	___	___
e. Use reciprocal lay, aiming circle, or compass laying technique.	___	___
f. Use spades.	___	___
g. Use DAP or collimator.	___	___
h. Manually elevate and traverse the tube.	___	___
i. Receive firing data from adjacent howitzer by wire.	___	___
j. Operate travel lock.	___	___
	___	___
2. Receive firing data from the POC over a voice net.		
a. Notify the POC.	___	___
b. Use spades.	___	___
c. Receive firing data from the POC over a voice net.	___	___
d. Lay the howitzer with the gunner's control handle.	___	___
e. Use DAP or collimator.	___	___
f. If moving, navigate manually to destination, use another howitzer to provide location and for reciprocal lay.	___	___

Evaluation Task 14: Occupation (Continued)

3. The howitzer has no digital communication.		
a. Notify the POC.	___	___
b. Collocate within 30-50 meters of operational gun and use operational gun's data or determine firing data in the POC (this method is slower than collocation with an operational gun, but more accurate).	___	___
c. Use a voice net for fire direction. COS can move W18 cable from digital radio to voice radio and change frequency and frequency hopping in radio.	___	___
d. Manually input data into the AFCS.	___	___
e. Report rounds complete.	___	___
4. The navigation system is inoperative.		
a. Notify the POC.	___	___
b. The POC provides firing data to the howitzer.	___	___
c. The POC can send another howitzer to get a more accurate position or use hasty survey techniques.	___	___
d. Use a DAP or collimator.	___	___
5. The howitzer has lost hydraulic power.		
a. Notify the POC.	___	___
b. Load, traverse, and elevate manually according to the procedures in the current -10 series TM.	___	___
6. The gun drive servos are inoperative.		
a. Notify the POC.	___	___
b. Lay with the chief of section hydraulic control handle.	___	___
c. Lay manually using the gunner's elevating hand wheel.	___	___
7. The howitzer has lost voice radio communications.		
a. Notify the POC.	___	___
b. Use wire to an adjacent howitzer.	___	___
c. Use the FAASV's radio.	___	___
d. Use digital net as a voice and digital net.	___	___
8. The transmission, final drive, or engine is inoperative.		
a. Notify the POC.	___	___
b. Tow the howitzer to a subsequent position using the FAASV and use the APU to power AFCS.	___	___
c. Continue firing until repaired or replaced.	___	___

Scoring

I-47. If all "go" ratings are received in a subtask, the section will be awarded 10 points each for a maximum of 80 points. For any "no go" rating in the subtask area, 0 points will be awarded for that subtask. Note: If any unsafe conditions exist (i.e., howitzer not laid properly or collimator improperly set) the section will receive 0 points for this task.

TASK 15: USE OF CONVEYOR

Conditions

I-48. Due to the howitzer degraded mode, the COS has decided to use mated operations. The FAASV will be backed up to the howitzer and the conveyor is to be put into operation.

Standards

I-49. Extend and operate conveyor IAW TM without error.

Evaluation

Evaluation Check List	Go	No Go
1. Was the conveyor properly extended and put into operation?		

Scoring

I-50. For a "go" rating, 10 points will be awarded. For a "no go" rating, 0 points will be awarded.

TASK 16: FIRE MISSIONS IN DEGRADED MODE

Conditions

I-51. Your howitzer AFCS has gone out and you are required to fire missions in the degraded operations mode. Your howitzer is conducting combat operations and has established a firing capability without the aid of the Paladin's automation.

Standards

I-52. The howitzer is ready to fire within 45 seconds (60 seconds for high angle, 1 minute for Copperhead) after the receipt of quadrant.

Evaluation

Evaluation Check List	Go	No Go
1. The POC issues safety "T" to COS which he records on his safety "T" (if applicable).		
2. The POC issues the fire commands.		
3. Howitzer section responds to the POC's fire commands.		
4. The COS announces the fire commands.		
5. Driver will raise the RPMs of the howitzer to 1,000 to 1,200 RPM and will record the fire mission on DA Form 4513-R.		
6. The COS ensures section personnel follow commands. a. "DO NOT LOAD"-Take all necessary actions to prepare for firing without loading; report "NUMBER __-IS LAID" when complete. b. "AT MY COMMAND"- Take all necessary action to prepare for firing, report "NUMBER __ IS READY" when complete. c. "AZIMUTH"-Traverse weapon immediately to required deflection. d. "SPECIAL CORRECTIONS"-Record and apply special corrections for DF, QE, and FZ setting. Upon end of mission return to standard corrections. e. "(LEFT) (CENTER) (RIGHT) SECTOR"- Apply sector corrections. Upon end of mission return to standard corrections. f. "CANCEL TERRAIN CORRECTIONS" -Set gunner's aid counters to 0. Upon end of mission return to standard corrections.	___ ___ ___ ___ ___ ___	___ ___ ___ ___ ___ ___
7. Number 1 man prepares ammunition by lot and shell/fuze combination (Set time if time fuze is used).		
8. COS checks fuze for tightness and if time fuze is used checks time setting.		
9. Number 1 man will ram projectile (pushes manual control lever forward, holding lever for 4 seconds to allow full extension of rammer cylinder rod and proper seating).		
10. Number 1 man prepares propellant which was announced.		
11. COS checks the proper propellant before number 1 man places it in the tube.		

Evaluation Task 16: Fire Missions in Degraded Mode (continued)

12. Number 1 man will load charge in tube with red igniter pad facing the rear of the tube announcing, "CHARGE _, I SEE RED". Number 1 man will then announce "CLOSING" and lift the breech operating handle causing the breech to close. Number 1 man will ensure witness marks align and announce "WITNESS MARKS ALIGN".		
13. At the same time the gunner set announced DF on the pantel and set the QE on the elevation quadrant.		
14. The gunner traverses onto the aiming point.		
15. The gunner elevates to the announced QE.		
16. Gunner levels all bubbles and announces "SET" and "READY".		
17. The COS verifies data, bubbles, and sight picture.		
18. COS will command, "PRIME". Number 1 man will prime.		
19. COS will command, "HOOKUP". Number 1 man will hook up.		
20. COS will command, "FIRE" and number 1 man will fire. (If it is AMC, COS waits until the command is given to fire by POC).		
21. COS is responsible to ensure the following special instructions are executed or computed correctly if given by the POC:		
a. "ZONE FIRE"-Correctly compute required QE, fire announced QE first and subsequent QE in any order.	___	___
b. "SWEEPING FIRE"-Correctly compute required DF, fire announced DF first and subsequent DF in any order.	___	___
c. "SWEEP AND ZONE"-Correctly compute required QE and DF, fire announced DF and QE first, and all combinations of DF and QE.	___	___
d. "CONTINUOUS FIRE"-Load and fire as rapidly as possible consistent with maintenance of accuracy and sustained rate of fire of howitzer. Continue until command to CHECK FIRING or CEASE LOADING.	___	___
e. "FIRE AT WILL"-Howitzer COS controls howitzer fires as the situation and target necessitate.	___	___
22. COS ensures that establishes safety principles are observed during firing.		

Scoring

I-53. If all steps are graded as a "go", the section will receive 100 points. 0 points will be awarded for any "no go". If any unsafe data is fired, the section will receive 0 points for that mission. 1 point will be deducted for each second over the allowed time not to exceed 20 points.

TASK 17: DIRECT FIRE

Conditions

I-54. A stationary target is positioned 400-800 meters from the howitzer. The COS is given a series of 3x5 cards that requires the section to use direct laying procedures.

Standards

I-55. Engage a target in the direct fire mode as outlined in the TM within time and safety standards. Note: Central lay method will be used for this task.

Evaluation

Standards	Scoring Direct Fire Penalty	Max Point Cut
The COS issues correct and complete fire commands within 20 seconds of the receipt of each card, and section members announce correct commands.	1 point deducted for each omitted or incorrect fire command, or for each command that takes over 20 seconds.	5
The announced lead and range or elevation are set off.	6 points deducted for every incorrect lead, range, or elevation.	6
All bubbles are centered when howitzer is fired (first round only).	2 points deducted for each bubble not centered.	4
The time from the last digit of range or elevation until the howitzer is fired is 20 seconds or less.	1 point deducted for each second over 20.	5

Scoring

I-56. Each situation card is worth a total of 10 points. Each section will be graded on 4 separate situation cards for a total of 40 points.

Phase V: NBC OPERATIONS

TASK 18: ASSUME MOPP LEVEL 2

Conditions

I-57. Enroute to this location you crossed a contaminated area.

Standards

I-58. Operate in a contaminated environment in MOPP level 4.

Evaluation

Evaluation Check List	Go	No Go
1. Did all section members have all required MOPP gear?		
2. Were all section members in the proper MOPP level?		
3. Was MOPP gear worn properly?		
4. Did the section stay in MOPP throughout the mission?		
5. Did section take proper precautions prior to crossing contaminated area?		

Scoring

I-59. For each "go" rating 2, points will be awarded, for a total of 10 points. For a "no go" rating, 0 points will be awarded.

TASK 19: NBC OCCUPATION

Conditions

I-60. Having crossed a contaminated area you must provide fire support prior to going to a decontamination site.

Standards

I-61. Operate in a contaminated environment in MOPP level 4 performing AFCS update and occupation.

Evaluation

Evaluation Check List	Go	No Go
1. Did the section stay in MOPP during occupation?		
2. Did the COS update his AFCS at the SCP prior to occupation?		
3. Did the COS follow proper procedures during occupation?		
4. Was the occupation accomplished within time standards?		

Scoring

I-62. For each "go" rating, 5 points will be awarded, for a total of 20 points. For any "no go" rating, 0 points will be awarded.

TASK 20: FIRE MISSION IN NBC EQUIPMENT

Conditions

I-63. While in MOPP you must conduct an indirect fire mission.

Standards

I-64. Conduct indirect fire mission in MOPP level 4, preparing ammunition for firing, verifying data, issuing fire commands, and firing safe announced data.

Evaluation

Evaluation Check List	Go	No Go
1. Did the section stay in MOPP?		
2. Was the round properly prepared for firing?		
3. Did the COS compare and verify all data?		
4. Did COS announce firing commands?		
5. Was proper data fired?		

Scoring

I-65. For each "go" rating, 3 points will be awarded, for a total of 15 points. For any "no go" rating, 0 points will be awarded. If any unsafe data is fired, the section will receive 0 points for this task.

TASK 21: UTILIZING THE M256 KIT

Conditions

I-66. Having completed your fire missions you must determine the type of contamination if any. The COS has instructed the section to utilize a M256 kit.

Standards

I-67. Use M256 Kit without error to determine and report type of contamination present in area.

Evaluation

Evaluation Check List	Go	No Go
1. Did the section have M256 kit readily available?		
2. Did the section have personnel identified to conduct the test?		
3. Did the section follow proper procedures for conducting the test?		
4. Was the proper report/findings sent to the POC?		
5. Did the section remain in MOPP 4 during the test?		

Scoring

I-68. For each "go" rating, 2 points will be awarded for a total of 10 points. For any "no go" rating, 0 points will be awarded.

Phase VI: NIGHT OPERATIONS

TASK 22: NIGHT OCCUPATION

Conditions

I-69. During the hours of darkness, your section received movement orders to relocate to a new position.

Standards

I-70. Occupy new position under cover of darkness and perform procedures IAW TM without error.

Evaluation

Evaluation Check List	Go	No Go
1. Did the section update the AFCS prior to occupying the firing area?		
2. Did the COS align his howitzer with the azimuth of fire (+/- 10 mils)?		
3. Did the COS press ARRIVED key to send location to POC?		
4. Did the COS verify direction by using the M2 compass?		
5. Did the COS determine site data?		
6. Did the COS input min and max QE?		
7. Did the COS verify firing limits?		
8. Were prefire checks completed IAW -10 manual?		
9. Did gunner establish an alternate aiming point and record it on the gunner's reference card?		
10. Was position improvement done as time permits?		

Scoring

I-71. For each "go" rating, 3 points will be awarded, for a maximum of 30 points. For a "no go" rating, 0 points will be awarded.

TASK 23: CONDUCT NIGHT FIRE MISSIONS

Conditions

I-72. You have completed the occupation of a new firing position and reported to the POC that you are RTF. You will conduct indirect fire missions as sent from the POC.

Standards

I-73. The howitzer section is ready to fire within 30 seconds (45 seconds for high angle, 1 minute for Copperhead excluding inspection of the round) after receipt and acknowledgment of the fire mission.

Evaluation

Evaluation Check List-Four Missions:	Go	No Go
1. COS operates the AFCS and processes the fire mission.		
2. COS responds and issues the fire commands.		
3. Driver will raise the RPMs of the howitzer to 1,000 to 1,200 RPM and will record the fire mission on DA Form 4513-R.		
4. COS will activate servos and push LOAD KEY.		
5. Number 1 man prepares ammunition by lot and shell/fuze combination (sets time if time fuze is used).		
6. Gunner prepares announced propellant.		
7. COS checks fuze for tightness and if time fuze is used checks time setting.		
8. Number 1 man will ram projectile (pushes manual control lever forward, holding lever for 4 seconds to allow full extension of rammer cylinder rod and proper seating).		
9. COS will verify charge before gunner loads in tube. Gunner will place charge in tube red igniter pad facing the rear and announce "CHARGE, I SEE RED". Gunner will then announce "CLOSING" and lift the breech operating handle causing the breech to close. Gunner will ensure witness marks align and announce "WITNESS MARKS ALIGNED".		
10. COS will press LAY key and announce "LAY LIGHT IS LIT, ACTUAL AND COMMAND DEFLECTION AND QUADRANT ARE WITHIN TOLERANCE (+/- 0.9 mils) AND NO WARNING MESSAGE IS PRESENT". Gunner will check all three things and announce VERIFIED. (If it is a high angle fire mission, the command to PRIME will be given before pressing the LAY key.) Gunner will announce "CHECK FIRING" if a violation of the above steps occurs or if data does not match.		
11. COS will command "PRIME". Number 1 man will prime.		
12. COS will command "HOOK UP". Number 1 man will hook up.		
13. COS will command "FIRE" and Number 1 man will fire. (If it is AMC, COS waits until the command is given to fire over the AFCS.		

Scoring

I-74. If all steps are graded as a "go", the section will be awarded 100 points for the mission. For each "no go" rating 0 points will be awarded. Note: If any unsafe data is fired, the section will receive 0 points for the mission.

Appendix J

AFCS/BCS Spheroid and Datum Tables

This appendix provides AFCS/BCS spheroid and datum tables for the Paladin system per TM 9-2350-314-10. Selection of the datum to be used is performed from the setup and information displays (enter MAP/DATUM display).

Table J-1. Australian National Spheroid (Spheroid Code 1)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Australian National Spheroid			
1	ANO	Anna 1 Astro 1965	-491	-22	435
2	AUA	Australian Geodetic 1966	-133	-48	148
3	AUG	Australian Geodetic 1984	-134	-48	149

Table J-2. Bessel (Ethiopia) 1841 Spheroid (Spheroid Code 2)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**

		Bessel 1841 (Ethiopia, Indonesia, Japan, and Korea)			
4	BUR	Bukit Rimpah	-384	664	-48
5	BAT	Djakarta (Batavia)	-377	681	-50
6	GSE	Gunung Segara	-403	684	41
7	MAS	Massawa	639	405	60
8	TOY-M	Tokyo	-148	507	685

Table J-3. Bessel (Nambia) 1841 Spheroid (Spheroid Code 3)

Local Geodetic Datums			**Transformation Parameters**		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Bessel 1841 (Nambia)			
9	SCK	Schwarzeck	616	97	-251

Table J-4. Clarke 1866 Spheroid (Spheroid Code 4)

Local Geodetic Datums			**Transformation Parameters**		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Clarke 1866 Spheroid			
10	BER	Bermuda 1957	-73	213	296
11	CAC	Cape Canaveral	-2	151	181

12	GUA	Guam 1963	-100	-248	259
13	LCF	L.C. 5 Astro 1961	42	124	147
14	LUZ-A	Luzon Philippines	-133	-77	-51
15	LUZ-B	Luzon Mindanao Island	-133	-79	-72
		North American 1927			
16	NAS-C	(CONUS)	-8	160	176
17	NAS-D	Alaska (Excluding Aleutian Islands)	-5	135	172
18	NAS-Q	Bahamas (Excluding San Salvador Island)	-4	154	178
19	NAS-E	[Canada and Newfoundland]	-10	158	187
20	NAS-O	Canal Zone	0	125	201
21	NAS-P	Caribbean	-3	142	183
22	NAS-N	Central America	0	125	194
23	NAS-U	Greenland (Hayes Peninsula)	11	114	195
24	NAS-L	Mexico	-12	130	190
25	NAS-R	San Salvador Island	1	140	165
26	OHA-M	Old Hawaiian	61	-285	-181
27	PUR	Puerto Rico	11	72	-101

Table J-5. Clarke 1880 Spheroid (Spheroid Code 5)

Local Geodetic Datums	Transformation Parameters

Local ID Code	Local ID (Display)	Datum	Delta X	Delta Y	Delta Z
		Clarke 1880 Spheroid			
		Adindan			
28	ADI-M	Ethiopia, Sudan	-166	-15	204
29	ADI-E	Burkina Faso	-118	-14	218
30	ADI-F	Cameroon	-134	-2	210
31	ADI-C	Mali	-123	-20	220
32	ADI-D	Senegal	-128	-18	224
33	AIA	Antigua Island Astro 1943	-270	13	62
		Arc 1950			
34	ARF-M	[Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, and Zimbabwe]	-143	-90	-294
35	ARF-H	Burundi	-153	-5	-292
36	ARS	Arc 1960	-160	-6	-302
37	PHA	Ayabelle Lighthouse	-79	-129	145
38	CAP	Cape	-136	-108	-292
39	CGE	Carthage	-263	6	431
40	DAL	Dabola	-83	37	124
41	FOT	Fort Thomas 1955	-7	215	225
42	LEH	Leigon	-130	29	364
43	LIB	Liberia 1964	-90	40	88

44	MIK	Mahe 1971	41	-220	-134
45	MER	Merchich	31	146	47
		Minna			
46	MIN-A	Cameroon	-81	-84	115
47	MIN-B	Nigeria	-92	-93	122
48	ASM	Montserrat Island Astro 1958	174	359	365
49	MPO	M'Poraloko	-74	-130	42
		Nahrwan			
50	NAH-A	Masirah Island (Oman)	-247	-148	369
51	NAH-B	United Arab Emirates	-249	-156	381
52	NAH-C	Saudi Arabia	-243	-192	477
53	FAH	Oman	-346	-1	224
54	PTB	Point 58	-106	-129	165
55	PTN	Point Noire 1948	-148	51	-291
56	MVS	Viti Levu 1916	51	391	-36

Table J-6. Everest (Brunei and East Malaysia) Spheroid (Spheroid Code 6)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Everest (Brunei and East Malaysia) Spheroid			

57	TIL	Timbalai 1948			
		[Brunei and East Malaysia]	-679	669	-48

Table J-7. Everest (India 1830) Spheroid (Spheroid Code 7)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Everest (India 1830) Spheroid			
58	IND-B	Indian			
		Bangladesh	282	726	254
59	INF-A	Indian 1954	217	823	299
60	INH-A	Indian 1975	209	818	290
61	KAN	Kandawala	-97	787	86

Table J-8. Everest (India 1956) Spheroid (Spheroid Code 8)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Everest India 1956 Spheroid			
62	IND-I	Indian			
		India, Nepal	295	736	257

Table J-9. Everest (West Malaysia and Singapore) 1948 Spheroid (Spheroid Code 9)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Everest (West Malaysia and Singapore1948) Spheroid			
63	KEA	Kertau 1948			
		West Malaysia and Singapore	-11	851	5

Table J-10. Geodetic Reference System (GRS) 80 Spheroid (Spheroid Code A)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		GRS 80 Spheroid			
64	NAR	North American 1983	0	0	0

Table J-11. Helmert 1906 Spheroid (Spheroid Code B)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Helmert Spheroid			
65	OEG	Old Egyptian 1907	-130	110	-13

Table J-12. Hough 1960 Spheroid (Spheroid Code C)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Hough 1960 Spheroid			
66	ENW	Wake-Eniwetok 1960	102	52	-38

Table J-13. International 1924 Spheroid (Spheroid Code D)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		International 1924 Spheroid			
		Ain El Abd 1970			
67	AIN-A	Bahrain Island	-150	-250	-1
68	AIN-B	Saudi Arabia	-143	-236	7
69	ASC	Ascension Island 1958	-205	107	53
70	ATF	Astro Beacon "E" 1945	145	75	-272
71	TRN	Astro Tern Island (FRIG) 1961	114	-116	-333
72	SHB	Astro DOS 71/4	-320	550	-494
73	ASQ	Astronomical Station 1952	124	-234	-25
74	BID	Bissau	-173	253	27
75	IBE	Bellevue (IGN)	-127	-769	472

76	BOO	Bogota Observatory	307	304	-318
77	CAZ	Camp Area Astro	-104	-129	239
78	CAI	Campo Inchauspe	-148	136	90
79	CAO	Canton Astro 1966	298	-304	-375

Table J-13 Continued. International 1924 Spheroid (Spheroid Code D)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
80	CHI	Chatham Island Astro 1971	175	-38	113
81	CHU	Chua Astro	-134	229	-29
82	COA	Corrego Alegre	-206	172	-6
83	GIZ	DOS 1968	230	-199	-752
		European 1950			
84	EAS	Easter Island 1967	211	147	111
85	EUR-M	[Austria, Belgium, Denmark, Finland, France, Federal Republic of Germany*, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland] *Prior to 1 January 1993	-87	-98	-121
86	EUR-K	[England, Ireland, Scotland Channel, and Shetland Islands]	-86	-96	-120
87	EUR-S	[Iraq, Israel, Jordan, Kuwait, Lebanon, Saudi Arabia, Syria]	-103	-106	-141

88	EUR-E	Cyprus	-104	-101	-140
89	EUR-F	Egypt	-130	-117	-151
90	EUR-H	Iran	-117	-132	-164
91	EUR-L	Malta	-107	-88	-149
92	EUS	European 1979			
		[Austria, Finland, Netherlands, Norway, Spain, Sweden, and Switzerland]	-86	-98	-119
93	GAA	Gan 1970	-133	-321	50
94	GEO	Geodetic Datum 1949	84	-22	209
95	GRA	Graciosa Base SW 1948	-104	167	-38
96	DOB	GUX 1 Astro	252	-209	-751
97	HEN	Herat North	-333	-222	114
98	HJO	Hjorsey 1955	-73	46	-86
99	HKD	Hong Kong 1963	-156	-271	-189
100	HTN	Hu-Tzu-Shan	-637	-549	-203
101	ISG	ISTS 061 Astro 1968	-794	119	-298
102	IST	ISTS 073 Astro 1969	208	-435	-229
103	JOH	Johnston Island 1961	189	-79	-202
104	KEG	Kerguelen Island 1949	145	-187	103
105	KUS	Kusaie Astro 1951	647	1777	-1124
106	MID	Midway Astro 1961	912	-58	1227
107	NAP	Naparima, British West Indies	-10	375	165

108	FLO	Observatorio Meteorologico 1939	-425	-169	81
109	PLN	Pico de las Nieves	-307	-92	127
110	PIT	Pitcairn Astro 1967	185	165	42
111	POS	Porto Santo 1936	-499	-249	314
112	PRP-M	Provisional South American 1956	-288	175	-376

Table J-13 Continued. International 1924 Spheroid (Spheroid Code D)

Local Geodetic Datums			**Transformation Parameters**		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
113	HIT	Provisional South Chilean 1963	16	196	93
114	QAT	Qatar National	-128	-283	22
115	QUO	Qornoq	164	138	-189
116	REU	Reunion	94	-948	-1262
117	MOD	Rome 1940	-225	-65	9
118	SAO	Sao Braz	-203	141	53
119	SAE	Santo (DOS) 1965	170	42	84
120	SAP	Sapper Hill 1943	-355	21	72
121	SGM	Selvagem Grande 1938	-289	-124	60
122	TAN	Tananarive Observatory 1925	-189	-242	-91
123	TDC	Tristan Astro 1968	-632	438	-609

124	WAK	Wake Island Astro 1952	276	-57	149
125	YAC	Yacare	-155	171	37
126	ZAN	Zanderij	-265	120	-358

Table J-14. Krassovsky 1940 Spheroid (Spheroid Code E)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Krassovsky 1940 Spheroid			
127	AFG	Afgooye	-43	-163	45

Table J-15. Modified Fisher 1960 Spheroid (Spheroid Code F)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		Modified Fisher 1960 Spheroid			
128	SOA	South Asia	7	-10	-26

Table J-16. South American 1969 Spheroid (Spheroid Code G)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**

		South American 1969 Spheroid			
129	SAN-M	South American 1969	-57	1	-41

Table J-17. World Geodetic System (WGS) 72 Spheroid (Spheroid Code H)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		WGS 72 Spheroid			
130	WD	WGS 72	0	0	0

Table J-18. WGS 84 Spheroid (Spheroid Code I)

Local Geodetic Datums			Transformation Parameters		
Local ID Code	**Local ID (Display)**	**Datum**	**Delta X**	**Delta Y**	**Delta Z**
		WGS 84 Spheroid			
131	WE	WGS 84	0	0	0

Appendix K

M93 Chronograph Muzzle Velocity System

This appendix describes the M93 chronograph MVS operations and procedures for calibrating or updating current MVVs for the COS, POC, and platoon leadership per TM 9-2350-314-10.

GENERAL DESCRIPTION

K-1. The MVS is a MV measurement system, which operates on the Doppler principle. The system is based on a X-band transceiver and a MV processor. The purpose of the M93 MVS is to provide an accurate MV reading for a projectile fired from the howitzer. The M93 MVS is designed to communicate measured projectile velocities via a military standard-1533 data bus to the AFCS. This information can be used to provide a reasonable estimate of the average MV for rounds to be fired for a new fire mission; thereby improving the possibility of a first round hit on the target.

K-2. The MVS consists of the following components (Figure K-1):

- M93 radar antenna transceiver.
- W92 power/data cable.
- Mounting bracket with 1553 bus terminator and storage connector.
- W93 (1553 bus) cable assembly (connects MVS to AFCS).

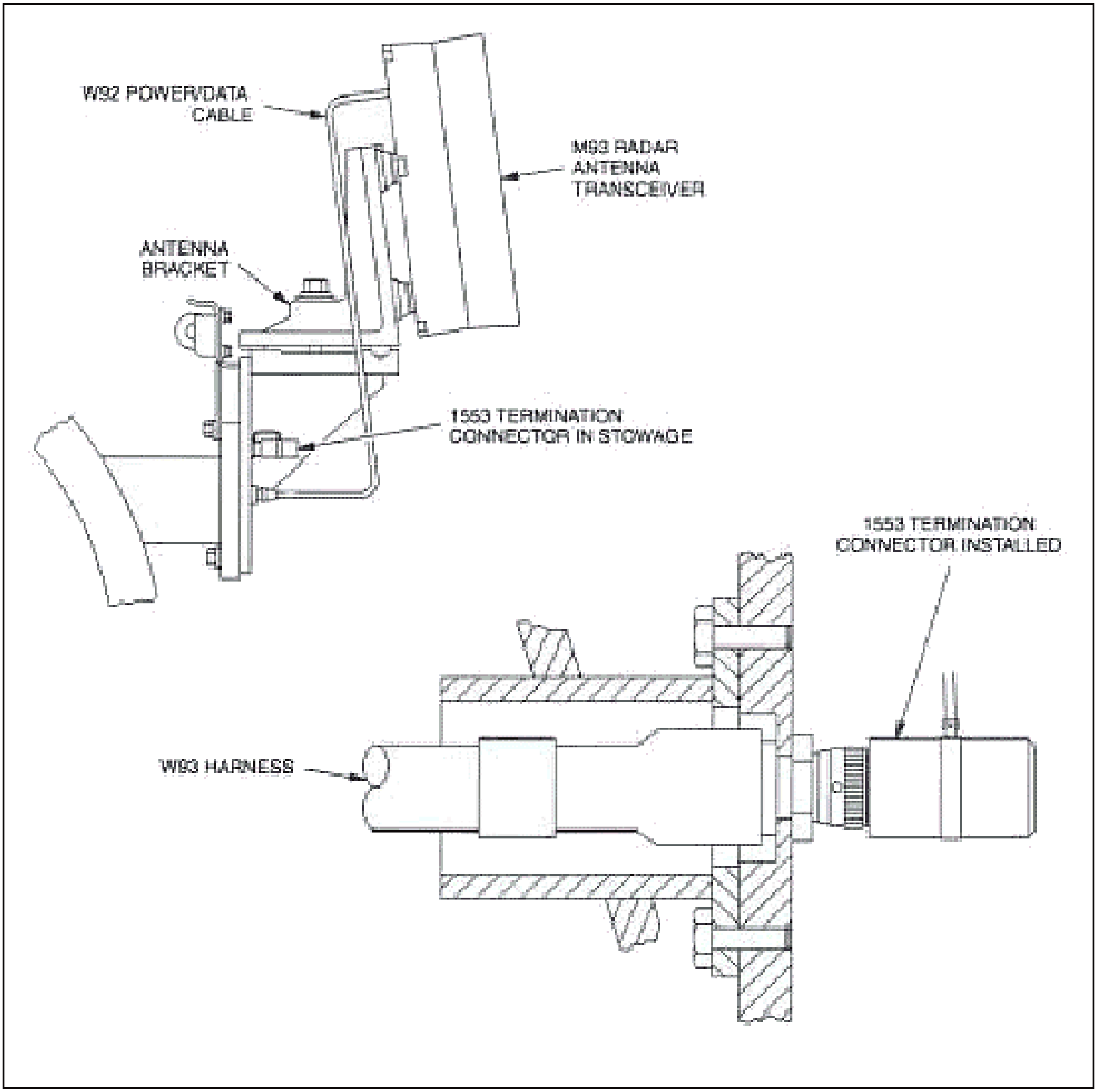

Figure K-1. M93 Muzzle Velocity System

K-3. When not in use, the MVS can remain installed on the howitzer. If the MVS is not mounted on the howitzer, ensure that the termination connector is installed on the wiring harness W93 connector at the MVS mounting bracket. If the MVS must be stored it will be IAW TM 9-2350-314-10. The MVS must be re-installed prior to turning on the vehicle master switch.

ENVIRONMENTAL INFORMATION

K-4. The M93 MVS is designed to withstand adverse conditions, which may be present during storage and operation. The M93 MVS will function properly without degradation under the following conditions:

- Operating temperatures from –50 to +125 degrees Fahrenheit.
- Storage temperatures from –50 to +150 degrees Fahrenheit.
- 0 to 95 percent relative humidity, including condensation.
- Shocks and vibrations present during firing and transport.
- High altitude during air transport.
- Rain, wind, sand, and dust.
- Solar radiation (direct sunlight).
- Salt and fog.
- Environments leading to growth of fungus.

INSTALLATION

13B COS

K-5. Note: The MVS should be installed before all missions and must be connected prior to AFCS initialization.

- Insure vehicle master power switch is in the "off" position.
- Inspect M93 radar antenna head for any damage. Install antenna bracket on mounting bracket.
- Remove 1553 bus terminator from W93 cable connector and connect to the storage connector.
- Inspect all connectors for bent pins.
- Ensure proper cable connections. Inspect W92 cable to M93 radar antenna and W93 cable connector.

OPERATIONAL SEQUENCE

COS DUTIES

- Power up the AFCS.
- Check AFCS status.
- Initialize AFCS.
- Enter extended propellant lots. (Note: To use the MVS, you must have an extended propellant lot code in the AFCS ammunition inventory.)
- Enter minimum number of rounds for MVV calculation as directed by the TSOP.

- Prepare for POC BCS to send fire missions digitally.

K-6. Note: The AFCS will calculate a solution; the AFCS will report a MVV to the POC if certain requirements are met:

- AFCS processing a new MVV.
- Deletion of a MVV.
- +/- 2 meters per second change from previous MVV.

K-7. The AFCS must detect readings within +/- 100 meters per second from standard. Additionally, the AFCS will not generate a MVV unless the "MVV ROUND" entry has been met or exceeded. The AFCS sends the MVV automatically to the POC BCS. Once the AFCS receives acknowledgment from the BCS the system will apply the new MVV to the database.

TROUBLESHOOTING

MVS NOT DETECTED DURING AFCS POWER UP

K-8. Power up status screen shows two dash marks (--) in status column.

Procedures

K-9. **First.**

- Check that MVS radar antenna is installed correctly.
- Check W92 cable connections at MVS antenna and at the W93 cable connector
- Check W92 cable for damage.

K-10. **Second.**

- Power down AFCS by ensuring the DU power switch is placed in the "off" position.
- Ensure the vehicle master power switch is in the "off" position.
- Disconnect W92 cable and check for bent or broken pins or damage to connectors.
- Connect 1553 termination connector to the W93 harness.
- Start operational sequence power up status for MVS is "OK".
- Power down completely.
- Reconnect W92 cable and recycle power. If problem exists notify unit maintenance.
- Start operational sequence. If problem exists notify unit maintenance.

NO MVV ACQUIRED

- Step 1. Was "EOM" sent to the AFCS?
- Step 2. Was the "MVV ROUNDS" set to the minimum required?
- Step 3. Was the required minimum number of rounds fired?
- Step 4. Did the AFCS use the same type of ammunition combination and quantity required by the BCS for the fire mission?
- Step 5. Check last mission data to verify if reading was taken.

MVS DECREMENTS ROUNDS PREMATURELY WHEN BREECH IS CLOSED

- When this occurs, no useful MVV data can be gathered.
- Request guidance from POC regarding completion of fire mission.
- Turn in MVS to unit maintenance for repair/replacement.

STEP BY STEP PROCEDURES FOR CALIBRATION

K-11. Note: Before powering up the howitzer, inspect and connect the M93 MVS cables and head.

- Initialize the AFCS at a SCP.
- Receive a move order to a firing area and perform occupation procedures.
- Do a navigation update at a SCP (if necessary)
- Receive BCS PROVIDED AMMO from POC (one time only).
- Enter/verify extended lot for propellant.
- Set MVV ROUNDS as directed.
- Enter current propellant temperature.
- POC will request MVVs from AFCS (transparent to operator).
- From SET UP AND INFORMATION menu, select AFCS STATUS and ensure MVS is operational.
- From MAINTENANCE menu, select BORESIGHT entry and verify the AZ offset, roll offset, and the elevation offset against the DA Form 2408-4 Weapon Record Data (platoon sergeant is responsible for checking this data).
- Ensure borescope and pullover has been performed.
- Ensure a minimum of 50 meters between guns.
- Once everything is verified, conduct fire missions. (POC sends a WHEN READY digital fire mission).
- To view the MV acquired on the AFCS, EOM must first be sent. At EOM go to SETUP AND INFORMATION menu. Select MUZZLE VELOCITY and then select VIEW LAST MISSION DATA.

K-12. **Note:** For a more accurate MVV, ensure the tube is warm or a warm up round has been fired.

PLATOON LEADERSHIP ACTIONS

K-13. The following is a checklist (Table K-1) that assists the platoon leadership in obtaining MVs. It is imperative that each of the steps be followed to allow for greater probability of obtaining usable MVs whether at a dedicated calibration site or updating MVVs during a live firing exercise.

Table K-1. Muzzle Velocity Checklist

PLATOON	**GUN 1**	**GUN 2**	**GUN 3**
M93 CONNECTED (PRIOR TO POWER UP)			
NAV POSITION UPDATE (VERIFY PLGR FIGURE OF MERIT 1)			
ROUNDS, FUZES (BCS PROVIDES), VERIFY			
POWDER TEMPERATURE			
MVV ROUNDS (1-9) (UNIT TSOP)			
SELECT AFCS STATUS AND ENSURE MVS IS OPERATIONAL			
BORESIGHT ENTRY			
VERIFICATION MISSION			

POC RESPONSIBILITIES

K-14. The POC’s main responsibility during the operation of the M93 is to verify and record all information reported from the AFCS. The POC will verify that communication is established by requesting MVVs from the AFCS. There are different methods for obtaining MVVs from the AFCS. The POC FDC chief and/or FDO must decide the preferred method:

INITIAL CALIBRATION (NO PREVIOUS MVVs RECORDED)

- Ensure MVVs are deleted from the AFCS.
- Gun must delete by date time group, projectile, and propellant lot.
- POC will request MVVs from howitzer to verify deletion.
- Delete MVVs in POC database.

Note. To ensure that the AFCS has no MVVs, the POC can send a MVV table to the AFCS with a non-existing shell/fuze combination set with a MVV reading of 0.0. A blank table cannot be sent to the AFCS. (There must be at least one entry in the MVV table.)

PREVIOUS MVVs ALREADY RECORDED AND DESIRED LOT TO MEASURE HAS NO MVV

- Verify previous MVVs on AFCS and BCS with recorded historical data.
- Verify lot has no previous MVV in AFCS and LCU database based on AFCS ammunition entered.

PREVIOUS MVVs ALREADY RECORDED AND DESIRED LOT TO MEASURE HAS PREVIOUS MVV

- Verify previous MVVs on AFCS and BCS with recorded historical data.

Note: A new MVV will not be generated unless there is a change of +/- 2.0 meters per second from recorded MVV.

K-15. The POC will then send BCS provided AMMO (if not already done). Once AFCS has received the AMMO and the operator has had time to execute, the POC will request AMMO to verify it has been received. The POC will then verify that the AFCS has extended lot designators and the MVS round count has been set to appropriate setting. The POC is now ready to send a mission with the appropriate round count.

K-16. Upon EOM the AFCS will send a MVV as long as certain requirements are met:

- AFCS calculates a new MVV
- Change in 2 meters per second from previously recorded MVV.

K-17. Once the AFCS receives an acknowledgment from the BCS, the MVV will be stored. If there is no acknowledgement from the BCS the MVV will not be stored on the AFCS. Once the BCS receives the MVV in the INPUT queue, the MVV should be displayed and verified by the FDC chief and FDO. Once the MVV has been verified the

LCU operator will execute the MVV and the FDO will record it. The POC will request the MVV from the AFCS to verify proper MVV and will conduct a verification mission

K-18. Note: A MVV that is stored on the AFCS will be applied to other MVVs from 3 charges up to 3 charges down, as long as there are no MVVs for that shell/propellant combination. (e.g., If charge 6W HEA has recorded MVVs and a charge 5W HEA is being shot with no MVVs, the AFCS will apply the charge 6W to the 5W to get the most accurate data. If all requirements are met with the MVS a MVV for the 5w should be generated and sent to the POC.)

K-19. The POC M93 operation checklist is provided at Table K-2. For troubleshooting procedures for faults found, refer to Table K-3.

Table K-2. POC M93 Operation Checklist

PROCEDURE	COMPLETED
VERIFY COMMUNICATIONS	
VERIFY MVVs ON AFCS AND BCS DATABASE ARE CURRENT	
SEND BCS PROVIDED TO AFCS	
VERIFY EXTENDED LOT DESIGNATORS IN AFCS	
VERIFY MVS ROUND COUNT IN AFCS BY VOICE	
SEND MISSION WITH APPROPRIATE ROUND COUNT	
VERIFY MVV RECEIVED FROM AFCS (FDC CHIEF AND FDO)	
PROCESS MVV (EXECUTE)	
RECORD MVV	
VERIFICATION MISSION	

Table K-3. POC M93 Operation Troubleshooting Procedures

VERIFY COMMUNICATIONS	Verify initialization parameters in AFCS and LCU database. Verify radio frequencies and setting. Try voice on digital radio.
VERIFY MVVs IN DATABASE IN AFCS AND LCU	Verify that all MVVs are current from previously recorded MVVs (MVV book).
SEND BCS PROVIDED TO AFCS	Verify lots sent to gun are correct and match ammunition inventory.
VERIFY EXTENDED LOT DESIGNATORS IN AFCS	Request MVVs from AFCS and verify extended lot designators.
VERIFY MVS ROUND COUNT IN AFCS	Make sure that MVS round count is equal to or greater than the mission fired count.
SEND MISSION WITH APPROPRIATE ROUND COUNT	If mission does not have appropriate rounds a MVV will not be generated.
VERIFY MVV RECEIVED FROM AFCS (FDCCHIEF AND FDO)	Verify that MVV received is accurate. If the MVV is invalid, then delete the MVV by propellant lot from the AFCS.
RECORD MVV	The battalion and batteries should keep a detailed record of all MVVs for each weapon.

Appendix L

Sample Precombat Checks

The tables in this appendix provide sample precombat checks (PCCs) for Paladin mission and survivability preparations a battery will execute. These checklists may be used in a variety of situations and are not intended to replace unit TSOPs or other system(s) designed to track and report the status/progress of a unit. By incorporating some version of these sample PCCs into operations, the commander can more efficiently communicate exactly what must be done. For example, it is easier to direct the Paladin section to complete the SCATMINE PCC than to individually specify all the subtasks required.

SURVIVABILITY PCCs

Table L-1. NBC Operations

SECTION:
_____ M256 KIT ON HAND
_____ M11/M13 DECONTAMINATION APPARATUS ON HAND
_____ MASKS AND HOODS FITTED AND CHECKED
_____ MOPP GEAR INVENTORIED AND ACCESSIBLE
_____ ALL NONESSENTIAL EQUIPMENT STOWED AND ALL EQUIPMENT COVERED
_____ SURVEY TEAM IDENTIFIED AND REHEARSED
_____ ANTIDOTE KITS ON HAND
_____ REHEARSE BUDDY AID PROCEDURES
_____ REVIEW HASTY DECONTAMINATION PROCEDURES
PLATOON:
_____ PMCS AND EMPLACE M8 ALARMS
_____ REHEARSE NBC REACTION DRILL AND TEAMS
_____ CHECK BOC PLOTTING CHEMICAL DOWNWIND MESSAGES AND REPORTING
NBC HAZARD LOCATIONS TO ALL LEADERS
_____ REHEARSE CONTAMINATED CASUALTY EVACUATION (CASEVAC)
_____ COORDINATE DELIBERATE DECONTAMINATION PLAN WITH BATTALION
_____ MAP WITH CONTAMINATED ROUTES IN CASEVAC VEHICLE
_____ BOC HAS ALL MOPP EQUIPMENT SIZES FOR REORDER
_____ EXTRA FILTERS AND EXPENDABLES ON HAND

Table L-2. Air Threat

SECTION:
_____ SET M2 HEADSPACE AND TIMING
_____ CLEAN M2
_____ TEST FIRE M2 (AS DIRECTED)
_____ PRACTICE CHANGING M2 BARRELS
_____ PRACTICE STOPPAGE AND IMMEDIATE ACTION DRILLS
_____ RANGE CARD ON HAND WITH AIR TRPs
_____ REVIEW AIRCRAFT THREAT CARDS
_____ REVIEW BATTERY AIR ATTACK SIGNALS
_____ CHECK CAMOUFLAGE:
- NETS SERVICEABLE/COVER VEHICLES
- WINDSHIELDS, LIGHTS COVERED
- NETS OFF M2
_____ VERIFY AIR DEFENSE ARTILLERY (ADA) WARNING WITH COS
_____ VERIFY SIGNAL FLAGS ARE ON HAND
_____ REHEARSE ADA MOVEMENT DRILLS
_____ REPORT COMPLETION OR PROBLEMS TO PLATOON SGT
PLATOON:
_____ ASSIGN AIR SECTORS OF FIRE
_____ ESTABLISH AIR TRPs
_____ VERIFY COVERAGE ON DEFENSE DIAGRAM
_____ ISSUE ADA WARNING TO COS
_____ CONDUCT AIR ATTACK REHEARSAL
_____ CONDUCT CASEVAC PCC
_____ POSITION OFF AIR AVENUES OF APPROACH
_____ MAXIMIZE DISPERSION
_____ COORDINATE FOR ADA COVERAGE WITH TOC

Table L-3. Counterfire Threat

SECTION:
_____ SURVIVABILITY POSITIONS DUG FOR EVERY SOLDIER
_____ OVERHEAD COVER FOR EVERY SOLDIER
_____ VERIFY AND RECONNOITER ALTERNATE POSITION AND ROUTE
_____ SANDBAG COLLIMATOR AND BURY WIRE
_____ CRATER ANALYSIS TEAM IDENTIFIED AND TRAINED
_____ REHEARSE HASTY DISPLACEMENT DRILL
_____ REHEARSE HASTY OCCUPATION
_____ CHECK CAMOUFLAGE (IF THREAT IS VISUAL)
- NETS SERVICEABLE/COVER VEHICLES
- WINDSHIELDS, LIGHTS COVERED
_____ INVENTORY AID BAG AND LITTERS
_____ MINIMIZE EQUIPMENT ON THE GROUND
_____ REPORT COMPLETION OR PROBLEMS TO PLATOON SERGEANT
PLATOON:
_____ MAXIMIZE DISPERSION
_____ POSITION IN DEFILADE, BUT AVOID HIGH ANGLE
_____ REQUEST ENGINEER SUPPORT
_____ IDENTIFY IMMEDIATE ACTION STATUS
_____ IDENTIFY VOLLEY TO MOVE CRITERIA
_____ FULLY PREPARE ALTERNATE POSITION
_____ REQUEST CRITICAL FRIENDLY ZONE FOR BATTERY
_____ CONDUCT CASEVAC PCC
_____ REHEARSE HASTY DISPLACEMENT AND OCCUPATION
_____ CHECK CLASS IV ON HAND

Table L-4. Mounted Ground Threat

SECTION:
_____ SECTOR MARKED (DAY OR NIGHT) FOR CREW SERVED WEAPONS AND HOWITZER
_____ MEASURE/OBTAIN RANGES TO DEAD SPACE, KEY TERRAIN, AND TRPs
_____ SIGHT AND COMPUTE DATA TO TRPs FROM ALL WEAPONS
_____ COMPLETE RANGE CARDS FOR CREW SERVED WEAPONS, HOWITZER, AND AT-4
_____ REHEARSE DIRECT FIRE CREW DRILL
_____ PLAN KILLER JUNIOR FOR DEAD SPACE
_____ PMCS/FUNCTIONS CHECK ALL WEAPONS
_____ PMCS/FUNCTIONS CHECK ALL NIGHT SIGHTS/NIGHT VISION GOGGLES
_____ AMMUNITION ON HAND FOR ALL WEAPONS
_____ FIGHTING POSITIONS COMPLETE WITH OVERHEAD COVER
_____ REVIEW THREAT VEHICLE IDENTIFICATION
_____ VERIFY BORESIGHT ON DF TELESCOPE
_____ REPORT COMPLETION OR PROBLEMS TO PLATOON SERGEANT
PLATOON:
_____ POSITION OFF ENEMY AVENUES OF APPROACH

_____ ESTABLISH BATTERY ENGAGEMENT AREA WITH TRIGGERS AND TRPs
_____ IDENTIFY NATURAL TRPs OR EMPLACE TRPs; SURVEY TRPs
_____ FDC COMPUTES RANGE AND AZIMUTH TO EACH TRP
_____ FDC COMPUTES SELF ILLUMINATION TARGETS
_____ POSITION WEAPONS TO MAXIMIZE FIRES IN ENGAGEMENT AREAS
_____ REHEARSE TANK KILLER TEAMS AND REACTION FORCE
_____ REHEARSE CASEVAC

Table L-5. Dismounted Threat

SAME AS MOUNTED GROUND THREAT PCC EXCEPT:
PLATOON:
_____ USE FORMATION TO MAXIMIZE PERIMETER SECURITY
_____ USE DEFENSIVE WIRE
_____ FOCUS ON 6400 MIL SECURITY
_____ USE PATROLLING

Table L-6. CASEVAC Operations

SECTION:
_____ COMBAT LIFESAVER BAGS COMPLETE
_____ CASUALTY COLLECTION POINT IDENTIFIED AND BRIEFED
_____ LITTERS LOCATED AND CROSS LOADED
_____ STRAPS AND TIEDOWNS WITH THE LITTERS
_____ VERIFY COMMUNICATIONS WITH THE BOC
_____ VERIFY BATTLE ROSTER FOR ALL PERSONNEL
_____ DA FORM 1155/1156 FILLED OUT AND IN AID POUCH
_____ REHEARSE BUDDY AID PROCEDURES
_____ ACCOUNT FOR SECTION PERSONNEL IN AND OUT OF POSITION
PLATOON:
_____ PRECOMBAT INSPECTION (PCI) SECTION CHECKS
_____ REHEARSE CASEVAC IN EACH POSITION
_____ IDENTIFY BOC REPRESENTATIVE TO COLLECT BATTLE ROSTER AT CASUALTY COLLECTION POINT
_____ CONDUCT COMMUNICATIONS CHECKS ON A/L WITH BATTALION AND WITH CASEVAC VEHICLE
_____ ENSURE BOC UPDATES AND DISSEMINATES ALL ACTIVE AMBULANCE EXCHANGE POINTS TO LEADERS
_____ MAP WITH AMBULANCE EXCHANGE POINTS IN CASEVAC VEHICLE

PCCs TO SUPPORT ESSENTIAL FIELD ARTILLERY TASKS

Table L-7. SCATMINE

SECTION: _____ SCATMINE DISTRIBUTED IN ACCORDANCE WITH FDC GUIDANCE; REPORT NUMBER OF RAAMSs AND ADAMs _____ CORRECT FUZES AND POWDERS ON HAND; LOTS REPORTED TO FDC _____ AMMUNITION LOADED IN ACCORDANCE WITH PLAN: SHOOT FROM GROUND, AMMUNITION VEHICLE, OR GUN? _____ CONDUCT FULL-UP REHEARSAL _____ SURVIVABILITY MOVE PLAN REHEARSED _____ COUNTERFIRE REACTION DRILL REHEARSED FDC: _____ COMPUTE AIMPOINTS _____ DIRECT AMMUNITION BREAKDOWN BY GUN AND VERIFY _____ CONDUCT FULL-UP TECHNICAL REHEARSAL; REPORT REHEARSED EMPLACEMENT TIME TO BATTALION S3 _____ PLOT AIMPOINTS ON CHART AND VERIFY PLATOON/BATTERY: _____ PREPARE ALTERNATE POSITION COMPLETELY _____ BRIEF IMMEDIATE ACTION STATUS

Table L-8. Copperhead

SECTION: _____ COPPERHEAD TRAINER ON HAND _____ EXECUTE DRY FIRE MISSION AND ROUND INSPECTION IAW PLATOON LEADER'S TIMELINE _____ INSPECT ACTUAL COPPERHEAD IAW -10 TM _____ VERIFY AND REPORT POWDER TEMPERATURE IN ACCORDANCE WITH PLATOON LEADER'S TIMELINE _____ CAPTURE MVV; RECEIVE EXPECTED MV FROM FDC _____ VERIFY PULSE REPETITION FREQUENCY (PRF) CODE WITH FDC PLATOON: _____ ESTABLISH COPPERHEAD TIMELINE FROM TRAINER REHEARSAL TO READY TO FIRE TIME _____ CONDUCT VERIFICATION MISSION AFTER MET OR OTHER CHANGES _____ VERIFY PRF CODE WITH OBSERVER _____ VERIFY ANGLE T < 800 MILS

Table L-9. Smoke

SECTION:
_____ AMMUNITION DISTRIBUTED IAW FDC GUIDANCE; REPORT NUMBER OF ROUNDS BY LOT
_____ CORRECT FUZES AND POWDERS ON HAND AND REPORTED TO FDC
_____ AMMUNITION LOADED IN ACCORDANCE WITH PLAN SEGREGATED BY LOT
_____ CONDUCT FULL-UP REHEARSAL
_____ SURVIVABILITY MOVE PLAN REHEARSED
_____ COUNTERFIRE REACTION DRILL REHEARSED
FDC:
_____ VERIFY AIMPOINTS, PLOT AND CHECK FOR INTERVENING CRESTS
_____ RANGE VERIFIED FOR PROPELLANT DISTRIBUTED
_____ ENSURE M825 WORKAROUND CONDUCTED PROPERLY
_____ SITE VERIFIED (NO GUNS HAVE A SITE TO CREST ISSUE)
_____ DIRECT AMMUNITION BREAKDOWN BY GUN AND LOT; VERIFY WITH PLATOON SERGEANT/PLATOON LEADER
_____ CONDUCT FULL-UP TECHNICAL REHEARSAL; REPORT REHEARSED TIME TO BATTALION S3/FDO
_____ COMPENSATE FOR ALL NONSTANDARD CONDITIONS
PLATOON/BATTERY:
_____ PREPARE ALTERNATE POSITION COMPLETELY
_____ BRIEF IMMEDIATE ACTION STATUS

Table L-10. Massing

SECTION:
_____ AMMUNITION DISTRIBUTED IAW FDC GUIDANCE; REPORT NUMBER OF ROUNDS BY LOT
_____ CORRECT FUZES AND POWDERS ON HAND AND REPORTED TO FDC
_____ AMMUNITION LOADED IAW PLAN SEGREGATED BY LOT
_____ CONDUCT FULL-UP REHEARSAL
_____ MEASURE AND REPORT POWDER TEMPERATURE OF MASSING LOT EVERY 30 MINUTES
_____ REHEARSE CHANGING AIMING REFERENCE POINTS
_____ STORE MASSING AMMUNITION UNIFORMLY
_____ VERIFY BORESIGHT
FDC:
_____ DETERMINE AMMUNITION REQUIREMENTS
_____ DIRECT AMMUNITION BREAKDOWN BY GUN AND LOT; VERIFY WITH PLATOON SERGEANT/PLATOON LEADER
_____ CONDUCT FULL-UP TECHNICAL REHEARSAL; REPORT REHEARSED TIME TO BATTALION S3/FDO
_____ COMPENSATE FOR ALL NONSTANDARD CONDITIONS; MEET REQUIREMENTS FOR ACCURATE PREDICTED FIRE
PLATOON/BATTERY:
_____ PREPARE ALTERNATE POSITION COMPLETELY

_____ BRIEF IMMEDIATE ACTION STATUS
_____ SURVEY IN POSITION AND GUNS
_____ VERIFY UNIFORM STORAGE OF MASSING LOTS

Table L-11. Artillery Raid

SECTION:
_____ AMMUNITION LOADED IAW MISSION
_____ CONDUCT MAP RECONNAISSANCE OF ROUTE AND POSITION
_____ BRIEF ROUTE TO ALL PERSONNEL
_____ RECOVERY PLAN UNDERSTOOD
_____ TARGETS BRIEFED AND REHEARSED WITH FDC
_____ ALL VEHICLES TOPPED OFF WITH FUEL
_____ PMCS VEHICLES AND HOWITZERS
_____ MOVEMENT FORMATION PLAN REHEARSED
_____ DO THREAT PCC FOR LIKELY THREATS
_____ CHECK ALL NIGHT VISION GOGGLES, NIGHT SIGHTS, AND LIGHTING DEVICES (IN SECTION COLOR)
PLATOON:
_____ RECONNOITER (MINIMUM MAP RECONNAISSANCE) ROUTE AND POSITION AREA; BRIEF LEADER'S PLAN IN DETAIL
_____ CONDUCT IPB OF POSITION AREA WITH S2; DIRECT APPROPRIATE THREAT PCCs
_____ VERIFY RECOVERY PLAN
_____ REHEARSE CASEVAC PLAN
_____ TAKE MISSION ESSENTIAL VEHICLES ONLY
_____ VERIFY SURVEY PLAN FOR UNIT AND RADAR
_____ PLAN AND TRACK REQUIRED LOGISTICS SUPPORT
_____ REHEARSE SECURITY PLAN
_____ REHEARSE ACTIONS ON OBJECTIVE

PERSONNEL AND EQUIPMENT PCCs

Table L-12. INDIVIDUAL PREPARATION FOR COMBAT

_____ LOAD-BEARING EQUIPMENT COMPLETE
_____ FIRST AID PACKET COMPLETE
_____ EAR PLUGS
_____ CANTEEN FULL W/M17 DRINKING CAP
_____ HELMET W/ CAMOUFLAGE COVER AND BAND
_____ WEAPONS ZERO
_____ DA 1156 CASUALTY FEEDER W/ BATTLE ROSTER
_____ DA 1155 WITNESS STATEMENT
_____ FLACK VEST
_____ FLASH LIGHT W/ FILTERS AND BATTERIES
_____ NBC INDIVIDUAL EQUIPMENT SERVICEABLE:
    _____ PROTECTIVE MASK W/ CARRIER
    _____ OPTICAL INSERTS (IF REQUIRED)
    _____ ANTI-FOGGING KIT
    _____ HOOD
    _____ CHEMICAL COVER
    _____ M258A1 DECONTAMINATION KIT
    _____ M8/M9 DETECTOR PAPER
    _____ PROTECTIVE CLOTHING (SUIT, BOOTS, GLOVES)
_____ CURRENT MOPP IMPLEMENTED
_____ INDIVIDUAL WEAPON W/ LOADED MAGAZINES
    AND BASIC LOAD OF AMMUNITION
_____ IDENTIFICATION TAGS AROUND NECK
_____ IDENTIFICATION CARD
_____ DRIVER'S LICENSE
_____ CHALLENGE AND PASSWORD CONFIRMED

Table L-13. First Sergeant

_____ INDIVIDUAL PCIs COMPLETED (SUPPORT PERSONNEL)
_____ LP/OP BRIEFED/POSITIONED
_____ BATTERY DEFENSE CHECKED
_____ FIELD SANITATION ENFORCED
_____ HELIPAD IDENTIFIED/MARKED
_____ CASUALTY COLLECTION POINT IDENTIFIED
_____ ACCOUNTABILITY OF PERSONNEL TO ALOC
_____ ACCOUNTABILITY OF SENSITIVE ITEMS TO ALOC
_____ VEHICLE STATUS TO ALOC

Table L-14. Platoon Leader

STAND TO:
_____ SITUATION BRIEF
_____ CHALLENGE/PASSWORD

Table L-15. Platoon Sergeant

_____ VERIFY PERIMETER DEFENSE
_____ LP/OPs CHECKED
_____ EARLY WARNING DEVICES

Table L-16. Gunnery Sergeant

_____ ACCOUNTABILITY OF AIMING CIRCLES
_____ ADVANCE PARTY BAGS COMPLETE

Table L-17. Chief of Section

FIGHTING / SURVIVABILITY POSITION:
_____ INDIVIDUAL PCIs COMPLETED
_____ M2/M60/M19 PCIs COMPLETE
_____ RANGE CARD PREPARED
_____ AIMING STAKES IN PLACE
_____ FLANK AND OVERHEAD COVER IN GOOD REPAIR
_____ GRENADE SUMP CLEAN AND FREE OF DEBRIS
_____ BRIEF ON SITUATION
_____ CONFIRM CHALLENGE AND PASSWORD
_____ PERSONNEL ACCOUNTABILITY
_____ SENSITIVE ITEMS
_____ VEHICLE STATUS
_____ WEAPONS STATUS
CAMOUFLAGE:
    _____ ALL VEHICLES/ EQUIPMENT/ POSITIONS
    _____ NETS NOT TOUCHING
    _____ GLASS AND MIRRORS COVERED
_____ LOAD PLAN CHECKED

Table L-18. Howitzer Section Chief

PMCS:

_____ INTERCOMMUNICATION SYSTEM
_____ HYDRAULIC POWER PACK
_____ REPLENISHER SYSTEM PRESSURE (17-24 PSI)
_____ RECUPERATOR
_____ RECOIL SYSTEM

_____ VERIFY AMMUNITION COUNT ON DA Form 4513
_____ SEND CURRENT AMMUNITION COUNT TO FDC
_____ SEND POWDER TEMPERATURE TO FDC

Table L-19. Gunner

PMCS:

_____ FIRE EXTINGUISHER BOTTLES
_____ TRAVERSING MECHANISM
_____ ELEVATING MECHANISM
_____ TELESCOPE MOUNT M145
_____ PANORAMIC TELESCOPE
_____ COLLIMATOR

_____ REFERENCE POINTS VERIFIED
_____ PRIORITY TARGET DATA RECORDED
_____ VERIFY BORESIGHT WITH M140 ALIGNMENT DEVICE

Table L-20. Number One Cannoneer

PMCS:

_____ RAMMER
_____ BREECH OPENING CAM AND ROLLERS
_____ FIRING MECHANISM, FIRING BLOCK ASSEMBLY
_____ PRIMER CHAMBER
_____ BREECHBLOCK
_____ OBTURATOR SPINDLE

_____ IDENTIFY TUBE CONDITION

Table L-21. Number Two Cannoneer

PMCS:
- _____ BUSTLE RACK
- _____ MUZZLE BRAKE
- _____ M140 ALIGNMENT DEVICE
- _____ SPADES

_____ AMMUNITION SEGREGATED BY LOT
_____ AMMUNITION COUNT

Table L-22. Driver

PMCS:
- _____ FIXED FIRE EXTINGUISHER
- _____ ROAD WHEELS, IDLER WHEELS, TRACK TENSION
- _____ TRAVEL LOCK
- _____ PARKING BRAKE
- _____ FUEL FILTERS
- _____ FUEL LEVEL
- _____ COOLING SYSTEM
- _____ ENGINE OIL LEVEL
- _____ TRANSMISSION LEVEL
- _____ INSTRUMENTS AND GAUGES
- _____ STEERING
- _____ BATTERIES
- _____ FINAL DRIVES

Table L-23. M2/M60/M19 Gunner

_____ PMCS PERFORMED
_____ SPARE BARRELS, CLEANING TOOLS, GLOVES AND RUPTERED-CARTRIDGE EXTRACTORS PRESENT
_____ HEAD SPACE AND TIMING GAUGE SERVICEABLE
_____ HEAD SPACE AND TIME SET ON M2 MACHINE GUN
_____ MACHINE GUN PROPERLY MOUNTED TO INLCUDE LOCK AND PINS
_____ FUNCTION CHECK PERFORMED
_____ AMMUNITION BASIC LOAD PRESENT
_____ RANGE CARD PREPARED
_____ VERIFY LEFT AND RIGHT LIMITS

Table L-24. Vehicle Preparation for Combat

DRIVER:
_____ PMCS PERFORMED
_____ TOPPED OFF
_____ LOAD PLAN PRESENT
_____ LOADED ACCORDING TO LOAD PLAN
_____ POL PACKAGED PRODUCTS (INCLUDING WEAPONS OIL)
_____ WATER CAN FULL
_____ MRE/RATIONS STOWED
_____ WEAPONS CLEANING KITS
_____ ON-VEHICLE MATERIAL (OVM) CLEAN AND SERIVCEABLE
_____ BASIC ISSUE ITEMS PRESENT
_____ SPARE TRACK BLOCKS
_____ FIRST AID KITS COMPLETE
_____ TOOLS AND TOOL KITS
_____ FIRE EXTINGUISHERS (FIXED AND PORTABLE) SEALED, TAGGED AND UPDATED
_____ M13/M11 DECONTAMINATION APPARATUS SERVICEABLE AND MOUNTED
_____ 2-4 QUARTS OF DS-2/VEHICLE PRESENT
_____ GOGGLES
_____ INTERIOR CLEAN AND ORDERLY

Table L-25. NBC Equipment: NBC Representative Check

_____ INDIVIDUAL PCIs COMPLETED
_____ AUTOMATIC CHEMICAL AGENT ALARMS ARE EMPLACED AND OPERATIONAL WITH 400 METERS WD-1 WIRE
_____ PMCS PERFORMED ON M8A1
_____ M229 REFILL KIT ISSUED FOR EACH M8A1 AUTOMATIC CHEMICAL AGENT ALARM
_____ ONE COMPLETE AND SERVICEABLE M256/M256A1 CHEMICAL AGENT DETECTOR KIT ISSUED PER SECTION
_____ IM-174 SERIES RADIAC METERS ISSUED
_____ TWO SETS OF BATTERIES ISSUED FOR EACH IM-174
_____ IM-93/147 RADIAC METERS (DOSIMETERS) ISSUED
_____ GTA 3-6-2 NBC WARNING/REPORTING SYSTEM ISSUED
_____ PYRIDOSTIGMINE BROMIDE TABLETS AND NERVE AGENT ANTIDOTE AVAILABLE TO DISTRIBUTE TO PERSONNEL
_____ NBC MARKING SET PRESENT
_____ NBC TEMPLATES ON HAND

Table L-26. Medic

_____ INSPECT AID BAG

Table L-27. Communications

_____ INDIVIDUAL PCIs COMPLETED (PLATOON)
PMCS COMPLETE:
    _____ SPARE COMMUNICATIONS EQUIPMENT
    _____ COMMUNICATIONS PLATOON VEHICLES
_____ ALL SENSITIVE ITEMS ACCOUNTED FOR
_____ COORDINATED PICK UP/TURN IN OF SIGNAL OPERATION INSTRUCTIONS
_____ COORDINATED PICK UP/TURN IN OF COMMUNICATIONS SECURITY EQUIPMENT
_____ COORDINATED PICK UP/TURN IN OF COMMUNICATIONS EQUIPMENT

Table L-28. Fire Direction Officer

VERIFY BCS DATA BASE:
_____ AFU;UPDATE
_____ BCS;PIECES
_____ AFU;BAMOUP
_____ AFU;REG
_____ MVV FILE
_____ MET;CM
_____ BCS;SWITCHES
_____ FIRE PLAN FILE
_____ TARGET KNOWN POINT FILE
_____ SECONDARY CHECKS MEET TOLERANCE
_____ DIGITAL/VOICE COMMUNICATIONS WITH GUNS
_____ COMMUNICATIONS WITH BOC
_____ PRIORITY TARGETS/FPFs (UPDATED)

Table L-29. Fire Direction Chief

_____ UPDATE FILE
_____ AMMUNITION FILE
_____ MVV FILE
_____ REGISTRATION FILE
_____ MET FILE
_____ TARGET KNOWN POINT FILE

Table L-30. M577 Preparation for Combat

DRIVER:
_____ PMCS PERFORMED
_____ TOPPED OFF
_____ LOAD PLAN PRESENT
_____ LOADED ACCORDING TO LOAD PLAN
_____ POL PACKAGED PRODUCTS (INCLUDING WEAPONS OIL)
_____ WATER CAN FULL
_____ MEALS READY TO EAT/RATIONS STOWED
_____ WEAPONS CLEANING KITS
_____ OVM CLEAN AND SERVICEABLE
_____ BIIs PRESENT
_____ SPARE TRACK BLOCKS
_____ FIRST AID KITS COMPLETE
_____ TOOLS AND TOOL KITS
_____ FIRE EXTINGUISHERS (FIXED AND PORTABLE) SEALED, TAGGED, AND UPDATED
_____ M13/M11 DECONTAMINATION APPARATUS SERVICEABLE AND MOUNTED
_____ 2-4 QUARTS OF DS-2/VEHICLE PRESENT
_____ GOGGLES
_____ INTERIOR CLEAN AND ORDERLY
_____ INTERCOMMUNICATIONS SYSTEM

Table L-31. Radio-Telephone Operator (Communications Equipment)

PMCS COMPLETE:
_____ RADIOS
_____ ANTENNA
_____ MULTIPLEXER
_____ SECURE EQUIPMENT
_____ KYK-13 ACCOUNTED FOR/PRESENT
_____ CALL SIGN BOARD PRESENT/CURRENT
_____ PROPER FREQUENCIES SET
_____ MULTIPLEXER SET/TUNED
NET CALL COMPLETE:
_____ FIRE SUPPORT COORDINATION NET
_____ FIRE DIRECTION NET
_____ TA-312/ TA PRESENT, OPERATIONAL WITH BATTERIES
_____ AN/GRA-39 OPERATIONAL WITH BATTERIES, DR-8s
_____ BLANK REPORT FORMS ON HAND
_____ SPARE EQUIPMENT AVAILABLE:
_____ HAND MICROPHONES
_____ HEADSETS
_____ ANTENNAS
_____ BATTERIES

Table L-32. Generator Operator

_____ PMCS PERFORMED
_____ TOPPED OFF
_____ PROPERLY MOUNTED

Table L-33. Vehicle Commander

VEHICLE PMCS COMPLETE:
_____ AUTOMOTIVE
_____ GENERATOR
_____ COMMUNICATIONS
_____ ARMAMENT
_____ CURRENT SOI
_____ GREASE/WATERPROOF MARKERS
_____ PEN/PENCIL
_____ NOTEBOOK
_____ BINOCULARS PRESENT/SERVICEABLE
_____ NIGHT VISION DEVICES PRESENT/SERVICEABLE
_____ SPARE BATTERIES PRESENT
_____ COMPASS PRESENT/SERVICEABLE/DECLINATED

_____ CVC HELMET OPERATIONAL
_____ MAP AND OVERLAY
_____ GOGGLES
_____ HEADSPACE AND TIMING CHECKED ON M2 MACHINE GUN
_____ VEHICLE LOAD PLAN CHECKED

Table L-34. TOC Shift OIC

_____ OPERATIONS/INTELLIGENCE MAPS POSTED WITH CURRENT GRAPHICS
_____ UNIT STATUS CHARTS CURRENT
_____ TOC SHIFT BRIEFED ON CURRENT SITUATION
_____ ALTERNATE TOC DESIGNATED/PREPARED TO ASSUME MISSION
TOC SHIFT BRIEF ON JUMP TOC PLAN:
    _____ PERSONNEL IDENTIFIED
    _____ VEHICLE/EQUIPMENT IDENTIFIED
    _____ NEW LOCATION/ROUTE IDENTIFIED
BATTALION PCIs COMPLETED/CORRECTIVE ACTION TAKEN:
_____ TOC
_____ A BATTERY
_____ B BATTERY
_____ C BATTERY
_____ COMBAT TRAINS
_____ FIELD TRAINS
_____ COMMANDER/S3 INFORMED OF PCI COMPLETION

Table L-35. TOC Shift NCOIC

_____ TOC PERSONNEL ACCOUNTED FOR
_____ INDIVIDUAL PCIs COMPLETED (TOC SHIFT)
_____ REFERENCE MANUALS CHECKED BY LOAD PLAN
_____ TOC SHIFT PRESENT
_____ TOC SET UP TO STANDARD
_____ TOC OPERATIONS LOG ESTABLISHED
_____ TOC OPERATIONS SUPPLIES PRESENT FOR SUSTAINED OPERATIONS
_____ ALTERNATE TOC/CP PREPARED TO PERFORM MISSION
TOC CONFIGURED FOR A JUMP CAPABILITY:
    _____ PERSONNEL
    _____ EQUIPMENT
_____ SLEEP PLAN ESTABLISHED
_____ EFFECTIVE DOWNWIND MESSAGE/CHEMICAL DOWNWIND MESSAGE
    MESSAGE PRESENT AND DISSEMINATED IF REQUIRED
_____ MOPP LEVEL ESTABLISHED/DISSEMINATED
_____ ADA WARNING/WEAPONS CONTROL STATUS ESTABLISHED/DISSEMINATED

OPERATIONS AND INTELLIGENCE PCIs COMPLETED:
_____ VEHICLE COMMANDERS
_____ RTO
_____ AFATDS
REMAINING TOC PCIs COMPLETED:
_____ FDC
_____ NBC
_____ SURVEY
_____ RADAR
_____ COMMUNICATIONS
REMAINING BATTALION PCIs COMPLETED:
_____ A BATTERY
_____ B BATTERY
_____ C BATTERY
_____ COMBAT TRAINS
_____ FIELD TRAINS

Table L-36. Armament Systems Gunner

_____ PMCS PERFORMED
_____ CLEAN
_____ SPARE BARRELS, CLEANING TOOLS, GLOVES AND RUPTURED-CARTRIDGE EXTRACTORS PRESENT
_____ HEAD SPACE AND TIMING GAUGE SERVICEABLE
_____ HEAD SPACE AND TIMING SET ON M2 MACHINE GUN
_____ MACHINE GUNS PROPERLY MOUNTED TO INCLUDE LOCK AND PINS
_____ FUNCTION CHECK PERFORMED
_____ AMMUNITION BASIC LOAD PRESENT

Glossary

AAR	after action review
ACR	armored cavalry regiment
ACU	AFCS computer unit
ADA	air defense artillery
ADAM	area denial artillery munitions
adj	adjust
adrs	address
AFATDS	advanced field artillery tactical data system
AFCS	automatic fire control system
AFES	automatic fire extinguisher system
AFSO	aerial fire support observer
AFU	ammunition and fire unit
A/L	administrative and logistics
ALOC	administrative and logistics operations center
alt	altitude

AMC	at my command
ammo	ammunition
AOF	azimuth of fire
APU	auxiliary power unit
AR	Army regulation
ARPA	Archaeological Resources Protection Act
ARTEP	Army training and evaluation program
ATC	ammunition team chief
ATHS	airborne target handover system
ATP	ammunition transfer point
AUTL	Army Universal task list
az	azimuth
BAO	battalion ammunition officer
BAS	battalion aid station
BAT	be advised that
BC	battery commander
BCS	battery computer system
BDA	battle damage assessment

BII	basic issue item
BITE	built-in test equipment
BMO	battalion maintenance officer
BMT	battalion maintenance technician
bn	battalion
BOC	battery operations center
BSA	brigade support area
BSOC	battalion support operations center
C2	command and control
CANALL	cancel all
CASEVAC	casualty evacuation
CCL	combat configured load
CCP	confidence check point
CEP	circular error probable
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFC	chloroflouro carbons
CFF	call for fire
CFL	coordinated fire line

CFR	Code of Federal Regulations
chg	charge
CM	computer met
CNR	combat net radio
COLT	combat observation lasing team
comm	communication
comnds	commands
CONUS	continental United States
coord	coordinate
CP	command post or concrete piercing (fuze)
COS	chief of section
CSECT	center sector
CSR	controlled supply rate
CSS	combat service support
CVC	combat vehicle crewman
CWA	Clean Water Act
D	digital
DA	Department of the Army

DAP	distant aiming point
DBR	database recording
DD:HH:MM	day:hour:minute
DELALL	delete all
destn	destination
df	deflection
DOT	Department of Transportation
DPICM	dual-purpose improved conventional munitions
DRMO	Defense Reutilization Marketing Office
DRU-H	dynamic reference unit-hybrid
DS	direct support
DTG	date time group
DU	display unit
E	easting
ECO	environmental compliance office
EFAT	essential field artillery task
EFST	essential fire support task
elev	elevation

EO	executive order
EOD	explosive ordnance disposal
EOM	end of mission
EOL	end of the orienting line
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Endangered Species Act
EW	electronic warfare
FA	field artillery
FAASV	field artillery ammunition support vehicle
FAAD	firing area defense diagram
FASP	field artillery support plan
FD	fire direction
FDC	fire direction center
FDO	fire direction officer
FED	forward entry device
FFE	fire for effect
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act

FIST	fire support team
FLOT	forward line of own troops
FM	field manual, fire mission, or frequency modulated
FOCMD	forward observer command
FPF	final protective fire
FR	fire request
FRTP	flat rack transfer point
FSB	forward support battalion
FSE	fire support element
FSCM	fire support coordinating measure
FSCOORD	fire support coordinator
FSO	fire support officer
ft	feet
fz	fuze
geom	geometry
GPS	global positioning system
GRS	geodetic reference system
GS	general support

GSG	gunnery sergeant
GSR	general support reinforcing
HB	high-burst
HE	high explosive
HEMTT	heavy expanded-mobility tactical truck
HHB	headquarters and headquarters battery
HHS	headquarters, headquarters and service battery
HM/HW	hazardous material/hazardous waste
HMMWV	high-mobility multipurpose wheeled vehicle
how	howitzer
hrs	hours
HTC	howitzer tracking chart
HTU	hand-held terminal unit
HQ	headquarters
IAW	in accordance with
ICM	improved conventional munition
id	identification
IFSAS	initial fire support automation system

in	inch
IP	internet protocol
IPB	intelligence preparation of the battlefield
km	kilometer
kw	kilowatt
LCU	lightweight computer unit
ldr	leader
LOGPAC	logistics package
LP/OP	listening post/observation post
LRP	logistics release point
LRU	line replaceable unit
LSECT	left sector
maint	maintenance
MAP MOD	map modification
MAPS	modular azimuth positioning system
max	maximum
mech	mechanical (fuze)
met	meteorological

METT-TC mission, enemy, terrain and weather, troops, time available, and civil considerations

min QE minimum quadrant elevation

MLRS multiple launch rocket system

MMS meteorological measuring system

MOPP mission oriented protective posture

MPI mean point of impact

MSDS material safety data sheet

MSE mobile subscriber equipment

MSN mission

MSR main supply route

MSU mutual supported unit

MTO message to observer

MTP mission training plan

MTSQ mechanical time superquick (fuze)

MV muzzle velocity

MVS muzzle velocity system

MVV muzzle velocity variation

N northing

NAGPRA	Native American Graves Protection and Repatriation Act
nav	navigation
NBC	nuclear, biological, and chemical
NCO	noncommissioned officer
NCOIC	NCO in charge
NCS	net control station
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
O&I	operations and intelligence
OBCO	observer coordinates (observer location)
obsr	observer
OCONUS	outside the continental United States
OEBGD	Overseas Environmental Baseline Guidance Document
OSHA	Occupational Safety and Health Administration
OVM	on-vehicle material
PA	position area

PADS	position azimuth determining system
pantel	panoramic telescope
PCC	precombat check
PCI	precombat inspection
PCU	power conditioner unit
PD	point detonating (fuze)
PDIU	prognostic/diagnostic interface unit
PDSQ	point detonating superquick (fuze)
PE	probable error
PLGR	precision lightweight GPS receiver
PLS	palletized load system
plt	platoon
pltn	platoon
PMCS	preventive maintenance checks and services
POC	platoon operations center
POL	petroleum, oils, and lubricants
posn	position
PRF	pulse repetition frequency

PRI	priority
PROP	propellant
psi	pounds per square inch
PSNCO	personnel services NCO
PTM	plain text message
QE	quadrant elevation
R	reinforcing
RAAMS	remote antiarmor mine system
RAM	reliability, availability, and maintainability
RAP	rocket assisted projectile
RAT	record as target
RCRA	Resource Conservation Recovery Act
REG	registration
REQ	request
rg	range
rng	range
RPM	revolutions per minute
RSECT	right sector

RSO	reconnaissance survey officer
RSOP	reconnaissance, selection, and occupation of position
RTF	ready to fire
R3SP	rearm, refuel, resupply, and survey point
SA	subsequent adjust
SARA	Superfund Amendment Reauthorization Act
SBT	subscriber table
SCATMINE	scatterable mine
SCP	survey control point
sec	second
sect	sector or section
SGT	sergeant
SH	shell
shft	shift
SINCGARS	single channel ground & airborne radio system
SOP	standing operating procedures
SP	self-propelled or start point
sph	spheroid

sprt	support
STP	soldier's training publication (soldier's manual)
subq	subsequent
surv	surveillance
sys	system
TA	target acquisition
TAA	tactical assembly area
TC	track commander or training circular
temp	temperature
TGT	target
ti	time
TLP	troop leading procedure
TM	technical manual
TOC	tactical operations center
TOT	time on target
TRP	target reference point
TSOP	tactical SOP
TTP	tactics, techniques, and procedures

UMCP	unit maintenance collection point
URN	unit reference number
USAFAS	United States Army Field Artillery School
UTE	unable to execute
V	voice
VHF	very high frequency
VMS	vehicle motion sensor
VT	variable time
WGS	world geodetic system
XO	executive officer
ZUPT	zero velocity update
1SG	first sergeant

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