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TOW WEAPONS SYSTEMS

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PREFACE

This manual discusses the many changes in the TOW missile, TOW training, and OPFOR armored vehicles and countermeasures. It includes training information on the M220A1 (basic) and M220A2 tube-launched, optically tracked, wire-guided (TOW) weapon systems and carriers (M966/M901 -series). Its intended audience includes leaders and members of mechanized infantry, infantry, airborne, and airmobile infantry organizations who train and test individuals and crews, (All mechanized units in E Company with M2/M3 Bradley TOW vehicles should refer to FM 23-1 for advanced gunnery.)

The proponent of this publication is US Army Infantry School. Send comments and recommendations on DA Form 2028 directly to Commandant, US Army Infantry School, ATTN: ATSH-INB-B, Fort Benning, Georgia 31905-5595.

Unless otherwise stated, masculine nouns and pronouns do not refer exclusively to men.

CHAPTER 1

INTRODUCTION

The TOW is a crew-portable heavy antitank missile weapon system that can be operated from armored, lightly armored, and unarmored multipurpose vehicles and helicopters, and from the ground mount. The system consists of a guided missile and a launcher to engage tanks, fortifications, and other materiel targets. The term TOW is an acronym derived from the words that describe the principal operating features of the missile—tube-launched, optically tracked, wire-guided. The launcher initiates, tracks, and controls the flight of the missile by guidance signals transmitted over a command-link wire that connects the missile with the launcher.

1-1. CHARACTERISTICS

The TOW weapon system consists of a launcher, which has tracking and control capabilities, and the missile, which is encased in a launch container. The launcher is equipped with self-contained, replaceable units.

a. **Capabilities.** The TOW is mainly an antitank weapon used for long-range engagement of armored targets. It can be employed in all weather conditions as long as the gunner can see his target through the daysight tracker or nightsight. The TOW also provides a long-range assault capability against heavily fortified bunkers, pill boxes, and gun emplacements.

(1) The ITOW missile can destroy targets at a minimum range of 65 meters and a maximum range of 3,750 meters. The TOW 2B missile can destroy targets at a minimum range of 288 meters when fire from the ground mount and 200 meters when tired from the HMMWV, ITV, or BTV. The TOW 2B has a maximum range of 3,750 meters whether ground- or vehicle-mounted.

(2) The automatic missile tracking and control capabilities of the TOW weapon system provide a high first-round-hit probability. To operate the system, the gunner places the cross hairs of the sighting system (either the daysight tracker or the nightsight) on the target, fires the missile, and centers the cross hairs on the target image until missile impact. The optical tracking and command functions within the system guide the missile along the gunner's line of sight. The gunner does not apply lead, windage, or elevation.

b. **Mobility.** The TOW weapon system can be vehicle-mounted or ground emplaced (tripod-mounted) for operation. Missiles can be launched from either operational mode. (Detailed operating procedures for each configuration are provided in Chapters 2, 3, and 4.)

(1) The entire system can be hand-carried by a weapon crew; therefore, emplacement sites can be changed quickly to minimize detection or to engage targets that are out of range.

(2) The vehicle-mounted launcher is more mobile and can be quickly prepared for use. The launcher can be assembled and disassembled without the use of tools.

(3) Built-in self-test circuits can be used to check the operational condition of the assembled launcher whether ground- or vehicle-mounted.

1-2. SYSTEM CONFIGURATIONS

The TOW weapon system comes in two configurations—the M220A1 (TOW) and the M220A2 (TOW 2).

a. **M220A1 TOW Weapon System.** The M220A1 TOW (Figure 1-1) consists of a tripod, a traversing unit, a launch tube, a day sight tracker, an AN/TAS-4 nightsight, a missile guidance set (MGS), a battery assembly housed in the compartment of the MGS, and an encased missile.

(1) The M220A1 TOW weighs about 265.5 pounds with all of its components and carrying cases; with encased missile (BGM-71A), it weighs 320 pounds. (For a detailed description of the M220A1 TOW, see TM 9-1425-472-12.)

(2) The M220A1 TOW can fire all four configurations of TOW missiles, which include many types. However, it cannot take full advantage of the BGM-71D TOW 2 and BGM-71E TOW 2A or TOW 2B counter countermeasures when tracking through obscurants.

b. **M220A2 TOW 2 Weapon System.** The M220A2 TOW 2 (Figure 1-2, page 1-5) is a combination of a modification to the M220A1 TOW launcher and the addition of a new missile. The traversing unit, the digital MGS, and the AN/TAS-4A thermal nightsight of the M220A1 TOW launcher were modified to form the M220A2 TOW 2 launcher. (For a detailed description of the M220A2 TOW 2, see TM 9-1425 -450-12.)

(1) The M220A2 TOW 2 weapon system weighs about 256.5 pounds with all of its components and carrying cases; with encased missile BGM-71D, it weighs about 318.5 pounds.

(2) The TOW 2 missile (BGM-71D) improvements include a new guidance link, a full-caliber 6-inch warhead, a reloaded flight motor, and a longer warhead probe.

(3) The M220A2 TOW 2 launcher is compatible with all four missile configurations. It can achieve a higher probability of hit against all types of targets through improved microprocessor-based electronics that use digital design techniques.

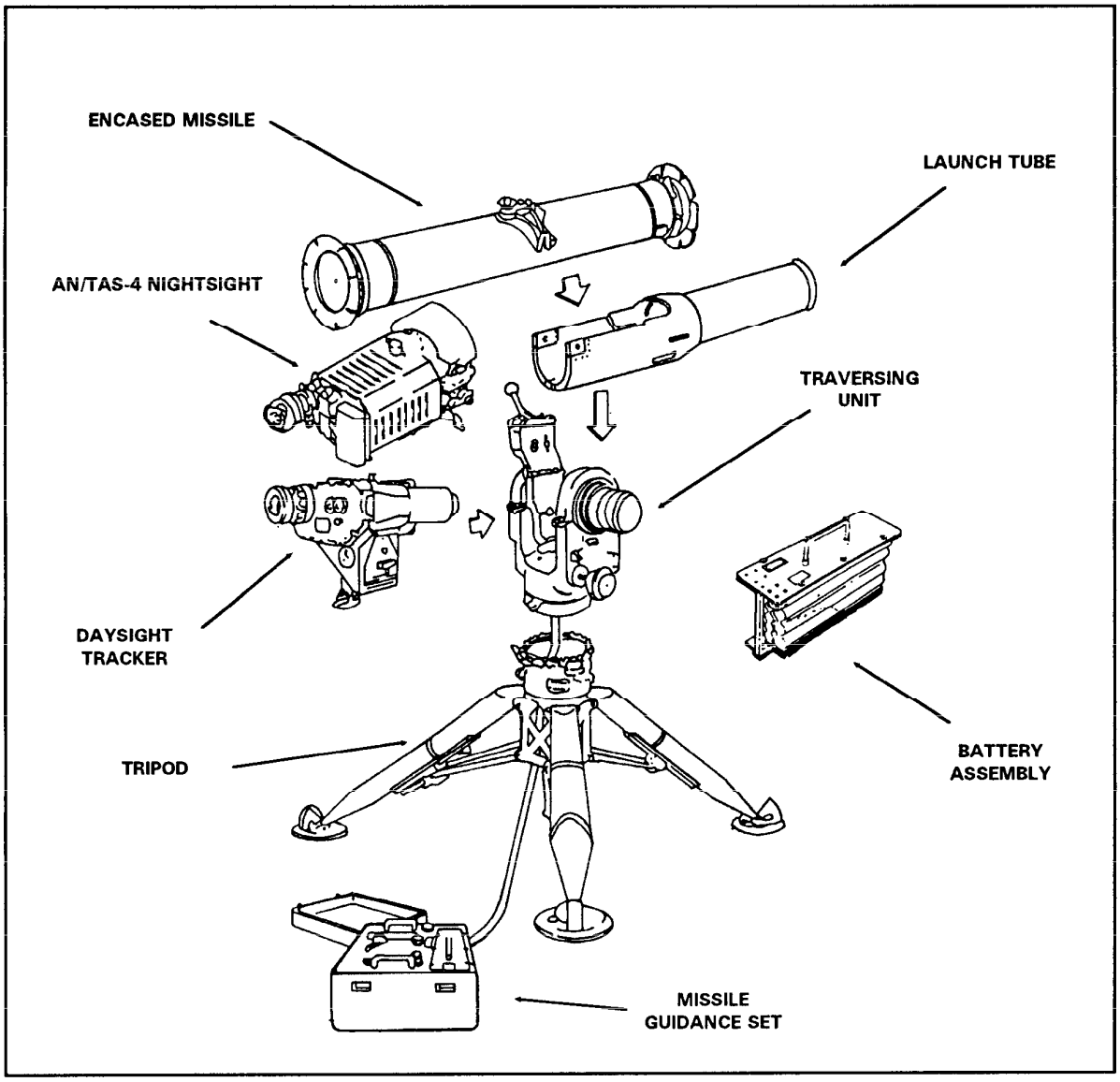


Figure 1-1. M220A1 TOW components.

1-3. MISSILE CONFIGURATIONS AND TYPES

The TOW missile comes in four configurations with numerous types. These types mainly consist of minor MWOs that are transparent to the operator and are continually added to. This FM will not attempt to deal with the various types but will confine itself to the four major configurations. For a current list of the types, refer to the latest changes to the FM. All configurations use the same basic airframe, aerodynamic control system, command-link wire, and missile electronics designs.

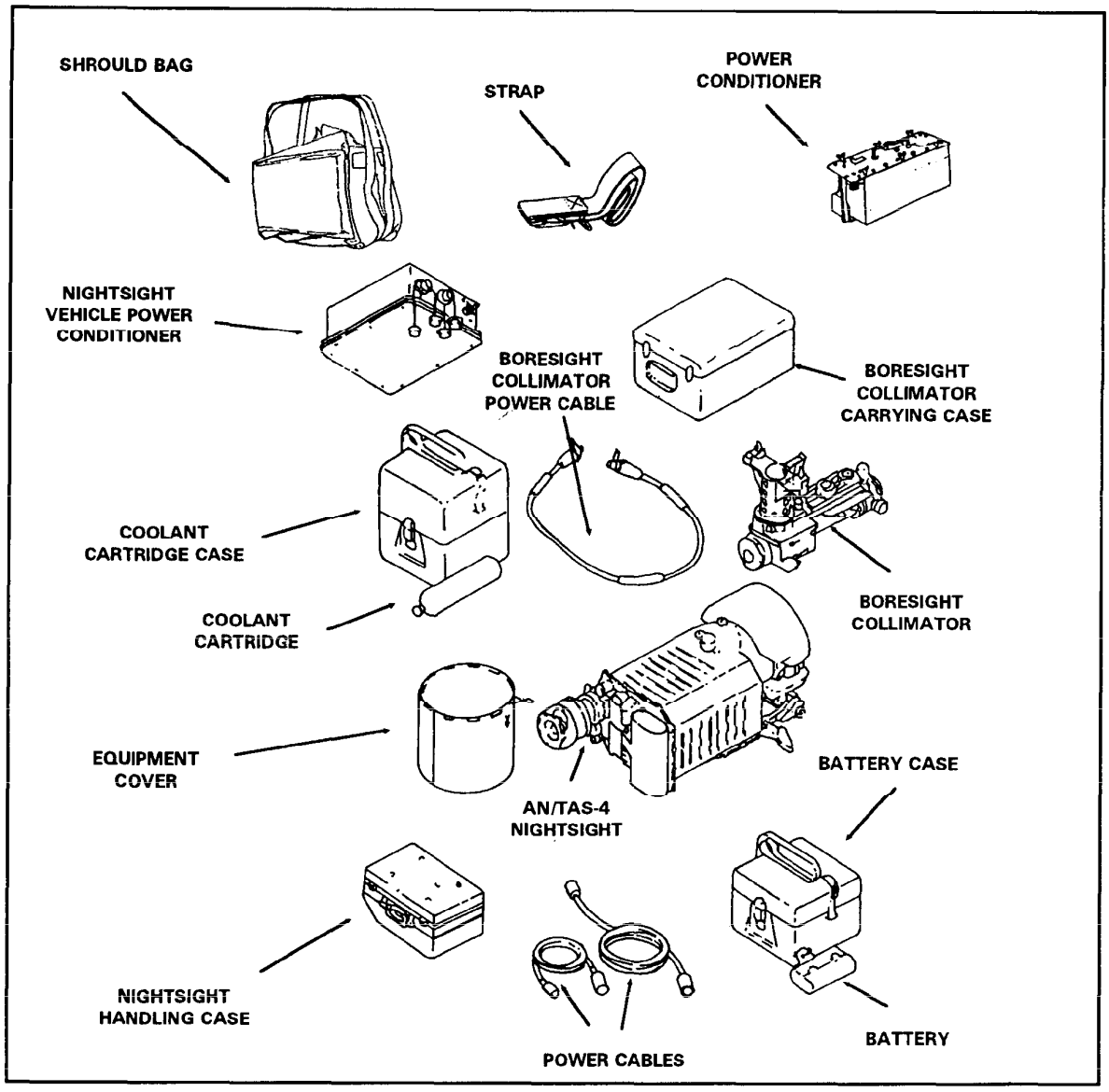


Figure 1-1. M220A1 TOW components (continued).

a. The first configuration is the improved TOW (ITOW). These missiles have improved 5-inch warheads that include extensible probes to provide detonation at a greater standoff distance from the target and to improve penetration.

b. The second configuration is the TOW 2. This missile has a full-caliber 6-inch warhead that includes an extensible probe. In addition to the infrared radiator of the ITOW missile, TOW 2 has a second infrared radiator to provide

hardened system performance against battlefield obscurants and countermeasures. The second radiator is called the thermal beacon and provides link compatibility with the electro-optical infrared nightsight, which is part of the TOW 2 launcher system.

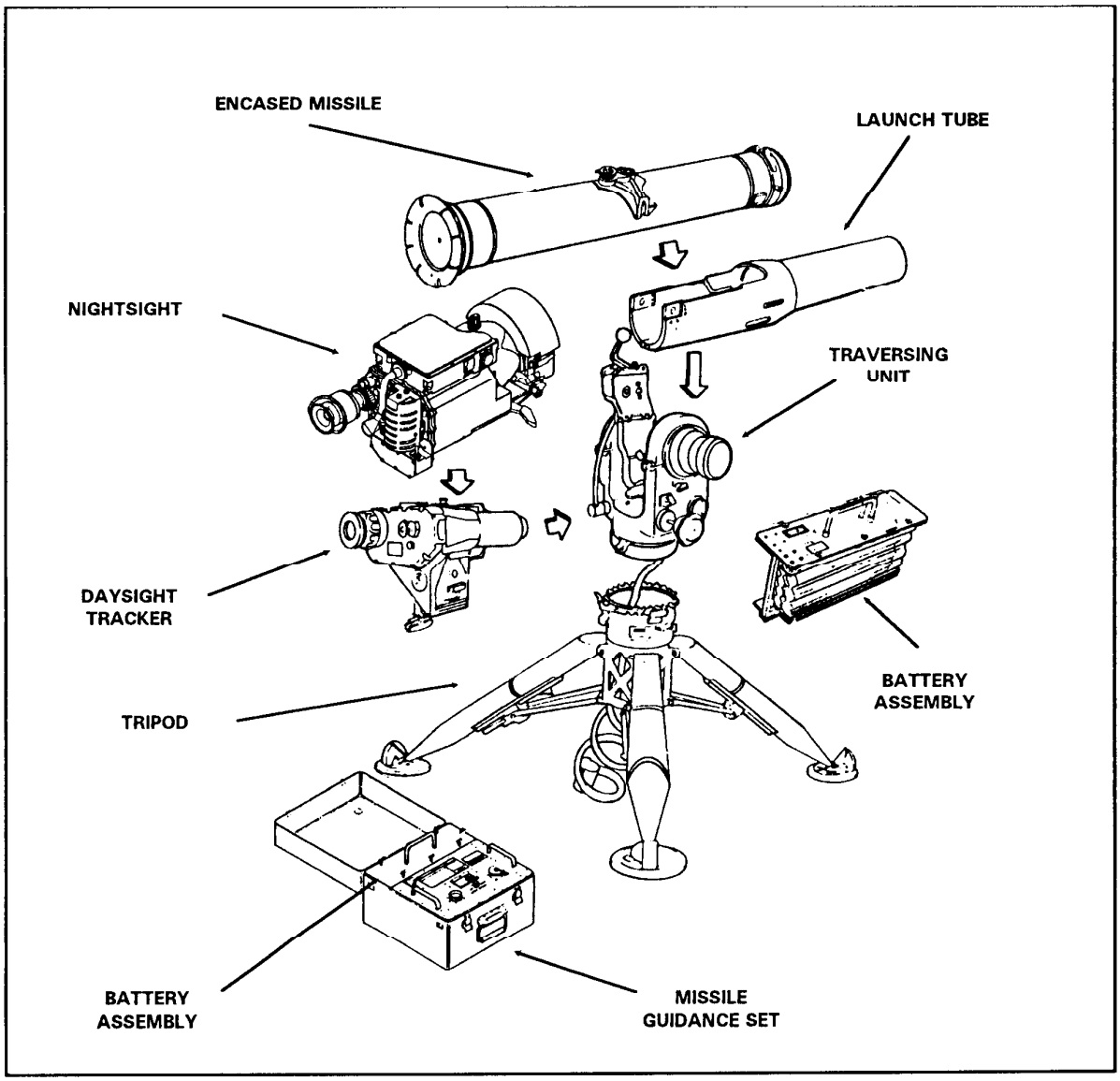


Figure 1-2. M220A2 TOW components.

c. The third configuration is the TOW 2A. The TOW 2A has an added small explosive charge in the tip of the extensible probe providing improved performance against reactive armor by premature detonation.

d. The fourth configuration is the TOW 2B. The TOW 2B has an entirely different warhead and kill mechanism than the other TOW missiles. It is a top-attack missile (fly over/shoot down [FOSD]) that defeats enemy armor at its most vulnerable point-the top deck of the turret and hull. The TOW 2B has a tandem warhead that fires two explosively formed projectiles (EFPs) down through the thin upper deck armor of the enemy vehicle. The gunner tracks the target the same as any other TOW missile with the cross hairs on center mass, but the missile automatically flies 2.25 meters above the line of sight (LOS). When the missile senses that it is directly above the target (by means of the target's shape and magnetic field), it automatically fires its warhead.

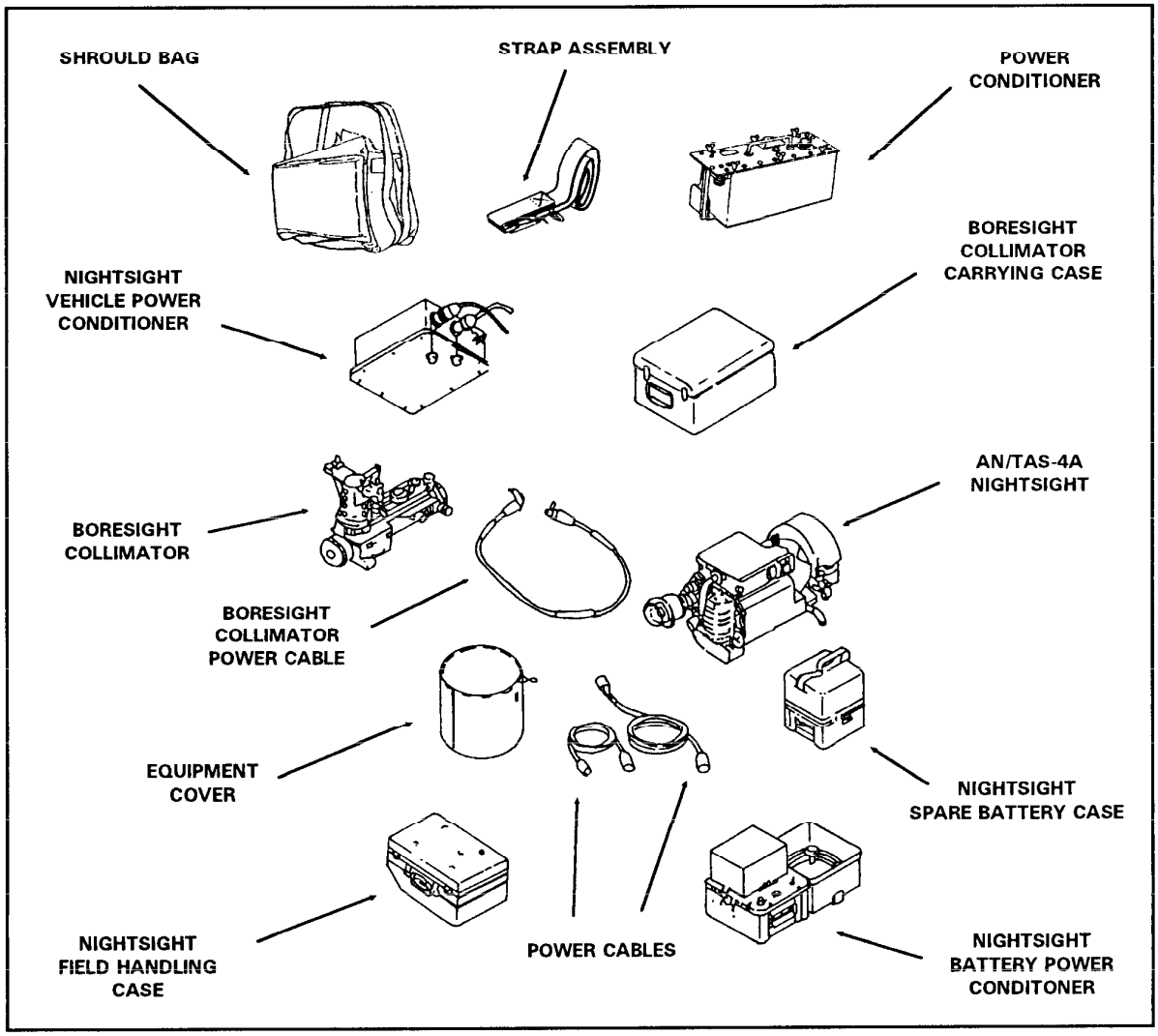


Figure 1-2. M220A2 TOW components (continued).

1-4. TOW MISSILE IDENTIFICATION

With the increased number of TOW missile types and wide variations in their capabilities (especially armor penetration), TOW crews and range safeties must be able to quickly and accurately identify the specific type of missile they have.

a. The configuration of the missile can be readily identified by the various identification decals, tapes, and stencils on the missile case (Figure 1-3 and Table 1-1.) (See TM 9-1410-470-34 for current information on TOW missiles.)

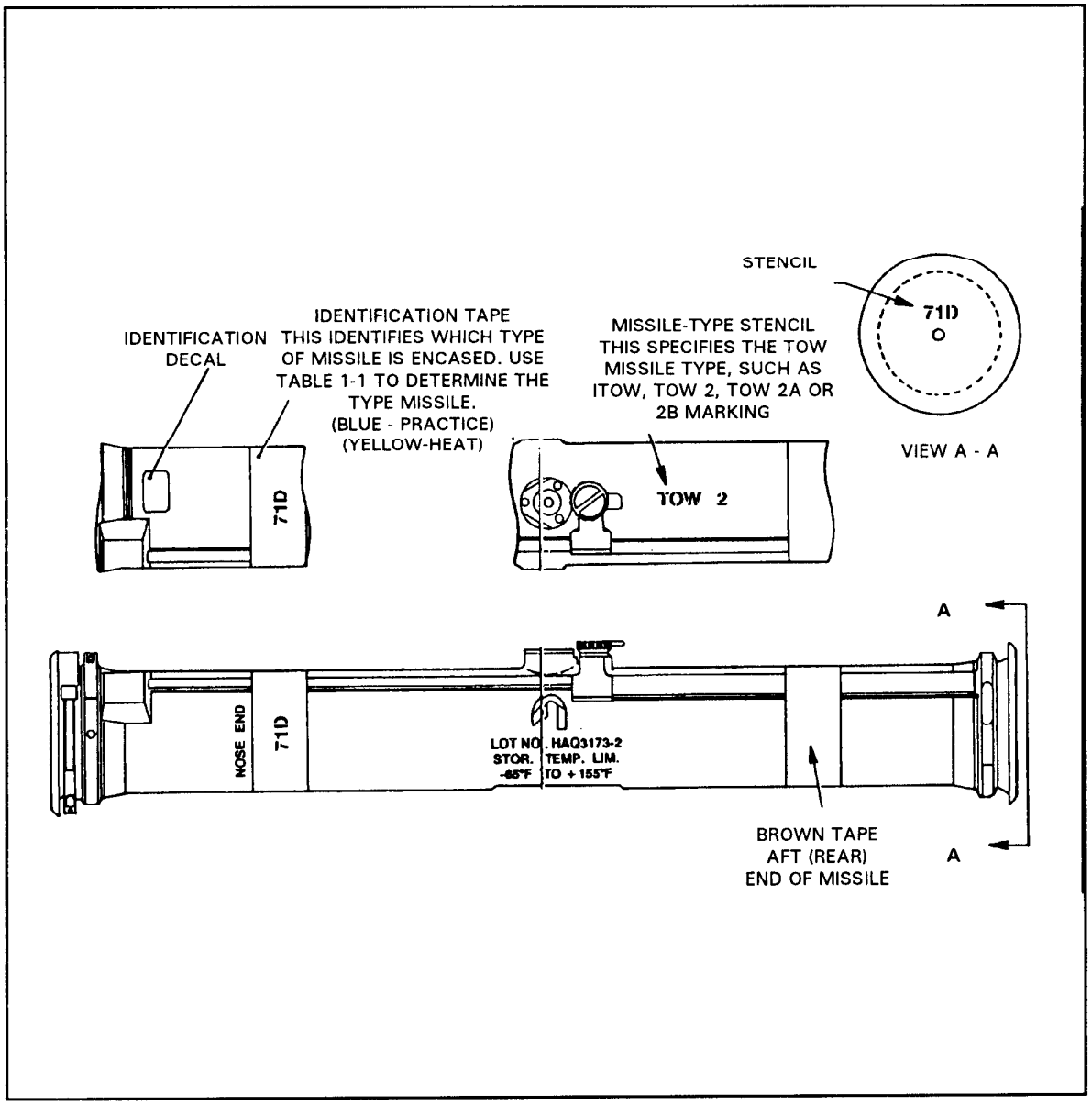


Figure 1-3. TOW missile case markings.

TYPE OF MISSILE	DECAL PLATE DATA
Improved TOW Practice	Guided Missile Practice, STD, BTM-71A1
Improved TOW HE	Guided Missile Surface Attack, ITOW-BGM-71C
TOW 2 Practice	Guided Missile Practice, TOW 2, BTM-71D-1B
TOW 2 HE	Guided Missile Surface Attack, TOW 2, BGM-71D-3B
TOW 2A Practice	Guided Missile Practice, TOW 2A, BTM-71D-1B
TOW 2A HE	Guided Missile Surface Attack, TOW 2A, BGM-71E-3B
TOW 2B Practice	Guided Missile Practice, TOW 2B, BTM-71E-2B
TOW 2B HE	Guided Missile Surface Attack, TOW 2B, BGM-71F
Decals are located on the nose end of the launcher tube. They describe the type of round and model. BLUE—indicates practice round. YELLOW—indicates HE round. WHITE—indicates HE or practice round. BROWN—indicates low explosive (live rocket motor).	

Table 1-1. TOW missile identification.

b. The TOW 2B missile is unique because it is a fly over/shoot down missile. It is marked with a decal as shown in Figure 1-4.

1-5. INTERNAL COMPONENTS AND SEQUENCE OF OPERATIONS

A TOW crewman or leader who thoroughly understands his weapon will be able to employ it to its maximum effectiveness. This paragraph describes the internal missile operations from trigger depression to missile impact. This information will increase the 11H soldier's knowledge of how his weapon functions.

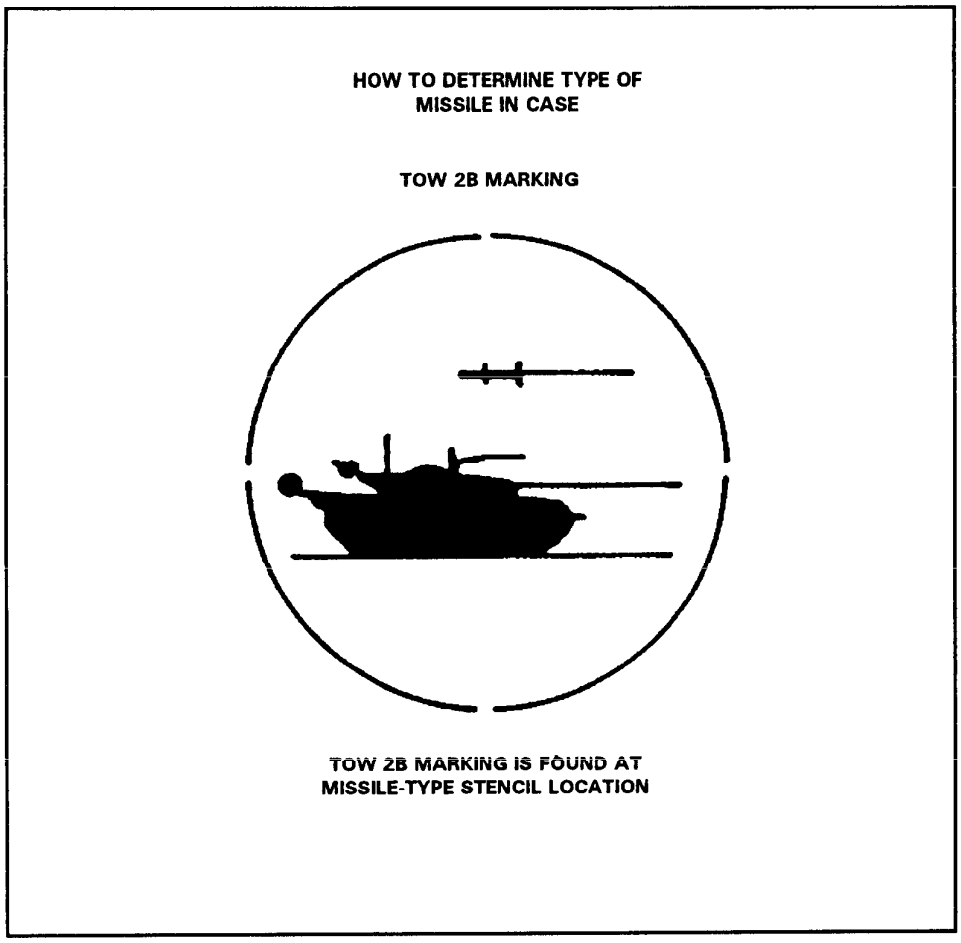


Figure 1-4. TOW 2B marking.

a. **Major Internal Sections and Components.** The missile is divided into three major sections and the launch container.

(1) *Front section.* The front section contains the warhead and the electronics.

(a) The warhead contains an extensible probe on the ITOW and TOW 2-series (17 inches on TOW 2, 10 inches on ITOW). All missile types have a crush ogive switch to detonate the missile (located in the end of the probe tip on ITOW and TOW 2). The warhead is a conventional shaped charge (except TOW 2B) with a copper cone and liner and a detonator at the rear of the charge. The diameter of the warhead is 5.2 inches on ITOW and 6 inches on TOW *2* and 2A.

(b) All electronic circuitry necessary to perform on-board electronic functions while the missile is in flight is contained in the front section. This

circuitry receives steering signals from the MGS and corrects the missile flight path to conform to LOS.

(2) *Center section.* The center section contains the thermal batteries, the gyroscope, and flight motor wings.

(a) The missile has three thermal batteries, which are used instead of storage batteries because their shelf life is much longer. The chemical reaction that produces both heat and electricity is started by an electrical charge that is part of the prefire signal sent when the trigger is depressed. Within approximately two tenths of a second the batteries begin producing electricity.

(b) The gyroscope stabilizes the missile in flight, and it provides information about the attitude of the missile to the MGS from sensors in its housing. When the prefire signal is sent to the missile, an explosive squib on the neck of a bottle of compressed nitrogen is ignited. This produces the popping sound and whirring noise that is heard after the gunner depresses the trigger and before the missile launches. The escaping nitrogen causes the gyroscope to begin spinning in its bracket. When the gyroscope reaches 42,000 rpm, it automatically disengages from its bracket and begins to spin freely in its housing. This causes an electrical current that ignites the launch motor launching the missile from the weapon system.

NOTE: The process of the thermal batteries heating up to produce electricity and the gyroscope coming up to speed and igniting the launch motor takes about 1.5 seconds. This causes the delay between the time when the gunner presses the trigger and the missile actually fires.

(c) The flight motor is a solid fuel rocket motor with two nozzles protruding through the body of the missile at 30-degree angles. The flight motor bums for 1.6 seconds. During this time, it provides all the momentum necessary for the full flight of the missile. For the rest of its flight, the missile coasts on momentum and the lift provided by the four wings. The wings are located just aft of the flight motor, recessed into the body of the missile during storage and spring loaded. When the missile leaves the launch container, the wings open and lock into place. The wings are set at 45-degree angles to the body of the missile.

(3) *Aft section.* The aft section contains the wire spools, the launch motor, the actuator control system and control surface push rods, a bottle of compressed helium, the flight control surfaces, the xenon beacon (on all missiles), and the thermal beacon (on TOW 2-series missiles only).

(a) Wire spools. Two wire spools, each holding 3,750 meters of wire, are located at the rear of the missile. The wire is made of fine steel and is coated with a thin layer of varnish for insulation. There is virtually no tension on the wire, so it droops down on the ground behind the missile as the missile flies downrange.

(b) Launch motor. The launch motor is a solid fuel rocket that burns entirely inside the launch tube. It provides just enough thrust to propel the missile to a point where the flight motor can ignite safely without injuring the gunner.

(c) Flight control surfaces. Four flight control surfaces are located on the aft end of the TOW missile set at 90-degree angles to the body of the missile. The TOW, unlike the Dragon, does not spin in flight but maintains a stable position. One pair of flight control surfaces controls the "up and down" (pitch) corrections while the other pair controls the "left and right" (yaw) corrections. Like the wings, the flight control surfaces are recessed into the body of the missile while in the launch container. They spring out and lock into place when the missile leaves the launch container.

(d) Actuator control system/push rods/helium bottle. The TOW missile makes steering corrections by moving the flight control surfaces. It moves them by opening and closing the valve on a bottle of compressed helium. The escaping helium moves a system of push rods back and forth. The push rods are connected to the flight control surfaces and move them in turn. The valve on the helium bottle opens and closes in response to signals sent by the on-board electronics, which are responding to signals sent down the wires by the MGS.

(e) Xenon beacon. The xenon beacon emits an infrared beacon, which is picked up by the infrared receiver on the daysight tracker. The infrared receiver measures the angle at which the infrared beam strikes, thus providing the major source of data on the position of the missile to the MGS. The xenon beacon consists of a bulb filled with xenon gas and two electrodes. When an electric current passes between the two electrodes, it creates a spark, which excites the gas. This excited gas emits infrared light that exits from a window on the rear of the beacon as a narrow beam. All basic TOW infrared beacons operate on the same frequency (the infrared light turns on and off at the same rate of speed). This causes two problems: First, two systems cannot be placed closer than 300 meters because the beacons overlap and the MGS has no means of distinguishing between the missiles, causing it to lose control. Second, jamming the daysight tracker is fairly simple if the enemy knows the correct frequency. The TOW 2 overcomes these problems by having the MGS send a signal to the missile that controls the frequency at which the xenon beacon is operating. The MGS varies this pattern randomly, speeding it up and slowing it down in no apparent pattern. The MGS is always able to distinguish its missile from other missiles because no two missiles will be operating on the same frequency at the same time. For the same reason, the eneny cannot jam the system.

(f) Thermal beacon. Under some battlefield conditions such as heavy smoke, dust, or fog, the xenon beacon, which operates on the lower end of the infrared spectrum, cannot penetrate the obscuration. With the TOW missile and weapon system it is sometimes possible for the gunner to be able to acquire the

target, yet the infrared receiver on the daysight tracker cannot acquire the infrared beacon and the system loses the missile. TOW 2-series missiles have a thermal beacon to correct this deficiency. The thermal beacon operates on the upper end of the infrared spectrum and will penetrate any obscurant the nightsight can see through. A postamplifier was added to the AN/TAS-4A nightsight on the TOW 2 weapon system to acquire the thermal beacon and track it in much the same manner as the infrared beacon. The basic AN/TAS-4 is a passive sight, but the AN/TAS-4A is an active sight with the ability to steer the missile to any target that the gunner can see through the sight itself.

(4) *Launch container.* The launch container is the fiberglass tube that holds the missile. It protects the missile from environmental and physical damage while in storage, secures it in the weapon system when about to be fired, and electrically connects the missile to the weapon system during firing.

b. **Sequence of Operations.** The sequence of operations (Table 1-2) starts from the time that the gunner presses the trigger. The time that each event occurs is given in negative or positive numbers, with O being the time that the launch motor fires.

c. **Tracking and Steering of the Missile While in Flight.** As the missile flies downrange, the infrared beam from the rear of the missile enters the infrared receiver on the daysight tracker, is reflected by a spinning mirror in the rear of the infrared receiver called a nutater, and strikes the infrared sensor in the front of the infrared receiver. The pattern that this reflected beam makes on the sensor measures the angle of the beam and tells the MGS where the missile is. The MGS has two other sources of information on the location and attitude of the missile: the gyroscope and the traversing unit. Both of these have sensors. The gyroscope measures the attitude of the missile while in flight, and the traversing unit measures how quickly and in what direction the gunner moves it. The MGS uses this information to make a very precise determination of where the missile is in relation to the gunner's aiming point. This automatically steers the missile toward that point. This process continues until the missile impacts the target

1-6. TOW TRAINING STRATEGY

TOW training strategy synchronizes institutional and unit training to produce TOW crews and units that win on the battlefield.

a. The training strategy for TOW begins in 11H OSUT where the soldier is taught critical Skill Level 1 common skill tasks and critical 11 H Skill Level 1 tasks. He is trained to be a loader, gunner, and driver. His training is tracked for either the ITV or HMMWV (M901-series or M966 vehicles), depending on his initial assignment.

TIME (SECONDS)	EVENT
-1.5	Gunner presses trigger, system sends prefire sequence to missile, starts chemical reaction in thermal batteries, blows explosive squib off nitrogen bottle, gyroscope starts spinning.
0	Gyroscope reaches 42,000+ rpm and disengages, sends electrical current to launch motor, launch motor fires.
+.05	Missile exits launch tube.
+.08	Wing 2 switch closes.
+.10	Wing 4 switch closes, helium bottle opens, timed part of arming sequence starts, flight motor ignites.
+.145	Delay switch changes state (part of arming sequence).
+.18	Safety and arming unlock occurs. As missile accelerates to 19 Gs, the "G" force causes a rotor in the warhead to unlock.
+.53	S&A clock mechanism rotates and aligns detonator with warhead. Missile is armed.
+1.6	Flight motor burns out. Missile is fully armed and travelling at maximum velocity. It will coast the rest of the way on momentum and the lift from the four wings.

Table 1-2. Sequence of operations.

b. Much individual and most collective, tactical, and gunnery training takes place in the unit. Primary sources for tactical and leader training are FM 7-91, ARTEP 7-91-MTP, and ARTEP 7-91-Drill.

c. The Skill Level 1 and 2 soldiers, squads, and crews are trained in the unit. Gunners take part in an individual gunner's qualification program that includes TOW Tables 1 and 3 and then qualify on Tables 2 and 4. The squads

and crews practice on TOW Tables 5 and 7 and then qualify on Tables 6 and 8. (See Chapter 5 for more detailed information on TOW training. See DA Pam 350-381 for strategies and resource requirements.)

d. The section is the basic TOW fighting organization; therefore, section training is critical. Sections practice on TOW Table 9 and qualify on Table 10.

e. Platoon gunnery events consist mainly of Table 11 for practice and Table 12 for qualification. Also, the platoon must conduct a semiannual force-on-force exercise to demonstrate its proficiency with a maneuver element.

f. TOW training in units is supported by MOS-specific tracks in BNCOC and ANCOC, and the TOW Master Gunner Course for NCOs (SGT [P] through SFC).

g. Army Correspondence Course Program (ACCP) courses also support TOW training (see ACCP catalog for specific courses). An interactive video disk (IVD) version of the TOW Master Gunner Course is also available.

CHAPTER 2

TRIPOD-MOUNTED TOW/TOW 2

Regardless of the type of carrier the TOW weapon system is mounted on, at times it will be employed as a ground-mounted system. This may be due to tactical requirements such as helicopter insertion for an antiarmor ambush, or it may be due to mechanical failure or battle damage to the carrier. The following information and procedures apply to all TOW units. During combat or field training, TOW crews will sometimes be required to dismount the TOW system. Each TOW crew dismounts the TOW IA W dismount procedures for the appropriate vehicle as outlined in this manual.

Section I. OPERATION PROCEDURES

Operation procedures for the TOW weapon system include performing a system checkout, conducting preventive maintenance checks and services (PMCS), selecting firing positions, and preparing TOW missiles for operation.

2-1. SYSTEM CHECKOUT

The TOW weapon system is setup on the tripod to conduct a system checkout to ensure that the system is working properly before engaging targets. System checkout procedures are conducted before and after installation of an M220-series launcher on its organic carrier; daily, after the system is in use; or anytime the system has been in storage for one week. (See TM 9-1425-472-12 [M220A1] or TM 9-1425-450-12 [M220A2] for complete details.) After the system checkout procedures are completed, the weapon is mounted or installed on its organic carrier IAW the appropriate TM.

2-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

A preventive maintenance checks and services (PMCS) should be performed before, during, and after operation of the TOW weapon system. PMCS are performed daily if the system is in continuous use. (See TM 9-1425-472-12 [M220A1] or TM 9-1425-450-12 [M220A2] for complete details.)

2-3. SELECTION OF FIRING POSITIONS

When the TOW is assembled for ground emplacement, the tripod must be level for effective operation of the weapon. If the tripod is not level, lateral (azimuth)

movement of the traversing unit produces a change in the elevation angle of the launch tube; therefore, acquiring and tracking the target may be difficult. An unlevel tripod can cause an electronic control error during the final tracking operation (while the command-link wire is guiding the missile to its target). For ground emplacement, proper adjustment of the tripod legs compensates for uneven ground up to a slope of 30 degrees. Therefore, the firing position must not slope more than 30 degrees. When the tripod legs are properly positioned, the bubble in each level will be between the marks on the level indicator. The TOW is not fired from a position where the traversing unit has a lateral cant of more than 10 degrees. The ideal firing position is as level as possible. However, the missile can be fired from a position where the tripod is canted as much as 30 degrees directly downhill or uphill. After the site is selected and the weapon emplaced, the squad leader and gunner make a range card for the position. (For detailed information on making a range card, see Appendix C.)

2-4. PREPARATION OF MISSILES

The TOW missile requires complete attention to detail when preparing it for firing missions. Missile identification, inspection, and correct handling procedures eliminate safety hazards to personnel and equipment. (See TM 9-1425-450-12 or TM 9-1425-472-12 for complete details.)

Section II. PERFORMANCE PROBLEMS AND DESTRUCTION PROCEDURES

TOW crew members must recognize and overcome performance problems and limitations to survive in battle. Each unit develops and maintains an SOP for the proper destruction of ammunition and weapon systems.

2-5. MALFUNCTIONS

A malfunction is the failure of ammunition to function correctly when fired, or the unexpected functioning of explosive components during a test. Premature functioning during handling, maintenance, storage, transportation, or deployment constitutes a malfunction. Any abnormal functioning such as failure of the missile to leave the launch container on launch motor ignition also constitutes a malfunction. During operation of the TOW, a malfunction occurs if the missile fails to launch after the normal 1.5-second delay after the firing trigger has been pressed or if the missile fails to function properly in flight. Two major types of malfunctions are *hangfire* and *misfire.* In-flight malfunctions are classified as two basic types-duds and erratic flight. Defective missiles (either fired or encased) must be disposed of by an explosive ordnance disposal (EOD) team only.

NOTE: When appropriate, weapon and vehicle TM checklists should be used when correcting malfunctions. (See TM 9-1425-450-12.)

a. **Hangfire.** A hangfire is an unexpected delay in the functioning of a series of ammunition components. It may occur anywhere in the series of events, from pressing the firing trigger to launch motor ignition. After the trigger is pressed, the distinctive impulse of the squibs firing (to activate the missile batteries and gyro) and the gyro spin noise can be heard.

(1) If the missile fails to fire, alert the crew by announcing "Hangfire" and continue to track the target for one minute.

(2) If the missile fails to launch after one minute, close the trigger cover, lower the arming lever, place the elevation lock in the 8-degree down position, and place the azimuth lock in the locked position. Open the bridge clamp and remove the missile from the launch tube. Carry it to a dud pit or a safe distance from friendly troops.

(3) Point the missile downrange at all times and notify EOD personnel.

WARNING

The encased missile will become hot to the touch if the TOW thermal batteries, which generate temperatures higher than 800 degrees F, are activated. The encased missile will produce smoke if the thermal beacon has been ignited.

b. **Misfire.** A misfire (complete failure to fire) occurs if the launch motor fails to ignite after the firing trigger has been pressed. This type of failure may be caused by a faulty firing circuit, a failure of electrical power, poor electrical connections, short circuits, or faulty components in the ignition or propellant systems. When the missile fails to launch, the prefire functions are not heard and the condition is a misfire. The target is tracked for one minute and the trigger is pressed again.

(1) Alert the crew by announcing, "Misfire," and check the battery (see notes 2 and 3). Then, check the MGS to ensure the coil cable connector is properly attached to connector J1. Turn the coil cable connector locknut clockwise until it is tight to make sure the coil cable connector is locked in place. Ensure the bridge clamp locking handle is properly seated. Lower the arming lever and check the backblast area to ensure no personnel are in danger; then, raise the arming lever. Press the trigger again.

(2) If the missile still fails to launch, continue tracking the target for one minute or at the gunner's discretion (in combat). Close the trigger cover, lower the arming lever, place the elevation lock in the 8-degree down position, and

place the azimuth lock in the locked position. Open the bridge clamp and remove the missile from the launch tube.

(3) Move the missile a safe distance away (minimum 100 meters) and place it on the ground, preferably in a dud pit. Point the missile downrange at all times and notify EOD personnel.

c. **Dud.** A dud is any missile that has been launched (fired from the launch tube) but failed to fly to the target or failed to detonate on target impact. The warhead of all duds must be considered to be armed, and therefore, extremely dangerous. The location of all duds will be noted and referred to EOD personnel for disposal.

d. **Erratic Flight.** An erratic or uncontrolled missile flight may result due to any of the following conditions:

- Shorted or broken command-link wires.
- Defective missile wing or control surface.
- Defective rocket motor.
- Excessively high gunner tracking errors.

NOTES:

1. In a training situation, wait 30 minutes after announcing, "Hang-fire" before proceeding.

2. For the M220A1, (MGS self-test position 1) check for proper band reading. If out of band reading, replace the battery.

3. For the M220A2, do MGS self-test for battery. If battery fails, replace the battery.

4. In a training situation, lower the arming lever, close trigger cover, place elevation lock in locked position, place azimuth lock in locked position, and wait 30 minutes.

5. Report all misfires, hangfires, and other missile malfunctions IAW AR 75-1.

2-6. FIRING LIMITATIONS

Some conditions may limit the firing and engagement capabilities of the TOW. The following information should be considered before engaging targets. (See TM 9-1425-450-12 for updated firing limitations.)

a. **Firing Over Water.** Firing across bodies of water wider than 1,100 meters can reduce the range of the TOW. Signals being sent through the command-link wires are shorted out when a large amount of wire is submerged in water. Maximum and limited range firing over water varies according to missile type. If the range is less than 1,100 meters, the missile's range is not

affected. A TOW position should be as high above and as far back from the water as the tactical situation allows. The squad or section leader should analyze his sector as soon as the position is occupied to determine if water will affect the employment of the TOW.

(1) The various types of TOWS listed may be fired over water to a maximum range as shown in Figure 2-1 (TOW launcher and target at water surface level).

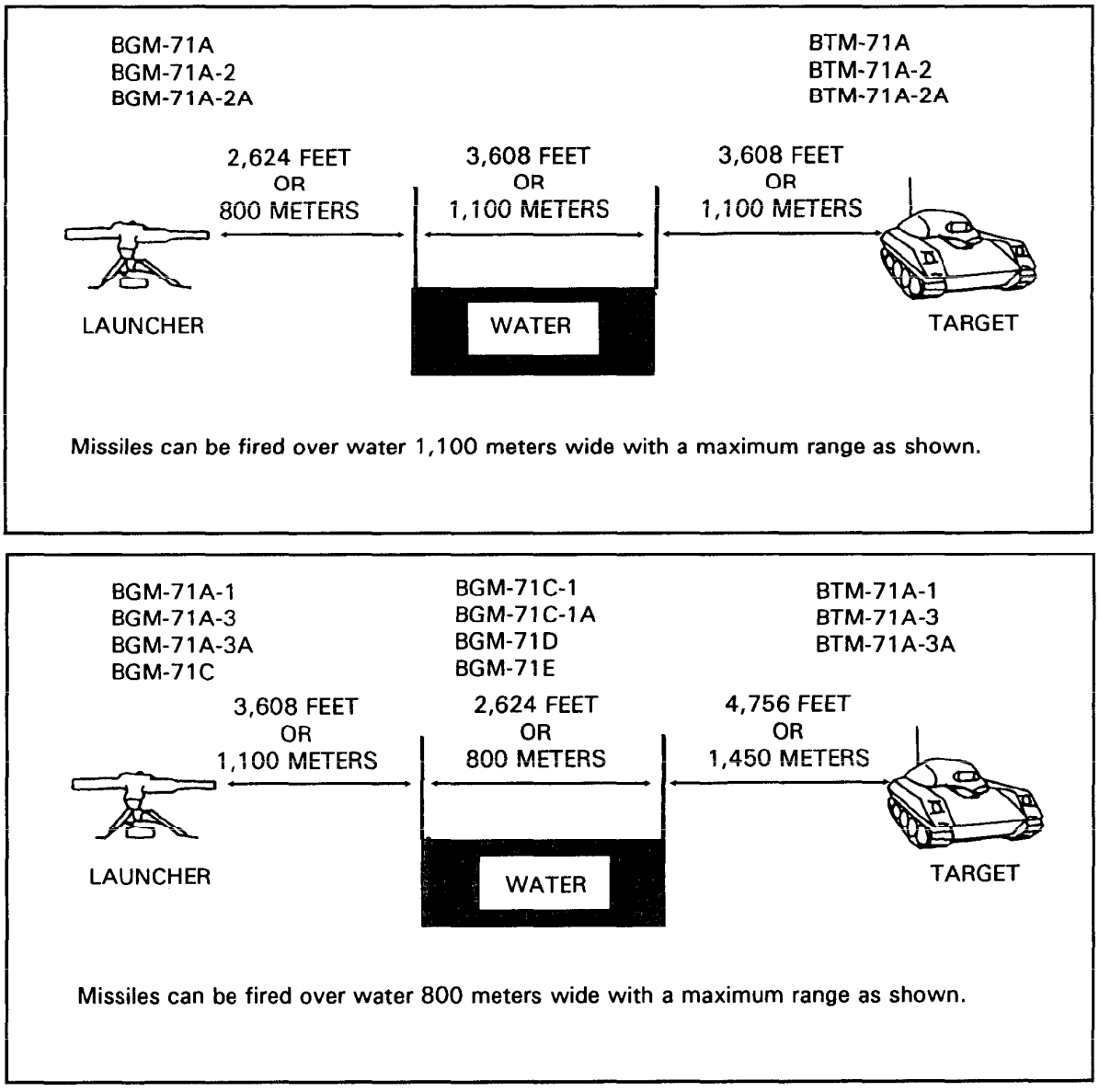


Figure 2-1. Maximum TOW missile range.

(2) The various types of TOWS listed may be fired over water to a limited range as shown in Figure 2-2 (TOW launcher and target at water surface level).

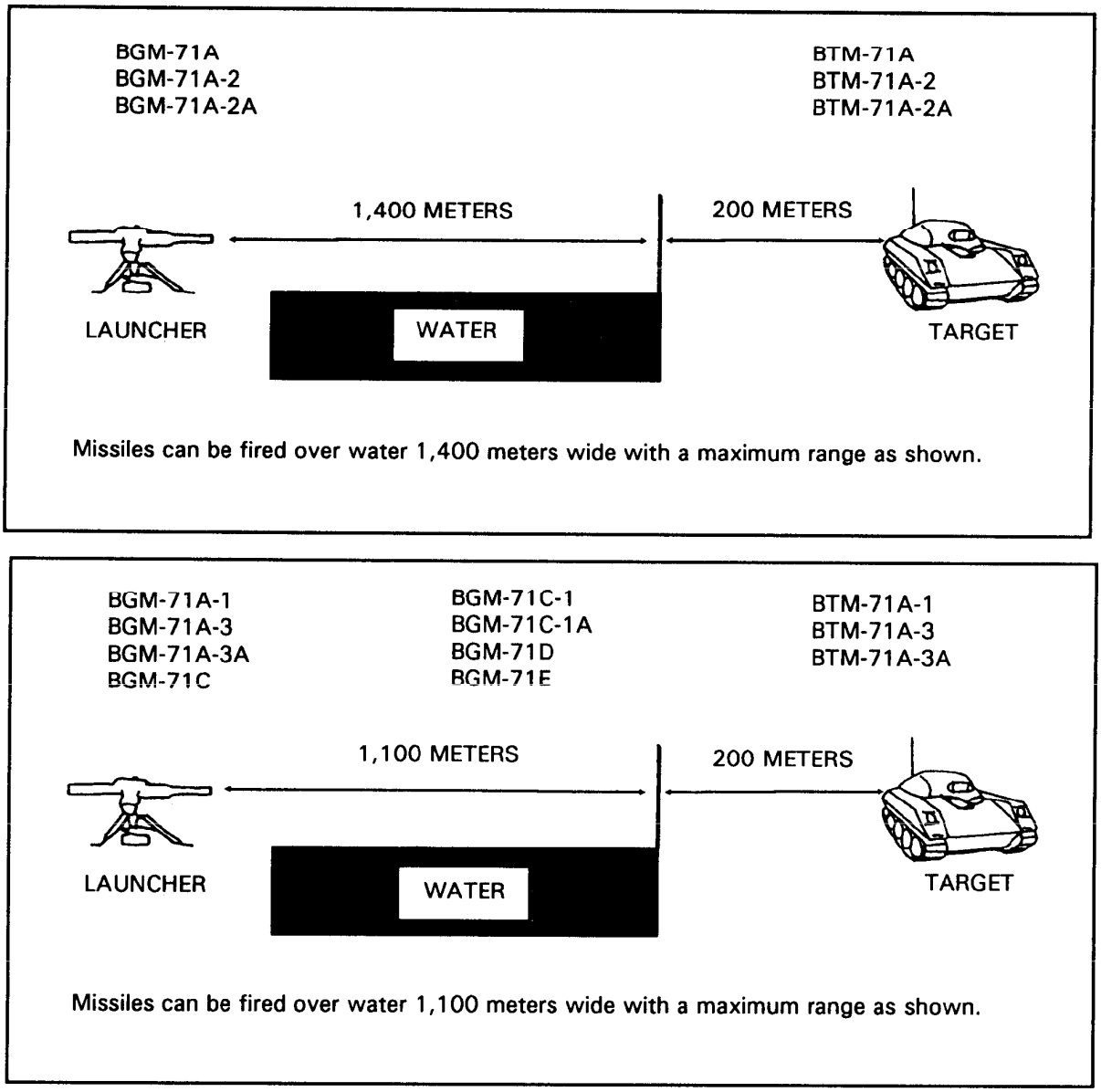


Figure 2-2. Limited TOW missile range.

(3) To determine the extended range of missiles when firing over water (when TOW launcher or target is above surface level of water), use Table 2-1.

(a) Determine the type of missile being used.

(b) Determine the height above the water surface of the TOW launcher and place a tick mark at the corresponding height in the left-hand column of the table.

(c) Determine the height above the water surface of the target. Place a tick mark at the corresponding height in the right-hand column of the table.

(d) Connect the two tick marks with a straight line. The point where the lines intersect the center column is the maximum range the missile can travel without getting too close to the water.

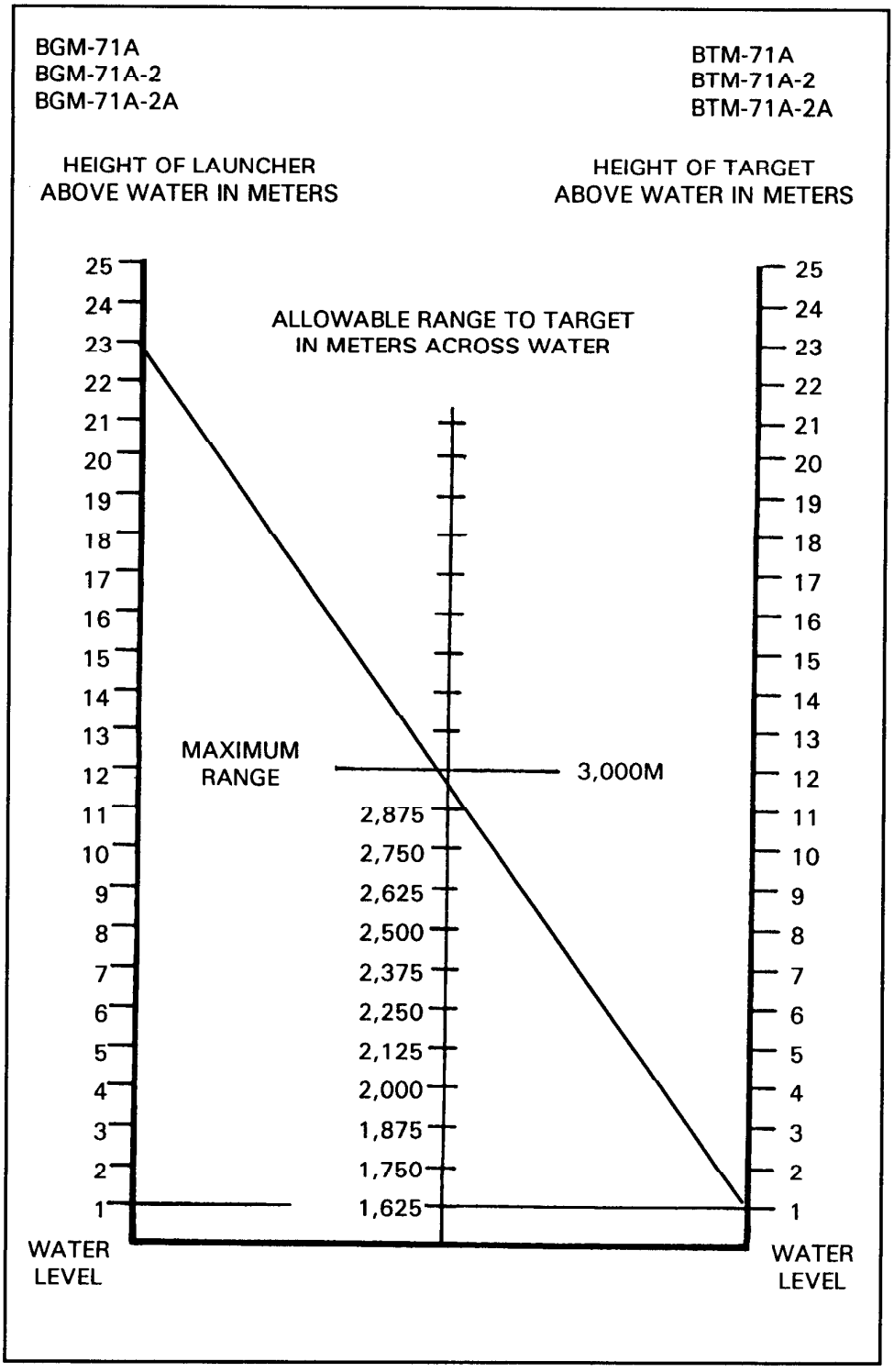
b. **Firing Over Electrical Lines.** If the command-link wires contact a live high-voltage power line, personnel can be injured or control of the missile can be lost. The launcher electronics may also be damaged. In addition to power lines, other high-voltage sources include street cars, electric train ways, and some moving target trolleys on training ranges.

c. **Firing in Windy Conditions.** Gusty, flanking, or quartering winds can cause the launch tube to vibrate and spoil the tracking performance. The effect is similar to driving in a strong crosswind. Erecting a windscreen next to the launcher helps to reduce this problem. Strong winds can move the missile around during flight, but as long as the cross hairs are kept on the center mass of the target, the weapon system itself can compensate for wind effects.

d. **Firing Through Smoke and Area Fires.** Smoke can obscure the line of sight and hide the target when using the daysight tracker. A smooth tracking rate should be maintained as the target disappears into a smoke cloud so that the missile will still be on target or very close as the vehicle goes out the other side of the smoke cloud. (This technique should be practiced during field tracking exercises.) A fire can burn through the command-link wire, causing loss of control of the missile. The gunner should avoid firing through fire and over fires if there is a possibility that the wires will contact the fire before missile impact.

e. **Firing from Bunkers and Buildings.** In accordance with AR 385-62, C 1, 5 Jan 77; Chapter 1, paragraphs 1 through 4; and Chapter 6, paragraph 6-11, TOWS will not be fired from buildings, bunkers, or within 100 meters of a vertical or nearly vertical backstop without the approval of the Commanding General.

f. **Clearance Requirements.** The TOW muzzle must have at least nine inches of clearance at the end of the launch tube so the wings and control surfaces of the missile will not be damaged when they extend after clearing the launch tube. The muzzle of the launch tube must extend beyond any enclosure, window sill, or aperture, and at least 30 inches of clearance must be between the line of sight and any obstruction from 500 to 900 meters downrange. A 30-inch line-of-sight clearance ensures a high probability the missile will not strike the ground on the way to the target (Figure 2-3, page 2-10).


BGM-71A
BGM-71A-2
BGM-71A-2A
BTM-71A
BTM-71A-2
BTM-71A-2A
HEIGHT OF LAUNCHER ABOVE WATER IN METERS
HEIGHT OF TARGET ABOVE WATER IN METERS
ALLOWABLE RANGE TO TARGET IN METERS ACROSS WATER
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
MAXIMUM RANGE
3,000M
2,875
2,750
2,625
2,500
2,375
2,250
2,125
2,000
1,875
1,750
1,625
WATER LEVEL
WATER LEVEL

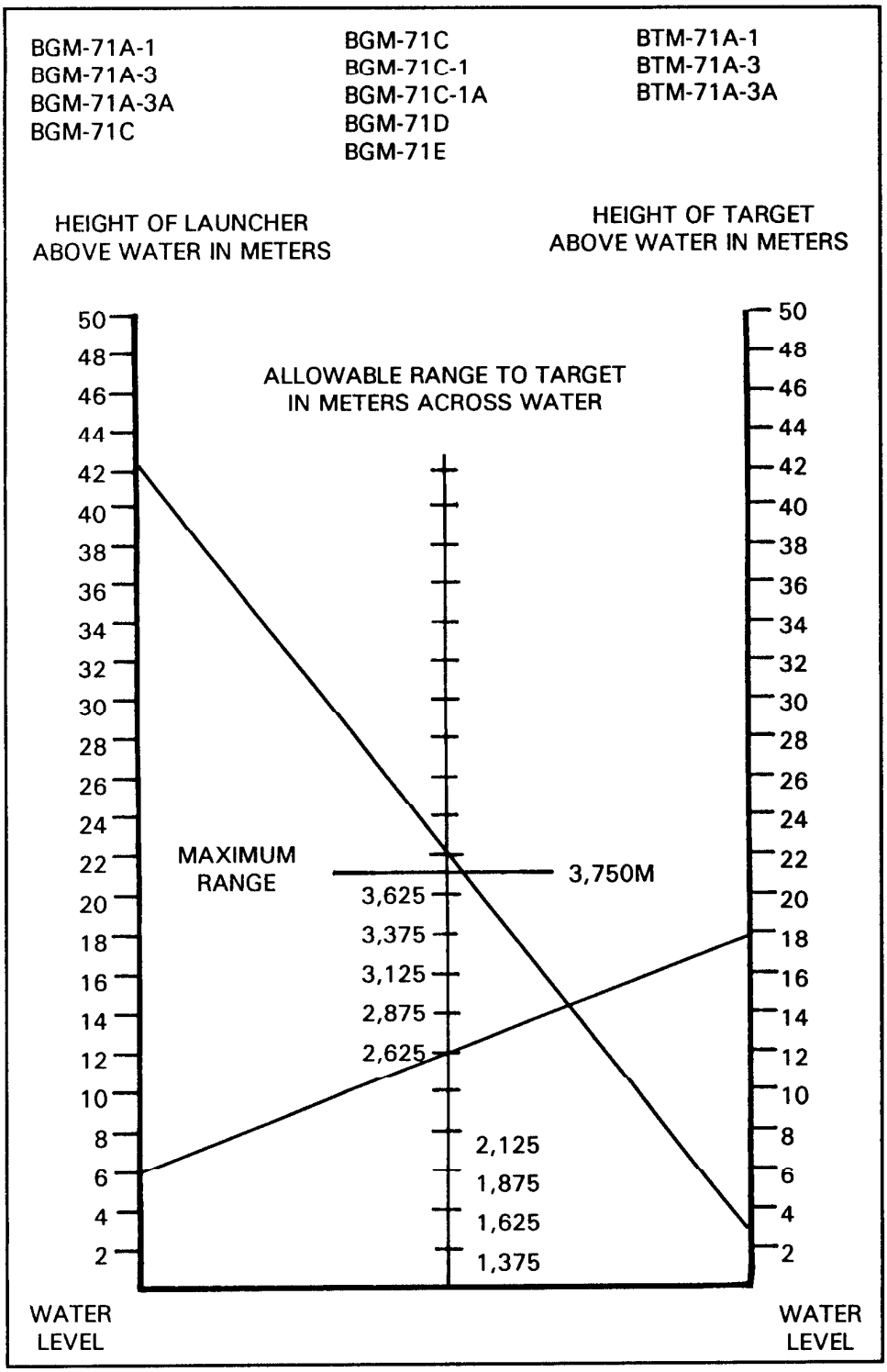


Table 2-1. Extended range over water (continued).

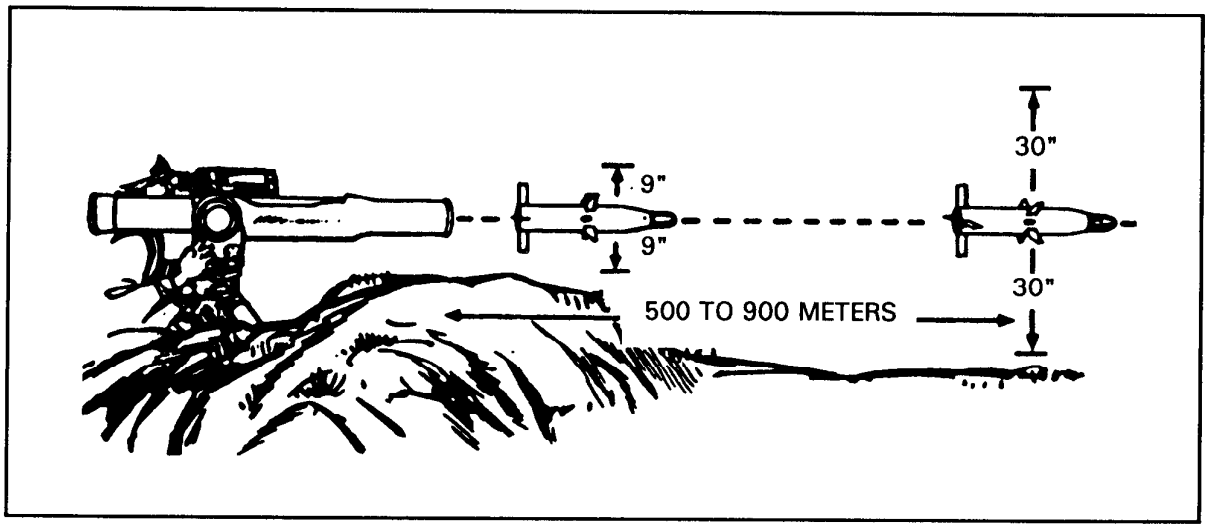


Figure 2-3. Clearance requirements.

2-7. DESTRUCTION OF TOW WEAPON SYSTEMS

When subject to capture in the combat zone, the encased missile and weapon system and its components are destroyed by the TOW squad. This action is taken when, in the judgment of the unit commander, the tactical situation warrants it, and when it is necessary IAW orders or policy established by the commander.

> NOTE: The following information is for guidance only. Certain procedures outlined require the use of explosives and incendiary grenades that may not be authorized items for the TOW squad. The issue of these and related materials and the conditions for destruction are command decisions.

Destruction of TOW components by mechanical means, explosives, gunfire, or burning renders them useless to the enemy. The best method to destroy everything is to set fire to the carrier. To prevent the enemy from obtaining useful equipment, the encased missiles and certain weapon system parts should be destroyed. When lack of time or personnel prevents destruction of all parts, the encased missiles and the priority parts of each weapon system must be destroyed. Destroying the same parts of each weapon system prevents the enemy from assembling a complete weapon system. Priority is used to select the parts for destruction. If destruction is directed, the TOW squad selects a point of destruction that will cause the greatest obstruction to enemy movement and not create a hazard to friendly troops.

Each organization and installation that uses, maintains, or stores the encased missiles or weapon system parts should have an SOP for TOW destruction. The procedure should contain priorities of destruction, methods of destruction,

quantities of explosives required, and instructions for destruction. The destruction plan should be flexible to cover any situation.

a. **Destruction of Encased Missiles.** The encased missile is a priority item and should be destroyed by any of the following methods. The expended launch containers should also be destroyed or removed from the battlefield so that enemy troops may not use them to make improvised munitions and booby traps.

> WARNING
> Do not attempt to destroy encased missiles by mechanical methods.

(1) *Launch the missiles.* If the system is operational and time permits, launch the missiles into enemy territory before destroying the vehicle. Missile detonation should hinder the enemy in every way possible without endangering friendly units or equipment.

(2) *Use explosives.* To destroy the TOW using explosives, become familiar with the provisions of FM 5-25.

(a) Using three pounds of TNT or equivalent, prepare and place a 1-pound explosive charge 6 to 8 inches from the nose end, a 1-pound explosive charge 4 to 6 inches behind the electrical connector, and a 1-pound explosive charge 6 to 8 inches from the motor end of the missile (Figure 2-19).

NOTE: Because the missile contains high explosive, a smaller explosive charge may be used to destroy it.

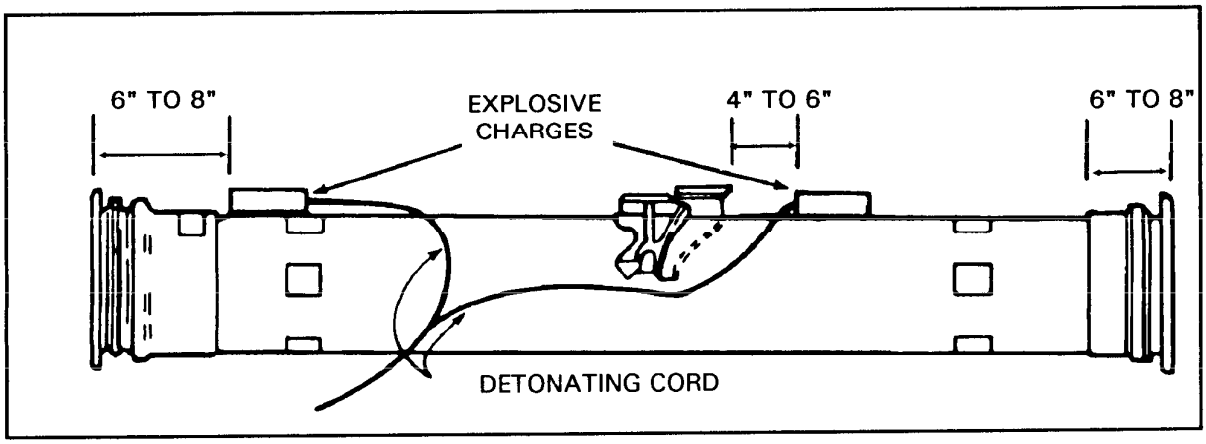


Figure 2-4. Explosive charges on an encased missile.

(b) Determine if electrical blasting caps and wire or nonelectric blasting caps and safety fuses will be used for priming and detonating the explosive charges. If nonelectric caps are used, crimp them to a safety fuse at least 2 meters long.

> **WARNING**
> Safety fuse burns at the rate of 1 foot in 30 to 40 seconds. Safety fuse, which contains black powder, and blasting caps must be protected from moisture at all times.

(c) Connect the charges with detonating cord to produce a simultaneous detonation. Dual prime the charges to reduce the possibility of a misfire.

> **WARNING**
> The blasting caps, detonating cord, and safety fuses must be kept separate from the charges until needed.

(d) If the charges are primed with nonelectric blasting caps, ignite the safety fuses and take cover at once. If the charges are primed with electric blasting caps, take cover before firing.

(3) *Use gunfire.* Use well-aimed shots from artillery, rockets, rifle grenades, or tank guns to destroy the encased missile by gunfire.

> **WARNING**
> The live rocket motors and high-explosive antitank warhead are a hazard to soldiers firing at the encased missile. Therefore, small arms should not be used. Firing artillery from ranges of 1,000 meters or less must be done from cover. Cover must also be used when rifle grenades or rockets are fired.

b. **Destruction of Weapon Systems.** Destruction of TOW parts should be done so that the use or restoration to serviceable condition is impossible. In addition, certain weapon system parts could provide important information to the enemy.

(1) *Priority of destruction.* If time does not permit the destruction of the complete weapon system, destroy as many parts as possible in the following priority:

- Daysight tracker.
- Nightsight.
- Missile guidance set.
- Traversing unit.
- Battery assembly.
- Launch tube.
- Tripod.
- Battery power conditioner (TOW 2).

The order of destruction for an M901/M901A1 should be as follows:

- Optics-nightsight, daysight tracker, ITA, and SLP.
- Missile guidance set.
- Hydraulic lines.
- Electrical cables.
- Gunner's control panel.
- Gunner's hand control.

(2) *Destruction methods.* Consider the location of friendly units and the availability of personnel, materials, and time required for destruction when selecting the method of destroying TOW parts. The following list of destruction methods is in priority sequence; however, the considerations stated above could change the priority or method of destruction used.

(a) Explosives. Use at least 1 pound of explosive on each part. Place the explosive inside the part, if possible, to cause the greatest destruction. For example, remove the coil cable and place the charge in the traversing unit, or remove the battery assembly from the MGS, place the charge in the battery well, and replace the battery. After placing the charge, cover the parts with filled sandbags or other heavy materials to increase the explosive effect.

(b) Gunfire. Use well-aimed shots from artillery, rockets, tank guns, rifle grenades, rifle fire, or other small-arms fire to make the weapon system useless to the enemy. When using small-arms fire, aim for critical parts. The vehicle can be destroyed by artillery or tank guns from a range of 1,000 meters.

(c) Mechanical. Smash the TOW parts with axes, picks, crowbars, or rocks, or drive over each part with a tracked vehicle (make sure the parts are on a hard surface or they must be dug up to ensure they have been made useless). Destroy the priority parts if enough time and personnel are available.

WARNING

Do not try to destroy the battery assembly by mechanical methods. An electrical safety hazard may result if the power output terminals are short-circuited. Discard the battery assembly if no other means of destruction is available.

(d) Burning. After maximum damage has been done to the weapon system and vehicle parts by other destruction methods, and if time permits, set fire to the resulting debris. Use vehicle fuels and lubricants to aid burning. Place one or more incendiary grenades on each part.

CHAPTER 3

M966-MOUNTED TOW/TOW 2

The M966-rnounted TOW is a one-vehicle (1 1/4-ton truck) combat system that is air-transportable, versatile, maintainable, and survivable (Figure 3-1). Its 16-inch ground clearance, four-wheel independent suspension, steep approach and departure angles of 60-percent gradability, side slope of 40-percent, and 30-inch (without kit, 60-inch with kit) water-fording capability provides the off-road mobility and speed needed in combat. The vehicle carries one complete launcher system, six encased missiles, and a three-man crew. This chapter discusses the duties of the crew and the detailed operations of the weapon system.

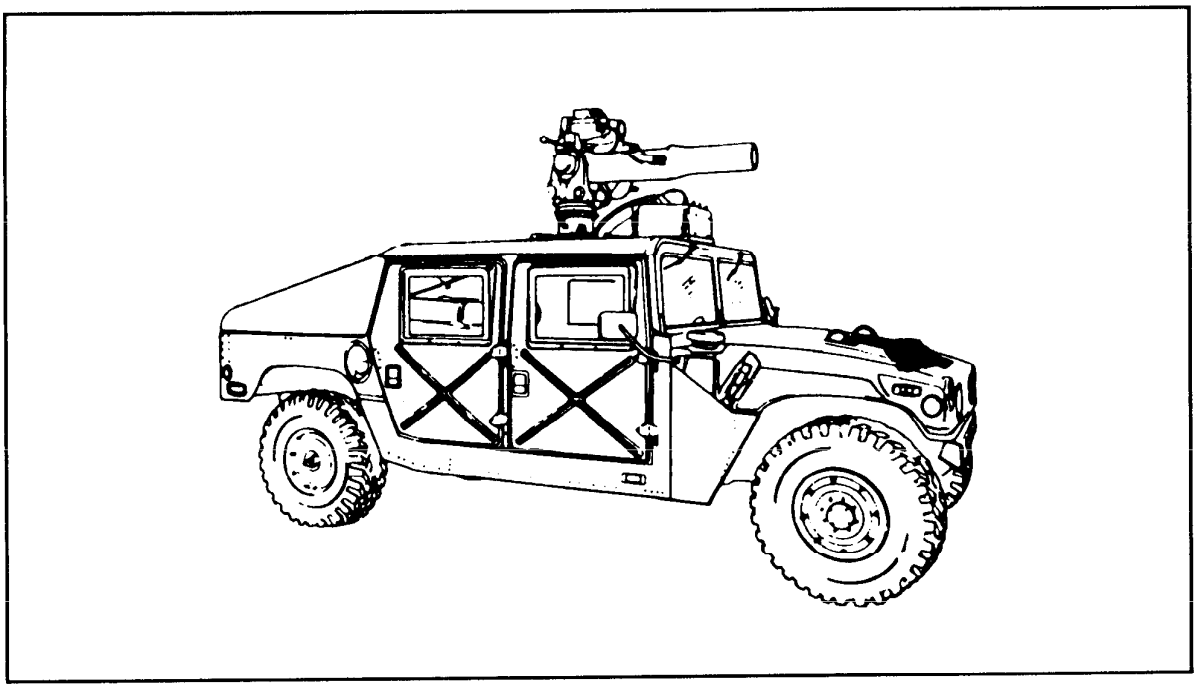


Figure 3-1. M966-mounted TOW.

Section I. INDIVIDUAL DUTIES AND RESPONSIBILITIES

The three-man crew consists of the squad leader, the gunner, and the driver-loader. The duties and responsibilities of each crew member are discussed in the following paragraphs.

3-1. SQUAD LEADER

The squad leader is responsible for the combat readiness and tactical employment of his squad. This includes discipline, health and welfare, training, and maintenance of equipment and weapons. Other specific duties include the following:

- Directing the driver over the exact route.
- Detecting and identifying targets.
- Issuing fire commands.
- Controlling fire and movement.
- Supervising and assisting in dismounting and assembly of the M220-series TOW launcher.
- Employing the squad according to the orders of the section leader.
- Selecting primary, alternate, and supplementary firing positions.
- Requesting squad resupply.
- Informing the section leader of events that affect the tactical situation and of the status of his crew.
- Carrying the tripod, launch tube, coolant cartridges, battery case or BPCs, and binoculars when the TOW is used in the ground mode.
- Acting as the gunner when needed.
- Assisting the gunner in system check-out procedures.
- Supervising construction of the TOW firing position.
- Determining the direction of fire.

3-2. GUNNER

Specific duties of the gunner include the following:

- Conducting system check-out procedures.
- Acquiring, recognizing, and identifying armored vehicles.
- Determining if a target can be engaged.
- Engaging targets.
- Recognizing and eliminating firing-angle limitations.
- Adjusting the gunner's platform before stowing the MGS.

- Stowing the TVPC in the MGS and stowing the MGS, nightsight, and traversing unit.
- Preparing range cards for the TOW.
- Removing the nightsight, daysight tracker, launch tube, traversing unit, and MGS when the TOW is used in the ground mode.
- Carrying the MGS and daysight tracker to the firing position when the TOW is used in the ground mode.

3-3. DRIVER-LOADER

The driver-loader is a dual-purpose position in the M966 TOW squad. Specific duties of the driver-loader include the following:

- Driving the M966.
- Maintaining the vehicle.
- Camouflaging the vehicle.
- Carrying the traversing unit, encased missile, nightsight, and collimator to the firing position when the TOW is used in the ground mode.
- Securing the area.
- Stowing battery assembly, collimator, encased missiles, daysight tracker, spare battery case, coolant cartridges and batteries (or BPCs), and tripod on the M966 with the assistance of the squad leader.
- Maintaining radio equipment.
- Removing misfired missiles.

Section II. OPERATION PROCEDURES

Before using the M966-mounted TOW/TOW 2, the squad must install the M220-series TOW launcher and encased missiles and must prepare the M966 for TOW firing. (To install an M220A1 TOW launcher and encased missiles on an M966, see TM 9-1425-472-12. To install an M220A2 TOW launcher and encased missiles on an M966, see TM 9-1425 -450-12.)

3-4. EQUIPMENT STORAGE

The TOW system components are stored in the interior of the vehicle (Figure 3-2 [M220Al], page 3-4 and Figure 3-3 [M220A2]), page 3-5.

a. Six encased missiles are stowed in the missile racks on the left rear of the cargo area.

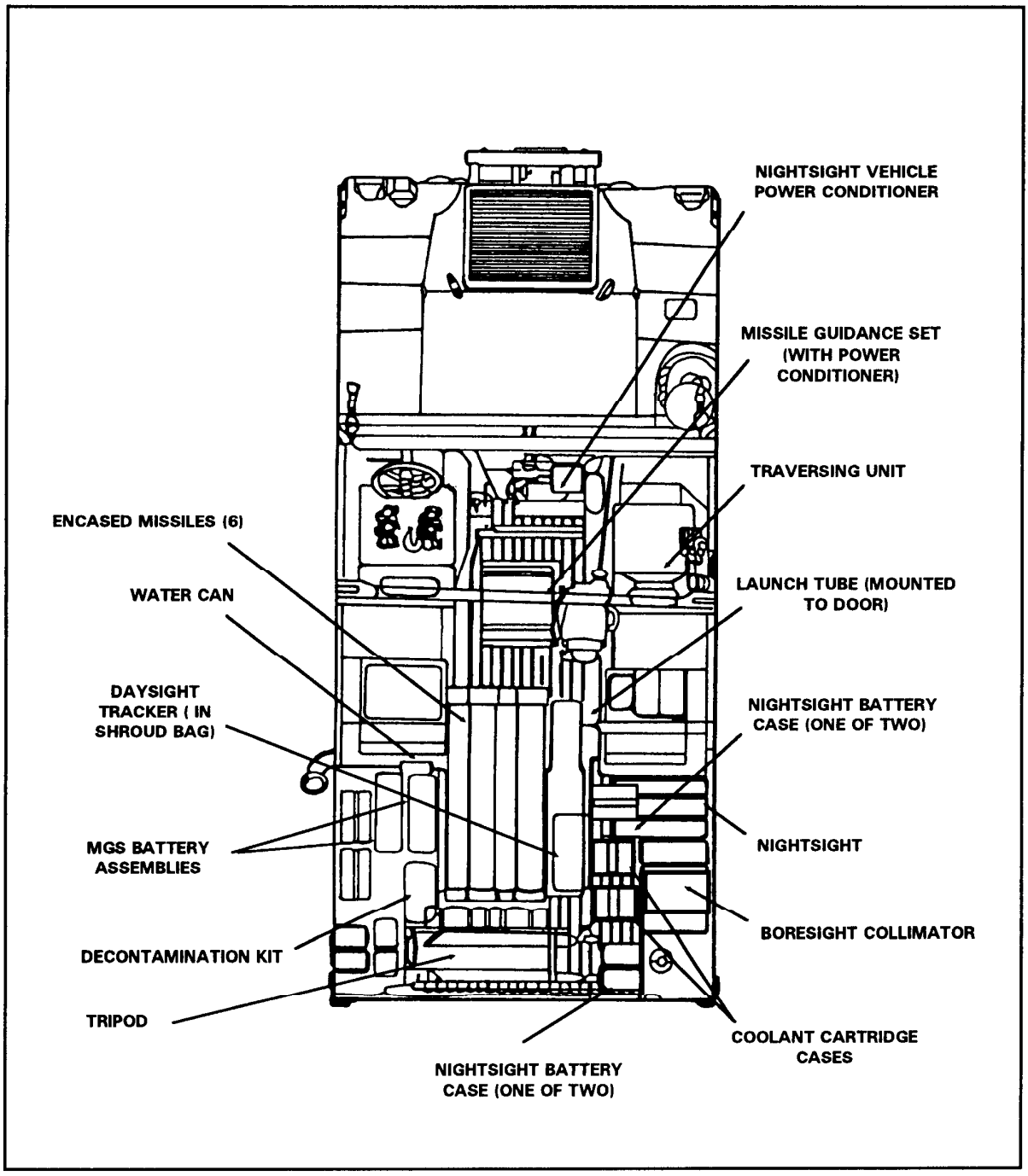


Figure 3-2. Stowing M220A1 on M966.

b. The traversing unit is stowed on the traversing unit adapter behind the right front passenger seat.

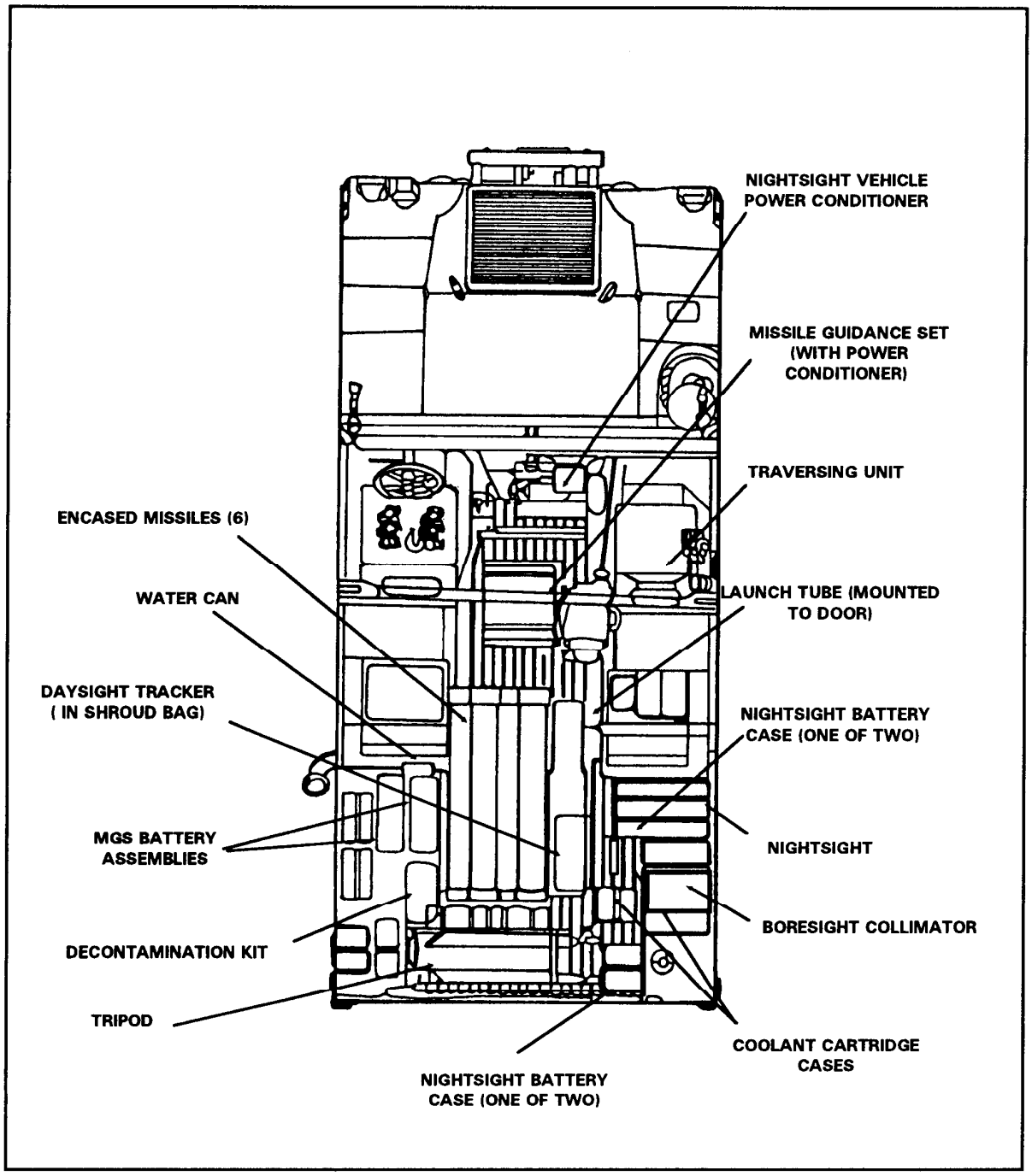


Figure 3-3. Stowing M220A2 on M966.

c. The MGS is stowed on the gunner's platform between the left and right rear passenger seat.

d. The nightsight and collimator are stowed on the right cargo shelf.

e. The launch tube is stowed on the right side of the cargo shell door.

f. The BPC and spare battery pack, or the nightsight coolant cartridges and the 4.8-volt nickel cadmium battery, are stowed in the floor bracket next to the right wall of the cargo shelf.

g. The daysight tracker is stowed in the floor bracket next to the missile rack.

h. The battery assemblies are stowed in the battery rack above the missile rack.

i. The tripod is stowed retracted, lying across the rear of the cargo area.

j. The TVPC is stowed in the MGS.

3-5. HMMWV INTERCHANGEABLE MOUNT SYSTEM

The HIMS is used to convert an M966 TOW HMMWV carrier into an automatic weapons platform (Figure 3-4). The HIMS provides units equipped with M966 TOW HMMWV carriers with low cost, quick, and effective options for tailoring forces for contingency missions. The HIMS contains two parts. (The HIMS technical data package contains the information needed to operate the HIMS and whereto find the materials needed. TM 9-2320-280-10 contains the combat loading plans for the vehicle.)

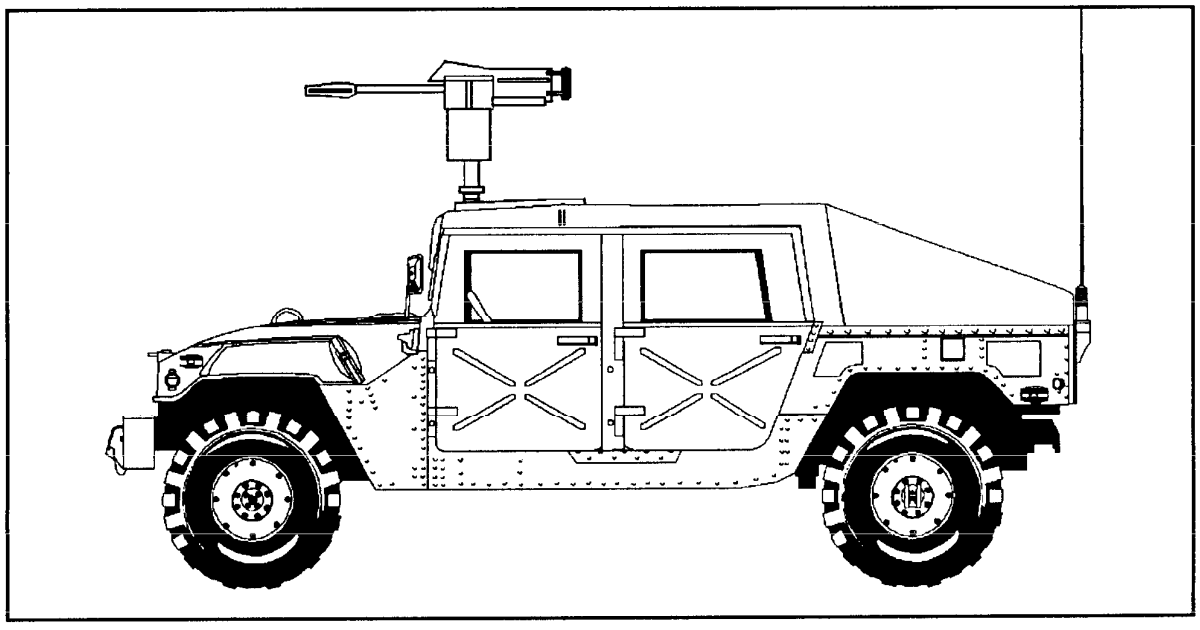


Figure 3-4. M966 with HIMS.

a. Part one is an armament mount panel assembly with pintle that mounts on the M 1025 armament HMMWV carrier. This part is interchangeable with the missile guidance tray on the M966 TOW HMMWV carrier. The common turret ring of the two vehicles will accommodate the armament mount panel assembly using existing holes. No modifications are required.

b. Part two consists of a locally fabricated internal floor stowage plate that has automatic weapons stowage brackets, ammunition stowage trays, and footman tiedown straps already mounted for quicker emplacement. This plate is made of sheet aluminum and is mounted in the floor of the M966 TOW HMMWV carrier after removal of selected items of the TOW bracketry.

3-6. PREPARATION OF AN M966 FOR TOW FIRING

The three-man crew prepares the M966 for TOW firing by performing the following:

a. The gunner, driver-loader, and squad leader release the latches securing the hatch cover (Figure 3-5, page 3-8). The driver-loader enters the right rear passenger door.

b. The gunner removes the MGS from its stowed position.

(1) The gunner unlatches the retaining strap securing the MGS.

(2) The gunner releases the latches to remove the MGS cover and hands the cover to the squad leader.

(3) The squad leader stows the MGS cover in the front passenger's footwell of the vehicle.

(4) The gunner tilts the MGS to the vertical position on the gunner's platform and releases the lower coupling clamp on the traversing unit adapter.

c. The gunner positions the weapon station. The gunner opens the hatch and enters the weapon station, secures the hatch with the retaining latch, and rotates the weapon station by pulling upon the brake handle so that the backrest is toward the rear of the vehicle. To lock the weapon station, the gunner pushes down on the brake handle.

d. The gunner lifts the MGS through the weapon station, places it on the MGS tray, and secures it with the straps (Figure 3-6, page 3-8).

e. The gunner installs the traversing unit.

(1) The gunner opens the pedestal mount cover and secures it (Figure 3-7, page 3-9).

(2) The gunner lifts the traversing unit with adapter attached from the stowage base and secures the traversing unit to the pedestal mount with the coupling clamp ensuring that the traversing unit azimuth lock is toward the rear of the vehicle.

(3) The squad leader pulls the coil cable out of its retaining cup and hands it to the gunner (Figure 3-8, page 3-9).

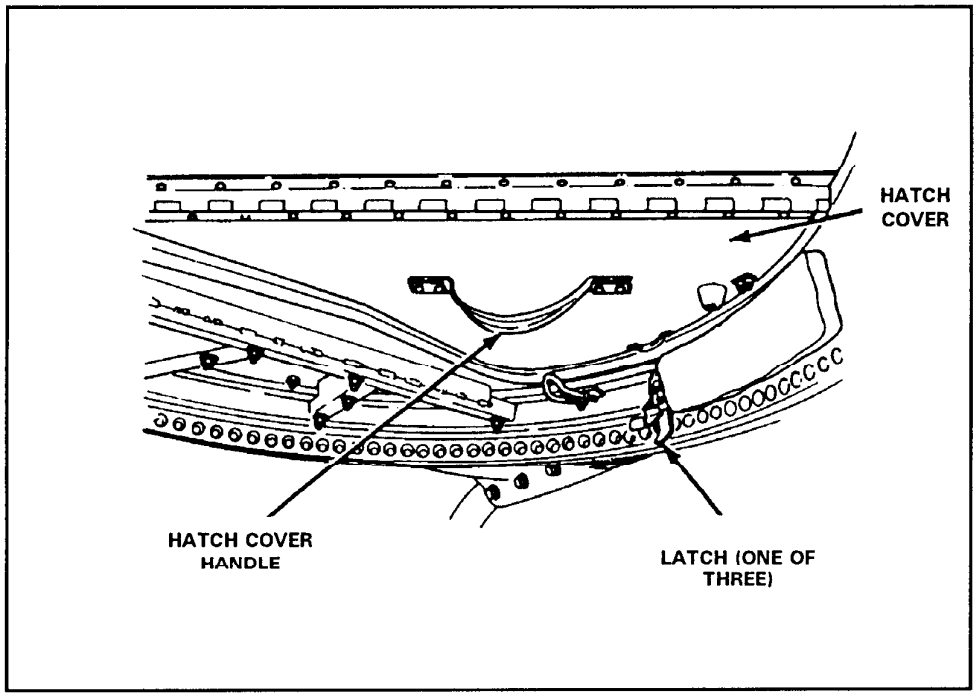


Figure 3-5. Hatch cover and latch.

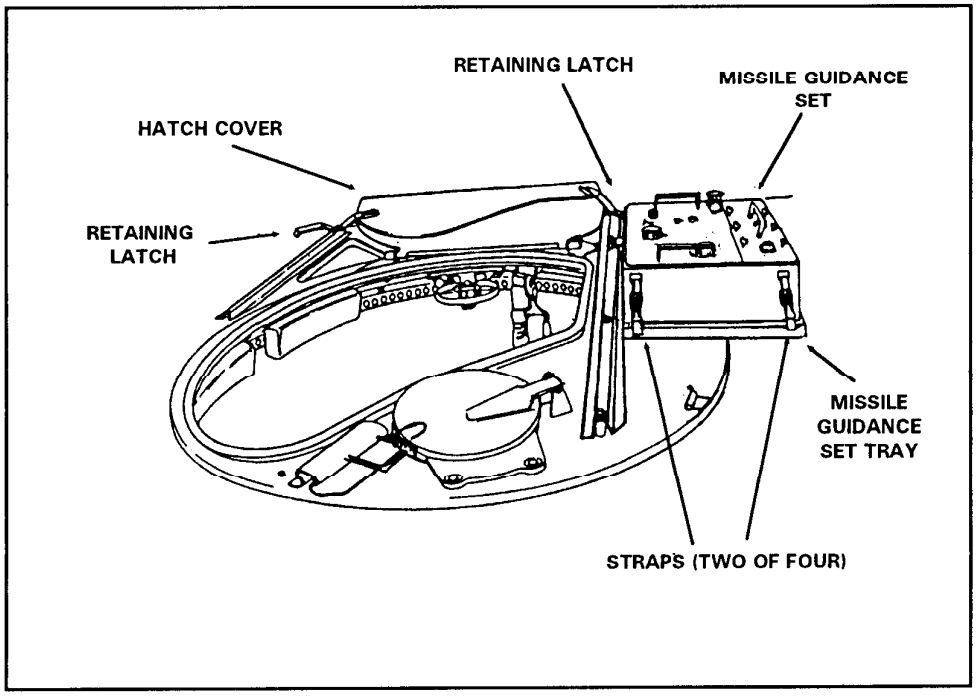


Figure 3-6. Hatch cover retaining latches and MGS tray.

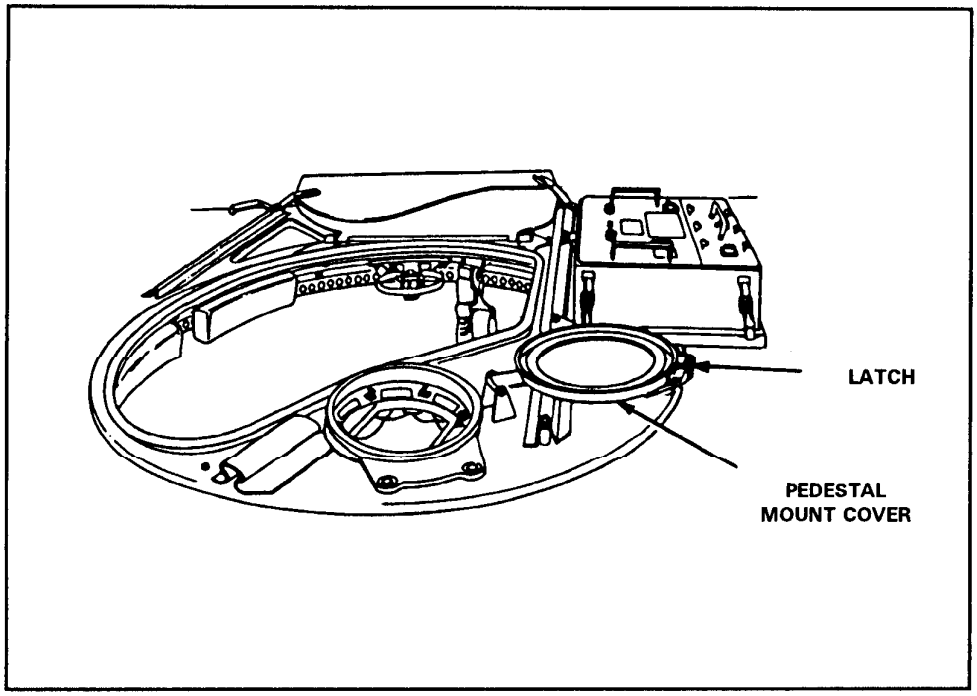


Figure 3-7. Pedestal mount cover and latch.

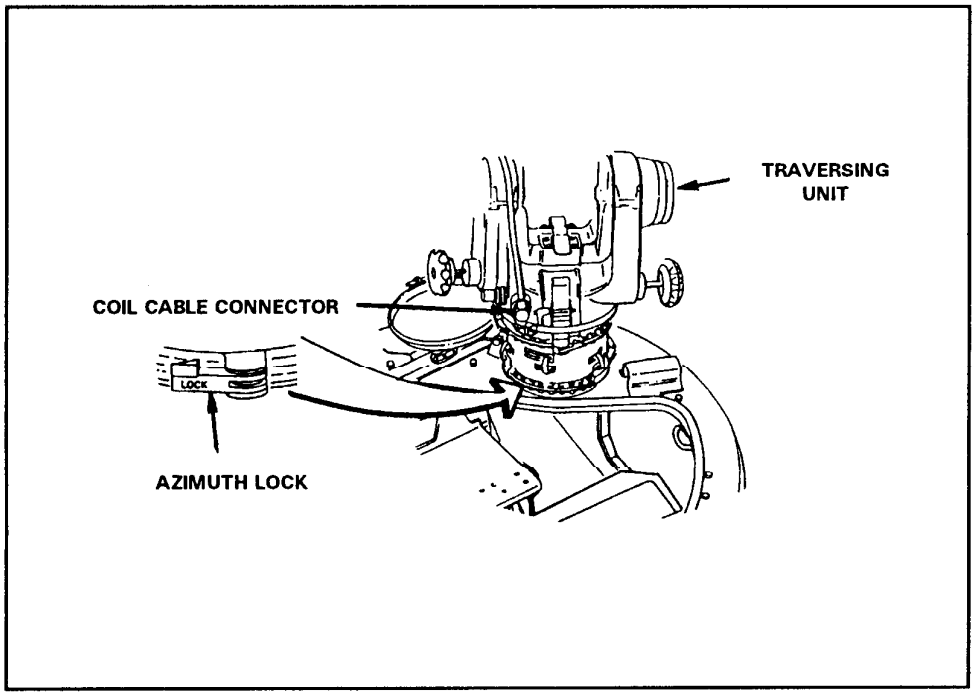


Figure 3-8. Coil cable connector.

f. The gunner connects the coil cable connector by aligning the yellow indexing line on the coil cable connector with the yellow indexing line on the J1 connector on the MGS (Figure 3-9). He turns the nut on the coil cable connector in the direction of the arrow until the red mark (band) on the M 1 connector on the MGS cannot be seen. (Do not apply downward pressure on the coil cable connector. This can cause misalignment and bent pins.)

CAUTION

Ensure that no dirt is in the end of the coil cable connector. Dirt can cause a bad connection with the MGS, resulting in poor system operations.

NOTE: On the MGS for the basic TOW, push down to seat the coil cable connector on the M 1 connector and tighten the locking nut.

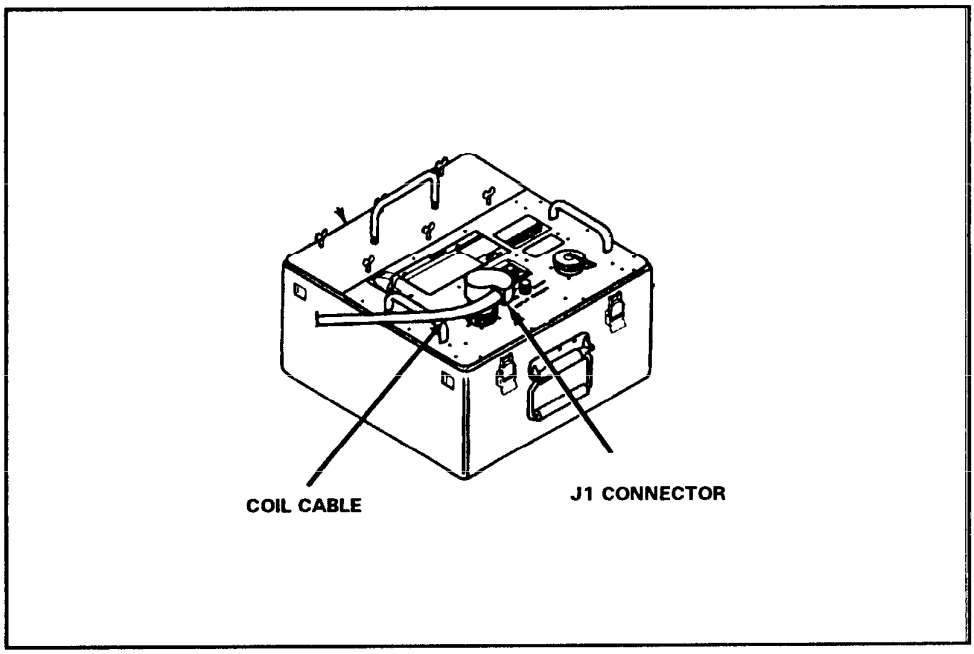


Figure 3-9. Coil cable connector and J1 connector.

g. The gunner installs the launch tube.

(1) The driver-loader uses the forward latch to open the cargo shell door and hands the launch tube to the gunner.

(2) The gunner installs the launch tube on the traversing unit and secures it with the launch tube latch (Figure 3-10).

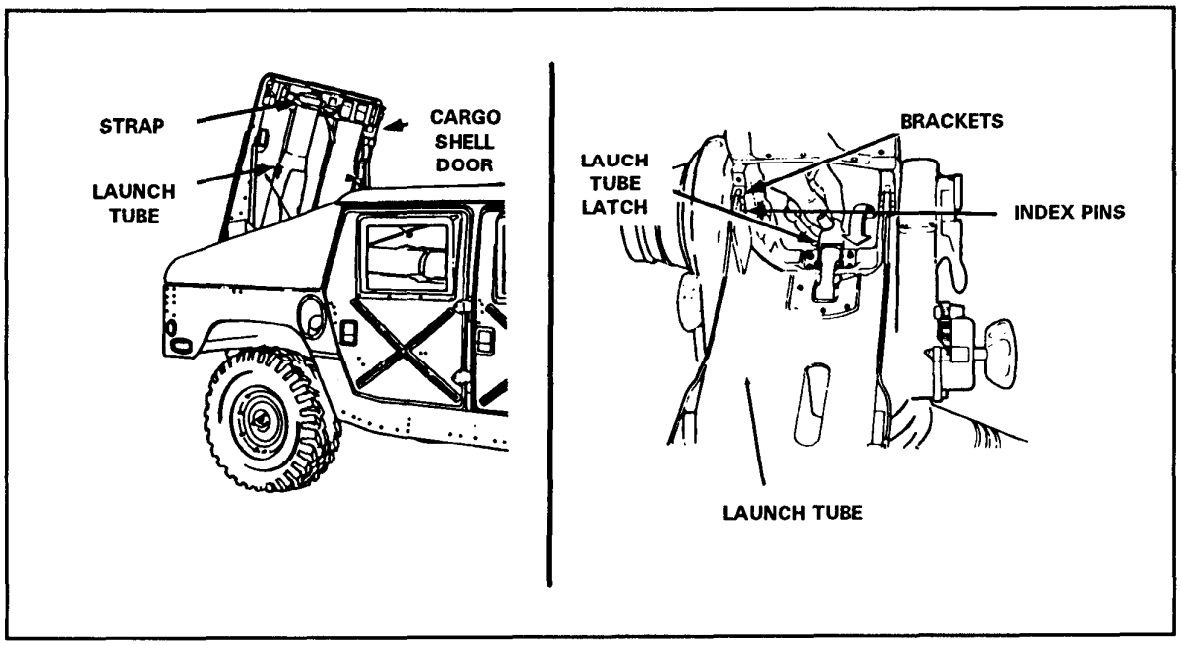


Figure 3-10. Launch tube latch.

h. The gunner installs the daysight tracker.

(1) The driver-loader hands the daysight tracker to the gunner.

(2) The gunner mounts the daysight tracker on the traversing unit boresight plate. 'He secures the daysight tracker-by locking the latch handle (Figure 3-11, page 3-12).

(3) The driver-loader stows the nightsight case in its bracket.

(4) The squad leader connects connector P2 of the TVPC power cable to the power conditioner cable.

(5) The squad leader unwinds the nightsight power conditioner cable and TVPC cable and hands both to the gunner.

(6) The gunner connects the nightsight power cable 2W2 to the nightsight input power conditioner J1 (Figure 3-12, page 3-13), then connects the TVPC power cable P1 to connector J1.

(7) The squad leader turns on the TVPC.

(8) The gunner turns on the power conditioner.

(9) The gunner checks steps 10 through 15 of system self-test on TOW 2 (positions 1 and 7 on basic TOW), then collimates the nightsight.

NOTE: The limiter assembly limits elevation to 20 degrees and depression to 10 degrees. If the limiter is used, the gunner makes sure both elevation and depression limiters are in the up position and pinned (Figure 3-13, page 3-13).

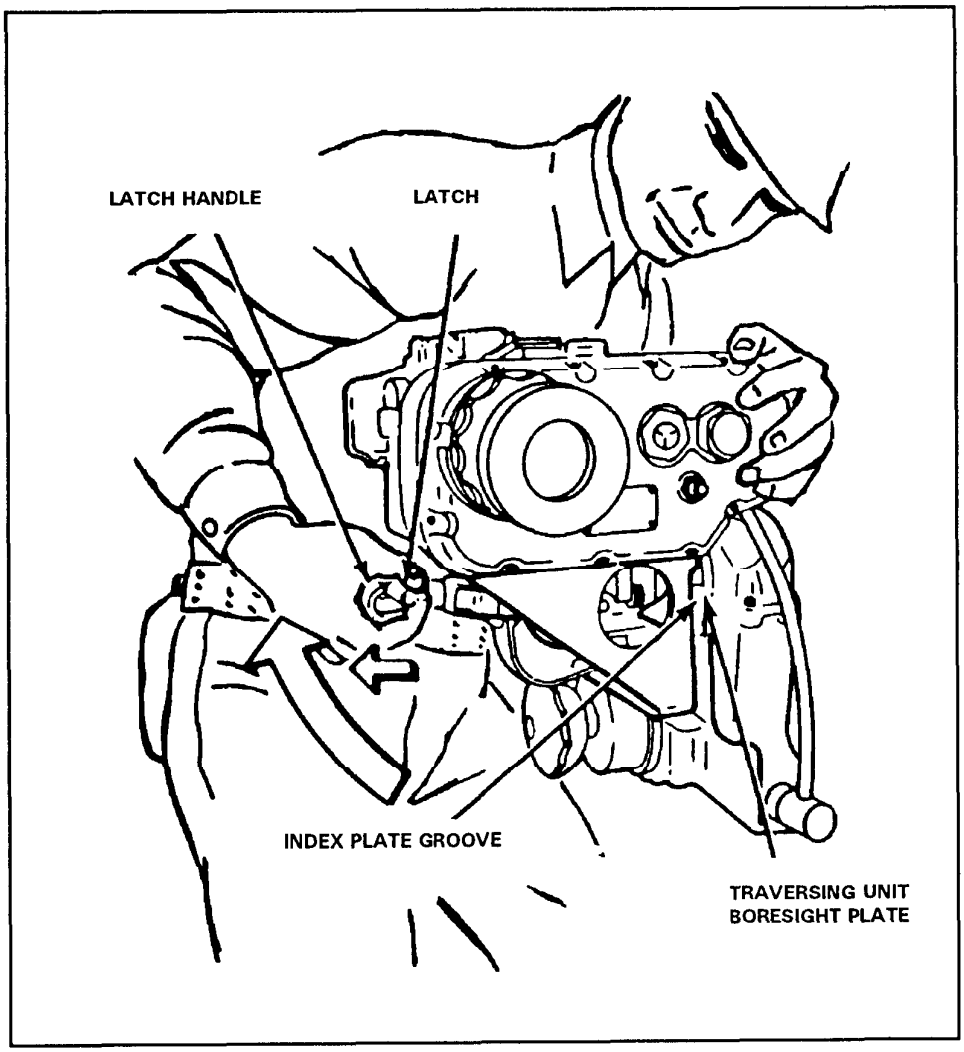


Figure 3-11. Daysight tracker on traversing unit boresight plate.

WARNING

Injury to the gunner and damage to the equipment can occur if the TOW system is fired at angles greater than 20 degrees or less than -20 degrees for all firing positions except over the cargo shell door. If firing over the cargo shell door, firing angles should not be greater than 20 degrees or less than -13 degrees. Pressure waves and flying debris can cause injury to personnel and damage to equipment.

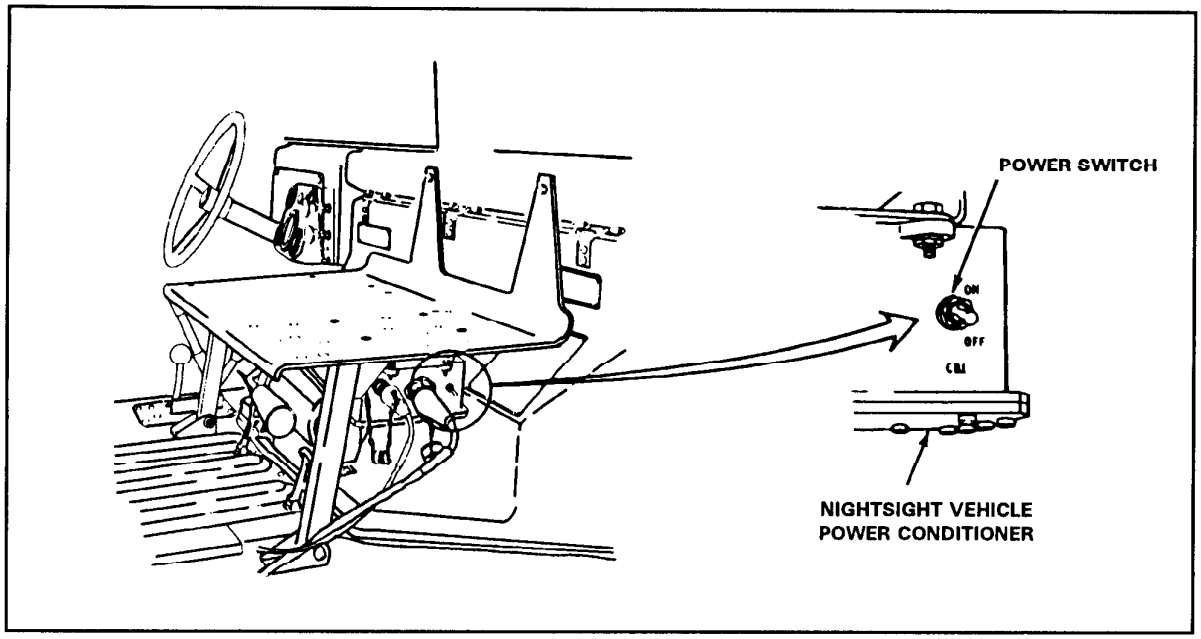


Figure 3-12. Nightsight power cable 2W2, J1 connector, and vehicle power conditioner.

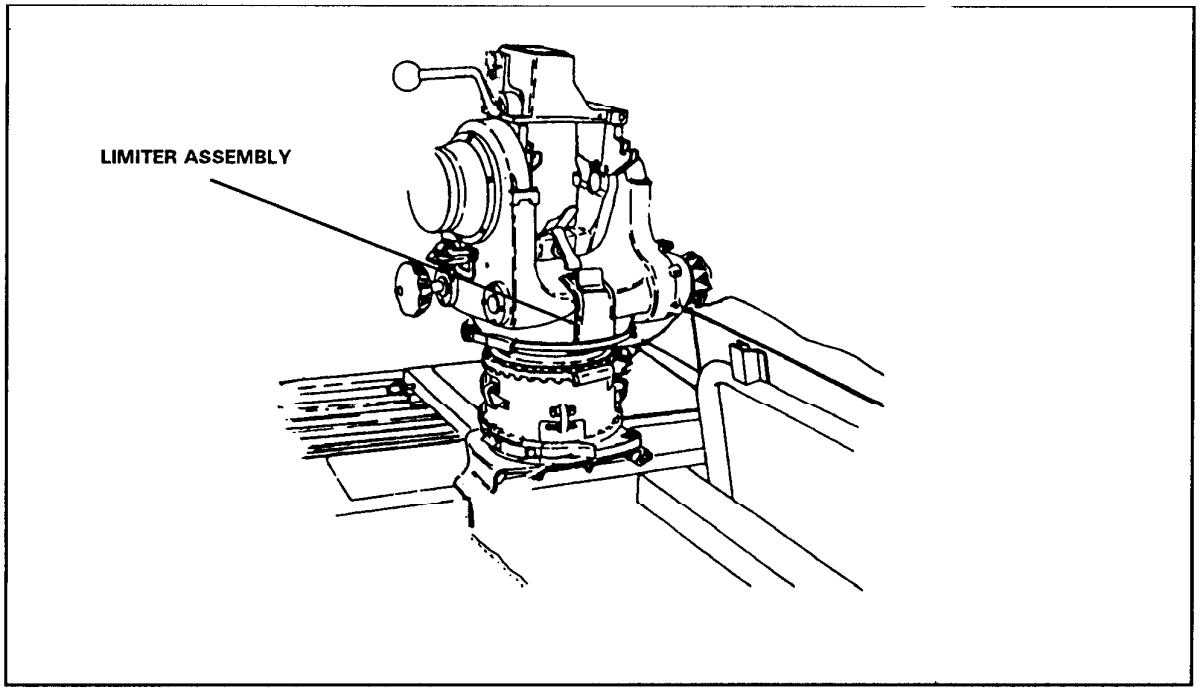


Figure 3-13. Limiter assembly location.

3-7. LOADING, ARMING, AND UNLOADING

The procedures for loading, arming, and unloading the M966-mounted TOW/TOW 2 areas follows:

a. **Load.** Missiles must be unloaded from the missile racks in numerical order. The forward handling ring, preformed packing, and quick-release clamp are saved in case the missile is not fired. If missile diaphragms get damaged while loading, the missile can still be fired. The following procedures are performed to-load the M966-mounted TOW/TOW 2

WARNING

Never open one end of the cargo shell door until the opposite end is securely closed. Personnel injury, equipment damage, or mission abort will occur if both ends open at the same time.

(1) On the traversing unit, the gunner ensures that the launch tube is locked in the 8-degree down position. He pushes the locking handle forward, then up, and opens the bridge clamp.

CAUTIONS

1. Do not drop an encased missile. Handling rings or launch container may be bent or damaged.
2. Do not break the diaphragm on the end of an encased missile. If water gets into the launcher container, the missile can be damaged.
3. Do not dispose of bad missiles. If an encased missile is damaged or handling rings are badly bent, return the encased missile to the ammunition unit for inspection.
4. Be careful not to punch a hole in an encased missile diaphragm when the forward handling ring is removed.

(2) The driver-loader unlatches and raises the cargo shell door using the forward latch. He removes the quick-release clamp and forward handling ring from the encased missile.

WARNING

Clear all personnel from the firing danger zone before proceeding with missile loading procedure.

(a) The driver-loader turns the inside portion of the protective cover two complete turns counterclockwise, and he removes it from the electrical connector. (The protective cover is kept for future use.)

(b) He turns the encased missile so that the electrical connector is facing up and hands it to the gunner.

(3) The gunner takes the encased missile from the driver-loader. He raises the back end of the missile and slides it forward and down into the launch tube until the missile indexing lugs are firmly in place. The gunner lowers the back end of the encased missile ensuring that the electrical connector joins with the bridge clamp. He lowers the bridge clamp and pushes down on the top of it. He pulls the bridge clamp locking handle downward and backward to lock the encased missile in the launch tube.

DANGER

Cargo shell door must be closed and securely latched at both ends before firing a missile. Firing a missile with the door not secure will cause injury to personnel, damage to equipment, or mission abort.

b. **Arm.** The following procedures are performed to arm the M966-mounted TOW/TOW 2.

(1) The driver-loader closes the cargo shell door.

(2) The gunner makes sure the cargo shell door is securely latched at the forward end.

WARNING

Do not raise arming lever until ready to fire at selected target.

(3) The gunner checks the backblast area before raising the arming lever.

CAUTION

Do not press the trigger with an empty missile case in the launch tube. Possible shorts can result, damaging the prefire, fire, and wirecutter circuits.

c. **Unload.** The gunner lowers the trigger cover over the trigger after the missile has impacted and locks the traversing unit in the 8-degree down position. If a missile is prepared for firing and then not fired. it must be immediately tagged to show the time, date, and using unit. If the missile is not used within 90 days of initial preparation, it must be turned in to the ammuntion supply point.

CAUTION

If the missile is not fired, lower the arming lever before opening the bridge clamp. The command-link wires will be cut if the arming lever is not lowered.

3-8. TARGET ENGAGEMENT

The crew members perform the following target engagement procedures.

a. When the squad leader issues the fire command, the gunner releases the azimuth and elevation locks on the traversing unit and turns on the nightsight if necessary. If crew members other than the gunner are in or leaning on the M966, they must be very still while the gunner is tracking. Even small movements can cause the vehicle to move and adversely affect the gunner's aim.

b. The gunner acquires and begins to track the target.

(1) If the target cannot be acquired in the sight, he announces, "Lost."

(2) When the target has been acquired, he identifies it as friendly or enemy.

(3) If the target cannot be identified, he announces, "Cannot identify. "

(4) If the target is identified as enemy, he places the cross hairs on the center mass of the exposed portion of the target, presses the trigger, and smoothly tracks the target until missile impact.

(5) If the target is sighted out of the sector of fire, the gunner must rotate the weapon station to engage the target after the squad leader verifies the target's engageability.

3-9. IMMEDIATE ACTION

The crew members perform the following immediate action procedures in the event of a hangfire or misfire. If the gunner presses the trigger and nothing happens after 1.5 seconds, a misfire has occurred. If he presses the trigger and the pop of the explosive squib on the gyroscope is heard but the missile does not launch after 1.5 seconds, a hangfire has occurred.

DANGER

The crew must use extreme care to avoid injury from a delayed missile launch. A delayed launch usually occurs within 1 minute. However, it could occur as long as 30 minutes after pressing the trigger. Keep all personnel out of firing danger zones.

DANGER

Do not open the cargo shell door during failure to launch procedures. Should the missile fire with the cargo shell door open, severe injury to personnel or damage to equipment will result.

a. For a *hangfire*, the gunner alerts the crew by announcing, "Hangfire" and continues to track the target for one minute.

(1) If the missile fails to launch after one minute, he closes the trigger cover, lowers the arming lever and locks the elevation lock and the azimuth lock, ensuring that the launch tube is locked in the 8-degree down position (Figure 3-14, page 3-18).

NOTE: In a training situation, the crew dismounts the vehicle, closes the doors, calls EOD, and waits 30 minutes. The gunner may then remount the vehicle.

DANGER

If the vehicle is not positioned with its front or rear in line with the target, it must be repositioned so that either the front or rear of the vehicle is in line with the target. The weapon station must be rotated during vehicle repositioning so the forward end of the missile is pointing toward the target at all times.

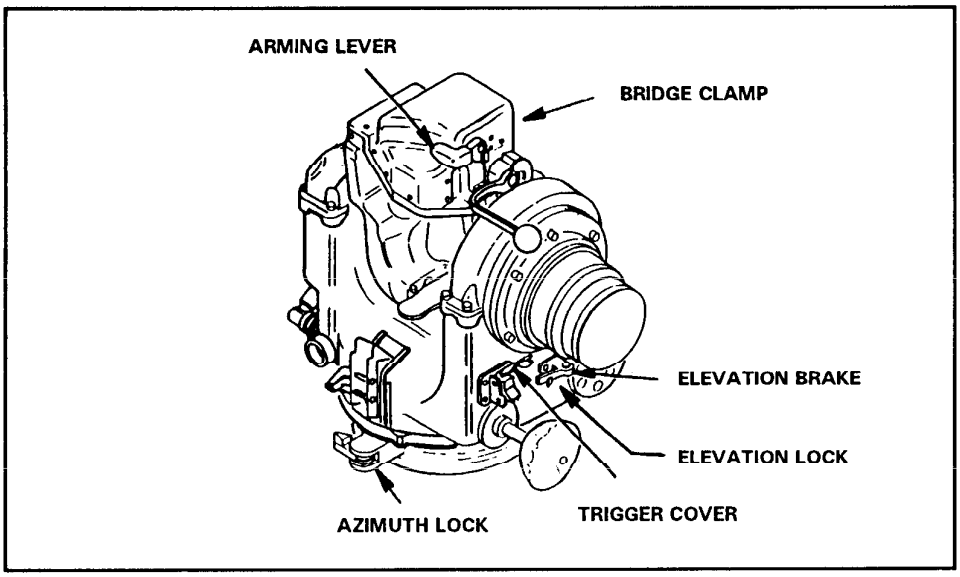


Figure 3-14. Trigger cover, arming lever, elevation lock, and azimuth lock.

(2) He opens the bridge clamp (Figure 3-15), removes the missile from the launch tube (keeping the missile pointed downrange at all times), and hands the missile over either side of the vehicle to the driver-loader (Figure 3-16).

WARNING

Do not hand off a malfunctioned missile to the front or rear of the vehicle. A malfunctioned missile must be handed off from the vehicle to either the left or right side.

(3) The driver-loader, keeping the missile pointed downrange, places the missile on the ground a safe distance from the vehicle. (In training, he places the missile on the ground at least 200 meters from the vehicle and marks the location.)

b. For a *misfire,* the gunner continues to track the target for one minute and presses the trigger again. He alerts the crew by announcing, "Misfire" and continues to track the target.

(1) If the missile still fails to launch, he disarms the missile by closing the trigger cover, lowers the arming lever, and locks the azimuth and elevation locks ensuring that the launch tube is locked in the 8-degree down position.

(a) The gunner presses the TEST-OPERATE switch to check the battery power. If he receives an OUT-OF-BAND/BATTERY FAIL, he checks to

ensure that the TVPC switch is in the ON position and that the P 1 cable is securely mated to the container. If all cables are connected securely, he replaces the power conditioner with a battery and checks the battery (Figure 3-17, page 3-20).

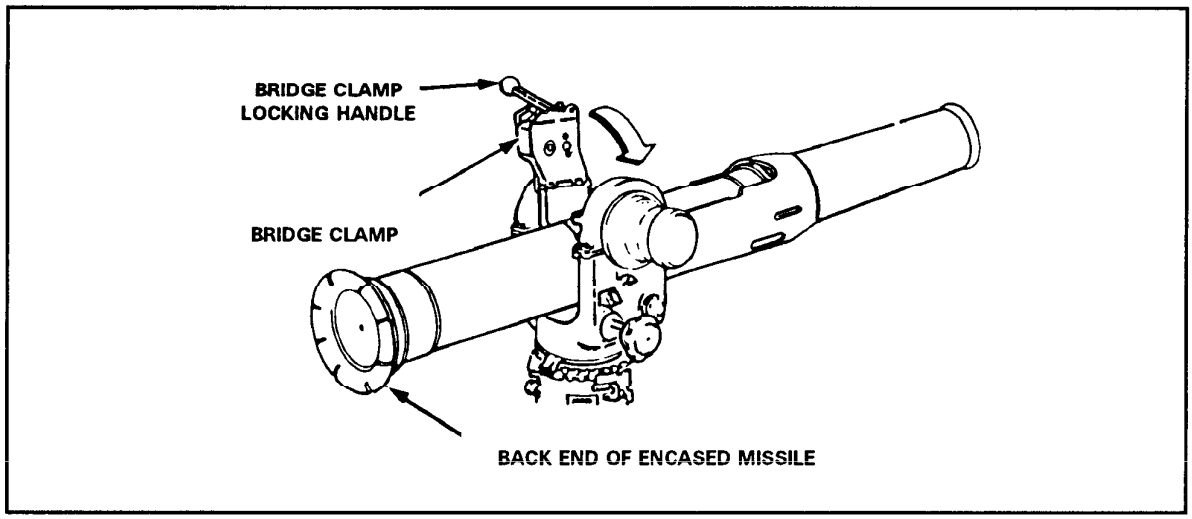


Figure 3-15. Bridge clamp, missile, and launch tube.

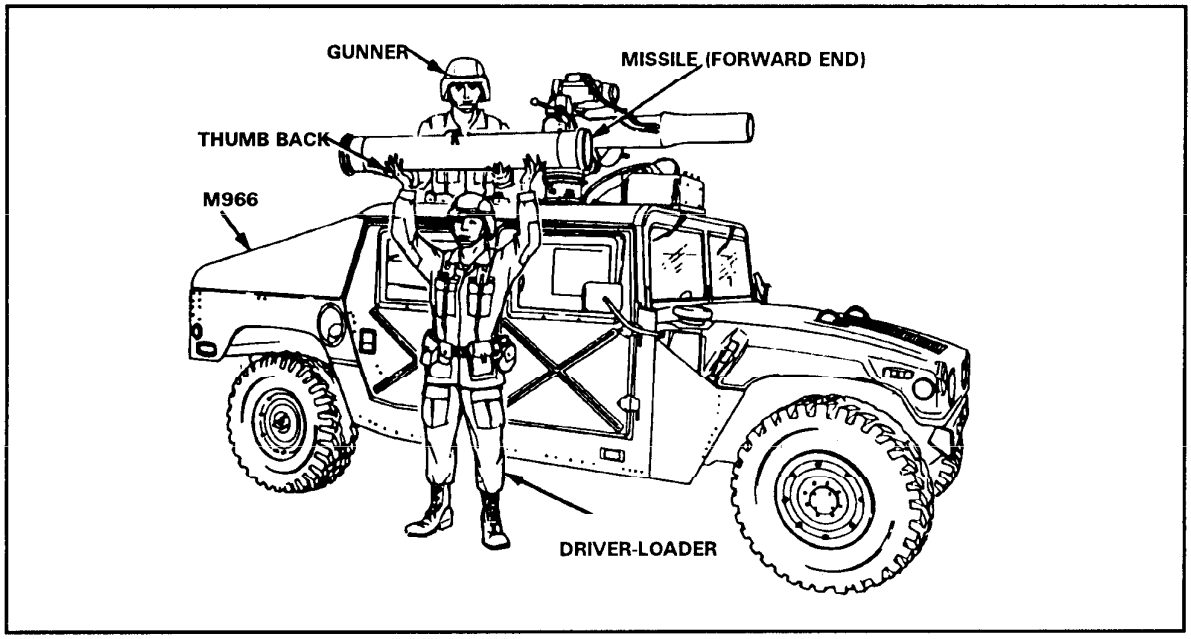


Figure 3-16. Driver-loader's position for receiving the missile from the gunner.

(b) He checks the coil cable connection to J1 connector. If it is not connected properly, he corrects it.

(c) He ensures the bridge clamp locking handle is properly seated, unlocks the azimuth and elevation locks, and raises the arming lever.

(d) He ensures the electrical connector is properly mated, raises the trigger cover, and presses the trigger.

(2) If the missile still fails to launch, the gunner may continue tracking the target for one minute (at the gunner's discretion in combat).

(a) He closes the trigger cover, lowers the arming lever, and locks the azimuth and elevation locks, ensuring the launch tube is locked in the 8-degree down position.

NOTE: In a training situation, the crew dismounts the vehicle, closes the doors, calls EOD, and waits 30 minutes. The gunner may then remount the vehicle.

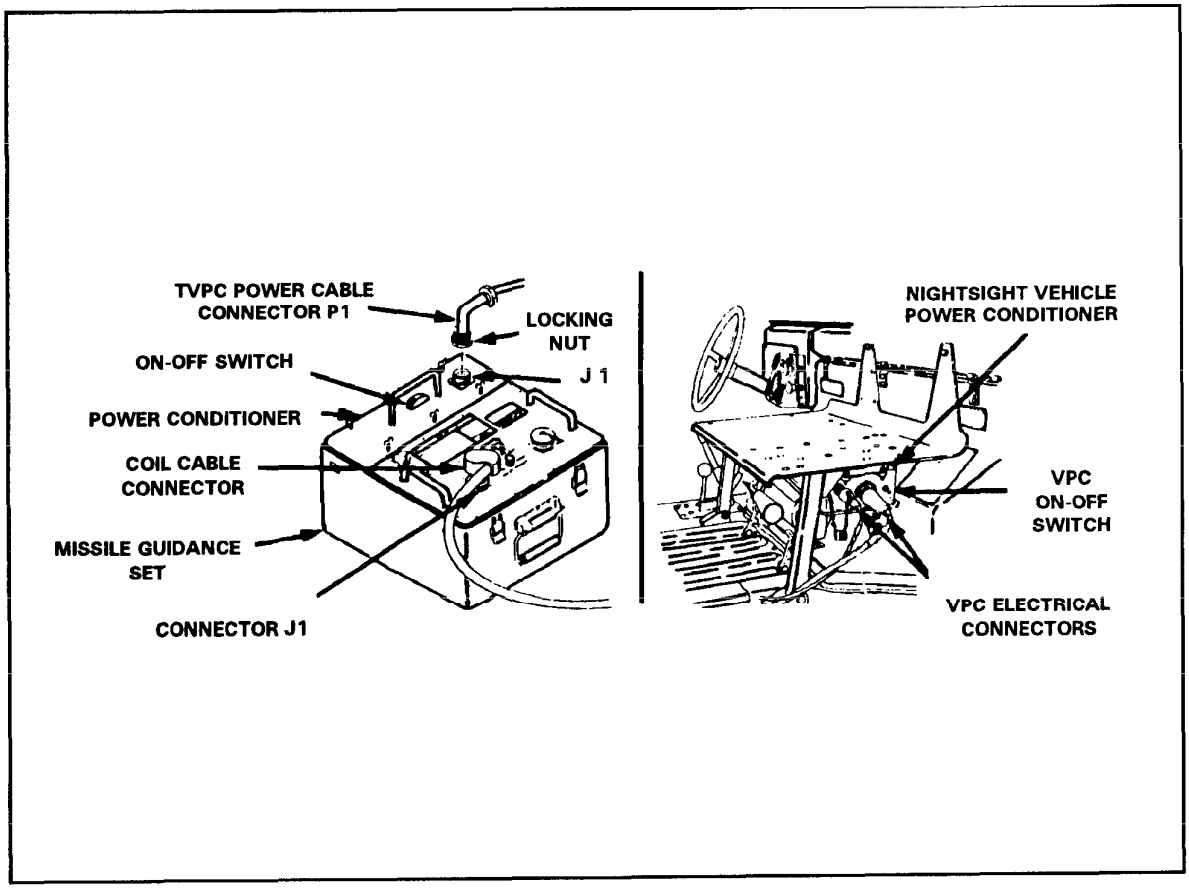


Figure 3-17. MGS, TVPC cable connector P1, power conditioner.

DANGER

If the vehicle is not positioned with its front or rear in line with the target, reposition it so that either the front or rear of the vehicle is in line with the target. Rotate the weapons station during vehicle repositioning so the forward end of the missile is pointing toward the target at all times.

(b) The gunner opens the bridge clamp, removes the missile from the launch tube (keeping the missile pointed downrange at all times), and hands the missile over either side of the vehicle to the driver-loader.

WARNING

Do not hand off malfunctioned missile to the front or rear of the vehicle. A malfunctioned missile must be handed off from the vehicle to either the left or right side.

(3) The driver-loader, keeping the missile pointed downrange, places the missile on the ground a safe distance from launcher. (In training, he places the missile on the ground at least 200 meters from the launcher and marks the missile location.)

3-10. M220A1 DISMOUNT

Specific actions must be followed when dismounting the M220A1 and moving it to the firing site. All actions happen simultaneously.

a. **Dismount Actions.** Each crew member begins executing his assigned responsibilities as soon as the squad leader commands, DISMOUNT THE TOW.

(1) *Squad leader's actions* The squad leader—

(a) Turns the VPC to the OFF position, places the MGS cover on the driver-loader's seat, and places the coil cable in its retaining cup on the traversing unit.

(b) Dismounts and goes to the rear of the vehicle; opens the cargo shell door using the rear latch; lowers the tailgate; removes the tripod, battery case, and coolant cartridge case and places them on the ground beside the launch tube (on left front side of vehicle in front of the MGS and the daysight tracker); closes the tailgate and cargo shell door.

(c) Enters the right rear passenger door, gets the collimator case and the

nightsight case, dismounts the vehicle, and places the collimator case and the nightsight case on the ground beside the vehicle.

(d) Carries the tripod, the coolant cartridge case, the battery case, and the launch tube to the firing site.

(2) *Gunner's actions* (assisted by driver-loader when needed). The gunner—

(a) Disconnects the coil cable from the MGS; disconnects the VPC and TVPC cables.

(b) Removes the nightsight and hands it to the driver-loader who places it on the ground. Removes the daysight tracker and hands it to the driver-loader who places it on the ground in front of the left side of the vehicle. (The nightsight should be put into its case and placed behind daysight tracker.)

(c) Removes the launch tube and hands it to the driver-loader who places it on the ground in front of the daysight tracker.

(d) Unlocks the top coupling clamp on the traversing unit adapter; removes the traversing unit (minus adapter); hands the traversing unit to the driver who places it on the ground behind the daysight tracker.

(e) Removes the TVPC from the MGS and places it to his rear on top of the vehicle within reach of the cargo hatch (see next step); unstraps the MGS and hands it to the driver-loader who places it on the ground beside the daysight tracker.

(f) Opens the cargo shell door by using the forward latch; switches the TVPC for the TOW battery assembly, and hands the battery assembly to the driver-loader to install in the MGS.

(g) Unstraps a missile and hands it to the driver-loader who places the missile on the ground behind the traversing unit. The gunner then closes the cargo shell door and dismounts the vehicle.

(h) Carries the daysight tracker and the MGS to the firing site.

(3) Driver-loader's *actions.* The driver-loader—

(a) Dismounts the vehicle and waits to receive equipment from the gunner.

(b) Aligns equipment as described in paragraphs 2a through 2g; installs the battery assembly in the MGS and then replaces the MGS cover on the MGS.

(c) Carries the traversing unit on the first trip, the missile on the second trip, and the nightsight and boresight collimator on the third trip to the firing site.

b. **Firing Position Actions.** Upon reaching the firing position, the crew proceeds with the following actions.

(1) *Squad leader's actions.* The squad leader—

(a) Places the coolant cartridge case, battery case, and launch tube on the ground. Sets up the tripod with the coupling clamp handle facing the direction of fire and unlocked.

(b) Pulls the coil cable out of the traversing unit retaining cup, installs the launch tube, and observes downrange for enemy targets.

(c) Issues fire commands.

(2) *Gunner's actions.* The gunner—

(a) Places the MGS on the ground next to the tripod and installs the daysight tracker on the traversing unit.

(b) Removes the MGS cover and connects the coil cable to the MGS.

(c) Installs the nightsight and turns the actuator switch to the ON position.

(d) Conducts the system self-test, boresight, and collimation.

(e) Engages the target upon receipt of the fire command.

(3) *Driver-loader's actions.* The driver-loader—

(a) Installs the traversing unit on the tripod.

(b) Returns to the vehicle for the missile; places the missile on the ground at the firing position to the right side of the weapon system.

(c) Returns to the vehicle to get the nightsight case and the boresight collimator case; returns to the firing position and hands the nightsight to the gunner.

(d) Places the collimator on the ground, removes it from its case, and installs it on the nightsight. Attaches the battery to the collimator.

(e) Removes the collimator from the nightsight; removes the battery from the collimator; places both the collimator and the battery back in their cases (if time permits).

(f) Loads the missile and arms it if commanded.

3-11. M220A1 REMOUNT

The following actions occur at the same time, when the squad leader commands, CEASE TRACKING, OUT OF ACTION.

a. **Firing Position Actions.** The following actions take place at the firing position before returning to the vehicle.

(1) *Squad leader's actions.* The squad leader—

(a) Removes the launch tube and places it on the ground.

(b) Folds the tripod legs and commands MOVE OUT. (The squad leader remains at the firing position until the driver-loader returns and all equipment is enroute to the vehicle.)

(c) Carries the coolant cartridge case, tripod, battery case, and launch tube back to the vehicle. Places the launch tube on the ground on the driver's side of the vehicle and the rest of the equipment on the ground behind the vehicle.

(2) *Gunner's actions.* The gunner—

(a) Disconnects the coil cable.

(b) Replaces the nightsight lens cover, removes the nightsight, and places it on the ground near the driver-loader.

(c) Removes the daysight tracker and picks up the MGS; carries them to the vehicle.

(d) Places the daysight tracker and the MGS on top of the vehicle and enters the gunner's station.

(3) *Driver-loader's actions.* The driver-loader—

(a) Removes the encased missile (or empty launch container if the missile was fired).

(b) Removes the traversing unit from the tripod, carries it to the vehicle, and hands it to the gunner when the gunner reenters the gunner's station.

(c) Returns to the firing position to get the nightsight and collimator; returns to the vehicle and hands the nightsight to the gunner; sets the collimator and the nightsight case on the ground near the rear of the vehicle.

(d) Returns to the firing position to get the encased missile (if a missile was not fired) and carries it to the vehicle. Hands the missile to the gunner.

b. **Remount Actions.** The following actions are performed to remount the vehicle.

(1) *Squad leader's actions.* The squad leader—

(a) Stows the coolant cartridge, battery case, tripod, nightsight case, and collimator on the vehicle.

(b) Hands the TVPC and VPC cables to the gunner. Enters the squad leader's seat in the vehicle and turns the VPC to the ON position.

(c) Places the MGS cover on the floorboard.

(d) Assists other crew members as needed.

(2) *Gunner's actions.* The gunner—

(a) Receives the traversing unit from the driver-loader, installs it on the traversing unit adapter, and secures it with the top coupling clamp.

(b) Installs the MGS in the MGS tray and secures it with the straps; hands the MGS cover to the squad leader; connects the coil cable.

(c) Installs the daysight tracker and nightsight, and connects the VPC.

(d) Moves into the cargo area and places the unfired missile in the missile rack (if necessary).

(e) If time permits, conducts the system self-test, boresight, and collimation; exchanges the battery assembly for the TVPC; connects the TVPC cable.

(3) *Driver-loader's actions.* The driver-loader assists the squad leader and gunner as needed. He closes the tailgate and cargo shell door at the end of the drill.

NOTE: If a missile was fired, the empty launch container is destroyed.

3-12. M220A2 DISMOUNT

Specific actions must be followed when dismounting the M220A2 and moving it to the firing site. All action happen simultaneously.

NOTE: Infantry units using the M966 conduct many types of missions. Therefore, during dismount operations, all equipment must be properly stored before leaving the vehicle.

a. **Dismount Actions.** The following actions occur at the same time when the squad leader commands, DISMOUNT THE TOW.

(1) *Squad leader's actions.* The squad leader—

(a) Turns the VPC to the OFF position, places the MGS cover on the driver-loader's seat, and places the coil cable in its retaining cup on the traversing unit.

(b) Dismounts and goes to the rear of the vehicle; opens the cargo shell door using the rear latch; lowers the tailgate; removes the tripod and the BPC and places them on the ground beside the launch tube (on the left front side of the vehicle in front of the MGS and the daysight tracker); closes the tailgate and cargo shell door.

(c) Enters the right rear passenger door, gets the collimator case and the nightsight case, dismounts the vehicle, and places the collimator case and the nightsight case on the ground beside the vehicle.

(d) Carries the tripod, BPC, and launch tube to the firing site.

(2) *Gunner's actions (assisted by driver-loader when needed).* The gunner—

(a) Disconnects the coil cable from the MGS and disconnects the VPC and TVPC cables.

(b) Removes the nightsight and hands it to the driver-loader who places it on the ground. Removes the daysight tracker and hands it to driver-loader who places it on the ground in front of the left side of the vehicle. (The nightsight should be put into its case and placed behind the daysight tracker.)

(c) Removes the launch tube and hands it to driver-loader who places it on the ground in front of the daysight tracker.

(d) Unlocks the top coupling clamp on the traversing unit adapter, removes the traversing unit (minus adapter), and hands it to the driver-loader who places it on the ground behind the daysight tracker.

(e) Removes the TVPC from the MGS and places it to his rear on top of the vehicle within reach of the cargo hatch (see next step); unstraps the MGS and hands it to the driver-loader who places it on the ground beside the daysight tracker.

(f) Opens the cargo shell door by using the forward latch; exchanges the TVPC for the TOW battery assembly; hands the battery assembly to the driver-loader to install in the MGS.

(g) Unstraps a missile and hands it to the driver-loader who then places the missile on the ground behind the traversing unit. The gunner then closes the cargo shell door and dismounts the vehicle.

(h) Carries the daysight tracker and the MGS to the firing site.

(3) *Driver-loader's actions.* The driver-loader—

(a) Dismounts the vehicle and waits to receive equipment from the gunner.

(b) Aligns equipment as described in paragraphs 2a through 2g; installs the battery assembly in the MGS and then installs the MGS cover on the MGS.

(c) Carries the traversing unit on the first trip, the missile on the second trip, and the nightsight and boresight collimator on the third trip to the firing site.

b. **Firing Position Actions.** Upon reaching the firing position, the crew proceeds with the following actions:

(1) *Squad leader's actions.* The squad leader—

(a) Places the BPC and launch tube on the ground; sets up the tripod with the coupling clamp handle facing the direction of fire and unlocked; connects the BPC cable and turns the BPC to the ON position; places the BPC cable within reach of the gunner.

(b) Pulls the coil cable out of the traversing unit retaining cup; installs the launch tube; observes downrange for enemy targets.

(c) Issues fire commands.

(2) *Gunner's actions.* The gunner—

(a) Places the MGS on the ground next to the tripod and installs the daysight tracker on the traversing unit.

(b) Removes the MGS cover and connects the coil cable to the MGS.

(c) Installs the nightsight and turns the actuator switch to the ON position.

(d) Conducts the system checkout, boresight, and collimation.

(e) Engages the target upon receipt of the fire command.

(3) *Driver-loader's actions.* The driver-loader—

(a) Installs the traversing unit on the tripod.

(b) Returns to the vehicle for the missile; places it on the ground at the firing position to the right side of the weapon system.

(c) Returns to the vehicle and gets the nightsight case and collimator case; returns to the firing position, takes the nightsight out of the case, and hands it to the gunner.

(d) Places the collimator case on the ground; removes the collimator from its case and installs it on the nightsight. Attaches the boresight cable to the collimator.

(e) Disconnects the boresight cable and removes the collimator from the nightsight; places the collimator in its case (time permitting).

(f) Loads the missile and arms it upon receipt of the fire command.

3-13. M220A2 REMOUNT

The following actions occur at the same time, when the squad leader commands, CEASE TRACKING, OUT OF ACTION.

a. **Firing Position Actions.** The following actions are performed at the firing position.

(1) *Squad leader's actions.* The squad leader—

(a) Removes the launch tube and places it on the ground.

(b) Places the coil cable in the retaining cup in the bottom of the traversing unit.

(c) Folds the tripod legs and commands MOVE OUT (The squad leader remains at the firing position until the driver-loader returns and all equipment is en route to the vehicle.

(d) Carries the BPC, tripod, and launch tube back to the vehicle. Places the launch tube on the ground on the driver's side of the vehicle and the rest of the equipment on the ground behind the vehicle.

(2) *Gunner's actions.* The gunner—

(a) Disconnects the coil cable.

(b) Replaces the nightsight lens cover; removes the nightsight and sets it on the ground near the driver-loader.

(c) Removes the daysight tracker, picks up the MGS, and carries them to the vehicle.

(d) Places the daysight tracker and MGS on top of the vehicle and enters the gunner's station.

(3) *Driver-loader's actions.* The driver-loades—

(a) Removes the encased missile (or empty launch container if the missile was fired).

(b) Removes the traversing unit from the tripod, carries it to the vehicle, and hands it to the gunner when the gunner reenters the gunner's station.

(c) Returns to the firing position to get the nightsight and collimator; returns to the vehicle and hands the nightsight to the gunner; sets the collimator and the nightsight case on the ground near the rear of the vehicle.

(d) Returns to the firing position, gets the encased missile (if the missile was not fired), and carries it to the vehicle. Hands the missile to the gunner.

b. **Remount Actions.** The following actions are performed to remount the vehicle.

(1) *Squad leader's actions.* The squad leader—

(a) Stows the BPC, tripod, collimator, and nightsight case on the vehicle.

(b) Hands the TVPC and VPC cables to the gunner. Enters the squad leader's seat in the vehicle and turns the VPC to the ON position.

(c) Places the MGS cover on the floorboard.

(d) Assists the other crew members as needed.

(2) *Gunner's actions.* The gunner—

(a) Receives the traversing unit from the driver-loader, installs it on the traversing unit adapter, and secures it with the top coupling clamp.

(b) Installs the MGS in the MGS tray and secures it with the straps; hands the MGS cover to the squad leader; connects the coil cable.

(c) Installs the daysight tracker and the nightsight, and connects the VPC.

(d) Moves into the cargo area and places the unfired missile in the missile rack (if necessary).

(e) Conducts the system checkout, boresight, and collimation (if time permits); exchanges the battery assembly for the TVPC and connects the TVPC cable.

(3) *Driver-loader's actions.* The driver-loader assists the squad leader and gunner as needed.

NOTE: If a missile was fired, the empty launch container is destroyed.

3-14. FIRING LIMITATIONS

Firing limitations for the M966-mounted TOW/TOW 2 are the same as for the tripod-mounted TOW/TOW 2 with an additional limitation: Restricted firing angles are those greater than +20 degrees or less than -20 for all firing positions except firing over the cargo shell door. The firing angle over the cargo shell door should not exceed +20 degrees or -13 degrees.

CHAPTER 4

M901-SERIES IMPROVED TOW VEHICLE

The M901-series improved TOW vehicle (ITV) is a one-vehicle weapon system (Figure 4-1). The M901 employs the M220A1 TOW and the M901A1 employs the M220A2 TOW 2. The ITV is manned by a four-man crew—the squad leader, the gunner, the loader, and the driver.

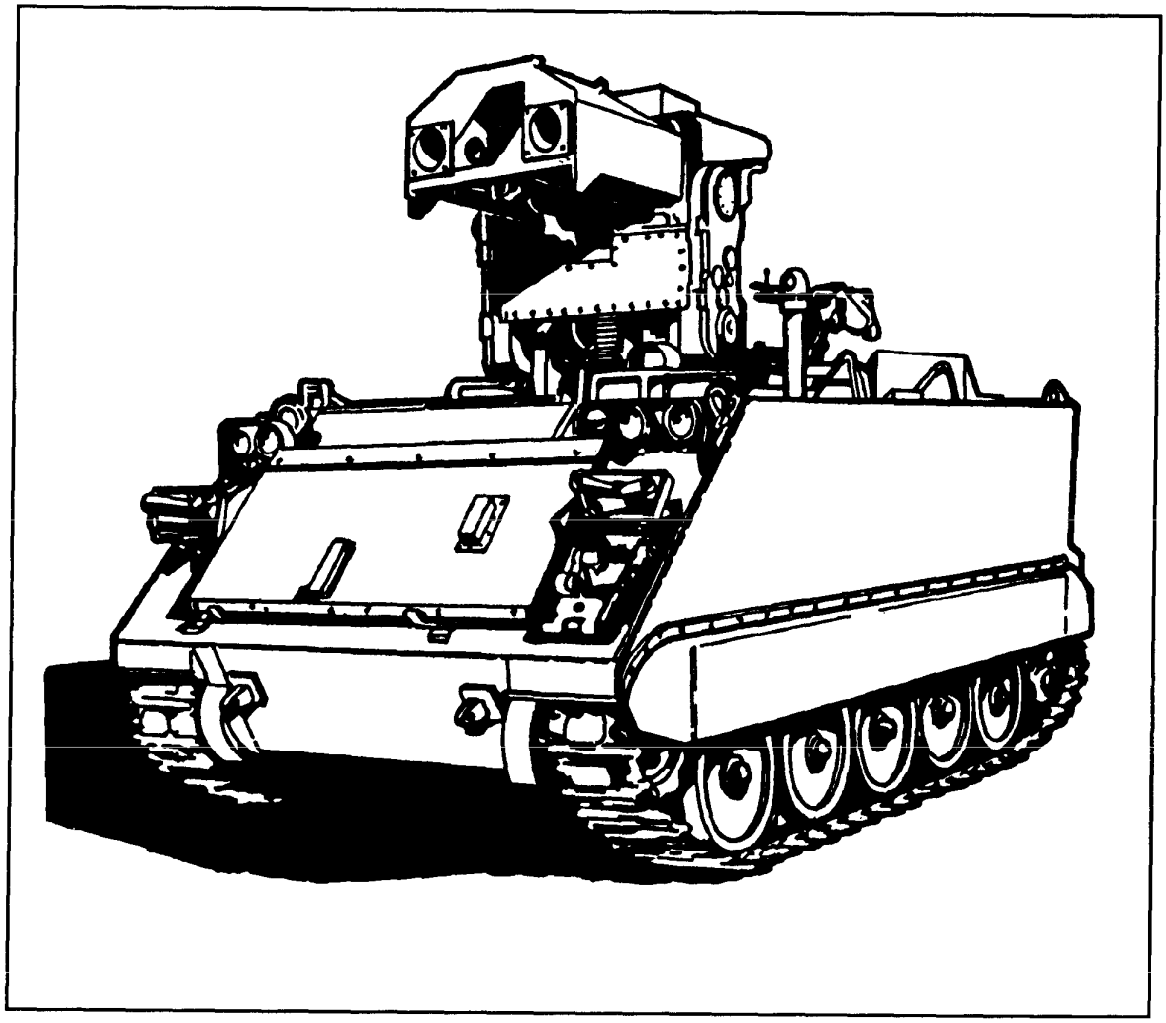


Figure 4-1. M901-series ITV.

Section I. INDIVIDUAL DUTIES AND RESPONSIBILITIES

The four-man TOW crew consists of the squad leader, gunner, loader, and driver. The duties and responsibilities of each crew member are discussed in the following paragraphs and in Tables 4-1 through 4-7 at the end of this chapter.

4-1. SQUAD LEADER

The squad leader is responsible for the combat readiness and tactical employment of his squad. This includes crew discipline, health and welfare, training, and maintenance of equipment and weapons. Other specific duties include—

- Detecting and identifying targets.
- Issuing fire commands.
- Controlling fire and movement.
- Supervising and assisting in the dismounting and assembly of the M220A1/A2 TOW launcher.
- Employing the squad according to the orders of the section leader.
- Selecting the squad's primary, alternate, and supplementary firing positions for the ITV and, when necessary, for the tripod-mounting of TOW/TOW 2.
- Operating the SLP.
- Requesting squad resupply.
- Keeping the section leader informed of events that affect the tactical situation and the status of the crew.
- Helping the loader boresight the daysight tracker.
- Planning and controlling the fire of the M60 machine gun.
- Carrying the tripod, batteries, and coolant cartridge cases for the nightsight (basic TOW), the tripod and BPC (TOW 2), and binoculars (both systems) when employing the TOW in the ground mode.
- Acting as a gunner and helping raise the side armor, when needed.
- Conducting the system check-out procedures with the aid of the gunner and loader.
- Establishing local security.
- Assisting in determining if a target can be engaged.

4-2. GUNNER

The gunner's duties include

- Assisting in system check-out procedures.
- Acquiring, recognizing, and identifying armored vehicles using the ITV daysight tracking system.
- Determining if a target can be engaged.
- Engaging targets.
- Recognizing and eliminating a firing angle limitation.
- Helping conduct the turret operational checks.
- Helping the loader collimate the nightsight.
- Removing and carrying the MGS (with battery assembly) and the launch tube when the TOW/TOW 2 is used in the ground mode.
- Stowing the M60 machine gun and closing the gunner's hatch, when required.
- Firing the M60 machine gun when directed to do so by the squad leader.
- Preparing range cards for the TOW and the M60 machine gun.
- Maintaining the M220A1/A2 TOW components, the gunner's weapon station, and the M60 machine gun.

4-3. LOADER

The loader's duties include—

- Inspecting and stowing the encased missiles.
- Preparing missiles for loading.
- Loading the launcher.
- Helping the gunner collimate the nightsight.
- Helping the squad leader boresight the daysight tracker.
- Removing and carrying the traversing unit, the collimator, and an encased missile when the TOW/TOW 2 is used in the ground mode.
- Raising the side armor and lowering the cargo hatch.
- Helping the driver camouflage the vehicle.
- Helping the driver clear the carrier's top deck before the launcher is erected.

- Manually erecting the launcher, when necessary.
- Maintaining the communications equipment.
- Checking the backblast area.
- Removing a misfired missile from the launcher.

4-4. DRIVER

The driver's duties include—

- Maintaining the carrier with the crew's help.
- Driving the carrier tactically (performing evasive maneuvers, fording the carrier, and positioning the carrier in a firing position).
- Camouflaging the carrier and the firing position (with the loader's help) before the launcher is erected.
- Securing all radio antennas.
- Installing the daysight tracker and nightsight on the ITV.
- Helping the loader stow missiles on the missile rack.
- Manning the M60 machine gun when the TOW/TOW 2 is in the ground mode.
- Removing and carrying the daysight tracker and nightsight when the TOW/TOW 2 is in the ground mode.
- Carrying an encased missile (if needed) when the TOW/TOW 2 is used in the ground mode.
- Positioning the ITV in a covered and concealed position when the TOW/TOW 2 is in the ground mode.

Section II. OPERATION PROCEDURES

Before using the M901-series dual launcher, install the M220-series TOW launcher and encased missiles and prepare the M901 for TOW firing.

4-5. CHARACTERISTICS

The M901-series ITV has a high first-round hit probability with a rapid engagement rate. It provides the crew and weapon system protection from small-arms fire and artillery fragments. The squad leader has about a 270-degree range of view through the squad leader's periscope (SLP), which enhances the ITV's capability to operate from concealed and full-hull defilade

270-degree range of view through the squad leader's periscope (SLP), which enhances the ITV's capability to operate from concealed and full-hull defilade positions. The turret launcher has the capability for day and night acquisition and tracking of targets, and it provides firing coverages of 360 degrees in azimuth and +35 to -30 degrees in elevation. The ITV has stowage provisions for tripod-mounted TOW components configured so the ground system can be dismounted and set up in three to five minutes. In addition, the ITV can ford small bodies of water (40 inches or less) and is air transportable. It has the following characteristics"

- A complete M220-series TOW weapon system stowed and strapped in fixed mounting brackets. The daysight tracker and nightsight (AN/TAS-4 or AN/TAS-4A) are mounted in an operational ready state.
- A dual TOW missile launcher.
- M243 smoke grenade launchers.
- A 3X acquisition sight with a 25-degree field of view.
- Remote actuators that allow daysight tracker and nightsight adjustments.
- An M60 machine gun mounted on a traversing rail.
- A hydraulically and electrically powered turret that can be operated manually.

4-6. INSTALLATION OF AN M220-SERIES TOW LAUNCHER AND ENCASED MISSILES

To install an M220-series TOW launcher and encased missiles on an M901-series ITV, see TM 9-2350-259-10.

4-7. PREPARATION OF AN M901-SERIES ITV FOR TOW FIRING

At no time should the turret be placed into operation without performing the operational checklist (Table 4-6).

a. Erect Launcher from a Stow Position (Gunner). Before erecting the launcher, the gunner ensures that the top deck in front of the gunner's station is clear. He locks the M60 machine gun and pintle mount in the stow position and closes the gunner's hatch. He ensures the TURRET POWER switch is OFF. Before starting the engine, the driver turns off the radio. He then turns the master switch ON and starts the engine. He checks the driver's instrument panel and idles the engine at 1,200 to 1,500 rpm. Before the turret power is applied, the gunner checks the gunner's control panel and ensures the switches are as shown in Figure 4-2, page 4-6.

DANGER

To avoid injury to personnel and damage to equipment, clear the top deck of personnel and loose objects.

NOTE: The launcher can be erected by using battery power, but the vehicle's engine should be started to avoid draining the batteries. When operating the launcher using battery power, the driver monitors the battery generator indicator on the driver's instrument panel. If the indicator needle is in the red section while the turret is operating, the driver stops operations and starts the engine. (The driver turns the emergency power switch ON in case a power surge disengages the 5-ampere fuze.) After starting the engine, he idles it at 1,200 to 1,500 rpm. He turns the emergency power off after the engine starts.

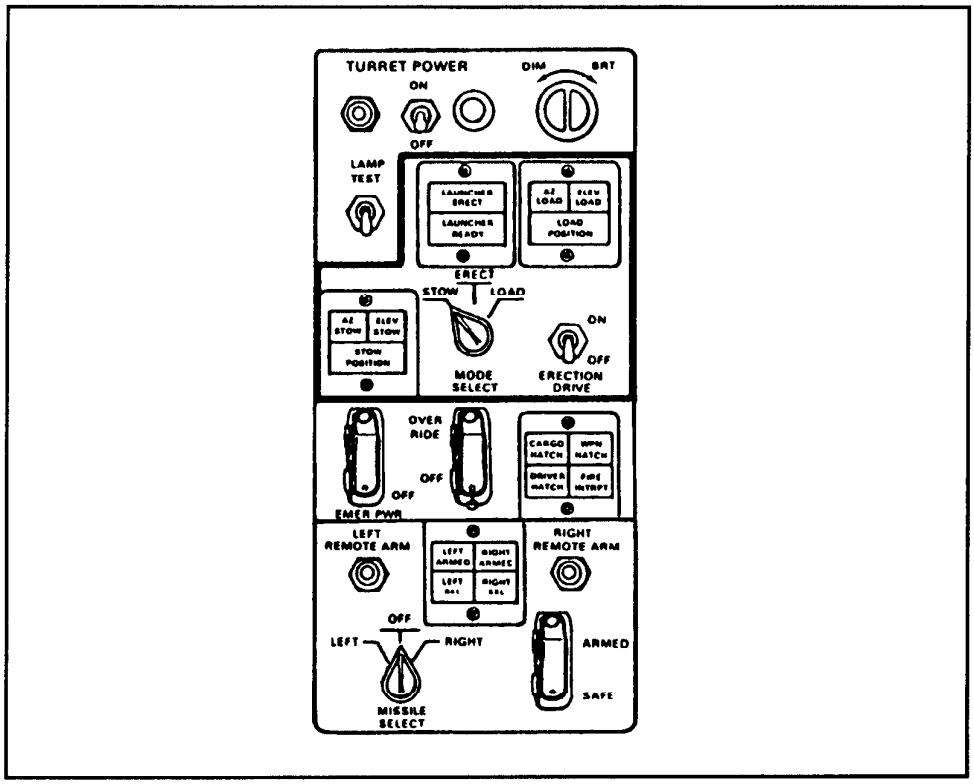


Figure 4-2. Gunner's control panel.

(1) The gunner turns the TURRET POWER switch to the ON position. AZ STOW, ELEV STOW, and STOW POSITION indicators will be on.

(2) The gunner turns the MODE SELECT knob to ERECT (Figure 4-3). He pushes up on the ERECTION DRIVE switch and holds it in the ON position until—

- LAUNCHER ERECT and LAUNCHER READY lights are on.
- AZ STOW and ELEV STOW lights remain on.
- STOW POSITION indicator light is off.

LAUNCHER ERECT and LAUNCHER READY lights will only come on after the launcher is erected and locked in position.

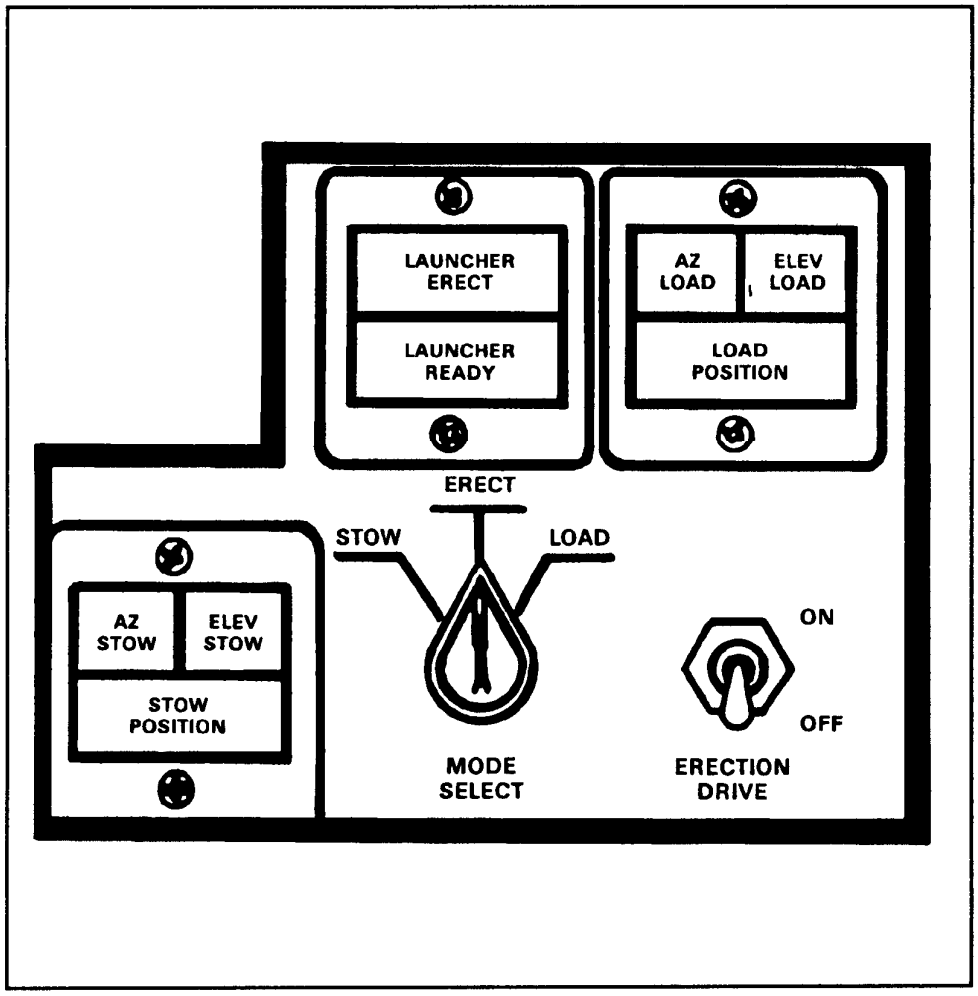


Figure 4-3. MODE SELECT knob and ERECTION DRIVE switch.

b. Prepare a Dual Launcher for Loading (Gunner).

WARNING

Do not operate gunner's hand controls (GHCs) unless both the LAUNCHER ERECT and LAUNCHER READY indicators are on. If the indicators are not on, the launcher could fall, resulting in serious injury to personnel and damage to equipment.

(1) To traverse the turret (Figure 4-4), the gunner squeezes the action and slew switches and rotates the GHC counterclockwise until the turret azimuth indicator reads almost 0 degrees. The AZ LOAD indicator will light (Figure 4-4).

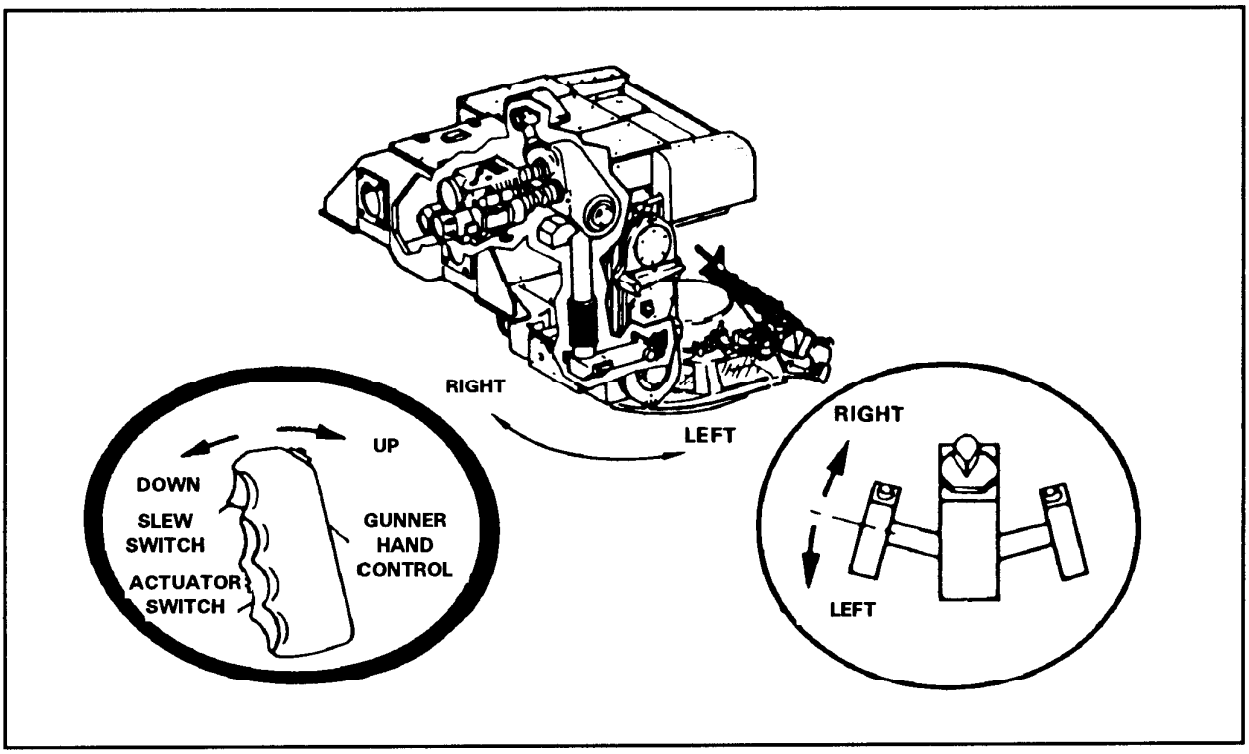


Figure 4-4. Gunner's hand controls.

(2) To elevate the launcher, the gunner squeezes the action switches and rotates the GHC backward elevating the launcher to maximum elevation. The ELEV LOAD indicator will light.

(3) To place the launcher in the load position, the gunner moves the MODE SELECT knob to LOAD. He holds the ERECTION DRIVE switch to ON until the LOAD POSITION indicator lights and the LAUNCHER ERECT and LAUNCHER READY indicator lights are OFF, then releases the switch. The

READY TO LOAD light on the fire interrupt/intercom assembly will also be on, indicating to the loader to proceed with loading the launcher.

c. Load a Dual Launcher and Return to Stow Position (Loader). Before loading the launcher, the loader ensures the READY TO LOAD indicator is lit.

(1) The loader opens the cargo hatch to the first detent. He secures the encased missile and places indexing lugs on the launcher rail and slides the missile forward until the front of the missile seats against the forward centering ring. He holds the missile in place while pulling down the locking handle (Figure 4-5, page 4-10). (He repeats the procedure for the other missile if two missiles are to be loaded.) The loader closes the cargo hatch by releasing the cargo hatch detent lock lug and pulling down on the cargo hatch strap.

(2) Once the launcher has been loaded, the gunner moves the MODE SELECT switch to ERECT. He pushes the ERECTION DRIVE switch up and holds until the LAUNCHER ERECT, LAUNCHER READY, AZ LOAD, and ELEV LOAD indicators are lit. Then, he traverses the turret to about 180 degrees (the AZ STOW indicator light should come on) and depresses the launcher until the ELEV STOW indicator lights. He moves the MODE SELECT switch to STOW and pushes the ERECTION DRIVE switch up and holds it. The STOW position indicator will light when the launcher is in the stow position (at this time the LAUNCHER ERECT and LAUNCHER READY indicators should be off); if the indicator lights go off, the gunner erects the launcher and repeats the stowing procedures. Once the launcher is in the STOW position, the gunner moves the TURRET POWER switch to OFF.

CAUTIONS

1. Ensure the missile is fully seated against the front of the launch tube before engaging the missile locking handle. If abnormal force (greater than 30 pounds) is required to lock the missile locking handle, place the locking handle in the unlocked position and reseat the missile, ensuring it is fully seated against the front of the launch tube. Raise the missile up firmly against the launcher guide rails and attempt to place the missile locking handle to the locked position. If abnormal force is still required to lock the missile locking handle, remove the missile and inspect it for damage. If the missile is damaged, discard it and load a serviceable missile into the launch tube. If the missile is not damaged, notify organizational maintenance. Failure to observe this caution may result in damage to the system.
2. Never elevate the turret to get the ELEV STOW light to come on. This will damage the turret when stowing.

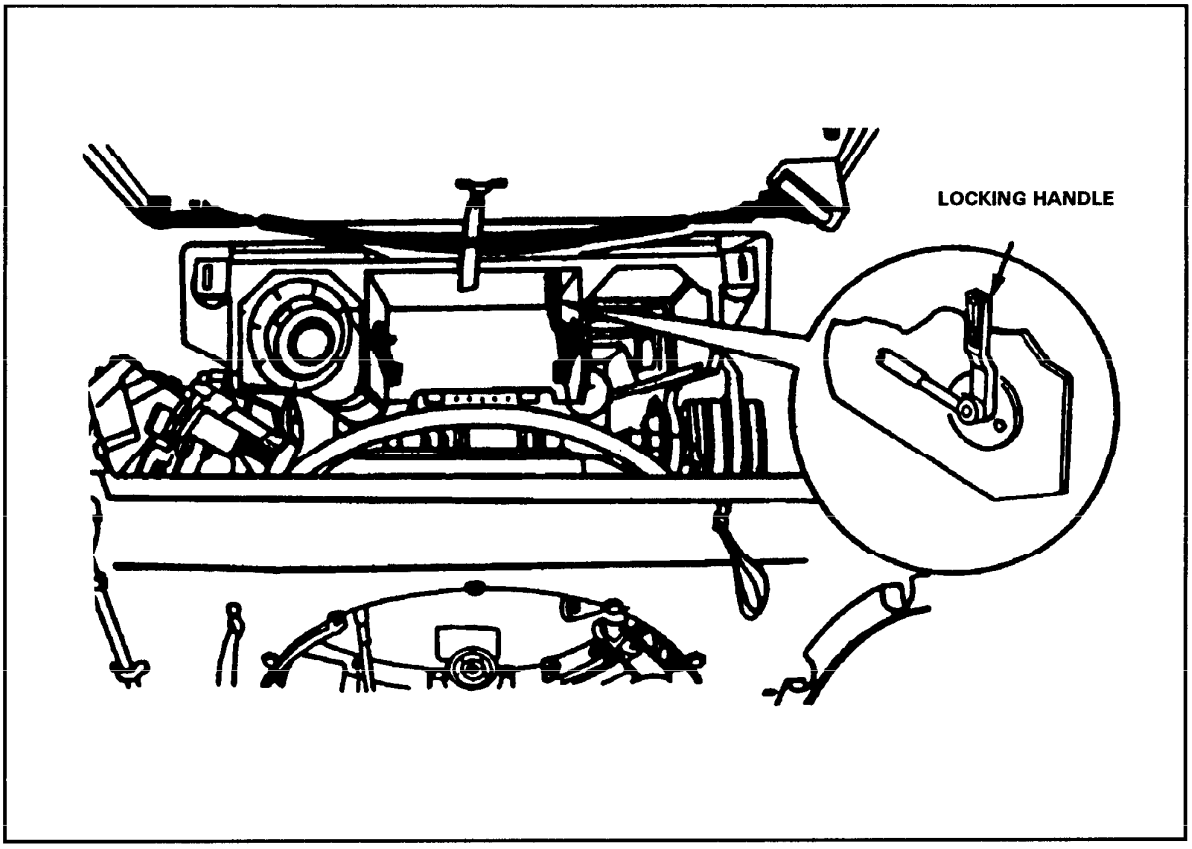


Figure 4-5. Locking handle.

4-8. TARGET ENGAGEMENT

The crew performs the following procedures to engage a target.

a. The gunner erects the launcher from the stowed position.

b. The gunner turns the SELECT switch to 3X (Figure 4-6A). In response to the fire command (Table 4-1, page 4-27) he tracks the target by rotating the turret in the direction of the target.

(1) The gunner grasps both GHCs while squeezing one or both action switches and turning the GHC assembly clockwise to rotate the turret to the right or counterclockwise to rotate the turret to the left.

(2) If speed is desired, the gunner presses one or both slew switches (increasing the speed four times).

(3) The gunner elevates or depresses the launcher with either one or both GHCs.

(4) The gunner rotates the GHC and pushes forward (while squeezing the action switch) to depress the launcher; he rotates the GHC and pulls back to elevate the launcher.

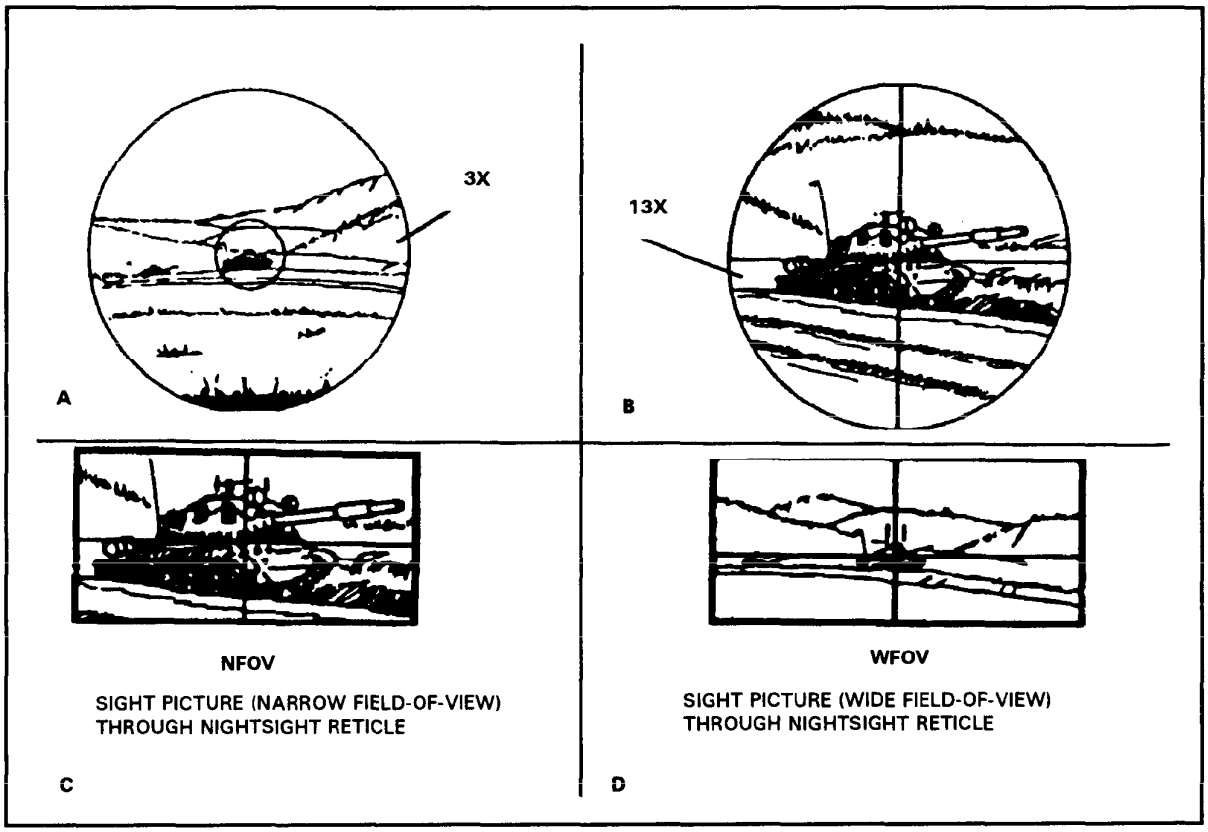


Figure 4-6. Sight pictures.

c. The gunner centers the reticle on the target. He turns the SIGHT SELECT switch to 13X (line of sight to target is now through the daysight tracker Figure 4-6B]). He turns the SIGHT SELECT switch to NIGHT and pulls the field of view selector all the way out. (The target is now seen through the nightsight in the narrow field of view mode Figure 4-6C].) The cross hairs and the rectangular sight picture are illuminated providing a close-up picture of the target. The gunner adjusts the brightness, contrast, and range focus controls to get the best possible target image. For the M901A1, the gunner uses the following procedures.

(1) He locates the target using the daysight tracker, but fires using the nightsight. Smoke, dust, and so forth can obscure the battlefield even during daylight. The nightsight allows continuous observation of the target regardless of battlefield visibility conditions. During limited visibility, the gunner uses the nightsight for target location and engagement. When firing the TOW 2 system, he always turns the nightsight ON, regardless of which sight is used, to ensure that the enhanced capabilities of the TOW 2 are used during firing, flight, and impact.

(2) Certain conditions may permit degraded firing. If, during the system check-out procedure, the MGS display indicates a nightsight (postamplifier) failure and that is the only failure indicated, the gunner can still fire the TOW 2 using the daysight tracker. However, if limited visibility conditions cause a handoff to the nightsight during flight, control of the missile may be lost.

WARNING

Do not operate the GHCs unless both LAUNCHER ERECT and LAUNCHER READY indicators on the gunner's control panel are on. If the indicators are not on, the launcher could fall, resulting in serious injury to personnel and damage to equipment.

d. The gunner selects a missile by turning the MISSILE SELECT switch to the left or to the right (depending on which missile is to be fired). He places the ARMED-SAFE switch to ON while keeping the cross hairs on the target. He looks for LEFT SELECT and LEFT ARMED lights or RIGHT SELECT and RIGHT ARMED lights to light up on the control panel (depending on which missile is to be fired). He fires the missile by pressing either or both TRIGGER switches and keeps tracking the target until the missile impacts. If the trigger light does not light up immediately, he presses both TRIGGER switches again. (A 1.5-second delay normally occurs between the time the TRIGGER switch is pressed and the missile is launched.) If the missile does not fire 1.5 seconds after the trigger is pressed, the missile is treated as a misfire. The gunner selects the second missile to engage another target.

4-9. IMMEDIATE ACTION

The crew performs immediate action procedures as described in Table 4-2 to eliminate the malfunction, and they continue the mission in the fastest and safest manner.

4-10. RELOADING

The crew performs the following procedures to reload the TOW/TOW 2 on the M901-series.

a. The gunner notes the turret deflection of the target area so he can quickly return to the target after reloading. He moves the launcher to the load position. When the LOAD POSITION light comes on, he announces, "Ready."

b. The loader unstraps and prepares two missiles in the storage rack (positions 9 and 10). He places one of the missiles on the carrier floor and

watches the READY TO LOAD light while listening for the gunner to announce "Ready." When the gunner announces, "Ready," and the READY TO LOAD light is on, the loader opens the cargo hatch to the first stop position. He unlocks the left launch tube locking handle (UP is unlocked) and removes the expended missile case. He throws the expended missile case out of the carrier over the left side. He loads the missile that is on the carrier floor by placing the missile's indexing lugs on the left launch tube guide rails and sliding the missile forward until it slips into the centering ring at the front of the launch tube. He supports the missile with the heel of his left hand to keep from puncturing the missile diaphragm with his fingers. He locks the left launch tube locking handle (DOWN is locked). He follows the same procedures for reloading the right launch tube except all left-handed actions will be right-handed actions. He slams the hatch closed, announces, "Up," and moves two more missiles to the ready rack.

c. The gunner rotates the MODE SELECT switch to the ERECT position and watches the gunner's control panel. When the fire interrupt and cargo hatch lights go off, he holds the ERECTION DRIVE switch up. When the LAUNCHER READY light comes on, he slews the launcher to the proper deflection, depresses the launcher until a target is seen, and announces, "Identified."

NOTE: The squad leader may require the loader to observe the backblast area.

4-11. EMERGENCY ACTION

The crew performs the following emergency action procedures.

a. After the gunner commands, ERECT THE LAUNCHER MANUALLY, the squad takes these actions.

(1) The gunner—

(a) Sets the EMER PWR switch to the UP position.

(b) Sets the MODE SELECT switch to the ERECT position. Loosens the strap securing the hydraulic pump handle. (If the TURRET POWER switch is ON, turning it OFF is not necessary.)

(c) Slides out of the gunner's seat to allow the squad leader room to pump up the hydraulic pressure. (The gunner should not pump the hydraulic hand pump unless absolutely necessary. Fatigue that results from pumping may affect his tracking ability.)

(d) Sits in the squad leader's seat and observes the battlefield through the SLP.

(e) Moves back to the gunner's seat and slews the turret to observe the battlefield and engage targets (after the squad leader has pumped the hydraulic pressure to 1,400 pounds per square inch [psi] and the launcher is erected and locked).

(2) The squad leader—

(a) Stands up and leans into the gunner's station after the gunner leaves.

(b) Pumps the hydraulic pump handle as the loader cranks the launcher to the erect position (maintains at least 1,400 psi).

(c) Returns to the squad leader's seat when the launcher is erect and locked in place. (The erection locks can be heard driving into place and the LAUNCHER ERECT and LAUNCHER READY lights on the gunner's control panel will come on.) Secures the hydraulic pump handle with a strap before returning to the squad leader's seat.

(3) The loader—

(a) Gets the handcrank from the driver, exits the carrier through the crew door in the rear ramp, climbs to the top of the carrier, and moves to the right side.

(b) Locates the access cover on the launcher erection arm and unscrews it. (The access cover is attached to the launcher erection arm with a chain.)

(c) Inserts the handcrank as far as it will go into the hole in the erection arm. Turns the handcrank until the launcher is erect and the upper locks engage.

- If the crank is hard to crank, it may not be inserted all the way or the emergency power battery may be discharged.
- Slow down as the launcher nears the erect position to be sure the upper locks engage and do not move past the erect position.

(d) Removes the handcrank, replaces the access cover, and returns to his on-carrier position.

b. The squad follows alternate procedures for erecting the launcher with backup power.

(1) The gunner—

(a) Sets the EMER PWR switch to the UP position and the MODE SELECT switch to the ERECT position. (TURRET POWER does not have to be turned off.)

(b) Loosens the strap securing the hydraulic pump handle, moves to the squad leader's seat, and observes the battlefield through the SLP.

(c) Returns to the gunner's seat when the launcher is erect and traverses the turret to observe the battlefield and engage targets.

(2) The squad leader—

(a) Takes turns with the loader pumping the hydraulic pump until the pressure gauge reaches 1,750 psi or higher; then holds the ERECTION DRIVE switch UP.

(b) Releases the ERECTION DRIVE switch when the LAUNCHER ERECT and LAUNCHER READY lights come on.

c. The squad acquires and engages targets using emergency power.

(1) The gunner—

(a) Ensures the launcher is erect and traversed to approximate deflection to target.

(b) Ensures the hydraulic pressure is at least 1,200 psi and EMER PWR switch is up (ON).

(c) Tells the squad leader or loader to pump up the hydraulic pressure as required. (Do NOT pump when tracking a target-tracking will be jerky.)

(d) Acquires the target using the 3X telescope.

(e) Switches to the 13X daysight tracker when the target has been acquired and fires the missile. Tracks the target until missile impact.

(2) The squad leader and loader switch back and forth pumping up hydraulic pressure when the gunner requests. (The loader should be the primary pumper because the squad leader needs to observe the battlefield.)

d. The squad reloads the dual launcher during an emergency.

(1) The primary method of reloading the dual launcher in an emergency is for the loader to exit the carrier through the cargo hatch and reload the launch tubes with the launcher still in the erect position. The squad leader hands the missiles to the loader.

(2) An alternate method of reloading the dual launcher in an emergency is for the squad leader (or loader, only if absolutely necessary) to pump up hydraulic pressure as directed by the gunner. The gunner ensures the hydraulic pressure is at least 1,750 psi before moving the launcher from the erect position to the load position and back to the erect position from the load position. He directs the squad leader or the loader to pump up hydraulic pressure when necessary.

(3) All other procedures are the same as for a normal reload.

e. The squad stows the launcher using emergency power.

(1) The squad leader or the loader pumps up hydraulic pressure as directed by the gunner.

(2) The gunner ensures the hydraulic pressure is at least 1,750 psi before moving the launcher from erect to stow. He directs the squad leader or the loader to pump up hydraulic pressure when necessary.

(3) When the stow position light comes on, the gunner secures the hydraulic pump handle with the securing strap.

(4) All other procedures are the same as for a normal stow.

4-12. DISMOUNT AND REMOUNT

During the operation of the ITV, the TOW may have to be dismounted from the carrier and used tripod-mounted to engage the enemy—for example, during vehicle electrical failure, during mechanical failure, if the vehicle is disabled from indirect fire, if the sector of fire cannot be covered while mounted, or on the command of the section or squad leader. Once the mission has been

completed from the tripod-mounted mode, a secondary mission may require remounting the carrier and moving to a different firing position. (See Tables 4-3 and 4-4, pages 4-38 and 4-40, for the dismount and remount procedures for an M901-series.)

4-13. EVACUATION

In case of fire, the crew evacuates by performing the following:

a. The driver opens the driver's hatch and exits the vehicle.

b. The gunner opens the gunner's hatch and exits the vehicle.

c. The squad leader follows the gunner out the gunner's hatch. Once outside, the squad leader pulls the fixed fire extinguisher handle.

d. The loader exits the carrier the fastest way possible through either the gunner's or driver's hatches. The gunner's hatch is usually the best, but if that is blocked by either the gunner or squad leader, the driver's hatch maybe faster.

4-14. M60 MACHINE GUN OPERATION

The secondary weapon for the M901-series is the M60 machine gun. It is used for security of the vehicle and crew.

a. **Mount, Stow, and Dismount Procedures.**

(1) *Mount the machine gun and pintle.* Place the machine gun pintle in the socket of the pintle mount. Tighten the pintle mount locking handle on the side of the socket. Rotate the pintle to ensure it does not bind and rotates freely. Place the M60 machine gun on the machine gun mount and check the front mounting lug to ensure it is engaged in position inside the mounting recess. Lower the butt of the gun on the machine gun mount until the mounting latch engages the rear locking pin. The gun should snap in place.

(2) *Stow the machine gun.* Push the pintle mount frame to the right side of the traversing rail and lock it in position with the traversing rail lock. Push the butt of the gun down into the travel lock receiver. The travel lock is spring loaded and should automatically lock the gun in the raised position.

CAUTION

Make sure the gun is in the stow position when operating the turret.

(3) *Dismount the machine gun.* Release the travel lock on the pintle mount and pull the butt of the gun up. Release the machine gun from the stow position and tilt the weapon so the muzzle is pointed downward. Release the mounting latch; push it forward and pull up on the weapon at the same time.

b. **Target Engagement Procedures.**

(1) *Sight and aim.* When firing an M60 machine gun mounted, the sights are not used. Look over the top of the weapon and adjust the fire to the target by the strike of the bullets on the ground or by the tracer path.

(a) To engage linear targets (Figure 4-7), engage the entire width of the target. Lay the gun on the center of mass, or portion of the target that presents the-greatest threat. Traverse the fire to either flank, then cover the remainder of the target.

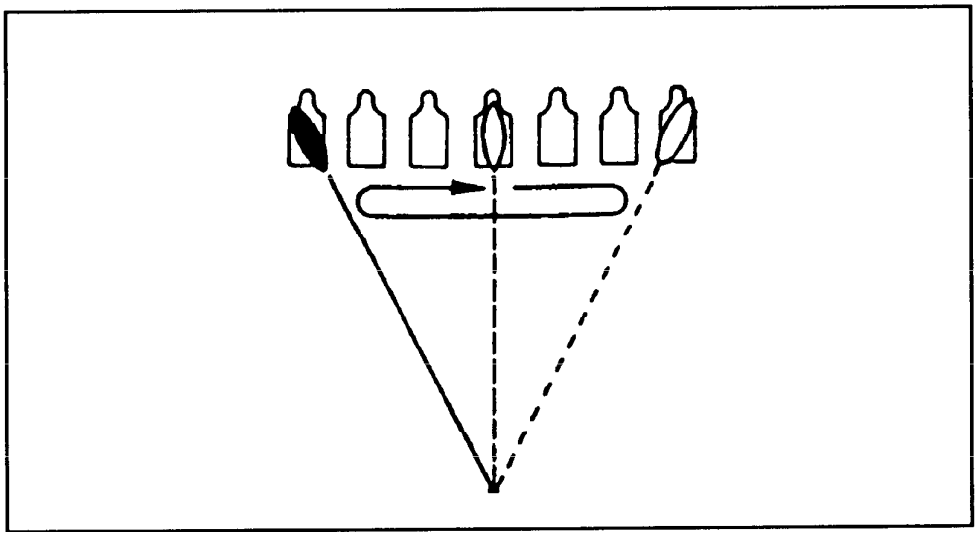


Figure 4-7. Linear target engagement.

(b) To engage linear target with depth (Figure 4-8, page 4-18), engage the entire width and depth of the target. Lay the gun on the center of mass, or portion of the target that presents the greatest threat. Traverse and search to the flank closest to the position, then cover the entire target.

(c) To engage deep target (Figure 4-9, page 4-18), engage the entire target depth. Lay the gun on the center of mass, or portion of the target that presents the greatest threat. Search to the portion of the target nearest the position, then the entire target.

(d) To engage moving targets (Figure 4-10, page 4-19), apply correct lead on a moving target. Place the point of aim far enough in front of the target so the fire and the target meet.

(2) *Observe fire.* Observe either the dust raised by the strike of the round, or the tracers, and make an adjustment to bring the fire onto the target.

(3) *Adjust fire.* When the strike of the rounds is observed, or tracers are going high over the target, immediately cease fire and start over again.

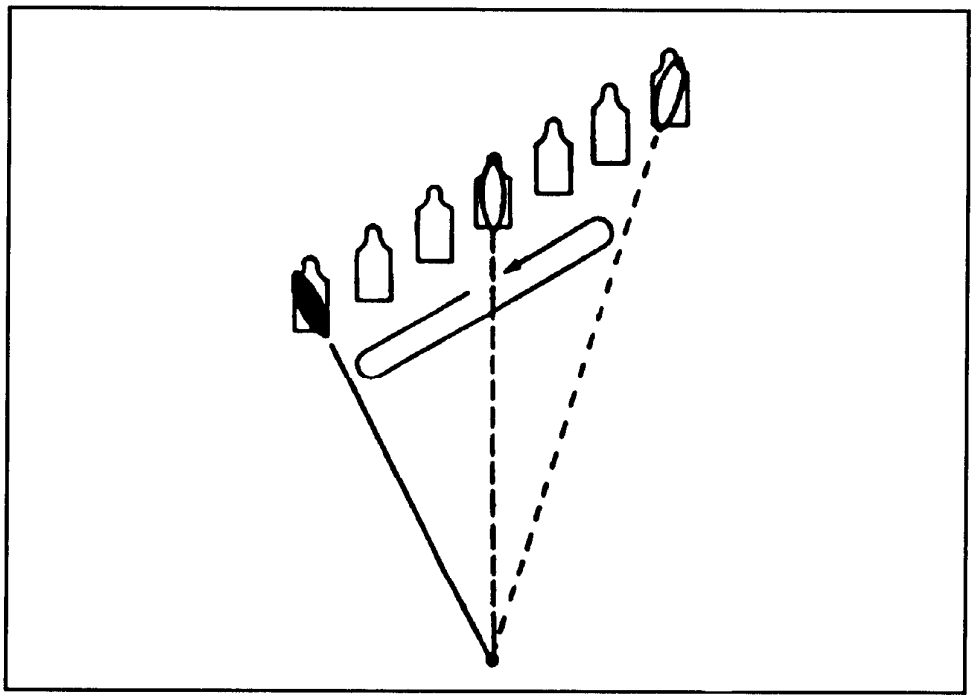


Figure 4-8. Linear target with depth engagement.

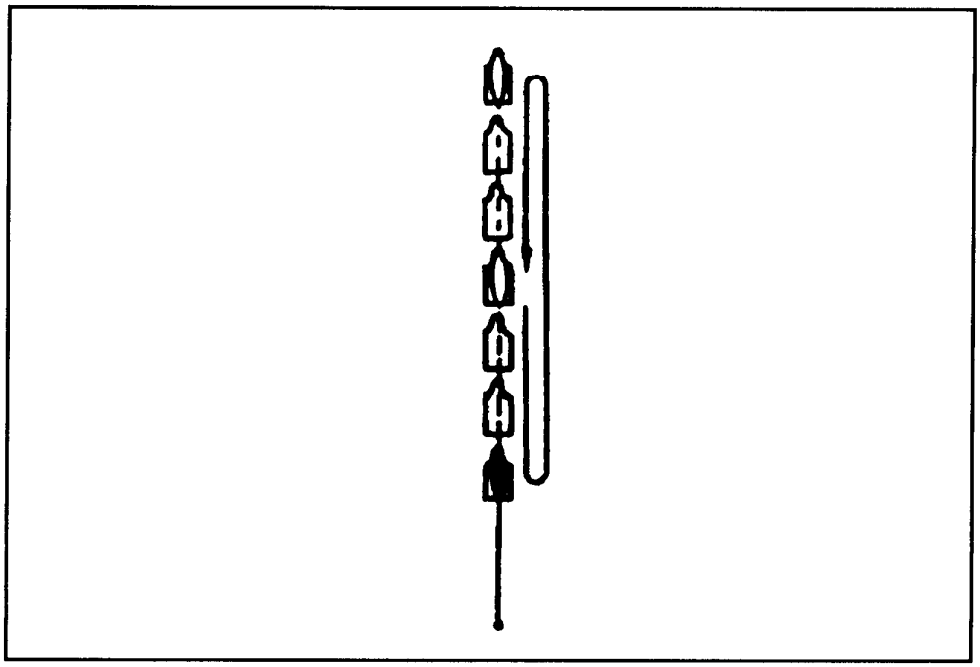


Figure 4-9. Deep target engagement.

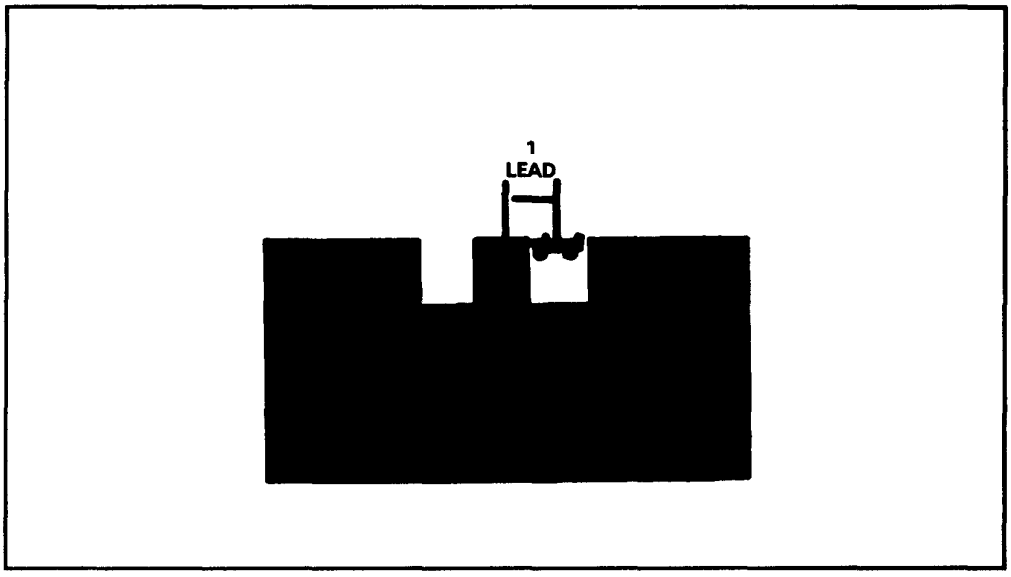


Figure 4-10. Moving target engagement.

4-15. SQUAD LEADER'S PERISCOPE OPERATION

The SLP can be used to help detect targets and determine the range to them. It has a possible 270-degree field of view. However, depending on the position of the launcher, the field of view may be less than 270 degrees.

a. **Description.** The parts of an SLP are a humidity indicator, a focus control ring, the eye cup, the reticle, an azimuth control knob, and an elevation control knob (Figure 4-11, page 4-20).

(1) The humidity indicator contains replaceable desiccant. DA Form 2404 is used to report when the desiccant shows pink.

(2) The focus control ring is directly behind the eye cup. The squad leader turns the focus ring while looking through the SLP to properly focus the image.

(3) The eye cup is an inflated rubber eye protector to protect the eye during use of the SLP.

(4) The SLP reticle is a nonmoveable azimuth scale in degrees. Zero is always to the front of the vehicle. As the SLP is rotated, the azimuth indicator is rotated around the azimuth scale to indicate the direction to the target in relation to the vehicle. Four stadia lines, located in the center of the reticle, are used to compute the estimated range to targets.

(5) The azimuth control knob rotates the SLP in azimuth. The squad leader turns the knob clockwise to rotate the line of sight to the left. (Three rotations of control knob causes the line of sight to rotate 360 degrees in azimuth.)

(6) The elevation control knob is rotated clockwise to raise the line of sight and counterclockwise to lower the line of sight. The full range of motion is 10 degrees above horizontal and 20 degrees below horizontal.

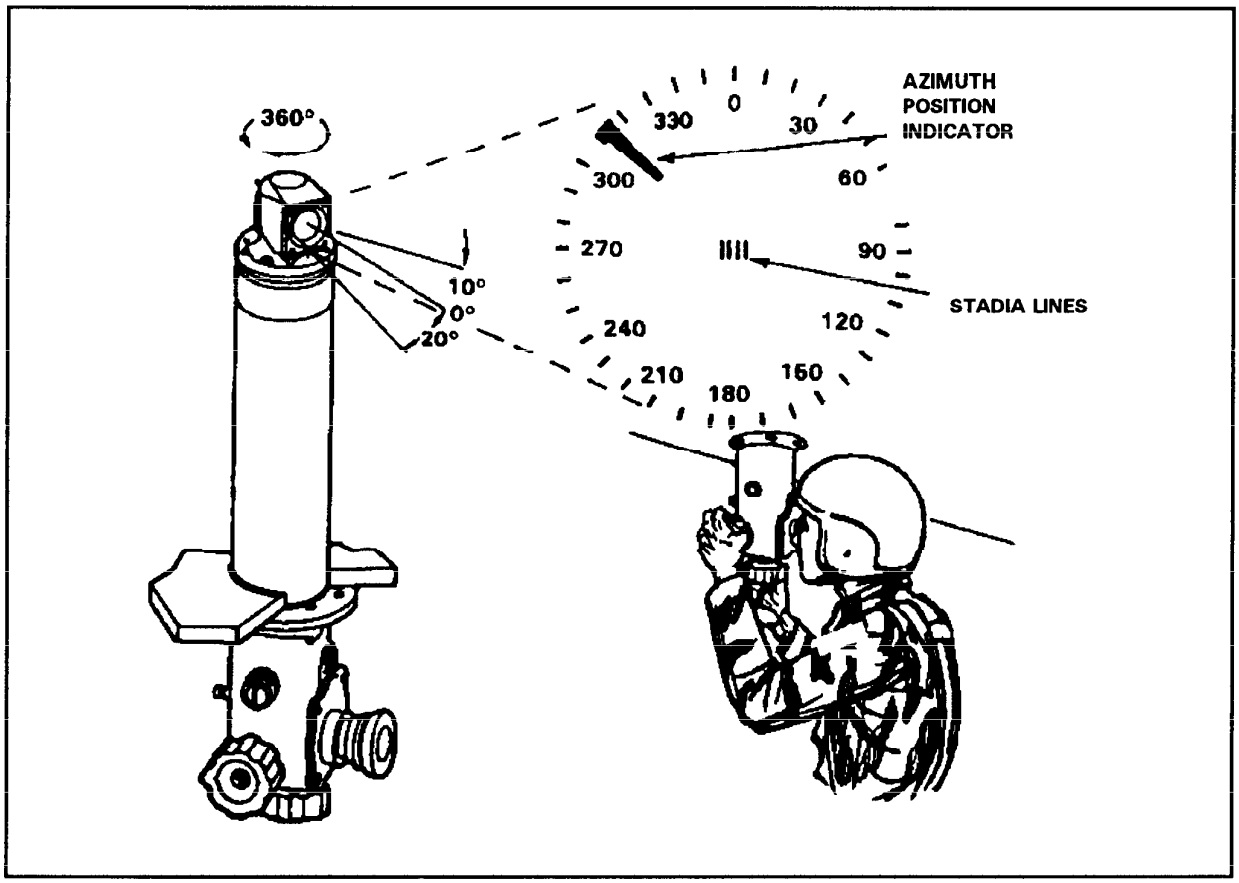


Figure 4-11. Squad leader's periscope.

b. **Use of the SLP.** The squad leader places his eye against the eye cup and presses firmly to look through the periscope. He focuses the SLP by adjusting the focus controls for a clear image of an object at the edge of the field of view. He turns the azimuth control knob clockwise or counterclockwise to search the area for enemy activity. He turns the elevation knob clockwise or counterclockwise to raise or lower the line of sight of the SLP. If a target is detected, he looks at the azimuth scale, reads the degrees under the azimuth indicator, and relays the reading to the gunner.

c. **Target Range Determination.** The SLP can be used to determine the range to a target.

(1) The squad leader places the stadia lines (Figure 4-12) on the target and determines how wide the target is in mils. Within the periscope reticle are four stadia lines. The distance between the two center lines is 3 mils; the distance between the two outer lines is 8 mils.

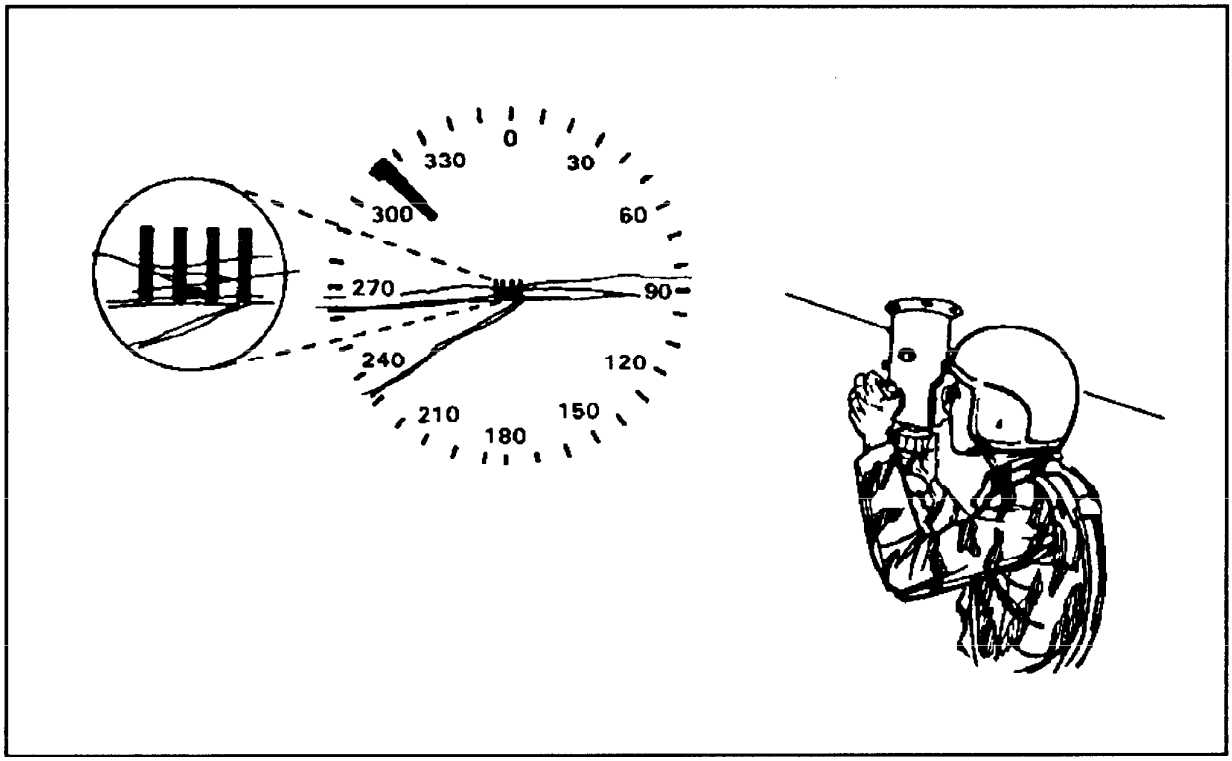


Figure 4-12. Stadia lines.

(2) To determine the estimated range to the target, the squad leader uses the following formula:

ES — Estimated size of target (meters).
AS — Apparent size of target (mils).
1,000 — Base number used to compute all ranges to targets.

$$\frac{ES \times 1{,}000}{AS} = \text{Estimated range}$$

For computing range, all tanks are considered to be 6 meters long (viewed broadside) and 3 meters wide (viewed head-on).

EXAMPLE: A 6-meter-long tank (viewed broadside) bounded by the inner stadia lines (3 mils).

$$\frac{3 \times 1{,}000}{3} = \frac{3{,}000}{3} = 1{,}000$$

Range to target is estimated to be 1,000 meters.

(3) Using Table 4-5 on page 4-42, the squad leader locates the estimated size of the target (meters) on the left side of the table and the apparent size of the target (mils) along the bottom of the table. He looks across the table on the meter line and up on the mil line until they meet. At the point where the lines meet is the estimated range to target.

EXAMPLE: A 6-meter-long tank, bounded by the outer stadia lines (8 mils). Using the table, go across from 6 meters and up from 8 mils. The figure found, 750, is the estimated range to the target in meters.

(4) A tank at 3,000 meters viewed head on is 3 meters wide (Figure 4-13); viewed broadside it is 6 meters long (Figure 4- 14). To determine if target is in range, the target must appear the same size or larger. If a determination cannot be made, the squad leader has the gunner use the daysight tracker or nightsight to determine if the target is in range.

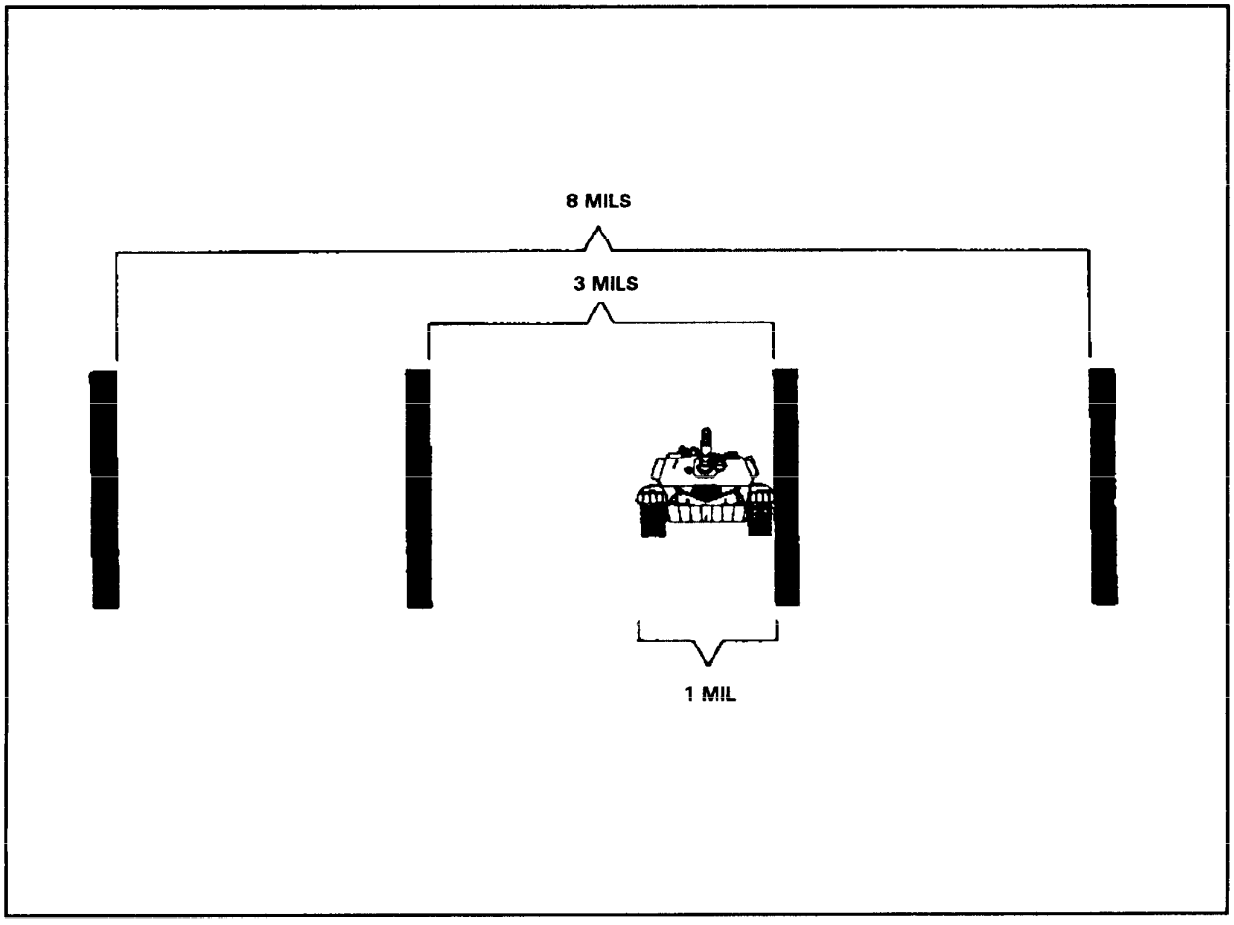


Figure 4-13. Tank head-on appearance at 3,000 meters.

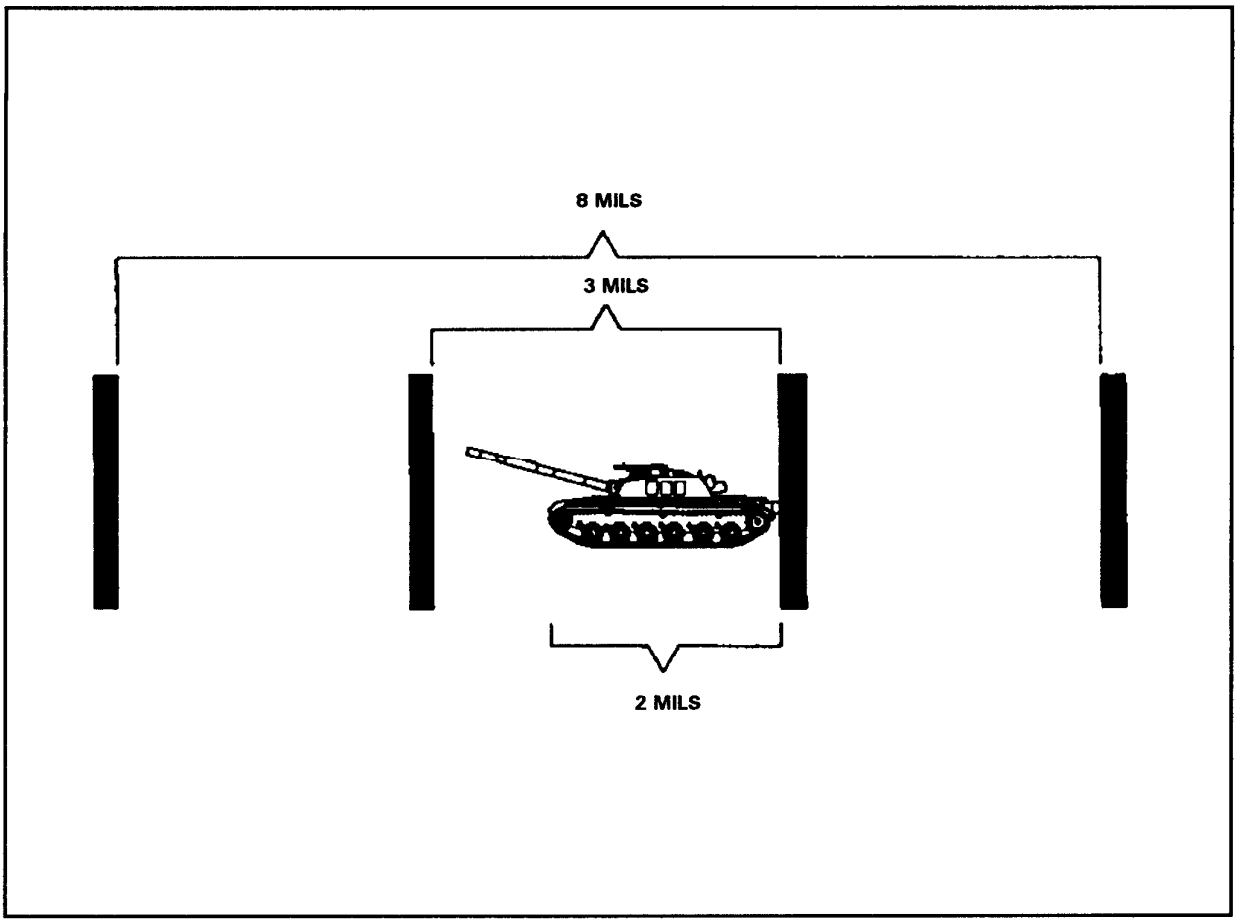


Figure 4-14. Tank flank appearance at 3,000 meters.

4-16. M243 SMOKE GRENADE LAUNCHER OPERATION

The following paragraphs explain how to load, fire, and conduct misfire procedures when using the M243 smoke grenade launcher.

WARNING

1. Do not stand in front of a loaded grenade launcher.
2. Do not place any part of the body in front of the launcher while loading or unloading.

a. **Load Grenade Launcher.** The gunner places the grenade launcher ARM-OFF switch in the OFF position and ensures the power lamp is not on (Figure 4-15, page 4-24). The loader removes the rubber cover from the tubes

and ensures that the tubes are free of foreign objects. The loader inserts a smoke grenade into each tube and pushes down on the grenade's top so that the spring clip at the base of each grenade engages the tip plug at the bottom of each tube. He rotates each grenade about a half turn clockwise to ensure electrical contact.

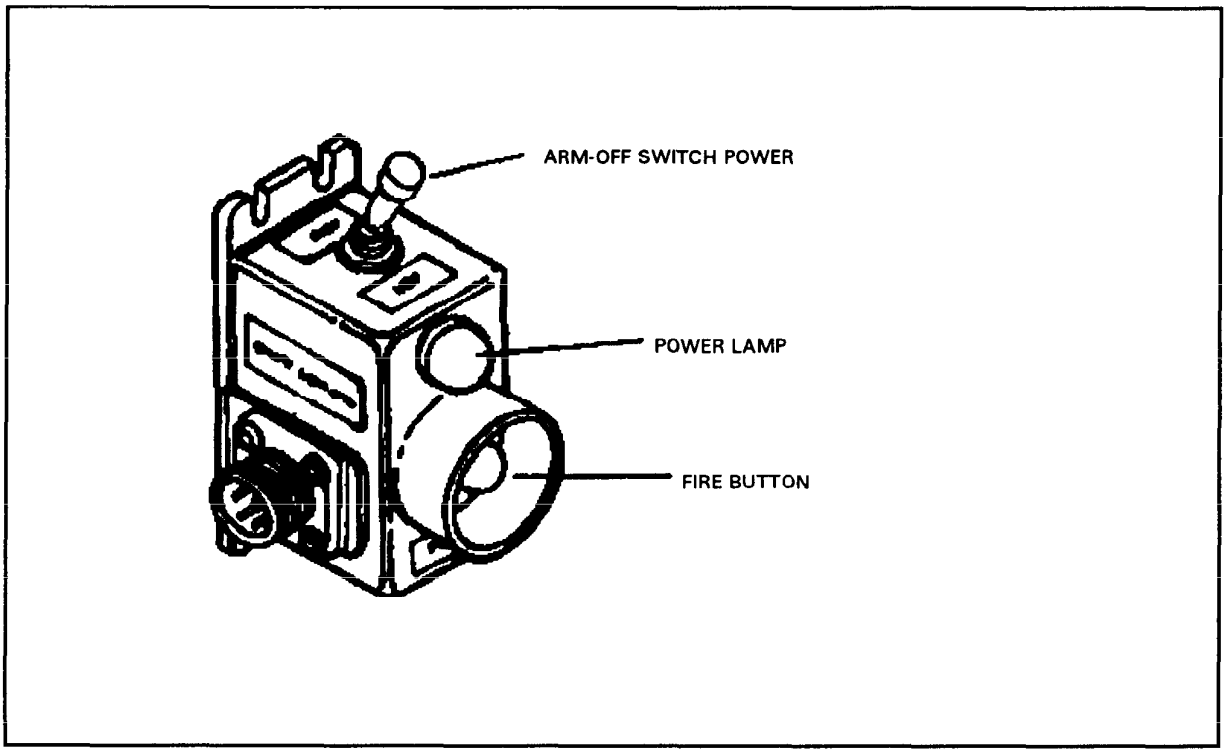


Figure 4-15. Smoke grenade ARM-OFF switch, power lamp, and fire button.

> WARNING
> Before firing, make sure no obstacles are directly in front of the vehicle.

b. **Fire the Smoke Grenades.** Eight grenades detonate in about a 105-degree arc 30 meters from the vehicle. The smoke cloud is about 9 meters high and lasts about one to three minutes, depending on wind (Figure 4-16). The front of the vehicle is facing the area where the smoke is to conceal the movement of the vehicle. The gunner places the smoke launcher ARM-OFF switch to ARM. He presses the FIRE button when ready to fire.

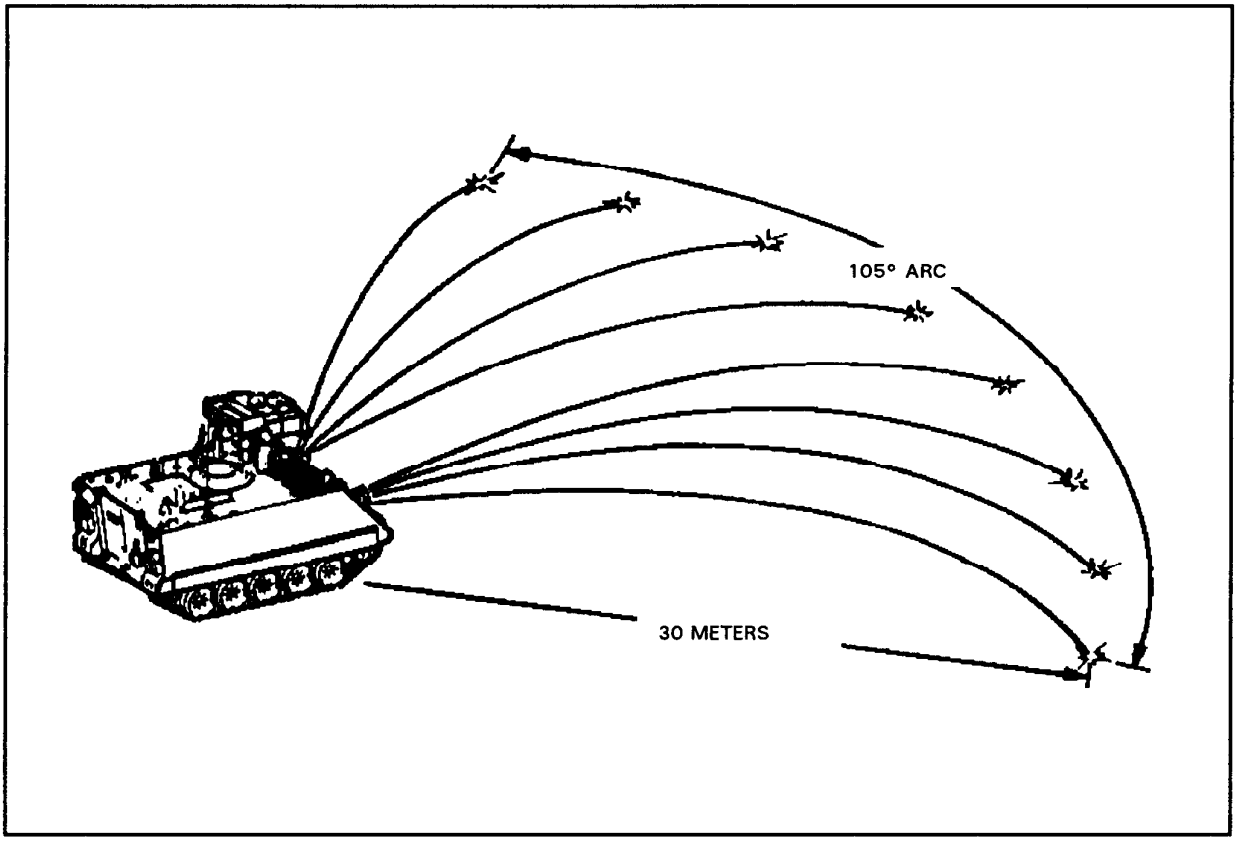


Figure 4-16. Pattern of detonation.

WARNING
Do not remove misfired grenade under unloading procedures. Use procedures for misfire.

c. Perform Misfire Procedures. If a grenade fails to fire, the gunner makes two more attempts to fire it. If the grenade still does not fire, the gunner ensures that the ARM-OFF switch is OFF and the power lamp is not on. The loader ensures the grenade is firmly seated. If the grenade is not firmly seated, the loader loads it properly. The gunner positions the ARM-OFF switch to ARM and attempts to fire the grenade, If the grenade will not fire when firmly seated, the crew attempts to fire the grenade from another launch tube. If the grenade fires, organizational maintenance is notified of a defective launch tube. If the grenade still does not fire, it is treated as a dud.

WARNING

In a training situation, do not attempt to move a dud grenade. If a grenade fails to ignite after being launched, wait 15 minutes; then notify EOD personnel. Give type, quantity, and precise location of dud.

4-17. FIRING LIMITATIONS

Firing limitations for the M901-series mounted TOW/TOW 2 are the same as for the tripod-mounted TOW/TOW 2.

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
1	Element: ALERT. Commands: SQUAD	During daylight, if carrier is moving, secures the machine gun, closes the hatch, erects the launcher, closes front ventilator, and selects the acquisition sight. Moves the launcher to the target area, and observes the target area. During reduced visibility, selects the nightsight and pushes in the FOV selector to select wide field of view.	Secures antenna to antenna hook. Turns the nightsight on (if needed), raises the side armor, closes the cargo hatch, closes the rear ventilator, and observes the backblast area through the ramp vision block.	If the carrier is moving, brings it to a rapid but controlled halt in a hasty covered and concealed position; closes the hatch; and observes the sector of responsibility. If the vehicle is at a halt, closes the hatch and observes the sector of responsibility. In all situations, monitors warning and instrument panels.
2	Element: TARGET IDENTIFICATION/ LOCATION. Announces target description/location.	Completes the alert action. Looks for the target described by the squad leader. NOTE: Normally, the fire command will be given in rapid order, such as SQUAD, T-SIXTY TWO TANK, DEFLECTION THREE FIVE SEVEN, AT MY COMMAND. Crewmen must be alert and act quickly.	Continues to observe the backblast area.	Continues to observe the sector of responsibility and monitor the panels.

Table 4-1. Engagement procedures for M901-series.

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
2 (cont'd)		If given deflection, moves the launcher to the announced deflection and repeats the deflection reading to the squad leader. If given a reference point, locates the reference point in acquisition sight and moves the launcher to the target area. When the target appears within the 5.5-degree center reticle of the 3X sight, switches to the 13X daysight tracker or to the nightsight (NFOV). If the target cannot be acquired in the sight, announces, "LOST.		
	If gunner announces, "LOST," gives additional location information.			

Table 4-1. Engagement procedures for M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
2 (cont'd)		When the target has been acquired, places the cross hairs of the sight on the visible center of mass, recognizes the target by type, and identifies it as enemy or friendly.		
	If gunner announces, "CANNOT IDENTIFY," attempts to identify and gives further instructions.	(If the target cannot be identified, announces, "CANNOT IDENTIFY.")		
		If the target is friendly, announces, "FRIENDLY."		
	If gunner announces, "FRIENDLY," gives further instructions	After identifying the target as enemy, decides if it is engageable.		
	If the gunner announces, "CANNOT ENGAGE," chooses another target by starting with the description element.	(If target is not engageable, announces, "CANNOT ENGAGE.")		If the gunner announces, "CANNOT ENGAGE," waits for further instructions.
	OR			

Table 4-1. Engagement procedures for M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
2 (cont'd)		If the squad leader gives a new description element, looks for the target described.		
	Tells the driver to move the carrier.	If the squad leader tells the driver to move the carrier, gives the driver brief directions.		Moves the carrier by following gunner's directions.
		If the target can be engaged, announces, "IDENTIFIED," continues to observe target, checks the trigger light to make sure it is not on, and selects and arms a missile.	After gunner announces, "IDENTIFIED," announces, "BACKBLAST CLEAR," or "BACKBLAST NOT CLEAR."	

Table 4-1. Engagement procedures for M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
2 (cont'd)	If the fire interrupt is due to an open hatch, directs the appropriate crewman to close his hatch.	If the fire interrupt alarm comes on during the engagement sequence, announces "INTERRUPT." Gives the driver short commands (DRIVER BACK, MORE, STOP) to move the carrier. After the interrupt has been eliminated, places the cross hairs of the sight on the target's visible center of mass and continues the engagement.		If the gunner announces, "INTERRUPT," moves the carrier at the command of the gunner.
3	Element: METHOD OF ENGAGEMENT. Squad leader/section leader directs FRONTAL, DEPTH, or CROSSFIRE when the gunner is faced with multiple targets.			
4	Element: EXECUTION	Continues to track the target and waits for the command of execution.	Continues to observe the backblast area.	Continues to observe the sector of responsibility and monitor the panels.

Table 4-1. Engagement procedures for M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
4 (cont'd)	Command of FIRE indicates that the gunner should engage target when he has acquired it and is tracking it. AT MY COMMAND indicates that the squad leader/section leader will determine the moment of engagement.	Presses one or both triggers and continues to track the target until impact.		

Table 4-1. Engagement procedures for M901-series (continued).

STEP	SQUAD LEADER	GUNNER	LOADER	DRIVER	CORRECTIVE ACTION
1		Presses both triggers.	NOTE: In a training situation, remove the battery or TVPC from the MGS before turning the MISSILE SELECT switch to the other missile and/or the SAFE-ARM switch to the SAFE position. Failure to do this will cut the command-link wire and damage the missile.		If the missile fails to fire, perform Step 2.
2*		Alerts the crew by saying, "Misfire."			Continue to track; perform Step 3.
3*		Selects and arms the other missile and attempts to fire. a. Checks for popped-out remote arm circuit breaker. b. Checks left select and left arm or right select and right arm; ensures indication lights are on.			If the second missile fails to fire, proceed to Step 3a. a. Push in circuit breaker if it is out. b. If OFF, turn SAFE-ARM switch to SAFE and MISSILE SELECT swithc monentarily to OFF and reselect.

*Steps 2,3, and 4 are performed simultaneously.

Table 4-2. Immediate action procedures.

STEP	SQUAD LEADER	GUNNER	LOADER	DRIVER	CORRECTIVE ACTION
3* (cont'd)		c. Checks to see if FIRE INTRPT and/or HATCH OPEN lights are on. **WARNING** **Be sure to use all safety precautions when using the override switch. Do not fire into the vehicle if the override switch is used.**			c. If both lights are on, open and close the hatch to get rid of the interrupt light. If only the FIRE INTRPT light is on, move the vehicle, if possible, or select another target. If tactical conditions require, use the override switch.
4*	a. Makes sure the MGS cable is securely connected.				a. Press down on the cable connection and check for proper seating. Proceed to Step 5.

*Steps 2,3, and 4 are performed simultaneously.

Table 4-2. Immediate action procedures (continued).

Table 4-2. Immediate action procedures (continued).

STEP	SQUAD LEADER	GUNNER	LOADER	DRIVER	CORRECTIVE ACTION
4* (cont'd)	b. Checks MGS battery.				b. If battery test indicates OUT OF BAND/FAIL, replace MGS battery with an emergency power battery. If TVPC is used, replace with spare battery.
		Continues to track.			
5		Attempts to fire two more times.			If the missile fails to launch, proceed to Step 6.
6		Places the SAFE-ARMED switch to SAFE and places the MISSILE SELECT switch to OFF. Announces, "Missile safe; missile select off." Continues to track.			

*Steps 2,3, and 4 are performed simultaneously.

STEP	SQUAD LEADER	GUNNER	LOADER	DRIVER	CORRECTIVE ACTION
6* (cont'd)		NOTE: On a training mission, the crew members remain at their station for 30 minutes after Step 5 before continuing with the next step.			
7	Commands, "PIVOT STEER LEFT."	Continues to track.		Pivot steers left.	
8		Observes turret azimuth indicator.			
9	Commands, "OPEN CARGO HATCH," once the carrier is 90 degrees and the turret has stopped at about 85 to 88 degrees.	Commands, "DRIVER STOP," when turret azimuth reads between 85 to 88 degrees.		Stops on gunner's command.	
10			a. Opens the cargo hatch 90 degrees.		

Table 4-2. Immediate action procedures (continued).

STEP	SQUAD LEADER	GUNNER	LOADER	DRIVER	CORRECTIVE ACTION
10* (cont'd)			b. Exits the carrier through the cargo hatch to the top of the carrier. Once on top, removes the misfired missile(s) carefully and hands it over the side of the carrier to the squad leader.		
11	a. Exits the carrier through the crew door and receives the misfired missile(s) from the left side of the carrier. b. Carries the misfired missile(s) a safe distance from the vehicle, ensuring the missile is pointed toward the enemy.	**WARNING** **Do not stand in front or in back of the launcher while unloading the misfired missile.**			

Table 4-2. Immediate action procedures (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
1	Commands, "DISMOUNT THE TOW."			Halts vehicle in a covered and concealed position (or as directed by squad leader) and lowers the ramp.
2	Removes tripod, BPC, and binoculars from stowage locations and moves to the ground firing position.	Removes MGS from mounting brackets (with battery assembly installed); removes TVPC and installs battery assembly; and carries MGS and launch tube to the ground firing position.	Moves out of squad leader's way. Removes launch tube and places it on the ground at the right rear of the vehicle. Removes traversing unit from stowage location and carries it to the ground firing position.	Removes optical sight and nightsight, lays them on the top of the carrier, closes sight access cover, replaces nightsight eyepiece, moves to the ground, and carries the sights to the ground firing position.
3	Sets up and levels the tripod so it is oriented in the direction of fire and places the BPC near the tripod. Connects BPC cable and places it within gunner's reach.	Installs the sights, connects the MGS, connects BPC cable and PA cable and turns on BPC. Turns the nightsight on, conducts a system self-test (steps 10 through 15 and steps 22 through 34). Connects collimator power cable to nightsight, and prepares to engage targets.	Installs the traversing unit on the tripod. Installs the launch tube. Returns to the carrier for an encased missile, the collimator, and (if the ground firing position is beyond voice range) the TA-312 telephone. Installs collimator on nightsight, hooks up power cable to the collimator, and removes and stows when collimated.	Returns to the carrier, closes the driver's hatch, secures more machine gun ammunition (if necessary). Opens the gunner's hatch, loads and mans the machine gun, and monitors the radio.

Table 4-3. Dismount procedures for M901-series-mounted TOW.

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
4	Observes the target area for possible targets.	Prepares to engage targets.	Gives the TA-312 to the squad leader and loads the encased missile in the launcher. Returns to the carrier for the WD-2 communication wire and more missiles. As he returns to the ground firing position, lays the communications wire, connects it to the TA-312, and assumes duty position as loader.	

Table 4-3. Dismount procedures for M901-series-mounted TOW (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
1	Commands: INSTALL THE TOW. Disconnects and stows BPC cable then slings the BPC and binoculars around his neck. Assists in stowing the coil cable in the traversing unit.	Disconnects the BPC cable and PA cable from the nightsight. Removes the nightsight and daysight tracker. Disconnects the coil cable from the MGS.	Unloads the encased missile or expended launch container and removes launch tube and traversing unit.	Locks the machine gun (unloading it if necessary), moves to the ground firing position and picks up the nightsight and daysight tracker.
2	After the other components are removed by the crew, picks up the tripod and moves to the carrier. Stows the BPC, tripod, and binoculars. Opens driver's hatch and takes on-board duty position.	Moves to the carrier with the launch tube and MGS. Places the launch tube at the right rear of the vehicle. Installs the TVPC into the MGS, installs the MGS, and takes on-board duty position.	Carries the traversing unit to the carrier and stows it. Returns to the ground firing position, picks up TA-1, collimator, and or encased missile and stows them in the carrier with the straps provided. Also, installs the launch tube before taking on-board duty position.	Returns to the carrier, opens sight access cover, sets the sight on +0-, installs the daysight tracker, hooks up VPC cable and collimator power cable, installs nightsight, connects postamplifier cable, connects actuators, stows free end of collimator power cable in range focus storage bracket, turns nightsight ON, and closes and secures access cover. NOTE: Before taking on - board duty position, ensures the VPC is turned on.

Table 4-4. Remount procedures for M901-series-mounted TOW.

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER
2 (cont'd)			NOTE: If the driver is still installing the sights, recovers the WD-1 communications wire before taking on-board duty position.	If necessary (and not installing the sights), returns to the ground firing position and recovers the WD-1 wire (if the tactical situation allows).

Table 4-4. Remount procedures for M901-series-mounted TOW (continued).

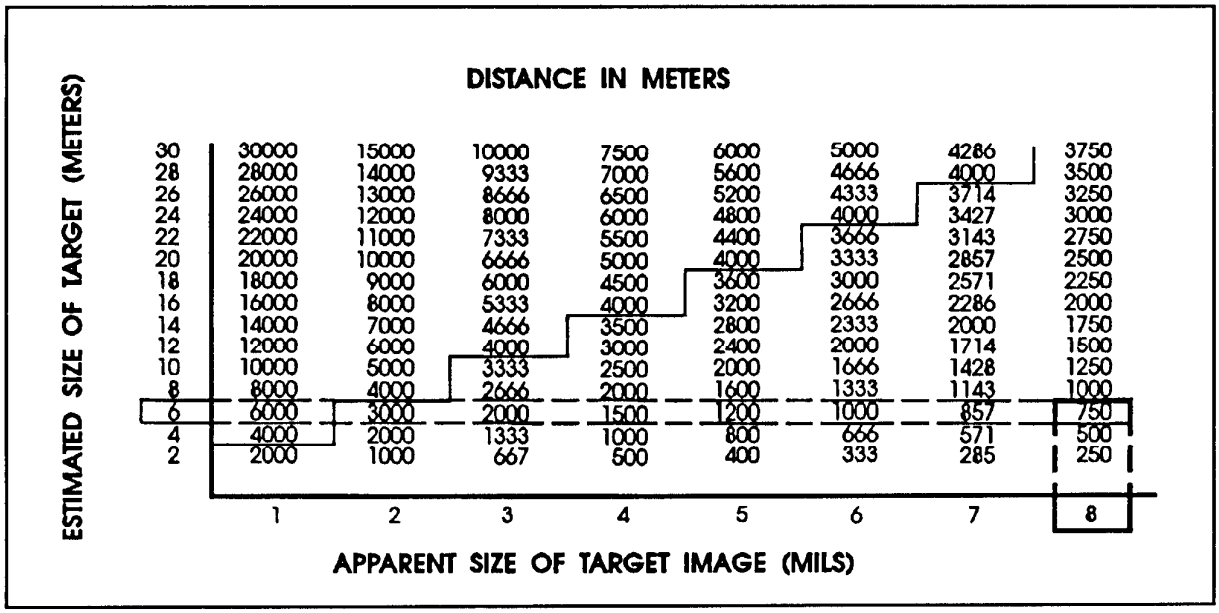


Table 4-5. Range to target.

4-18. OPERATIONAL CHECKLIST AND TROUBLESHOOTING FOR M901-SERIES

The operational checklist (OCL) and troubleshooting table are supplements to the TM. They do not replace the TM or scheduled PMCS. The TM must be used when correcting or reporting faults.

a. An OCL should be performed before placing the turret of the M901-series into operation (Table 4-6) if the tactical situation does not permit PMCS. Each procedure in the checklist is important to the operational readiness of the vehicle.

b. To perform an OCL, the operator must also know how to troubleshoot the system. Some of the more frequent faults that may occur and the corrective action to be taken to correct the fault are listed in Table 4-7. If a fault is found, refer to the TM.

c. The operator must remember to check the weapon system before installing it on the vehicle--daily, once it has been installed, and weekly, when it is not in use. In addition to checking the boresight during check-out procedures, check it—

- After difficult cross-country movement.
- After a change in temperature of 10 degrees.
- Every four hours.

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
1	Commands: CLEAR TOP DECK.	Opens hatch. Checks for debris.	Steps outside the carrier and checks top deck for debris or personnel.	Opens hatch. Checks for debris.	GUNNER: CLEAR.
2	Commands: CHECK CONNECTIONS AND SLIP RING.		Checks turret hydraulic fittings and electrical connections and ensures that nothing is under slip ring.		LOADER: UP.
3	Commands: SECURE MACHINE GUN.	Checks to ensure that machine gun is secured to the monorail and locked in the elevated position.			GUNNER: SECURE.
4	Commands: CHECK HYDRAULIC FLUID.	Checks for presence of hydraulic fluid (not level).			GUNNER: UP.
5	Commands: CLOSE ALL HATCHES.	Closes the gunner's hatch.	Closes the cargo hatch.	Closes the driver's hatch.	GUNNER: CLOSED. LOADER: CLOSED. DRIVER: CLOSED.

Table 4-6. Operational checklist for the M901-series.

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
6	Commands: START ENGINE.			Starts engine and checks the warning lights panel and driver's instrument panel.	DRIVER: UP.
7	Commands: CHECK GUNNER'S CONTROL PANEL.	Checks gunner's control panel from left to right and from top to bottom.			GUNNER: TURRET POWER, OFF; MODE SELECT, STOW; ERECTION DRIVE, OFF; EMERGENCY POWER, OFF; OVERRIDE, OFF; MISSILE SELECT, OFF;ARM SWITCH, SAFE
8	Commands: CHECK LIGHTS.	Checks to ensure that all gunner's control panel lights come on and vary in brightness, and that turret power lamp comes on.			GUNNER: UP.
9	Commands: TURN TURRET POWER ON.	Turns on turret power and checks the gunner's control panel lights.			GUNNER: TURRET POWER, ON; AZIMUTH STOW, ON; ELEVATION STOW, ON; STOW POSITION, ON.

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
10	Commands: CONDUCT SYSTEM CHECK-OUT PROCEDURE. Conducts system check-out procedure.				SQUAD LEADER: UP
11	Commands: CHECK READY-TO-LOAD LIGHT.	Checks to ensure that READY-TO-LOAD light comes on.			GUNNER: UP
12	Commands: ERECT THE LAUNCHER	Erects the launcher and checks the gunner's control panel indicators.			GUNNER: LAUNCHER ERECT, ON; LAUNCHER READY, ON; AZIMUTH STOW, ON; ELEVATION STOW, ON; STOW POSITION, OFF.
13	Commands: CHECK HYDRAULIC FLUID AND PUMP.	Bleeds the hydraulics as follows:			GUNNER: UP.

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLAY
13 (Continued)		Sets the emergency power switch to the gunner's control panel to the up (on) position. Grasps the hand grips of the gunner's hand controls. Squeezes the action switches. Rotates the hand grips rearward until the launcher reaches maximum elevation. Rotates the hand grips forward to depress the launcher to minimum elevation.			

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
13 (Continued)		Attempts to elevate the launcher again to ensure that the hydraulic pressure has been bled (relieved). The launcher should not move. Checks the level of hydraulic fluid and nitrogen precharge. Checks backup system. Sets emergency power switch to the OFF position. Ensures that the hydraulic pump runs and that the hydraulic pressure gage shows 1,500 psi to 1,900 psi.			
14	Commands: TRAV-ERSE WITHOUT ACTION SWITCHES.	Attempts to traverse the turret without squeezing the action switches.			GUNNER: NORMAL

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLAY
15	Commands: TRAVERSE RIGHT.	Traverses right using only the right action switch.			
	Conducts MGS system check-out procedure.				
	Commands: TRAVERSE LEFT.	Traverses left using only the left action switch.			
	Continues MGS system check-out procedure.				
	Commands: ELEVATE.	Elevates the launcher.			
	Continues system check-out procedure.				
	Commands: DEPRESS.	Depresses the launcher.			GUNNER: UP.
	Continues system check-out procedure.				

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLAY
16	Commands: CHECK SLEW.	Traverses slowly to the right; engages slew switch. Traverses slowly to the left; engages slew switch.			GUNNER: UP.
17	Commands: PRESS RIGHT TRIGGER. Commands: PRESS LEFT TRIGGER.	Depresses trigger button. Depresses trigger button.			GUNNER: TRIGGER LIGHT, ON. GUNNER: TRIGGER LIGHT, ON.
18	Commands: SLEW TO LOAD.	Slews turret to 0 degrees, lowers launcher to the load position, and observes the indicators on the gunner's control panel.	Watches the READY-TO-LOAD light.		GUNNER: LOAD POSITION, ON. LOADER: READY-TO-LOAD, ON.
19	Commands: CHECK LAUNCH TUBES.		Opens cargo hatch to the first position.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLAY
19 (Continued)		Watches gunner's control panel lights.			GUNNER: CARGO HATCH, ON; FIRE INTERRUPT, ON.
			Checks launch tube for debris and operation of missile locking handles, then closes the cargo hatch.		LOADER: LAUNCHER UP.
		Watches gunner's control panel lights.			GUNNER: CARGO HATCH, OUT; FIRE INTERRUPT, OUT.
20	Commands: ERECT THE LAUNCHER.	Erects the launcher and watches the gunner's control panel lights.			GUNNER: LAUNCHER READY, ON.
21	Commands: DEPRESS LAUNCHER.	Depresses launcher to minimum elevation and watches the gunner's control panel lights.			GUNNER: DEPRESSED.

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
22	Commands: OPEN WEAPON HATCH.	Opens the weapon hatch and watches the gunner's control panel lights.			GUNNER: WEAPON HATCH, ON; FIRE INTERRUPT, ON.
	Commands: TRAVERSE.	Attempts to traverse.			GUNNER: NORMAL.
	Commands: CLOSE WEAPON HATCH.	Closes weapon hatch and watches the gunner's control panel lights.			GUNNER: WEAPON HATCH, OUT; FIRE INTERRUPT, OUT.
	Commands: OPEN DRIVER'S HATCH.			Opens hatch.	GUNNER: DRIVER HATCH, ON; FIRE INTERRUPT, ON.
	Commands: TRAVERSE.	Attempts to traverse.			GUNNER: NORMAL.
	Commands: CLOSE DRIVER'S HATCH.			Closes driver's hatch.	
		Watches the gunner's control panel lights.			GUNNER: DRIVER HATCH, OUT; FIRE INTERRUPT, OUT.
	Commands: OPEN CARGO HATCH.		Opens cargo hatch.		GUNNER: CARGO HATCH, ON; FIRE INTERRUPT, ON.

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
23	Commands: SELECT AND ARM LEFT MISSILE.	Selects and arms left missile and watches the gunner's control panel lights.			GUNNER: ARMED.
			Watches the launcher's RADs from the open cargo hatch.		LOADER: LEFT RAD, DOWN
	Commands: SELECT RIGHT MISSILE.	Selects right missile and watches the gunner's control panel lights.			GUNNER: ARMED.
			Watches the launcher's RADs from the open cargo hatch.		LOADER: LEFT RAD, UP; RIGHT RAD, DOWN.
	Commands: SAFE, MISSILE. MISSILE SELECT OFF.	Safes missile and sets missile select to OFF. Watches the gunner's control panel lights.			GUNNER: SAFE, OFF.
			Watches the launcher's RADs from the open cargo hatch.		LOADER: RIGHT RAD, UP.

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
24	Commands: CLOSE CARGO HATCH.	Watches the gunner's control panel lights.	Closes cargo hatch.		GUNNER: CARGO HATCH, OUT; FIRE INTERRUPT, OUT.
25	Commands: SLEW THREE HUNDRED SIXTY DEGREES.	Ensures that the launcher is fully depressed, slews the turret (slowly), and watches the gunner's control panel lights.			GUNNER: FIRE INTERRUPT, ON; OFF; ON; OFF; ON; OFF.
26	Commands: CHECK SIGHTS.	Slews the turret to 180 degrees azimuth. a. Elevates the launcher. b. Sets the SIGHT SELECTOR on the gunner's hand control to 3X. c. Looks through the eyepiece.	Opens the cargo hatch to the full open position.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (continued)		d. Focuses the sight picture using the focus ring. e. Selects a target from 1,500 to 2,000 meters away. f. Centers the target in the circular reticle of the 3X sight. g. Sets the SIGHT SELECTOR switch on the gunner's hand control to 13X. h. Ensures that the target is about in the center of the circular reticle and in focus. NOTE: If the target is not in focus or cannot be seen, notify organizational maintenance.			

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		i. Moves head 6 to 12 inches back and looks into the eyepiece. The sight picture should be circular (1). If it is not circular (2), the image transfer assembly objective lens is not aligned with the daysight tracker. To check it at night, shine a flashlight into the objective lens of the daysight tracker. NOTE: The image transfer assembly must be aligned before continuing. j. Sets the SIGHT SELECTOR switch to the NIGHT position. k. Checks to ensure that the target is in the new sight picture.			

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		l. Moves head 6 to 12 inches back and looks into the eyepiece. The sight picture should be circular and will be red. If it is not, the image transfer assembly objective lens is not aligned with the nightsight. See troubleshooting for the alignment procedure. m. Holds the nightsight brightness remote control switch up and then down. Brightness of the sight picture should vary. n. Holds the nightsight contrast remote control switch up and then down. Contrast of the sight picture should vary.			

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		o. Holds the nightsight range focus remote control switch up and then down. Focus of the target in the sight picture should vary. NOTE: This control changes the focus slowly, so check it enough times to make sure that it is working. p. Adjusts range focus, brightness, and contrast to get the clearest sight picture of the target. q. Pulls the field-of-view remote control out. Field-of-view should change from wide to narrow.			

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		r. Pushes the field-of-view remote control in. The field-of-view should change from narrow to wide.			
		s. Sets the SIGHT SELECTOR switch to 13X.			
		t. Says, "BORE-SIGHT THE DAYSIGHT TRACKER."			
		u. Depresses the launch to minimum elevation.			
	Commands: HOLD THE TEST-OPERATE SWITCH IN THE TEST POSITION.		a. Lifts the elevation boresight knob cover.		
	a. Watches the elevation indicator; determines green center reading.		b. Adjusts the elevation boresight knob according to the squad leader's instructions.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)	b. Talks the loader through adjusting the elevation boresight knob on the daysight tracker until a green center reading shows on the elevation indicator. c. Watches the azimuth meter on the MGS to determine indicator reading. d. Talks the loader through adjusting the azimuth boresight knob on the daysight tracker until a green center shows on the azimuth indicator. e. Releases the TEST-OPERATE switch.		c. Lowers the elevation boresight knob cover. d. Lifts the azimuth boresight knob cover. e. Adjusts the azimuth boresight knob according to the squad leader's instructions. f. Lowers the azimuth boresight knob cover.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)	Commands: COLLIMATE THE NIGHTSIGHT.	a. Ensures the SIGHT SELECTOR switch on the gunner's hand control is set to 13X. b. Looks through the eyepiece. c. Ensures that both collimator reticle and nightsight reticle can be clearly seen (3). NOTE: You may have to adjust the focus and or have the loader turn on the daysight tracker reticle light. d. Aligns the two reticles by talking the loader through the adjustment of the collimator elevation and azimuth knobs (4).	Installs collimator to sights a. Turns the collimator locking handles up and in as far as they will go. b. Attaches the collimator to the mounting pads and guide pins on the nightsight. c. Tightens the locking handles on the collimator by turning them downward to secure it to the nightsight. d. Releases the free end of the power cable from the range focus storage area. Aligns the power cable to the power input connector on the collimator.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		NOTE: Accuracy is very important. The small circle of the boresight collimator should be divided into four equal wedges by the daysight tracker reticle. a. Sets the SIGHT SELECTOR switch on the gunner's hand control to NIGHT. b. Looks through the eyepiece. c. Ensures that the field-of-view is set at narrow and the collimator reticle and nightsight reticle can be seen clearly (5). NOTE: The range focus, brightness, and or contrast may have to be adjusted.	Adjusts the azimuth and elevation knobs on the collimator according to the instructions from the gunner.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		d. Aligns the two reticles by talking the loader through the adjustment of the nightsight azimuth and elevation boresight knobs (6). NOTE: If the reticles cannot be aligned, the gunner must tell the loader to set the nightsight coarse azimuth knob to position 2.	a. Unlocks the nightsight latching handle. b. Lifts the nightsight lightly. c. Sets the coarse azimuth adjustment knob to position 2. d. Lowers the nightsight.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)			e. Locks the nightsight latching handle.		
		Realigns the collimator to the daysight tracker (d above, (3) and (4)) and aligns the nightsight to the collimator (d above, (5) and (6)).	a. Unlocks the azimuth and elevation boresight knobs on the nightsight. b. Adjusts the azimuth and elevation knobs according to the instructions from the gunner. c. Locks azimuth and elevation knobs on the nightsight.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		a. Sets field-of-view to wide and confirms alignment of the reticles. b. Returns selector to narrow field-of-view. c. Sets SIGHT SELECTOR switch to 13X and confirms alignment of reticles.			GUNNER: SIGHTS UP. LOADER: COLLIMATOR OFF.
			Removes the collimator from the nightsight.		
			a. Removes the power cable from the collimator and places the free end into range focus storage area. b. Removes the collimator from the nightsight.		

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)			c. After launcher is elevated, closes cargo hatch.		
		a. Elevates the launcher to maximum elevation			
		b. Waits for cargo hatch to be closed.			GUNNER: CARGO HATCH, OUT; FIRE INTERRUPT, OUT.
		NOTE: If the tactical situation will not allow the nightsight to be collimated using a collimator, use the following field-expedient method.			
		a. Boresights the daysight tracker.			
		b. Selects a target from 2,000 to 3,000 meters away.			

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		NOTE: The target must have features that give a well-defined point of aim, such as a bridge, house, or smokestack. c. Aligns the day-sight tracker reticle with the target by using the gunner's hand control (7). NOTE: Do not touch the gunner's hand control until boresight/alignment of the nightsight is finished. d. Switches to the nightsight. e. Talks the loader through adjusting the azimuth and elevation boresight knobs on the nightsight until the nightsight reticle is aligned with the target (8).			

Table 4-6. Operational checklist for the M901-series (continued).

SEQUENCE	SQUAD LEADER	GUNNER	LOADER	DRIVER	CREW MEMBER'S REPLY
26 (Continued)		***CAUTION*** ***FAILURE TO FULLY OPEN CARGO HATCH MAY RESULT IN DAMAGE TO THE NIGHTSIGHT LENS.***			
27	Commands: STOW LAUNCHER.	Stows the launcher.			GUNNER: STOW POSITION, ON.
28	Commands: TURRET POWER OFF.	Turns turret power OFF and checks gunner's control panel from right to left, bottom to top.			GUNNER: ARM SWITCH, SAFE; MISSILE SELECT, OFF; OVERRIDE, OFF; EMERGENCY POWER, OFF; ERECTION DRIVE, OFF; MODE SELECT, STOW; TURRET POWER, OFF.

Table 4-6. Operational checklist for the M901-series (continued).

	STEP	FAULT AND CORRECTIVE ACTION
1.	CLEAR TOP DECK.	Debris, personnel, or any other obstruction on top of the carrier. Remove it.
2.	CHECK CONNECTIONS AND SLIP RING.	a. Hydraulic fluid leaking at more than three drops per minute. Notify organizational maintenance. b. Electrical connectors loose or disconnected. Tighten and correct. c. Electrical connectors broken, wires frayed, or cut. Notify organizational maintenance. d. Debris or other obstruction under slip ring. Remove it.
3.	SECURE MACHINE GUN.	The M60 machine gun is not secure in its mount. See TM 9-2350-259-10, Chapter 2, Section III. If still not secure, notify organizational maintenance.
4.	CHECK HYDRAULIC FLUID.	Hydraulic fluid does not show in the reservoir. Notify organizational maintenance.
5.	CLOSE ALL HATCHES.	Hatch or hatches will not close and or lock. Notify organizational maintenance.
6.	START ENGINE. Chapter 3, Section III.	For any engine problem, see TM 9-2350-259-10,
7.	CHECK GUNNER'S. CONTROL PANEL	a. If any switches are not set as described in the OCL, Set switches as described in the OCL. b. The safety wire on the OVERRIDE switch cover is broken or disconnected. Notify organizational maintenance.

Table 4-7. Troubleshooting for the M901-series.

STEP		FAULT AND CORRECTIVE ACTION
8.	CHECK LIGHTS.	a. No lights on the gunner's control panel. Turn DIM-BRT knob. If lights still do not work, notify organizational maintenance. b. One or more lights do not come on. Replace bulb (see TM 9-2350-259-10, Chapter 3, Section III). If light(s) still do not come on, notify organizational maintenance. c. Lights will not brighten or dim. Notify organizational maintenance. d. Turret power light does not come on. Turn the turret power light. If light still does not come on, replace the bulb (see TM 9-2350-259-10, Chapter 3, Section III).
9.	TURRET POWER ON.	The lights for TURRET POWER, AZ STOW and EL STOW, and STOW POSITION do not come on. Check circuit breakers. Notify organizational maintenance.
10.	CHECK SYSTEM . CHECKOUT	a. If no lamp indicators are on, turn display intensity knob fully clockwise. Replace battery assembly if trouble persists. Check VPC. b. If all lamp indicators are not lit for 3 seconds, replace MGS. c. If BATT FAIL indicator lights, replace battery in ground system. On vehicle, replace VPC with a TOW battery. Notify organizational maintenance if trouble persists. d. If MGS FAIL indicator lights, replace MGS.

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
10. (Continued)	e. MGS PASS indicator does not glow steadily. Set night sight field-of-view switch to narrow field-of-view. Replace the nightsight. f. PA FAIL indicator lights, and OSS PASS indicator lights. Check to see that nightsight is ON and functioning. Ensure that cables are properly connected. Replace nightsight. Notify organizational maintenance if trouble persists. g. OSS FAIL indicator lights. Turn azimuth and elevation adjustment knobs on optical sight fully in one direction, then back, then off three or four turns, and repeat test. Replace optical sight. On ground TOW system, replace battery power conditioner batteries. h. OSS PASS indicator does not glow steadily. Adjust boresight knob until OSS PASS indicator does not blink. If OSS PASS indicator still does not glow steadily, replace optical sight. i. If OSS PASS indicator does not glow steadily, the optical sight is not boresighted. Turn azimuth and elevation adjustment knobs until green lamp in the center of the AZ-EL cross is lit and glowing steadily. If AZ-EL cross does not glow steadily, reset boresight knobs to near center and replace optical sight. If AZ-EL cross glows steadily, the optical sight is boresighted. Proceed to step 11.

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
10. (Continued)	j. Green lamp in center of boresight cross is not lit or blinking. Adjust AZ and EL boresight knobs on the optical sight, as necessary. If trouble persists, notify organizational maintenance.
11. CHECK READY-TO-LOAD LIGHT.	Ready-to-load light does not come on. Repeat the procedure used for the turret power light in step 9.
12. ERECT THE LAUNCHER.	For any problem, see TM 9-2350-259-10, Chapter 3, Section II.
13. CHECK HYDRAULIC FLUID AND PUMP.	Hydraulic fluid level is below the line in the reservoir, hand pump does not increase pressure, or nitrogen precharge is below level indicated in TM 9-2350-259-10, Chapter 2, Section II. Notify organizational maintenance.
14. TRAVERSE WITHOUT ACTION SWITCHES.	Turret does not traverse normally. Notify organizational maintenance.
15. TRAVERSE RIGHT OR TRAVERSE LEFT.	a. On the vehicle system, use gunner's hand controls to traverse right and traverse left while holding the TEST-OPERATE switch to test, and observe the boresight cross. Replace the MGS if lights on the boresight cross fail to move. Notify organizational maintenance if trouble persists. Elevate or depress. b. On the vehicle system, use gunner's hand controls to elevate and depress launcher while holding the TEST-OPERATE switch to test, and observe the boresight cross. Replace the MGS if lights on boresight cross fail to move up for elevation and for depression of the launcher. Notify organizational maintenance if trouble persists.

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
16. CHECK SLEW.	a. Turret does not slew right. Squeeze the left slew switch. If turret slews, notify organizational maintenance that right slew switch does not work. If turret still does not slew, notify organizational maintenance. b. Turret does not slew left. Squeeze the right slew switch. If turret slews, notify organizational maintenance that left slew switch does not work. If turret still does not slew, notify organizational maintenance.
17. PRESS RIGHT TRIGGER.	a. Trigger light does not come on. Check gunner's control panel for FIRE INTRPT. If FIRE INTRPT is on, correct interrupt condition. b. Trigger light still does not come on. Change bulb in trigger light (see TM 9-2350-259-10, Chapter 3, Section III). Press right trigger again. If light still does not come on, notify organizational maintenance.
PRESS LEFT TRIGGER.	Trigger light does not come on. (See steps 17a and 17b above.)
18. SLEW TO LOAD POSITION.	a. Elevation and or azimuth load lights do not come on. Conduct lamp test. (See step 9 in the operational checklist.) If lights work, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.) If azimuth and elevation lights still do not come on, notify organizational maintenance. b. Azimuth and elevation lights are on, but the launcher will not move to the LOAD position. Check to be sure the MODE SELECT switch is set to LOAD. Attempt to move the launcher again. If the launcher still does not move, notify organizational maintenance.
18. (Continued)	c. Launcher moves to load position, but LOAD POSITION

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
	light does not come on. Conduct lamp test. (See step 9 in the operational checklist.) If light works, notify organizational maintenance. If light does not work, change the bulb. (See TM 9-2350-259-10, Chapter 3, Section III.) If LOAD POSITION light still does not come on, notify organizational maintenance.
	d. READY TO LOAD light does not come on. Push in on the light. If light does not come on, change the bulb. (See TM 9-2350-259-10, Chapter 3, Section III.) If light works, notify organizational maintenance.
19. CHECK LAUNCH TUBE.	a. One or both missile locking handles do not operate, or one or both indexing lugs do not extend or retract. Notify organizational maintenance.
	b. Debris in the launch tube. Remove it.
20 ERECT THE LAUNCHER.	a. Launcher does not erect. Check gunner's control panel and pressure gage. If pressure and gunner's control panel are normal, notify organizational maintenance.
	b. Launcher erects but launcher erect and or launcher ready lights do not come on. Conduct lamp test. (See step 9, operational checklist.) If lights work, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.)
	Launcher erect and launcher ready lights still do not come on, notify organizational maintenance.
21. DEPRESS LAUNCHER.	Launcher will not depress. Notify organizational maintenance.
22. OPEN WEAPON HATCH.	a. Weapon hatch and or fire interrupt lights do not come on.

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
	Conduct lamp test. If light(s) works, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.) Weapon hatch and or fire interrupt light(s) does not come on, notify organizational maintenance.
TRAVERSE.	b. Turret traverses and does not sound as loud as usual. Notify organizational maintenance.
CLOSE WEAPON HATCH; OPEN DRIVER'S HATCH	c. Weapon hatch light does not go out. Notify organizational maintenance.
	d. Driver's hatch and or fire interrupt lights do not come on. Conduct lamp test. If light(s) work, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.) If driver's hatch and or fire interrupt light(s) still does not come on, notify organizational maintenance.
TRAVERSE.	e. Turret traverses and does not sound as loud as usual. Notify organizational maintenance.
CLOSE DRIVER'S HATCH; OPEN CARGO HATCH.	f. Driver's hatch light does not go out. Notify organizational maintenance.
	g. Cargo hatch and or fire interrupt lights do not come on. Conduct lamp test. If light(s) works, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.)

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
22. (Continued)	If cargo hatch and or fire interrupt light(s) still does not come on, notify organizational maintenance.
23. SELECT AND ARM LEFT MISSILE	a. Fire interrupt alarm does not sound. Notify organizational maintenance.
	b. Left select and or left armed lights does not come on. Check for FIRE INTRPT. If lamp is on, move launcher until it goes out. Light(s) still does not come on, notify organizational maintenance. Check circuit breaker. If it is out, push in. If light(s) still does not come on, notify organizational maintenance. Conduct lamp test. If light(s) works, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.) If left select and or left armed lights still do not come on, notify organizational maintenance.
	c. Left launcher RAD does not come down. Notify organizational maintenance.
SELECT RIGHT MISSILE.	d. Left select and left armed lights do not go out, or the fire interrupt alarm does not sound. Notify organizational maintenance.
	e. Right select and right armed lights do not come on. Check for FIRE INTRPT. If lamp is on, move launcher until it goes out. If light(s) still does not come on, notify organizational maintenance. Check circuit breaker. If it is out, push in. If light(s) still does not come on, notify organizational maintenance. Conduct lamp test. If light(s) works, notify organizational maintenance.

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
23. (Continued)	If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.) If right select and right armed lights still do not come on, notify organizational maintenance.
	f. Left RAD does not go up and or right RAD does not come down. Notify organizational maintenance.
SAFE MISSILE, MISSILE SELECT OFF.	g. The fire interrupt alarm does not stop or the fire select and right armed lights do not go out and or the right RAD does not go up. Notify organizational maintenance.
24. CLOSE CARGO HATCH.	The cargo hatch will not close and or the cargo hatch and or fire interrupt light(s) does not go out. Notify organizational maintenance.
25. SLEW 360 DEGREES.	The fire interrupt light does not come on as the launcher passes any one or all of the following positions on the carrier: right front corner, left front corner, or rear deck. Notify organizational maintenance.
26. CHECK SIGHTS.	a. The target centered in the circular reticle of the 3X sight is not in the 13X optical sight field-of-view, or it is not focused. Notify organizational maintenance.
	b. The optical sight picture is not centered. Align the image transfer assembly objective lens with the optical sight. (See TM 9-2350-259-10, Chapter 2, Section III.)
	c. One or more of the nightsight remote controls does not work. Check remotes for proper installation. If remotes are correct, notify organizational maintenance.

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
26. (Continued)	d. The MGS azimuth and elevation lights will not move while attempting to boresight the optical sight. Replace the optical sight. If the lights still do not move, replace the MGS. Conduct the test again. Notify organizational maintenance about the inoperable optical sight and or MGS. e. Azimuth and elevation meter lights will not stop fluctuating. Set boresight knobs on the optical sight, and repeat the test. NOTE: The following is true only if attempts on both coarse azimuth positions 1 and 2 have failed. f. The reticle on the boresight collimator cannot be aligned with the optical sight reticle. Replace the collimator and notify organizational maintenance. The nightsight reticle cannot be aligned with the collimator reticle. Replace the collimator, notify organizational maintenance, and try again. If it still cannot be aligned, replace the nightsight. h. Cannot see the collimator reticle. Replace the collimator battery. If it still does not light up, replace the collimator.
27. STOW THE LAUNCHER.	a. Elevation and or azimuth stow lights do not come on. Conduct lamp test. If light(s) works, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.)

Table 4-7. Troubleshooting for the M901-series. (continued).

STEP	FAULT AND CORRECTIVE ACTION
27. (Continued)	If elevation and azimuth stow lights still do not come on, notify organizational maintenance. b. Azimuth and elevation stow lights are on, but the launcher will not move to the STOW position. Check to be sure the MODE SELECT switch is set to STOW. Attempt to move the launcher again. If it still does not move, notify organizational maintenance. c. Launcher moves to the STOW position, but the STOW POSITION light does not come on. Conduct lamp test. If light(s) works, notify organizational maintenance. If light(s) does not work, change the bulb(s). (See TM 9-2350-259-10, Chapter 3, Section III.) If STOW POSITION light still does not come on, notify organizational maintenance.
28. POWER OFF.	CHECKS COMPLETE.

Table 4-7. Troubleshooting for the M901-series. (continued).

CHAPTER 5

TOW TRAINING PROGRAM

The TOW Training Program is a comprehensive program of required training and testing that begins with individual Skill Level 1 tasks and progresses through individual gunner qualification to squad-, section-, and platoon-level testing and verification. This process has been condensed and unified into a program that consists of 12 TOW Gunnery Tables plus a quarterly gunners' skill test. All mandatory TOW training and testing are included in this program. Additional types of TOW training, such as STXs and CO EXEVALs, will be performed with the frequency prescribed in STTAC and in the manner described in ARTEP 7-91. The unit commander must assess the training status of the individual unit to determine what additional TOW training is necessary to support the 12 mandatory training tables and must prepare his crews to pass their required testing.

SECTION I. TRAINING ASSESSMENT AND PLANNING

Differences between resources required and resources available will affect both the time required to conduct and sustain training and the unit's ability to meet the required standards. Required resources and maintenance assistance should be planned for and requested well in advance. Nothing should be left to chance, because resources will be wasted and training opportunities lost. A good program must have provisions for routine inspection of the TOW weapon systems by direct support units. Leaders must adjust the training program to meet the changing needs of the unit. (See Table 5-1 for ammunition requirements according to DA Pam 350-38, page 5-2.)

5-1. COMMANDER'S RESPONSIBILITY

All mandatory TOW gunnery training and testing are included in the 12 TOW Gunnery Tables plus the quarterly Gunner's Skill Test. However, the commander must still conduct an accurate assessment of the state of TOW training in his unit to determine what additional training is necessary to prepare his unit for the quarterly and semiannual tables. *He must remember that his units must meet the standards outlined in DA PAM 350-38 to be certified in the training status C1, fully trained.* A good assessment of training requirements and thorough planning produce an effective unit training program. To accomplish this, the commander should start early, be thorough, and be flexible

and creative. All aspects of the training program should be coordinated to produce the desired results.

a. The commander should refer to FM 25-101 when developing his unit training program. This FM applies the doctrine established in FM 25-100 and assists leaders in the development and execution of training programs.

b. The heart of an effective training program is the development of a METL and the soldier tasks, leader tasks, and collective tasks that support the METL. Battle focus drives the METL development process; the METL is based on the wartime mission, and the unit must train as it plans to fight. Chapter 2 of FM 25-101 illustrates this process in clear and practical terms.

EVENT/TABLE	TRACK A (rounds)	TRACK B (rounds)	TRACK C (rounds)
GST	0	0	0
TABLES 1 & 2	0	0	0
TABLES 3 & 4	0	0	0
TABLES 5 & 6	240	60	0
TABLES 7 & 8	40	20	0
TABLES 9 & 10	48	24	0
TABLES 11 & 12	48	24	0

Table 5-1. Required TOW gunnery tables and ammunition needed per system per year (IAW DA Pam 350-38 STRAC).

5-2. SUSTAINMENT TRAINING AND EVALUATION

As individual TOW crewmen, squads, sections and platoons become qualified, the commander should maintain that status by sustainment training and evaluation, and by crew stabilization. Personnel changes are inevitable in units. Before TOW squads lose their crew integrity and combat readiness, personnel changes should be examined in detail and alternative solutions sought where possible. Figure 5-1 is an example of a crew stability management chart used to record training milestones and qualifications.

5-3. TOW TRAINING Guidelines

A soldier must track all targets and perform all individual and collective tasks and battle drills discussed in this manual to become a fully trained 11H heavy antiarmor weapon system crewman. Soldier training publications and ARTEP battle drills for TOW provide tasks, conditions, and standards for combat-critical skills.

VEH NO.	TOW DUTY POSITION	JAN 93	FEB 93	MAR 93	APR 93	MAY 93	JUN 93
A-31	SECTION LEADER	8278 (NOTE 1)	8278	8632 (NOTE 2)	8632	8632	8632
A-31	GUNNER	7257	7257	7257 GST (NOTE 3)	7257	7257	7257
A-31	LOADER	4410	4410	4410 GST	4410	4410	4410
A-31	DRIVER	3981	3981 GST	1850 SQD QUAL	1850	1850	1850
A-32	SQUAD LEADER	8273	8273 GST	1711 SQD QUAL	1711	1711	1711
A-32	GUNNER	1984	1984 GST	1984 SQD QUAL	1984	1984	1984
A-32	LOADER	2029	2029 GST	2029 SQD QUAL	2029	2029	2029
A-32	DRIVER	9699	9699 GST	9699 SQD QUAL	9699	9699	9699

NOTES:

1. This number represents the last four of the individual's social security number. It is written in black in this particular block and remains black until the individual leaves the duty position.
2. This number is written in red, signifying the change in personnel. April 93 number goes to black.
3. Training data is colored in green to indicate successful completion; red indicates failure.

Figure 5-1. Example of a crew stability management chart.

a. When a crew member becomes skilled in his job, he should be trained to do another crew member's job (cross-trained). Therefore, the loss of one crew member will not make the squad combat-ineffective.

b. Training should be conducted under realistic conditions. To properly develop combat skills, training must be conducted in a tactical environment with emphasis on the type of threat the crew can expect to face in combat.

c. Multiechelon training should be conducted to save time and resources. For example, while squads are training in crew tasks, leaders can train to execute their tactical command and control responsibilities.

d. Training should be conducted with supported units. When possible, tactical training should be conducted with the type of units to be supported in combat—infantry, mechanized infantry, and armor. TOW units must be able to interface with the units they support.

e. Training should be concentrated in areas where it is most needed. Time should not be wasted by training skills the unit and soldiers have already mastered. The trainer must know where the weak spots are and train to correct them.

f. Sections and squads will not always beat full strength. The mission in combat and in training can still be accomplished if understrength units are organized with the following rules in mind:

(1) Key leadership positions should always be filled. For example, the gunner may have to fill the position of the squad leader.

(2) The primary weapon system should always be manned. If the loader becomes a casualty, the squad leader may have to load the TOW and control the squad at the same time. If the gunner becomes a casualty, the squad leader must operate and fire the TOW.

5-4. TOW GUNNERY TABLES

The TOW Training Program consists of 12 gunnery tables plus the Gunners' Skill Test. Tables 1 through 6 and the Gunners' Skill Test must be performed quarterly. Tables 7 through 12 must be performed semiannually. (See Table 5-2 for frequency of events as required by DA Pam 350-38 STRAC.)

NOTE: The second quarterly GST should be conducted within seven days before conducting Tables 7 through 12.

Tables 1 through 4 will be performed with the Tow Gunnery Trainer (TGT). Tables 5 through 12 will be performed with the TOW Field Tactical Trainer (TFTT). The TFTT replicates the flight and performance characteristics of the TOW.

EVENT/TABLE	TRACK A (rounds)	TRACK C (rounds)	TRACK D (rounds)
GST	4	2	1
TABLES 1 & 2	4	1	0
TABLES 3 & 4	4	1	0
TABLES 5 & 6	4	1	0
TABLES 7 & 8	2	1	0
TABLES 9 & 10	2	1	0
TABLES 11 & 12	2	1	0

Table 5-2. Frequency of required TOW gunnery events.

5-5. CONDUCT OF UNIT TOW TRAINING

TOW training involves individual and collective training divided into four phases. Each unit must complete these phases as required.

a. Phase 1—Individual Training.

- Conduct refresher training on STP tasks as deemed necessary to prepare for the Gunners' Skill Test.
- Conduct sustainment training with the TGT as deemed necessary to prepare for TOW Gunnery Tables 1 through 4.
- Conduct Gunners' Skill Test.
- Conduct TOW Gunnery Table 1, Individual Gunnery Practice.
- Conduct TOW Gunnery Table 2, Individual Gunnery Qualification.
- Conduct TOW Gunnery Table 3, Advanced Gunnery Practice.
- Conduct TOW Gunnery Table 4, Advanced Gunnery Qualification.

b. Phase 2—Squad Training.

- Conduct refresher training on the installation and operation of TFTT or MILES equipment as deemed necessary in preparation for TOW Gunnery Tables 5 and 6.
- Conduct TOW Gunnery Table 5, Baseline Gunnery Practice.
- Conduct TOW Gunnery Table 6, Baseline Gunnery Qualification.
- Conduct squad-level sustainment training as deemed necessary to prepare for TOW Gunnery Tables 7 and 8.

- Conduct TOW Gunnery Table 7, Squad Gunnery Practice, in preparation for Table 8.
- Conduct TOW Gunnery Table 8, Squad Gunnery Qualification.

c. Phase 3—Section Training.

- Conduct section-level sustainment training as deemed necessary to prepare for TOW Gunnery Tables 9 and 10.
- Conduct TOW Gunnery Table 9, Section Gunnery Practice, in preparation for Table 10.
- Conduct TOW Gunnery Table 10, Section Gunnery Qualification.

d. Phase 4—Platoon Training.

- Conduct platoon-level sustainment training as deemed necessary to prepare for TOW Gunnery Tables 11 and 12.
- Conduct TOW Gunnery Table 11, Platoon Gunnery Practice, in preparation for Table 12.
- Conduct TOW Gunnery Table 12, Platoon Gunnery Qualification.

5-6. COLLECTIVE TRAINING

Collective training is the coordinated performance of individual skills and tasks as a team. Collective tasks are normally performed by more than one soldier.

a. Common crew task training is the first level of collective training. Common crew tasks provide the basic technical collective tasks performed by the crew to accomplish the wartime mission. These tasks tell "how to" and allow each soldier in the crew to perform his tasks. As a result, the squad leader, gunner, driver, and loader combine their learned individual technical skills to perform as one crew on their assigned vehicle.

b. The critical squad and platoon collective tasks are called battle drills. Battle drills are mostly independent of METT-T and require minimal leader actions to execute. They are standardized throughout the U.S. Army. Battle drills are in the applicable drill book for each echelon and equipment-type unit. The battle drills for antiarmor platoons are in ARTEP 7-91-Drill.

c. Common crew tasks are tasks performed by a TOW crew that are not battle drills but are performed in the same manner. An example of a common crew task is Dismount/Remount the TOW. Crew tasks are crucial to applying tactics to enhance survival and to accomplish the TOW crew's mission of providing antiarmor direct fire support to destroy the enemy.

d. Collectively, common crew tasks and battle drills form each action the crew must perform. For example, this manual discusses the common crew tasks to mount, stow, dismount, and engage a target with an M60 machine gun mounted on an ITV.

e. ARTEP training exercises are used to practice, evaluate, and sustain collective tasks and mission proficiency. They have specific goals and are modified based on METT-T factors. Exercises are structured to the availability of resources, time, and training areas. (See appropriate ARTEP for details on conducting ARTEP exercises.)

SECTION II. TOW TRAINING PHASES

The TOW training program is divided into four phases: individual training, squad training, section training, and platoon training. Phase I (individual training) consists of the Gunners' Skill Test and TOW Gunnery Tables 1 through 4. Phase II (squad training) consists of TOW Gunnery Tables 5 through 8. Phase III (section training) consists of TOW Gunnery Tables 9 and 10. Phase IV (platoon training) consists of TOW Gunnery Tables 11 and 12. (All scoring forms are located in the back of this manual for local reproduction.)

5-7. PHASE I: INDIVIDUAL TRAINING

Individual training covers all tasks that are performed by a single TOW crewman. These tasks include Skill Level 1 11H soldier's manual tasks and individual gunnery. They are the building blocks that form the foundation of TOW training.

a. Gunners' Skill Test The Gunners' Skill Test comprises two parts. Part 1 (DA Form 7331-R, Figure 5-2, page 5-10) comprises the Skill Level 1 tasks for the TOW weapon system listed in Subject Area 16 of STP 7-11H14-SM-TG plus some additional tasks. All 11H soldiers must take this portion of the test and receive a GO on at least 70 percent of the tasks. Part 2 (DA Form 7332-R, Figure 5-3, page 5-11) comprises two groups of tasks taken from STP 7-11H14-SM-TG plus some additional tasks (some for HMMWV-equipped units and some for M901 ITV-equipped units). All 11H soldiers must be tested on the group of tasks that applies to the vehicle his unit is equipped with and receive a GO on at least 70 percent of those tasks. Some of the tasks are combined individual/crew tasks. Since every member of the crew must be cross trained, the combined individual/crew tasks will be performed in rotation and every member of the crew will be tested on each part. (ALL Echo units equipped with M2/M3 BTVS will not perform the combat vehicle identification task on the GST. They will conduct this task during the BGST.)

TASK: All 11H soldiers: Perform the TOW gunner's tasks listed in (1) below. All 11H soldiers in HMMWV-equipped units: Perform the TOW gunner's tasks listed in (2) below.

All 11H soldiers in ITV-equipped units: Perform the TOW gunner's tasks listed in (3) below.
CONDITIONS: Testing will be hands on, with the appropriate equipment. Specific conditions will be found in the reference cited for each task.
STANDARDS: Specific standards for each task listed will be found in the appropriate reference. The overall minimum standard to receive a GO on the Gunners' Skill Test is for each individual to receive a GO on at least 70 percent of the tasks he is required to test on.

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(1) The GST, Part 1 consists of the following tasks.
(a) 071-056-0004 Maintain an M220-series launcher system.
(b) 071-056-0007 Load an M220-series launcher system.
(c) 071-056-0008 Unload an M220-series launcher system.
(d) 071-056-0009 Engage targets with an M220-series launcher system.
(e) 071-056-0010 Perform immediate action for an M220-series launcher system malfunction.
(f) 071-056-0005 Conduct a system check-out on an M220A1 launcher system. (Tested only if unit is equipped with M220A1 systems.)
(g) 071-056-0013 Conduct a system check-out on an M220A2 launcher system. (Tested only if unit is equipped with M220A2 systems.)
(h) 071-056-0030 Determine M220-series launcher system firing limitations.
(i) No Task Number Identify combat vehicles. (See Appendix I.)
(j) No Task Number Determine if a target can be engaged by an M220-series launcher system. (See Chapter 6.)
(k) 071-317-0000 Prepare an antiarmor range card.
(l) No Task Number Assemble an TOW-series launcher system. (See TM 9-1425-472-12 [M220A1] or TM 9-1425-450-12 [M220A2].)
(2) The GST, Part 2 for M966 HMMWV-equipped units consists of the following tasks:
(a) 071-056-0032 Conduct dismounting and remounting of an M220A1 launcher system on an M966 vehicle (for units equipped with M220A1 only).
(b) 071-056-0034 Conduct dismounting and remounting of an M220A2 launcher system on an M966 vehicle (for units equipped with M220A2 only).
(c) No Task Number Place the M966 vehicle in the ready-to-fire configuration. (See TM 9-1425-450-12.)
(3) The GST, Part 2 for M901 ITV-equipped units consists of the following tasks:
(a) 071-056-0041 Conduct dismounting and remounting of an M220A1 launcher system on an M901 vehicle (for units equipped with M220A1 only).
(b) 071-056-0045 Conduct dismounting and remounting of an M220A2 launcher system on an M901 vehicle (for units equipped with M220A2 only).

(c) 071-034-0001 Load an M243 or M259 smoke grenade launcher.

(d) 071-034-0002 Unload an M243 or M259 smoke grenade launcher.

(e) No Task Number Mount, dismount, and remount an M60 machine gun on an M901-series vehicle. (See Chapter 4, paragraph 4-14.)

(f) 071-056-0020 Load a dual launcher while mounted on an M901-series vehicle.

(g) 071-056-0021 Unload a dual launcher while mounted on an M901-series vehicle.

(h) No Task Number Operate an M901 dual launcher using emergency action procedures. (See Chapter 4, paragraph 4-11.)

(4) The GST, Part 2 for M2/M3 BTV-equipped units consists of the following tasks:

(a) No Task Number Conduct dismounting and remounting of an M220A1 launcher system on an M2/M3 BTV (for units equipped with M220A1 only). (See Appendix J.)

(b) No Task Number Conduct dismounting and remounting of an M220A2 launcher system on an M2/M3 BTV (for units equipped with M220A2 only). (See Appendix J.)

GUNNER SKILL TEST (ALL 11H) - PART 1

For use of this form, see FM 23-34. The proponent agency is TRADOC.

NAME:	RANK:	UNIT:	DATE:
THOMPSON, DAVID B.	SGT	C 2/2 IN	13 AUG 93

TEST#	TASK NUMBER	TASK TITLE	GO/NO GO
1	071-056-0004	MAINTAIN AN M220-SERIES LAUNCHER SYSTEM	GO HHR.
2	071-056-0007	LOAD AN M220-SERIES LAUNCHER SYSTEM	GO KLC.
3	071-056-0008	UNLOAD AN M220-SERIES LAUNCHER SYSTEM	GO KLC.
4	071-056-0009	ENGAGE TARGETS WITH AN M220-SERIES LAUNCHER SYSTEM	GO KLC.
5	071-056-0010	PERFORM IMMEDIATE ACTION FOR AN M220-SERIES LAUNCHER SYSTEM MALFUNCTION	1. NOGO BLC. 2. GO BLC.
6	071-056-0005	CONDUCT A SYSTEM CHECK OUT ON AN M220A1 LAUNCHER SYSTEM	
7	071-056-0013	CONDUCT A SYSTEM CHECK OUT ON AN M220A2 LAUNCHER SYSTEM	GO K.M.
8	071-056-0030	DETERMINE M220-SERIES LAUNCHER SYSTEM FIRING LIMITATIONS	GO R.H.
9	NO TASK NUMBER	IDENTIFY COMBAT VEHICLES	GO A.Q.
10	NO TASK NUMBER	DETERMINE IF A TARGET CAN BE ENGAGED BY AN M220-SERIRES LAUNCHER SYSTEM (SEE FM 23-34, CH 6)	GO R.P.
11	071-317-0000	PREPARE AN ANTIARMOR RANGE CARD	GO R.P.
12	NO TASK NUMBER	ASSEMBLE AN M220-SERIES LAUNCHER SYSTEM	GO W.E.

DA FORM 7331-R, JUL 94

Figure 5-2. Example of completed DA Form 7331-R, Scorecard for Gunners' Skill Test, Part 1.

GUNNER SKILL TEST (ALL 11H) - PART 2

For use of this form, see FM 23-34. The proponent agency is TRADOC.

NAME:	RANK:	UNIT:	DATE:
WILLIAMS, RAY	SPC	CSC 2/1 IN	13AUG93

TEST#	TASK NUMBER	TASK TITLE	GO/NO GO
1	NO TASK NUMBER	PLACE THE 966 VEHICLE IN THE READY-TO-FIRE CONFIGURATION (SEE FM 23-34 CH 3)	GO KLC
2	071-056-9932	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A1 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A1 EQUIPPED UNITS ONLY)	
3	071-056-0034	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A2 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A2 EQUIPPED UNITS ONLY)	GO KLC
4	071-056-0041	CONDUCT DISMOUNTING AND REMOUNTING OF AN M220A1 LAUNCHER SYSTEM ON AN M901 VEHICLE (M220A1-EQUIPPED UNITS ONLY)	
5	071-056-0045	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A2 LAUNCHER SYSTEM ON AN M901 VEHICLE (M220A2 EQUIPPED UNITS ONLY)	
6	071-034-0001	LOAD AN M243 OR M259 SMOKE GRENADE LAUCHER	
7	071-034-0002	UNLOAD AN M243 OR M259 SMOKE GRENADE LAUCHER	
8	NO TASK NUMBER	MOUNT, DISMOUNT, AND REMOUNT AN M60 MACHINE GUN O AN M901 VEHICLE (SEE FM 23-34, CH 4)	
9	071-056-0020	LOAD A DUAL LAUNCHER WHILE MOUNTED ON AN M901 VEHICLE	
10	071-056-0021	UNLOAD A DUAL LAUNCHER WHILE MOUNTED ON AN M901 VEHICLE	
11	NO TASK NUMBER	OPERATE AN M901 DUAL LAUNCHER USING EMERGENCY ACTION PROCEDURES (SEE FM 23-34, CH 4)	
12	NO TASK NUMBER	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A1 LAUNCHER SYSTEM ON AN M2/M3 BTV (FOR UNITS EQUIPPED WITH M220A1 ONLY)	
13	NO TASK NUMBER	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A2 LAUNCHER SYSTEM ON AN M2/M3 BTV (FOR UNITS EQUIPPED WITH M220A2 ONLY)	

DA FORM 7332-R, JUL 94

Figure 5-3. Example of completed DA Form 7332-R, Scorecard for Gunners' Skill Test, Part 2—Carrier-specific tasks.

(4) The following are the tasks, conditions, and standards for the unnumbered tasks in the Gunner's Skill Test.

TASK: Identify combat vehicles.
CONDITIONS: Given a classroom with appropriate audiovisual equipment and assorted vehicle GTAs. (See the local Training Aids Support Center for the combat vehicle slides.)
STANDARDS: Given a 12-second exposure time for each slide, the soldier must correctly identify 36 out of 40 vehicles by nomenclature as described in Appendix I.

TASK: Determine if a target can be engaged by an M220-series TOW launcher system.
CONDITIONS: In the field, given an operational, assembled M220-series TOW launcher system and tactical vehicles placed in realistic situations; or indoors, given a series of graphic presentations of target engageability situations or using the TGT.
STANDARDS: Correctly determine target engageability for the M220-series TOW launcher system in terms of range and obstructions using both the daysight tracker and nightsight as described in Chapter 6, paragraph 6-1.

TASK: Assemble an M220-series launcher system.
CONDITIONS: Given a complete but unassembled M220-series launcher.
STANDARDS: Correctly assemble an M220-series launcher system as described in TM 9-1425-472-12 (M220A1) or TM 9-1425-450-12 (M220A2) within 3 minutes.

TASK: Place the M966 HMMWV in the ready-to-fire configuration.
CONDITIONS: Given an M966 HMMWV, an M220-series TOW launcher complete, and an MSR.
STANDARDS: Correctly place the M966 in the ready-to-fire configuration as described in TM 9-1425-475-12 (M220A1) or TM 9-1425-450-12 (M220A2) within 5 minutes.

TASK: Mount, dismount, and remount an M60 machine gun on an M901-series vehicle.
CONDITIONS: Given an M901-series vehicle, an operational M60 machine gun, and an operational pintle mount.
STANDARDS: Correctly mount, dismount, and stow an M60 machine gun on an M901-series vehicle as described in Chapter 4, paragraph 4-14.

TASK: Operate an M901 dual launcher using emergency action procedures.
CONDITIONS: Given an operational M901 dual launcher.
STANDARDS: Correctly operate an M901 dual launcher using emergency action procedures as described in Chapter 4, paragraph 4 11.

TASK: Conduct dismounting and remounting of an M220A1 launcher system on an M2/M3 BTV (for units equipped with M220A1 only).
CONDITIONS: Given a complete TOW launcher, an encased missile, an M2/M3 BTV, and a TOW crew.
STANDARDS: Dismount and remount and secure the launcher and missile on the M2/M3 BTV as described in Appendix J.

TASK: Conduct dismounting and remounting of an M220A2 launcher system on an M2/M3 BTV (for units equipped with M220A2 only).
CONDITIONS: Given a complete TOW launcher, an encased missile, an M2/M3 BTV, and a TOW crew.
STANDARDS: Dismount and remount and secure the launcher and missile on the M2/M3 BTV as described in Appendix J.

b. **TOW Gunnery Table 1, Individual Gunnery Practice.** TOW Gunnery Table 1 consists of firing a minimum of 2 practice events (instructional firing) in preparation for actual gunner qualification on TOW Gunnery Table 2. Units will use the TGT to conduct this table.

TASK: Verify on TOW Gunnery Table 1, Individual Gunnery Practice using the TGT.
CONDITIONS: Indoors, using the TGT. The gunner will fire a minimum of two 10-shot events using the TGT. They will be selected from the events listed in Table 5-3, page 5-15.

STANDARDS: To verify on TOW Gunnery Table 1 and progress to TOW Gunnery Table 2, the gunner must fire at least one 10-shot event with a cumulative score of at least 625 points and at least 6 hits.

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(1) *Preparation of the TGT for gunner practice.* The TGT is not designed for use as an outdoor trainer. Therefore, it should always be set up and used indoors. It may be used in tents or under shelter as long as it is not exposed to the elements, particularly dust or blowing sand. It may be used in either the tripod-mounted mode or in the HMMWV-mounted mode. The TGT should never be mounted on a moving HMMWV. It should be assembled and operated according to the instructions in TM 9-6920-452-10.

(2) *Personnel duties.* Normally, only two people at a time, the gunner and the trainer, will be involved in training with the TGT. The trainer will usually be either the squad or section leader. Other members of the squad should be occupied with concurrent training. Other gunners should not be allowed to watch during conduct of the event. Once the TGT has been assembled and warmed up, the trainer must assemble a plan group that conforms to one of the 10-shot events listed in Table 5-3. The trainer should have the TGT inspected and warmed up, and the plan group constructed before the gunner is brought in to begin engaging targets. When constructing the plan group, the trainer ensures battle sounds are ON, target size is set at 100 percent, and obscuration is set to last for 1.5 seconds for the thermal sight and for the daysight tracker. When everything is ready, the trainer should bring the gunner in and brief him before beginning the event. The briefing should include the following:

- Safety considerations.
- Breath control—Remind the student of proper procedures.
- Obscuration—Tell the student the obscuration setting used.
- Sight—Tell the student which sight he will use.
- Special conditions—Tell the student any special conditions (multiple targets and so forth) that apply.

(3) *Conduct of training.* When the TGT is ready for operation, the plan group has been constructed, and the gunner has been briefed and is in place, the trainer begins conducting the table. Before the trainer starts each mission, he gives the gunner a fire command and tells him to fire when ready. During the mission, the trainer does not coach the gunner in any way. The gunner must determine when to fire and at which target. After each mission, the trainer gives the gunner the results and then proceeds to the next mission.

NOTE: The trainer has the option of thoroughly debriefing the gunner on his performance at the end of each mission or of saving all 10 missions and reviewing them after the table is complete. The trainer must remember that the TGT will only save a maximum of 20 missions at one time.

TABLE NO.	1	2	3
DISK NO.	DFT 10	DFT 11	DFT 12
MISSION NO.	2	1	22
	3	2	24
	6	4	26
	8	3	28
	9	18	29
	18 (THERMAL)	26 (THERMAL)	2 (THERMAL)
	14 (THERMAL)	27 (THERMAL)	3 (THERMAL)
	12 (THERMAL)	28 (THERMAL)	4 (THERMAL)
	15 (THERMAL)	29 (THERMAL)	9 (THERMAL)
	22 (THERMAL)	30 (THERMAL)	10 (THERMAL)

Table 5-3. 10-shot events for the TGT.

(4) *Scoring.* The two scoring criteria for TOW Gunnery Table 1 are total point score and number of hits. The point score for the table consists of the cumulative point score for all 10 missions. The minimum number of hits is 6 out of 10. The trainer should use DA Form 7333-R to record results (Figure 5-4, page 5-17).

(5) *Sustainment training.* Units are required to conduct monthly sustainment training. This training should not be confused with the quarterly tables. Missions for monthly sustainment training may be taken from any of the videodiscs and are chosen at the trainer's discretion. The missions in Table 5-3 should not be used for sustainment training, if possible.

c. **TOW Gunnery Table 2, Individual Gunnery Qualification.** TOW Gunnery Table 2 will be set up and run the same as TOW Gunnery Table 1. It will be performed with the TGT.

TASK: Qualify on TOW Gunnery Table 2, Individual Gunnery Qualification using the TGT.
CONDITIONS: Indoors using the TGT. The gunner will fire a 10-shot event selected from Table 5-3.
STANDARDS: To qualify on TOW Gunnery Table 2 and progress to TOW Gunnery Table 3, the gunner must fire one 10-shot event with a cumulative score of at least 625 points and at least 6 hits. The gunner's classification (expert, first class, second class) will be determined by the cumulative point score using the point scale as shown in Figure 5-4.

NOTE: Preparation of the TGT, personnel duties, and conduct of training are the same as for TOW Gunnery Table 1.

d. **TOW Gunnery Table 3, Advanced Gunnery Practice.** TOW Gunnery Table 3 (DA Form 7334-R, Figure 5-5, page 5-19) consists of a series of missions performed with the TGT that train and test advanced gunnery skills. These skills include determining a target's engageability, identifying targets (to include friend or foe), prioritizing targets, deciding which fire control methods to use, and engaging evasive targets that are hard to track such as helicopters, obscured targets, or extreme-range targets. Only the assigned gunners in each squad are required to verify on TOW Gunnery Table 3. (Other members of the squad may perform the table if time permits and the trainer thinks it useful.) TOW Gunnery Table 3 can only be performed with the TGT. Gunners must verify on TOW Gunnery Table 3 to progress to TOW Gunnery Table 4, Advanced Gunnery Qualification.

(1) *Gunner verification on TOW Gunnery Table 3, Advanced Gunnery Practice.*

TOW GUNNERY TABLE 1 AND 2: INDIVIDUAL GUNNERY

☒ PRACTICE ☐ QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

DATA REQUIRED BY PRIVACY ACT OF 1974

AUTHORITY: 10USC 30129g. Executive Order 9397. **PRINCIPAL PURPOSE(S):** Records individual's performance on record fire range. **ROUTINE USE(S):** Evaluation of individual's proficiency and basis for determination of award of proficiency badge; SSN is used for positive identification purposes only. **MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION:** Voluntary; individuals not providing information cannot be rated/scored on a mass basis.

NAME: ERVIN D	RANK: SGT	SSAN: 000-00-0011	UNIT: C 2/2 IN
DATE: 30 SEPT 93		DISK# 12	

MISSION#	INDIVIDUAL GUNNERY TASK TESTED	SIGHT	SCORE	SUCCESSFUL	
# 22		OS	90	(YES)	NO
# 24		OS	90	(YES)	NO
# 26		OS	90	(YES)	NO
# 28		OS	80	(YES)	NO
# 29		OS	85	(YES)	NO
# 2		TS	88	YES	(NO)
# 3		TS	81	(YES)	NO
# 4		TS	78	(YES)	NO
# 9		TS	66	(YES)	NO
# 10		TS	75	(YES)	NO
	TOTAL TRACKING SCORE		823	SUCCESSFUL MISSIONS: 9	

GUNNER CLASSIFICATION

EXPERT / 875 - 1000 1ST CLASS / 750 - 874 2ND CLASS / 625 - 749

SCORING INDIVIDUAL GUNNERY TABLES

IN THE INDIVIDUAL GUNNERY TABLES, THE GUNNER RATING IS DETERMINED BY HIS TOTAL POINT SCORE FOR 10 MISSIONS, PLUS HE MUST HAVE AT LEAST 6 SUCCESSFUL MISSIONS. A SUCCESSFUL MISSION IS ONE WHERE THE GUNNER CORRECTLY FOLLOWS THE TRAINERS FIRE COMMANDS AND ENGAGES AND DESTROYS THE CORRECT TARGET.

DA FORM 7333-R, JUL 94

Figure 5-4 Example of completed DA Form 7333-R, TOW Gunnery Tables 1 and 2, Individual Gunnery Practice and Qualification Scorecard.

TASK: Verify on Table 3, Advanced Gunnery Practice.
CONDITIONS: Indoors, using the TGT. The gunner will fire a minimum of two lo-shot events using the TGT. The 10-shot events will be selected from Table 5-4.
STANDARDS: To verify on TOW Gunnery Table 3 and progress to TOW Gunnery Table 4, the gunner must score at least 625 points. The gunner must also receive a GO on at least 6 out of 10 missions.

(2) *Personnel duties.* The trainer (usually the squad or section leader) sets up the TGT IAW TM 9-6920-452-10, creates the planning group for each 10-shot event, briefs the gunner, gives the fire commands for each mission, and completes DA Form 7334-R (TOW Gunnery Tables 3 and 4, Advanced Gunnery Practice and Qualification Scorecard, Figure 5-5). He also debriefs and critiques the gunner at the end of each 10-shot event.

(3) *Conduct of training.* Conduct of advanced gunnery training with the TGT is more complex than individual gunnery. The trainer must not only observe and record the gunner's tracking performance but also brief, observe, and score the particular advanced gunnery task that is presented in each separate mission. The trainer selects the lo-shot event from Table 5-4, page 5-20. The sequence of missions in each lo-shot event should be changed continuously to prevent the gunner from becoming familiar with them.

(a) Before each mission, the trainer must present a fire command to the gunner that clearly states what the gunner must do. For example, if a particular mission involves prioritizing targets (such as tanks are higher priority targets than APCs), the trainer gives the command "GUNNER! TARGETS TO YOUR FRONT! ENGAGE TANKS FIRST! FIRE WHEN READY! "

(b) In some missions, the task involved may not require specific fire commands. These tasks include determining a target's engageability,, engaging evasive/obscured targets, and identifying targets (to include friend or foe). When giving fire commands for these missions, the trainer need only give general instructions, such as "GUNNER! TARGETS TO YOUR FRONT! FIRE WHEN READY!"

(4) *Scoring.* The trainer has two criteria for scoring each of these missions: tracking and success of the mission. The trainer will record the gunner's performance on the DA Form 7334-R (Figure 5-5).

(a) Tracking score. TOW Gunnery Table 3 is scored in the same manner as TOW Gunnery Table 1 except for target identification (to include friend or foe) missions. In these missions, if the gunner correctly identifies a target as friendly and does not fire on it, he receives 100 points. If he fires on a friendly target, he receives 0 points whether he hits it or not. The total tracking score from the 10 missions (Table 5-4) determines the gunner's ranking.

TOW GUNNERY TABLE 3 AND 4: ADVANCED GUNNERY

☐ PRACTICE ☒ QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

DATA REQUIRED BY PRIVACY ACT OF 1974

AUTHORITY: 10USC 30129g. Executive Order 9397. **PRINCIPAL PURPOSE(S):** Records individual's performance on record fire range. **ROUTINE USE(S):** Evaluation of individual's proficiency and basis for determination of award of proficiency badge; SSN is used for positive identification purposes only. **MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION:** Voluntary; individuals not providing information cannot be rated/scored on a mass basis.

NAME: HEIDER, R.	RANK: SPC	SSAN: 000-01-0000	UNIT: C 3/2 IN
DATE: 30 AUG 93		DISK# 10	

MISSION#	INDIVIDUAL GUNNERY TASK TESTED	SIGHT	SCORE	SUCCESSFUL
# 1	EVASIVE TARGET	OS	81	(YES) NO
# 7	TARGET ENGAGEABILITY	OS	78	(YES) NO
# 12	FIRE CONTROL METHODS	TS	73	(YES) NO
# 14	EVASIVE/OBSURE TARGET	TS	66	(YES) NO
# 22	TARGET PRIORITY	TS	81	YES (NO)
# 24	TARGET ENGAGEABILITY	OS	83	(YES) NO
# 28	EVASIVE TARGET	OS	91	(YES) NO
# 29	TARGET PRIORITY	OS	78	(YES) NO
# 26	TARGET PRIORITY	OS	80	(YES) NO
# 13	FRATRICIDE	OS	100	(YES) NO
	TOTAL TRACKING SCORE		811	SUCCESSFUL MISSIONS: 9

GUNNER CLASSIFICATION

EXPERT / 875 - 1000 1ST CLASS / 750 - 874 2ND CLASS / 625 - 749

SCORING ADVANCE GUNNERY TABLES

IN THE INDIVIDUAL GUNNERY TABLES, THE GUNNER RATING IS DETERMINED BY HIS TOTAL POINT SCORE FOR 10 MISSIONS, PLUS HE MUST HAVE AT LEAST 6 SUCCESSFUL MISSIONS. A SUCCESSFUL MISSION IS ONE WHERE THE GUNNER CORRECTLY FOLLOWS THE TRAINERS FIRE COMMANDS AND ENGAGES AND DESTROYS THE CORRECT TARGET. IF THE MISSIONS IS A FRATRICIDE MISSION, THE GUNNER SHOULD NOT ENGAGE THE TARGET. IF HE DOES NOT ENGAGE THE FRIENDLY VEHICLE, HE SCORES 100 POINTS AND A SUCCESSFUL MISSION., IF HE ENGAGE THE FRIENDLY VEHICLE, HE SCORES 0 POINTS AND AN UNSUCCESSFUL MISSION. IN TARGET ENGAGEABILITY AND EVASIVE TARGET SCENARIOS IT DOES NOT MATTER WHICH TARGET IS ENGAGED.

DA FORM 7334-R, JUL 94

Figure 5-5. Example of completed DA Form 7334-R, TOW Gunnery Tables 3 and 4, Advanced Gunnery Practice and Qualification Scorecard.

(b) Successful mission score. The gunner must achieve a GO on at least 6 out of 10 missions. The requirements for a mission to be successful vary according to the advanced gunnery task that is presented in each mission. A successful mission is defined as follows:

- The gunner successfully engages (destroys) the correct target as determined by the trainer's instructions for that particular mission. In a mission to determine a target's engageability, a hit on any target presented is scored as a success. In scenarios to prioritize targets or determine the method of fire control, the gunner must engage the correct target according to the instructions given to him in the fire command.
- In a scenario to identify targets (including friend or foe), the gunner must not fire on friendly targets.
- Engaging evasive/obscured targets does not require special skills or actions from the gunner. These targets are simply hard to hit. A hit on any target is scored as a successful mission.

Disk No.	Mission No.
DFT10	1 Evasive Target/Optical Sight
	7 Target Engageability/Optical Sight
	12 Fire Control Methods/Thermal Sight
	14 Evasive/Obscure Target/Thermal Sight
	22 Target Priority/Thermal Sight
	24 Target Engageability/Optical
	28 Evasive Target/Optical
	29 Target Priority/Optical
	26 Target Priority/Optical
	13 Fratricide/Optical
DFT12	7 Fratricide/Thermal
	9 Fratricide/Thermal
	22 Target Priority/Optical
	23 Target Priority/Thermal
	5 Target Priority/Thermal
	6 Target Priority Thermal
	10 Target Priority/Thermal
	12 Target Priority/Thermal

Table 5-4. 10-shot events for advanced gunnery tables.

Disk No.	Mission No.
DFT12 (continued)	15 Evasive Target/Thermal 11 Evasive Target/Thermal
DFT13	30 Target Engageability/Daysight Tracker 7 Target Priority/Daysight Tracker 26 Target Engageability/Daysight Tracker Target Engageability/Daysight Tracker 21 Fratricide/Daysight Tracker 6 Target Priority/Thermal 10 Target Priority/Thermal 8 Target Priority/Thermal 15 Target Priority/Thermal 12 Target Priority/Thermal
DFT15	2 Target Engageability/Dual 5 Target Priority/Dual 6 Target Priority/Dual 7 Target Priority/Dual 9 Target Priority/Dual 11 Target Engageability/Dual 12 Evasive Target/Dual 8 15 Target Engageability/Dual 3 15 Target Engageability/Dual 15 Target Engageability/Dual
	Note: As reviewer discs become available and are verified, they will be added to the manual as a change.

Table 5-4. 10-shot events for advanced gunnery tables (continued).

Training Notes: 1. In the mission descriptions in Table 5-4, the term "evasive target" refers to evasive, obscured, or difficult targets and helicopters.

2. The term "target priority" refers to missions in which different types of targets are presented (such as tanks and APCs) or in which some are moving and some are stationary. (Using these differences as criteria, the trainer chooses the high priority target for the gunner.)

3. In the missions where the type of sight is listed as dual, both sights

are active and the gunner may choose whichever sight he prefers for the engagement or may change sights during the engagement.

4. In the fire control missions, the trainer gives the gunner a choice of fire control methods (frontal, depth, or crossfire), and the gunner must engage the appropriate target out of the group presented.

(5) *Sustainment training.* Each month every 11H soldier is required to perform sustainment training on the TGT. The trainer may choose from all missions available for this training. He must remember that he is preparing his soldiers for the quarterly gunnery tables and should choose scenarios that train his soldiers in the skills and engagements in which they are weakest. Since only assigned gunners are *required* to perform and pass TOW Gunnery Tables 3 and 4, the trainer must be sure they are trained on the difficult advanced scenarios. Other members of his TOW crews should be trained as thoroughly as time permits and their training weaknesses require.

e. **TOW Gunnery Table 4, Advanced Gunnery Qualification.** TOW Gunnery Table 4 is similar to TOW Gunnery Table 3. It consists of a series of missions performed with the TGT that train and test advanced gunnery skills. Gunners will be evaluated on their ability to track and hit targets, and on their ability to perform advanced gunnery skills. These skills include determining a target's engageability, identifying targets (to include friend or foe), prioritizing target 's, choosing a method of fire control, and engaging targets that are difficult to track, such as helicopters, obscured targets, and extreme-range targets. Only assigned gunners in each squad are required to qualify on TOW Gunnery Table 4. (Other members of the squad may perform the table if time permits and the trainer thinks it useful.) TOW Gunnery Table 4 can only be performed with the TGT. Therefore, units that do not have access to the TGT are not required to perform this table. Gunners must qualify on TOW Gunnery Table 4 to progress to TOW Gunnery Table 5, Baseline TFTT Gunnery Practice.

(1) *Gunners' qualification on TOW Gunnery Table 4, Advanced Gunnery Qualification.*

TASK: Qualifty on TOW Gunnery Table 4, Advanced Gunnery Qualification.
CONDITIONS: Indoors, using the TGT. The gunner will fire one 10-shot event using the TGT. The 10-shot event will be selected from Table 5-4.
STANDARDS: To qualify on TOW Gunnery Table 4 and progress to TOW Gunnery Table 5, the gunner must score a total of at least 625 points. The precise ranking of the gunner (Expert, 1st class, or 2d class) is determined according to the scale shown on the scorecard. In addition, the gunner must receive a GO on at least 6 out of 10 missions.

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(2) *Personnel duties.* Personnel duties, conduct of training, and sustainment training are the same as for TOW Gunnery Table 3.

(3) *Scoring.* TOW Gunnery Table 4 is scored the same as TOW Gunnery Table 3. The form shown in Figure 5-5, TOW Gunnery Tables 3 and 4, Advanced Gunnery Practice and Qualification Scorecard, is used to score the table.

5-8. PHASE II: SQUAD TRAINING

Phase II begins squad-level TOW training. TOW Gunnery Tables 5 and 6 are static gunnery exercises from a baseline. TOW Gunnery Tables 7 and 8 are moving gunnery exercises where the vehicle moves from point to point on a course and engages a series of targets. These gunnery exercises are used to train and evaluate the TOW unit's combat capability. Each element has two tables: a practice table to train and a qualification table for evaluation. Each table is performed once during the day and once during the night under realistic (simulated) battlefield conditions. Point scores for target engagements are based on a combat model that predicts success based on the time from target detection to target engagement, type of target, and range to target. These scores are taken from the live-fire point calculation sheet (Figure 5-16, pages 5-44 and 5-45). Point scores are also affected by crew cuts (crew cuts are crew errors, either major or minor, that reduce the point score for a target engagement). The actual rating is calculated by adding the scores for the day and night phases and dividing them by two to get an average score. During move-out scenarios, the senior trainer is normally to the rear of the leader's vehicle for evaluation and training purposes. An assistant evaluator of the appropriate rank and experience is normally assigned to each additional vehicle that is evaluated as part of the same exercise. Evaluators must monitor crew conversations and fire commands.

a. **TOW Gunnery Table 5, Baseline TFTT Gunnery.** TOW Gunnery Table 5 reacquaints crews with TFTT and allows them to troubleshoot the equipment. It refreshes crews on TFTT gunnery and target engagement techniques to prepare the crews for the practice and qualification tables that follow.

TASK: Conduct baseline TFTT gunnery practice (day and night).
CONDITIONS: On an MPRC or in the field, given a TOW weapon system, its organic carrier, TFTT system, M80 blast simulators, and either pop-up moving targetry or tactical vehicles equipped with TFTT retroreflector assembly, as appropriate. (Use of MILES harness and LTIDs is optional.) The table will be conducted once during daylight and once at night.
STANDARDS: To complete TOW Gunnery Table 5 and progress to TOW

Gunnery Table 6, the crew must successfully install, troubleshoot and operate the TFTT system once during daylight and again at night IAW the appropriate TM. The crew must also successfully acquire, engage, and destroy 6 out of 10 targets presented in Table 5 (once during daylight and once at night).

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(1) *Conduct.* In TOW Gunnery Table 5, the system and or carriers are set up in static positions on a baseline. A range with pop-up or moving targets equipped with TFTT retroreflectors should be used if available. (Use of MILES harness or LTIDs is optional.) If such a range is not available, tactical vehicles equipped with TFTT retroreflectors maybe used. (Use of tactical vehicles equipped with MILES harness or LTIDs is optional.) The TOW systems will not move but will engage a series of moving and or pop-up targets from the baseline. TOW Gunnery Table 5 will be fired twice; once during daylight and once at night. Some of the engagements will be designated as NBC engagements and will be performed with the crew in MOPP 4.

(2) *Scoring.* To count as a successful engagement, the target must be killed within 30 seconds or less after exposure. Use DA Form 7335-R (TOW Gunnery Tables 5 and 6, Baseline TFTT Gunnery Practice and Qualification Scorecard, Figure 5-6, page 5-26) to record the crew's score (day or night).

(3) *Suggested support requirements.* The following support requirements are recommended when conducting TOW Gunnery Tables 5 through 8.

- Minimum evaluators (evaluators will not assist the gunner in finding or identifying targets):
  - — One evaluator per squad.
  - — One evaluator in the range tower to record scores on engagements.
- Opposing forces: None.
- Support troops: None.
- Vehicles/communications:
  - — One CVC helmet per squad evaluator (ITV only).
  - — One PRC-77/68 per squad evaluator.
  - — Two PRC 77/68 for the tower evaluator (one primary, one spare).
  - — Two frequencies (one for the tower and squad evaluator and one for the antiarmor squad).

- Maneuver area:
  - — Multipurpose range complex.
  - — A route for the element to move from the assembly area to the first firing point without damaging the underground wiring.
- Firing area:
  - — The TOW backblast area (75 meters by 90 degrees) will be clear.
  - — Smoke may be used.
- Training aids, devices, and special equipment:
  - — TFTT system.
  - — Sufficient TFTT retroreflectors to cover targets. (Use of MILES harness and LTIDs is optional.)
- Ammunition: Ten M80 blast simulators per TOW, per iteration.
- Key references: FM 7-91, FM 23-34, and live-fire point calculation sheet.

(4) *Trainer/evaluator guidelines.* Because this table is conducted on an MPRC, marking the firing positions may be necessary. At night, the roads must be marked with luminous tape.

b. **TOW Gunnery Table 6, Baseline TFTT Gunnery Qualification.** TOW Gunnery Table 6 is conducted according to the same conditions and standards as TOW Gunnery Table 5. DA Form 7335-R (TOW Gunnery Tables 5 and 6, Baseline TFTT Gunnery Practice and Qualification Scorecard, Figure 5-6, page 5-26) is used to score the table.

c. **TOW Gunnery Table 7, Squad Gunnery Practice.** This table trains the TOW squad to engage stationary and moving targets in a simulated battlefield scenario (Figure 5-7, page 5-29). It prepares the TOW squad for TOW Gunnery Table 8, Squad Gunnery Qualification, by presenting engagement scenarios and task requirements similar to those for evaluation. TOW Gunnery Table 7 may be conducted by a TOW HMMWV on an MPRC light or by an ITV on an MPRC heavy without modification.

(1) *Conduct.* All firings will be from the hull down position. Reload procedures will be executed from a defilade position. All stationary targets should be mounted on pop-up mechanisms to facilitate target acquisition and scoring. If pop-up mechanisms are not available, exposed stationary targets will be placed in an appropriate array. If exposed targets must be used, the exercise should be designed so that targets are presented only to the position from which they should be engaged. Moving targets should be presented at speeds from 5 to 40 kph.

TOW GUNNERY TABLES 5 AND 6: BASELINE TFTT GUNNERY
☐ PRACTICE ☒ QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SQUAD: 1 ST	SECTION: 1 ST	PLATOON: 1 ST	COMPANY: C 3/60IN
DATE: 3 SEPT. 93		DAY: X	NIGHT:

ENGAGEMENT	TARGET DESCRIPTION	HIT/MISS/TIME	GO/NG
TARGET 1	STATIONARY T72/FLANK/ 1,000 - 1,500 METERS	(HIT) MISS TIME: 21 SEC.	GO
TARGET 2	STATIONARY T72/FLANK/ 2,100 - 3,750 METERS	(HIT) MISS TIME: 25 SEC.	GO
TARGET 3	STATIONARY T72/FRONTAL/ 2,100 - 3,750 METERS	(HIT) MISS TIME: 23 SEC.	GO
TARGET 4	STATIONARY T72/OBLIQUE/ 2,100 - 3,750 METERS/NBC	(HIT) MISS TIME: 24 SEC.	GO
TARGET 5	STATIONARY T72/DEFILADE/ 800 - 1,500 METERS/NBC	HIT (MISS) TIME: 21 SEC.	NG
TARGET 6	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	(HIT) MISS TIME: 28 SEC.	GO
TARGET 7	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	(HIT) MISS TIME: 26 SEC.	GO
TARGET 8	MOVING T72/FLANK/ L-R, 5 KPH 1,000 - 1,500 METERS	(HIT) MISS TIME: 27 SEC.	GO
TARGET 9	MOVING T72/FLANK/ L-R, 10 KPH 2,100 - 3,750 METERS	(HIT) MISS TIME: 26 SEC.	GO
TARGET 10	MOVING T72/FLANK/ L-R, 40 KPH 1,000 - 1,500 METERS	(HIT) MISS TIME: 23 SEC.	GO
		OVERALL GO/NO GO:	9

IN ORDER TO RECEIVE A GO ON ANY TARGET ENGAGEMENT, THE GUNNER MUST HIT THE TARGET WITHIN 30 SECONDS AFTER THE TARGET IS EXPOSED. TO RECEIVE A GO ON TABLE 5, THE CREW MUST RECEIVE A GO ON "INSTALL TFTT" AND A GO ON AT LEAST 6 OUT OF 10 TARGET ENGAGEMENTS, BOTH DAY AND NIGHT.

DA FORM 7335-R, JUL 94

Figure 5-6. Example of completed DA Form 7335-R, TOW Gunnery Tables 5 and 6, Baseline TFTT Gunnery Practice and Qualification Scorecard.

(2) *Scoring.* The squad is rated based on the total point score. For scoring gunnery, time will start for the first target when the target is raised and will stop when the target is hit. AU reloads will be made from a hull defilade position. Time for the second target begins when the vehicle reoccupies the firing position and ends when the target is hit. DA Form 7336-R (TOW Gunnery Table 7, Squad Gunnery Practice Scoresheet, Figure 5-8, page 5-30) will be used to record scores.

(a) The table consists of five tasks. Each task consists of one or more target engagements from one firing position. Each target engagement is worth a maximum of 100 points. The point wore is determined by the time taken to kill the target using the live-fire point calculation sheet (Figure 5-16, pages 5-44 and 5-45). Any crew or leader cuts are deducted from this score (Tables 5-5 and 5-6, pages 5-28 and 5-33).

(b) Each task is also worth a maximum of 100 possible points. This score is calculated by adding the scores for all engagements made during the task and dividing by the number of targets engaged. For example, three targets were engaged and the scores were 75, 82, and 93 for a total of 250 points divided by 3 (the number of targets presented) for a task score of 81 points.

(c) Each table is performed once during the day and once at night. Scoring for day engagements will be made by the evaluator in the range tower. Scoring for night engagements will be made by both evaluators. The scores of the two events are added together for a maximum possible score of 1,000 points. This is the final score for the gunnery table.

NOTE: This scoring process is the same for Tables 7 through 12.

CREW CUTS	
MINOR (Deduct 5 points)	**MAJOR (Deduct 30 points)**
Improper fire commands. Firing before receiving command to fire. Incorrect engagement techniques (such as engaging the least dangerous target before the most dangerous target).	Failure to conduct system self-test/boresight before engaging first target. Failure to collimate day sight/nightsight before engaging first target. Failure to be in MOPP4 and close all hatches during NBC engagement. Engagement of friendly targets (if friendly targets are presented).

Table 5-5. Crew cuts.

d. **TOW Gunnery Table 8, Squad Gunnery Qualification.** TOW Gunnery Table 8 evaluates the TOW squad on its ability to engage stationary and moving targets in a simulated battlefield scenario (Figure 5-7). The conduct, scoring, suggested support requirements, and trainer/evaluator guidelines are the same as for TOW Gunnery Table 7. The squad's scores will be recorded on DA Form 7337-R, (TOW Gunnery Table 8, Squad Qualification Scoresheet, Figure 5-9, page 5-31).

OPERATION ORDER

SITUATION:

Enemy. The enemy is trying to gain control of key military bases, landing strips, and ports. The 125th and 45th Motorized Rifle Regiments have pushed north towards the objectives of the airfields at Ft. Campbell and Duck AFB. They have been held along the 00 East-West gridline in the vicinity of McKenna. The 125th MPR has swung northeast and is advancing on objectives at EH 42250770 (Watts airstrip) and EH 45101235 (Duffell railhead). Their intent is to secure these areas to facilitae resupply for themselves and for future reinforcements. The 125th is operating at 75 per cent strength and morale is high with the anticipation that they will meet their objectives with little resistance from American forces in the area. The 125th has T72s and BRMs. They are well trained in chemical warfare and have used nonpersistant chemical agents in recent engagements.

Friendly. The section mission is to deny enemy reconnaissances the ability to gain information on the defense of Watts airstrip and Duffell railhead. To our left is _____ (whatever section is appropriate). A Company of the 15th Engineer Battalion has constructed some firing positions and barriers. Our platoon will have priority of fires from one section of our battalion 4.2-inch mortars.

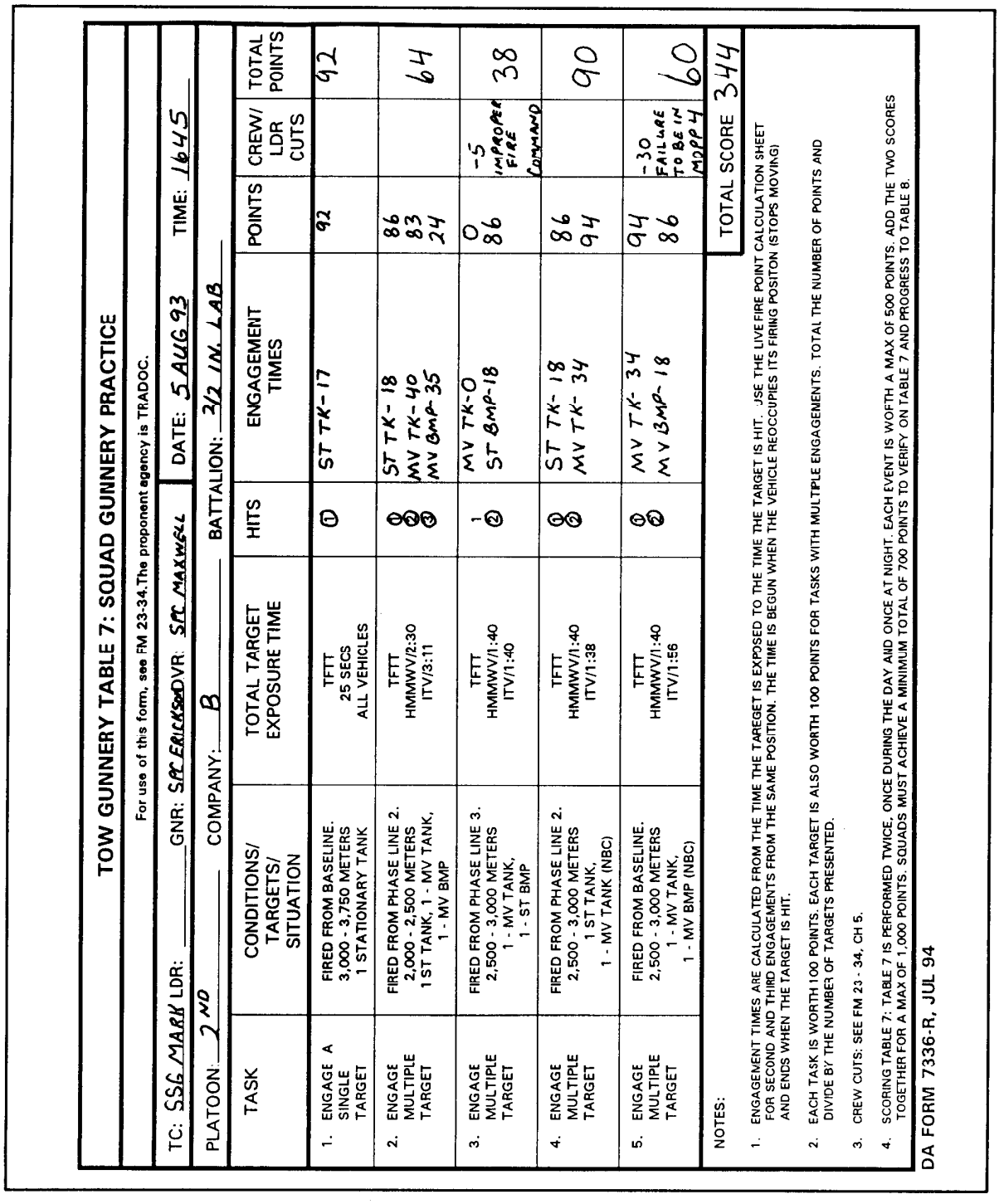
MISSION:

The mission of your squad will be to defend in sector north of Marshall Creek to destroy enemy reconnaissance to prevent them from gaining intelligence concerning Watts airstrip.

EXECUTION:

Concept of the operation. Your squad will occupy on order five battle positions: BP 1 at EH 42260840; BP 2 at EH 42560855; BP 3 at EH 42000858; BP 4 at EH 41810860; and BP 5 at EH 41460872. On order, you will depart from the release point at EH 42340866 and move to BP 1.

Figure 5-7. Example squad gunnery practice and qualification scenario.



TOW GUNNERY TABLE 7: SQUAD GUNNERY PRACTICE

For use of this form, see FM 23-34. The proponent agency is TRADOC.

TC: SSG MARK LDR: _____ GNR: SPC ERICKSON DVR: SPC MAXWELL DATE: 5 AUG 93 TIME: 1645

PLATOON: 2ND COMPANY: B BATTALION: 3/2 INF. LAB

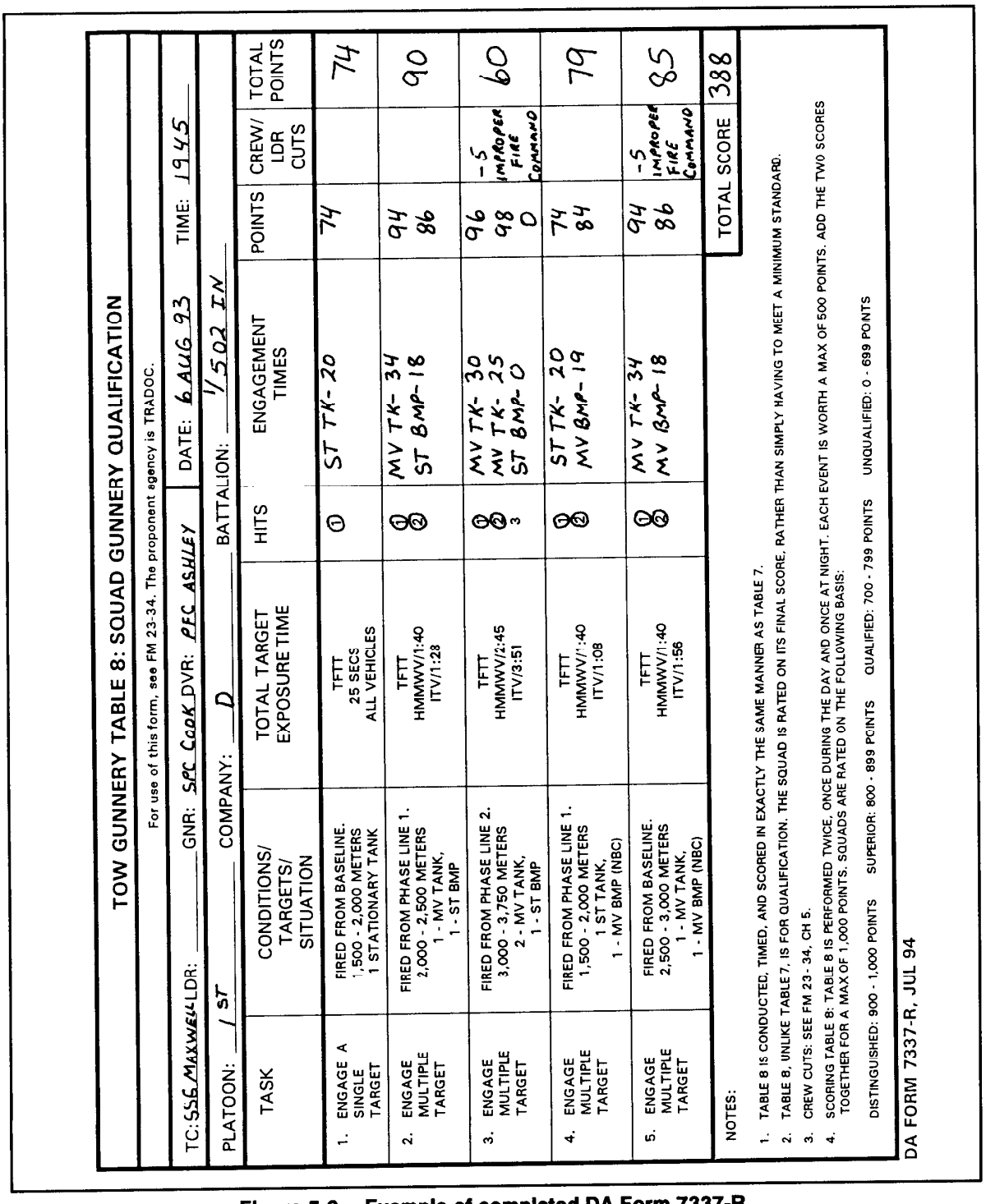
TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	①	ST TK- 17	92		92
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 2,500 METERS 1 ST TANK, 1 - MV TANK, 1 - MV BMP	TFTT HMMWV/2:30 ITV/3:11	① ② ③	ST TK- 18 MV TK- 40 MV BMP- 35	86 83 24		64
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 2,500 - 3,000 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV/1:40 ITV/1:40	1 ②	MV TK-0 ST BMP-18	0 86	-5 IMPROPER FIRE COMMAND	38
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,500 - 3,000 METERS 1 ST TANK, 1 - MV TANK (NBC)	TFTT HMMWV/1:40 ITV/1:38	① ②	ST TK- 18 MV TK- 34	86 94		90
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV/1:40 ITV/1:56	① ②	MV TK- 34 MV BMP- 18	94 86	-30 FAILURE TO BE IN MOPP 4	60
						TOTAL SCORE	344

NOTES:

1. ENGAGEMENT TIMES ARE CALCULATED FROM THE TIME THE TAREGET IS EXPOSED TO THE TIME THE TARGET IS HIT. USE THE LIVE FIRE POINT CALCULATION SHEET FOR SECOND AND THIRD ENGAGEMENTS FROM THE SAME POSITION. THE TIME IS BEGUN WHEN THE VEHICLE REOCCUPIES ITS FIRING POSITON (STOPS MOVING)
2. EACH TASK IS WORTH 100 POINTS. EACH TARGET IS ALSO WORTH 100 POINTS FOR TASKS WITH MULTPLE ENGAGEMENTS. TOTAL THE NUMBER OF POINTS AND DIVIDE BY THE NUMBER OF TARGETS PRESENTED.
3. CREW CUTS: SEE FM 23 - 34, CH 5.
4. SCORING TABLE 7: TABLE 7 IS PERFORMED TWICE, ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WOFTH A MAX OF 500 POINTS. ADD THE TWO SCORES TOGETHER FOR A MAX OF 1,000 POINTS. SQUADS MUST ACHIEVE A MINIMUM TOTAL OF 700 POINTS TO VERIFY ON TABLE 7 AND PROGRESS TO TABLE 8.

DA FORM 7336-R, JUL 94

Figure 5-8. Example of completed DA Form 7336-R, TOW Gunnery Table 7, Squad Gunnery Practice Scoresheet.



TOW GUNNERY TABLE 8: SQUAD GUNNERY QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

TC: 536 MAXWELL LDR: _____ GNR: SFC COOK DVR: PFC ASHLEY DATE: 6 AUG 93 TIME: 1945

PLATOON: 1 ST COMPANY: D BATTALION: 1/502 IN

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 1,500 - 2,000 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	①	ST TK- 20	74		74
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 1. 2,000 - 2,500 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV/1:40 ITV/1:28	① ②	MV TK- 34 ST BMP- 18	94 86		90
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 3,000 - 3,750 METERS 2 - MV TANK, 1 - ST BMP	TFTT HMMWV/2:45 ITV/3:51	① ② 3	MV TK- 30 MV TK- 25 ST BMP- 0	96 98 0	-5 IMPROPER FIRE COMMAND	60
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 1. 1,500 - 2,000 METERS 1 ST TANK, 1 - MV BMP (NBC)	TFTT HMMWV/1:40 ITV/1:08	① ②	ST TK- 20 MV BMP- 19	74 84		79
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV/1:40 ITV/1:56	②	MV TK- 34 MV BMP- 18	94 86	-5 IMPROPER FIRE COMMAND	85
						TOTAL SCORE	388

NOTES:

1. TABLE 8 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLE 7.
2. TABLE 8, UNLIKE TABLE 7, IS FOR QUALIFICATION. THE SQUAD IS RATED ON ITS FINAL SCORE, RATHER THAN SIMPLY HAVING TO MEET A MINIMUM STANDARD.
3. CREW CUTS: SEE FM 23-34, CH 5.
4. SCORING TABLE 8: TABLE 8 IS PERFORMED TWICE, ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WORTH A MAX OF 500 POINTS. ADD THE TWO SCORES TOGETHER FOR A MAX OF 1,000 POINTS. SQUADS ARE RATED ON THE FOLLOWING BASIS:

   DISTINGUISHED: 900 - 1,000 POINTS SUPERIOR: 800 - 899 POINTS QUALIFIED: 700 - 799 POINTS UNQUALIFIED: 0 - 699 POINTS

DA FORM 7337-R, JUL 94

Figure 5-9. Example of completed DA Form 7337-R, TOW Gunnery Table 8, Squad Gunnery Qualification Scoresheet.

5-9. PHASE III: SECTION TRAINING

Phase III begins section-level TOW training. TOW Gunnery Tables 9 and 10 are moving gunnery exercises where the vehicle moves from point to point on a course and engages a series of targets. These gunnery exercises are used to train and evaluate the TOW unit's combat capability. Each element has two tables: a practice table to train and a qualification table for evaluation. Each table is performed once during the day and once during the night under realistic (simulated) battlefield conditions. Point scores for target engagements are based on a combat model that predicts success based on the time from target detection to target engagement, type of target, and range to target. These scores are taken from the live-fire point calculation sheet (Figure 5-16, pages 5-44 and 5-45). Point scores are also affected by crew cuts (crew cuts are crew errors, either major or minor, that reduce the point score for a target engagement). The actual rating is calculated by adding the scores for the day and night phases and dividing them by two to get an average score. During move-out scenarios, the senior trainer is normally to the rear of the leader's vehicle for evaluation and training purposes. An assistant evaluator of the appropriate rank and experience is normally assigned to each additional vehicle that is evaluated as part of the same exercise. Evaluators must monitor crew conversations and fire commands.

a. **TOW Gunnery Table 9, Section Gunnery Practice.** This table trains the TOW section to control fire and distribution. It contains offensive and defensive engagements in a simulated battlefield scenario (Figure 5-10, page 5-35). TOW Gunnery Table 9 prepares the TOW section for the qualification table by presenting engagement scenarios and task requirements similar to those for evaluation. It may be conducted by a TOW HMMWV on an MPRC light or by an ITV on an MPRC heavy without modification.

(1) *Conduct.* All firings will be from the hull down position. Reload procedures will be executed from a defilade position. All stationary targets should be mounted on pop-up mechanisms to facilitate target acquisition and scoring. If pop-up mechanisms are not available, exposed stationary targets will be placed in an appropriate array. If exposed targets must be used, the exercise should be designed so that targets are presented only to the position from which they should be engaged. Moving targets should be presented at speeds from 5 to 40 kph.

(2) *Scoring.* The section is rated based on the total point score accumulated. For scoring gunnery, times for engagements will be scored separately for each vehicle. Start time for the section leader's vehicle will be the same as in TOW Gunnery Table 7. Start time for the squad leader's vehicle will be upon completion of the fire directive by the section leader, which will include the method of engagement. Stop time will be when the target is hit. Points will be awarded IAW the live-fire point calculation sheet (Figure 5-16, pages 5-44 and 5-45). Deductions will be made from this point score when a

major or minor crewcut error (Table 5-5, page 5-28) or a section leader cut error (Table 5-6) is made. The evaluator in the range tower will score day engagements. Both evaluators will score night engagements. DA Form 7338-R (TOW Gunnery Table 9, Section Gunnery Practice Scoresheet, Figure 5-11, page 5-36) will be used to record the scores.

LEADER CUTS	
MINOR (Deduct 10 points)	**MAJOR (Deduct 30 points)**
Give incorrect fire commands. Fail to give SITREP to tower.	Fail to properly distribute and control section fires.

Table 5-6. Section leader cuts.

(3) *Suggested support requirements.* The following support requirements are recommended when conducting TOW Gunnery Tables 9 and 10.

- Minimum evaluators (evaluators will not assist the gunner in finding or identifying targets):
  - One evaluator per section and squad.
  - Two evaluators in the range tower to record scores on engagements.
- Opposing forces: None.
- Support troops: None.
- Vehicles/communications:
  - One CVC helmet per section and squad evaluator (ITV only).
  - One PRC-77/68 per section and squad evaluator.
  - Two PRC 77/68 for the tower evaluator (one primary, one spare).
  - Two frequencies (one for the tower and section evaluator and one for the antiarmor squad).
- Maneuver area:
  - Multipurpose range complex.

— A route for the element to move from the assembly area to the first firing point without damaging the underground wiring.

- Firing area:
  - — The TOW backblast area (75 meters by 90 degrees) will be clear.
  - — Smoke may be used.
- Training aids, devices, and special equipment:
  - — TFTT system.
  - — Sufficient TFTT retroreflectors to cover the targets. (Use of MILES harness and LTIDs is optional.)
- Ammunition: Six M80 blast simulators per TOW, per iteration.
- Key references: FM 7 91, FM 23 34, and live fire point calculation sheet.

(4) *Trainer/evaluator guidelines.* Because this table is conducted on an MPRC, marking the firing positions may be necessary. At night, the roads must be marked with luminous tape.

b. **TOW Gunnery Table 10, Section Gunnery Qualification.** TOW Gunnery Table 10 evaluates the TOW section on controlling fire and distribution. It contains offensive and defensive engagements in a simulated battlefield scenario (Figure 5-10). The conduct, scoring, suggested support requirements, and trainer/evaluator guidelines are the same as for TOW Gunnery Table 9. The section's scores will be recorded on DA Form 7339-R (TOW Gunnery Table 10, Section Gunnery Qualification Scoresheet, Figure 5-12, page 5-37).

OPERATION ORDER

SITUATION:

Enemy. The enemy is trying to gain control of key military bases, landing strips, and ports. The 125th and 45th Motorized Rifle Regiments have pushed north towards the objectives of the airfields at Ft. Campbell and Duck AFB. They have been held along the 00 East-West gridline in the vicinity of McKenna. The 125th MRR has swung northeast and is advancing on objectives at EH 42250770 (Watts airstrip) and EH 45101235 (Duffell railhead). Their intent is to secure these areas to facilitate resupply for themselves and for future reinforcements. The 125th is operating at 75 per cent strength and morale is high with the anticipation that they will meet their objectives with little resistance from American forces in the area. The 125th has T72s and BRMs. They are well trained in chemical warfare and have used nonpersistant chemical agents in recent engagements.

Friendly. The platoon mission is to deny enemy reconnaissances the ability to gain information on the defense of Watts airstrip and Duffell railhead. To our left is _____ (whatever platoon is appropriate). A Company of the 15th Engineer Battalion hs constructed some firing positions and barriers. Our platoon will have priority of fires from one section of our battalion 4.2-inch mortars.

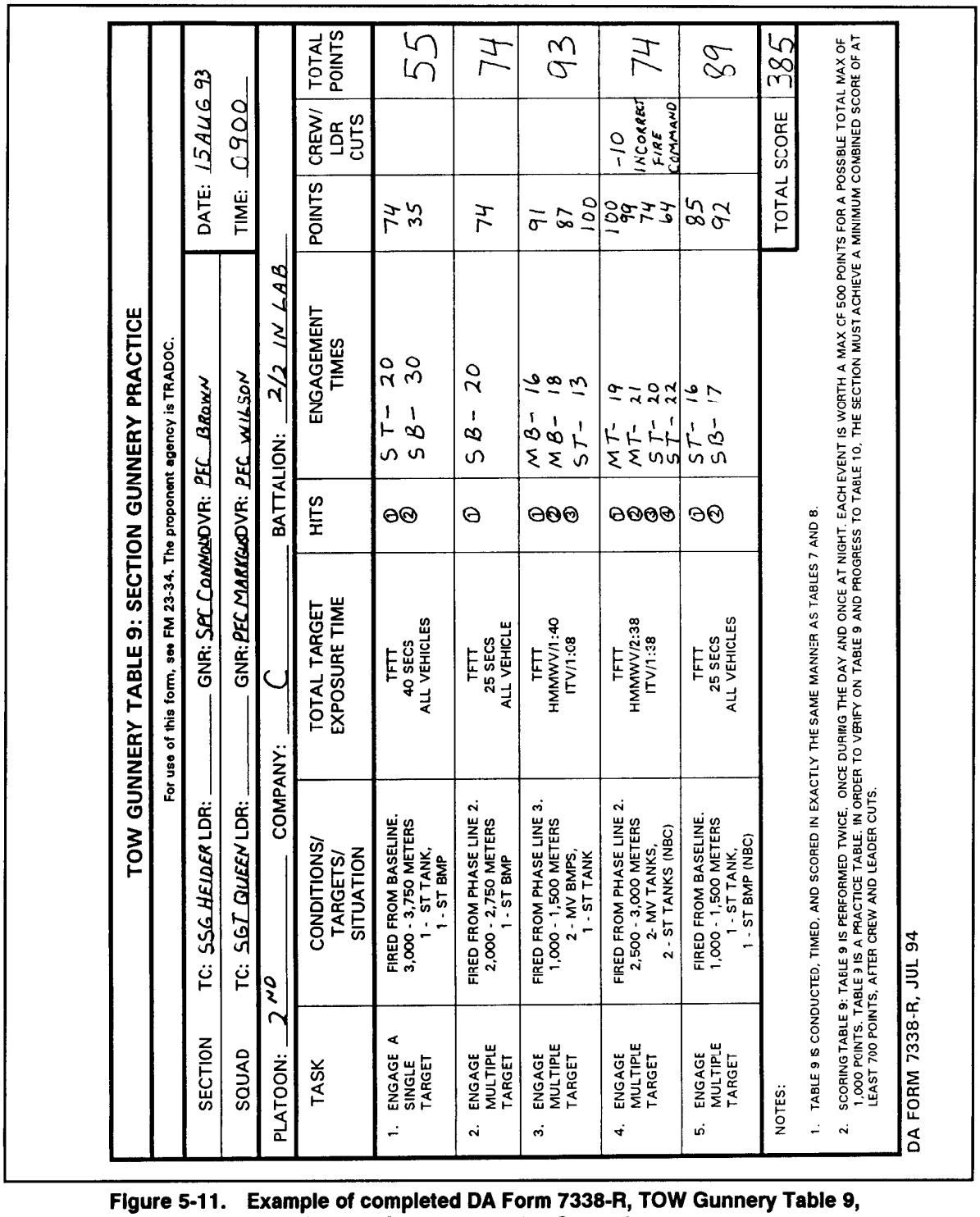
MISSION:

The mission of your section will be to defend in sector north of Marshall Creek to destroy enemy reconnaissance to prevent them from gaining intelligence concerning Watts airstrip.

EXECUTION:

Concept of the operation. Your section will occupy on order five battle positions: BP 1 at EH 42260840; BP 2 at EH 42560855; BP 3 at EH 42000858; BP 4 at EH 41810860; and BP 5 at EH 41460872. On order, you will depart from the release point at EH 42340866 and move to BP 1.

Figure 5-10. Example section gunnery practice and qualification scenario.



TOW GUNNERY TABLE 9: SECTION GUNNERY PRACTICE

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION TC: SSG HEIDER LDR: _____ GNR: SFC CONNORS DVR: PFC BROWN — DATE: 15AUG 93

SQUAD TC: SGT QUEEN LDR: _____ GNR: PFC MARKS DVR: PFC WILSON — TIME: 0900

PLATOON: 2ND COMPANY: C BATTALION: 2/2 IN LAB

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 1 - ST TANK, 1 - ST BMP	TFTT 40 SECS ALL VEHICLES	① ②	ST - 20 SB - 30	74 35		55
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 2,750 METERS 1 - ST BMP	TFTT 25 SECS ALL VEHICLE	①	SB - 20	74		74
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 1,500 METERS 2 - MV BMPS, 1 - ST TANK	TFTT HMMWV/1:40 ITV/1:08	① ② ③	MB - 16 MB - 18 ST - 13	91 87 100		93
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,500 - 3,000 METERS 2- MV TANKS, 2 - ST TANKS (NBC)	TFTT HMMWV/2:38 ITV/1:38	① ② ③ ④	MT - 19 MT - 21 ST - 20 ST - 22	100 99 74 64	-10 INCORRECT FIRE COMMAND	74
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 1,000 - 1,500 METERS 1 - ST TANK, 1 - ST BMP (NBC)	TFTT 25 SECS ALL VEHICLES	① ②	ST - 16 SB - 17	85 92		89
						TOTAL SCORE	385

NOTES:

1. TABLE 9 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLES 7 AND 8.
2. SCORING TABLE 9: TABLE 9 IS PERFORMED TWICE, ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WORTH A MAX OF 500 POINTS FOR A POSSIBLE TOTAL MAX OF 1,000 POINTS. TABLE 9 IS A PRACTICE TABLE. IN ORDER TO VERIFY ON TABLE 9 AND PROGRESS TO TABLE 10, THE SECTION MUST ACHIEVE A MINIMUM COMBINED SCORE OF AT LEAST 700 POINTS, AFTER CREW AND LEADER CUTS.

DA FORM 7338-R, JUL 94

Figure 5-11. Example of completed DA Form 7338-R, TOW Gunnery Table 9, Section Gunnery Practice Scoresheet.

TOW GUNNERY TABLE 10: SECTION GUNNERY QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION TC: SSG BERRY LDR: PFC KIM GNR: SPC MARK DVR: PFC SMITH — DATE: 28 AUG 93

SQUAD TC: SGT WATT LDR: PFC LUCK GNR: SPC COLEMAN DVR: PFC RICHARDS — TIME: 1600

PLATOON: 2 ND COMPANY: E BATTALION: 2/16 IN

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - MV TANK, 2 - ST BMP	TFTT HMMWV/2:38 ITV/2:36	① ② ③ ④	MT- 30 MT- 37 SB- 17 SB- 16	96 93 92 100	-10 INCORRECT ENGAGMENT TECH.	85
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 2,500 METERS 1 - MV TANK	TFTT 40 SECS ALL VEHICLES	①	MT- 40	83		83
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 1,500 METERS 1 - MV BMPS, 1 - ST TANK	TFTT 25 SECS ALL VEHICLES	① ②	ST- 64 MB- 59	64 59		62
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,500 - 3,000 METERS 1 - ST BMP, 2 - MV TANKS (NBC)	TFTT HMMWV/2:40 ITV/2:26	① ② ③	SB- 18 MT- 34 MT- 24	86 94 98		93
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 1 - ST TANK, 1 - ST BMP (NBC)	TFTT 25 SECS ALL VEHICLES	① 2	ST- 20 MB- 0	74 0		37
					TOTAL SCORE		360

NOTES:

1. TABLE 10 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLE 8 AND 9.
2. SCORING TABLE 10: TABLE 10 IS PERFORMED TWICE. ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WORTH A MAX OF 500 POINTS FOR A POSSIBLE TOTAL MAX OF 1,000 POINTS. TABLE 10 IS A QUALIFICATION TABLE. IN ORDER TO PROGRESS TO TABLE 11, THE SECTION MUST ACHIEVE A MINIMUM COMBINED SCORE OF AT LEAST 700 POINTS.

DA FORM 7339-R, JUL 94

Figure 5-12. Example of completed DA Form 7339-R, TOW Gunnery Table 10, TOW Section Gunnery Qualification Scoresheet.

5-10. PHASE IV: PLATOON TRAINING

Phase IV begins platoon-level TOW training. TOW Gunnery Tables 11 and 12 are moving gunnery exercises where the vehicle moves from point to point on a course and engages a series of targets. These gunnery exercises are used to train and evaluate the TOW unit's combat capability. Each element has two tables: a practice table to train and a qualification table for evaluation. Each table is performed once during the day and once during the night under realistic (simulated) battlefield conditions. Point scores for target engagements are based on a combat model that predicts success based on the time from target detection to target engagement, type of target, and range to target. These scores are taken from the live-fire point calculation sheet (Figure 5-16, pages 5-44 and 5-45). Point scores are also affected by crew cuts (crew cuts are crew errors, either major or minor, that reduce the point score for a target engagement). The actual rating is calculated by adding the scores for the day and night phases and dividing them by two to get an average score. During move-out scenarios, the senior trainer is normally to the rear of the leader's vehicle for evaluation and training purposes. An assistant evaluator of the appropriate rank and experience is normally assigned to each additional vehicle that is evaluated as part of the same exercise. Evaluators must monitor crew conversations and fire commands.

a. **TOW Gunnery Table 11, Platoon Gunnery Practice.** This table trains the TOW platoon to control fire and distribution. It contains offensive and defensive engagements in a simulated battlefield scenario (Figure 5-13, page 5-41). TOW Gunnery Table 11 prepares the TOW platoon for the qualification table by presenting engagement scenarios and task requirements similar to those for evaluation. It may be conducted by a TOW HMMWV on an MPRC light or by an ITV on an MPRC heavy without modification.

(1) *Conduct.* All firings will be from the hull down position. Reload procedures will be executed from a defilade position. All stationary targets should be mounted on pop-up mechanisms to facilitate target acquisition and scoring. If pop-up mechanisms are not available, exposed stationary targets will be placed in an appropriate array. If exposed targets must be used, the exercise should be designed so that targets are presented only to the position from which they should be engaged. Moving targets should be presented at speeds from 5 to 40 kph.

(2) *Scoring.* The platoon is rated based on the total point score accumulated. For scoring gunnery, times for engagements will be scored separately for each vehicle. Start time will begin upon completion of the directive given to the vehicle commander. Stop time will be when the target is hit. Points will be awarded IAW the live-fire point calculation sheet (Figure 5-16, pages 5-44 and 5-45). Deductions will be made from this point score when a major or minor crew cut error (Table 5-5, pages 5-28) or a platoon leader cut error (Table 5-7) is made. The evaluator in the range tower will score

day engagements. Both evaluators will score night engagements. DA Form 7340-R (TOW Gunnery Table 11, Platoon Gunnery Practice Scoresheet, Figure 5-14, page 5-42) will be used to record the scores.

PLATOON LEADER CUTS	
MINOR (Deduct 10 points)	**MAJOR (Deduct 30 points)**
Give incorrect fire commands. Fail to give SITREP to tower.	Fail to properly distribute and control section fires.

Table 5-7. Platoon leader cuts.

(3) *Suggested support requirements.* The following support requirements are recommended when conducting TOW Gunnery Tables 11 and 12.

- Minimum evaluators (evaluators will not assist the gunner in finding or identifying targets):
  - — One evaluator per platoon, section, and squad.
  - — Two evaluators in the range tower to record scores on engagements.
- Opposing forces: None.
- Support troops: None.
- Vehicles/communications:
  - — One CVC helmet per platoon, section, and squad evaluator (ITV only).
  - — One PRC-77/68 per platoon, section, and squad evaluator.
  - — Two PRC 77/68 for the tower evaluator (one primary, one spare).
  - — Two frequencies (one for the tower and platoon evaluator and one for the antiarmor platoon).
- Maneuver area:
  - — Multipurpose range complex.
  - — A route for the element to move from the assembly area to the first firing point without damaging the underground wiring.

- Firing area:
  - — The TOW backblast area (75 meters by 90 degrees) will be clear.

    Smoke may be used.
- Training aids, devices, and special equipment:
  - — TFTT system.
  - — Sufficient TFTT retroreflectors to cover the targets. (Use of MILES harness and LTIDs is optional.)
- Ammunition: Six M80 blast simulators per TOW, per iteration.
- Key references: FM 7-91, FM 23-34, and live-fire point calculation sheet.

(4) *Trainer/evaluator guidelines.* Because this table is conducted on an MPRC, marking the firing positions may be necessary. At night, the roads must be marked with luminous tape.

b. **TOW Gunnery Table 12, Platoon Gunnery Qualification.** TOW. Gunnery Table 12 evaluates the TOW platoon on controlling fire and distribution. It contains offensive and defensive engagements in a simulated battlefield scenario (Figure 5-13). The conduct, scoring, suggested support requirements, and trainer/evaluator guidelines are the same as for TOW Gunnery Table 11. The platoon's scores will be recorded on DA Form 7341-R (TOW Gunnery Table 12, Platoon Gunnery Qualification Scoresheet, Figure 5-15, page 5-43).

SITUATION:

Enemy. The enemy is trying to gain control of key military bases, landing strips, and ports. The 125th and 45th Motorized Rifle Regiments have pushed north towards the objectives of the airfields at Ft. Campbell and Duck AFB. They have been held along the 00 East-West gridline in the vicinity of McKenna. The 125th MRR has swung northeast and is advancing on objectives at EH 42250770 (Watts airstrip) and EH 45101235 (Duffell railhead). Their intent is to secure these areas to facilitate resupply for themselves and for future reinforcements. The 125th is operating at 75 per cent strength and morale is high with the anticipation that they will meet their objectives with little resistance from American forces in the area. The 125th has T72s and BRMs. They are well trained in chemical warfare and have used nonpersistant chemical agents in recent engagements.

Friendly. The company mission is to deny enemy reconnaissances the ability to gain information on the defense of Watts airstrip and Duffell railhead. To our left is _____ (whatever company is appropriate). A Company of the 15th Engineer Battalion hs constructed some firing positions and barriers. Our platoon will have priority of fires from one section of our battalion 4.2-inch mortars.

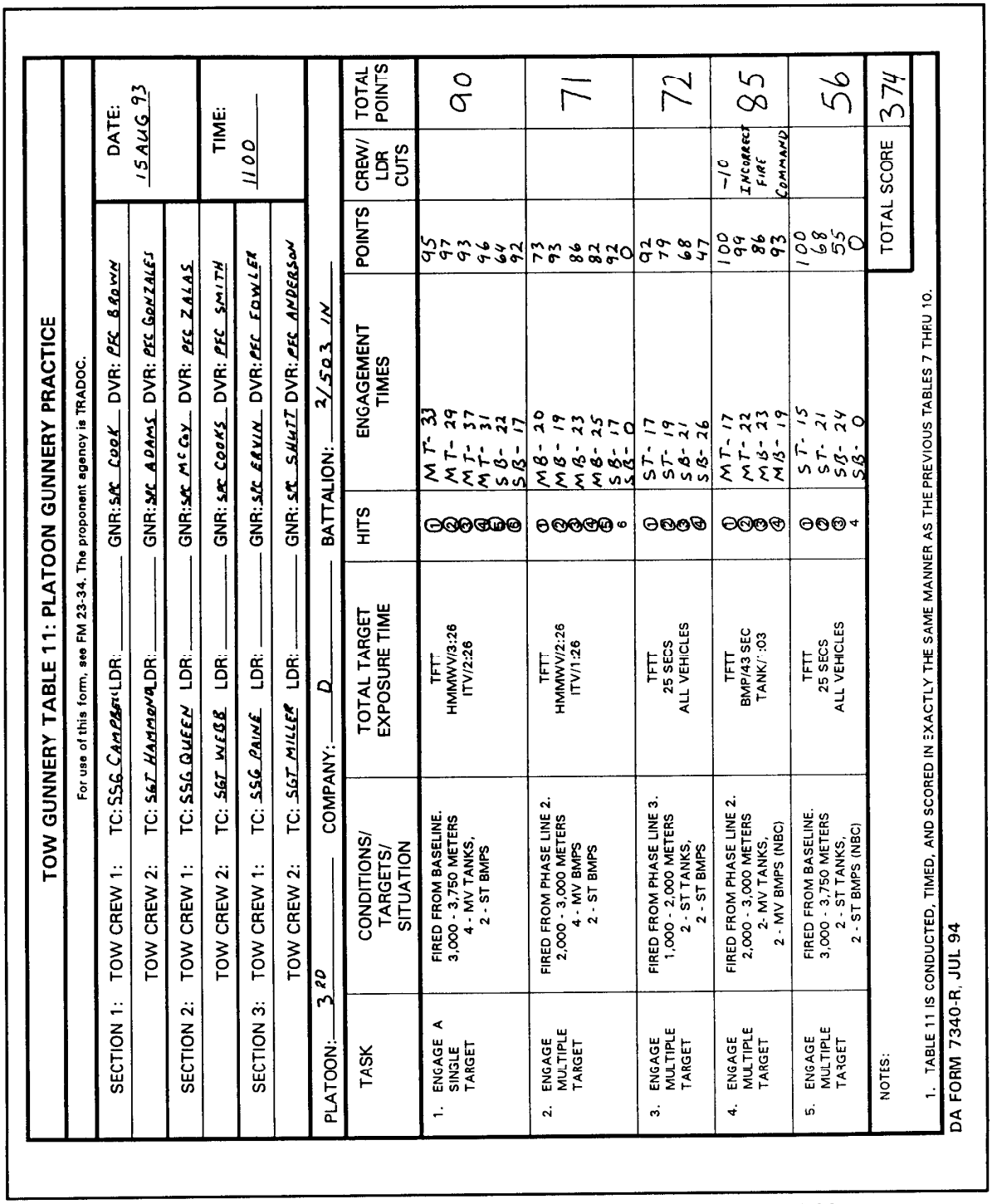
MISSION:

The mission of your platoon will be to defend in sector north of Marshall Creek to destroy enemy reconnaissance to prevent them from gaining intelligence concerning Watts airstrip.

EXECUTION:

Concept of the operation. Your platoon will occupy on order five battle positions: BP 1 at EH 42260840; BP 2 at EH 42560855; BP 3 at EH 42000858; BP 4 at EH 41810860; and BP 5 at EH 41460872. On order, you will depart from the release point at EH 42340866 and move to BP 1.

Figure 5-13. Example platoon gunnery practice and qualification scenario.



TOW GUNNERY TABLE 11: PLATOON GUNNERY PRACTICE

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION 1: TOW CREW 1: TC: SSG CAMERON LDR: _____ GNR: SPC COOK DVR: PFC BROWN — DATE: 15 AUG 93

TOW CREW 2: TC: SGT HAMMOND LDR: _____ GNR: SPC ADAMS DVR: PFC GONZALES

SECTION 2: TOW CREW 1: TC: SSG QUEEN LDR: _____ GNR: SPC McCOY DVR: PFC ZALAS — TIME: 1100

TOW CREW 2: TC: SGT WEBB LDR: _____ GNR: SPC COOKS DVR: PFC SMITH

SECTION 3: TOW CREW 1: TC: SSG PAINE LDR: _____ GNR: SPC ERVIN DVR: PFC FOWLER

TOW CREW 2: TC: SGT MILLER LDR: _____ GNR: SPC SHUTT DVR: PFC ANDERSON

PLATOON: 3RD COMPANY: D BATTALION: 2/503 IN

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 4 - MV TANKS, 2 - ST BMPS	TFTT HMMWV/3:26 ITV/2:26	① ② ③ ④ ⑤ ⑥	MT- 33 MT- 29 MT- 37 MT- 31 SB- 22 SB- 17	95 97 93 96 64 92		90
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 3,000 METERS 4 - MV BMPS 2 - ST BMPS	TFTT HMMWV/2:26 ITV/1:26	① ② ③ ④ ⑤ ⑥	MB- 20 MB- 19 MB- 23 MB- 25 SB- 17 SB- 0	73 93 86 82 92 0		71
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 2,000 METERS 2 - ST TANKS, 2 - ST BMPS	TFTT 25 SECS ALL VEHICLES	① ② ③ ④	ST- 17 ST- 19 SB- 21 SB- 26	92 79 68 47		72
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 3,000 METERS 2- MV TANKS, 2 - MV BMPS (NBC)	TFTT BMP/43 SEC TANK/ :03	① ② ③ ④	MT- 17 MT- 22 MB- 23 MB- 19	100 99 86 93	-10 INCORRECT FIRE COMMAND	85
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - ST TANKS, 2 - ST BMPS (NBC)	TFTT 25 SECS ALL VEHICLES	① ② ③ 4	ST- 15 ST- 21 SB- 24 SB- 0	100 68 55 0		56

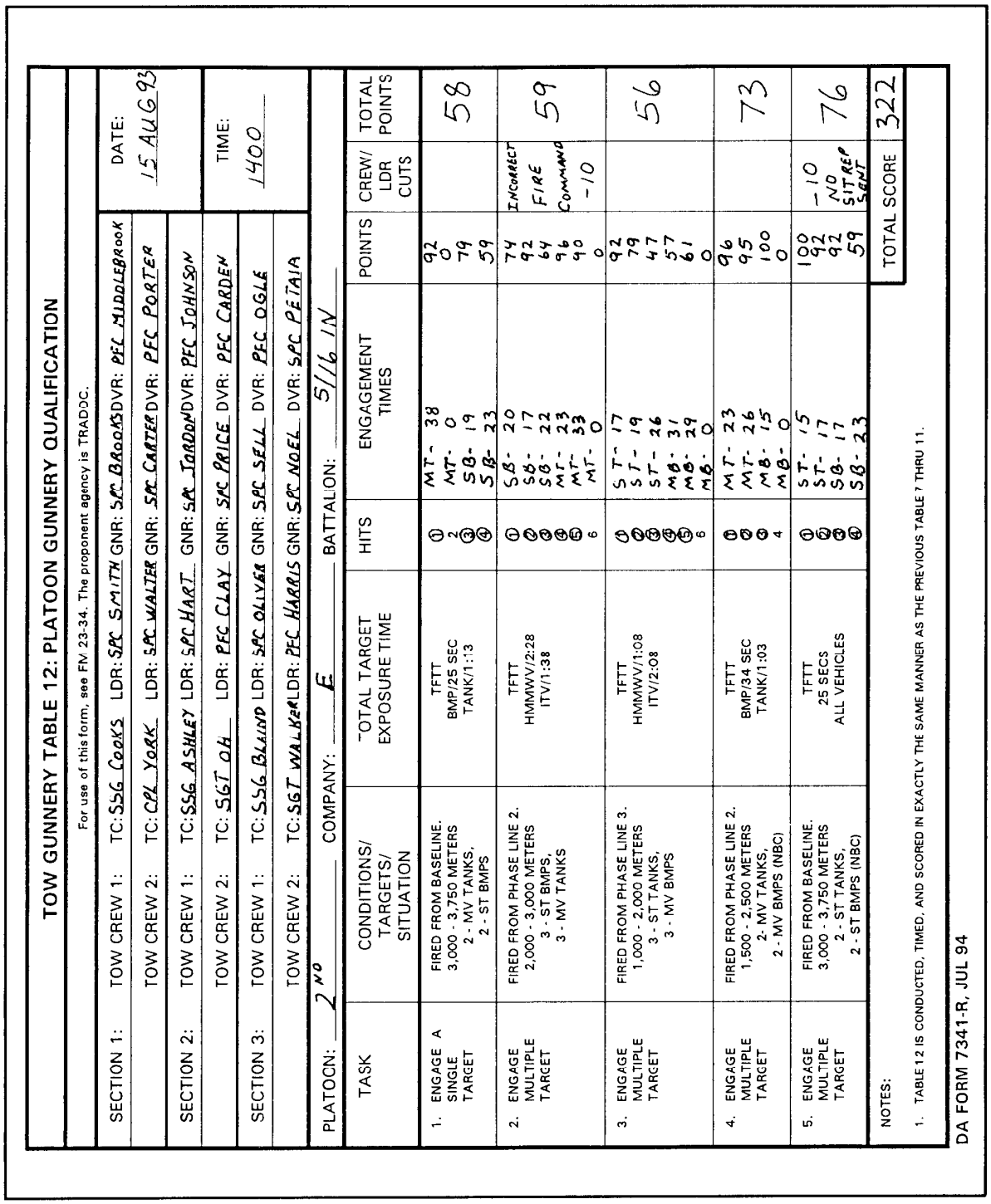
TOTAL SCORE 374

NOTES:

1. TABLE 11 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS THE PREVIOUS TABLES 7 THRU 10.

DA FORM 7340-R, JUL 94

Figure 5-14. Example of completed DA Form 7340-R, TOW Gunnery Table 11, Platoon Gunnery Practice Scoresheet.



TOW GUNNERY TABLE 12: PLATOON GUNNERY QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION 1:	TOW CREW 1:	TC: SSG COOKS	LDR: SFC SMITH GNR: SFC BROOKS DVR: PFC MIDDLEBROOK	DATE: 15 AUG 93
	TOW CREW 2:	TC: CPL YORK	LDR: SFC WALTER GNR: SFC CARTER DVR: PFC PORTER	
SECTION 2:	TOW CREW 1:	TC: SSG ASHLEY	LDR: SFC HART GNR: SFC JORDON DVR: PFC JOHNSON	TIME: 1400
	TOW CREW 2:	TC: SGT OH	LDR: PFC CLAY GNR: SFC PRICE DVR: PFC CARDEN	
SECTION 3:	TOW CREW 1:	TC: SSG BLAND	LDR: SFC OLIVER GNR: SFC SELL DVR: PFC OGLE	
	TOW CREW 2:	TC: SGT WALKER	LDR: PFC HARRIS GNR: SFC NOEL DVR: SFC PETAIA	

PLATOON: 2ND COMPANY: E BATTALION: 5/6 IN

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - MV TANKS, 2 - ST BMPS	TFTT BMP/25 SEC TANK/1:13	① ② ③ ④	MT- 38 MT- 0 SB- 19 SB- 23	92 0 79 59		58
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 3,000 METERS 3 - ST BMPS, 3 - MV TANKS	TFTT HMMWV/2:28 ITV/1:38	① ② ③ ④ ⑤ 6	SB- 20 SB- 17 SB- 22 MT- 23 MT- 33 MT- 0	74 92 64 96 90 0	INCORRECT FIRE COMMAND -10	59
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 2,000 METERS 3 - ST TANKS, 3 - MV BMPS	TFTT HMMWV/1:08 ITV/2:08	① ② ③ ④ ⑤ 6	ST- 17 ST- 19 ST- 26 MB- 31 MB- 29 MB- 0	92 79 47 57 61 0		56
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 1,500 - 2,500 METERS 2- MV TANKS, 2 - MV BMPS (NBC)	TFTT BMP/34 SEC TANK/1:03	① ② ③ 4	MT- 23 MT- 26 MB- 15 MB- 0	96 95 100 0		73
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - ST TANKS, 2 - ST BMPS (NBC)	TFTT 25 SECS ALL VEHICLES	① ② ③ ④	ST- 15 ST- 17 SB- 17 SB- 23	100 92 92 59	-10 NO SITREP SENT	76
NOTES:						TOTAL SCORE	322

1. TABLE 12 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS THE PREVIOUS TABLE 7 THRU 11.

DA FORM 7341-R, JUL 94

Figure 5-15. Example of completed DA Form 7341-R, TOW Gunnery Table 12, TOW Platoon Gunnery Qualification Scoresheet.

MOVING TARGET							
TIME SEC	STATIONARY TARGETS	BMP 65-900 METERS	BMP 901-2000 METERS	BMP 2001-3500 METERS	TANK 65-1500 METERS	TANK 1501-2500 METERS	TANK 2501-3750 METERS
1	100	100	100	100	100	100	100
2	100	100	100	100	100	100	100
3	100	100	100	100	100	100	100
4	100	100	100	100	100	100	100
5	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100
7	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100
9	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100
11	100	92	100	100	100	100	100
12	100	86	100	100	97	100	100
13	100	79	97	100	94	99	100
14	100	74	95	100	91	99	100
15	100	68	93	100	88	99	100
16	100	64	91	98	85	98	100
17	92	59	89	96	81	98	100
18	86	55	87	95	78	98	100
19	79	51	84	93	75	97	100
20	74	47	82	91	72	97	100
21	68	44	80	89	69	97	99
22	64	41	77	88	66	96	99
23	59	38	75	86	63	96	99
24	55	35	73	84	60	95	98
25	51	33	70	82	57	95	98
26	47	30	68	80	54	94	98
27	44	28	66	79	52	94	97
28	41	26	63	77	49	93	97
29	38	24	61	75	46	92	97
30	35	22	59	73	44	92	96
31	33	21	57	71	41	91	96
32	30	19	54	70	39	90	95
33	28	18	52	68	37	90	85
34	26	16	50	66	34	89	94
35	24	15	48	64	32	88	94
36	22	14	46	62	30	87	93
37	21	13	44	61	28	86	93
38	19	12	42	59	27	85	92
39	18	11	40	57	25	84	92
40	16	10	38	56	23	83	91
41	15	9	36	54	22	82	91
42	14	9	35	52	20	81	90
43	13	8	33	51	19	80	90
44	12	7	31	49	18	79	89
45	11	7	30	47	17	78	89
46	10	6	28	46	15	77	88
47	9	6	27	44	14	75	88
48	9	5	26	43	13	74	87
49	8	5	24	41	12	73	86
50	7	4	23	40	12	71	85
51	7	4	22	39	11	70	84
52	6	4	21	37	11	68	83
53	6	3	19	36	9	67	82
54	5	3	18	35	9	65	81

Figure 5-16. Example of TOW live-fire point calculation sheet.

MOVING TARGET							
TIME SEC	STATIONARY TARGETS	BMP 65-900 METERS	BMP 901-2000 METERS	BMP 2001-3500 METERS	TANK 65-1500 METERS	TANK 1501-2500 METERS	TANK 2501-3750 METERS
55	5	3	17	33	8	64	80
56	4	3	16	32	7	62	78
57	4	2	16	31	7	61	77
58	4	2	15	30	6	59	75
59	3	2	14	29	6	58	74
60	3	2	13	28	5	56	72
61	3	2	12	27	5	54	70
62	3	1	12	25	5	53	69
63	2	1	11	24	4	51	67
64	2	1	10	24	4	49	65
65	2	1	10	23	4	48	63
66	2	1	9	22	3	46	61
67	2	1	9	21	3	45	60
68	1	1	8	20	3	43	58
69	1	1	8	19	2	41	56
70	1	1	7	18	2	40	55
71	1		7	18	2	38	53
72	1		6	17	2	37	52
73	1		6	16	2	35	50
74	1		5	15	2	34	49
75	1		5	15	1	32	47
76	1		5	14	1	31	46
77			5	13	1	30	45
78			4	13	1	28	43
79			4	12	1	27	42
80			4	12	1	26	41
81			3	11	1	25	40
82			3	11	1	23	39
83			3	10	1	22	38
84			3	10	1	21	37
85			3	9		20	36
86			2	9		19	35
87			2	9		18	34
88			2	8		17	33
89			2	8		16	32
90			2	7		15	31
91			2	7		15	30
92			2	7		14	29
93			1	6		13	28
94			1	6		12	27
95			1	5		12	26
96			1	5		11	25
97			1	5		10	24
98			1	5		10	23
99			1	5		9	22
100			1	5		9	21
101			1	4		8	20
102			1	4		8	19
103			1	4		7	18
104				4		7	17
105				3		6	16
106				3		6	15
107				3		6	14
108				3		5	13

Figure 5-16. Example of TOW live-fire point calculation sheet (continued).

5-11. FIELD TRACKING

Field tracking (or tracking in a field environment) provides practice and experience in tracking uncooperative targets and should be performed in conjunction with FTXs. It is not an element in the 12 required TOW Gunnery Tables, but it is useful in preparing for them, especially tables 7 through 12. Other tactical employment tasks, such as occupying a firing position or completing a range card, should be performed at the same time. Careful planning by unit commanders will result in effective training that makes the best use of time, equipment, and personnel.

a. The tracking range should include an area more than 3,000 meters deep and at least 500 meters wide with hills and valleys, dead space, and covered terrain. Battlefield target conditions should be simulated as follows:

(1) Targets should be a variety of tanks, APCs, and other tactical vehicles. Many training installations now have various types of actual threat vehicles. These vehicles should be used when possible.

(2) Target vehicles should behave as much like real enemy vehicles on the battlefield as possible. They should change directions constantly and quickly (to include backing up for short distances) and should vary their speed. They should move within the gunner's sight picture from left to right, top to bottom, and bottom to top. The vehicles should move at angles to and from the weapon position as well as directly toward and away from the weapon.

(3) Gunners should see tanks and APCs in full and partial frontal, flank, and rear exposures.

(4) Gunners must engage the targets at all ranges with both the daysight tracker and the nightsight. To do so, they must be able to determine if a target is in range. Targets should move in and out of range so gunners can gain experience in target range determination.

(5) Armored vehicles should limit their exposure by moving quickly from one covered area to another to escape ATGM fires. The squad leader must have the gunner acquire and fire at the target while it is exposed. During field tracking, target vehicle exposure time is reduced to a minimum by having targets use covered areas during halts. This gives the gunner experience in tracking targets that disappear and reappear.

b. Field tracking should be performed under conditions that normally occur on the battlefield. These conditions include limited visibility caused by darkness, smoke, or fog; the discomfort of MOPP gear; and the noise and distraction caused by indirect and small-arms fire around the firing positions. Battlefield tracking conditions should be simulated as follows:

(1) The TOW crew members should train to engage targets during reduced visibility conditions using both the daysight tracker and the nightsight. Training should be conducted during daylight using the AN/TAS-4A. The AN/TAS-4A is a thermal sight, *not* just a nightsight. It offers many advantages in searching for and tracking targets in all kinds of weather and at any time of day. The

AN/TAS-4A should be used extensively in conjunction with the day sight to maximize the abilities of the system.

(2) Enemy capabilities include the use of nuclear, biological, and chemical munitions. These munitions may not affect the weapon, but a gunner's ability to track will be degraded if he has never tracked while wearing a protective mask and protective clothing. Training is more realistic when the entire crew wears protective masks and clothing during part of the field tracking exercises.

(3) The enemy will try to suppress TOW fires with artillery and mortar fires. A gunner's ability to keep the sight cross hairs on a target may be affected under these conditions, especially if he has not been properly trained. Distracters should be used in training to accustom gunners to such conditions and to minimize flinching. Grenade and artillery simulators are effective distracters. Small-arms fire can also be expected, but gunners should not be seriously distracted by its noise. Therefore, the simulation of small-arms fire is not required.

c. If facilities and equipment are not available to conduct a field tracking exercise, gunners should be allowed to track any uncooperative targets such as military or civilian vehicles traveling on a nearby highway. An y means available should be used to allow gunners to practice tracking targets that vary target speeds and directions of movement. This should be done often and can be accomplished in any location that has vehicle traffic.

d. TOW crews must be proficient in combat vehicle identification to gain the most benefit from field tracking. Combat vehicle identification skills have been standardized by GTA 17-2-11. This GTA includes six modules of 35-mm slides and instructor guides. Each module highlights five different NATO or Threat combat vehicles from five different views: frontal, right side, left side, right oblique, and left oblique.

CHAPTER 6

COMBAT TECHNIQUES OF FIRE

This chapter discusses the techniques and procedures of fire control, helicopter engagement, and firing the TOW under NBC and limited visibility conditions in a combat situation. These techniques and procedures greatly enhance the performance of the TOW weapon system in combat and increase its chances of survival.

Section I. FIRE CONTROL MEASURES

This section discusses fire control measures in combat to include target engagement determination procedures, the elements of fire commands, target tracking procedures, and target engagement procedures with the M220A1 and M220A2 TOW launchers.

6-1. TARGET ENGAGEMENT DETERMINATION

Mechanized units are trained to use terrain driving techniques to conceal movement, and drivers are taught to move vehicles quickly from one concealed position to another. TOW gunners and squad leaders must determine the range to a target and determine if the exposure time-the time a vehicle is in an opening between positions--is long enough to allow a missile to reach its target.

a. **Determine if a Target Is Within Range.** The TOW gunner or squad leader can use the nigh sight method or the binocular method to determine if a target is within range.

(1) *Nightsight method.* The reticle within the nightsight is marked with stadia lines on each side of the vertical crossline and just above the intersection of the vertical crossline and the horizontal crossline (Figure 6-1, page 6-2). Use these stadia lines to determine if a target is within range.

(a) Check to ensure the nightsight is in the narrow field of view.

(b) Look at the flank (broadside) of a target. If the ends of the target touch or extend beyond the stadia lines, the target is within range (Figure 6-2, page 6-2).

(c) If the target is moving straight or at an angle toward the position, use one-half of the stadia lines. If one side of the vehicle touches one of the stadia lines and the other side of the vehicle touches or extends beyond the vertical line of the crossline, the target is within range (Figure 6-3, page 6-2).

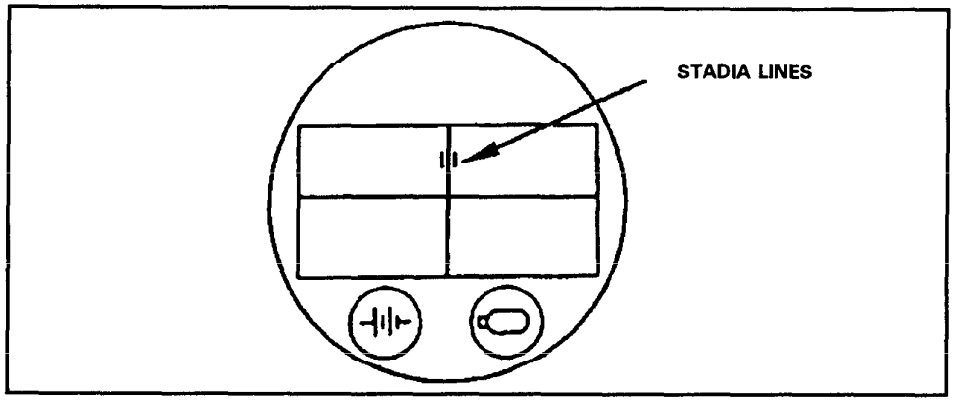


Figure 6-1. Stadia lines.

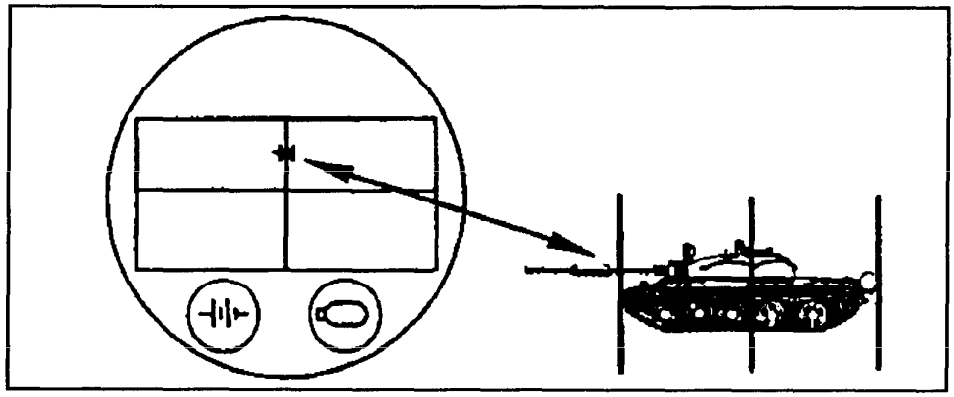


Figure 6-2. Target within range.

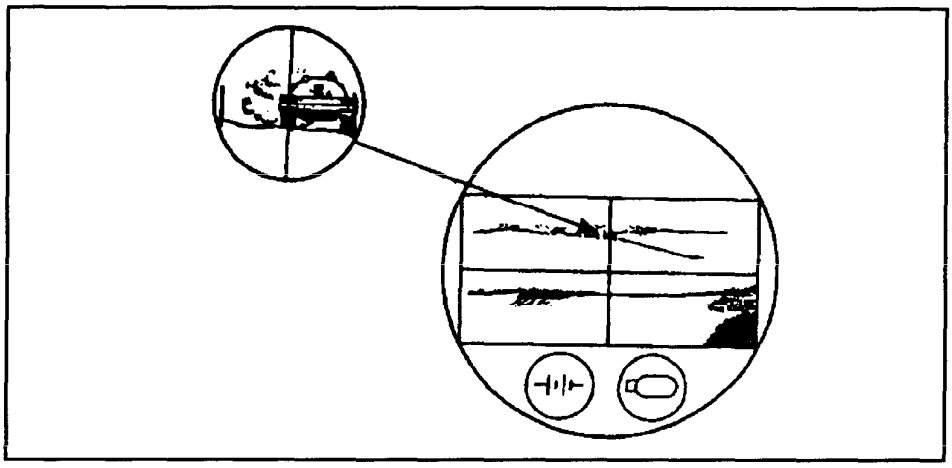


Figure 6-3. Target moving straight toward or away from position within range.

NOTE: When using the stadia lines to determine if a target is within range, keep two things in mind. First, the range is a rough estimate, based on the size of the target. A large vehicle may be out of range when the stadia lines show it to be in range. Second, the stadia lines are designed for a maximum engagement range of 3,000 meters.

(2) *Binocular method.* Use the reticle in binoculars to determine if a target is within range by looking at the length, width, or height of the vehicle. Follow the same procedures when using the M17 and M19 binoculars, even though the retitles differ slightly. The M17 tick marks are only 1.7 mils long while the tick marks on the M19 reticle are 5 mils long (2.5 mils on each side of the horizontal and vertical scales).

(a) To determine if a target is within range at 3,000 meters based on the *length* of the target, place the length of the target on the vertical scale. If one-third or more of the vehicle extends beyond the tick mark, the vehicle is in range (Figure 6-4). A vehicle 6.5 meters long will measure about 2.2 mils at 3,000 meters and about 1.7 mils at 3,750 meters.

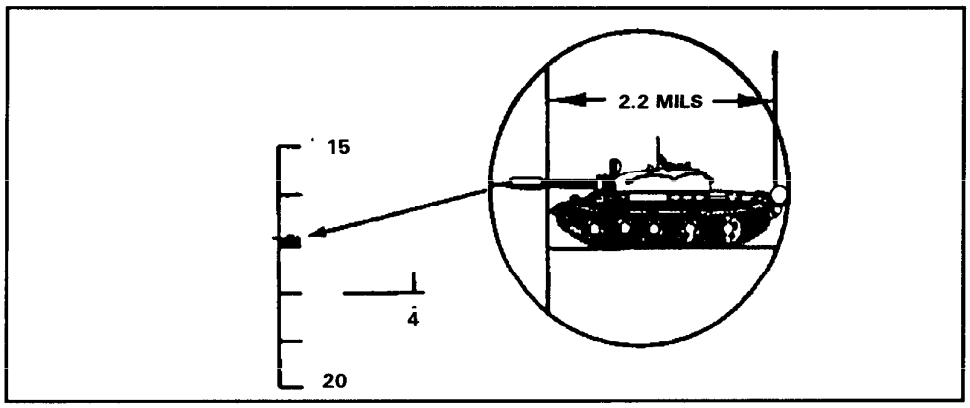


Figure 6-4. Target within range (flank or oblique) using M17 binoculars.

(b) To determine if a target is within range at 3,000 meters based on the *width* of the target, place the target on the small tick mark on the vertical scale. If the target covers two-thirds or more of the tick mark, the vehicle is within range (Figure 6-5, page 6-4). A vehicle 3.4 meters wide will measure 1.1 mils at 3,000 meters and .85 mils at 3,750 meters. (Most Warsaw Pact APCs are less than 3.4 meters wide and can be engaged at smaller mil values.)

(c) To determine if a target is within range at 3,000 meters based on the *height* of the target, place the target on one of the tick marks on the horizontal scale. If the height of the vehicle is one-half or more of the height of one of the tick marks, the vehicle is within range. A vehicle 2.4 meters high (the size of most Warsaw Pact vehicles) will measure .8 mils at 3,000 meters and .6 mils at 3,750 meters (Figure 6-6, page 6-4).

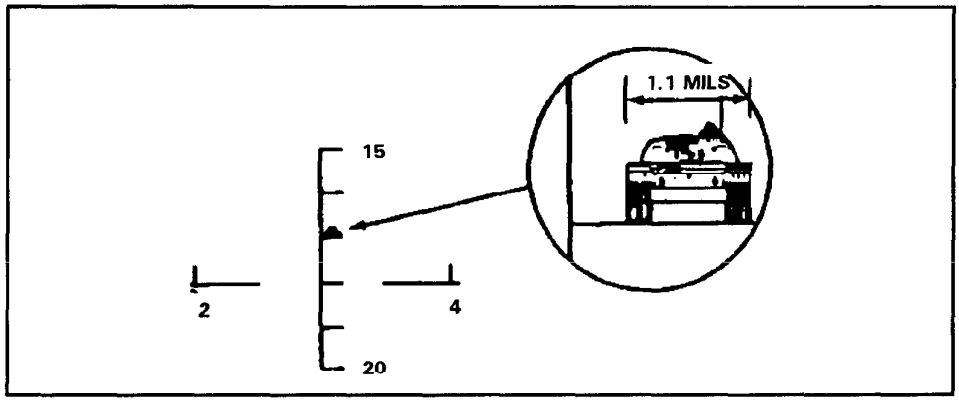


Figure 6-5. Target within range (frontal or rear) using M17 binoculars.

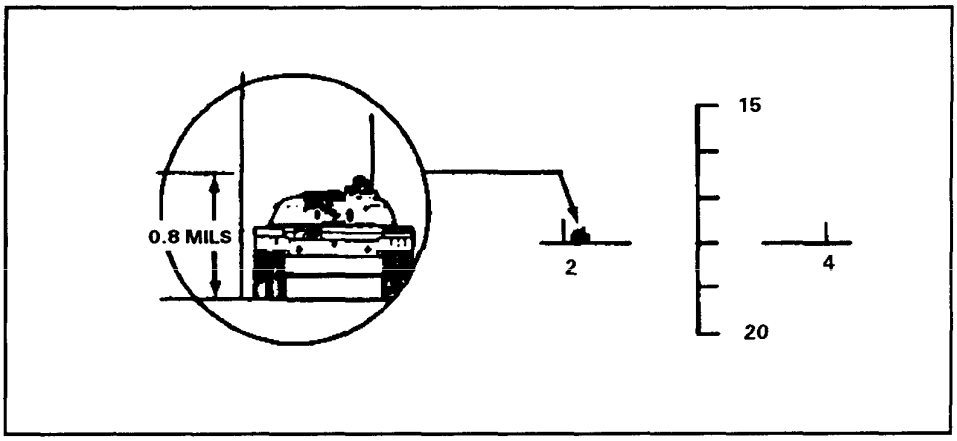


Figure 6-6. Target within range based on height.

NOTE: If the weapon system is in an elevated firing position or if the lower portion of the target vehicle is hidden by foliage or terrain, this method cannot be used.

b. **Determine Exposure Time.** The half-sight method of determining exposure time is based on a vehicle speed of 35 kph (the expected top vehicle speed of armored vehicles on level or gently sloping dry terrain).

(1) *Daysight tracker method.* Use the crosslines on the daysight tracker to determine the exposure time of a target.

(a) Place the crosslines of the daysight tracker on the center of the visible mass of the vehicle.

(b) If the area between the vertical crossline and the edge of the field of view in the direction of travel is clear of obstruction, the target is engageable (Figure 6-7).

(c) If obstructions appear between the vertical crossline and the edge of the field of view, the time of exposure would not be long enough for the missile flight before the target moved out of sight (Figure 6-7).

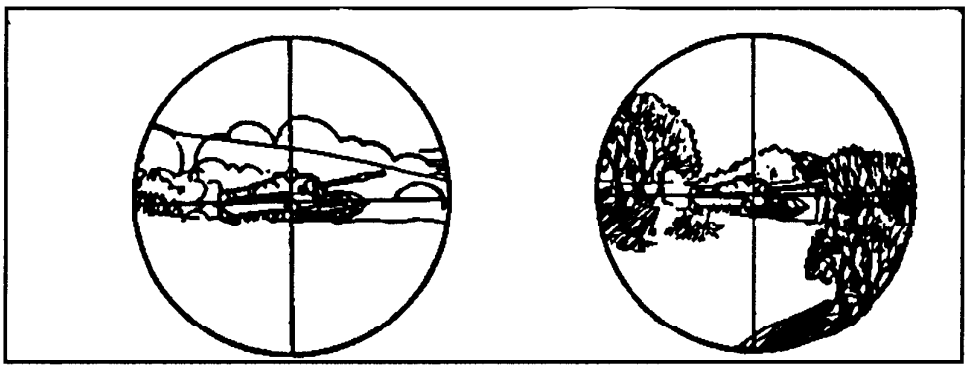


Figure 6-7. Obstruction.

(2) *Nightsight method.* The procedure to determine exposure time is the same for the nightsight as for the daysight tracker, except the nightsight must be set on narrow field of view.

(3) *Binocular reticle method.* Use the reticle in the binoculars to determine the exposure time of a target.

(a) Place the zero tick mark of the horizontal scale at the center of the vehicle.

(b) If the area between the vehicle and the 50-mil tick mark is clear of obstructions in the direction of travel, the target is engageable (Figure 6-8).

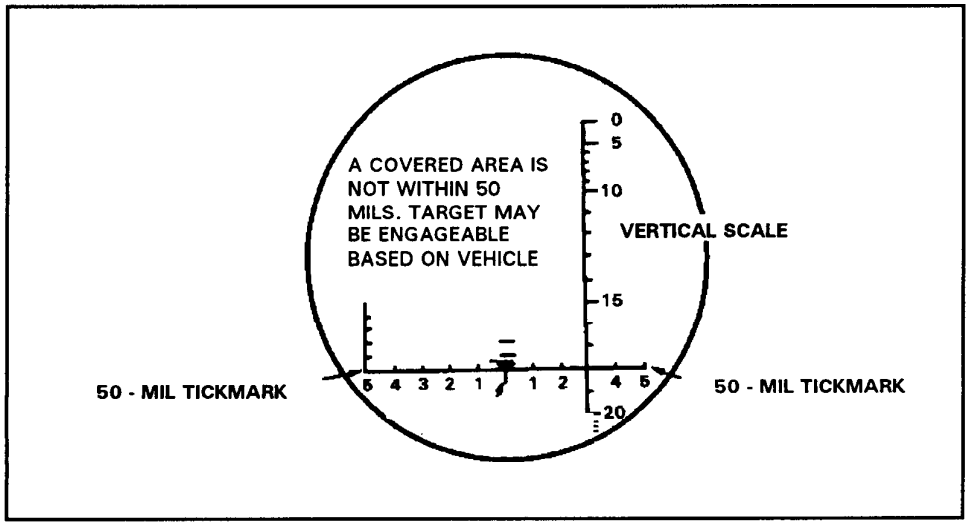


Figure 6-8. Binocular reticle method.

6-2. FIRE COMMANDS

The six elements of a fire command are alert, type of missile, target description, target direction, range, execution, and closing. Whether mounted or dismounted, the elements of the fire command are the same. (Figure 6-9 shows an example of a squad fire command.)

SQUAD LEADER:	SQUAD, TOW2A MISSILE; ONE TANK NORTH OF TRP 1; 2,000 METERS; AT MY COMMAND.
GUNNER:	IDENTIFIED.
SQUAD LEADER:	FIRE.
SQUAD LEADER:	CEASE TRACKING, OUT OF ACTION.

Figure 6-9. Example of a squad fire command.

a. **Alert.** The first element of the fire command alerts the crew for an immediate engagement. The squad leader commands, "Squad," and the gunner begins observing the target area.

b. **Type of Missile.** Because a variety of TOW missiles are used and their capabilities vary, a particular type of missile must be specified. A TOW crew in battle will probably have a mix of different missiles and a wide variety of target arrays to engage (see Chapter 1, TOW missile types and configurations). For example, if the target is a BTR-60 or BMP-1, the squad leader may command, TOW 2; if the target is a T-80 with reactive armor, he may command, TOW 2B.

c. **Target Description.** The second element identifies the target for the gunner. If several similar targets are present, this element tells the gunner which target to engage first. Most targets can be described by using the terms listed in Table 6-1. Targets that are combinations of the ones listed in Table 6-1, such as a truck mounting a missile system, are identified by combining terms—for example, TRUCK MOUNTING ANTITANK. When the gunner sees the target, he announces, "Identified." If multiple targets appear, the commander may specify which target will be engaged by the gunner—for example, FIRST TANK or RIGHT TRACK.

TARGET	ANNOUNCED AS
Any tank or tank-like vehicle	**TANK**
Several tanks	**TANK FORMATION**
Any unarmored vehicle	**TRUCK**
Any halftrack or armored personnel carrier	**TRACK**
Helicopters	**CHOPPER**
All fixed-wing aircraft	**PLANE**
Personnel	**TROOPS**
Any machine gun	**MACHINE GUN**
Any antitank gun or towed artillery piece	**ANTITIANK**
Any other target	**A short word or phrase that clearly describes the target.**

Table 6-1. Terms used to describe targets.

d. **Target Direction.** If the target is moving, the direction of movement is given after the description to aid the gunner in locating the target. After the gunner is given the location of a target, he can search for the target in the direction of movement. The following methods are also used to help the gunner locate the target.

(1) *Target reference point.* A TRP is an easily recognizable feature or point on the ground (either natural or man-made) used for identifying targets and controlling fires. They can be used to designate targets for companies, platoons, sections, and individual weapons. They can also be used to designate the center of an area where the commander plans to distribute or converge the fires of all his weapons. TRPs are usually designated by the company commander or platoon leaders.

(a) Weapons will engage targets from different directions, so compass points (for example, north, east), rather than "right" or "left," are used when giving directions centered on a TRP.

(b) On the M901A1, the squad leader gives the direction to the target by using the periscope deflection scale. Deflection from the TRP can be estimated, or it can be measured using the binocular mil scale or the circular reticle on the wide field of view—for example, 5.5 degrees at 1,000 meters is about 100 meters, or 200 meters at 2,000 meters.

(2) *Prominent features.* The commander may give the distance and direction from a prominent feature—for example, FROM HILL SEVEN SIX TWO, LEFT TWO HUNDRED, or FROM BRIDGE, RIGHT FOUR HUNDRED.

e. **Range.** The range is given to help the gunner identify his target and to determine its engageability. The squad or section leader can determine the range to the target using the naked eye, binoculars (mil-relation formula), or reference materials (maps, range cards).

(1) *Naked eye.* One method for using the naked eye to determine range is the football field method. The squad or section leader counts in 100-meter increments, estimating the number of football fields that could fit between the firing position and the target.

(2) *Binoculars.* Binoculars and the mil-relation formula can be used to determine range. To use this method, the squad or section leader must know the width, height, or length of the target. He determines the width, height, or length with the binocular's mil scale; substitutes the mil-relation; and computes the range.

(3) *Reference materials.* Maps can be used to determine range by counting the grid lines between the firing position and the target or by adjusting from a known point. Range cards can also be used to determine the range to the target.

f. **Execution.** Two commands are necessary for execution: a preparatory command and a command of execution.

(1) *AT MY COMMAND.* This preparatory command warns the gunner not to fire until given the command of execution.

(2) *FIRE.* This is the only command of execution used to fire a missile.

g. **Additional Commands.** In addition to the six elements of the fire command, some other commands are needed.

(1) The command CEASE TRACKING or CEASE TRACKING, OUT OF ACTION is issued after seeing the round detonate or when the squad or section leader wants to halt firing.

(a) CEASE TRACKING tells the crew the squad or section leader intends to stay in position and engage another target immediately or when one appears.

(b) CEASE TRACKING, OUT OF ACTION tells the crew the squad or section leader intends to move to another position.

(2) To determine the method of engagement, the section leader (or above) selects a fire pattern depending on the opposing force's formation. The section leader directs, FRONTAL, DEPTH, or CROSSFIRE, when the gunner is faced with multiple targets.

(3) When the target is identified, the gunner announces, "Identified."

(4) If the gunner cannot see the target, he announces, "Lost."

(5) If the gunner cannot identify the target, he announces, "Cannot identify."

(6) The loader announces, "Backblast clear," *before* the command of execution is given.

h. **Repeating Commands.** When a crew member fails to hear or understand any element of a fire command, he announces the element in question. For example, if the gunner asks, "Location?" the squad leader repeats the location element such as, "From hill seven six two, west two hundred."

i. **Correcting Errors.** To correct an error in a fire command, the squad leader announces, "Correction," and corrects only the element in error. He completes the command by announcing all elements after the corrected element. He does not try to correct an element that has been needlessly included, such as the direction element. He corrects the omission of an element by announcing "Correction" and then the omitted element. After announcing the omitted element, he completes the command.

j. **Commands for the Driver.** Although directions to the driver are not part of the fire command, they are given by the squad leader or gunner in short terms.

6-3. TARGET TRACKING

To track a target, the gunner visually acquires the target through the daysight tracker system of the TOW. He can track the target by either optical or electro-optical means, depending on the system configuration being used and on the visibility conditions.

a. To track the target, the gunner operates the hand controls on the traversing unit to keep the retitles in the launcher sight aligned with the target. The daysight tracker system is attached to and aligned with the launch tube. The launch tube stabilizes the exit of the missile from the launcher for initial alignment during missile flight. On achieving target alignment, the gunner fires the missile by manually depressing the trigger switch. Thereafter, all operations are automatic and the gunner's only task is to maintain alignment of the sight reticle on the target until missile impact.

b. Deviations of the missile from the line-of-sight trajectory are sensed in the launcher sight by infrared means that receive information from infrared radiators attached to the missile. This information is processed in the form of electrical signals to produce error signals proportional to the azimuth and

elevation displacements of the missile from the intended trajectory. Correction commands are derived from these error signals and are sent to the missile over the command-link wires, which are dispensed from the missile. The missile performs corrective maneuvers using aerodynamic control surfaces that deflect in response to the command signals from the launcher. On target impact, a high-explosive, shaped-charge warhead is detonated.

6-4. TARGET ENGAGEMENT WITH THE M220A1 (BASIC TOW)

Specific procedures are followed to engage a target with the M220A1.

a. Position the eye well into the rubber eyepiece and place both hands firmly on the control knobs (Figure 6-10). Place the body so there is no contact between the shoulder and the encased missile. The only contact with the launcher is with the hands and eye. Assume a firing position that is comfortable. An uncomfortable position causes muscle tension, which affects the ability to track smoothly.

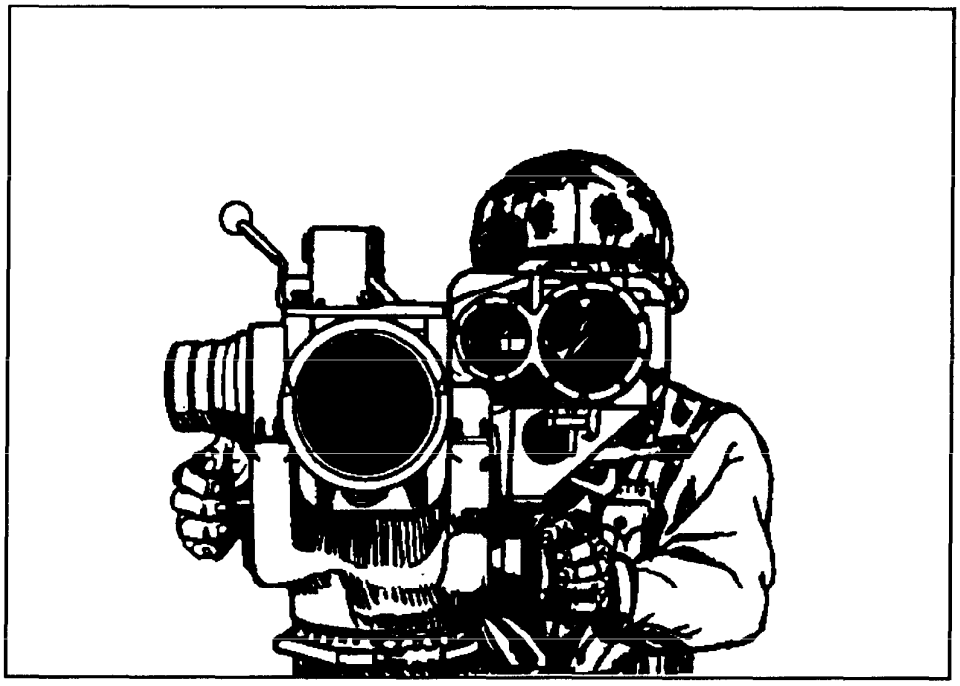


Figure 6-10. Control knobs.

NOTE: When firing from the tripod, kneel on one or both knees.

b. Raise the trigger protective cover and establish a smooth tracking rate while keeping the cross hairs on the center of visible mass of the target (Figure 6-11).

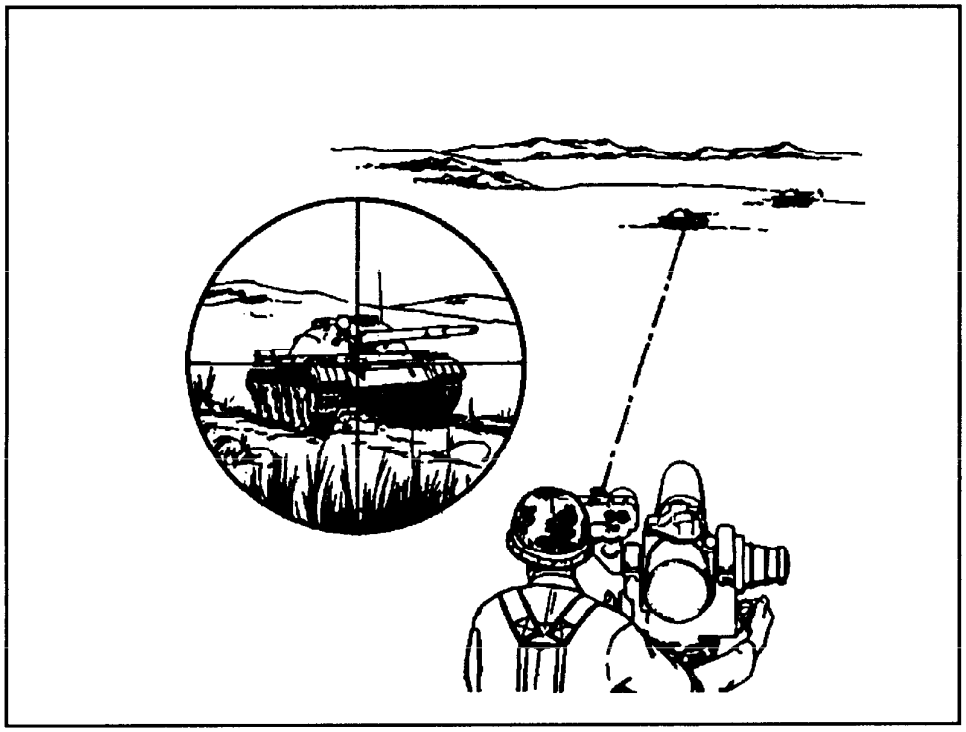


Figure 6-11. Cross hairs on the center of visible mass of the target.

c. Move the launch tube left or right by applying a smooth, steady force to both control knobs (pushing one and pulling on the other) and rotating the body from the waist up as the launcher moves. Elevate or depress the launch tube by applying a smooth, steady turning force to both control knobs. Applying pressure to only one control knob, or applying uneven pressure, makes it more difficult to track smoothly. Maintain the same arm, shoulder, and head position throughout an engagement. Any change in body position other than leaning with the controls will cause a jerking motion that could result in grounding of the missile.

d. Proper breath control is especially important during the first and last 400 meters of missile flight. Improper breathing will cause poor tracking. Take a deep breath and let part of it out; then, press the trigger. After a 1.5-second delay, the missile will launch. The delayed firing of the launch motor may cause you to flinch or jerk the control knobs if you are not prepared for it. Be prepared for two noises after the trigger is pressed. The first noise is the gyro being activated. While it is not loud, it may cause you to think a misfire has occurred, and you may not be prepared for the next noise. The second noise is the launch motor firing and it *is* loud. The dust, smoke, heat, and debris from the backblast may cause flinching. When the missile appears in the sight picture, ignore it.

Never try to guide the missile. If distracted, tracking becomes poor and chances of hitting the target are reduced. Continue to track the target at a smooth tracking rate, keeping the cross hairs on the center of visible mass until missile impact (Figure 6-12).

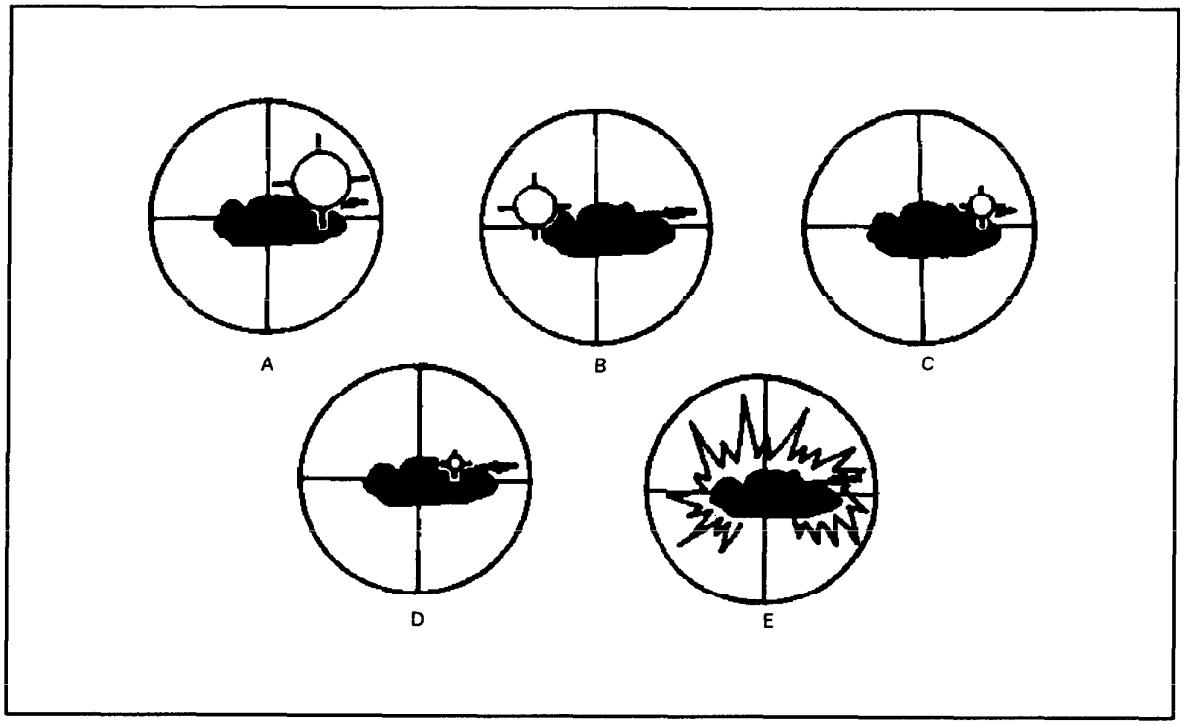


Figure 6-12. Keep cross hairs on the center of visible mass.

6-5. TARGET ENGAGEMENT WITH THE M220A2 (TOW 2)

Specific procedures are followed to engage a target using the M220A2.

a. Looking through the daysight tracker, adjust the focus control until the cross hairs are in focus. (To see the cross hairs clearly, set RETICLE LIGHT switch to ON.) Position the cross hairs on the target, and remove the front lens cover from the nightsight by releasing two latches. Set the ON-OFF-STBY switch to ON. Look through the eyepiece and adjust the diopter adjustment ring to focus the reticle. Ensure the battery monitor light is off. Set the field of view selector to wide field of view, locate the target, and adjust the range focus, contrast, and brightness controls to obtain the best possible sight picture. Set the field of view selector to narrow field of view and adjust the range focus, contrast, and brightness knobs.

(1) Because handoff may occur when limited visibilty conditions exist, locate the target with the daysight tracker and fire using the nightsight. During daylight, the battlefield can be obscured by smoke, dust, and so forth. If limited

visibility conditions exist, the MGS automatically transfers control of the missile from the daysight tracker to the nightsight. The nightsight allows continuous observation of the target regardless of battlefield visibility conditions.

(2) To view the battlefield, ensure the TOW 2 nightsight ON-OFF-STBY switch is in the ON position. Battlefield conditions requiring the nightsight to be in operation are area target monitoring and target engagement. The ON-OFF-STBY switch on the TOW 2 nightsight allows greater battery life from the BPC when placed in the STBY position. After the TOW 2 nightsight has been turned on and allowed to cool down (about three minutes), place the ON-OFF-STBY switch in the STBY position. The STBY position causes the closed-cycle cooler to cycle OFF for 100 seconds and ON for 20 seconds. Cooldown is not required if the nightsight has been operating in the STBY position.

(3) When firing the TOW 2 system, ensure the nightsight is turned ON. Always allow three to five minutes cooldown time before operation regardless of which sight is used. This ensures that the enhanced capabilities of TOW 2 are used during firing, flight, and impact. Certain conditions may permit degraded firing. During the system check-out procedure, if the display indicates a nightsight (postamplifier) failure, the TOW 2 can be fired using the daysight tracker only. If limited visibility causes handoff during flight, control of the missile may be lost.

b. To complete the firing sequence, follow the procedures for the basic TOW launcher (paragraph 6-4).

Section II. HELICOPTER ENGAGEMENT

Enemy armor is the primary threat to friendly ground forces employed in forward areas. The primary mission of the TOW is the destruction of these tanks at the greatest possible range. However, TOW gunners can also successfully engage attacking enemy helicopters, which are a significant threat to ground forces.

6-6. OPERATIONAL CONCEPT

Engaging helicopters with TOWs should be considered primarily as a means of self-defense. TOW crews should not consider helicopters as a routine target of opportunity, but they should leave them to conventional ADA assets when possible.

a. TOW positions are selected to cover armor avenues of approach, but these long-range fields of fire also facilitate the engagement of aircraft. The section leader's, squad leader's, and crew's observation from these positions can provide the early warning required to successfully engage aircraft.

b. The engagement of attacking helicopters should be done by TOW sections, not individual weapon systems. TOW sections should automatically engage helicopters that are attacking their positions. If one squad in a section is being attacked by a helicopter, the other squad should engage the helicopter while the first squad seeks cover. TOW crews and sections should be trained to automatically respond to helicopter attacks in this manner.

6-7. GUNNERY TRAINING

Specific gunnery training is required to track a helicopter with a TOW. Crews should perform the training according to the following conditions and standards. In addition to these outdoor training exercises, a number of scenarios for the TGT include helicopters as targets.

a. **Conditions.** Training takes place during daylight on a range. The TOW crew is given either a ground- or vehicle-mounted TOW with a TFTT and a helicopter mounted with TFTT reflectors. The helicopter moves toward the TOW gunner at speeds between 40 and 80 knots and at ranges between 1,000 and 3,500 meters. Three target angles are used for tracking: head-on; approaching at 30 degrees; and an evasive track with a 90-degree turn.

b. **Standards.** Within 5 seconds the gunner must acquire and begin tracking the target. He must get a hit 6 out of 10 times with the TFTT.

Section III. NBC AND LIMITED VISIBILITY CONDITIONS

Specific procedures are followed to operate the TOW during NBC and limited visibility conditions.

6-8. DECONTAMINATION

TOW crewmen must know decontamination procedures and materials. They must know which decontamination materials to use on each type of surface on the weapon system. Using the wrong material can cause damage to the system (for example, using DS2 on rubber surfaces). Decontamination materials and methods are periodically revised. (Refer to Appendix C of FM 3-5 for the most up-to-date information.)

6-9. THERMAL TARGET RECOGNITION, IDENTIFICATION, AND ENGAGEMENT

The nightsight allows the TOW gunner to view targets during limited visibility conditions such as darkness, smoke, fog, rain, and snow. It produces images called *thermal target signatures* or *infrared target signatures,* which are different from the images seen in the daysight tracker. Targets standout in these infrared images and can be recognized at long ranges on a clear night and at

reduced ranges during poor visibility. Recognizing these targets requires trained and experienced gunners.

a. **Temperature and Thermal Images.** Most objects have a radiated temperature either higher or lower than their background. Even if the radiated temperature differences are less than a degree, they appear on the nightsight display. If there is no difference between the temperature of an object and its background, the object will not be seen in the display.

(1) If an object has a high temperature, it will appear bright red in the nightsight. If the object has a low temperature, it will appear black. Usually, targets are easier to identify at night, because their radiated temperature is hotter than their background.

(2) Some targets, such as tanks and APCs, have internal temperature variations that form visible patterns. These patterns are the basis of target signature cues. In a nightsight, the shapes of the hottest vehicle parts, such as engines and exhausts, appear bright red. Objects with a medium temperature, such as the warm tracks, appear a dim red. Objects with a cool temperature, such as the cool hull and other cool parts, appear black,

b. **Sources of Infrared Energy.** Infrared energy comes from different sources such as solar heat, fuel combustion heat, frictional heat, and reflected radiance.

(1) *Solar heat.* Solar heat comes from the sun and affects the exterior surface of objects. This heating highlights the outline of the object, which provides recognition cues to the gunner. These cues are usually similar to the overall appearance of the target. (For example, a solar-heated M113 appears box-like with a sloping front; a solar-heated M60 tank appears as a small oval atop a larger oval.) These shape cues are recognizable out to medium (1,000 to 2,500 meters) and long (beyond 2,500 meters) ranges. Since the sides have more defined contours, the side view shapes are usually easier to recognize than the front view. In addition to atmospheric variables and surface reflections, the solar heating rate is also affected by the object's ability to absorb sunlight. Generally, dark-colored objects are better absorbers of sunlight than light-colored objects.

(2) *Fuel combustion heat.* Fuel combustion heat comes from operating engines. The heat from operating engines is conducted to the surfaces of the surrounding engine compartment.

(a) Because engine compartment temperatures reach up to 200F, the surfaces of these compartments radiate features that can be easily detected on the nightsight at long ranges. Heated personnel space is also visible.

(b) Engine muffler and exhaust pipe temperatures are high, providing the gunner with good cues.

(c) Although the engine, heated compartments, and exhaust features themselves do not appear in the nightsight, their cue value is not any less. A

trained and experienced gunner can determine much about the vehicle from these cues.

(3) *Frictional heat.* Frictional heat is produced by the moving parts of vehicles. However, these features usually appear a dim red. This heat is less intense than the high temperatures from the engine combustion. Frictional heat is generated only when the vehicle is in motion.

(a) Frictional heat provides long-range cues to classify the vehicle as wheeled or tracked. At medium-range to short-range, these cues can be used to identify the vehicle.

(b) The vehicle's transport systems are the source of most frictional heat cues. Tracked vehicles have frictional heat in the tracks, road wheels, drive sprockets, support rollers, and shock absorbers. The smallest of these features can be identified at longer ranges when they are hot. Wheeled vehicles have frictional heat in the tires, shock absorbers, drive shafts, transmissions, axles, and differentials. The tires, shock absorbers, and differentials can be detected at medium-range to long-range.

(4) *Reflected radiance.* Certain smooth, glossy surfaces, such as windshields and glossy painted fenders, reflect radiation images from other sources. These reflections can produce odd images. For example, the fenders of a T-62 appear black because of thermal reflection; a glossy painted APC could be reflected off the vehicle's flat side surfaces. An overcast sky can cause warmer thermal reflections. Generally, surface reflections are diffuse in nature and do not usually cause problems.

6-10. EFFECTS OF WEATHER AND OBSCURANTS

Variations in solar heat, fuel combustion heat, frictional heat, and thermal reflection affect infrared signatures and infrared target recognition cues. In addition, some atmospheric conditions degrade the nightsight, while others can enhance it. Some of these factors are discussed below.

a. **Falling Precipitation.** Infrared energy does not transmit well through falling precipitation (rain, snow, and fog). The temperature of targets and background objects are decreased. The basic signature cues themselves do not change because of atmospheric transmission losses. Falling precipitation restricts nightsight visibility more than precipitation that has fallen.

(1) During rain or snow, background objects and frictionally heated and solar-heated target features lose heat. Frictional heat loss is caused by water and mud accumulating on the tracks, wheels, and other transport system parts. Engine compartment and exhaust temperatures remain high. Landmarks, such as tree lines, trails, and contour features, are often lost. The loss of heat in background objects reduces scene clutter, such as trees and rocks, and can increase target detection. Target recognition cues are usually reduced because of the loss of heat in certain target features.

(2) Because rain and snow have a cooling effect on the target's contrast, the nightsight contrast controls must be increased to compensate for the condition. However, a higher contrast setting produces a "snowy" image.

b. **Fallen Snow.** Fallen snow tends to make all ground temperatures the same. Depth perception by size comparison becomes difficult because of lack of terrain features with which to reference size.

c. **Dust, Diesel Fog, and Oil Smoke.** Dust particles from artillery impact greatly reduce nightsight visibility. Only the hotter objects and target features show through the obscurants.

6-11. COMPENSATION FOR TARGET APPEARANCE VARIABLES

Although vehicles have distinguishing characteristics or cues by which they can be classified and identified, vehicle appearance can be altered by changes in atmospheric and ground conditions. Therefore, the gunner must know to use the control settings of the nightsight to help compensate for these variables.

a. **Contrast and Brightness Control.** The contrast and brightness controls can be set for maximum internal detail of the target. The controls are balanced to give the clearest image of these target recognition cues. The following is general guidance for setting the image brightness and contrast controls. Gunners should be encouraged to experiment with the controls to understand the effects of the image controls on the thermal image and thermal signatures.

(1) *Brightness, Low: Contrast, Medium to High:* These settings are for scanning an area in search of targets. Background clutter is suppressed. Cool objects are not visible. Only the hot objects in the field of view are seen. When a possible target has been found, brightness can be increased and contrast can be lowered gradually to reveal more thermal detail in the suspected target. Low brightness and medium-to-high contrast settings are also for nightsight use in light fog, rain, or dust conditions.

(2) *Brightness, Low to Medium; Contrast, Medium:* This is the best overall setting for target detail. With medium contrast, brightness can be varied up and down to bring out features and determine the hottest vehicle parts. When brightness is lowered, the cooler parts, such as tracks, darken before hotter parts. Often, small changes in brightness can reveal much about the vehicle. For example, road wheels can sometimes be seen at long range if this technique is used. Experimentation is helpful in learning this target feature extraction technique.

(3) *Brightness, Medium; Contrast, Medium to High:* These settings work well in heavy fog or heavy dust when little can be seen with the TOW. The settings increase the snowy effect in the image, but they also increase the apparent sensitivity of the sight. The image appears distorted and is difficult to interpret. These settings are also good for searching a tree line in wet conditions.

They are sometimes useful with long-range targets. Beyond 2,500 meters, small target images, such as the front view of a BRDM-2, will have a few recognizable features. At long ranges, the higher contrast setting highlights the vehicle's hull and overall silhouette. This will not provide internal detail, but it will help the target stand out from the background and will aid in target detection.

b. **Focus Controls.** Most nightsight focus controls are sensitive; that is, a small movement of the control knob results in a large change in focal point. If a gunner has difficulty in focusing, he should check the adjustment of the image controls.

(1) The eyepiece focus should be adjusted first. The eyepiece focus is called the *diopter adjustment.* Once a gunner knows his diopter correction number, he can dial it in on any nightsight diopter ring. Correct diopter adjustment can usually be obtained by focusing the eyepiece so that the reticle is focused.

(2) The second focus adjustment is the objective range focus. The image controls should be adjusted at the low-to-medium level before focusing the objective lens. Focusing the objective lens is learned through trial and error. It is made difficult by the fact that infrared heat diffuses on objects and does not usually give clear-cut, straight lines on which to focus. Thus, the gunner must learn to focus by adjusting the control back and forth to get the best image. This is easier to do when the nightsight is aimed at a prominent object. Once the best image is determined, the gunner can experiment by focusing on different objects at different ranges.

6-12. BATTLEFIELD IDENTIFICATION

Battlefield identification using a nightsight is difficult. Although the identification problem is being studied, little is known about the ranges at which high-confidence identification can be expected. In a target-rich environment on a dry, clear night, high-confidence identification requires a thermal image of such features as road wheels, turret shapes, gun tube, and exhaust location. Limited experience indicates that the M60 versus T-62 thermal identification can be made between 1,000 to 2,000 meters in clear weather. When identifying targets, a gunner should ask himself these questions:

- Is the target moving?
- What direction is it moving?
- Where is the engine?
- Where is the exhaust?
- Is the target in the unit's sector?
- Should it be there?

- Is it in a formation?
- Is it firing at the unit?

6-13. PRIMARY RECOGNITION CUES

The following friendly and enemy vehicle recognition cues aid in training gunners.

a. **M1 ABRAMS Main Battle Tank.**

(1) *Classification.*

(a) Rear-engine vehicle.

(b) Oval-shaped track and road wheel pattern.

(c) Gun tube visible when recently fired.

(2) *Identification.*

(a) Side-view cues:

- Rear-engine vehicle with rearward exhaust.
- High-profile track pattern with hot, taut tracks (seven road wheels with wider gap between first and second wheel and three support rollers).
- Needle-nosed turret with flat angular sides, centered on chassis.
- Long gun tube is visible at long ranges when recently fired. (Bore evacuator is two-thirds of the way down the length of the barrel.)
- Left and right views are the same.

(b) Front-view cues:

- Two warm tracks separated by cool hull.
- Cool front hull denotes a rear-engine vehicle.
- Gun tube is visible when the gun has been recently fired.

(3) *Effects of motion.*

(a) Changing target views often reveal more features.

(b) Direction of movement denotes engine location.

(c) Bouncing is slower than that of a light vehicle.

(d) Exhaust plume location and direction are sometimes visible.

b. **T-62 Tank.**

(1) *Classification.*

(a) Rear-engine vehicle.

(b) Oval-shaped track and road wheel pattern.

(c) Overall combined hull, turret, and gun pattern may be visible with maximum setting.

(d) Gun tube is visible when it has been recently fired.

(2) *Identification.*

(a) Side-view cues:

- Rear-engine vehicle with left side exhaust.
- Low-profile slack tracks (five road wheels with unique spacing visible at short ranges).
- Left side hotter than right side.
- From left side, the rear half of the vehicle has a much larger heated area than the front half.
- Low overall profile with cool hull.
- Long gun tube (is visible when it has been recently fired).
- Small centrally mounted turret.

(b) Front-view cues:

- Cool, low overall profile with warm tracks separated by cool hull.
- Cool fenders above tracks may appear black.
- Small, dome-shaped turret.
- Long gun tube is visible when it has been recently fired. It appears as a red spot when aimed toward the unit. When unfired, it is visible only at short ranges.

(3) *Effects of motion.*

(a) Changing target views often reveal more features.

(b) Direction of movement denotes engine location.

(c) Transport system becomes warmer and more visible.

(d) Bouncing is slower than that of a light vehicle.

(e) Exhaust plume location and upward direction are sometimes visible.

c. **M2/M3 Bradley Fighting Vehicle.**

(1) *Classification.*

(a) Front-engine vehicle.

(b) Oval-shaped track and road wheel pattern.

(c) 25-mm barrel visible when recently fired.

(d) Amphibious.

(2) *Identification.*

(a) Side-view cues:

- Front-engine vehicle with upward exhaust.
- Has reinforced body armor where the shroud and body connect.
- High-profile track pattern with hot, taut tracks (six road wheels with gap between third and fourth road wheel and three support rollers).

- High overall center-mounted turret with TOW launcher on left side, centered on chassis.
- 25-mm gun barrel is visible at long range when recently fired.
- Left and right views are the same.

(b) Front-view cues:

- Two warm tracks separated by hot hull.
- Hot front hull denotes a front-engine vehicle.
- Gun barrel is visible when the gun has been recently fired.

(3) *Effects of motion.*
(a) Changing target views often reveal more features.
(b) Direction of movement denotes engine location.
(c) Bouncing is faster than that of a heavier vehicle.
(d) Exhaust plume location and direction are sometimes visible.

h. **BRDM-2 Reconnaissance Vehicle.**
(1) *Classification.*
(a) Rear-engine vehicle and exhaust
(b) Wheel pattern of separate wheel-size red spots.
(c) Overall profile of hull with (or without) turret.
(d) Gun tube is visible when it has been recently fired.
(2) *Identification.*
(a) Side-view cues:

- Rear engine is clearly visible at long ranges.
- Two tires clearly visible (each side). Their separation distance suggests a short wheel base vehicle.
- Two mufflers-one on each side of the top rear deck-increase engine area hot spot.
- Overall small size of vehicle is apparent.
- Side view gives a characteristic heat pattern formed by the rear mufflers and the wheels. This pattern is distinctive even at long ranges.
- Choppy ride over rough terrain is quite noticeable even at long ranges.
- Left and right views are the same.

(b) Front-view cues:

- Two warm tires separated by a cool hull. Red spot of differential may be visible between front tires.

- The cool front hull denotes a rear-engine vehicle.

NOTE: Entire frontal area may be made to appear hot if control is set on high.

- Dark surfboard is visible across the front of the hull.
- Tires are set closer together than tracks of most armored vehicles.
- The frontal aspect of the vehicle appears to have a higher "height to width" ratio than armored vehicles which appear wider and lower.
- Over rough terrain, the vehicle tends to bounce more than armored vehicles.

(3) *Effects of motion.*

(a) Changing target views often reveal more features.

(b) Direction of movement denotes engine location.

(c) Transport system becomes warmer and more visible.

(d) Exhaust plume location and upward direction are sometimes visible.

(e) This vehicle is lighter and shorter than tracked, armored vehicles and, therefore, will bounce more and generally will exhibit a choppier ride over rough terrain.

(4) *Special notes.*

(a) The first two front-view cues of this vehicle indicate that it is wheeled and has a rear engine. This information leads the observer to eliminate most trucks and most heavily armored vehicles as target possibilities.

(b) The side pattern is distinctive and easily recognized. The front pattern is more difficult. The front oblique pattern is difficult and can be confusing and misleading.

(c) Top-mounted weapons and electronic accessories can change the upper vehicle signature considerably, but the basic cue pattern of hull, wheels, and engine or muffler features should persist regardless of an y top side modification. However, the overall silhouette profile cues may be altered by such modifications.

SECTION IV. ELECTRO-OPTICAL COUNTERMEASURES

TOW crews may encounter electro-optical countermeasures on the battlefield. Therefore, the following procedures should be used as engagement criteria and not as maintenance checks.

6-14. TOW LAUNCHER

TOW gunners should complete boresight procedures at least as often as prescribed in the operator's manual to ensure the system remains boresighted. When properly boresighted, the boresight meter needles are centered. The sight

sensor must point at the ground or away from the sun or any other possible source of IR energy when the boresight procedure is being completed.

a. Once the boresight procedure is completed, the TOW crew leaves the self-test selector switch in position 7 and engages the test/operate switch (move to test position and hold) as the gunner acquires the target. The missile arming lever should not be raised at this time. If the self-test meter needles peg to one side, or become erratic, or both as the gunner aims at the target, electro-optical countermeasures are present and a shot against that target should not be attempted. The gunner waits for a flank shot or shifts targets.

b. The loader releases the test/operate switch as the gunner shifts targets. The loader reengages the test/operate switch (returns it to test position) when the gunner is ready to acquire a second target. Releasing the switch saves wear and tear on the daysight tracker sensor and conserves battery power, if batteries are being used.

c. If the meter needles return to center after the gunner places his cross hairs on a second target, he engages the target. The loader releases the test/operate switch and raises the arming lever, and the gunner fires the missile.

d. If the meter's needles are erratic after the gunner lays on the second target, he does not fire. He selects another target or waits for an oblique or flank shot ensuring the meter needles are centered before firing.

6-15. TOW 2 LAUNCHER

TOW 2 launchers firing TOW 2-series missiles are not vulnerable to electro-optical countermeasures. However, TOW 2 launchers firing non-TOW 2 missiles are vulnerable, and gunners should use the boresight indicators to determine whether a target should be engaged.

a. The loader completes the MGS self-test procedure as target engagement becomes imminent. The loader holds the self-test toggle switch in the test position before the missile is armed, as the gunner places his cross hairs on the target. If the green light stays on indicating electro-optical countermeasures are not present, the loader releases the toggle switch and raises the arming lever, and the gunner engages the target.

b. If the green boresight center light goes off and the red lights begin to flicker on and off indicating electro-optical countermeasures are present, the gunner does not engage the target. The loader holds the self-test toggle switch in the test position as the gunner acquires an alternate target. If the red lights go off and the green light comes on as the gunner lays his cross hairs on a second target, the loader releases the self-test toggle switch and arms the missile, and the gunner engages the target.

c. Because the TOW 2 self-test switch is reactivated each time the toggle switch is placed in the test position and the self-test cycle takes 15 to 20 seconds, the loader does not release the test switch while the gunner is acquiring alternate

targets. The leader releases the switch only after the green boresight light appears, signifying that it is safe to engage that target.

APPENDIX A

SAFETY

Units should develop local directives and SOPs. SOPs should include individual responsibilities, safety requirements, proximity limits for personnel and explosives, location and sequence of operations, equipment required for handling munitions, and protection for troops. Individual responsibility for operations involving explosives must be designated. Troops must not tamper with the encased missiles other than to remove the forward bundling ring.
Because of the danger to troops from the backblast, extreme care must be used in all phases of training. Emphasize this danger from the first stage of training. Conduct all crew tasks, position and tracking exercises, and firings with the simulation round as though missiles were being fired.

A-1. SAFETY PRECAUTIONS

The TOW backblast area extends 75 meters to the rear of the launcher and forms a 90-degree danger area. It is divided into a danger zone and a caution zone.

a. The *danger zone* extends 50 meters to the rear of the launcher. In this zone, serious casualties or fatalities are likely to occur from the blast and flying debris.

b. The *caution zone* extends an additional 25 meters to the rear of the danger zone. In this zone, a soldier is safe provided he does not face the aft end of the launcher. During training, the caution zone must be clear (Figure A-1, page A-2). (For further information on TOW firing limitations, see Chapter 2.)

WARNING

All crew members must wear V-51 R (or equivalent) earplugs that have been fitted by qualified medical personnel. Failure to use the proper earplugs during missile firing could cause serious injury.

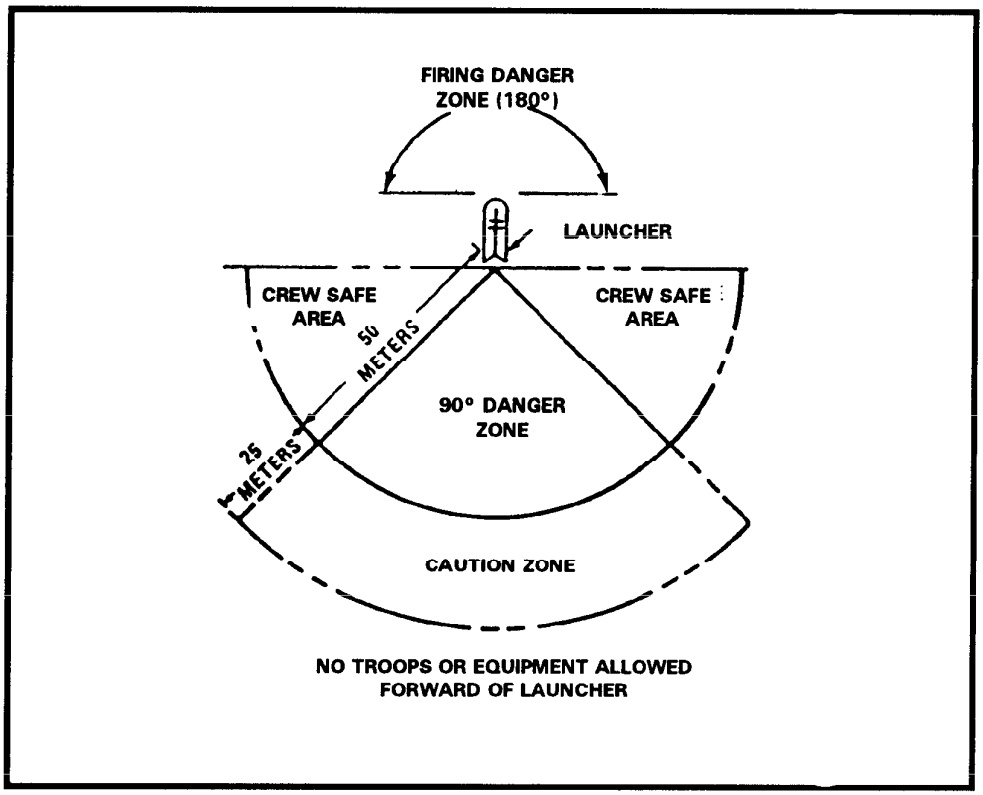


Figure A-1. TOW backblast area.

c. The surface danger zone for any firing range consists of a firing area, a target area, impact area, and danger areas surrounding these locations. An additional area for occupation by personnel during firings 'may also be required. The shape and size of the surface danger zone varies with the type of missile or rocket being fired. (Refer to AR 385-62 for dimensions.)

WARNING
When firing the TOW from confined spaces, such as dugouts or rooms, the gunner must be aware that structural damage to the enclosure may occur and occupants might be injured by flying debris. Severe concussion and concentration of toxic gases may result. There is also a danger of starting fires.

d. In accordance with AR 385-62, C 1, 5 Jan 77; Chapter 1, paragraphs 1 through 4; and Chapter 6, page 6-23, paragraph 6-11, TOWs will not be fired

from buildings, bunkers, or within 100 meters of a vertical or nearly vertical backstop without the approval of the commanding general.

A-2. MISSILE HANDLING PRECAUTIONS

Improper handling of the encased missile may damage the components and cause malfunctions when the missile is launched. If the encased missile is dropped, the end handling rings and the launch container may be damaged. If the missile has been damaged or there is damage to the launch container (other than minor deformation of handling rings), the encased missile should be returned to the ammunition unit for inspection and disposition.

A-3. SIGHTINC AND AIMINC PRECAUTIONS

Gunners must not look at the sun or bright lights while sighting through the daysight tracker; serious eye burn could result. They must not look through the daysight tracker at an air field test set on the control tower unless the distance between the daysight tracker and the test set is more than 300 feet.

A-4. FIRING ANGLE LIMITATIONS

Azimuth and elevation firing angles are limited by the traversing unit, the vehicle, and other external restrictions. All elevation angles are referenced to the horizontal plane of the traversing unit. All azimuth angles are referenced to the long axis of the vehicle and depend on whether the launch tube points over the front or rear of the vehicle. The other reference line is the line-of-sight from the TOW to the target.

WARNING

At angles greater than 20 degrees above ground level, hazards to the gunner may exist in the overpressure waves and debris caused by the backblast during training. Do not use angles greater than 20 degrees.

a. When the TOW is tripod-mounted, a 360-degree lateral track is possible, because the traversing unit is not restricted in azimuth. Mechanical stops limit the elevation angle coverage to 20 degrees below and 30 degrees above the horizontal plane. Before the missile is fired, the line-of-sight angle should be estimated at the expected time of launch and throughout the expected missile flight time. The firing position should be changed or a different target selected if an expected line-of-sight angle exceeds the firing limitation angle.

b. The firing angle limitations of the TOW carriers areas shown in Figures A-2 and A-3, page A-5.

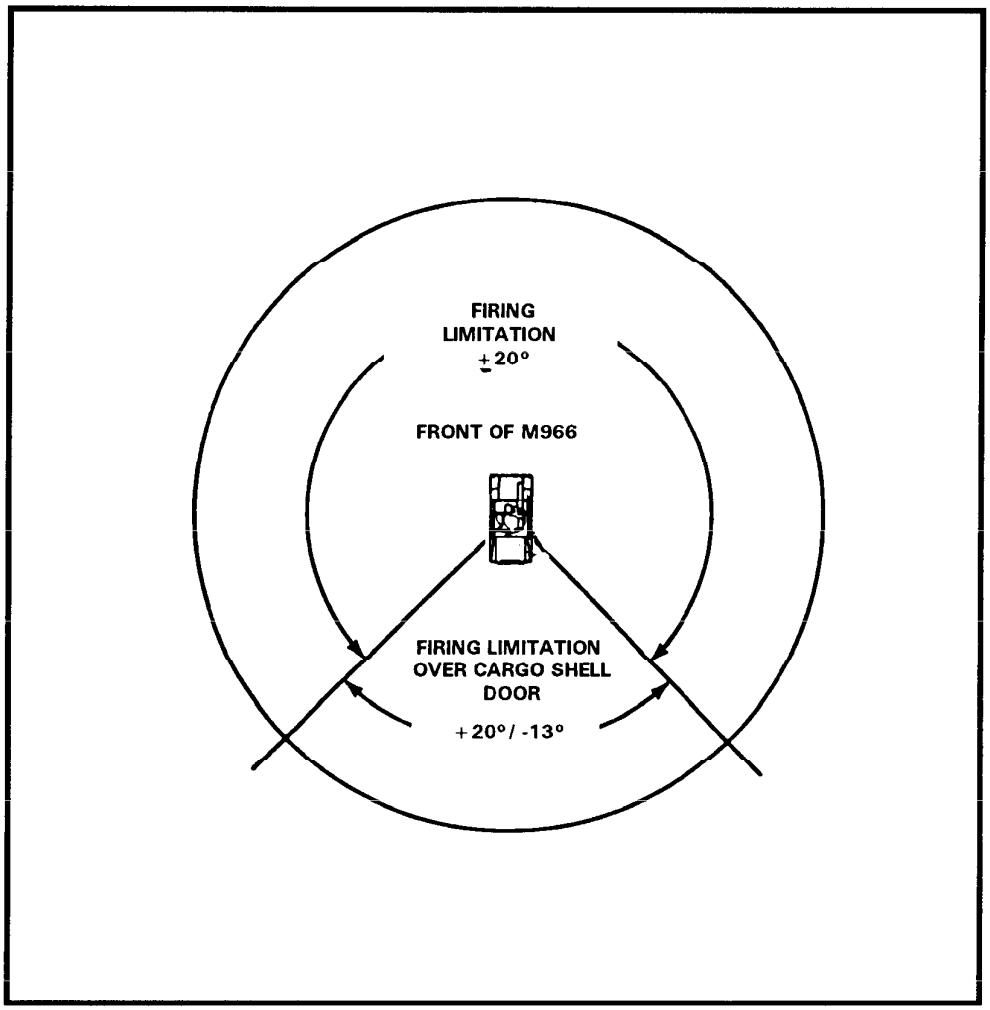


Figure A-2. M966-mounted TOW firing angle limitations.

A-5. SAFETY PRECAUTIONS FOR MILES

The gunner must follow these safety precautions:

a. Do not load an ATWESS cartridge until ready to fire. If the target is lost, remove the ATWESS cartridge from the firing chamber before moving.

b. Before pulling the PULL-TO-ARM switch, always check to ensure there are no personnel in the ATWESS danger zone. This zone extends for 75 meters behind the ATWESS firing chamber and covers an arc 90 degrees wide (Figure A-4, page 6).

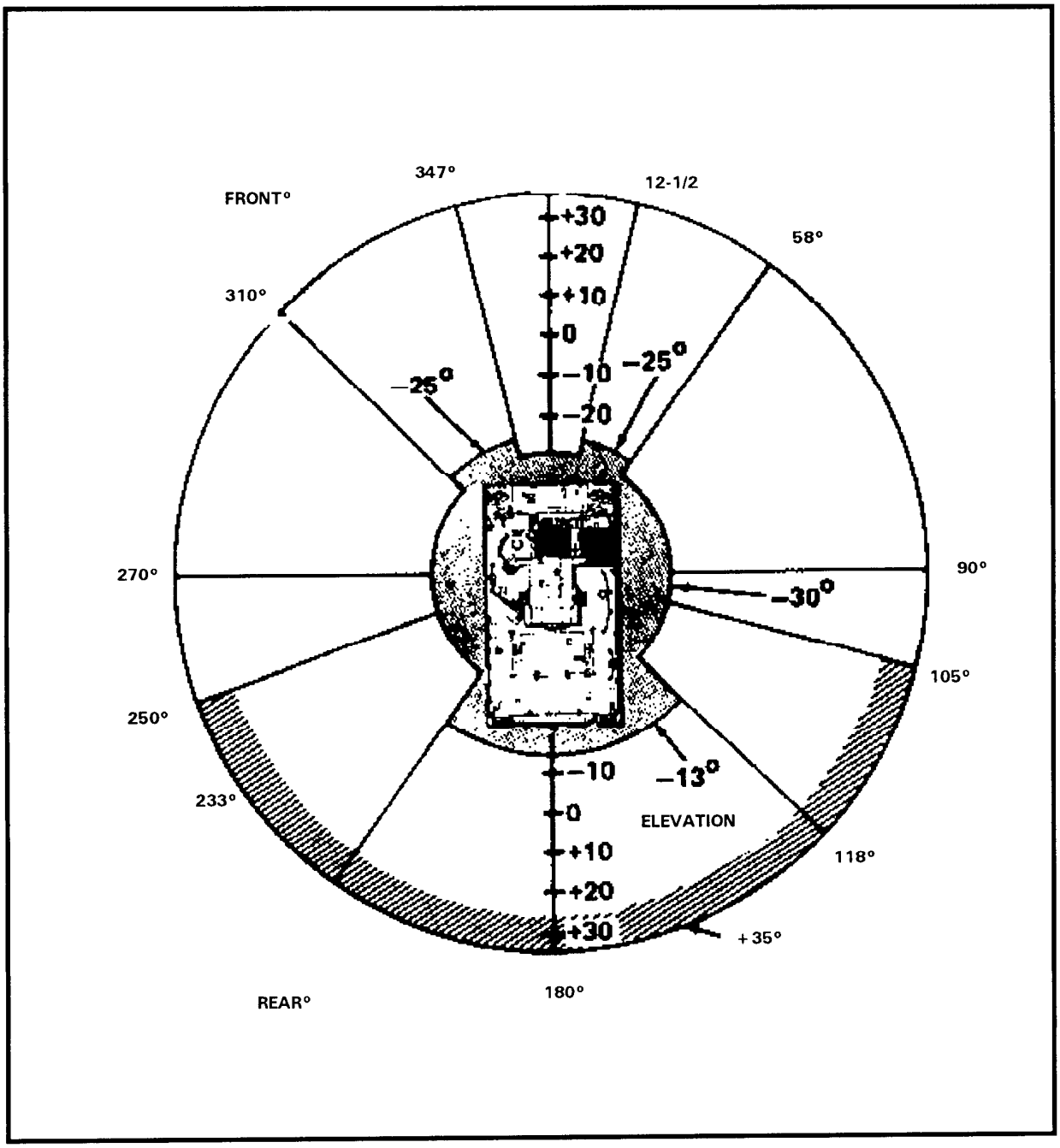


Figure A-3. M901/M901A1 ITV firing angle limitations.

c. Never view the laser being fired through stabilized optics, such as binoculars or telescopic weapon sights, when within 75 meters of the transmitter.

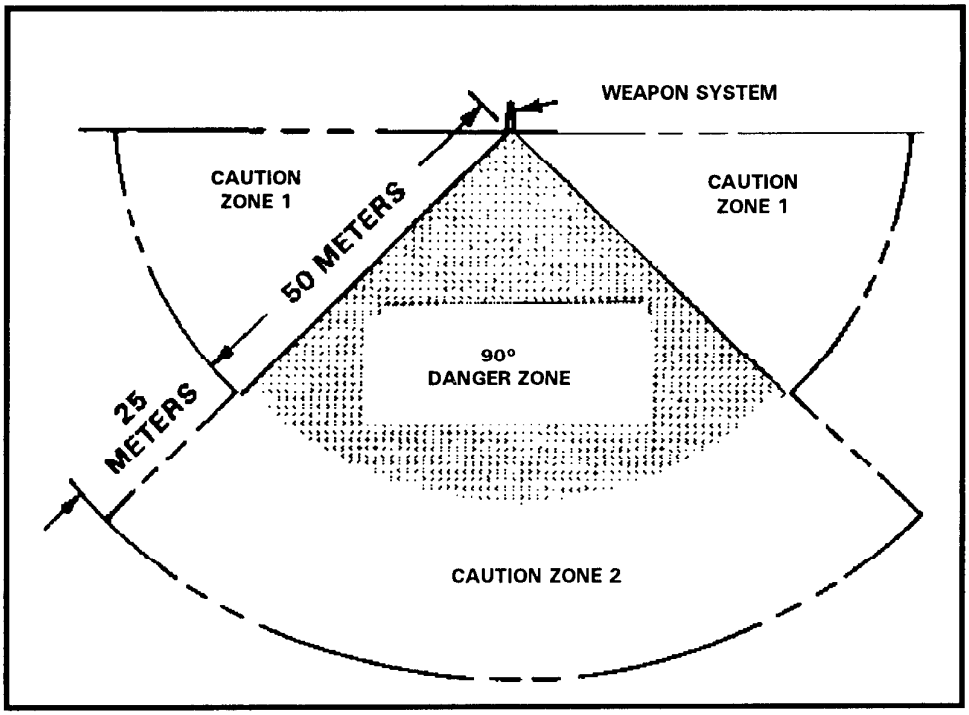


Figure A-4. ATWESS danger zone.

A-6. SAFETY PRECAUTIONS FOR THE TOW GUNNERY TRAINER

The following safety precautions must be observed when using the TGT.

DANGER

This equipment uses high voltage to operate. Never use ungrounded extension cords, ungrounded adapters, or any ungrounded outlet to connect the TGT. Death on contact may result if personnel fail to observe safety precautions.

a. Use two people to lift the instructor console. The console is heavy and lifting with only one man could result in serious injury.

b. Do not attempt to open shipping cases before pressing air pressure release valves on side of cases. Serious injury to personnel could result from opening cases with high pressure inside.

c. Turn off the power to the TGT trainer and disconnect the wall outlet plug before beginning cleaning procedures.

A-7. SAFETY PRECAUTIONS FOR THE TOW FIELD TACTICAL TRAINER

The following safety precautions must be observed when using the TFTT.

a. The laser light emitted by the TFTT is considered eye safe, but suitable precautions must be taken to avoid possible eye damage from overexposure to this radiated energy. The preface to TM 9-6920-453-10, the laser range safety procedures in AR-385-63, and TB MED-279 discuss these precautions.

b. The M80 blast simulator used with the TFTT can cause death or injury. Observe the precautions listed in the preface of TM 9-6920-453-10.

c. To avoid personnel injury and equipment damage, four people are needed to lift and carry each shipping container.

The following safety precautions must be observed when using the TGT.

DANGER

This equipment uses high voltage to operate. Death on contact may result if personnel fail to observe the safety precautions listed in TM 9-6920453-10.

APPENDIX B

TOW TRAINING DEVICES

For many years TOW training devices consisted of the M70-series training sets and MILES TOW equipment. Recently, the Precision Gunnery Training System (PGTS) has been fielded. PGTS consists of two systems, an indoor and an outdoor trainer. The TGT is the indoor system and the TFTT is the outdoor system. The TGT will be used in place of the M70 to qualify individual gunners and for additional sustainment training as the unit sees fit. The TFTT will be used in place of the M70 for outdoor tracking sustainment and in place of MILES when conducting Tables 5 through 12 of the TOW Training Tables.
MILES TOW equipment is the most realistic device available for simulating tactical engagements. It is valuable in maneuver training exercises and Army training and evaluation programs. However, MILES TOW is not a precision gunnery trainer and should not be used to train gunner tracking skills.

Section I. MULTIPLE-INTEGRATED LASER ENGAGEMENT SYSTEM

MILES is a training system used in force-on-force training and in FTXs. Commanders should use an MPRC to verify MILES equipment before the unit's rotation to the NTC. (See gunnery Tables 7 through 12 in Chapter 5 for target arrays.)

B-1. COMPONENTS AND FEATURES

This paragraph discusses the different components, features, and capabilities of MILES.

a. **Components.**

(1) The following are the eight components in the MILES TOW transit case:

- Operator's manual.
- Man-worn laser detector (two sets).
- Yellow keys.
- TOW laser transmitter/tracker head simulator.

- Missile guidance set adapter.
- Miscellaneous hardware.
- Hook-pile tape pads.
- Control console mounting bracket.

(2) The following are the ten MILES APC system components packed in the APC transit case.

- Operator's manual.
- Control console.
- Laser transmitter for M2.
- Battery box.
- Hardware.
- Combat vehicle kill indicators.
- Weapon's keys.
- Cable assembly.
- Combat vehicle laser detector belt segments.
- Man-worn laser detectors.

(3) The following are the 12 MILE ITV system components packed in the ITV transit case.

- Operator's manual.
- MILES control console.
- Battery box.
- Miscellaneous hardware.
- Weapon's keys (one orange, one yellow).
- Combat vehicle kill indicator cable assembly.
- ITV interface cable.
- Console mounting adapter.
- Combat vehicle laser detector belt segments (three Number 1's, two Number 2's).
- Laser transmitter for M2.

b. **Features.**

Range: 3,750 meters; M60, 1,100 meters.

Tracking time: 10 seconds.

Kill codes:	Visual	Audio
Near miss	2 CVKI flashes	2 tones
Hit	4 to 6 CVKI flashes	4 to 6 tones
Kill	Continuous flash	Continuous tone

Basic load: 12 ATWESS cartridges.

Backblast area: 75 meters by 90 degrees.

TOW laser tracking: head assembly optics 10 power.

Refire ability: every 10 seconds.

c. **Capabilities.** MILES-equipped weapons have the same range and operational capabilities as the normal weapons. The effective range of the transmitter may be reduced by a dirty transmitter lens. The M60 machine gun is effective against lightly armored MILES-equipped vehicles and personnel. The TOW 2 is effective against armored MILES-equipped vehicles.

B-2. SAFETY PRECAUTIONS

The following safety precautions should be observed when using MILES.

a. Do not load an ATWESS cartridge until ready to fire. If the target is lost, remove the ATWESS cartridge from the firing chamber before moving.

b. Before pulling the PULL-TO-ARM switch, always check to ensure there are no personnel in the ATWESS danger zone. This zone extends for 75 meters behind the ATWESS firing chamber and covers an arc 90 degrees wide (Figure B-1, page B-4).

c. Never view the laser being fired through stabilized optics, such as binoculars or telescopic weapon sights, when within 75 meters of the transmitter.

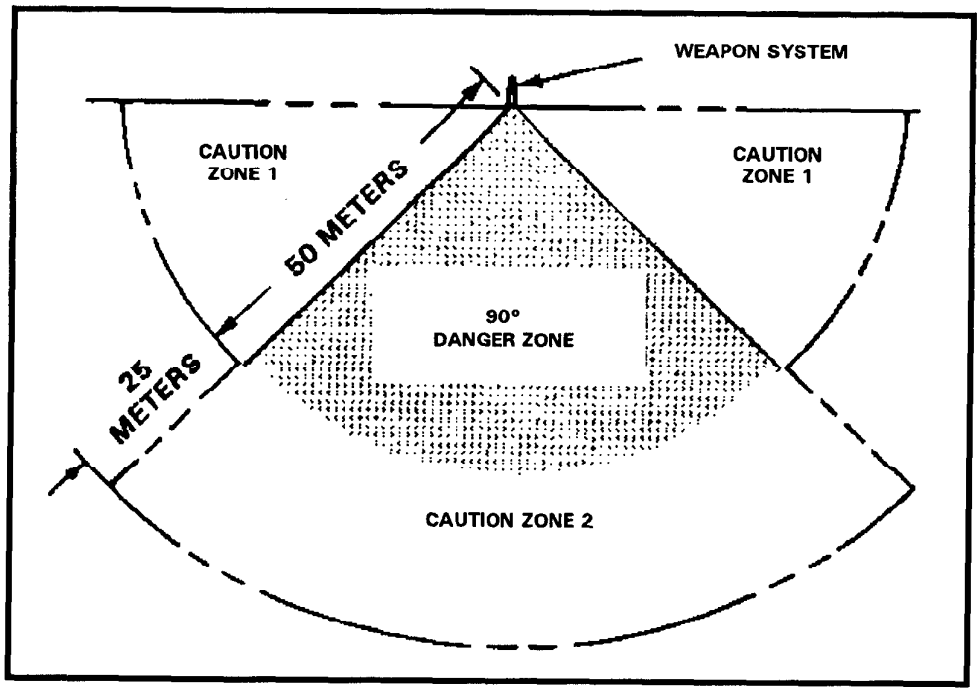


Figure B-1. MILES TOW backblast area.

Section II. TOW GUNNERY TRAINER

The TGT is a new trainer used indoors for individual advanced gunnery tables. It provides realistic training.

B-6. COMPONENTS AND FEATURES

The TGT consists of TGT-unique components and TOW 2 components. The major TGT-unique components are the instructor station (Figure B-2) and the student station (Figure B-3).

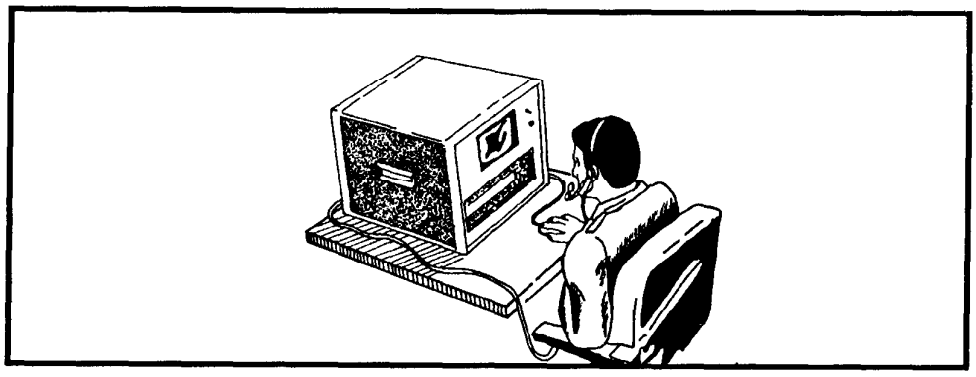


Figure B-2. Instructor station.

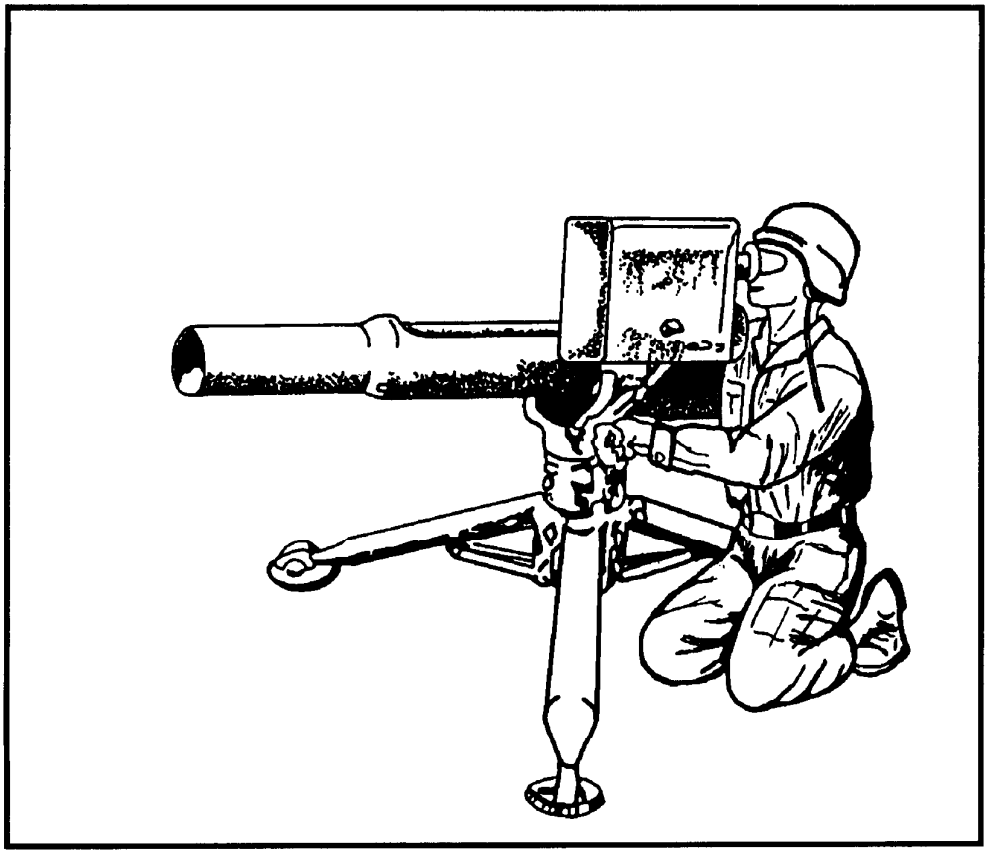


Figure B-3. Student station.

a. The TGT simulates the sight(s), controls, switches and indicators of the M220E4 TOW 2 weapon system. Through the gunner's sight(s) you see battlefield scenes, which include both enemy and friendly vehicles. Using the controls and switches, the gunner selects a target, fires, and tracks it. The headsets simulate the blast of the TOW and the singing of the wire. The gunner sees and hears hit-and-miss explosions and hears commands from the instructor and battlefield sounds of small arms and guns. The score is displayed at the end of each mission.

b. TGT trains novice gunnery skill training, gunnery skill progression, and sustainment training. It is used to train the following skills:

- Correct firing position.
- Target identification.
- Target engageability determination.
- Target engagement, including tracking and firing.

B-4. ASSEMBLY AND OPERATION

The following manuals are used for proper assembly and operation of the TGT.

a. TM 9-6920-452-10, Chapter 2, Section 1, discusses procedures for unpacking, assembly, disassembly, and repacking for storage/shipment.

b. TM 9-6920-452-10, Chapter 2, Section 2, discusses preparation for operation, preliminary inspections, warm-up, and operational checkout procedures.

c. TM 9-6920-452-10, Chapter 2, Section 3, discusses operating procedures performed by the instructor in order to conduct training.

B-5. SAFETY PRECAUTIONS

The following safety precautions should be observed when using the TGT.

> DANGER
> **This equipment uses high voltage to operate. Never use ungrounded extension cords, ungrounded adapters, or any ungrounded outlet to connect the TGT. Death on contact may result if personnel fail to observe safety precautions.**

a. Use two people to lift the instructor console. The console is heavy and lifting with only one man could result in serious injury.

b. Do not attempt to open shipping cases before pressing air pressure relief valves on side of cases, Serious injury to personnel could result from opening cases with high pressure inside.

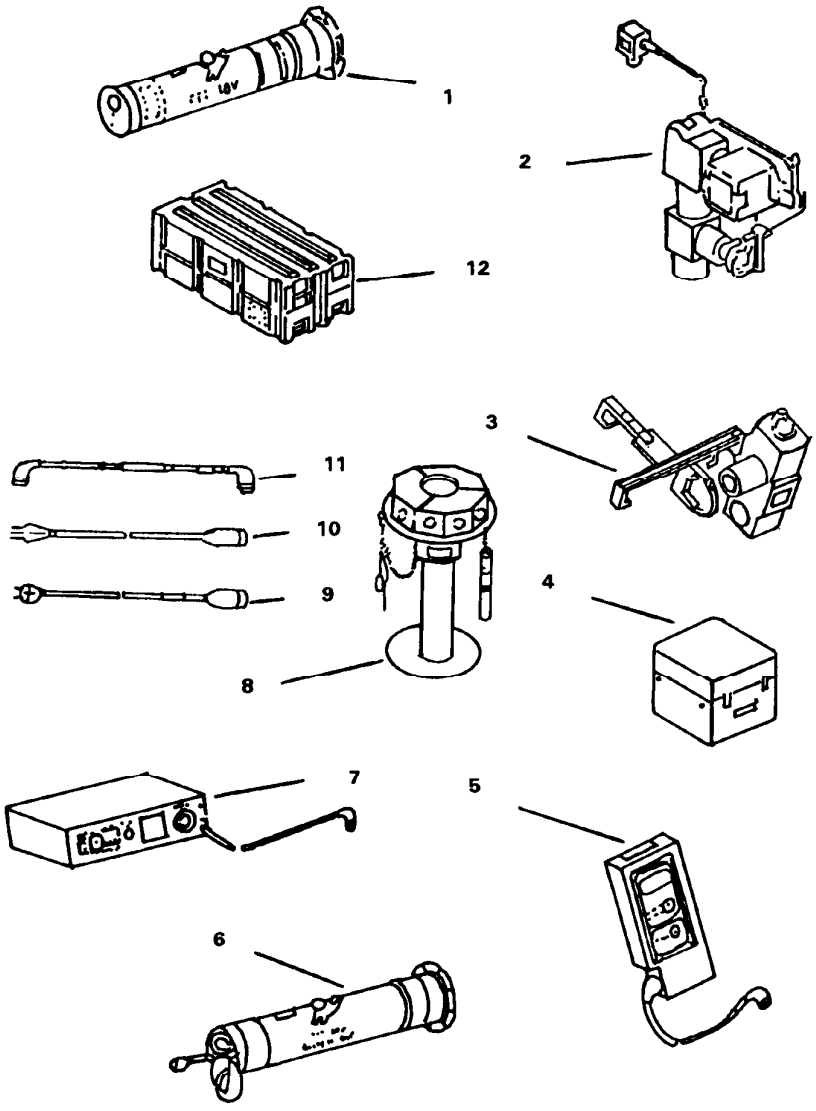
c. Turn off the power to the TGT trainer and disconnect the wall outlet plug before beginning cleaning procedures.

Section III. TOW FIELD TACTICAL TRAINER

The TFTT is used to teach precision gunnery skills to TOW gunners in the field. This training can occur on designated ranges, general outdoor areas, or representative tactical environments. The TFTT trains gunners to adopt a correct firing position, assess target engageability, and to engage and track the target. Missile launch, flight and impact effects are realistically simulated by the TFTT.

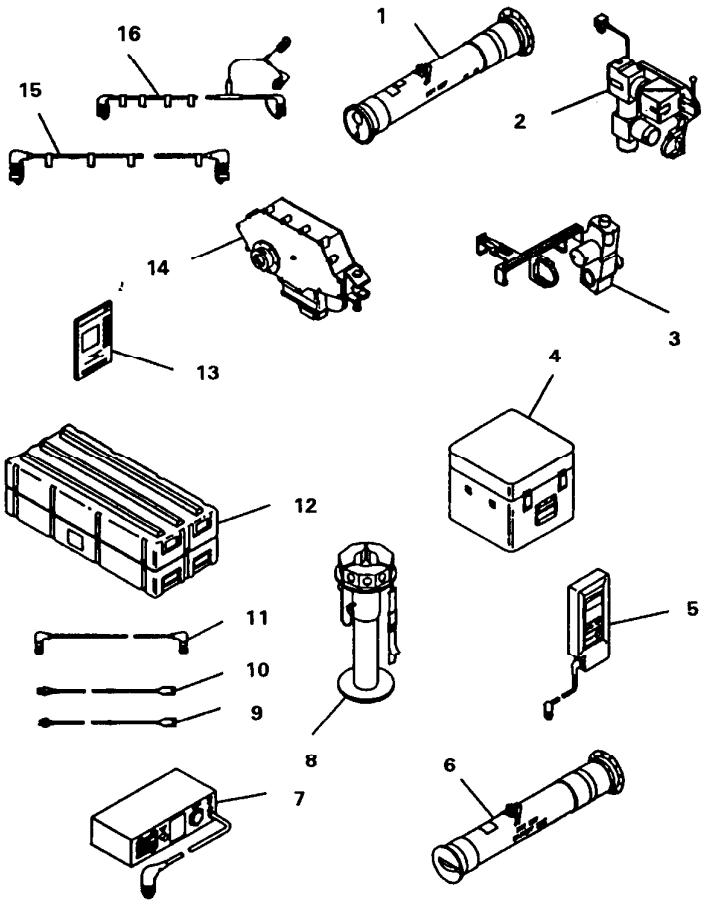
B-9. COMPONENTS AND FEATURES

The TFTT consists of TFTT-unique components and a TOW 2 weapon system. The TFTT attaches to the TOW 2 and replaces some of its components. The TFTT can be either tripod mounted or HMMWV mounted. It can be configured for the M966 (Figure B-4) or the M901 (Figure B-5, page B-8).



Trainer missile tube (1)
Daysight tracker interface (2)
Thermal sight interface (3)
Computer (4)
Remote control unit (5)
Battery tube (6)
Converter/charger (7)
Retroflector assembly and pedestal (8)
Cables (9, 10, 11)
Shipping containers (12)

Figure B-4. TOW field tactical trainer components (M966).



Trainer missile tube (1)
Daysight tracker interface (2)
Thermal sight interface (3)
Computer (4)
Remote control unit (5)
Battery tube (6)
Converter/charger (7)
Retroreflector assembly (8)
W2 cable (11)
2 shipping containers (12)
ITV/TOW FTT operator's manual (13)
ITV sight interface (14)
W3 cable (15)
W4 cable (16)
2 power cables (9 and 10)

Figure B-5. TOW field tactical trainer components (M901).

a. The TFTT uses the TOW 2 weapon system equipment to enhance training realism. In addition, most of the TFTT components are designed to resemble actual weapon system equipment. The TFTT uses a retroreflector to designate its target. The retroreflector returns a portion of the laser beam generated by the gunner. The laser beam enables precise measurement of target range and location relative to the gunner. The retroreflector can be mounted on a variety of target vehicles, which can be maneuvered as required during a training mission. Targets equipped with MILES sensors can also be engaged by the TFTT.

b. The TFTT operator loads the M80 blast simulator, sets the duration of the obscuration that simulates the smoke produced at missile launch, and selects the relative size of the target. Following missile launch, the operator monitors gunner performance during missile flight. At the end of each mission, the operator is provided with a readout of mission results.

B-7. ASSEMBLY AND OPERATION

The following manuals are used for proper assembly and operation of the TFTT.

a. TMs 9-6920-453-10 (M966) and 9-6920-707-10 (M901), Chapter 2, Section 1, discuss procedures for unpacking, assembly, disassembly, and repacking of the TFTT.

b. TMs 9-6920-453-10 (M966) and 9-6920-707-10 (M901), Chapter 2, Section 2, discuss procedures for preliminary inspection, power-up, and operational checkout of the TFTT.

c. TMs 9-6920-453-10 (M966) and 9-6920-707-10 (M901), Chapter 2, Section 3, discuss procedures for operating the TFTT.

B-8. SAFETY PRECAUTIONS

The laser light emitted by the TFTT is considered eye safe, but suitable precautions must be taken to avoid possible eye damage from overexposure to this radiated energy. See the preface to TM 9-6920-453-10 and the laser range safety procedures in AR-385-63 and TB MED-279 for these precautions. To avoid personnel injury and equipment damage, four people are required to lift and carry each shipping container.

DANGER

This equipment uses high voltage to operate. Death on contact may result if personnel fail to observe safety precautions listed in TMs 9-6920453-10 (M966) and 9-6920-707-10 (M901).

DANGER

The M80 blast simulator used with the TFTT can cause death or injury. Observe the precautions listed in the preface of TM 9-6920-453-10.

APPENDIX C

MULTIPURPOSE RANGE COMPLEXES

Multipupose range complexes are generic range complexes intended to accommodate a wide range of vehicles and weapon systems, from HMMVV-mounted TOWs to M1 tanks and helicopters. For TOW training purposes, MPRCs are primarily used for TOW Training Tables 5 through 12. Units will mount the TFTT retroreflector assembly on the targets.

C-1. DIMENSIONS AND LAYOUTS OF MULTIPURPOSE RANGE COMPLEXES

Heavy and light units can both use MPRCs. To get the most benefit from training on MPRCs, use the dimensions and layouts discussed herein.

a. **Heavy MPRCs.** A heavy MPRC consists of three 4,500-meter by 300-meter lanes (Figure C-1, page C-3), each separated by a 50-meter buffer zone. The total area occupies approximately 1,100 acres.

(1) Target and firing positions must be adjusted in the field to obtain intervisibility and to minimize site disturbance. Targets should use the protection of the natural terrain to minimize the size of any berms that might be required.

(2) Each 300-meter lane should contain the following targets:

- 4 moving armor targets.
- 20 stationary armor targets.
- 51 stationary infantry targets.
- 15 infantry moving targets.
- 10 defilade positions.

(3) Access to each target should be by means of a service road.

(4) The vehicle holding area should be close to the firing range baseline. This area requires approximately 5,000 square meters (sufficient area for parking and maneuvering of 17 mechanized vehicles).

b. **Light MPRCs.** A light MPRC is essentially identical to the heavy MPRC in concept and purpose. The primary difference is in the dimensions.

(1) A light MPRC consists of one 4,600-meter by 1,000-meter lane. This area comprises approximately 1,136 acres (Figure C-2, page C-4).

(2) The light MPRC has the following targets and fixed positions (see TC 25-8 for target arrays):

- Moving vehicle targets.
- Stationary vehicle targets.
- System calibration and stationary vehicle targets.
- Personnel targets.
- Moving personnel targets.
- Defilade positions.
- Hardened emplacements (for aviation gunnery).

C-2. SAFETY PRECAUTIONS

Observe the following safety precautions when training on MPRCs.

a. Gunnery tasks requiring the use of dud-producing ammunition cannot be fired on the range proper. Provisions must be made for these tasks in impact areas adjacent to the range.

b. The M80 blast simulator used with the TFTT can cause death or injury. Observe the precautions listed in the preface of TM 9-6920-453-10.

(1) Do not load an M80 blast simulator until ready to fire. If the target is lost, remove the M80 from the firing chamber before moving.

(2) Always check to ensure no personnel are in the M80 blast simulator's danger zone. This danger zone extends for 75 meters behind the M80's firing chamber and covers an arc of 90 degrees.

DANGER

This equipment uses high voltage to operate. Death on contact may result if personnel fail to observe the safety precautions listed in TM 9-6920453-10.

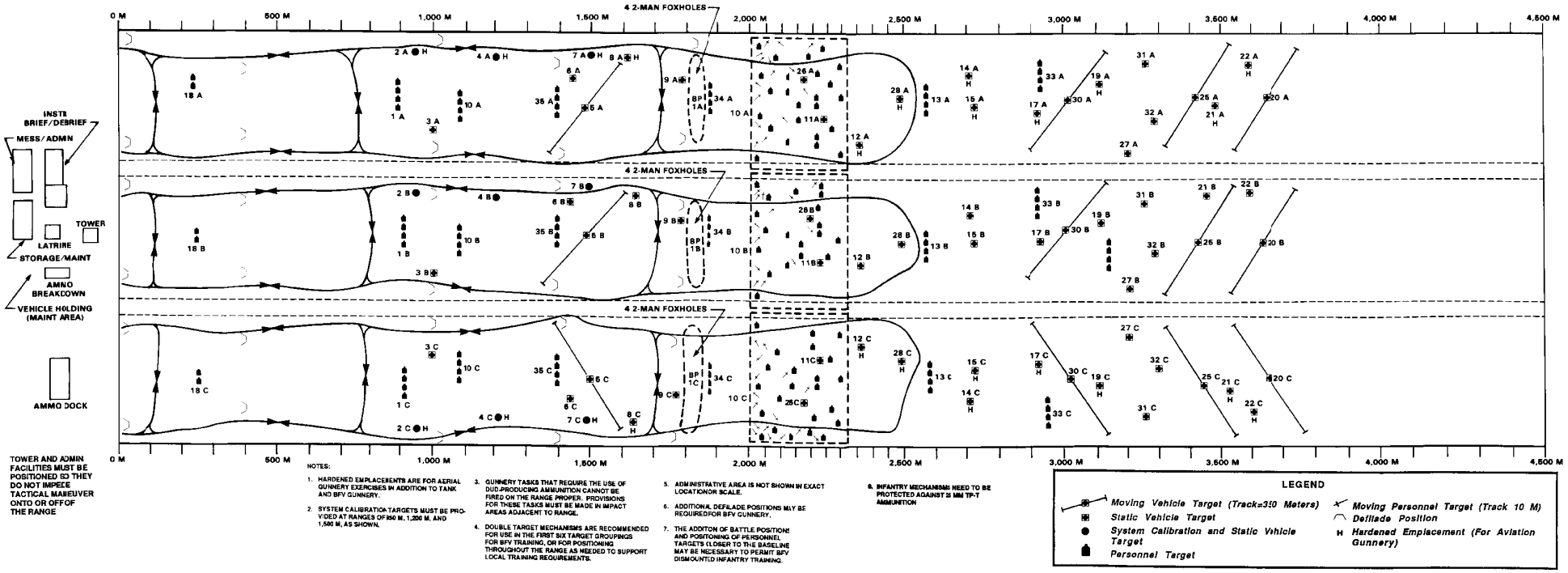
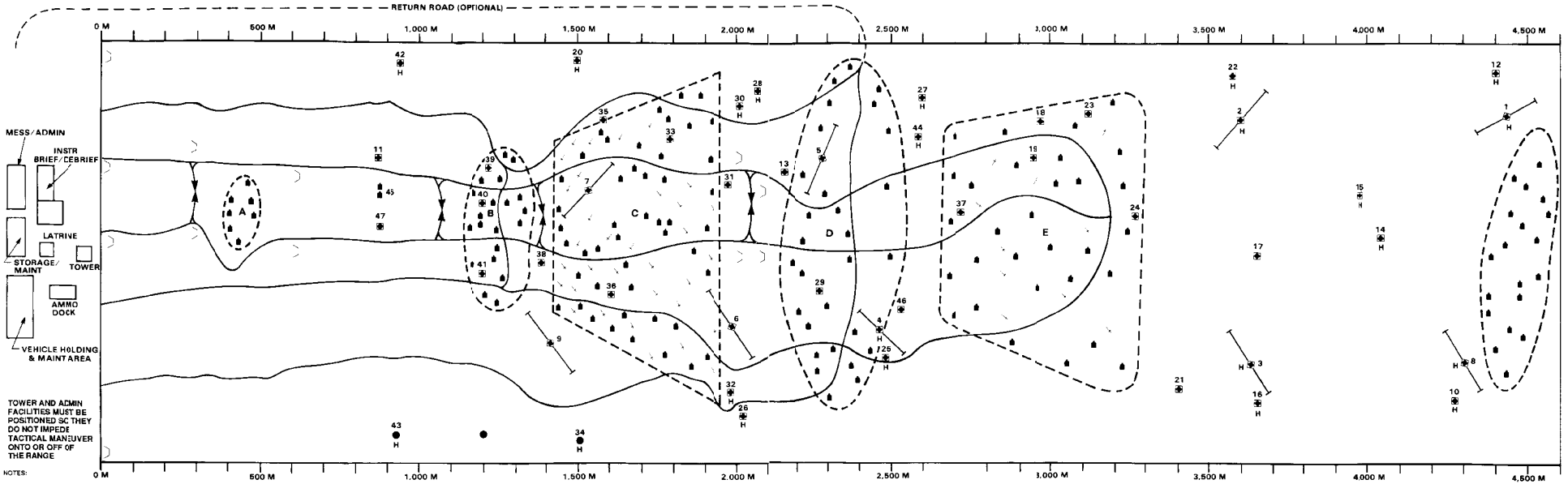


Figure C-1. Multipurpose range complex (heavy).



NOTES:

1. HARDENED EMPLACEMENTS ARE FOR AERIAL GUNNERY EXERCISES, IN ADDITION TO TANK AND BFV GUNNERY.
2. SYSTEM CALIBRATION TARGETS MUST BE PROVIDED AT RANGES OF 950 M, 1,200 M, AND 1,500 M, AS SHOWN.
3. GUNNERY TASKS THAT REQUIRE THE USE OF DUD-PRODUCING AMMUNITION CANNOT BE FIRED ON THE RANGE PROPER. PROVISIONS FOR THESE TASKS MUST BE MADE IN IMPACT AREAS ADJACENT TO RANGE.
4. DOUBLE TARGET MECHANISMS ARE RECOMMENDED FOR USE IN THE FIRST SIX TARGET GROUPINGS FOR BFV TRAINING, OR FOR POSITIONING THROUGHOUT THE RANGE AS NEEDED TO SUPPORT LOCAL TRAINING REQUIREMENTS.
5. ADMINISTRATIVE AREA IS NOT SHOWN IN EXACT LOCATION OR SCALE.
6. ADDITIONAL DEFILADE POSITONS MAY BE REQUIRED FOR BFV GUNNERY.
7. THE ADDITION OF BATTLE POSITIONS AND POSITIONING OF PERSONNEL TARGETS CLOSER TO THE BASELINE MAY BE NECESSARY TO PERMIT BFV DISMOUNTED INFANTRY TRAINING.

LEGEND

- *Moving Vehicle Target (Track=350 Meters)*
- *Static Vehicle Target*
- *System Calibration and Stationary Vehicle Target*
- *Personnel Target*
- *Moving Personnel Target (Track 10 M)*
- *Defilade Position*
- H *Hardened Emplacement (For Aviation Gunnery)*

Figure C-2. Multipurpose range complex (light).

APPENDIX D

FIGHTING POSITIONS

TOW fighting positions may be mounted or dismounted, depending on the situation. A camouflage net can be used with either configuration.

D-1. DISMOUNTED TOW FIGHTING POSITION

A tripod-mounted TOW fighting position must meet the following specifications:

- Allows the squad to engage the enemy in its assigned sector of fire.
- Provides protection for both the weapon and its crew.
- Blends with its surroundings so that it cannot easily be detected 35 meters to the front and cannot be seen from the air.

a. The steps in constructing the position should be conducted in the following sequence:

(1) Assemble the launcher.

(2) Clear the fields of fire while ensuring the sector is under observation.

(3) Dig the weapon position first, then add overhead protection for the crew.

(4) Build a parapet to the front and flanks of the position.

(5) Disconnect the MGS and place it in the position made for it. Place the launcher into the position. Reconnect the MGS and check the boresight.

(6) Improve the position by adding overhead cover for the crew and system.

(7) Camouflage the position.

(8) Inspect the position and its camouflage. If possible, move at least 35 meters to the front of the position and study it.

b. The initial position should look like Figure D-1, page D-2.

(1) Make the position 24 inches deep.

(2) Make the parapet at least 18 inches thick to keep out small-arms fire and artillery fragments. It should provide 9 inches of muzzle clearance under the launch tube.

(3) Do not place dirt or equipment in the backblast area.

(4) Scoop out a place for the MGS either under or to the front of the tripod.

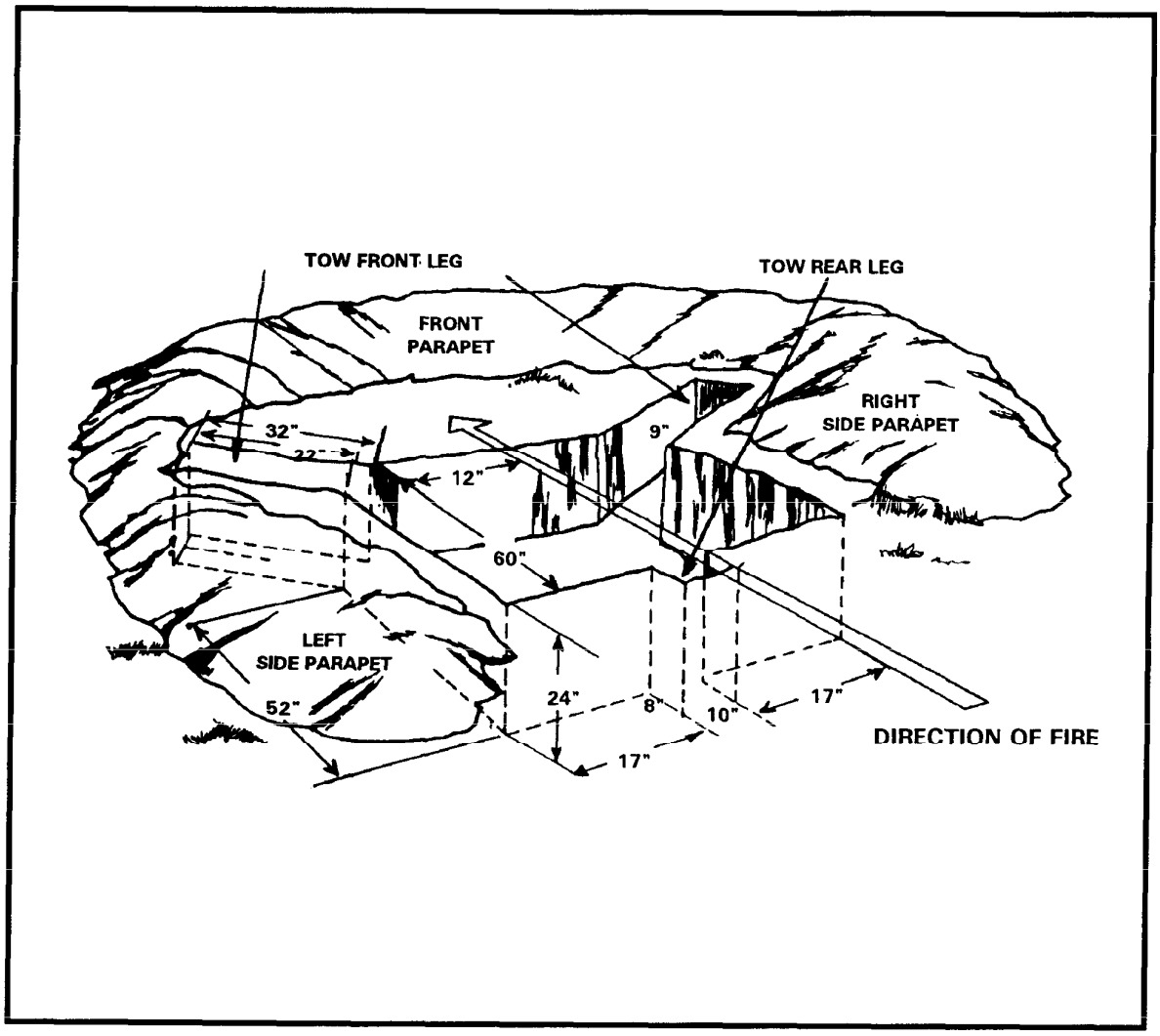


Figure D-1. Tripod-mounted TOW fighting position.

(5) Dig a storage/protective area for the crew and missiles to one flank at a 90-degree angle to the primary direction of fire. Use the strongest material available for the roof. Put canvas or plastic down before throwing dirt on the roof to keep the ceiling from leaking. Place at least 20 inches of dirt on top of the storage/protective area (Figure D-2).

(6) Ensure the ground behind the TOW is free of leaves and dirt out to 25 meters so the backblast does not leave a signature.

(7) Ensure all the standard principles of camouflage are followed. (For example, cover all fresh dirt with leaves and brush, replace withered foliage, always approach position from rear, and so forth.)

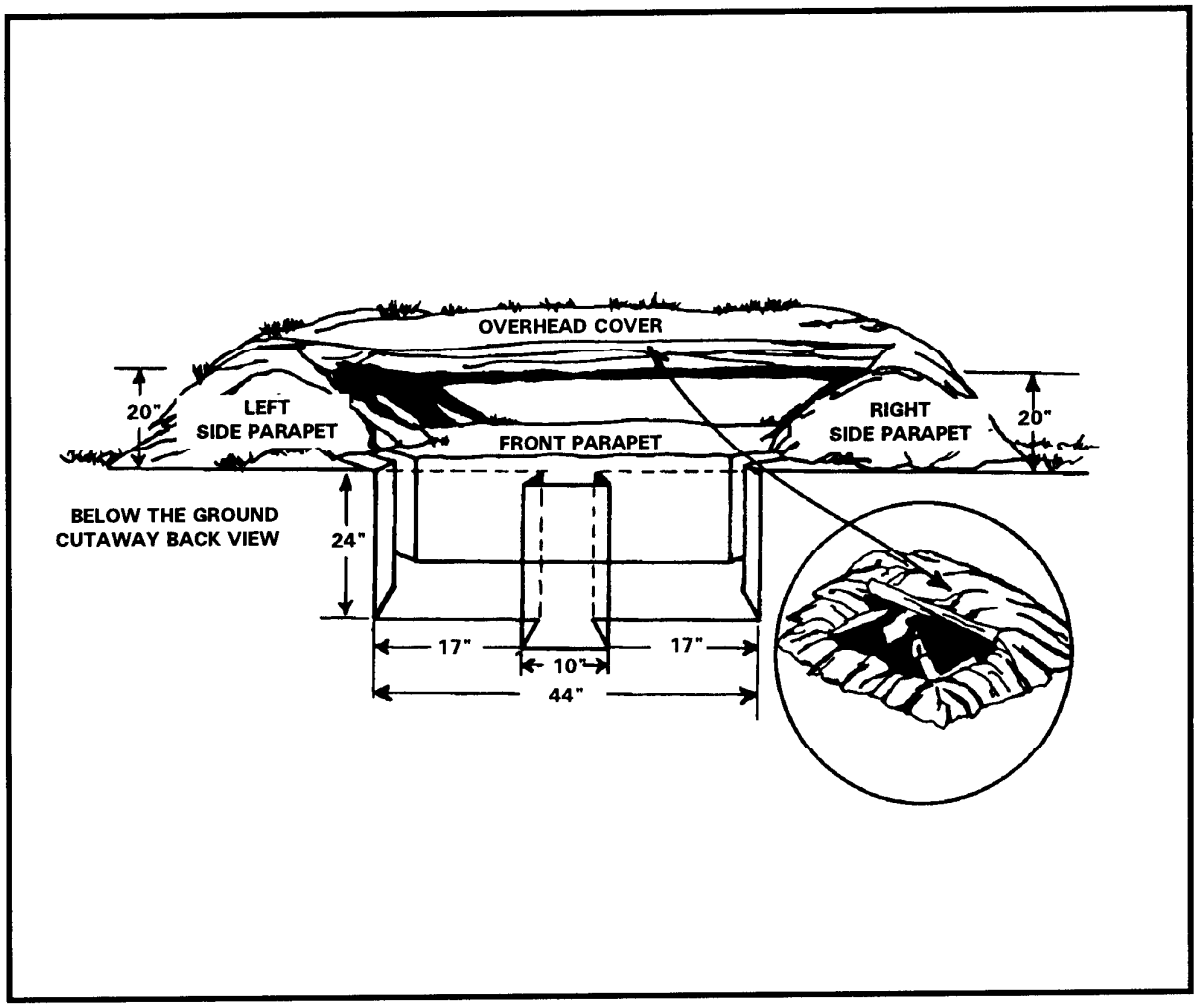


Figure D-2. Storage/protective area.

D-2. MOUNTED TOW FIGHTING POSITION

A mounted TOW fighting position must meet the following specifications:

- Does not restrict the TOW's target engagement.
- Provides concealment from ground and air observation for the crew and vehicle.
- Backblast area is as clear as possible of debris that would increase launch signature.

a. Camouflage and conceal the firing position.

(1) All vehicles travel to a position over the same route to prevent the enemy from detecting the number of vehicles present.

(2) The route taken should follow existing paths, roads, fences, or natural lines in terrain.

(3) Exposed routes should not end at a position.

(4) If only a short portion of the route into a position is exposed, sweep out the tracks with tree branches.

(5) Traffic in and out of a position should be held to essential movements only.

(6) Upon moving into a position, be sure to erase the trail leading into the position.

(7) Ensure all standard principles of camouflage are adhered to (same as for tripod-mounted position).

b. If a hull-down position is not available, use a hide position (Figure D-3).

c. If possible, move at least 35 meters in front of the position to ensure that it looks natural and blends with its surroundings.

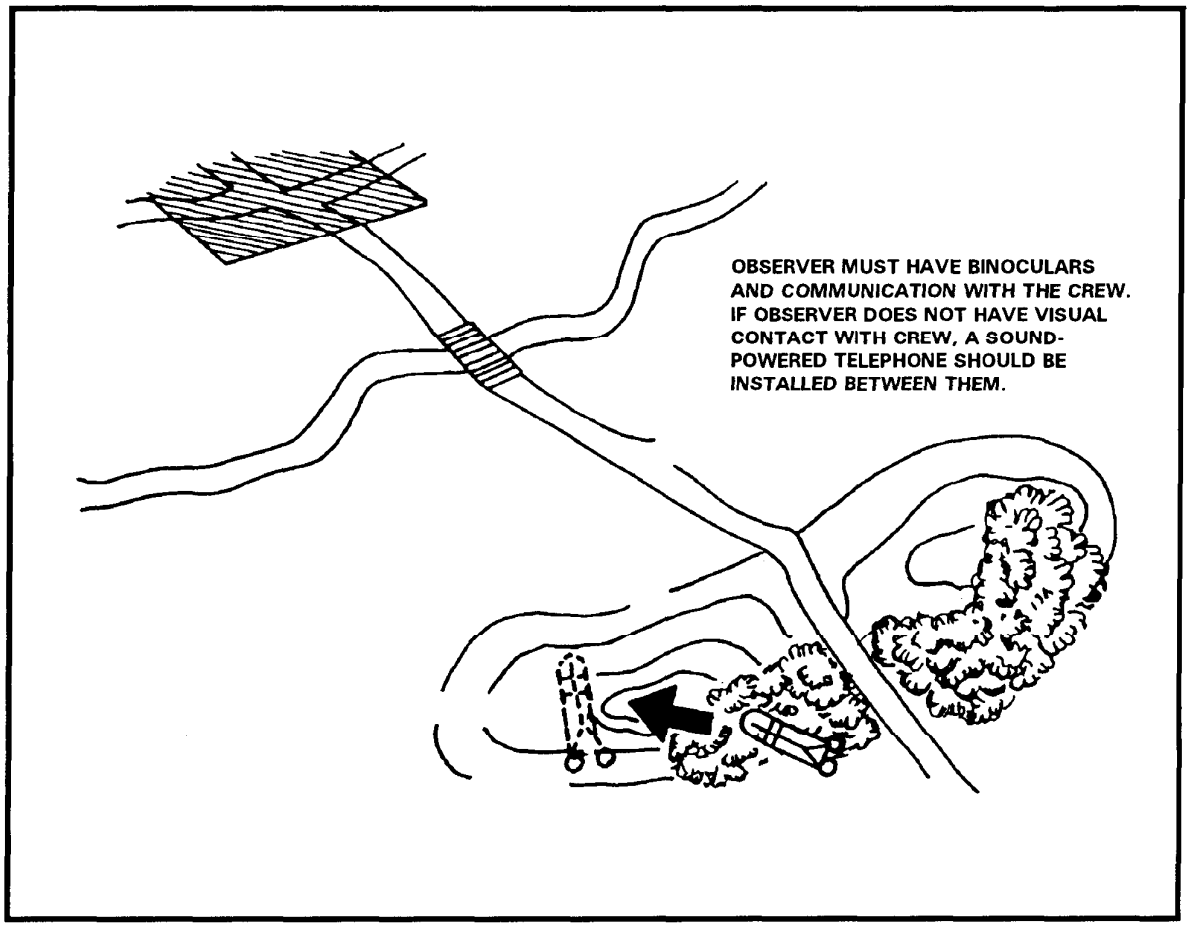


Figure D-3. TOW hide position.

D-3. CAMOUFLAGE NETS

When camouflaging any TOW fighting position, whether mounted or dismounted, the net must be positioned so it does not hang in the backblast area. If any portion of the net is in the backblast area, the net will be damaged and could collapse on top of the launcher when a missile is launched. Also, the net must not interfere with the field of fire.

APPENDIX E

STANDARD RANGE CARD

This appendix describes the various parts of a standard range card. It also provides a detailed discussion of how to complete a range card.

E-1. DESCRIPTION

A range card is a sketch of the terrain a weapon system has been assigned to cover by fire. It contains information that assists in the planning and controlling of fires, the rapid detection and engagement of targets, and the orientation of replacement personnel or units. By using a range card, a gunner can quickly and accurately determine the information he needs to engage targets.

a. A sector of fire is a part of the battlefield within which a gunner is responsible for engaging targets. Sectors of fire are assigned to ensure weapon systems will cover target approaches. Leaders should strive to overlap sectors to cover areas that cannot be engaged by one system. The leader gives a gunner boundaries running between prominent terrain features, or by left and right limits indicated by terrain features or azimuths. If necessary, the leader also assigns a gunner more than one sector of fire, designating one sector as primary and others as secondary.

b. The section/squad leader may also designate anticipated target engagement locations within the sector of fire. Those are recognizable terrain features on or near likely enemy avenues of approach. This information is placed on the range card.

c. Leaders may pick out natural or man-made terrain features that can be used as reference points for locating targets and adjusting direct/indirect fires. Those features are called target reference points (TRPs). TRPs are requested through the mortar or artillery fire support team (FIST) or fire support officer (FSO). If TRPs are in or near the sector of fire, the leader should point them out and tell the gunner their numbers. If he does, the gunner depicts the TRPs on his range card. Normally, a gunner has at least one TRP, but not more than three, in his sector of fire.

d. Natural or man-made terrain features, such as hills, draws, or buildings, may be within the sector(s) of fire that prevent the gunner from firing in that area. The area blocked by these features is called dead space. All dead space in the sector(s) of fire must be determined so leaders can plan other weapon systems or other types of fire to cover the area (for example, mortars, artillery, or mines). Dead space is indicated on the range card.

e. The length of the sector of fire is normally limited by the maximum engagement range of the antiarmor weapon, but it can be less if any natural or man-made terrain features (trees, fences) prevent the gunner from engaging targets at maximum range. Regardless of what affects it, the maximum engagement range is shown on the card as a maximum engagement line. The squad leader uses a map to determine the distance to the maximum engagement line.

f. All TRPs, anticipated target engagement areas, azimuth and distance to a known point, and left and right limits are numbered on the sector sketch and in the data section with corresponding numbers for quick reference.

E-2. PREPARATION PROCEDURES

EXAMPLE OF SECTION/SQUAD LEADER'S BRIEFING

"Our mission is to cover a sector of fire that begins at our present position and goes in the direction of the windmill to the maximum engagement range of 3,750 meters; it extends to the right across the high ground behind the houses, and hill, to the right edge of the orchard and returns here. The enemy should approach from the north and will probably use both Marshall Road and Lewis Road to enter our sector. We must plan on engaging the enemy in this area as soon as he is within range. There are two target reference points within your sector; the road intersection of Marshall Road and Duffell Road is TRP-Charlie One and the road junction of Lewis Road and Duffell Road is TRP-Charlie Two. Use the road junction of Campbell Road and Lewis Road to your left as a reference point to locate your position. The distance from the road j unction is 633 meters on an azimuth of 85 degrees." (See Figure E-1.)

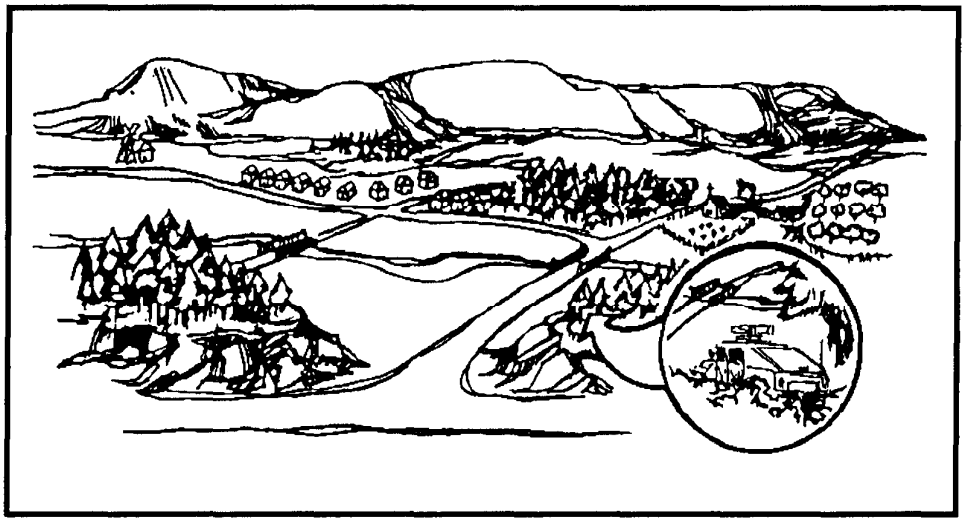


Figure E-1. Section/squad leader's briefing.

After the leader has given the necessary information, the gunner begins preparing DA Form 5517-R (Standard Range Card). If he is assigned alternate and supplementary firing positions, he prepares a range card for them also. The gunner prepares the range card by performing the following steps.

a. Draw a sector sketch of the entire sector. Make the sketch as large as possible, not to exceed the largest circle. For a large area covered by trees or woods, draw only the outline and lable the area; for example, "woods," or "orchard" (Figure E-2).

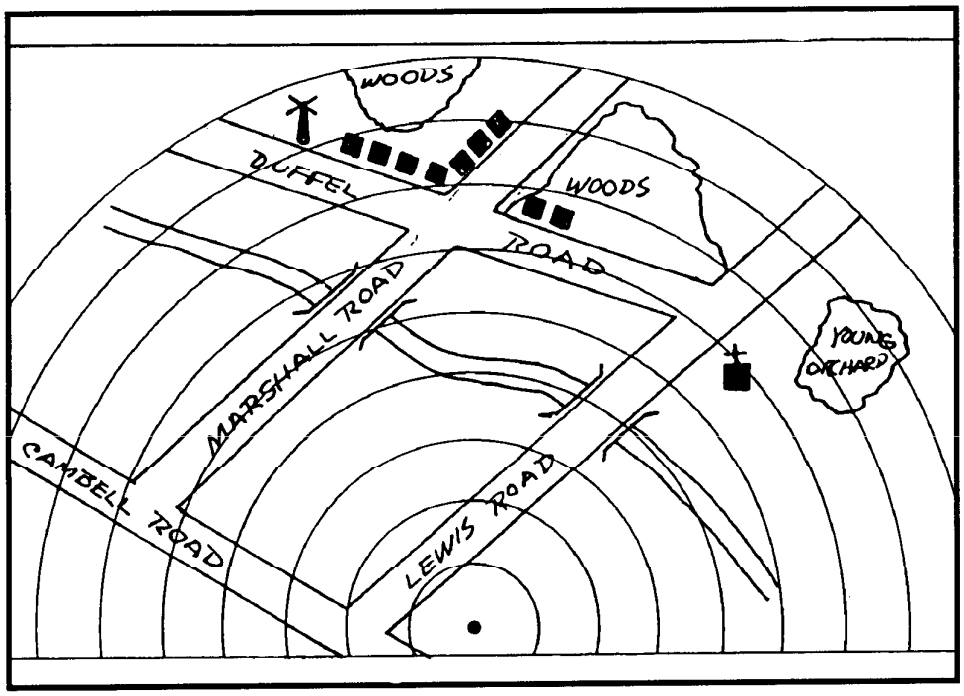


Figure E-2. Sketch of area on range card.

b. Draw lines from the weapon position (indicated by the black dot at lower center of range card) to show the right and left limits. Place a number 1 at the end of the left limit line and draw a circle around the number. Place a number 2 at the end of the right limit line and draw a circle around the number (Figure E-3, page E-4).

NOTE: After drawing left and right limit lines, the weapon symbol can be drawn over the black dot.

c. If there are no limitations, the maximum engagement line is curved and joins the left and right sector of fire boundaries at the maximum engagement range (Figure E-4, page E-4). If there are limitations, the maximum engagement line is drawn in front of the limiting terrain feature.

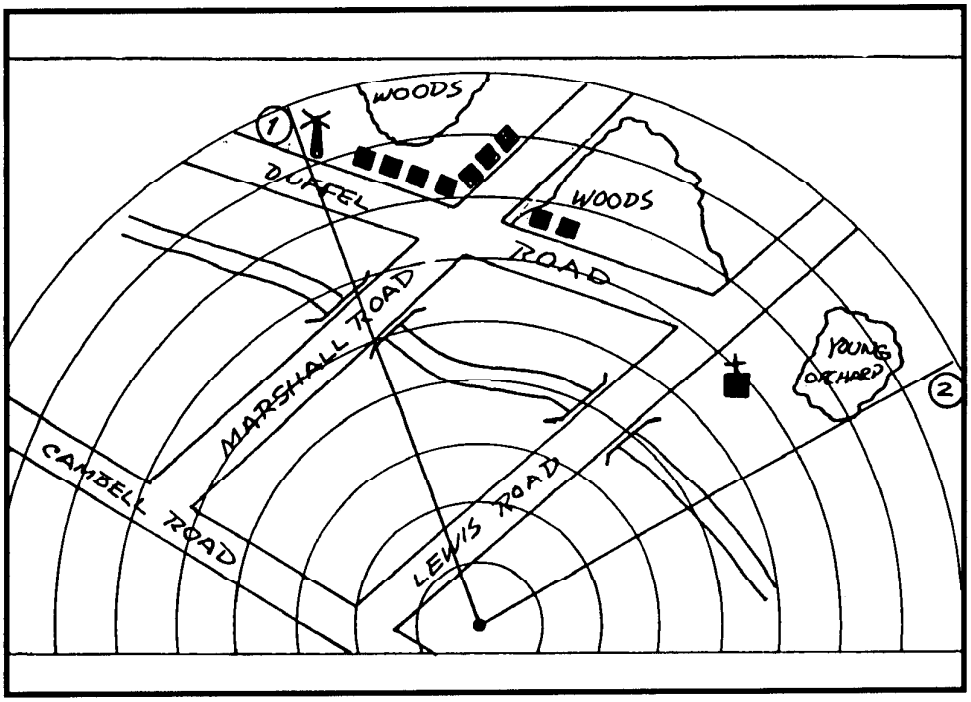


Figure E-3. Labeling sector of fire.

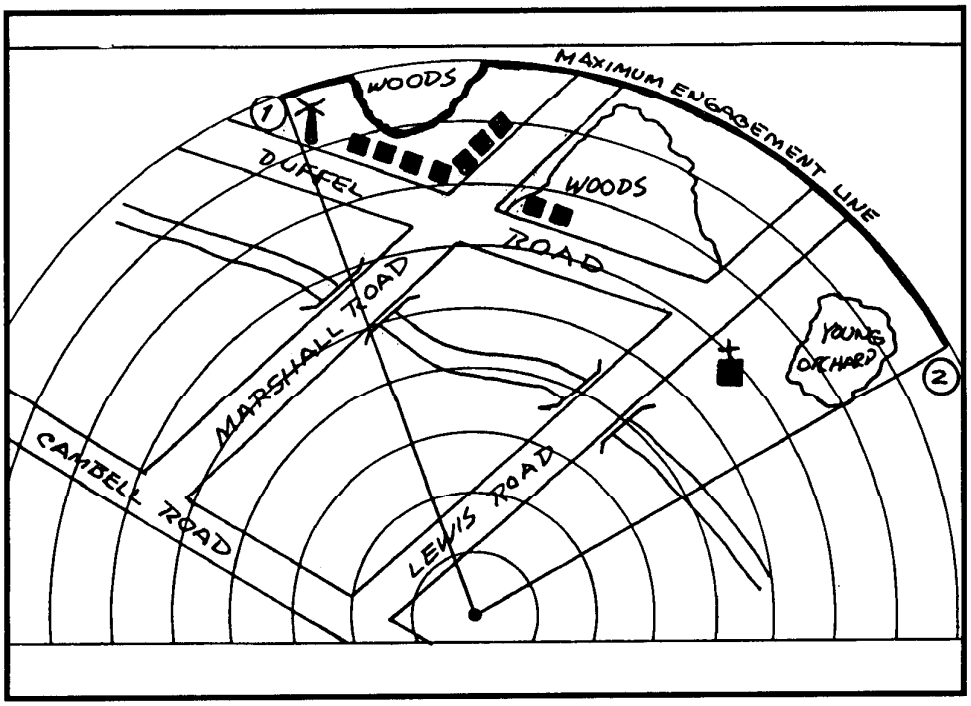


Figure E-4. Placement of maximum engagement line.

d. Number the anticipated target engagement areas (ATEAs) from left to right, starting with number 3. Place a number at the maximum engagement range of the target on the range card and circle the number (Figure E-5, page E-6).

e. Number the TRPs from left to right. Place the number below or next to the TRP on the range card and circle the number (Figure E-6, page E-6).

f. Place diagonal lines, or the words "dead space," where dead space occurs (Figure E-7, page E-7).

g. Use a compass to determine the azimuth from the firing position to the known point. Convert the direction to a back azimuth. Draw a line with multiple arrows from the known point to the firing position. Place a number at the known point and circle the number (Figure E-8, page E-7).

h. Fill in the marginal information at the top of the card.

(1) *Unit description--SQD, PLT, CO.* Never indicate a unit higher than company level.

(2) *Magnetic north.* Orient the range card with the terrain. Place the compass on the range card. Determine the direction of magnetic north arrow and mark it on the card.

i. Fill in the data section at the bottom of the card.

(1) *Position identification.* List either primary, alternate, or supplementary.

(2) *Weapon.* See Figure E-9, page E-8 for weapon symbols.

(3) *Date.* List the day and month.

(4) *Each circle equals _____ meters.* Write the distance between the circles in meters. To determine the distance, count the intervals from the weapon to the maximum engagement line (as determined by the squad leader). Divide the amount of intervals into the range of the maximum engagement line. This will give the distance between circles (Figure E-10, page E-8).

Example: 9 intervals into 3,750 meters = 416 meters between circles.

(5) No. *(number).* Starting with number 1, list the left limit, the right limit, and locations of ATEAs and TRPs shown on the sector.

(6) *Direction/deflection.* Only degrees or the azimuth from the azimuth bevel ring (improved TOW vehicle) is listed. Line through the word that does not describe the information listed.

(7) *Elevation.* This is only used with a ground-mounted machine gun using the traverse and elevation mechanism.

(8) *Range.* Distance in meters from the weapon to the TRP or target engagement area.

(9) *Ammunition.* List the type of ammunition used, if applicable.

(10) *Description.* List the name of the object; for example, road, windmill, church. If the item is a TRP, also list the TRP number.

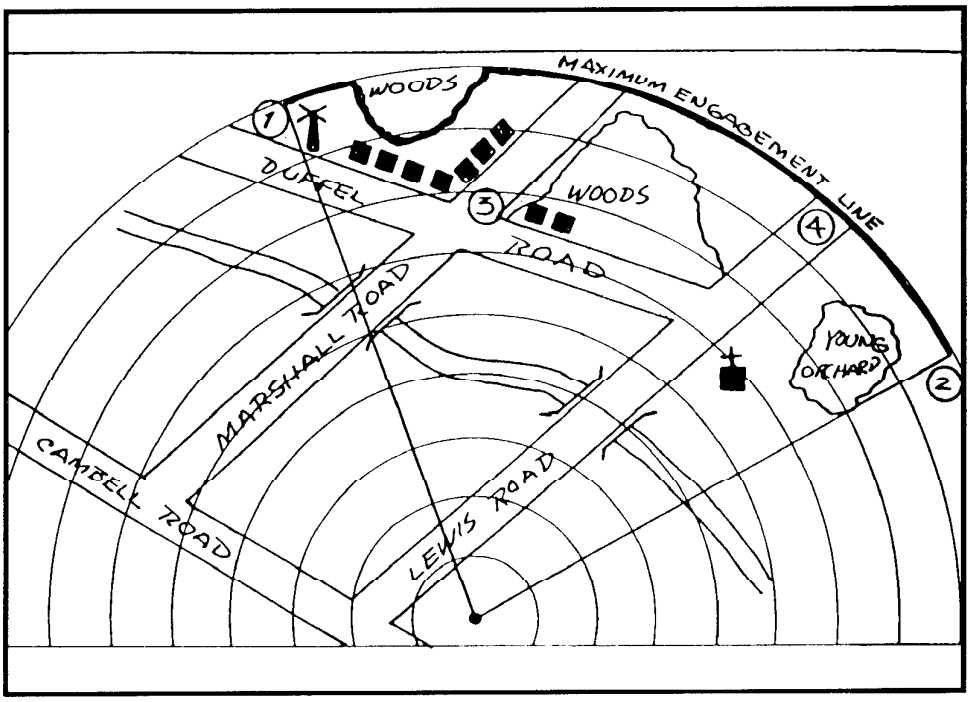


Figure E-5. Numbered target engagement locations.

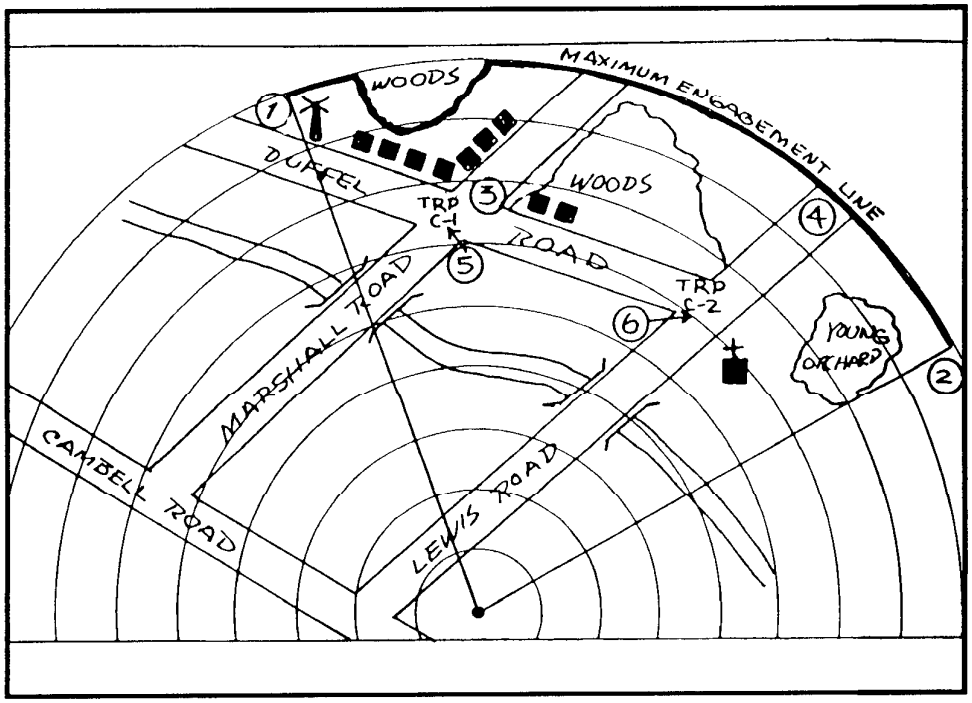


Figure E-6. Target reference points and numbers.

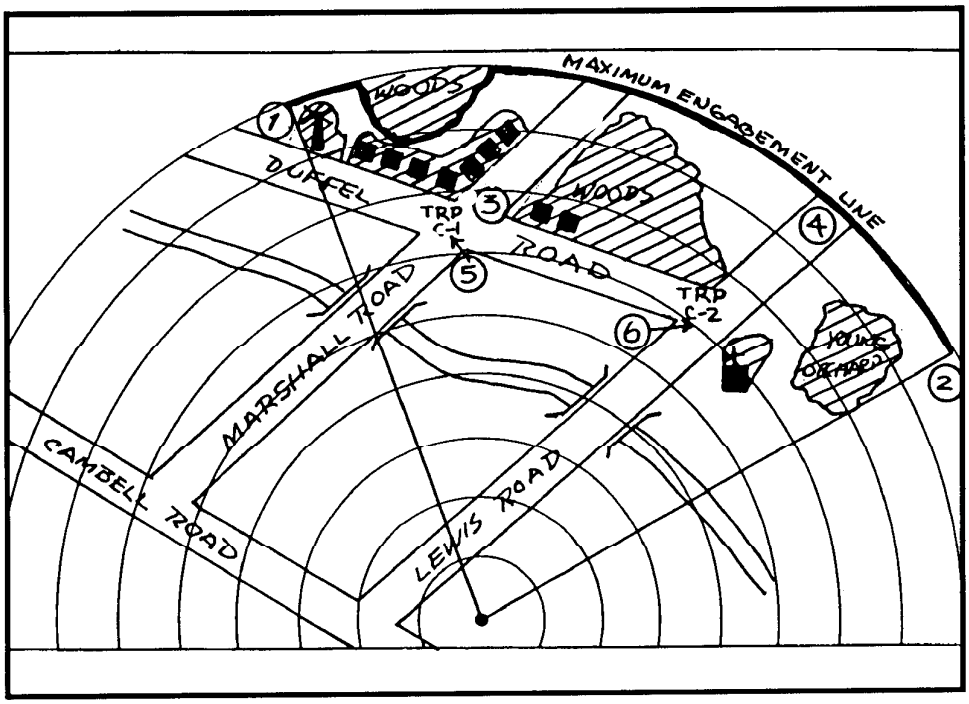


Figure E-7. Dead space indicated.

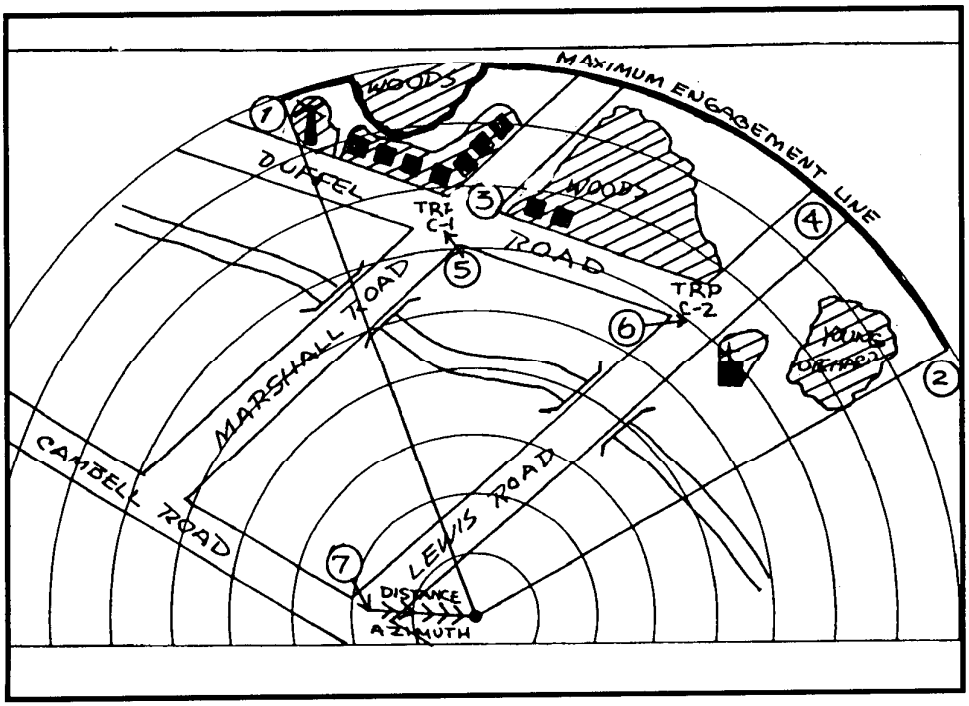


Figure E-8. Placement of distance and azimuth from a known point.

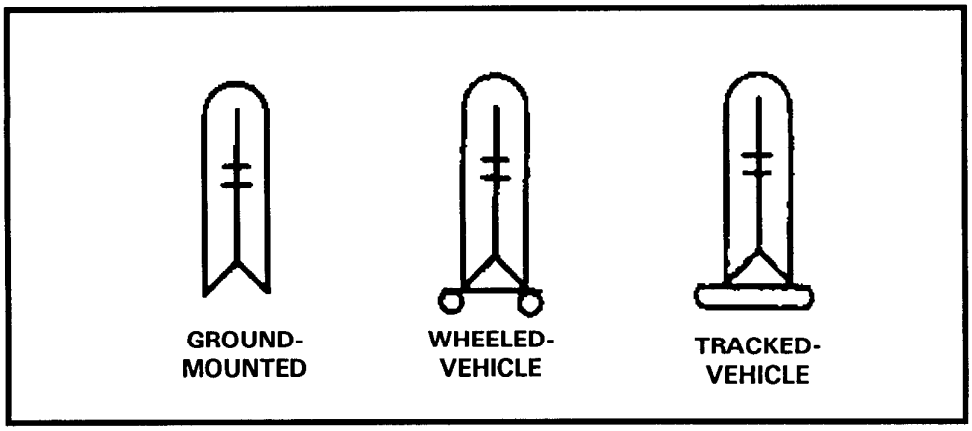


Figure E-9. Weapon symbols.

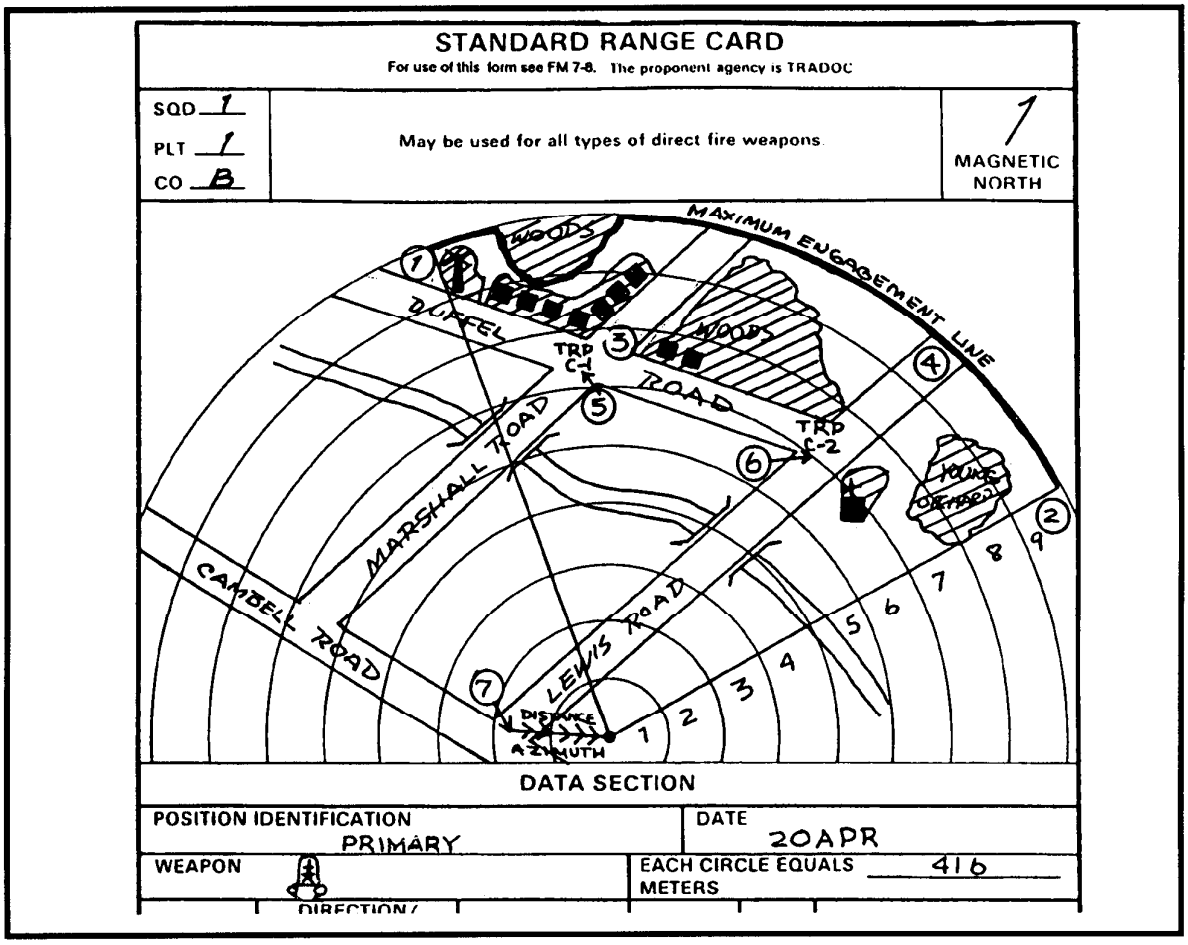


Figure E-10. Determining range interval on range card.

(11) *Remarks.* Enter the weapon's reference point and any additional information not listed in the range card section. If more space in the data section is needed, use the reverse side of the range card.

j. Make two range cards. Keep one at the firing position and give one to the squad or section leader for preparation of fire plans and final coordination of fires. (See Figure E-11 for a completed TOW range card.)

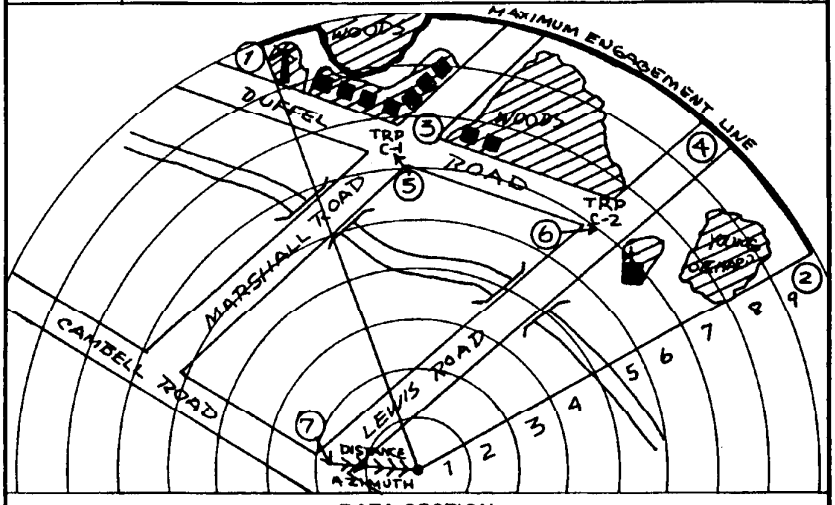
STANDARD RANGE CARD

For use of this form see FM 7-8. The proponent agency is TRADOC

SQD 1
PLT 1
CO B

May be used for all types of direct fire weapons.

7 MAGNETIC NORTH



DATA SECTION

POSITION IDENTIFICATION			DATE		
PRIMARY			20APR		
WEAPON			EACH CIRCLE EQUALS METERS		416
NO.	DIRECTION/ DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
1	346°		2200M		LEFT LIMIT
2	38°		2200M		RIGHT LIMIT
3	315°		2200M		ATEA
4	42°		2200M		ATEA
5	350°		1555M		TRP C-1 ROAD JUNCTION DUFFEL & MARSHALL
6	18°		1555M		TRP C-2 ROAD JUNCTION DUFFEL & LEWIS

REMARKS:
7 DISTANCE AND AZIMUTH FROM A KNOWN POINT

DA FORM 5517-R, FEB 86

Figure E-11. Example of a completed DA Form 5517-R, Standard Range Card for TOW.

E3. EXPEDIENT RANGE CARD

In combat, a DA Form 5517-R may not be available. The gunner must then draw a range card on anything available (Figure E-12). Preparation of the expedient range card follows the same procedures provided for the standard range card, but the weapon symbol must be used to indicate the location of the weapon position. The range card must include the following eight items:

- Weapon symbol.
- Sector of fire.
- Maximum engagement line.
- Range and azimuth to TRP/ATEA.
- Dead space.
- Distance and azimuth from a known point.
- Magnetic north arrow.
- Data section.

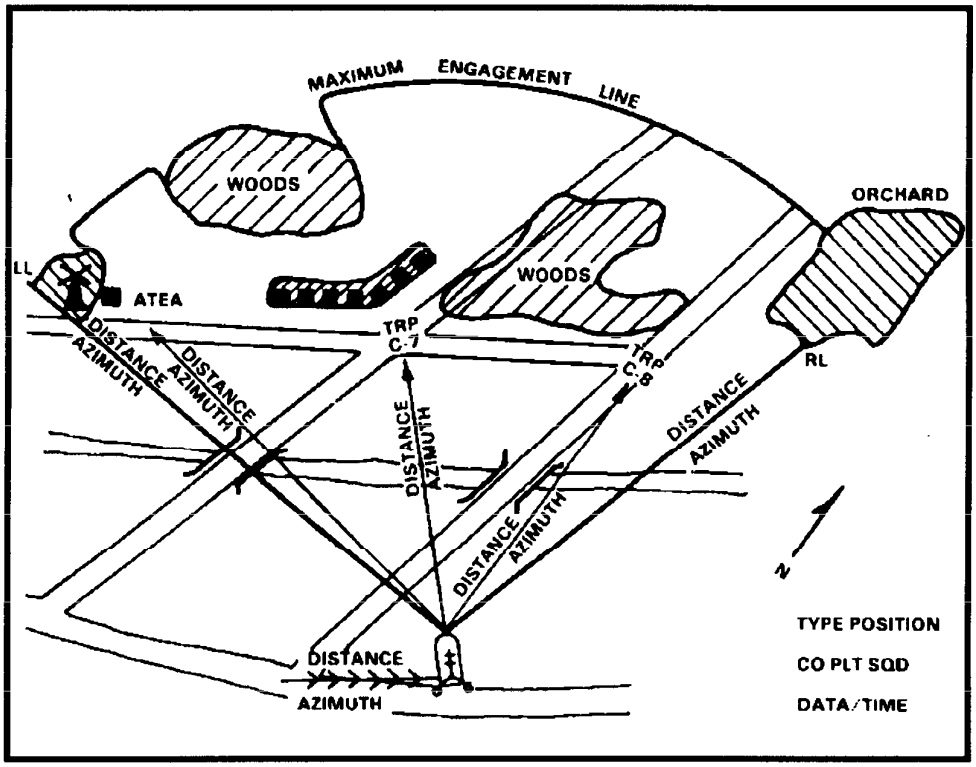


Figure E-12. Expedient range card.

E-4. PREPARATION OF AN ITV FIRING POSITION FOR USE AT NIGHT

After an ITV crew makes a range card, they mark the position of the ITV. After dark, the same ITV or an ITV from another unit can move into the same position and use the prepared range card.

a. **Flat Terrain to the Front.**

(1) When flat terrain is to the front (Figure E-13)—

(a) Complete the range card.

(b) Put out two aiming stakes with red-filtered flashlights pointed toward the ITV. Center the closest aiming stake on the driver's position, touching the hull and high enough for the driver to see.

NOTE: At this time, the hull should be marked with tape or chalk where the stake touches the hull for later use.

(c) Place the other stake 20 to 25 meters in front of the ITV in line with the first stake as seen by the driver.

(d) The gunner places the cross hair of his sight on the far aiming stake and records in the remarks section of the range card the deflection determined by the pointer on the degree scale.

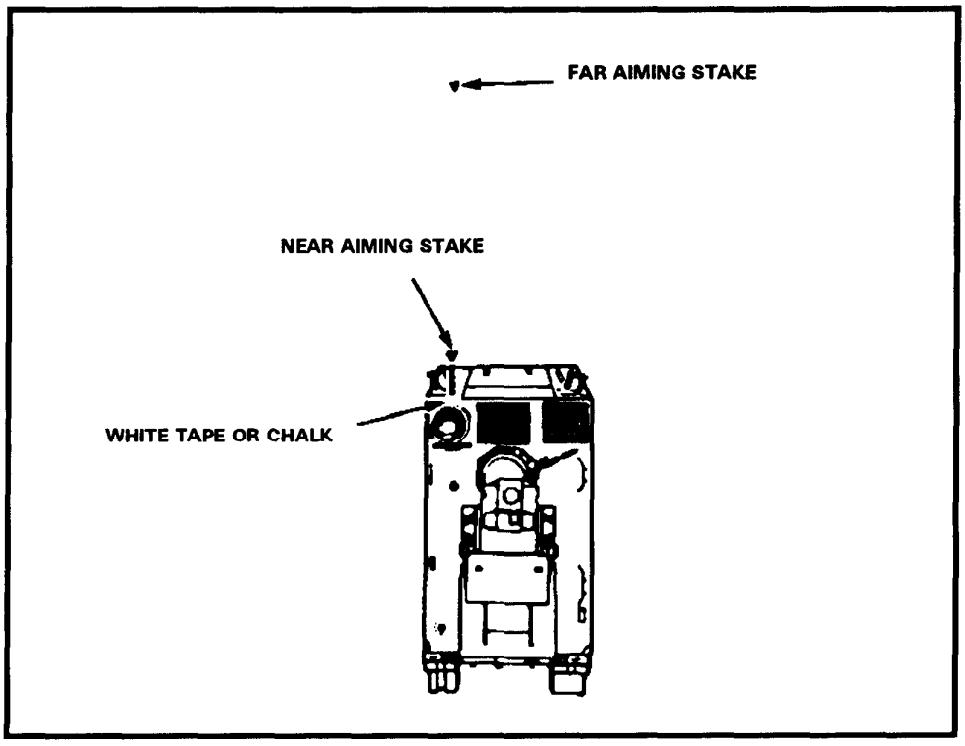


Figure E-13. Marking the ITV position (flat terrain)

(2) To move into a marked position that has flat terrain to the front—

(a) Turn on the flashlights on the aiming stakes.

(b) Line up the ITV with the two lighted stakes and move the ITV until the tape (or chalk marks) and both stakes are in line and the hull is touching the stake.

(c) Place the cross hair of the gunner's sight on the far stake. The deflection reading for the far stake should be the same as the one written on the range card. If it is not, the driver can reposition the vehicle slightly by using pivot steer.

(3) The ITV is now ready to fire from the range card.

b. **Sloping Terrain to the Front.**

(1) When the terrain to the front of the ITV falls away sharply (such as a cliff or high hill) (Figure E-14)—

(a) Complete the range card.

(b) Put in two ground stakes on either the right or left side of the ITV, front and rear, at the outside edge of the track where it leaves the ground.

(c) Put the first (far) aiming stake 30 to 50 meters from the ITV at a deflection more than 6 degrees from the direct front or rear of the ITV (any deflection reading from 006 degrees to 174 degrees, and from 186 degrees to 345 degrees).

(d) Traverse the turret to lineup the cross hair of the gunner's sight with the far aiming stike.

(e) Put out the second (near) aiming stake halfway between the ITV and the far stake and on line with them.

(f) Record, on the range card, the deflection determined by the pointer on the degree scale.

(2) To move into a marked position that has sloping terrain to the front—

(a) Stretch white tape between the two ground stakes to help position the ITV track.

(b) Move the turret to the deflection reading from the range card.

(c) Move the ITV up next to the white tape.

(d) Stop the ITV when the gunner sees the far aiming stake in line with the near aiming stake. (This may require the gunner to talk the driver into the position.)

(e) The IN is now ready to fire from the range card.

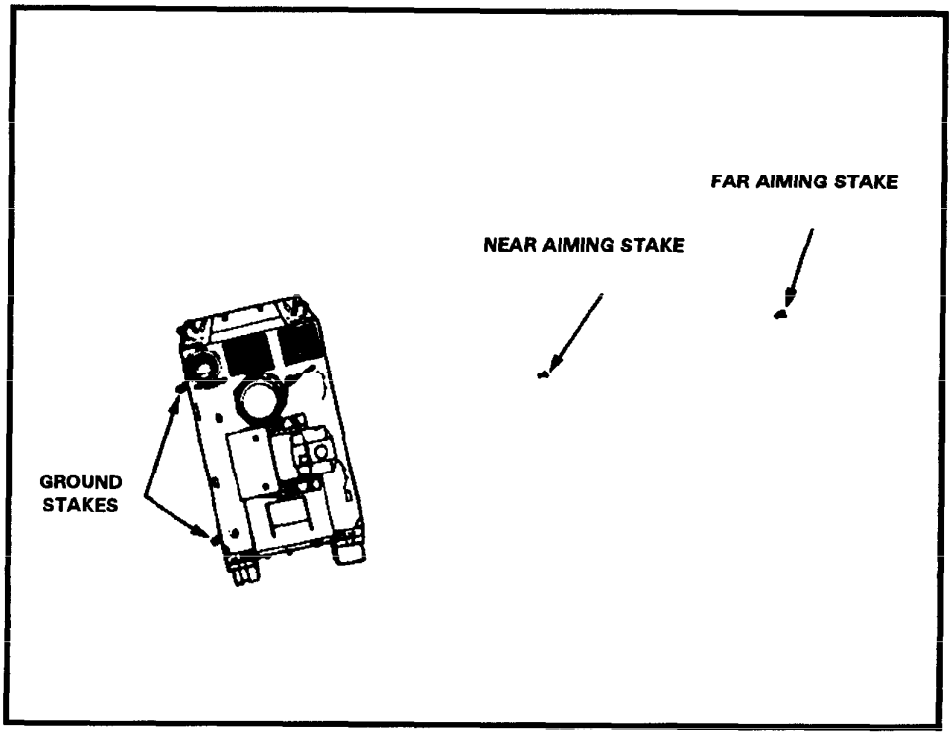


Figure E-14. Marking the ITV position (sloping terrain).

APPENDIX F

THREAT COUNTERPART SYSTEMS

Recent years have seen rapid and revolutionary changes in the field of armor and antiarmor warfare. The most radical changes have been in the design of armor itself, the fire control systems (especially in thermal sights), the warheads and kill mechanisms of the missiles, and the various countermeasures that have been developed. The rate of change is increasing, and antiarmor crewmen and trainers must make a continual effort to keep abreast of recent developments. What was true one year ago, or even two years ago, is not necessarily true today. Leaders who take their men into battle and make decisions based on outmoded information and assumptions are dooming those men to failure and death.

F-1. THREAT ARMORED VEHICLES

Armored vehicle identification in the past was a simple matter of distinguishing between vehicles manufactured by Warsaw Pact nations and those manufactured by NATO nations. Even then, many soldiers had difficulty distinguishing between vehicles on a simple "friend or foe" basis. Changes in international relations have made it less likely that we will meet the Warsaw Pact in battle, but more likely that we will meet a third world nation's troops. From the standpoint of vehicle identification, this greatly complicates the problem. Most third world nations do not manufacture their own vehicles, but buy them from other countries. As a result, many of them have vehicles from nearly every manufacturing nation in the world in their inventories. Twenty nations in the world today have more than 500 main battle tanks each. Two possible examples of many illustrate this point (Table F-1, page F-2).

a. The task of armored vehicle identification has become much more complex. The antiarmor crewman must now become familiar with a much wider variety of vehicles than before. He must also be well informed about what vehicles a potential enemy possesses.

b. This manual is not a complete FM on vehicle identification. However, the antiarmor crewman should be readily familiar with a few of the most recently fielded vehicles and the particular problems and capabilities they present.

COUNTRY	TYPE	ORIGIN
Iran	Type 59	China
	Type 69	China
	Chieftain	United Kingdom
	M48A5	USA
	M60A1	USA
	T62	Russia
	T72	Russia
	EE-9 Cascavel	Brazil
	M113	USA
Iraq	Type 59	China
	AMX-30	France
	Chieftain	United Kingdom
	T62	Russia
	T72	Russia
	EE-11 Urutu	Brazil
	Walid	Egypt
	MOWAG Roland	Switzerland
	M113A1	USA

Table F-1. Tank types and places of origin.

(1) *BMP-2* (Figure F-l). The BMP-2 is similar to the BMP-1, but with a major armament change from the 73-mm smoothbore of the BMP-1 to a 30-mm dual-purpose automatic cannon. The 30-mm gun has an effective range of from 2,000 to 3,000 meters, depending on the type of ammunition used, and 3,000 meters against subsonic aircraft and helicopters. Some BMP-2s have been seen with additional panels of applique armor mounted on the turret.

(2) *T-64B* (Figure F-2). The T-64B is similar in appearance to the T-64/64A. It has full length track skirts, only 8 smoke projectors, and the optic on the left side of the turret is twice the size of that on the T-64A. Significant differences are that it has a laser range finder, sometimes mounts reactive armor, has applique armor on the turret roof and sides and part of the hull roof, and fires the AT-8 Songster ATGM through the gun barrel.

(3) *T-72M1* (Figure F-3). The T-72M1 is an improved version of the basic T-72. Visual differences include full track skirts, smoke grenade launchers, and no right-hand optic. Significant differences include a probable laser range finder, thicker upper glacis, thicker frontal turret armor, applique armor on the turret roof, and provisions for mounting reactive armor. Overall,

its offensive capabilities are similar to the basic T-72, but it is much better protected. This tank has been nicknamed the "Super Dolly Parton" in the west.

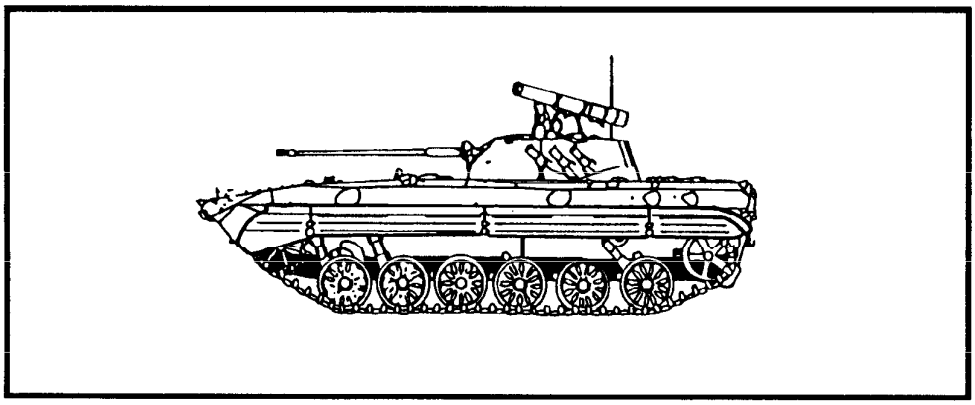


Figure F-1. BMP-2.

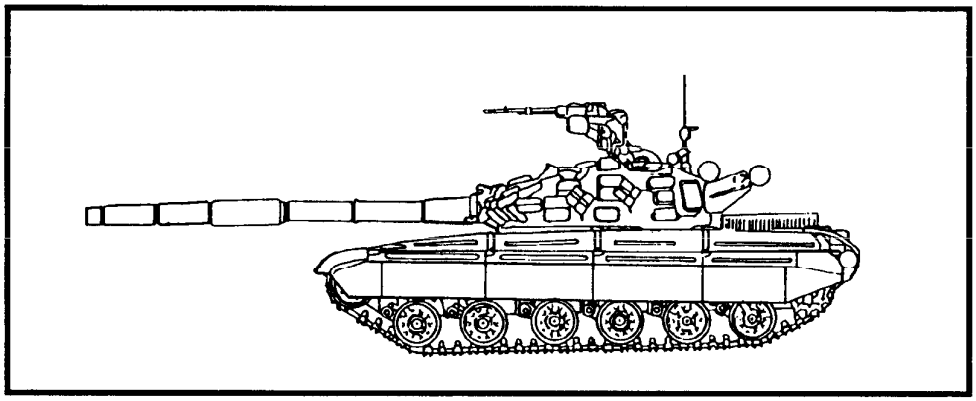


Figure F-2. T-64B.

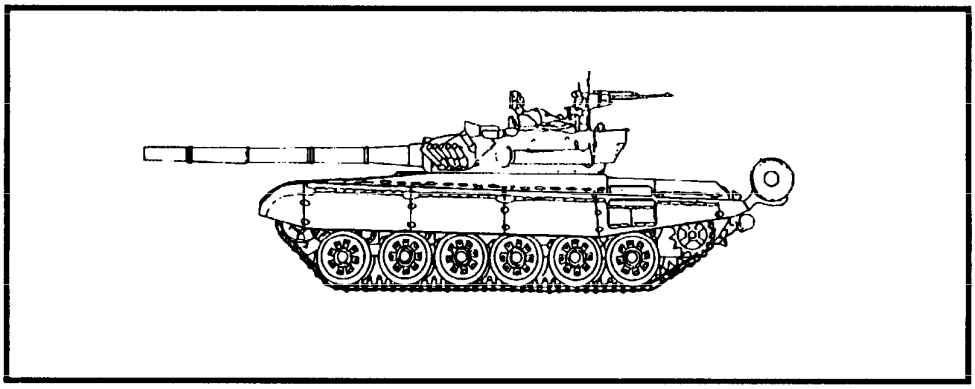


Figure F-3. T-72M1.

(4) *T-80* (Figure F-4). The most recent series-produced Russian tank, the T-80 has some features of both the T-64 and T-72, and other features unique to itself. Visual keys are rubber-tired road wheels, a self-entrenching blade on the lower glacis, a large left-hand optic, and smoke grenade launchers on the rear of the turret sides. Significant differences are the ability to fire the AT-8 Songster through the gun barrel (like the T-64B), improved mobility through a 1,000 horsepower turbine engine, a probable laser range finder, and probable enhanced armor on the glacis and turret (an upper glacis of steel layers enclosing fiberglass layers and a cast steel turret enclosing nonmetallic materials). In general, the offensive capabilities of the T-80 are similar to the T-64B, but it is faster and better protected.

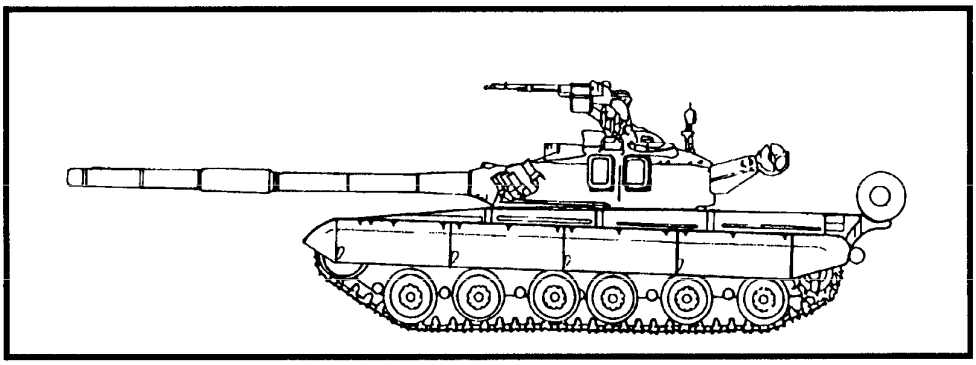


Figure F-4. T-80.

F-2. THREAT INFANTRY ANTIARMOR WEAPONS

The principal threat infantry antiarmor weapons areas follows:

a. **AT-2 Swatter** (Figure F-5). Three types: A, B, and C.
   Minimum range — 500 meters (A, B), Unknown (C).
   Maximum range — 2,500 meters (A), 3,500 meters (B), 4,000 meters (C).
   Warhead — HEAT.
   Armor pen — 500+ millimeters.
   Guidance — MCLOS (A, B), SACLOS (C).
   Command — Radio.
   Platforms — BRDM, Mi-8, Mi-24.

b. **AT-3 Sagger** (Figure F-6).
   Minimum range — 500 meters.
   Maximum range — 3,000 meters.
   Warhead — HEAT.
   Armor pen — 400+ millimeters.
   Guidance — MCLOS.
   Command — Wire.
   Platforms — Manpack, BRDM, Mi-2, Mi-8TB.

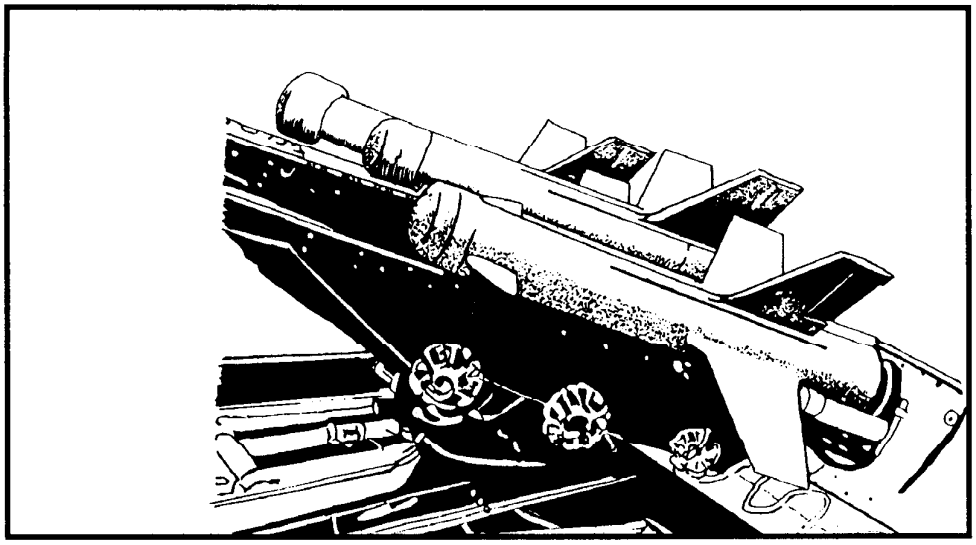


Figure F-5. AT-2 Swatter.

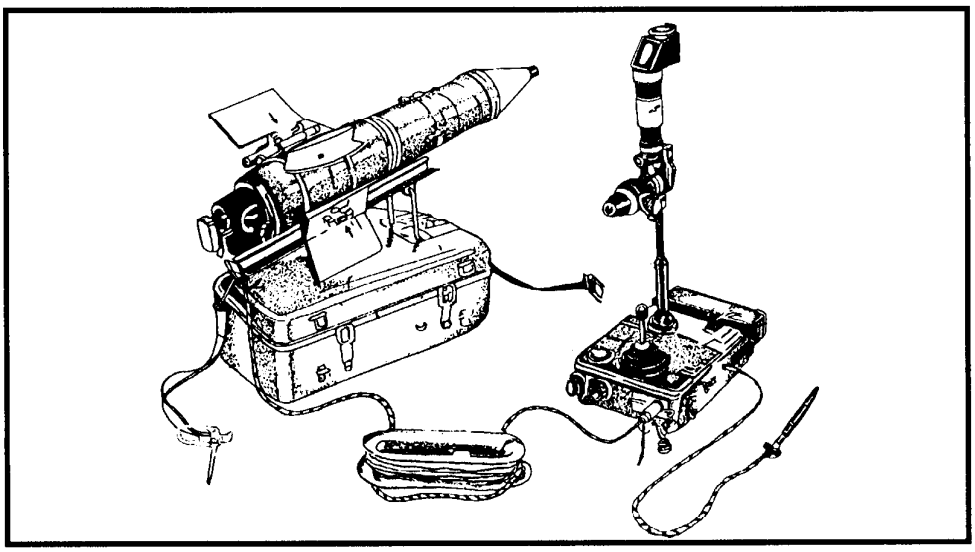


Figure F-6. AT-3 Sagger/manpack.

c. **AT-4 Spigot** (Figure F-7, page F-6).
Minimum range — 70 meters.
Maximum range — 2,000 meters.
Warhead — HEAT.
Armor pen — 500 to 600 millimeters.
Guidance — SACLOS.
Command — Wire.
Platforms — Manpack, BMP, BMD.

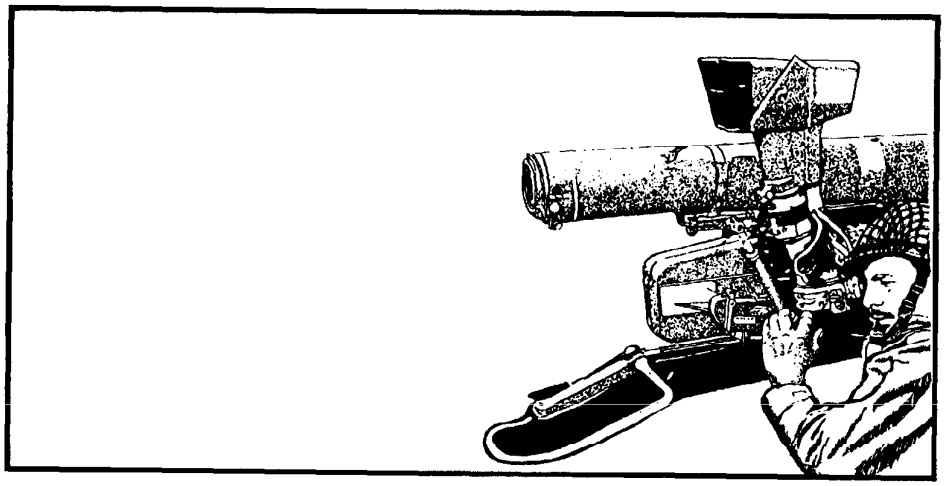


Figure F-7 AT-4 Spigot.

d. **AT-5 Spandrel** (Figure F-8).
Minimum range — 100 meters.
Maximum range — 4,000 meters.
Warhead — HEAT.
Armor pen — 500 to 600 millimeters.
Guidance — SACLOS.
Command — Wire.
Platforms — BRDM, BMP.

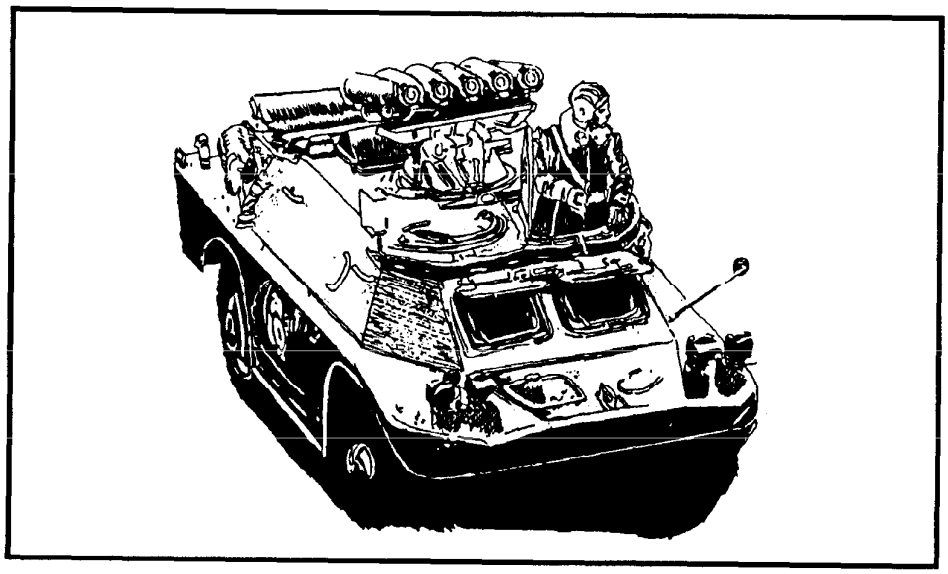


Figure F-8. AT-5 Spandrel.

e. **AT-6 Spiral** (Figure F-9).
Minimum range — 500 meters.
Maximum range — 5,000 meters.
Warhead — HEAT.
Armor pen — 600 to 700 millimeters.
Guidance — SACLOS.
Command — Radio.
Platforms — Mi-24.



Figure F-9. AT-6 Spiral.

f. **AT-7 Saxhorn** (Figure F-10, page F-8).
Minimum range — Unknown.
Maximum range — 1,000 meters.
Warhead — HEAT.
Armor pen — Unknown.
Guidance — SACLOS.
Command — Wire.
Platforms — Manpack.

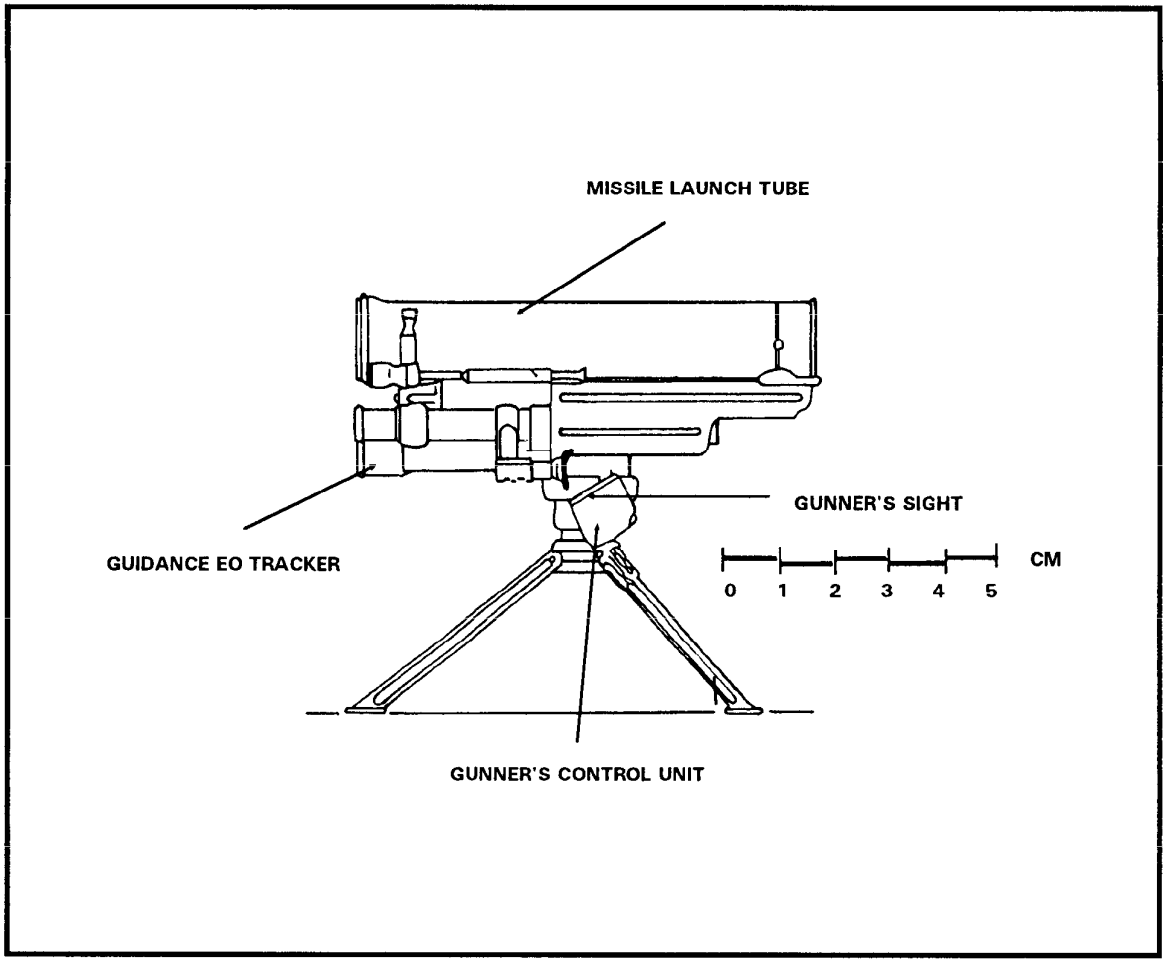


Figure F-10. AT-7 Saxhorn.

g. AT-8 Songster (Figure F-11). This missile is one of the newest ATGMs in the Russian inventory and represents a particular threat to TOW crews, especially ITVs. The missile is fired through the main gun tube of a T-64B or T-80, but uses a boost/sustain motor to propel it to the target. The missile has a 4,000-meter range and is supersonic, giving it a short flight time. Its principal role is antitank, but it can also be used against helicopters.

Minimum range — Unknown.
Maximum range — 4,000 meters.
Warhead — HEAT.
Armor pen — 700 to 800 millimeters.
Guidance — SACLOS.
Command — Radio.
Platforms — T-64B, T-80.

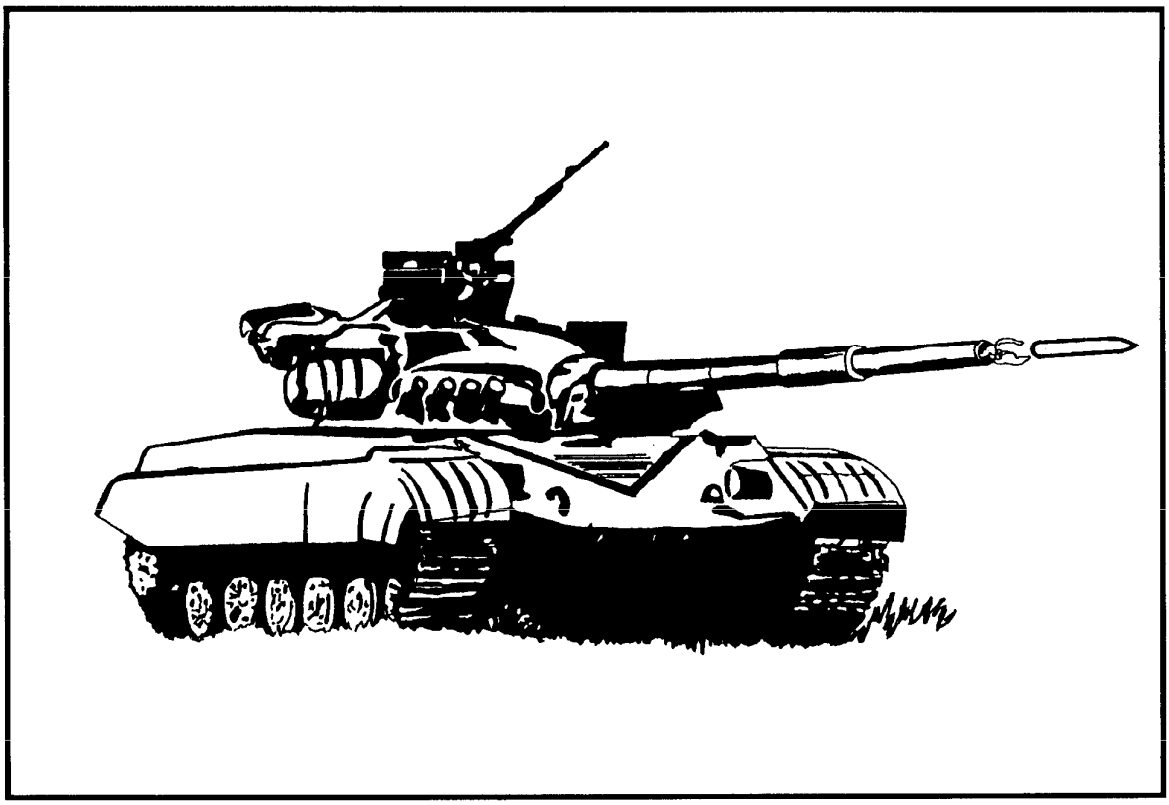


Figure F-11. AT-8 Songster.

F-3. THREAT INFANTRY ARMOR COUNTERMEASURES

For nearly 20 years the use of large numbers of ATGMs in infantry formations has been a keystone of U.S. Army antitank defenses. In particular, the deployment of thick belts of ATGMs has been the foundation of NATO's plans for the defense of Europe against the Warsaw Pact nations. The Russian Army has developed a number of potential countermeasures. The use of these countermeasures is not restricted to Warsaw Pact troops. They may be employed by any enemy we may face.

a. **Reconnaissance.** A high priority for Russian reconnaissance elements is to locate enemy ATGM sites before the main body enters their kill zone. Methods of reconnaissance can include aircraft, drones, signals intelligence, and conventional ground reconnaissance elements. Russian commanders expect to get 75 to 95 percent of their intelligence before the attack. Leaders must learn to emphasize careful camouflage and concealment and to conduct effective counterreconnaissance operations. Lessons learned at NTC show that the commander who loses the counterreconnaissance phase of the battle loses the battle. For Russian reconnaissance to be effective, the reconnaissance elements must spot your weapon systems and survive to report their location.

b. **Artillery.** Once Russian reconnaissance elements have spotted ATGM positions, the weapon of choice to destroy them is artillery. Since ATGMs area high-priority target for them, these positions will be subjected to intense barrages. The TOW is not designed to withstand such barrages. The best way to survive is to remain undetected and to avoid terrain that is likely to attract heavy artillery fire. Positions should be as well protected against artillery as possible. Move, if possible, when positions come under artillery fire.

c. **Helicopters.** Attack helicopters routinely follow artillery preparation. Again, ATGMs are high-priority targets. Russian attack helicopters will engage surviving ATGM positions with 57-mm rockets or its own ATGMs. Depending on the ATGM the helicopter is equipped with, it may be able to engage at up to 5,000 meters.

d. **Direct Fire.** Over half of the ammunition on a Russian tank is HE-FRAG. This ammunition is expressly designed to suppress ATGMs and fighting positions. Also, the T64B and T80 carry the AT-8 Songster, a supersonic missile with a 4,000-meter range. The primary role of this missile is believed to be destruction of antiarmor systems such as the Bradley, ITV, and attack helicopters.

e. **AGS-17 Automatic Grenade Launcher.** This weapon is similar to the U.S. MK 19, but fires a 30-mm round. It has a maximum effective range of 1,730 meters. This is less than maximum range for a TOW, but in many situations, the AGS-17 will be able to get close enough to engage a TOW. This weapon is very effective against a tripod- or HMMWV-mounted TOW, and is somewhat effective against lightly armored vehicles such as the Bradley and ITV.

f. **Lasers.** Most armies use laser range finders and target designators. Many of these are quite powerful and can cause temporary or permanent damage to a gunner's eyes when he is using direct-view magnifying optics. Some of these devices can even damage the sights themselves. Thermal sights are less vulnerable to lasers.

g. **Battlefield Obscurants.** The AN/TAS-4 series of thermal sights is able to penetrate many kinds of battlefield obscurants, but not all. Bispectral smoke and battlefield dust, among others, are largely opaque to thermal sights if they are thick enough. In addition, when using a basic or ITOW, the target may be seen, but the system is unable to guide the missile through the obscurants. Soviet doctrine relies heavily on extensive use of battlefield obscurants to suppress enemy ATGM positions.

h. **Combined Arms.** Soviet doctrine prefers to fight mounted, but if they run into strong ATGM defenses, they will dismount their infantry and advance at foot pace, with the infantry engaging personnel and ATGMs. The tanks will advance first, at about 6 kph, and the infantry will closely follow the tanks. The IFVs will follow the infantry and provide supporting fire.

F-4. INFANTRY ANTITARMOR COUNTER-COUNTERMEASURES

United States forces must have counter-countermeasures against reconnaissance, artillery, helicopters, direct free, grenadelaunchers, lasers, obscurants, and combined arms.

a. **Reconnaissance.** The best counter to reconnaissance elements is effective counterreconnaissance operations by defending forces. Equally important is effective and rigidly enforced camouflage and concealment.

b. **Artillery.** The best defense against artillery is not to be discovered by the enemy's reconnaissance elements. This may not be possible, so positions must be as well prepared against heavy artillery fire as time permits. When all else fails, it may be necessary to move positions. Secondary and alternate positions should be preselected for this eventuality.

c. **Helicopters.** The best defense against helicopters is not to be spotted in the first place. TOW positions should only engage helicopters in self-defense when they are already spotted and under attack. Helicopters not engaging TOW positions should be left to regular ADA assets. (See Chapter 6 for more detailed information.)

d. **Direct Fire.** TOW squads must maximize their chances of winning engagements with tanks and IFVs by choosing positions with good cover and concealment, striving for flank shots, striving for surprise, exercising good fire control, and carefully prioritizing their targets, to ensure that targets posing the most immediate threat are engaged first. This is, in fact, precisely the type of combat the TOW was intended to engage in.

e. **AGS-17 Automatic Grenade Launcher.** TOW squads must try to choose positions where it is difficult for enemy AGS-17 teams to get in range without being detected and engaged. Where the terrain is too close to permit this, TOW squads must emplace well behind friendly infantry, and let the infantry engage the AGS-17. The MK 19 or .50 caliber machine gun, if available, should be used to engage the AGS-17.

f. **Lasers.** Protective lenses should be installed on optical devices. The protective covers or doors on these devices should be closed when protective lenses are not available. Soldiers should wear laser-proof goggles at all times. (Soldiers are vulnerable to eye damage even when not looking through sighting devices.)

g. **Battlefield Obscurants.** TOW crews should train under realistic battlefield obscurant conditions whenever possible, so that they better understand the limitations of their thermal sights. Alternate positions that view the battlefield from a different angle and that may afford a better view should be identified and prepared. The battlefield should be carefully examined and marked to give gunners a better perspective of where things are when the field becomes partially or largely obscured. Soviet smokescreens normally end about 1,000 meters from enemy positions, so gunners should be prepared to engage targets immediately once they emerge from the smokescreen.

h. **Combined Arms.** TOW positions are ill-equipped to defend themselves against dismounted infantry. To survive a properly executed combined arms attack, TOW squads should be properly integrated into a combined arms defense, overmatching dug-in infantry, IFVs, and tanks. The TOW was never intended as a stand-alone weapon system, and leaders who attempt to employ it as such guarantee their destruction.

F-5. DIRECTED-ENERGY WEAPONS

Directed-energy weapons include lasers, microwave radiation emitters, and particle beam generators. By far the most likely type that ground troops will see in combat is the laser. This can take the form of a powerful laser range finder used as a weapon or as a specially designed laser weapon. The common perception of the laser is as a science fiction weapon that can vaporize a tank with a single blast. This is far from the truth. In fact, the laser beam will normally be invisible and is generally able only to temporarily blind a soldier who is hit in the eyes with it. If the soldier is using an optical sight of some kind, the effect is magnified. More powerful lasers may cause permanent blindness, but these are rare. Some lasers are also powerful enough to damage the lenses of optical sights or the electronics of electro-optical devices (generally thermal sights and image intensifiers). (For means of defense, see paragraph F-4 of this appendix. See FM 7-91, Appendix F for a more detailed discussion.)

F-6. IMPROVED ARMOR TECHNOLOGY

In the past decade, there has been a revolution in armor technology. Research and new developments have come from Europe, the United States, the USSR, and Israel. These improvements are continuing worldwide, and the antiarmor crewman must keep up with them. These improvements are also becoming much more common in third world armies, so the antiarmor crewman must expect to meet them wherever he goes. In addition, many older tanks and other AFVs are being retrofitted with improved armor protection, so it is not just the newer vehicles we need be concerned with. These advanced armor configurations improve the vehicles' survivability against all weapons, but for the most part they are specifically designed to protect against HEAT warheads. This is a complex technical subject, and growing more so every year, but essentially these improved types of armor fall into four categories.

a. **Reactive Armor.** Originally fielded by the Israeli Army, reactive armor appeared shortly after on Soviet tanks. Reactive armor comes in several varieties, but the principle is essentially the same on all. The armor consists of blocks of explosives sandwiched between two metal plates and bolted on the outside of the vehicle. Small arms and artillery shrapnel will not set off the blocks. However, when a HEAT round strikes the block, the explosive ignites

and blows outwards. The blast and the moving steel plates disperse and deflect the jet of the HEAT warhead, dramatically reducing its ability to penetrate armor. Many countries are now fielding different versions of reactive armor. One of its advantages is that it can easily be retrofitted onto older vehicles.

b. **Laminated Armor.** Laminated armor was developed in the West, most specifically by England, the United States, and West Germany. It consists of flat layers of steel armor plate with layers of ceramics, fiberglass, or other nonmetallic materials in between. This armor is highly effective against all types of weapons, but is difficult and expensive to manufacture. Vehicles with laminated armor are characterized by flat, slab sides, such as on the M1 and Leopard II.

c. **Composite Armor.** Composite armor consists of a nonmetallic core (usually some kind of ceramic) around which the rest of the steel of the hull or, more commonly, the turret, is molded. This is much more effective than conventional steel armor against all types of weapons, but less so than laminated armor. However, it is less difficult and expensive to manufacture. Hulls made of composite armor do not have to be slab sided, like those made of laminated armor.

d. **Applique Armor.** Applique armor is essentially extra plates mounted or welded on top of the hull or turret of a vehicle. They can be made of any material, but are frequently made of ceramic or laminated materials. Like reactive armor, applique armor is an easy and cost-effective way of improving the protection of older vehicles.

F-7. COUNTERMEASURES TO IMPROVED ARMOR TECHNOLOGY

The long-term answer to improved armor technology is primarily a technical issue: improving the kill mechanisms of our missiles to defeat the improved armor.

a. Two responses to improved armor have already been fielded: the TOW 2A and the TOW 2B. Other improved kill mechanisms will be fielded as time passes.

(1) The TOW 2A has an explosive charge in the tip of the extensible probe to prematurely detonate reactive armor and minimize its effect on the penetration abilities of the missile.

(2) The TOW 2B employs a new kill mechanism. It flies about 6 or 7 feet above the line of sight and detonates above the hull or turret of the tank. When it detonates, it creates two explosively formed penetrators (EFPs), which are metallic slugs traveling at very high speeds. These EFPs strike the top of the vehicle where the armor is thinnest and there are fewer reactive armor plates.

b. TOW crews can expect to be issued a mix of TOW missile types on the battlefield, with widely varying capabilities. Gunners and leaders must be

familiar with the different missile types and their respective capabilities. The proper type of missile must be chosen for each type of target (Table F-2).

THREAT VEHICLE TYPE TARGETS	SELECTION PRIORITY			
	FIRST	SECOND	THIRD	FOURTH
Tanks with applique armor.	TOW 2B	TOW 2A	TOW 2	ITOW
Tanks with explosive reactive armor.	TOW 2B	TOW 2A	TOW 2	ITOW
Tanks without applique/ reactive armor.	TOW 2B	TOW 2A	TOW 2	ITOW
Light armored personnel carriers	TOW 2	TOW 2A	TOW 2B	ITOW
Light armored wheeled vehicles.	TOW 2	TOW 2A	TOW 2B	ITOW
Antiaircraft vehicles.	TOW 2	TOW 2A	TOW 2B	ITOW
Armored vehicles in hull defilade positions.	TOW 2B	TOW 2A	TOW 2	ITOW
Bunkers/ fortifications.	TOW 2	TOW 2A	ITOW	TOW 2B

Table F-2. Missile selection priority chart.

c. TOW crews must strive harder than ever to find positions where they can engage enemy vehicles from the flank. Modern tanks with reactive armor have become increasingly difficult to kill from the front.

APPENDIX G

TOW TRAINING TIPS

Experiences at the National Training Center have produced many useful tips for training and employing TOWS Following these tips will greatly enhance the performance of TOW units in the field.

1. To reduce the effects of heat scintillation, fire from a higher to a lower elevation whenever possible.

2. Train crewmen to remove the protective covers from the electrical connectors of missiles before loading. This is the most common cause of misfires during live fire.

3. Emphasize the obstacle effects of TOW guidance wires. Wire will impede or stop vehicular and dismounted movement. Plan for their recovery and or destruction. Wire cutters are not fine enough to cut TOW wire. The wire must be cut with low-intensity flame when possible.

4. Perform a system self-test and collimate the nightsight to the daysight tracker every 4 hours; after every l0-degree change in temperature; and after moving cross country.

5. Select flat, level firing positions to improve hit probability.

6. Practice fire control and fire patterns at every opportunity.

7. Identify maximum engagement lines and TRPs as accurately as possible. Use adjacent tanks or FO/FIST laser range finders when available.

8. Perform the 180-day verification checks as often as possible (every 30 days is not too often). Verify in the assembly area immediately before combat or live-fire operations. Allow time to fix deficiencies.

9. Increase the amount of time spent tracking in MOPP4. Tracking in MOPP4 improves tracking skills even under MOPP1 conditions.

10. Ensure TOW live fire is conducted from the narrow field of view only.

11. Ensure ITVs, M966s, and BFVs with TOW 2 weapon systems receive priority issue of TOW 2 missiles.

12. Collimate nightsight to daysight each time the system is boresighted.

13 Know the diopter setting. This information should be posted on the system for ready reference.

14. M966 TOW HMMWV:

a. Shield the nightsight and daysight from direct sunlight. Cool the nightsight as much as possible to reduce system cool-down time.

b. Familiarize gunners with launch obscuration effects:

(1) White out — 1.5 seconds after trigger pull, block daysight for 2 to 5 seconds.

(2) Red out — 1.5 seconds after trigger pull, pass a lit cigarette lighter or other IR heat source 6 inches in front of the AN/TAS-4.

c. Remove AN/TAS-4 eyepiece when tracking in a protective mask. Replace with a doughnut-shaped foam cushion made from a sleeping mat or from ammunition packing and taped to AN/TAS-4.

d. Reinforce counter-rotation launch technique to reduce launch tube climb during live fire.

e. Train gunners to bring cross hairs back on target slowly, avoiding jerky movements.

f. Minimize movement of crew members on vehicle when missile is in flight.

g. Minimize blowing of sand and dust from missile launch, by placing a tarp on the ground in front of the launch tube or by wetting the ground down. Blowing dust and sand can cause the weapon system to lose the IR beacon on the missile.

15. ITV:

a. Ensure the squad leader's periscope and turret bezel ring give the same azimuth reading to within + or -3 degrees.

b. Align the 3X target acquisition sight to the daysight tracker. If they do not align, the ITA has slipped out of tolerance. Report to DS maintenance.

c. Protect the middle of the ITA from wind and sand by fabricating a curtain out of cloth or plastic.

d. Report to DS maintenance if the turret does not traverse smoothly or drifts out of position when stationary.

e. Remove the safety switch from the combat override switch in the assembly area only. Keep the switch cover down when not in use.

f. Use the squad leader's periscope when setting aiming stakes.

g. Ensure the squad leader and gunner practice coordinating with one another when locating and identifying targets.

h. Conserve nightsight batteries through the use of binoculars and other night observation devices.

i. Keep all optics covered when not in use.

j. Open the nightsight, collimator, and BPC cases periodically to reduce heat and provide ventilation.

k. Perform field-expedient collimation by picking a fixed point with IR signature 1,500 to 2,000 meters away. Put the daysight cross hairs on the target, lock down the system, acquire the target with the nightsight, and adjust the nightsight cross hairs to the target.

16. Fire Commands/Missile Selection. With the increase in the number of different types of missiles in the TOW inventory, it will sometimes be necessary to tell the gunner what type of missile to engage the target with (see

Appendix F, Table F-2). If a missile is not loaded in the weapon system, the squad leader can include the missile type in the target description portion of the fire command (SQUAD, T-80, TOW 2B). If a missile is loaded in the weapon system, the squad leader will have to make the decision whether time and the tactical situation make it desirable to unload and then reload the system. If a missile has just been fired, the missile reload type can be designated as part of the cease tracking command (CEASE TRACKING, TARGET DESTROYED, RELOAD WITH TOW 2A).

17. TOW MILES Gunnery. Because TOW MILES is an engagement simulator adapted as an interim gunnery trainer, it is important to return gunners to a precision tracking system before live-fire or combat operations. Because the tracking simulation of TOW MILES is less realistic and more forgiving of errors, hit success with the MILES simulator comes more easily than hit success with the actual TOW missile. This is especially true with panel targets equipped with the LTID. Exclusive training on TOW MILES sometimes lulls gunners into a false sense of tracking proficiency. As an engagement simulator in the role of tactical trainer, TOW MILES offers adequate tactical realism. Good TOW gunners are usually good MILES gunners. The reverse is not necessarily tree.

18. TOW Missile Clearance Requirements. If line-of-sight clearance is less than 30 inches, the probability of the missile hitting the ground or an obstruction is increased. Figure G-1 shows the probability of survival for the TOW. The reason for the deviation is that the missile does not precisely follow a gunner's line of sight.

RANGE TO TARGET	HEIGHT OF LINE OF SIGHT ABOVE THE GROUND		
	18 INCHES	20 INCHES	30 INCHES
200M	.98	.98	1.0
300M	.95	.96	1.0
400M	.91	.91	.98
500M	.86	.91	.98
1,000 to 3,000/3,750M	.56	.61	.93

Figure G-1. Probability of survival for the TOW (meters).

19. TOW Missile Time-Of-Flight Versus Range. Figures G-2 and G-3 show the time of flight of the TOW missile to various ranges. Using these figures allows the squad leader to accurately calculate the time it takes for the missile to reach its target.

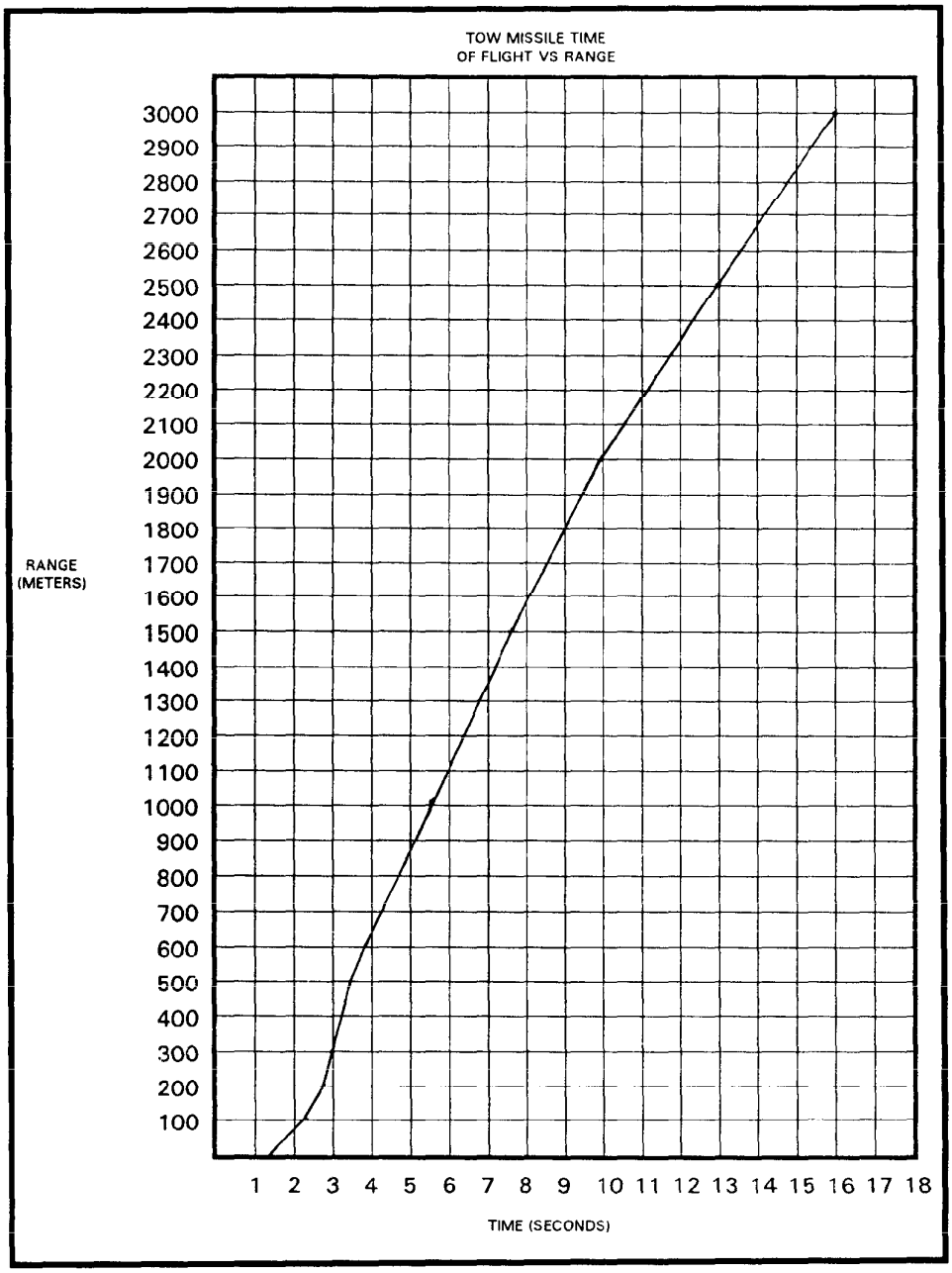


Figure G-2. TOW missile time-of-flight versus range.

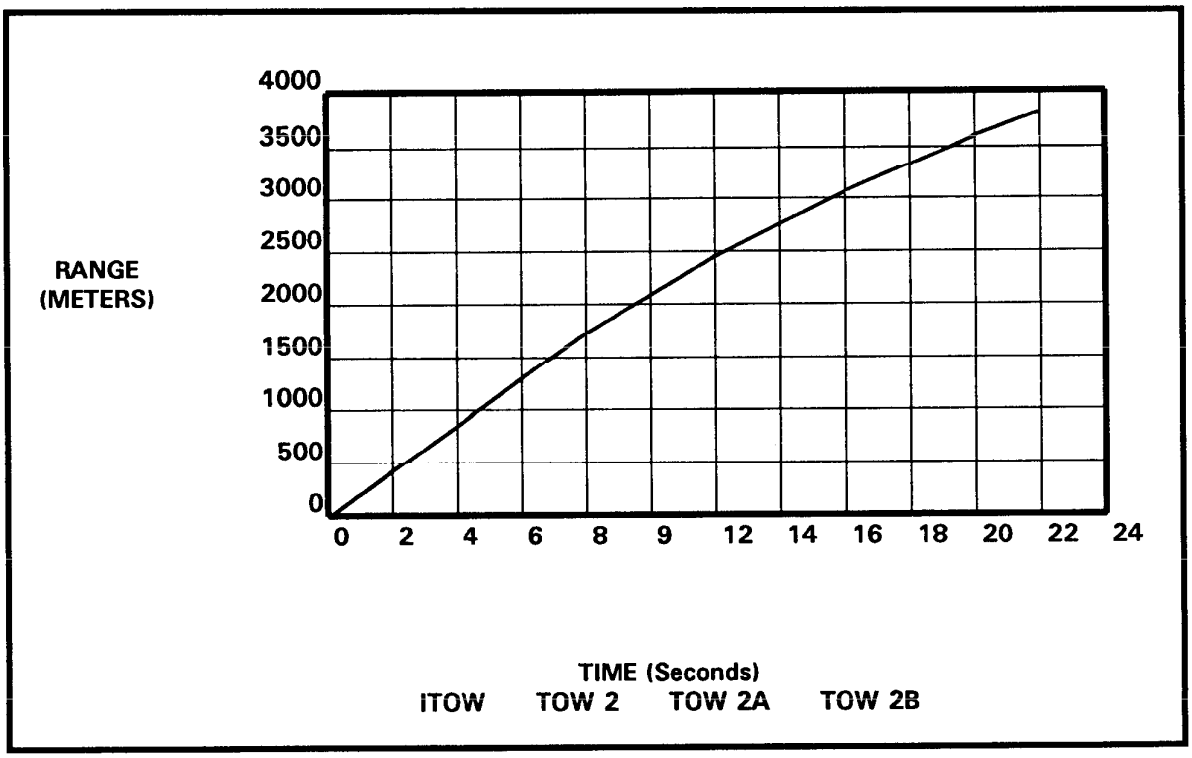


Figure G-3. TOW missile time-of-flight versus range (kilometers).

Appendix H

TRAIN-THE-TRAINER PROGRAM

The success of the TOW training program depends on trainers who are competent and well prepared. This appendix provides information to assist the TOW unit's chain of command in preparing and implementing an effective train-the-trainer program.

H-1. OBJECTIVES

The train-the-trainer program has specific objectives. Its purpose is to develop in every TOW trainer the skills, confidence, and willingness to train 11H soldiers to be proficient with their weapon system and effective in combat. An effective trainer must be able to—

- Set up and operate training equipment.
- Perform all 11H individual and collective tasks.
- Effectively coach a gunner during tracking training.
- Accurately assess the training strengths and weaknesses of individuals and crews.
- Plan and conduct training that will correct training weaknesses.
- Instill confidence in the individuals and crews he trains.

H-2. MISSION-ESSENTIAL TASK LIST

Each commander of a TOW unit should carefully examine his unit's wartime mission and develop a METL. He then organizes a unit sustainment training program that supports that METL. The TOW Training Program consists of quarterly and semiannual mandatory training events. That does not mean that no TOW training should be done in the interval between these events. The commander is responsible for assessing his wartime mission and his unit's current training status and then devising a unit sustainment training program. That program should both support his METL and prepare his unit for the next round of TOW gunnery tables.

H-3. TRAINER ASSESSMENT

Trainers in a TOW unit are normally the squad and section leaders and the platoon sergeants. The trainers are not chosen by their proficiency but by their duty position. Therefore, assessing the abilities of all element leaders is critical. Any shortcomings must be corrected. This assessment is primarily the responsibility of the commander and the platoon leaders and sergeants. This can be accomplished in several ways.

- Conduct periodic leader's tests, both written and hands on.
- Have all leaders perform all the tasks that their subordinates are required to take in the quarterly and semiannual mandatory training events (Gunner's Skill Test and TOW Gunnery Tables).
- Hold a competitive skill test each month with the winner being named trainer of the month.

Any of these methods, or any other the commander deems appropriate, are acceptable as long as they provide an accurate assessment. Trainers should be thoroughly refreshed in the skills they are deficient in before they are allowed to train and test subordinates. A soldier must know his superiors are more skilled than he is in order to have confidence in those superiors.

H-4. COMMAND BENEFITS

If a train-the-trainer program is conducted aggressively and regularly, the benefits to the unit are considerable.

a. The base of trainer expertise will remain solid and gradually spread through the unit.

b. Maintaining this base is easier than periodically recreating it.

c. Overall unit proficiency and esprit de corps will steadily rise.

d. A well-trained and proficient unit requires less time for sustainment training and leaves more time for other unit missions.

H-5. TRAINING TASKS

To be successful, the trainer must be thoroughly familiar with the operation of his training devices. All trainers must be able to correctly perform the following tasks:

---

a. **TOW Gunnery Trainer.**

TASK: Assemble the TGT.

CONDITIONS: Indoors, given a TOW tripod, traversing unit, and launch tube and all components of the TGT.

STANDARDS: Correctly assemble all components of the TGT IAW TM 9-6920-452-10, pages 2-11 through 2-36.

TASK: Prepare the TGT for operation.
CONDITIONS: Indoors, given a fully assembled and operational TGT.
STANDARDS: Correctly power on and warm up the TGT, and perform the operational checkout of the TGT IAW TM 9-6920-452-10, pages 2-39 through 2-54.

TASK: Conduct pre-operational procedures for the TGT.
CONDITIONS: Indoors, given an operational and fully assembled TGT.
STANDARDS: Correctly load the videodisc, program disk, and the data disk IAW TM 9-6920-452-10, pages 2-55 through 2-60.

TASK: Edit a planned group.
CONDITIONS: Indoors, given a fully assembled, operational TGT and matching data and videodiscs.
STANDARDS: Correctly edit a planned group to match the desired conditions in the mission IAW TM 9-6920-452-10, pages 2-60 through 2-66.

TASK: Perform operational procedures for the TGT.
CONDITIONS: Indoors, given an assembled, fully operational TGT with matching video and data disks and an edited planned group.
STANDARDS: Correctly brief the student and conduct a mission from the planned group IAW TM 9-6920-452-10, pages 2-72 through 2-83.

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b. **MILES.**

TASK: Install MILES on the TOW weapon system.
CONDITIONS: Outdoors, given a TOW traversing unit, tripod, nightsight, and launch tube and a TOW MILES tracker head, ATWESS tube, and MGS simulator.
STANDARDS: Correctly assemble, install, and test the TOW weapon system with TOW MILES IAW TM 9-1265-368-10-2, pages 20 through 22 (tasks 9 through 12).

TASK: Test the assembled TOW MILES.

CONDITIONS: Outdoors, given an assembled TOW weapon system with TOW MILES installed.
STANDARDS: Correctly test the TOW MILES IAW TM 9-1265-368-10-2, pages 23 through 26 (task 13).

TASK: Fire TOW and ATWESS.
CONDITIONS: Outdoors, given an assembled, tested, and operational TOW MILES system.
STANDARDS: Correctly and safely fire TOW MILES with ATWESS IAW TM 9-1265-368-10-2, pages 28 through 30 (task 15).

TASK: Reset MWLD and TOW MILES.
CONDITIONS: Outdoors, given an MWLD, an assembled, tested, and operational TOW MILES system, and a controller key.
STANDARDS: Correctly reset the MWLD and TOW MILES after they have been "killed" IAW TM 9-1265-368-10-2, page 32 (task 17).

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c. **TOW Field Tactical Trainer.**

TASK: Assemble the TFTT and install the retroreflector.
CONDITIONS: Outdoors, given a complete TOW system and a complete TFTT with retroreflector.
STANDARDS: Correctly install the TFTT and retroreflector IAW TM 9-6920-453-10 (M966) or TM 9-6920-707-10 (M901), pages 2-1 through 2-15.

TASK: Power up the TFTT and align the laser to the retroreflector.
CONDITIONS: Outdoors, given an assembled TFTT and an installed retroreflector.
STANDARDS: Correctly power up the TFTT and align the laser to the retroreflector IAW TM 9-6920-453-10 (M966) or TM 9-6920-707-10 (M901), pages 2-24 through 2-29.

TASK: Conduct operational procedures for the TFTT.
CONDITIONS: Outdoors, given an assembled, operational, aligned TFTT, and an installed retroreflector.
STANDARDS: Correctly conduct operational procedures for the TFTT to included setting target size and obscuration time, loading the M80 blast

simulator, and preparing the TFTT for firing IAW TM 9-6920-453-10 (M966) or TM 9-6920-707-10 (M901), pages 2-31 through 2-42.

TASK: Conduct system checks and test procedures for the TFTT.
CONDITIONS: Outdoors, given an assembled, operational, and aligned TFTT.
STANDARDS: Correctly perform all system checks and test procedures for the TFTT to include visual checks, cable checks, power checks, computer checks, alignment checks, and system and operational checks IAW TM 9-6920-453-10 (M966) or TM 9-6920-707-10 (M901), pages 2-43 through 2-51.

H-6. TRAINER CERTIFICATION PROGRAM

The commander may choose whatever method he thinks best to assess trainers, but he must include the following elements in a trainer certification program:

a. **Program Orientation.** When a new trainer first enters the unit, he must be briefed on the unit's instructor certification program so that he understands what is expected of him.

b. **Testing of 11H Individual Soldier Tasks.** Each trainer must be tested on each individual 11H task at least annually. Testing every trainer on every task more frequently is impractical. A more workable method is to conduct monthly or quarterly testing events where some portion of these tasks are tested, and over the course of a year all tasks are included.

c. **Testing of 11H Collective Tasks.** Trainers should be tested in all 11H collective tasks annually. Testing events should be spread out in partial monthly or quarterly events.

d. **Testing of Training Equipment Tasks.** This should be conducted in the same manner as the individual and collective tasks. The testable training equipment tasks are listed in paragraph H-5. These tasks are not found in the soldier's manual. The appropriate TMs must be referenced for the performance measures.

e. **Formal Records Keeping.** Formal records should be carefully maintained. If a trainer fails a particular task, he should be retrained and retested until he receives a go on it and all other tested tasks. No one should be allowed to train troops who has not received a go on all tasks tested to date. The soldiers' full confidence in the abilities of their trainers and leaders is critical to morale.

APPENDIX I

IDENTIFY COMBAT VEHICLES

Skill Level 1 11H soldiers must be able to identify combat vehicles according to the conditions and standards listed in this appendix.

a. **Task.** Identify combat vehicles.

b. **Conditions.** Given a classroom with a 35-mm slide projector, screen, slide tray with 40 combat vehicle slides, stopwatch, chair, desk or clipboard, and pencil. (See the local Training Aids Support Center for the combat vehicle slides.)

c. **Standards.** Given a 12-second exposure time for each slide, the soldier will identify 36 of 40 vehicles by nomenclature.

d. **Evaluation Procedures.** This task requires the crewman to identify combat vehicles from the front, side, oblique, or rear using day and thermal sights. Views of these combat vehicles should replicate ranges between 800 and 1,200 meters.

(1) *Administrative process.* At the station, the evaluator logs the soldier's information on a roster. The evaluator provides the soldier with all materials and equipment and displays them in a manner outlined in this guide. The evaluator must use the criterion performance checklist for this task. The evaluator informs the soldier of his performance on this task and directs him to the next station or to further training. The number of soldiers to be tested at one time depends on the classroom seating without compromising test procedures.

(2) *Administrative procedures for personnel receiving a NO-GO.* If the soldier does not achieve the standard indicated on the checklist, he receives a NO-GO. When a soldier receives a NO-GO, he must be critiqued, to include an explanation of vehicles that were incorrectly identified. The soldier will be retested with a second set of slides showing the same vehicles in a different view or a different order.

e. **Personnel, Equipment, and Material Required.**

- Qualified 11H sergeant or above.
- Forty 35-mm slides of combat vehicles. The 30 required vehicles for this test are listed in Figure I-1 (page I-4) and indicated by an asterisk. The balance will be taken from the other vehicles listed in Figure I-1. (For more information, see FM 1-402, FM 100-2-3, and GTA 17-2-13.)

- Classroom.
- Slide projector with screen.
- Stopwatch.
- Performance checklist (one per soldier).
- Chair, desk or clipboard (one per soldier).
- Pencil (one per soldier).

f. **Pretest Preparation.** Thirty vehicles will be taken from the prescribed list and ten will be selected by the commander based on the unit's contingency area. The station evaluator must ensure the slide projector is operational and the slides can be recognized from all locations in the classroom. Some projectors have an automatic setting for exposure of each slide; if used, this feature must be checked for accuracy.

(1) Select 30 required vehicle slides to be used along with 10 slides selected by the commander.

(2) Ensure the slide projector is operational.

(3) Ensure the slides can be recognized from all locations in the classroom.

g. **Pretest Conditions for Each Examinee.** The slide projector will be on, but slides will not be exposed.

h. **Test Planning Tree.**

Administrative: 5 minutes
Test: 15 minutes
Total: 20 minutes

i. **Instructions to Examinees.**

"LET ME HAVE YOUR ATTENTION. AT THIS STATION, YOU WILL BE TESTED ON YOUR ABILITY TO IDENTIFY COMBAT VEHICLES. YOU MUST CORRECTLY IDENTIFY THIRTY-SIX OF FORTY VEHICLES BY NOMENCLATURE. YOU WILL HAVE TWELVE SECONDS TO VIEW EACH SLIDE AND TEN SECONDS BETWEEN EACH SLIDE TO WRITE YOUR ANSWER ON THE PERFORMANCE CHECKLIST PROVIDED. BE SURE YOU DO NOT GET OUT OF SEQUENCE OR YOUR ANSWERS WILL BE INCORRECT. DO YOU UNDERSTAND THESE INSTRUCTIONS?"

Pause 5 seconds, then say, "YOU WILL HAVE TWENTY-TWO SECONDS TO COMPLETE EACH TASK." Pause, then say, "BEGIN."

Begin timing when the command "BEGIN" is given. If the examinee has not completed each task after the appropriate time, announce loud enough for the examinee to hear, "STOP."

PERFORMANCE CHECKLIST

TASK: Identify combat vehicles by nomenclature.

PERFORMANCE MEASURES:

1. Identified vehicle slide No. 1.
2. Identified vehicle slide No. 2.
3. Identified vehicle slide No. 3.
4. Identified vehicle slide No. 4.
5. Identified vehicle slide No. 5.
6. Identified vehicle slide No. 6.
7. Identified vehicle slide No. 7.
8. Identified vehicle slide No. 8.
9. Identified vehicle slide No. 9.
10. Identified vehicle slide No. 10.
11. Identified vehicle slide No. 11.
12. Identified vehicle slide No. 12.
13. Identified vehicle slide No. 13.
14. Identified vehicle slide No. 14.
15. Identified vehicle slide No. 15.
16. Identified vehicle slide No. 16.
17. Identified vehicle slide No. 17.
18. Identified vehicle slide No. 18.
19. Identified vehicle slide No. 19.
20. Identified vehicle slide No. 20.
21. Identified vehicle slide No. 21.
22. Identified vehicle slide No. 22.
23. Identified vehicle slide No. 23.
24. Identified vehicle slide No. 24.
25. Identified vehicle slide No. 25.
26. Identified vehicle slide No. 26.
27. Identified vehicle slide No. 27.
28. Identified vehicle slide No. 28.
29. Identified vehicle slide No. 29.
30. Identified vehicle slide No. 30.
31. Identified vehicle slide No. 31.
32. Identified vehicle slide No. 32.
33. Identified vehicle slide No. 33.
34. Identified vehicle slide No. 34.
35. Identified vehicle slide No. 35.
36. Identified vehicle slide No. 36.
37. Identified vehicle slide No. 37.
38. Identified vehicle slide No. 38.
39. Identified vehicle slide No. 39.
40. Identified vehicle slide No. 40.

TANKS

1. AMX13
2. AMX30
3. AMX30 SA
4. JP Kanone
5. Centurion
6. Centurion 15
7. Centurion RE
* 8. Challenger
* 9. Chieftain
10. Leopard 1
*11. Leopard 2
*12. M1 Abrams
13. M48A5
14. M551 Sheridan
15. M60A1
*16. M60A3
*17. Merkava
18. PT76
19. PT76 Type 60
20. T80U
21. T34 Medium
22. T54
23. T55
24. T55K
*25. T62
26. T64
27. T64A
28. T64B
29. T64K
*30. T72
31. T72 M84
32. T72M1
*33. T80
34. Type 59
35. Type 62
36. Type 69
37. Type 79
38. Type 80
39. Type 90
*40. Le Clerc

LIGHT-ARMOR—APC/IFV/RECONNAISSANCE

1. AML
2. AMX10
3. AMX10P
4. AMX10RC
5. BMD1
6. BMD 1979/3
* 7. BMD2
* 8. BMP1
9. BMP1K
10. BMP1KSH
*11. BMP2
*12. Bradley M2/M3
13. AMX VCI
14. Bradley M2A2
15. LVTP7 (AAV7A1)
16. Bradley M3A1
17. Bradley M3A2
*18. BRDM1
*19. BRDM2
20. BRDM2 AT3
21. BRDM2 AT5
22. BRDM2 RKH
23. BRDM2 SA9
24. BRDM2 U
25. BRM
26. BRM1
27. BTR152
28. KM900
29. BTR50PK
30. BTR60PA Cmd
*31. BTR60PB
*32. BTR70
33. BTR80
34. BTRD
35. Charrua
36. Condor
37. Cougar
38. EE-9 Cascavel
39. EE-11
40. Fox
41. FV432
42. IPR
43. IRM
44. Jaguar 1
45. Jaguar 2
*46. Luchs
*47. M113
48. M113A3
49. M3 APC (Fr)
*50. Marder
51. MCT (S)
52. Ferret MK 1
53. Ferret MK 2
54. MTLB
55. NFV-1
56. NVH-1
57. OT64
58. OT65
59. PSZH-IV
60. Ratel
61. Rooikat
62. Saxon
*63. Scimitar
*64. Scorpion
65. Striker
*66. VAB
*67. Warrior
68. WZ523
69. WZ551
70. YW531
71. YW534

*Required for test.

Figure I-1. Combat vehicle slide list.

ANTITANK SYSTEMS

1. ASU57
2. ASU85
3. AT1 Snapper
4. AT2 Swatter
5. AT3 Sagger
6. AT4 Spigot
7. AT5 Spandrel
8. AT6 Spiral
9. B10
10. PANHARD VCR HOT
*11. ITV M901
12. Milan ATGM
13. MT12
14. RPG2
15. RPG7
16. SPG9
17. SS11 Harpoon ATGM
18. Swingfire ATGM
19. Type 52 75-mm Recoilless Rifle
20. Type 56 RPG-2
21. Type 70-1 62-mm Rocket Launcher
22. Type 86

ANTIAIRCRAFT

1. AMX DCA 30-2
2. Chaparral
*3. Gepard
4. M163A1 VULCAN
5. Roland
6. S60
7. ZPU4
8. 2S6
*9. ZSU23-4
10. ZSU57-2
11. ZU23

SELF-PROPELLED MORTAR

1. M106 107-mm
2. M125 81-mm
3. T54 160-mm
4. Type 85 120-mm
5. Type 85 82-mm
6. YW304 82-mm
7. YW381 120-mm

*Required for test.

Figure I-1. Combat vehicle slide list (continued).

SELF-PROPELLED AND TOWED ARTILLERY

1. 2S1
2. 2S3
3. 2S4
4. 2S5
5. 2S7
6. 2S9
7. AL FAO 210-mm
8. Astros (MRL) 127-mm
9. Astros (MRL) 180-mm
10. Astros (MRL) 300-mm
11. BM21
12. CGT F1
13. Dana 152-mm (SP)
14. G-5 155-mm towed
15. G-6 155-mm (SP)
16. GCT 155-mm (SP)
17. GHN-45 155-mm towed
18. M107
19. M109A1
20. M109A2
21. M109A3
22. M109A6
23. M110A2
24. M1972 122-mm
25. M1973 152-mm
26. M1974 152-mm (SP)
27. M1975 130-mm (SP)
28. M1977 122-mm (SP)
29. M1978 170-mm (SP)
30. M1981 122-mm (SP)
31. M1985 MRL 122-mm (SP)
32. M1985 MRL 240-mm (SP)
33. M1989 170-mm
34. Majnoon 155-mm (SP)
35. MKF3
36. MLRS
37. Type 54-1 122-mm
38. Type 59 130-mm
39. Type 85 122-mm

MISCELLANEOUS

1. Artillery Command and Reconnaissance Vehicle
2. AVLB
3. Fox, NBC Reconnaissance M93
* 4. LAV-25
5. M728 CEV
* 6. M88A1
7. M9 ACE
8. PRP-3

*Required for test.

Figure I-1. Combat vehicle slide list (continued).

APPENDIX J

DISMOUNTING AND REMOUNTING A TOW LAUNCHER SYSTEM ON AN M2/M3 BTV

Specific actions must be followed when dismounting the TOW launcher from the M2/M3 BTV and moving it to the firing position. (The firing position should not be more than 25 meters from the vehicle.) All actions happen simultaneously. Other actions must be followed when remounting the TOW launcher on the M2/M3 BTV. (See Figures J-1 through J-3, pages J-7 through J-9.)

J-1. DISMOUNT ACTIONS FOR THE M220A1

Each crew member begins executing his assigned responsibilities as soon as the Bradley commander commands, "Dismount the TOW."

a. **Bradley Commander's Actions.** The Bradley commander—

(1) Directs the gunner to where the firing position will be located.

(2) Provides security and maintains communications.

b. **Gunner's Actions.** The gunner—

(1) Unstraps the tripod and launch tube and exits the vehicle.

(2) Carries the tripod and launch tube to the firing position.

c. **Assistant Gunner's Actions.** The assistant gunner—

(1) Unstraps his seat belt, unstraps and secures the traversing unit, and exits the vehicle.

(2) Carries the traversing unit on his first trip to the firing position (follows the gunner to the firing position); the daysight tracker and MGS on the second trip; the nightsight case, boresight collimator case, coolant cartridge case, and spare battery case on the third trip; and the encased missile on the fourth trip.

d. **Driver's Actions.** The driver—

(1) Lowers the ramp.

(2) Moves out of his seat and unstraps the daysight tracker, MGS, nightsight case, boresight collimator case, coolant cartridge case, spare battery case, and encased missile; aligns the equipment on the vehicle ramp.

(3) Returns to his seat after all the M220A1 equipment has been secured, and raises the ramp.

e. **Firing Position Actions.** Upon reaching the firing position, the gunner and assistant gunner proceed with the following actions:

(1) *Gunner's actions.* The gunner—

(a) Places the launch tube on the ground; sets up the tripod with coupling clamp handle facing the direction of fire and unlocked.

(b) Installs the daysight tracker on the traversing unit.

(c) Removes the MGS cover and connects the coil cable to the MGS.

(d) Conducts the system self-test, boresight, and collimation.

(e) Observes downrange for enemy targets and issues fire commands.

(2) *Assistant gunner's actions.* The assistant gunner—

(a) Installs the traversing unit on the tripod and relocks the coupling clamp handle.

(b) Returns to the vehicle for the daysight tracker and MGS; places them on the ground at the firing position to the left side of the weapon system.

(c) Returns to the vehicle for the nightsight case, boresight collimator case, coolant cartridge case, and spare battery case; places them on the ground at the firing position to the left of the weapon system; removes the nightsight from its case and hands it to the gunner.

(d) Returns to the vehicle and gets the encased missile; places it on the ground at the firing position to the right side of the weapon system.

(e) Installs the boresight collimator on the nightsight; attaches the boresight cable to the boresight collimator.

(f) Disconnects the boresight cable and removes the boresight collimator from the nightsight; places the boresight collimator in its case (time permitting).

(g) Loads the encased missile and arms it upon receipt of the fire command.

J-2. REMOUNT ACTIONS FOR THE M220A1

The following actions occur at the same time when the gunner commands, "Cease tracking, out of action."

a. **Firing Position Actions.** The following actions are performed at the firing position.

(1) *Bradley commander's actions.* The Bradley commander provides security and maintains communications.

(2) *Gunner's actions.* The gunner—

(a) Disconnects the coil cable and replaces the MGS cover.

(b) Replaces the nightsight lens cover; removes the nightsight, places it back in its case, and sets it on the ground next to the boresight collimator.

(c) Removes the daysight tracker; sets it on the ground next to the MGS.

(d) Folds the tripod legs and commands, "Move out. " (The gunner remains at the firing position until the loader returns and all equipment is en route to the vehicle.)

(e) Carries the tripod and launch tube back to the vehicle; stows the tripod and launch tube back in the mount and straps them down.

(3) *Assistant gunner's actions.* The assistant gunner—

(a) Removes the encased missile (or empty launch container if the missile was fired).

(b) Removes the launch tube from the traversing unit; places it on the ground next to the other equipment.

(c) Removes the traversing unit from the tripod, carries it to the vehicle, and hands it to the Bradley commander.

(d) Returns to the firing position, gets the daysight tracker and MGS and carries them to the vehicle; places them on the vehicle's ramp.

(e) Returns to the firing position; gets the nightsight case, boresight collimator case, coolant cartridge case, and spare battery case and carries them to the vehicle; places them on the vehicle's ramp.

(f) Returns to the tiring position; gets the encased missile (if the missile was not fired) and carries it to the vehicle; stows it in the missile rack.

(4) *Driver's actions.* The driver—

(a) Lowers the ramp.

(b) Exits his seat and receives the traversing unit from the assistant gunner and straps it down.

(c) Retrieves the MGS and daysight tracker.

(d) Retrieves the nightsight case, boresight collimator case, coolant cartridge case, and spare battery case.

b. **Remount Actions.** The following actions are performed to remount the BTV.

(1) *Bradley commander's actions.* The Bradley commander provides security and maintains communications.

(2) *Gunner's actions.* The gunner—

(a) Stows the tripod and launch tube.

(b) Enters the gunner's seat.

(3) *Assistant gunner's actions.* The assistant gunner—

(a) Stows the encased missile.

(b) Returns to the assistant gunner's seat and puts on his seat belt.

(4) *Driver's actions.* The driver—

(a) Stows the traversing unit, MGS, daysight tracker, nightsight case, boresight collimator case, coolant cartridge case, and spare battery case.

(b) Returns to his seat and raises the ramp after the assistant gunner stows the encased missile.

J-3. DISMOUNT ACTIONS FOR THE M220A2

Each crew member begins executing his assigned responsibilities as soon as the Bradley commander commands, "Dismount the TOW."

a. **Bradley Commander's Actions.** The Bradley commander—

(1) Directs the gunner to where the firing position will be located.

(2) Provides security and maintains communications.

b. **Gunner's Actions.** The gunner—

(1) Unstraps and secures the tripod, launch tube, and BPC case and exits the vehicle.

(2) Carries the tripod, launch tube, and BPC case to the firing position.

c. **Assistant Gunner's Actions.** The assistant gunner—

(1) Unstraps his seat belt, unstraps and secures the traversing unit, and exits the vehicle.

(2) Carries the traversing unit on his first trip to the firing position (follows the gunner to the firing position); the daysight tracker and MGS on the second trip; the nightsight case and the boresight collimator case on the third trip; and the encased missile on the fourth trip.

d. **Driver's Actions.** The driver—

(1) Lowers the ramp.

(2) Moves out of his seat and unstraps the daysight tracker, MGS, nightsight case, boresight collimator case, and encased missile; aligns the equipment on the vehicle ramp.

(3) Returns to his seat after all the M220A2 equipment has been secured, and raises the ramp.

e. **Firing Position Actions.** Upon reaching the firing position, the gunner and assistant gunner proceed with the following actions:

(1) *Gunner's actions.* The gunner—

(a) Places the launch tube and BPC case on the ground; sets up the tripod with coupling clamp handle facing the direction of fire and unlocked.

(b) Installs the daysight tracker on the traversing unit.

(c) Installs the nightsight on the daysight tracker.

(d) Removes the MGS cover and connects the coil cable to the MGS.

(e) Opens the BPC case and connects the power cable to the nightsight.

(f) Disconnects the boresight cable and removes the boresight collimator from the nightsight; places the boresight collimator in its case (time permitting).

(g) Loads the encased missile.

(h) Observes down range for enemy targets, arms missile, and issues fire commands.

(2) *Assistant gunner's actions.* The assistant gunner—

(a) Installs the traversing unit on the tripod and relocks the coupling clamp handle.

(b) Returns to the vehicle for the daysight tracker and MGS; places them on the ground at the firing position to the left side of the weapon system.

(c) Returns to the vehicle for the nightsight case and boresight collimator case; places them on the ground at the firing position to the left of the weapon system; removes the nightsight from its case and hands it to the gunner.

(d) Returns to the vehicle and gets the encased missile; places it on the ground at the firing position to the right side of the weapon system.

(e) Installs the boresight collimator on the nightsight; attaches the boresight cable to the boresight collimator.

(f) Conducts the system self test, boresight, and collimation.

(g) Observes down range for enemy targets and waits for fire commands.

J-4. REMOUNT ACTIONS FOR THE M220A2

The following actions occur at the same time when the gunner commands, "Cease tracking, out of action."

a. **Firing Position Actions.** The following actions are performed at the firing position.

(1) *Bradley commander's actions.* The Bradley commander provides security and maintains communications.

(2) *Gunner's actions.* The gunner—

(a) Disconnects the coil cable and replaces the MGS cover.

(b) Replaces the nightsight lens cover; removes the nightsight, places it back in its case, and sets it on the ground next to the boresight collimator.

(c) Removes the daysight tracker; sets it on the ground next to the MGS.

(d) Folds the tripod legs and commands, "Moveout." (The gunner remains at the firing position until the assistant gunner returns and all equipment is en route to the vehicle.)

(e) Carries the tripod, launch tube, and BPC case back to the vehicle; stows the tripod, launch tube, and BPC case and straps them down.

(3) *Assistant gunner's actions.* The assistant gunner—

(a) Removes the encased missile (or empty launch container if the missile was fired).

(b) Removes the launch tube from the traversing unit; places it on the ground next to the other equipment.

(c) Removes the traversing unit from the tripod, carries it to the vehicle, and hands it to the driver.

(d) Returns to the firing position, gets the daysight tracker and MGS and carries them to the vehicle; places them on the vehicle's ramp.

(e) Returns to the firing position; gets the nightsight case and boresight collimator case and carries them to the vehicle; places them on the vehicle's ramp.

(f) Returns to the firing position; gets the encased missile (if the missile was not fired) and carries it to the vehicle; stows it in the missile rack.

(4) *Driver's actions.* The driver—

(a) Lowers the ramp.

(b) Exits his seat and receives the traversing unit and straps it down.

(c) Retrieves the MGS and daysight tracker.

(d) Retrieves the nightsight case and boresight collimator case.

b. **Remount Actions.** The following actions are performed to remount the BTV.

(1) *Bradley commander's actions.* The Bradley commander provides security and maintains communications.

(2) *Gunner's actions.* The gunner—

(a) Stows the tripod, launch tube, and BPC case.

(b) Returns to his seat.

(3) *Assistant gunner's actions.* The assistant gunner—

(a) Stows the encased missile.

(b) Returns to his seat and puts on his seat belt.

(4) *Driver's actions.* The driver—

(a) Stows the traversing unit, MGS, daysight tracker, nightsight case, and boresight collimator case.

(b) Returns to his seat and raises the ramp after the assistant gunner stows the encased missile.

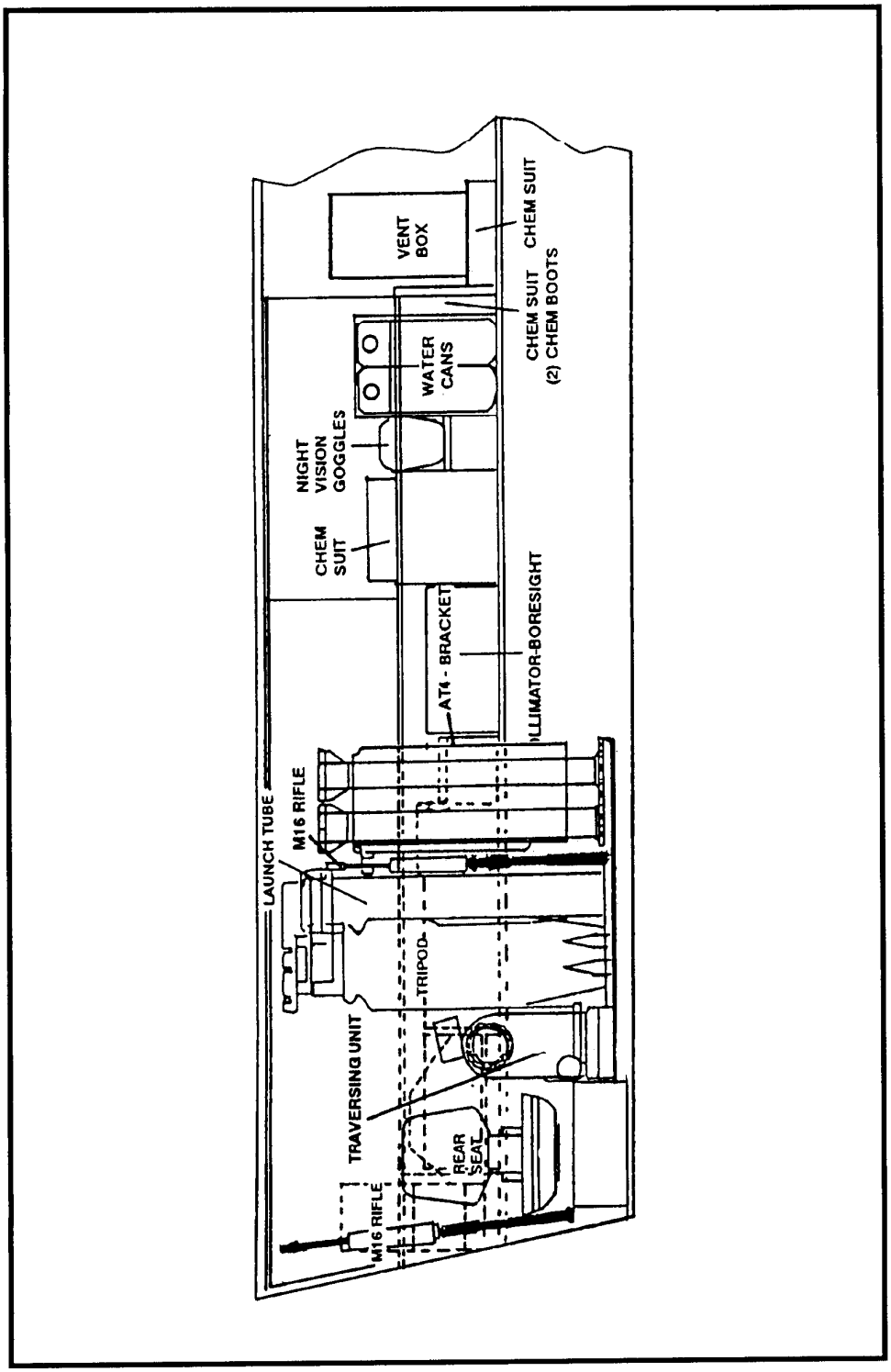


Figure J-1. Stowing TOW equipment on the BTV (left side).

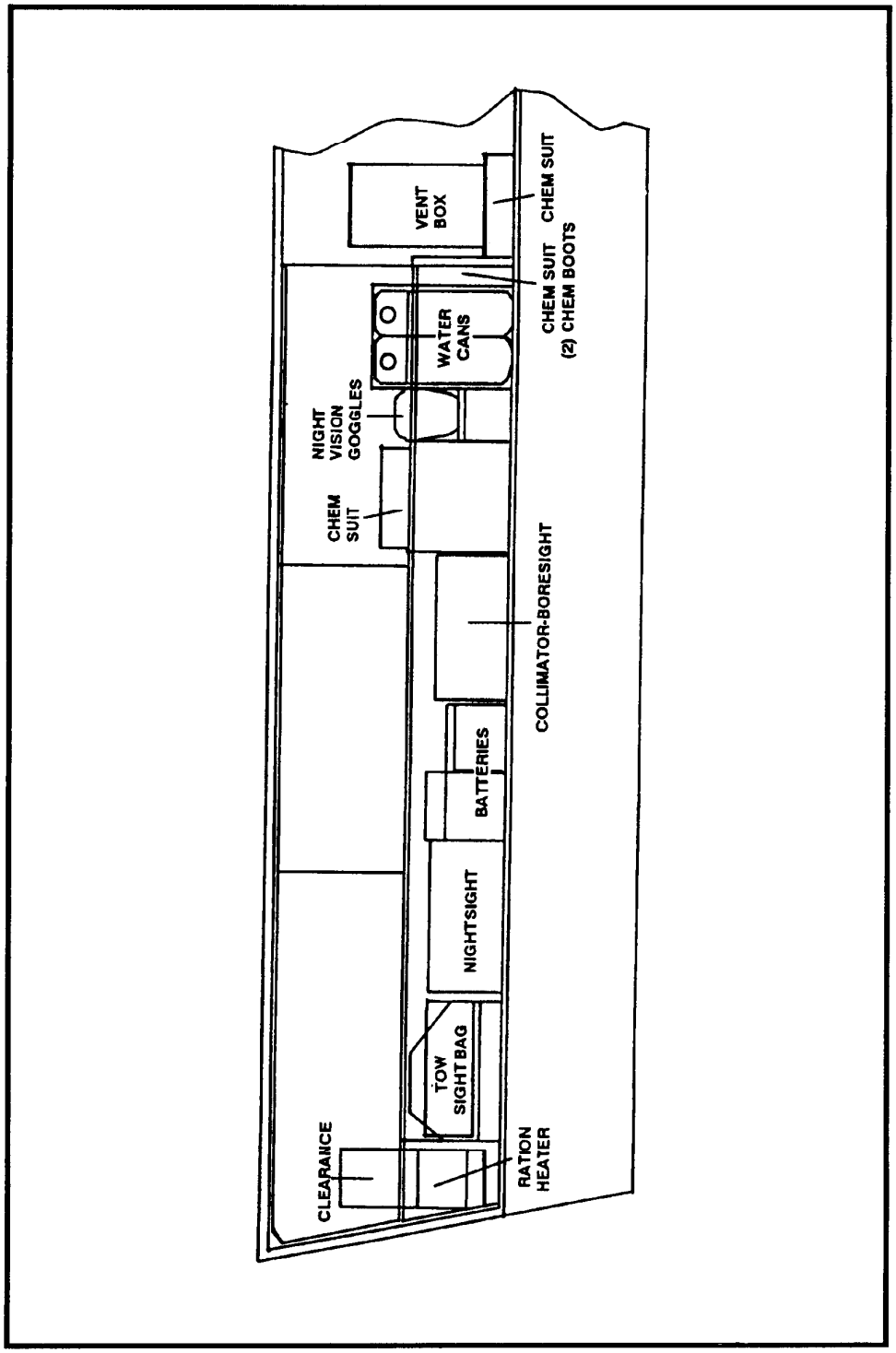


Figure J-2. Stowing TOW equipment on the BTV (left side, behind tripod and launch tube).

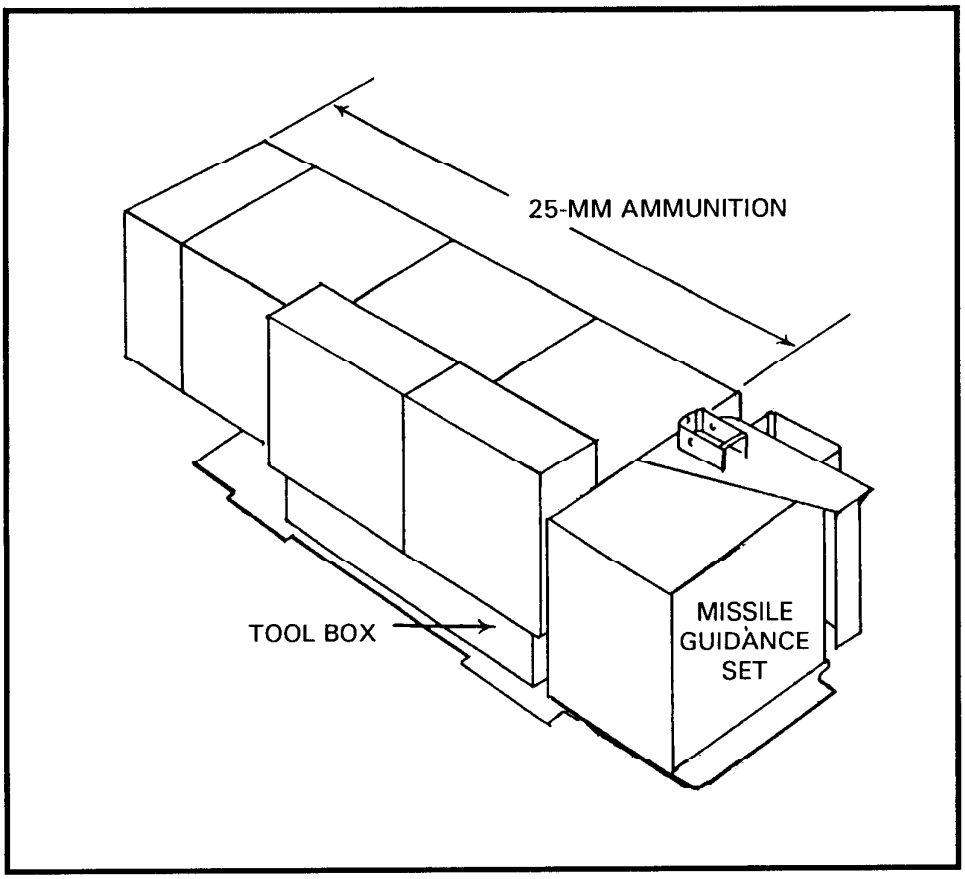


Figure J-3. Stowing TOW equipment on the BTV (right side).

GLOSSARY

Acronyms and Abbreviations

ACCP ..... Army Correspondence Course Program
ADA ..... air defense artillery
AFV ..... armored fighting vehicle
ANCOC ..... Advanced noncommissioned officer course
APC ..... armored personnel carrier
AR ..... Army regulation
ARTEP ..... Army training and evaluation program
ATEA ..... anticipated target engagement area
ATGM ..... antitank guided missile
ATTN ..... attention
ATWESS ..... antitank weapon effect signature simulator
AZ ..... azimuth

BGST ..... Bradley Gunner's Skill Test
BNCOC ..... Basic noncommissioned officer course
BPC ..... battery power condition
BTV ..... Bradley TOW vehicle

CO ..... company
CM ..... centimeter
CVC ..... combat vehicle crewman (helmet)
CVKI ..... combat vehicle kill indicator

DA ..... Department of the Army
DS ..... direct support

EFP ..... explosively formed projectiles
ELEV ..... elevation
EMER PWR ..... emergency power
EOD ..... explosive ordnance disposal

FIST ..... fire support team
FM ..... field manual
FO ..... forward observer
FSO ..... fire support officer
FTX ..... field training exercise

GCP ..... gunner's control panel
GHC ..... gunner's hand control
GST ..... Gunner's Skill Test
HMMWV ..... high mobility, multipurpose wheeled vehicle

IAW ..... in accordance with
IFV ..... infantry fighting vehicle
IMT ..... infantry moving target
IR ..... infrared
ITA ..... image transfer assembly
ITOW ..... improved TOW
ITV ..... improved TOW vehicle
IVD ..... interactive video disk

kph ..... kilometers per hour

LOS ..... line of sight
LTD ..... laser target detector
LTID ..... laser target interface device

MCLOS ..... manual command to line-of-sight guidance
METL ..... mission-essential task list
METT-T ..... mission, enemy, terrain, troops, and time available
MGS ..... missile guidance set
MILES ..... mulitple integrated laser engagement system
MOP ..... mission-oriented protective posture
MOS ..... military occupation specialty
MARC ..... multipurpose range complex
MSR ..... missile simulation round
MV ..... moving
MELD ..... man-worn laser detectors
MWO ..... modified work order

NATO ..... North Atlantic Treaty Organization
NBC ..... nuclear, biological, and chemical
NCO ..... noncommissioned officer
NTC ..... National Training Center

OCL ..... operator's checklist
OPFOR ..... opposing force
OSUT ..... one station unit training

PGTS ..... precision gunnery training system
PLT ..... platoon
PMCS ..... preventive maintenance checks and services
psi ..... pounds per square inch

rpm ..... revolutions per minute

SACLOS ..... semiautomatic command-to-line-of-sight guidance
SFC ..... sergeant first class
SGT(P) ..... sergeant (promotable)
SL ..... skill level; squad leader (figures only)
SLP ..... squad leader's periscope
SM ..... soldier's manual
SOP ..... standing operating procedure
SQD ..... squad
ST ..... stationary
STAY ..... standby
STRAP ..... Standards in Training Commission
STP ..... soldier training publication
STX ..... situational training exercise

TFTT ..... TOW field tactical trainer
TG ..... trainer's guide
TGT ..... TOW gunnery trainer
TOW ..... tube-launched, optically tracked, wire-guided
TM ..... technical manual (training manual)
TRP ..... target reference point
TVPC ..... TOW vehicle power conditioner

US ..... United States

VDC ..... volts direct current
VPC ..... vehicle power conditioner

REFERENCES

DOCUMENTS NEEDED

These documents must be available to the intended users of this publication.

AR 75-1	Malfunctions Involving Ammunition and Explosives. 01 March 1989.
AR 385-62	Regulations for Firing Guided Missiles and Heavy Rockets for Training, Target Practice and Combat. 05 January 1977.
AR 385-63	Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat. 15 October 1983.
AR611-201	Enlisted Career Management Fields and Military Occupational Specialties. 30 April 1992.
ARTEP 7-91-Drill	Drills for the Antiarmor (TOW) Platoon, Section, and Squad. 15 February 1990.
ARTEP 7-91-MTP	Mission Training Plan for Antiarmor Company/Platoon/Section. 12 October 1989.
DA Form 7331-R	Gunner Skill Test (All 11H)-Part 1. July 1994.
DA Form 7332-R	Gunner Skill Test (All 11H)-Part 2. July 1994.
DA Form 7333-R	TOW Gunnery Tables 1 and 2: Individual Gunnery. July 1994.
DA Form 7334-R	TOW Gunnery Tables 3 and 4: Advanced Gunnery. July 1994.

DA Form 7335-R	TOW Gunnery Tables 5 and 6: Baseline TFTT Gunnery. July 1994.
DA Form 7336-R	TOW Gunnery Table 7: Squad Gunnery Practice. July 1994.
DA Form 7337-R	TOW Gunnery Table 8: Squad Gunnery Qualification. July 1994.
DA Form 7338-R	TOW Gunnery Table 9: Section Gunnery Practice. July 1994.
DA Form 7339-R	TOW Gunnery Table 10: Section Gunnery Qualification. July 1994.
DA Form 7340-R	TOW Gunnery Table 11: Platoon Gunnery Practice. July 1994
DA Form 7341-R	TOW Gunnery Table 12: Platoon Gunnery Qualification. July 1994.
DA Pam 350-38	Standards in Weapons Training. 15 February 1993.
FM 3-5	NBC Decontamination. 23 July 1992.
FM 5-250	Explosives and Demolitions. 15 June 1992.
FM 7-91	Tactical Employment of Antiarmor Platoons, Companies, and Battalions. 30 September 1987.
FM 10-529	Airdrop of Supplies and Equipment: Rigging Heavy Antitank Assault Weapon System (TOW). 16 October 1986.
FM 25-100	Training the Force. 15 November 1988.
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STP 7-11I I14-SM-TG	Soldier's Manual, Skill Levels 1/2/3/4 and Trainer's Guide, MOS 11H, Heavy Antiarmor Weapons Infantryman. 30 September 1988.
TB MED 524	Occupational and Environmental Health: Control of Hazards to Health From Laser Radiation. 20 June 1985.
TC 25-8	Training Ranges. 25 February 1992.
TM 9-1265-368-10-2	Operator's Manual for Multiple Integrated Laser Engagement System (MILES), Simulator System, Firing Laser: M64 (NSN 1265-01-077-6083) for TOW Standard, TOW Long Range, TOW II, TOW II Extended Weapon System. 15 July 1988.
TM 9-1300-206	Ammunition and Explosives Standards. 30 August 1973.
TM 9-1410-470-34	Direct Support and General Support Maintenance Manual for Surveillance of Guided Missile Surface Attack, BGM-71A, BGM-71A-1, BGM-71A-2, BGM-71A-2A, BGM-71A-3, BGM-71A-3A, BGM-71C, BGM-71C-1, BGM-71C-1A, BGM-71D, or BGM-71E and Guided Missile Practice BTM-71A, BTM-71A-1 , BTM-71A-2, BTM-71A-2A, BTM-71A-3, or BTM-71A-3A (TOW Heavy Antitank/Assault Weapon System). 01 March 1988.
TM 9-1425-450-12	Operator and Organizational Maintenance Manual for TOW 2 Weapon System, Guided Missile System M220A2 (NSN 1440-014-9034) (TOW 2 Heavy Antitank/Assault Weapon System). 25 May 1983.

TM 9-1425-472-12	Operator's and Organizational Maintenance Manual for TOW Weapon System Guided Missile System, M220A1 (NSN 1440-00-169-1764) (TOW Heavy Antitank/Assault Weapon System). 01 January 1980.
TM 9-2320-280-10	Operator's Manual for Truck, Utility: TOW Carrier, Armored, 1-¼ Ton, 4X4, M966. 18 June 1991.
TM 9-2350-259-10	Operator's Manual for Combat Vehicle, Antitank, Improved TOW Vehicle, M901A1 (NSN 2350-01-103-5641).30 April 1990.
TM 9-6920-452-10	Trainer, Gunnery, Antitank: AN/TWQ-T1 (TOW Gunnery Trainer). 01 August 1991.
TM 9-6920-453-10	Trainer, Guided Missile: AN/TWQ-T3 (TOW Field Tactical Trainer). 20 March 1991.
TM 9-6920-707-10	Operator's Manual for Trainer, Guided Missile: AN/TWQ-T5 (Improved TOW Vehicle/TOW Field Tactical Trainer). 23 October 1992.
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DA Form 7332-R (Scorecard for Gunners' Skill Test, Part 2—Carrier-specific tasks), 5-11 (illus)
DA Form 7333-R (TOW Gunnery Tables 1 and 2, Individual Gunnery Practice and Qualification Scorecard), 5-17 (illus)
DA Form 7334-R (TOW Gunnery Tables 3 and 4, Advanced Gunnery Practice and Qualification Scorecard), 5-19 (illus)
DA Form 7335-R (TOW Gunnery Tables 5 and 6, Baseline TFTT Gunnery Practice and Qualification Scorecard), 5-26 (illus)
DA Form 7336-R (TOW Gunnery Table 7, Squad Gunnery Practice Scoresheet), 5-30 (illus)
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DA Form 7338-R (TOW Gunnery Table 9, Section Gunnery Practice Scoresheet), 5-36 (illus)
DA Form 7339-R (TOW Gunnery Table 10, Section Gunnery Qualification Scoresheet), 5-37 (illus)

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GUNNER SKILL TEST (ALL 11H) - PART 1

For use of this form, see FM 23-34. The proponent agency is TRADOC.

NAME:	RANK:	UNIT:	DATE:

TEST#	TASK NUMBER	TASK TITLE	GO/NO GO
1	071-056-0004	MAINTAIN AN M220-SERIES LAUNCHER SYSTEM	
2	071-056-0007	LOAD AN M220-SERIES LAUNCHER SYSTEM	
3	071-056-0008	UNLOAD AN M220-SERIES LAUNCHER SYSTEM	
4	071-056-0009	ENGAGE TARGETS WITH AN M220-SERIES LAUNCHER SYSTEM	
5	071-056-0010	PERFORM IMMEDIATE ACTION FOR AN M220-SERIES LAUNCHER SYSTEM MALFUNCTION	
6	071-056-0005	CONDUCT A SYSTEM CHECK OUT ON AN M220A1 LAUNCHER SYSTEM	
7	071-056-0013	CONDUCT A SYSTEM CHECK OUT ON AN M220A2 LAUNCHER SYSTEM	
8	071-056-0030	DETERMINE M220-SERIES LAUNCHER SYSTEM FIRING LIMITATIONS	
9	NO TASK NUMBER	IDENTIFY COMBAT VEHICLES	
10	NO TASK NUMBER	DETERMINE IF A TARGET CAN BE ENGAGED BY AN M220-SERIRES LAUNCHER SYSTEM (SEE FM 23-34, CH 6)	
11	071-317-0000	PREPARE AN ANTIARMOR RANGE CARD	
12	NO TASK NUMBER	ASSEMBLE AN M220-SERIES LAUNCHER SYSTEM	

DA FORM 7331-R, JUL 94

GUNNER SKILL TEST (ALL 11H) - PART 2

For use of this form, see FM 23-34. The proponent agency is TRADOC.

NAME:	RANK:	UNIT:	DATE:

TEST#	TASK NUMBER	TASK TITLE	GO/NO GO
1	NO TASK NUMBER	PLACE THE 966 VEHICLE IN THE-READY-TO-FIRE CONFIGURATION (SEE FM 23-34 CH 3)	
2	071-056-9932	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A1 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A1 EQUIPPED UNITS ONLY)	
3	071-056-0034	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A2 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A2 EQUIPPED UNITS ONLY)	
4	071-056-0041	CONDUCT DISMOUNTING AND REMOUNTING OF AN M220A1 LAUNCHER SYSTEM ON AN M901 VEHICLE (M220A1-EQUIPPED UNITS ONLY)	
5	071-056-0045	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A2 LAUNCHER SYSTEM ON AN M901 VEHICLE (M220A2 EQUIPPED UNITS ONLY)	
6	071-034-0001	LOAD AN M243 OR M259 SMOKE GRENADE LAUCHER	
7	071-034-0002	UNLOAD AN M243 OR M259 SMOKE GRENADE LAUCHER	
8	NO TASK NUMBER	MOUNT, DISMOUNT, AND REMOUNT AN M60 MACHINE GUN O AN M901 VEHICLE (SEE FM 23-34, CH 4)	
9	071-056-0020	LOAD A DUAL LAUNCHER WHILE MOUNTED ON AN M901 VEHICLE	
10	071-056-0021	UNLOAD A DUAL LAUNCHER WHILE MOUNTED ON AN M901 VEHICLE	
11	NO TASK NUMBER	OPERATE AN M901 DUAL LAUNCHER USING EMERGENCY ACTION PROCEDURES (SEE FM 23-34, CH 4)	
12	NO TASK NUMBER	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A1 LAUNCHER SYSTEM ON AN M2/M3 BTV (FOR UNITS EQUIPPED WITH M220A1 ONLY)	
13	NO TASK NUMBER	CONDUCT DISMOUNTING AND REMOUNTING OF AND M220A2 LAUNCHER SYSTEM ON AN M2/M3 BTV (FOR UNITS EQUIPPED WITH M220A2 ONLY)	

DA FORM 7332-R, JUL 94

TOW GUNNERY TABLE 1 AND 2: INDIVIDUAL GUNNERY

☐ PRACTICE ☐ QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

DATA REQUIRED BY PRIVACY ACT OF 1974

AUTHORITY: 10USC 30129g. Executive Order 9397. **PRINCIPAL PURPOSE(S):** Records individual's performance on record fire range. **ROUTINE USE(S):** Evaluation of individual's proficiency and basis for determination of award of proficiency badge; SSN is used for positive identification purposes only. **MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION: Voluntary; individuals not providing information cannot be rated/scored on a mass basis.**

NAME:	RANK:	SSAN:	UNIT:
DATE:		DISK#	

MISSION#	INDIVIDUAL GUNNERY TASK TESTED	SIGHT	SCORE	SUCCESSFUL	
#				YES	NO
#				YES	NO
#				YES	NO
#				YES	NO
#				YES	NO
#				YES	NO
#				YES	NO
#				YES	NO
#				YES	NO
#				YES	NO
	TOTAL TRACKING SCORE			SUCCESSFUL MISSIONS:	

GUNNER CLASSIFICATION

EXPERT / 875 - 1000 1ST CLASS / 750 - 874 2ND CLASS / 625 - 749

SCORING INDIVIDUAL GUNNERY TABLES

IN THE INDIVIDUAL GUNNERY TABLES, THE GUNNER RATING IS DETERMINED BY HIS TOTAL POINT SCORE FOR 10 MISSIONS, PLUS HE MUST HAVE AT LEAST 6 SUCCESSFUL MISSIONS. A SUCCESSFUL MISSION IS ONE WHERE THE GUNNER CORRECTLY FOLLOWS THE TRAINERS FIRE COMMANDS AND ENGAGES AND DESTROYS THE CORRECT TARGET.

DA FORM 7333-R, JUL 94

TOW GUNNERY TABLE 3 AND 4: ADVANCED GUNNERY

☐ PRACTICE ☐ QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

DATA REQUIRED BY PRIVACY ACT OF 1974

AUTHORITY: 10USC 30129g. Executive Order 9397. **PRINCIPAL PURPOSE(S):** Records individual's performance on record fire range. **ROUTINE USE(S):** Evaluation of individual's proficiency and basis for determination of award of proficiency badge; SSN is used for positive identification purposes only. **MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION: Voluntary; individuals not providing information cannot be rated/scored on a mass basis.**

+

NAME:	RANK:	SSAN:	UNIT:
DATE:		DISK#	

MISSION#	INDIVIDUAL GUNNERY TASK TESTED	SIGHT	SCORE	SUCCESSFUL
#				YES NO
#				YES NO
#				YES NO
#				YES NO
#				YES NO
#				YES NO
#				YES NO
#				YES NO
#				YES NO
#				YES NO
	TOTAL TRACKING SCORE			SUCCESSFUL MISSIONS:

GUNNER CLASSIFICATION

EXPERT / 875 - 1000 1ST CLASS / 750 - 874 2ND CLASS / 625 - 749

SCORING ADVANCE GUNNERY TABLES

IN THE INDIVIDUAL GUNNERY TABLES, THE GUNNER RATING IS DETERMINED BY HIS TOTAL POINT SCORE FOR 10 MISSIONS, PLUS HE MUST HAVE AT LEAST 6 SUCCESSFUL MISSIONS. A SUCCESSFUL MISSION IS ONE WHERE THE GUNNER CORRECTLY FOLLOWS THE TRAINERS FIRE COMMANDS AND ENGAGES AND DESTROYS THE CORRECT TARGET. IF THE MISSIONS IS A FRATRICIDE MISSION, THE GUNNER SHOULD NOT ENGAGE THE TARGET. IF HE DOES NOT ENGAGE THE FRIENDLY VEHICLE, HE SCORES 100 POINTS AND A SUCCESSFUL MISSION., IF HE ENGAGE THE FRIENDLY VEHICLE, HE SCORES 0 POINTS AND AN UNSUCCESSFUL MISSION. IN TARGET ENGAGEABILITY AND EVASIVE TARGET SCENARIOS IT DOES NOT MATTER WHICH TARGET IS ENGAGED.

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TOW GUNNERY TABLES 5 AND 6: BASELINE TFTT GUNNERY

☐ PRACTICE ☐ QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SQUAD:	SECTION:	PLATOON:	COMPANY:
DATE:		DAY:	NIGHT:

ENGAGEMENT	TARGET DESCRIPTION	HIT/MISS/TIME	GO/NG
TARGET 1	STATIONARY T72/FLANK/ 1,000 - 1,500 METERS	HIT MISS TIME:	
TARGET 2	STATIONARY T72/FLANK/ 2,100 - 3,750 METERS	HIT MISS TIME:	
TARGET 3	STATIONARY T72/FRONTAL/ 2,100 - 3,750 METERS	HIT MISS TIME:	
TARGET 4	STATIONARY T72/OBLIQUE/ 2,100 - 3,750 METERS/NBC	HIT MISS TIME:	
TARGET 5	STATIONARY T72/DEFILADE/ 800 - 1,500 METERS/NBC	HIT MISS TIME:	
TARGET 6	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	HIT MISS TIME:	
TARGET 7	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	HIT MISS TIME:	
TARGET 8	MOVING T72/FLANK/ L-R, 5 KPH 1,000 - 1,500 METERS	HIT MISS TIME:	
TARGET 9	MOVING T72/FLANK/ L-R, 10 KPH 2,100 - 3,750 METERS	HIT MISS TIME:	
TARGET 10	MOVING T72/FLANK/ L-R, 40 KPH 1,000 - 1,500 METERS	HIT MISS TIME:	
		OVERALL GO/NO GO:	

IN ORDER TO RECEIVE A GO ON ANY TARGET ENGAGEMENT, THE GUNNER MUST HIT THE TARGET WITHIN 30 SECONDS AFTER THE TARGET IS EXPOSED. TO RECEIVE A GO ON TABLE 5, THE CREW MUST RECEIVE A GO ON "INSTALL TFTT" AND A GO ON AT LEAST 6 OUT OF 10 TARGET ENGAGEMENTS, BOTH DAY AND NIGHT.

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TOW GUNNERY TABLE 7: SQUAD GUNNERY PRACTICE

For use of this form, see FM 23-34.The proponent agency is TRADOC.

TC: _____ LDR: _____GNR: _____DVR: _____ DATE: _____ TIME: _____

PLATOON:_____ COMPANY:_____ BATTALION: _____

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	1				
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 2,500 METERS 1 ST TANK, 1 - MV TANK, 1 - MV BMP	TFTT HMMWV/2:30 ITV/3:11	1 2 3				
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 2,500 - 3,000 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV/1:40 ITV/1:40	1 2				
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,500 - 3,000 METERS 1 ST TANK, 1 - MV TANK (NBC)	TFTT HMMWV/1:40 ITV/1:38	1 2				
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV/1:40 ITV/1:56	1 2				

NOTES:

TOTAL SCORE

1. ENGAGEMENT TIMES ARE CALCULATED FROM THE TIME THE TAREGET IS EXPOSED TO THE TIME THE TARGET IS HIT. USE THE LIVE FIRE POINT CALCULATION SHEET FOR SECOND AND THIRD ENGAGEMENTS FROM THE SAME POSITION. THE TIME IS BEGUN WHEN THE VEHICLE REOCCUPIES ITS FIRING POSITON (STOPS MOVING) AND ENDS WHEN THE TARGET IS HIT.
2. EACH TASK IS WORTH 100 POINTS. EACH TARGET IS ALSO WORTH 100 POINTS FOR TASKS WITH MULTIPLE ENGAGEMENTS. TOTAL THE NUMBER OF POINTS AND DIVIDE BY THE NUMBER OF TARGETS PRESENTED.
3. CREW CUTS: SEE FM 23 - 34, CH 5.
4. SCORING TABLE 7: TABLE 7 IS PERFORMED TWICE, ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WORTH A MAX OF 500 POINTS. ADD THE TWO SCORES TOGETHER FOR A MAX OF 1,000 POINTS. SQUADS MUST ACHIEVE A MINIMUM TOTAL OF 700 POINTS TO VERIFY ON TABLE 7 AND PROGRESS TO TABLE 8.

DA FORM 7336-R, JUL 94

TOW GUNNERY TABLE 8: SQUAD GUNNERY QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

TC: _____ LDR: _____ GNR: _____ DVR: _____ DATE: _____ TIME: _____

PLATOON: _____ COMPANY: _____ BATTALION: _____

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 1,500 - 2,000 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	1				
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 1. 2,000 - 2,500 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV/1:40 ITV/1:28	1 2				
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 3,000 - 3,750 METERS 2 - MV TANK, 1 - ST BMP	TFTT HMMWV/2:45 ITV/3:51	1 2 3				
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 1. 1,500 - 2,000 METERS 1 ST TANK, 1 - MV BMP (NBC)	TFTT HMMWV/1:40 ITV/1:08	1 2				
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV/1:40 ITV/1:56	1 2				

TOTAL SCORE	

NOTES:

1. TABLE 8 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLE 7.
2. TABLE 8, UNLIKE TABLE 7, IS FOR QUALIFICATION. THE SQUAD IS RATED ON ITS FINAL SCORE, RATHER THAN SIMPLY HAVING TO MEET A MINIMUM STANDARD.
3. CREW CUTS: SEE FM 23 - 34, CH 5.
4. SCORING TABLE 8: TABLE 8 IS PERFORMED TWICE, ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WORTH A MAX OF 500 POINTS. ADD THE TWO SCORES TOGETHER FOR A MAX OF 1,000 POINTS. SQUADS ARE RATED ON THE FOLLOWING BASIS:

   DISTINGUISHED: 900 - 1,000 POINTS SUPERIOR: 800 - 899 POINTS QUALIFIED: 700 - 799 POINTS UNQUALIFIED: 0 - 699 POINTS

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TOW GUNNERY TABLE 9: SECTION GUNNERY PRACTICE

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION TC: _____ LDR: _____ GNR: _____ DVR: _____ DATE: _____

SQUAD TC: _____ LDR: _____ GNR: _____ DVR: _____ TIME: _____

PLATOON: _____ COMPANY: _____ BATTALION: _____

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 1 - ST TANK, 1 - ST BMP	TFTT 40 SECS ALL VEHICLES	1 2				
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 2,750 METERS 1 - ST BMP	TFTT 25 SECS ALL VEHICLE	1				
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 1,500 METERS 2 - MV BMPS, 1 - ST TANK	TFTT HMMWV/1:40 ITV/1:08	1 2 3				
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,500 - 3,000 METERS 2- MV TANKS, 2 - ST TANKS (NBC)	TFTT HMMWV/2:38 ITV/1:38	1 2 3 4				
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 1,000 - 1,500 METERS 1 - ST TANK, 1 - ST BMP (NBC)	TFTT 25 SECS ALL VEHICLES	1 2				

NOTES:

TOTAL SCORE

1. TABLE 9 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLES 7 AND 8.
2. SCORING TABLE 9: TABLE 9 IS PERFORMED TWICE,. ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WORTH A MAX OF 500 POINTS FOR A POSSIBLE TOTAL MAX OF 1,000 POINTS. TABLE 9 IS A PRACTICE TABLE. IN ORDER TO VERIFY ON TABLE 9 AND PROGRESS TO TABLE 10, THE SECTION MUST ACHIEVE A MINIMUM COMBINED SCORE OF AT LEAST 700 POINTS, AFTER CREW AND LEADER CUTS.

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TOW GUNNERY TABLE 10: SECTION GUNNERY QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION TC: _____ LDR: _____ GNR: _____ DVR: _____ DATE: _____

SQUAD TC: _____ LDR: _____ GNR: _____ DVR: _____ TIME: _____

PLATOON: _____ COMPANY: _____ BATTALION: _____

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - MV TANK, 2 - ST BMP	TFTT HMMWV/2:38 ITV/2:36	1 2 3 4				
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 2,500 METERS 1 - MV TANK	TFTT 40 SECS ALL VEHICLES	1				
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 1,500 METERS 1 - MV BMPS, 1 - ST TANK	TFTT 25 SECS ALL VEHICLES	1 2				
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,500 - 3,000 METERS 1 - ST BMP, 2 - MV TANKS (NBC)	TFTT HMMWV/2:40 ITV/2:26	1 2 3				
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 1 - ST TANK, 1 - ST BMP (NBC)	TFTT 25 SECS ALL VEHICLES	1 2				

NOTES:

TOTAL SCORE

1. TABLE 10 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLE 8 AND 9.
2. SCORING TABLE 10: TABLE 10 IS PERFORMED TWICE. ONCE DURING THE DAY AND ONCE AT NIGHT. EACH EVENT IS WORTH A MAX OF 500 POINTS FOR A POSSIBLE TOTAL MAX OF 1,000 POINTS. TABLE 10 IS A QUALIFICATION TABLE. IN ORDER TO PROGRESS TO TABLE 11, THE SECTION MUST ACHIEVE A MINIMUM COMBINED SCORE OF AT LEAST 700 POINTS.

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TOW GUNNERY TABLE 11: PLATOON GUNNERY PRACTICE

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION 1: TOW CREW 1: TC: _____ LDR: _____ GNR: _____ DVR: _____

TOW CREW 2: TC: _____ LDR: _____ GNR: _____ DVR: _____

SECTION 2: TOW CREW 1: TC: _____ LDR: _____ GNR: _____ DVR: _____

TOW CREW 2: TC: _____ LDR: _____ GNR: _____ DVR: _____

SECTION 3: TOW CREW 1: TC: _____ LDR: _____ GNR: _____ DVR: _____

TOW CREW 2: TC: _____ LDR: _____ GNR: _____ DVR: _____

DATE: _____

TIME: _____

PLATOON: _____ COMPANY: _____ BATTALION: _____

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 4 - MV TANKS, 2 - ST BMPS	TFTT HMMWV/3:26 ITV/2:26	1 2 3 4 5 6				
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 3,000 METERS 4 - MV BMPS 2 - ST BMPS	TFTT HMMWV/2:26 ITV/1:26	1 2 3 4 5 6				
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 2,000 METERS 2 - ST TANKS, 2 - ST BMPS	TFTT 25 SECS ALL VEHICLES	1 2 3 4				
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 3,000 METERS 2- MV TANKS, 2 - MV BMPS (NBC)	TFTT BMP/43 SEC TANK/1:03	1 2 3 4				
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - ST TANKS, 2 - ST BMPS (NBC)	TFTT 25 SECS ALL VEHICLES	1 2 3 4				

NOTES:

1. TABLE 11 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS THE PREVIOUS TABLES 7 THRU 10.

TOTAL SCORE

DA FORM 7340-R, JUL 94

TOW GUNNERY TABLE 12: PLATOON GUNNERY QUALIFICATION

For use of this form, see FM 23-34. The proponent agency is TRADOC.

SECTION 1:	TOW CREW 1:	TC: _____	LDR: _____	GNR: _____	DVR: _____	DATE: _____
	TOW CREW 2:	TC: _____	LDR: _____	GNR: _____	DVR: _____	
SECTION 2:	TOW CREW 1:	TC: _____	LDR: _____	GNR: _____	DVR: _____	TIME: _____
	TOW CREW 2:	TC: _____	LDR: _____	GNR: _____	DVR: _____	
SECTION 3:	TOW CREW 1:	TC: _____	LDR: _____	GNR: _____	DVR: _____	
	TOW CREW 2:	TC: _____	LDR: _____	GNR: _____	DVR: _____	

PLATOON: _____ COMPANY: _____ BATTALION: _____

TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS
1 ENGAGE A SINGLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - MV TANKS, 2 - ST BMPS	TFTT BMP/25 SEC TANK/1:13	1 2 3 4				
2. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 2,000 - 3,000 METERS 3 - ST BMPS, 3 - MV TANKS	TFTT HMMWV/2:28 ITV/1:38	1 2 3 4 5 6				
3. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 3. 1,000 - 2,000 METERS 3 - ST TANKS, 3 - MV BMPS	TFTT HMMWV/1:08 ITV/2:08	1 2 3 4 5 6				
4. ENGAGE MULTIPLE TARGET	FIRED FROM PHASE LINE 2. 1,500 - 2,500 METERS 2- MV TANKS, 2 - MV BMPS (NBC)	TFTT BMP/34 SEC TANK/1:03	1 2 3 4				
5. ENGAGE MULTIPLE TARGET	FIRED FROM BASELINE. 3,000 - 3,750 METERS 2 - ST TANKS, 2 - ST BMPS (NBC)	TFTT 25 SECS ALL VEHICLES	1 2 3 4				
					TOTAL SCORE		

NOTES:

1. TABLE 12 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS THE PREVIOUS TABLE 7 THRU 11.

DA FORM 7341-R, JUL 94

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
06894

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