

TOW WEAPON SYSTEM



NOVEMBER 2003

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DEPARTMENT OF THE ARMY**

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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 carrier M966. Its intended audience includes leaders and members of mechanized infantry, light infantry, airborne, and airmobile infantry organizations who train and test individuals and crews. Units with M2/M3 Bradley fighting vehicle systems should also refer to FM 23-1 for additional training and testing requirements.

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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 fired from the ground mount and 200 meters when fired from the HMMWV or BFV. 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 crosshairs of the sighting system (either the daysight tracker or the nightsight) on the target, fires the missile, and centers the crosshairs 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 and 3.)

(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 daysight 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.

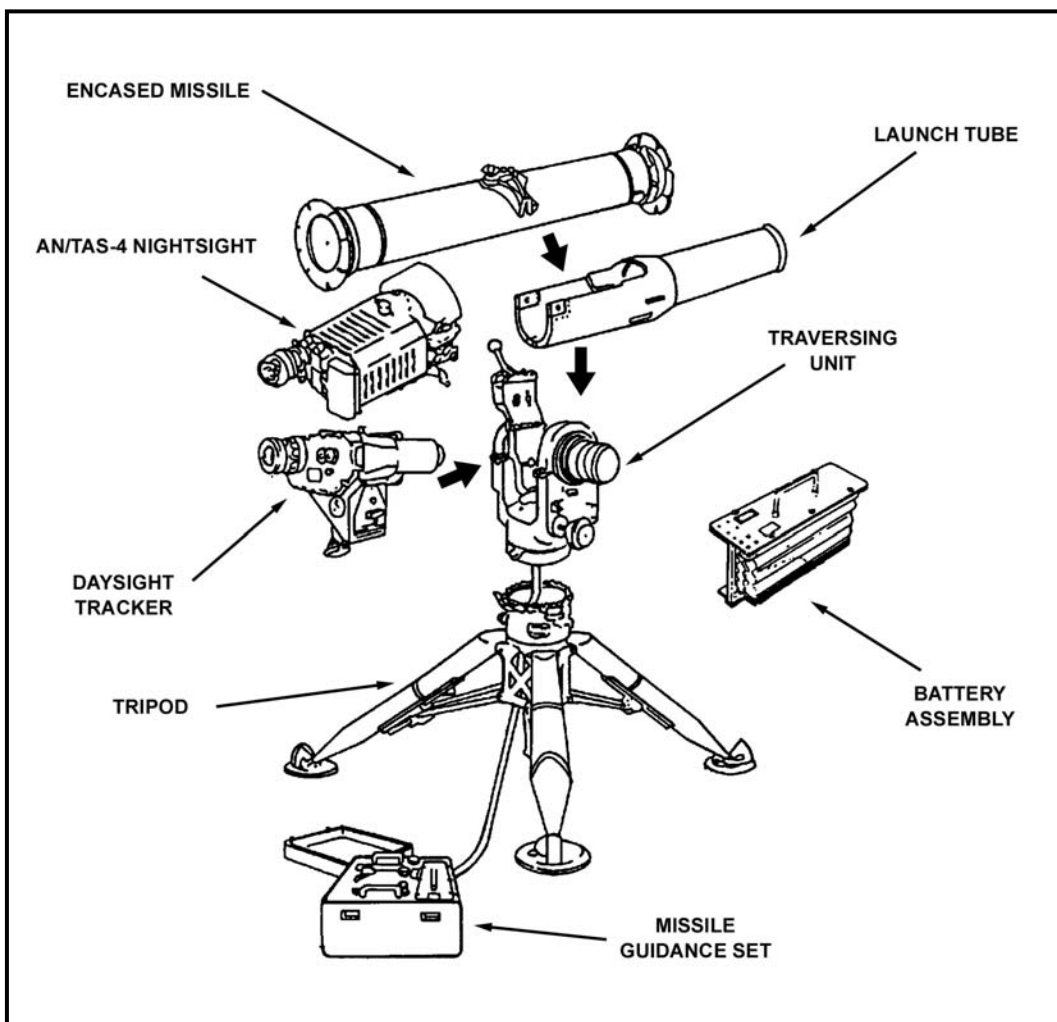


Figure 1-1. M220A1 TOW components.

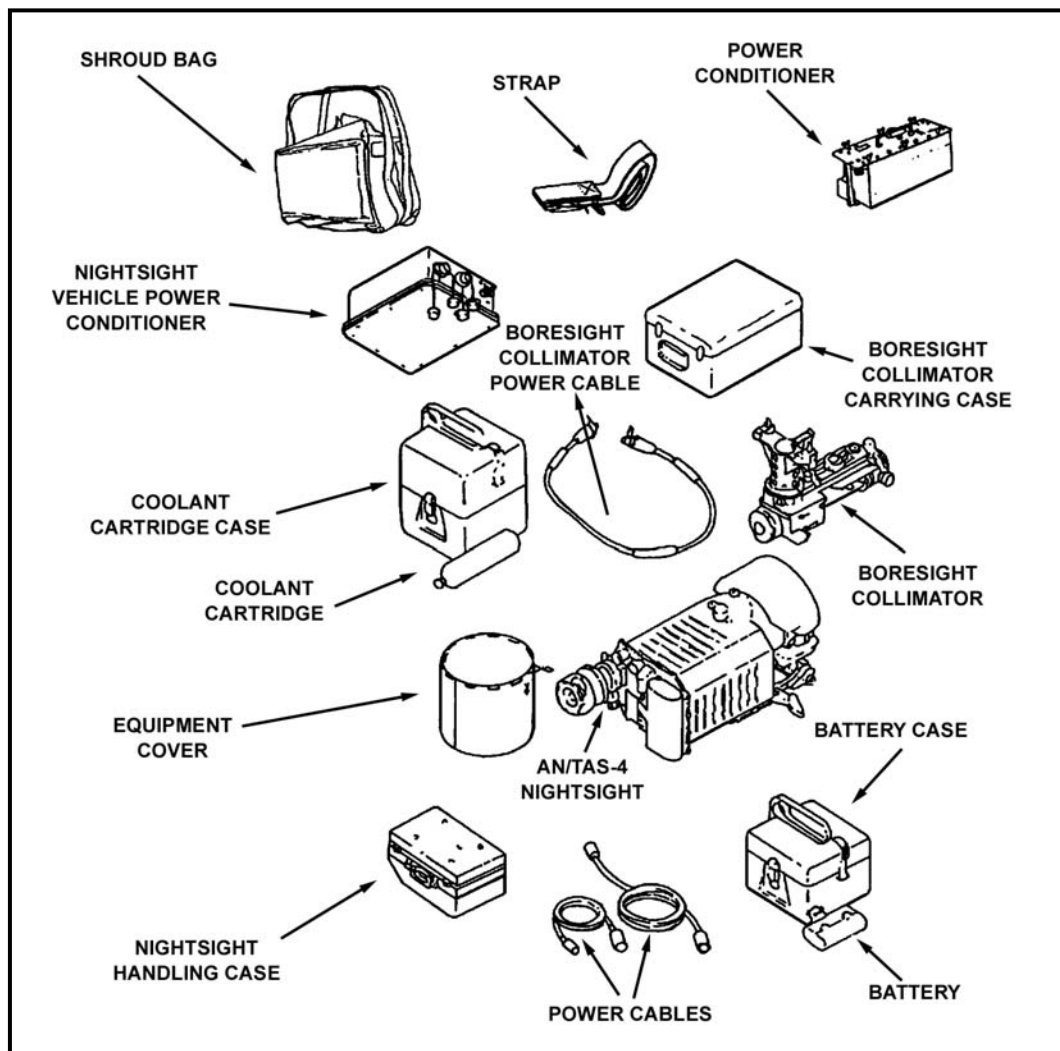


Figure 1-1. M220A1 TOW components (continued).

b. **M220A2 TOW 2 Weapon System.** The M220A2 TOW 2 (Figure 1-2, page 1-4) 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.

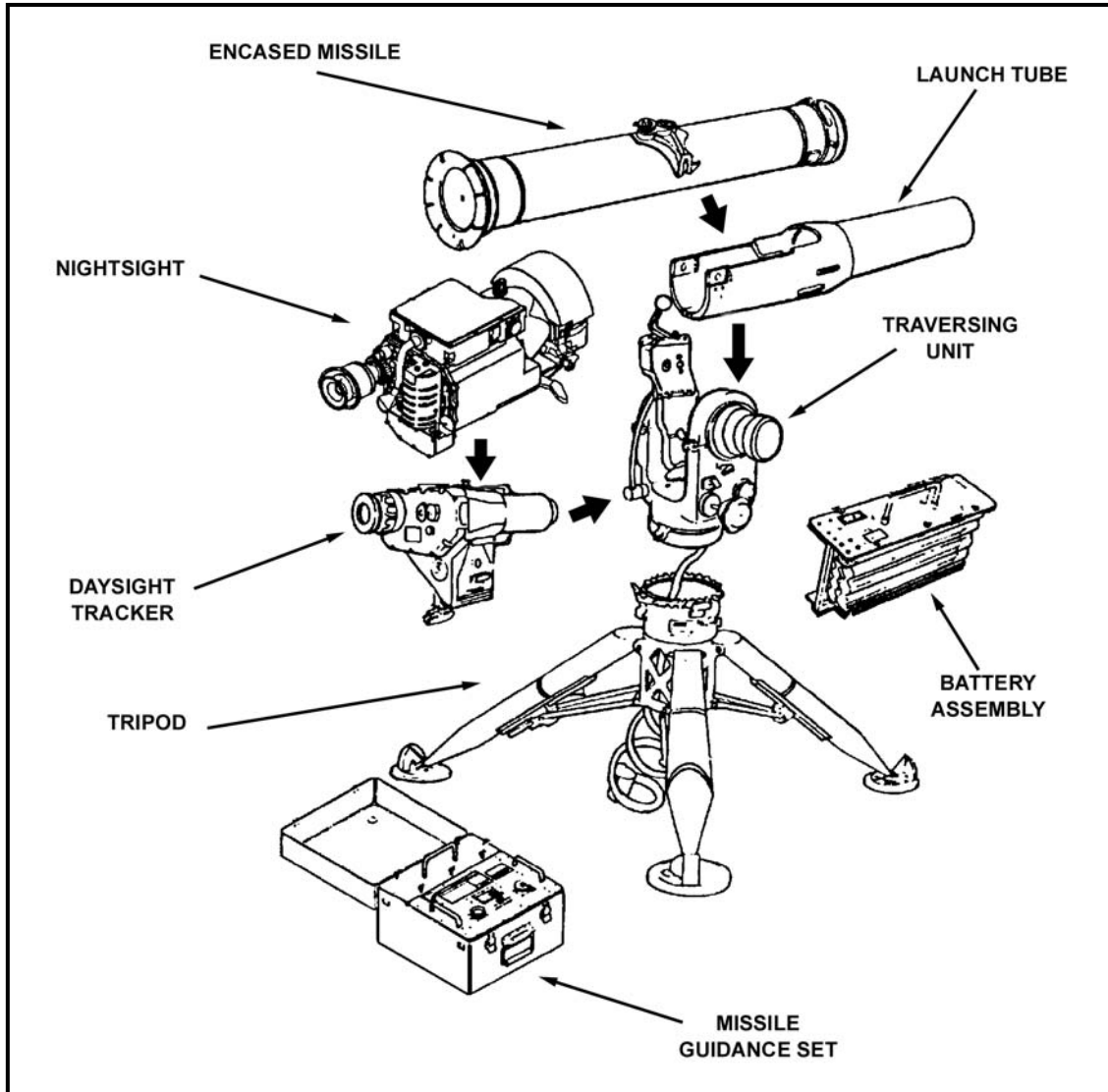


Figure 1-2. M220A2 TOW components.

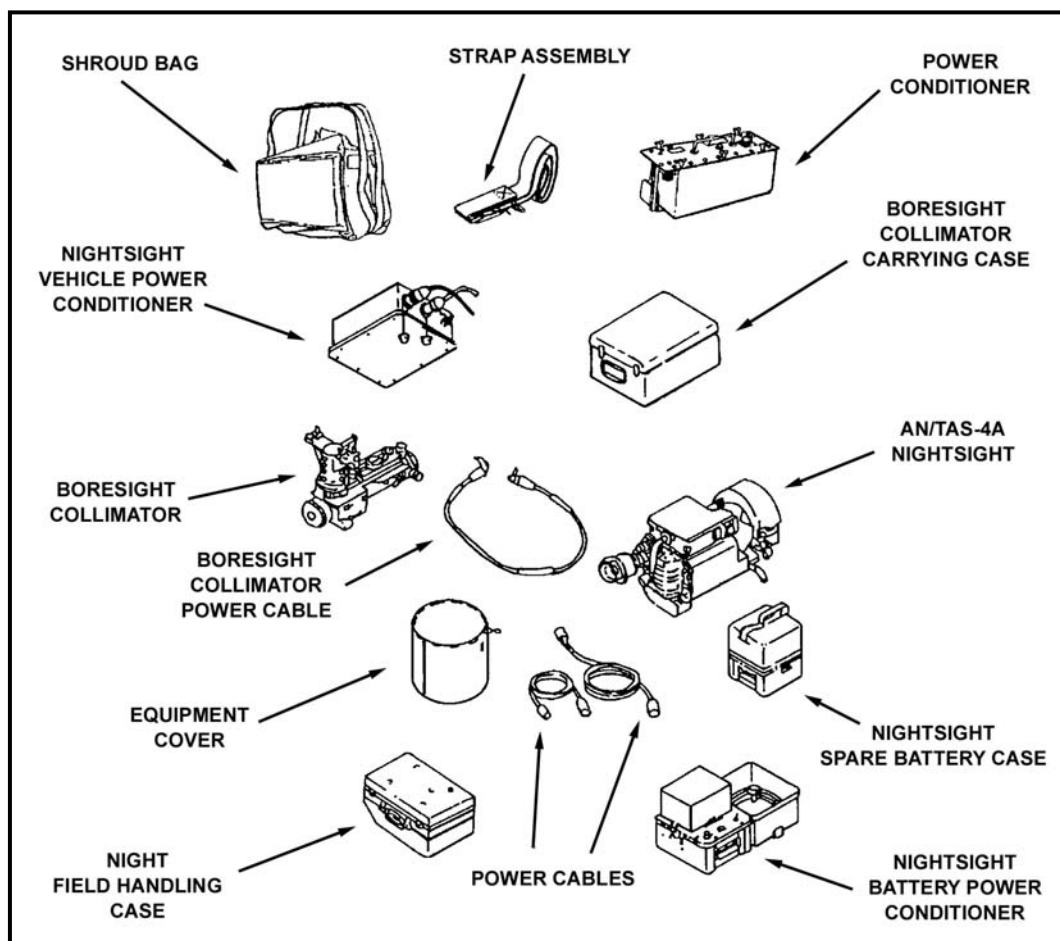


Figure 1-2. M220A2 TOW components (continued).

1-3. MISSILE CONFIGURATIONS AND TYPES

The TOW missile comes in four configurations with numerous types. These types mainly consist of minor modified work orders (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. All configurations use the same basic airframe, aerodynamic control system, command-link wire, and missile electronics designs.

a. The first configuration is the improved TOW (ITOW). These missiles have improved 5-inch warheads that include extended probes for greater standoff and penetration.

b. The second configuration is the TOW 2. This missile has a full-caliber 6-inch warhead that includes an extended 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 electrooptical infrared nightsight, which is part of the TOW 2 launcher system.

c. The third configuration is the TOW 2A. The TOW 2A has an added small explosive charge in the tip of the extended 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 crosshairs 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.

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.)

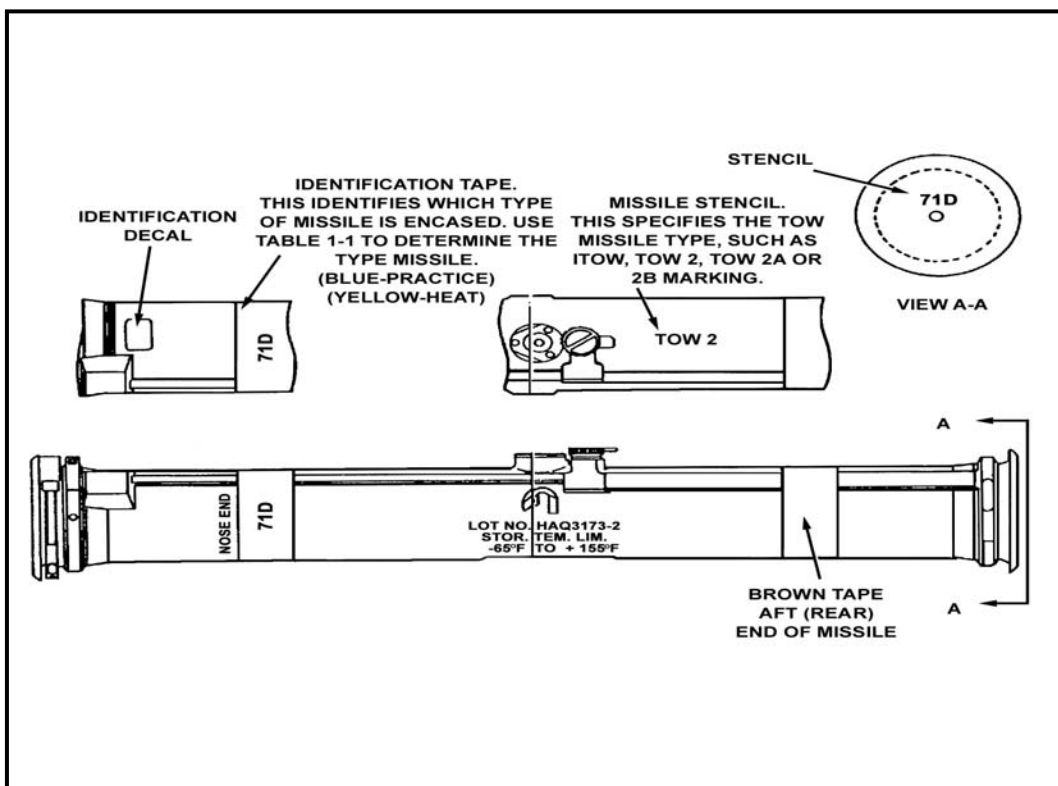


Figure 1-3. TOW missile case markings.

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, 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 an FOSSD missile. It is marked with a decal as shown in Figure 1-4.

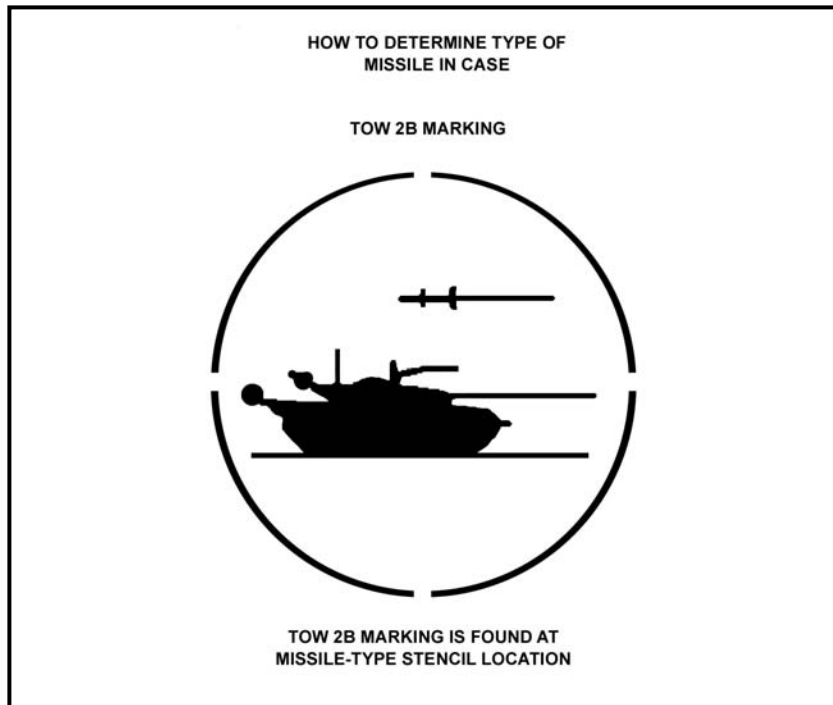


Figure 1-4. TOW 2B marking.

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, which will increase the soldier's knowledge of how his weapon functions.

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 extended 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, the flight motor, and 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 burns for 1.6 seconds. During this time, it provides all the momentum necessary for the full flight of the missile.

(d) 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 enemy 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 obscuration 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 0 being the time that the launch motor fires.

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.
+0.5	Missile exits launch tube.
+0.8	Wing 2 switch closes.
+1.0	Wing 4 switch closes; helium bottle opens; timed part of arming sequence starts; flight motor ignites.
+1.145	Delay switch changes state (part of arming sequence).
+1.18	Safety and arming unlock occurs. As missile accelerates to 19 Gs, the "G" force causes a rotor in the warhead to unlock.
+1.53	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.

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. (See Appendix A for training tips and Appendix B for a train-the-trainer program.)

a. The training strategy for TOW begins in 11B OSUT where the soldier is taught critical Skill Level 1 common skill tasks and critical 11B Skill Level 1 tasks. He is trained to be a loader, gunner, and driver.

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. Gunnery 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 4 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 Antiarmor Leader Course for NCOs (SGT[P] through SFC).

g. Army Correspondence Course Program (ACCP) courses also support TOW training. (See ACCP catalog for specific courses).

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 IAW 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 set up 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. (See Appendix C for more information on fighting positions.) 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 D.)

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 (do not lock the azimuth if it points the missile out of the left and right limits). 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, "Hangfire" 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).

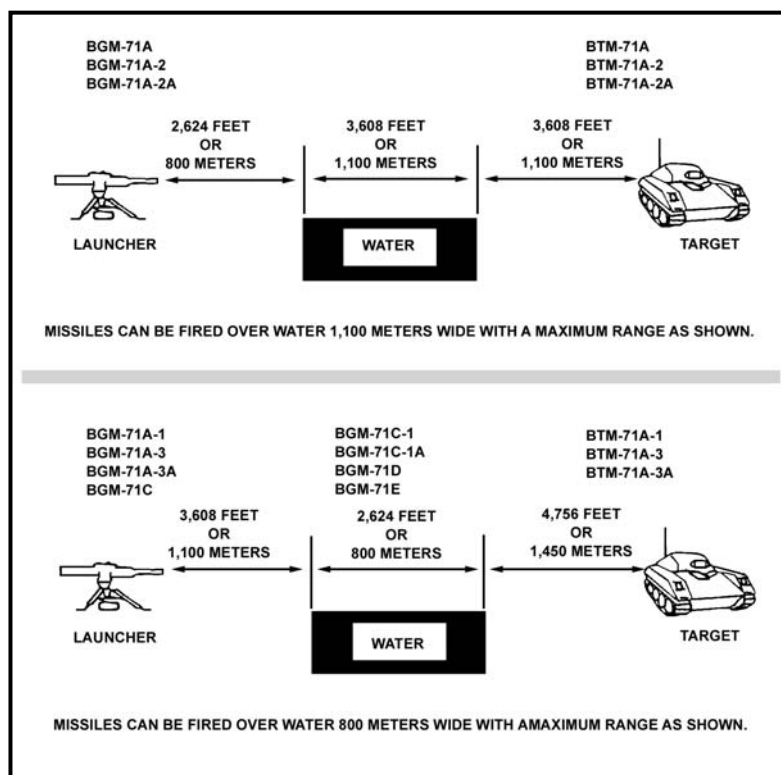


Figure 2-1. Maximum TOW missile range.

(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).

(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 (pages 2-6 and 2-7).

(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.

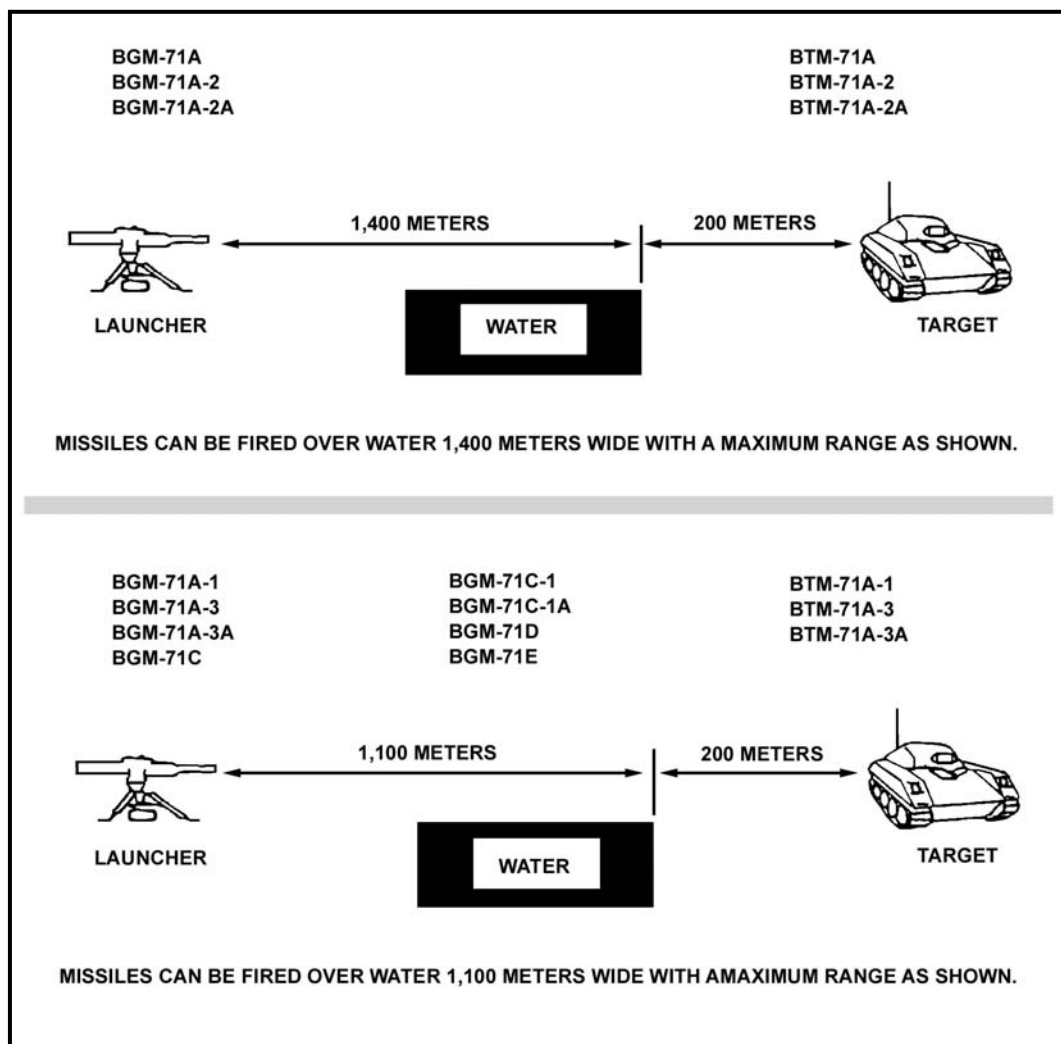


Figure 2-2. Limited TOW missile range.

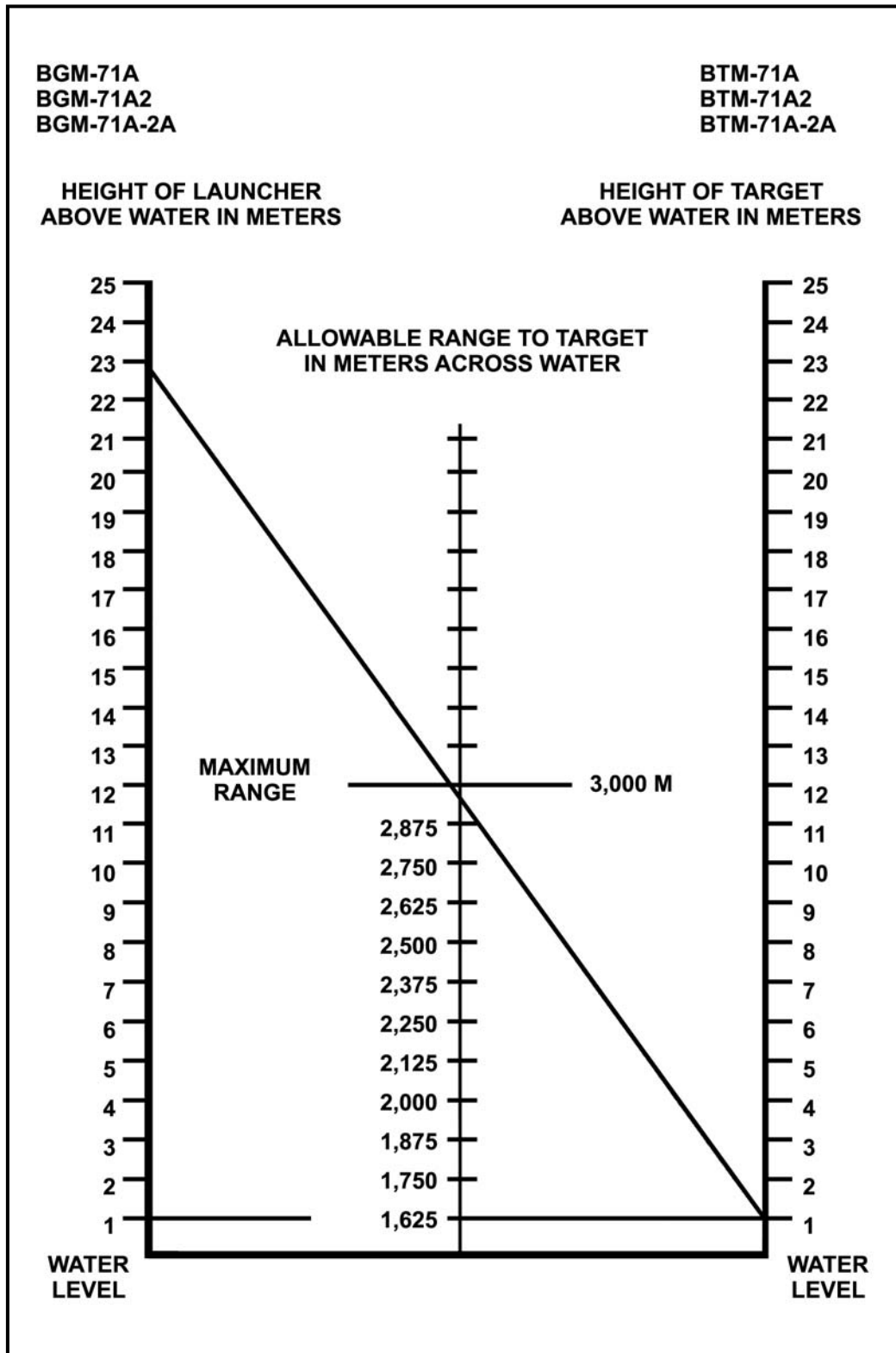


Table 2-1. Extended range over water.

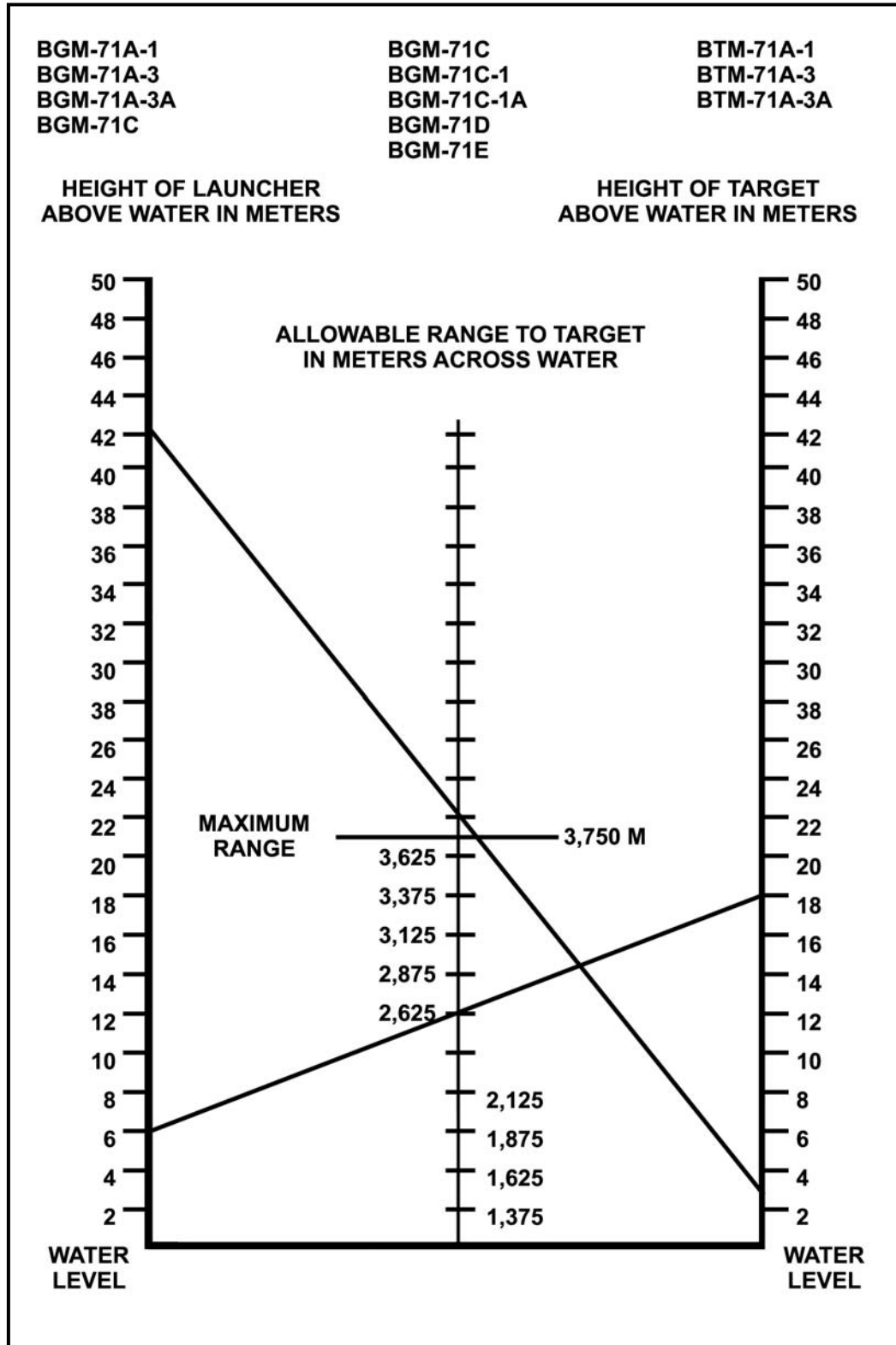


Table 2-1. Extended range over water (continued).

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 crosshairs 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 DA Pam 385-63, 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. (See Appendix E for further safety precautions.)

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).

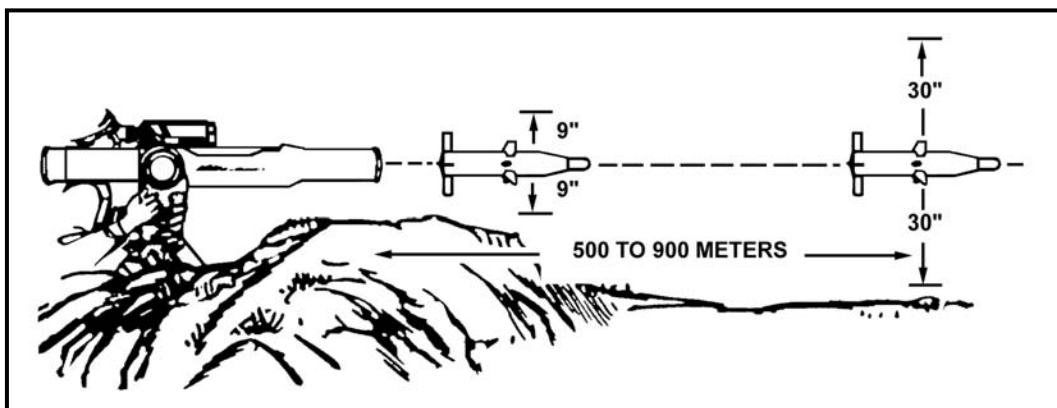


Figure 2-3. Clearance requirements.

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 5-250.

(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 2-4, page 2-10).

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

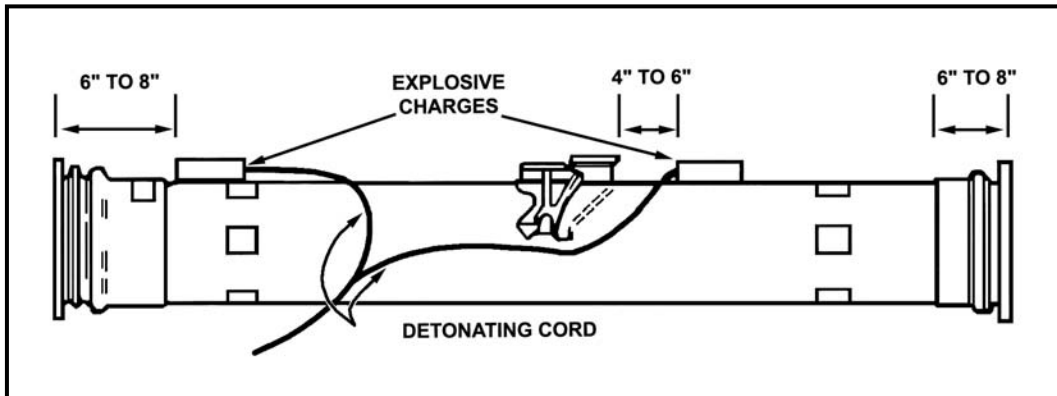


Figure 2-4. Explosive charges on an encased missile.

(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).

(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 one 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-mounted 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 gradation, 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.

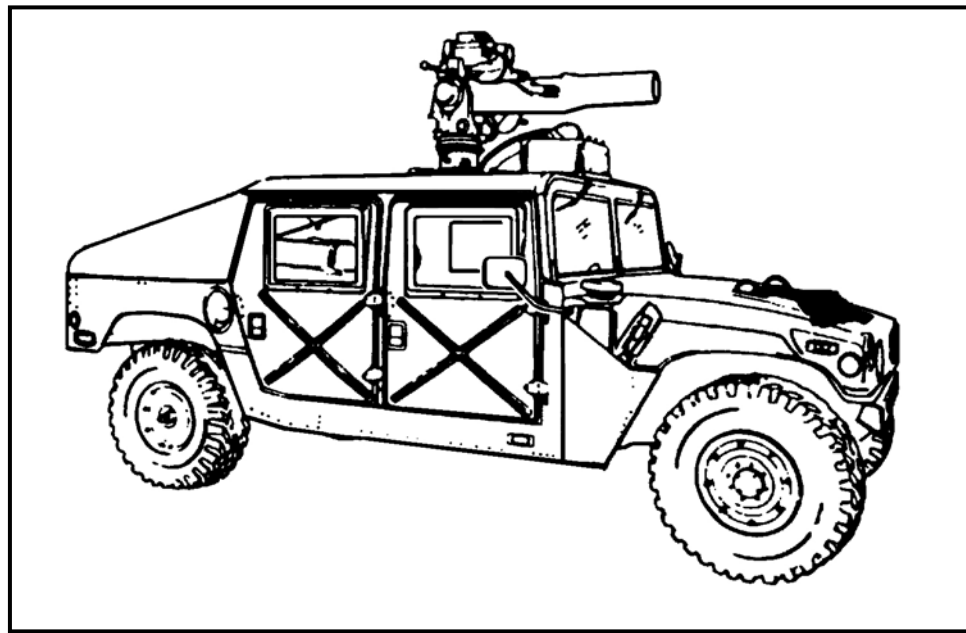


Figure 3-1. M966-mounted TOW.

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 [M220A1], 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.
- b. The traversing unit is stowed on the traversing unit adapter behind the right front passenger seat.
- 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.

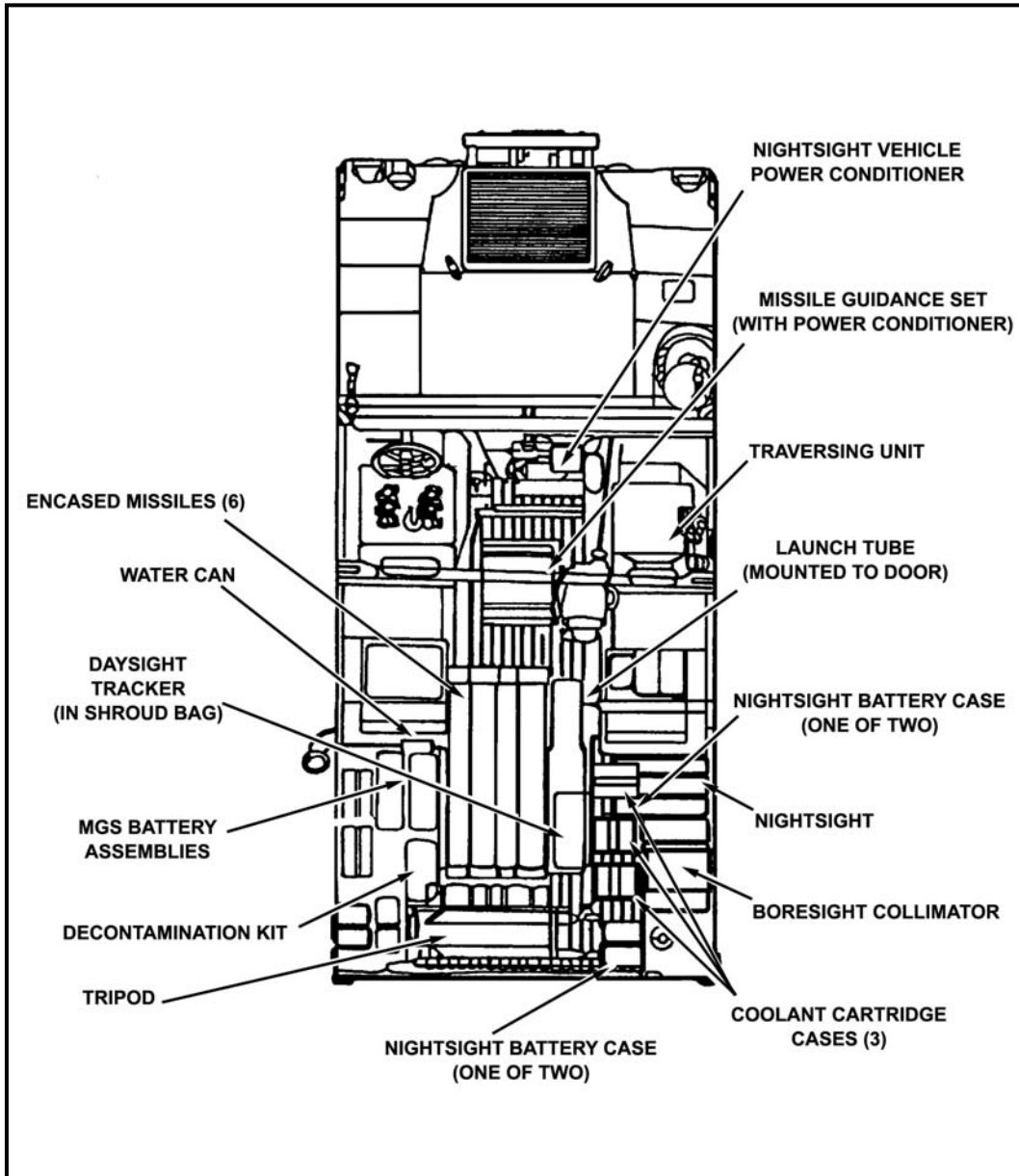


Figure 3-2. Stowing M220A1 on M966.

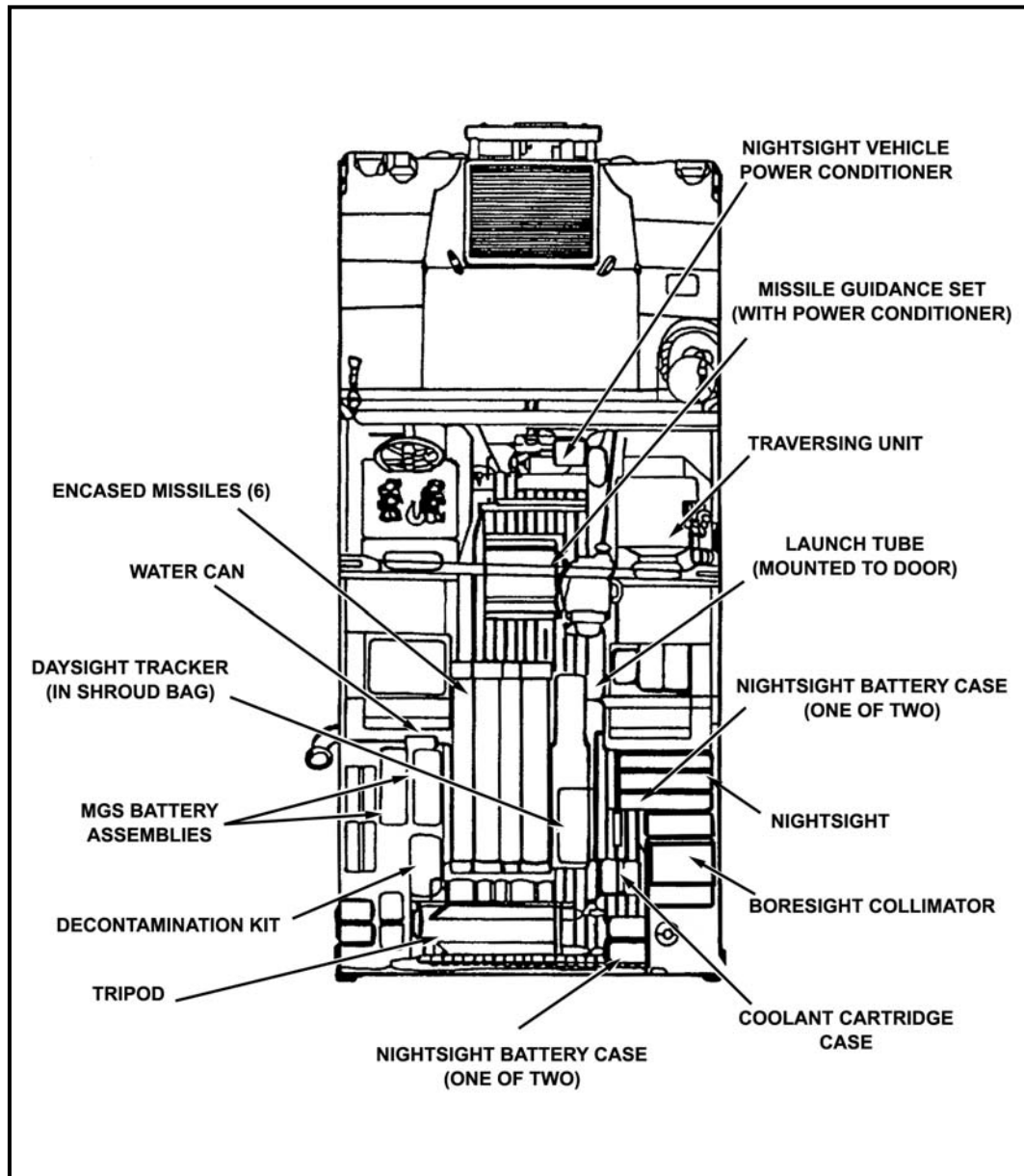


Figure 3-3. Stowing M220A2 on M966.

3-5. HMMWV INTERCHANGEABLE MOUNT SYSTEM

The HMMWV Interchangeable Mount System (HIMS) is used to convert an M966 TOW HMMWV carrier into an automatic weapons platform (Figure 3-4, page 3-6). 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 where to find the materials needed. TM 9-2320-280-10 contains the combat loading plans for the vehicle.)

a. Part one is an armament mount panel assembly with pintle that mounts on the M1025 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 tie-down 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.

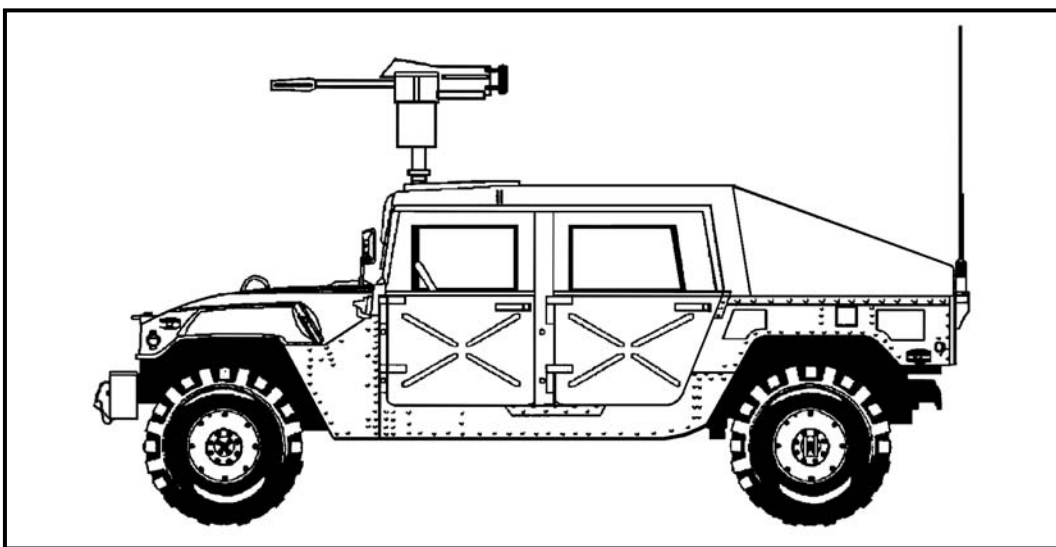


Figure 3-4. M966 with HIMCS.

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). 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 up on 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 3-8).

(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).

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, page 3-9). He turns the nut on the coil cable connector in the direction of the arrow until the red mark (band) on the M1 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 M1 connector and tighten the locking nut.

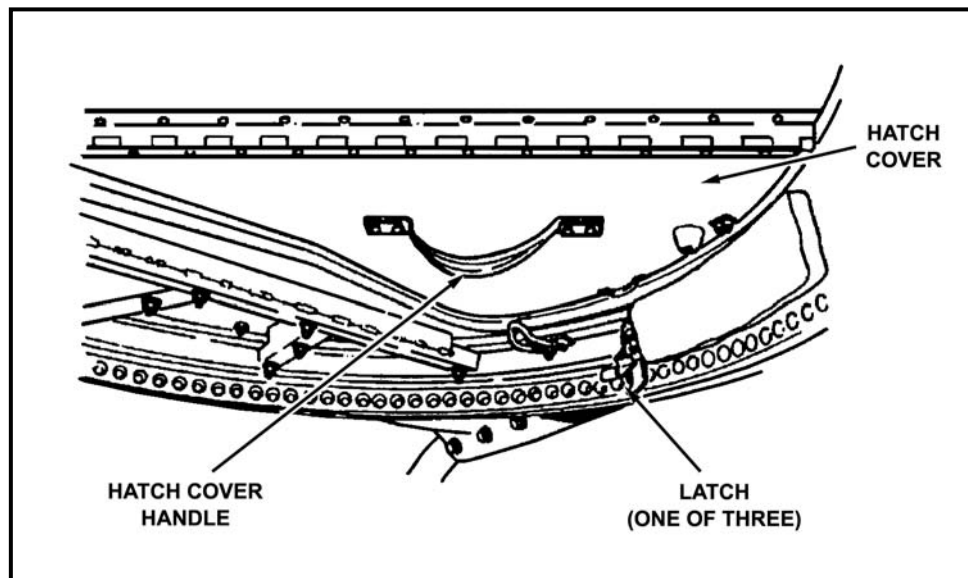


Figure 3-5. Hatch cover and latch.

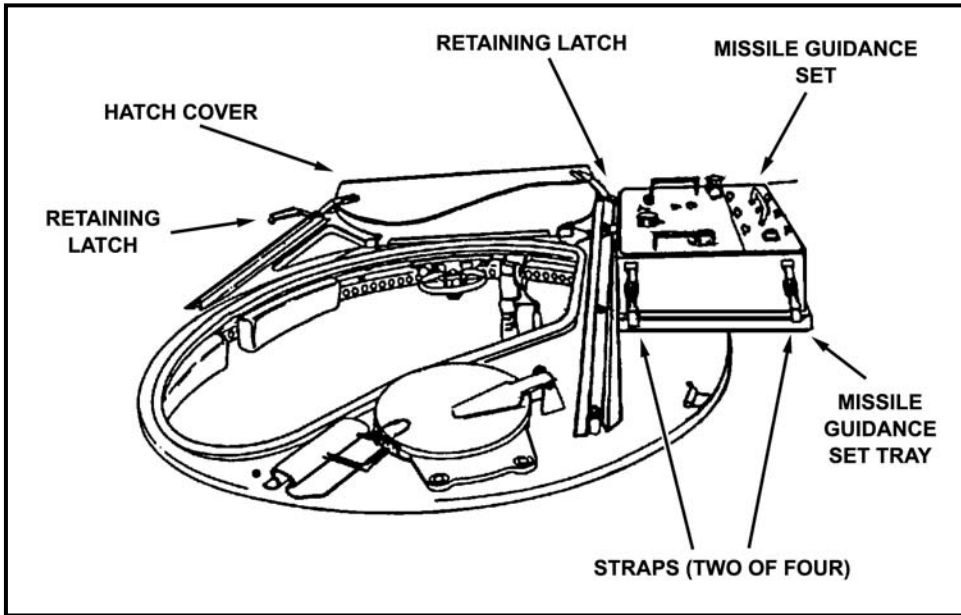


Figure 3-6. Hatch cover retaining latches and MIGS tray.

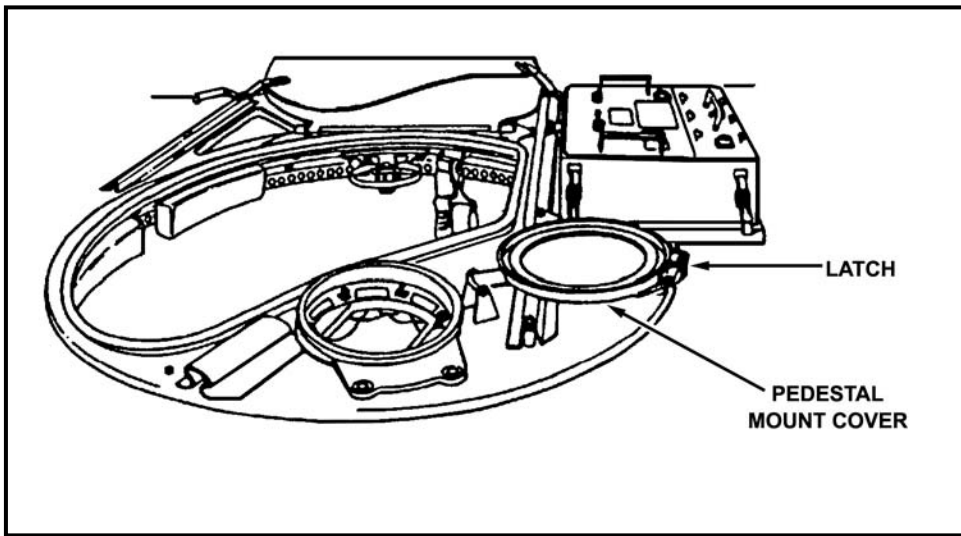


Figure 3-7. Pedestal mount cover and latch.

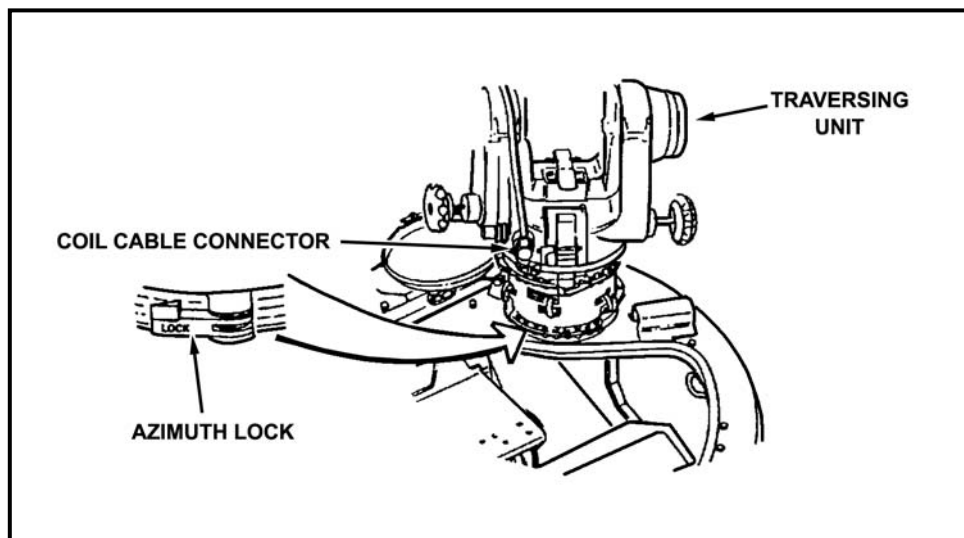


Figure 3-8. Coil cable connector.

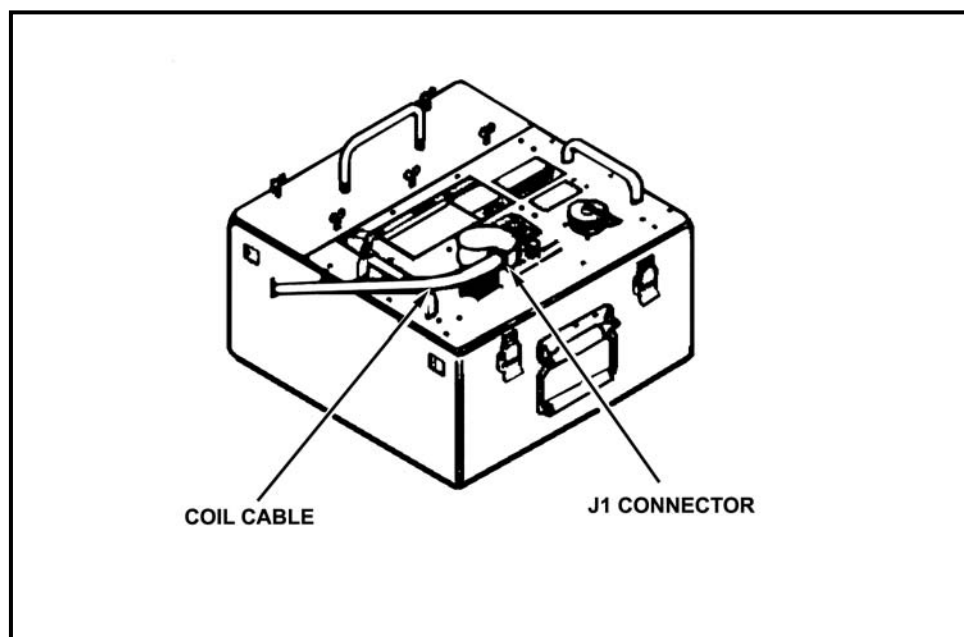


Figure 3-9. Coil cable connector and J1 connector.

- 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, page 3-10).

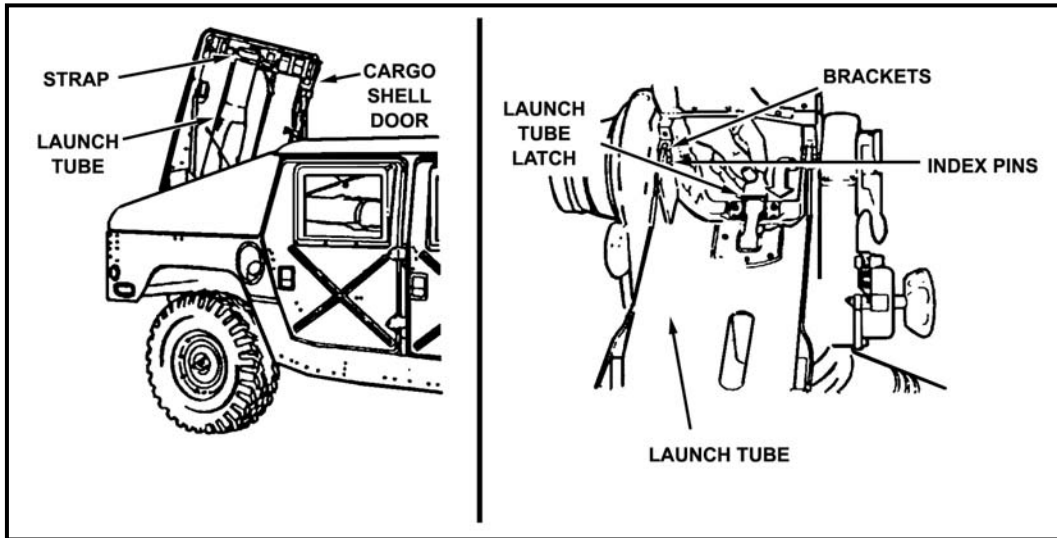


Figure 3-10. Launch tube latch.

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).

(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 3-12), 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 3-12).

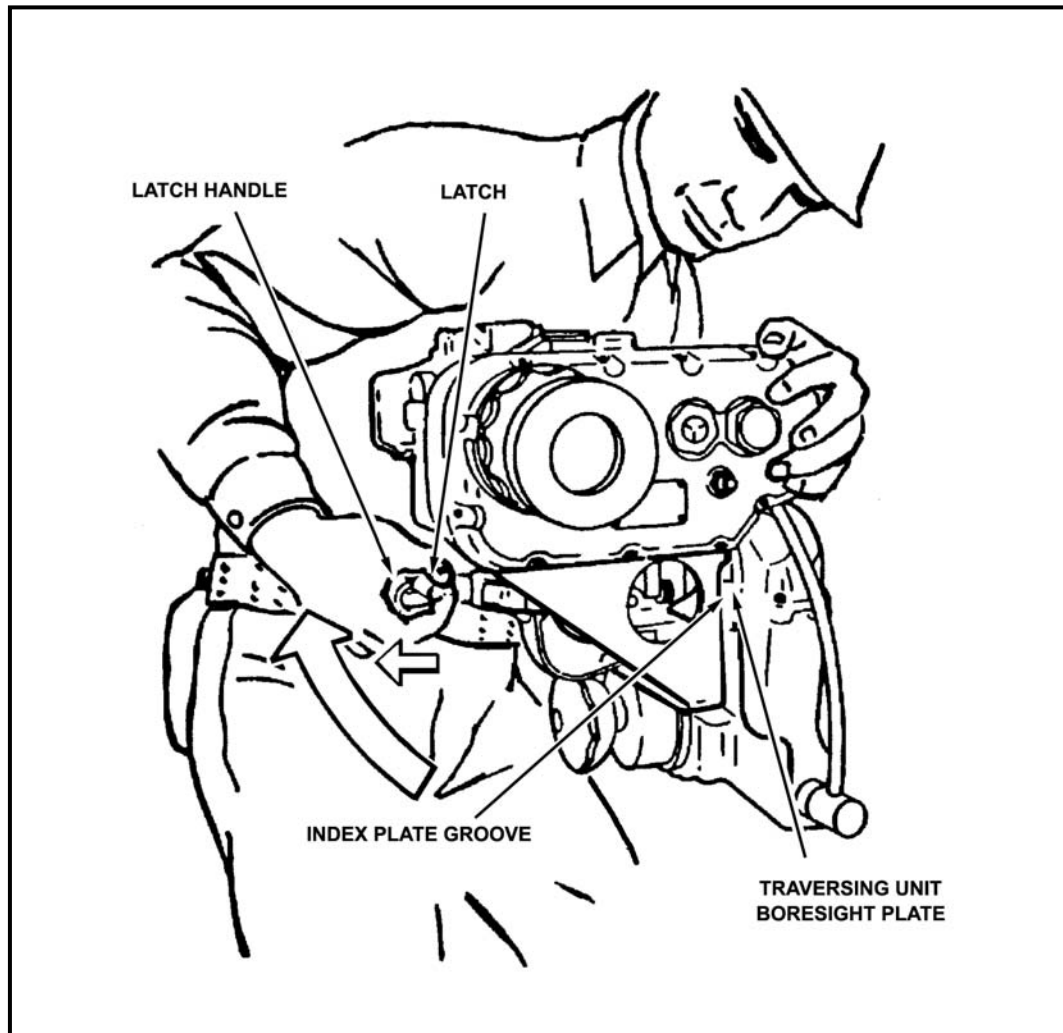


Figure 3-11. Daysight tracker on traversing unit boresight plate.

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.

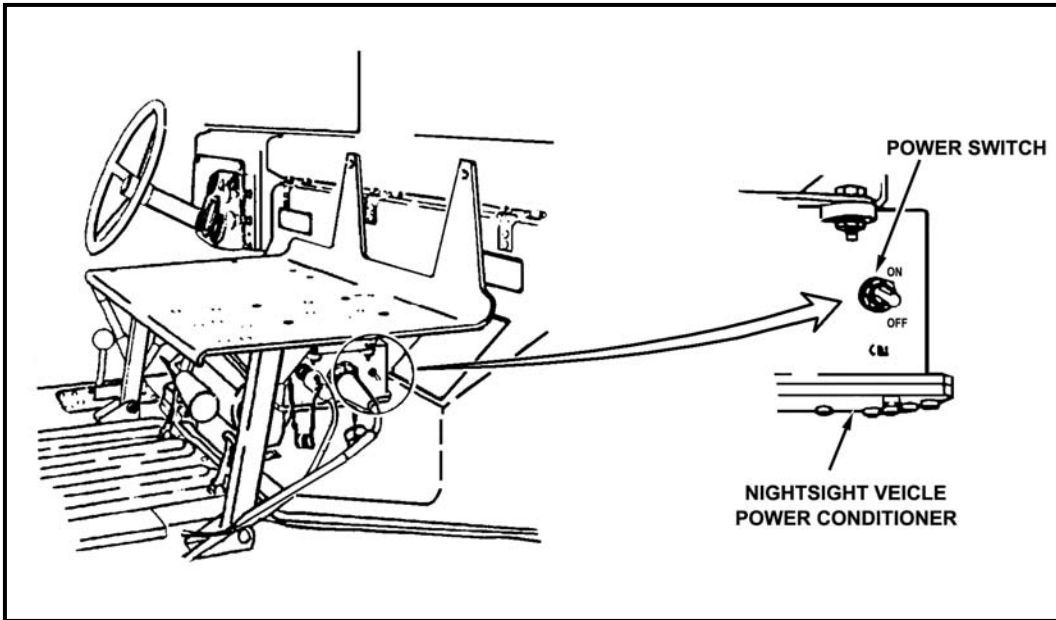


Figure 3-12. Nightsight power cable 2W2, J1 connector, and vehicle power conditioner.

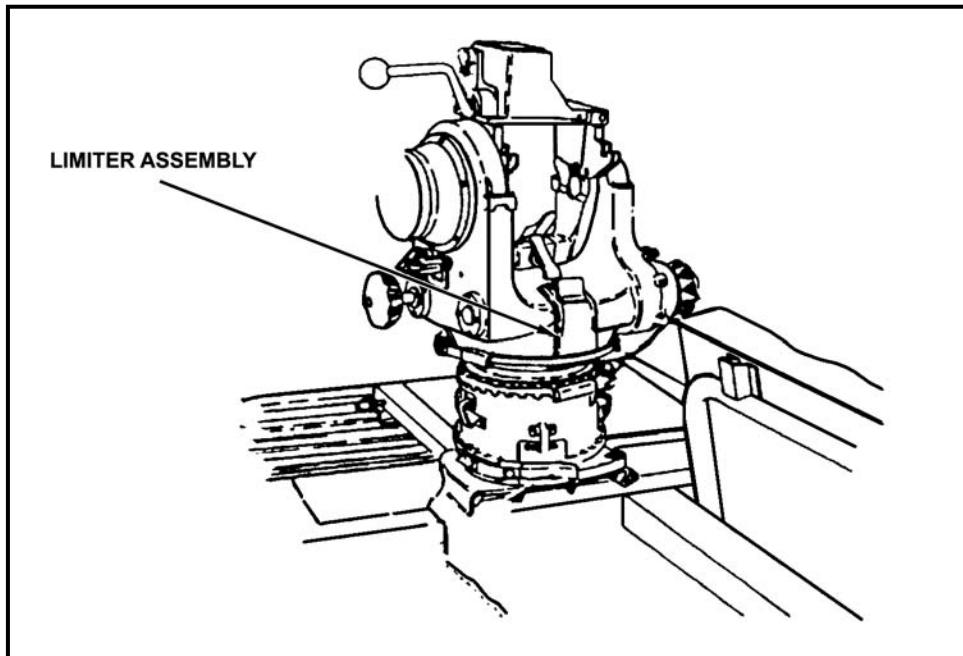


Figure 3-13. Limiter assembly location.

3-7. LOADING, ARMING, AND UNLOADING

The procedures for loading, arming, and unloading the M966-mounted TOW/TOW 2 are as 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 wire-cutter 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 ammunition 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 crosshairs 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).

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.

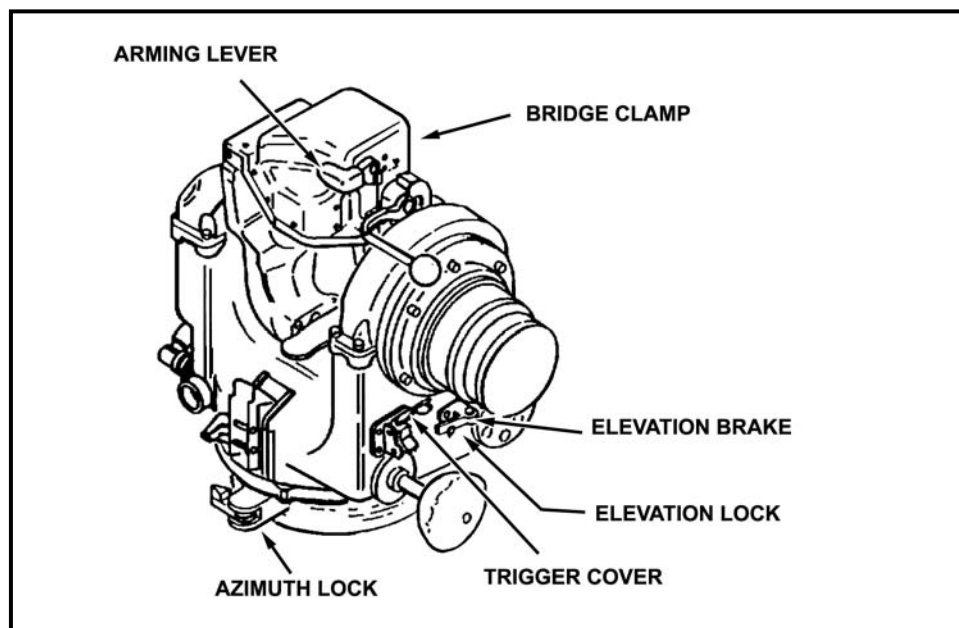


Figure 3-14. Trigger cover, arming lever, elevation lock, and azimuth lock.

(2) He opens the bridge clamp (Figure 3-15, page 3-18), 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, page 3-18).

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.

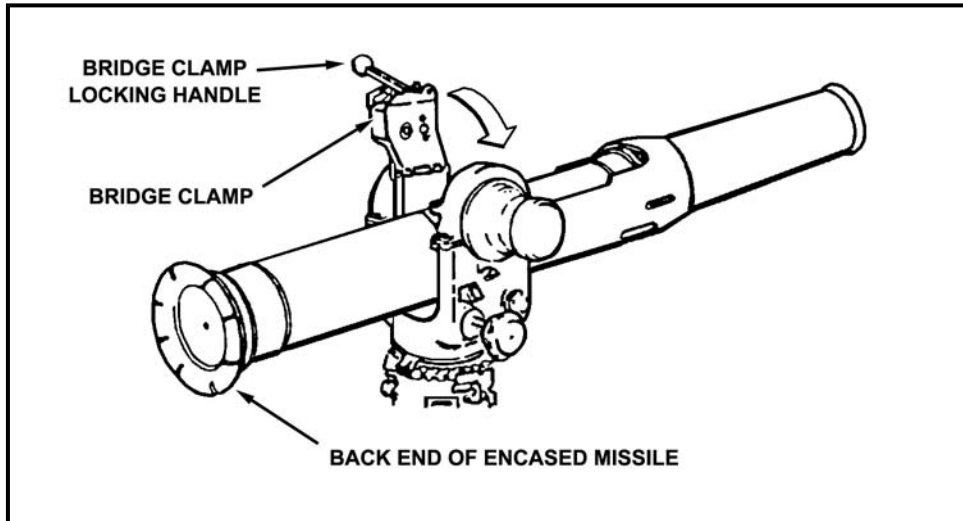


Figure 3-15. Bridge clamp, missile, and launch tube.

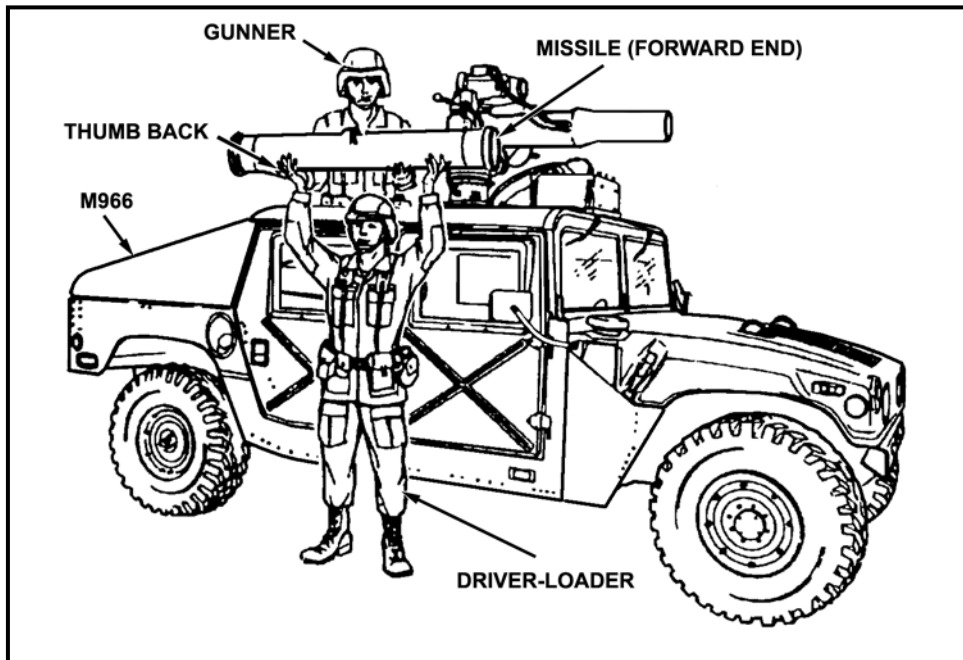


Figure 3-16. Driver-loader's position for receiving the missile from the gunner.

(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 P1 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).

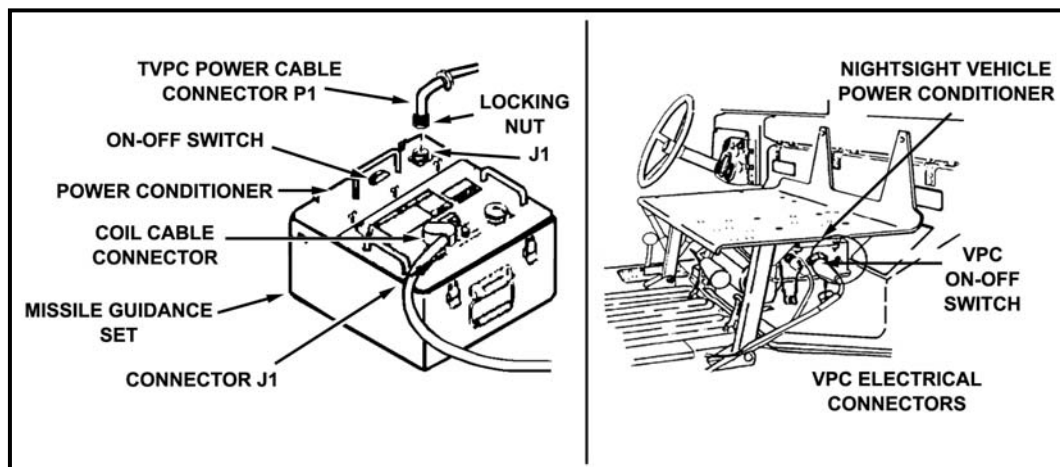


Figure 3-17. MGS, TVPC cable connector P1, power conditioner.

(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.

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 en route 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 (READY-TO-FIRE CONFIGURATION)

Specific actions must be followed when dismounting the M220A2 and moving it to the firing site. All actions 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 (READY-TO-FIRE CONFIGURATION)

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 enroute 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—
- Disconnects the coil cable.
 - Replaces the nightsight lens cover; removes the nightsight and sets it on the ground near the driver-loader.
 - Removes the daysight tracker, picks up the MGS, and carries them to the vehicle.
 - Places the daysight tracker and MGS on top of the vehicle and enters the gunner's station.
- (3) **Driver-Loader's Actions.** The driver-loader—
- Removes the encased missile (or empty launch container if the missile was fired).
 - 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.
 - 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.
 - 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—
- Stows the BPC, tripod, collimator, and nightsight case on the vehicle.
 - 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.
 - Places the MGS cover on the floorboard.
 - Assists the other crew members as needed.
- (2) **Gunner's Actions.** The gunner—
- Receives the traversing unit from the driver-loader, installs it on the traversing unit adapter, and secures it with the top coupling clamp.
 - 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.
 - Installs the daysight tracker and the nightsight, and connects the VPC.
 - Moves into the cargo area and places the unfired missile in the missile rack (if necessary).
 - 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

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 Gunner's 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 STRAC 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 4-1, page 4-2, for ammunition requirements according to DA Pam 350-38).

4-1. 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	TRC A* (M80 TOW blast simulator)	TRC B (M80 TOW blast simulator)	TRC C (M80 TOW blast simulator)	TRC D (M80 TOW blast simulator)
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	
*The STRAC determines a unit's ammunition requirements based on its training readiness condition (TRC). The four major categories are: TRC A, active Army; TRC B, National Guard enhanced brigades; TRC C, USAR and other National Guard units; and TRC D, Reserve training divisions.				

Table 4-1. Required TOW gunnery tables and ammunition needed per system per year (IAW DA Pam 350-38 STRAC).

4-2. 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 4-1 is an example of a crew stability management chart used to record training milestones and qualifications.

4-3. 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 heavy antiarmor weapon system crewman. Soldier training publications and ARTEP battle drills for TOW provide tasks, conditions, and standards for combat-critical skills.

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.

VEH NO.	TOW DUTY POSITION	JAN 93	FEB 93	MAR 93	APR 93	MAY 93	JUN 93
A-31	SECTION LEADER	8278 (NOTE 2)	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
<p>NOTES:</p> <ol style="list-style-type: none"> 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 4-1. Example of a crew stability management chart.

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 be at full strength. The mission in combat and in training can still be accomplished if under-strength 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.

4-4. TOW GUNNERY TABLES

The TOW Training Program consists of 12 gunnery tables plus the Gunner's Skill Test. The STRAC establishes the frequency of a unit's training requirements based on its TRC. A TRC A (active Army) unit, for example, is required to conduct Tables 1 through 6 and the Gunner's Skill Test and Tables 7 through 12 semiannually. (See Table 4-2 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.

EVENT/TABLE	TRC A*	TRC B	TRC C	TRC D
Weapons Training	12	4	1	1
Gunner's Sustainment	12	4	1	1
GST	4	1	1	1
TABLES 1 & 2*	4	2	1	1
TABLES 3 & 4	4	2	1	1
TABLE 5	4	1	1	1
TABLE 6	4	1	1	0
TABLES 7 & 8	2	1	0	0
TABLES 9 & 10	2	1	0	0
TABLES 11 & 12	2	1	0	0
*See STRAC Table 5-11 for details on personnel required to conduct training and any training devices used.				

Table 4-2. Frequency of required TOW gunnery events.

Tables 1 and 2 will be performed by all of the crew with the TOW Gunnery Trainer (TGT). Only gunners will perform tables 3 and 4. 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. (See Appendix F for more information on TOW training devices.)

4-5. 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 I—Individual Training.**

- Conduct refresher training on STP tasks as deemed necessary to prepare for the Gunner's Skill Test.
- Conduct sustainment training with the TGT as deemed necessary to prepare for TOW Gunnery Tables 1 through 4.
- Conduct Gunner's 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 II—Squad Training.**
- Conduct refresher training on the installation and operation of TFFT 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 III—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 IV—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.

4-6. 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-TC 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. 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 Gunner's 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.)

4-7. PHASE I: INDIVIDUAL TRAINING

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

a. **Gunner's Skill Test.** The Gunner's Skill Test comprises the Skill Level 1 tasks for the TOW weapon system listed in STP 7-11B1-SM-TG plus some additional tasks (Figure 4-2, page 4-7 and Figure 4-3, page 4-8). All soldiers assigned to TOW-equipped units must take this portion of the test and receive a GO on at least 70 percent of the tasks. 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.

TASK: Perform the TOW gunner's tasks listed in (1) 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.

(1) The GST 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 TOW-series launcher system firing limitations.
- (i) No Task Number Identify combat vehicles. (See Appendix G.)
- (j) No Task Number Determine if a target can be engaged by an M220-series launcher system. (See Chapter 5.)
- (k) 071-317-0000 Prepare an antiarmor range card.
- (l) No Task Number Assemble an M220-series launcher system. (See TM 9-1425-472-12 [M220A1] or TM 9-1425-450-12 [M220A2].)

GUNNER'S SKILL TEST - PART 1			
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.			
NAME	RANK	UNIT	DATE
THOMPSON, DAVID B.	SGT	C 2/2 IN	13 AUG 03
TEST#	TASK NUMBER	TASK TITLE	GO/NO GO
1	071-056-0004	MAINTAIN AN M220-SERIES LAUNCHER SYSTEM	GO H.H.R.
2	071-056-0007	LOAD AN M220-SERIES LAUNCHER SYSTEM	GO K.L.C.
3	071-035-0008	UNLOAD AN M220-SERIES LAUNCHER SYSTEM	GO K.L.C.
4	071-056-0009	ENGAGE TARGETS WITH AN M220-SERIES LAUNCHER SYSTEM	GO K.L.C.
5	071-056-0010	PERFORM IMMEDIATE ACTION FOR AN M220-SERIES LAUNCHER SYSTEM	1. NOGO B.L.C. 2. GO B.L.C.
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.R.
10	NO TASK NUMBER	DETERMINE IF A TARGET CAN BE ENGAGED BY AN M220-SERIES LAUNCHER SYSTEM (SEE FM 3-22.34, CH5)	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, AUG 2003 APO V1.00

Figure 4-2. Example of completed DA Form 7331-R, Gunner's Skill Test—Part 1.

GUNNER'S SKILL TEST - PART 2			
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.			
NAME	RANK	UNIT	DATE
WILLIAMS, RAY	SPC	CSC 7/1 IN	13 AUG 03
TEST#	TASK NUMBER	TASK TITLE	GO/NO GO
1	NO TASK NUMBER	PLACE THE M966 VEHICLE IN THE READY-TO-FIRE CONFIGURATION (SEE FM 3-22.34 CH 3)	GO K.L.C.
2	071-056-9932	CONDUCT DISMOUNTING AND REMOUNTING OF AN M220A1 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A1 - EQUIPPED UNITS ONLY)	
3	071-056-0034	CONDUCT DISMOUNTING AND REMOUNTING OF AN M220A2 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A2 - EQUIPPED UNITS ONLY)	GO K.L.C.
4	071-034-0001	LOAD AN M243 OR M259 SMOKE GRENADE LAUNCHER	
5	071-034-0002	UNLOAD AN M243 OR M259 SMOKE GRENADE LAUNCHER	

DA FORM 7332-R, AUG 2003 APD V1.00

Figure 4-3. Example of completed DA Form 7332-R, for Gunner's Skill Test—Part 2.

(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 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 G.

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 5, paragraph 5-1.

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.

b. TOW Gunnery Table 1, Individual Gunnery Practice. TOW Gunnery Table 1 consists of firing a minimum of two 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 4-3 (page 4-10).

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.

(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 4-3 (page 4-15). 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 4-3. 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 4-4).

(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 4-3 should not be used for sustainment training, if possible.

TOW GUNNERY TABLES 1 AND 2: INDIVIDUAL GUNNERY					
<input checked="" type="checkbox"/> PRACTICE		<input type="checkbox"/> QUALIFICATION			
For use of this form, see FM 3-22.34. 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	SSN	UNIT		
ERVIN, P.	SGT	000-00-0011	C 2/2 IN		
DATE		DISK#			
MISSION#	INDIVIDUAL GUNNERY TASK TESTED	SIGHT	SCORE	SUCCESSFUL	
# 22		DS	90	YES	NO
# 24		DS	90	YES	NO
# 26		DS	90	YES	NO
# 28		DS	80	YES	NO
# 29		DS	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 - 1,000		1ST CLASS / 750 - 874		2ND CLASS / 625 - 749	
SCORING INDIVIDUAL GUNNERY TABLES					
IN THE INDIVIDUAL GUNNERY TABLES, THE GUNNER'S RATING IS DETERMINED BY HIS TOTAL POINT SCORE FOR 10 MISSIONS WITH 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.					

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

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 4-3.

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 4-4.

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 (Figure 4-5, page 4-14) 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.***

TASK: Verify on Table 3, Advanced Gunnery Practice.

CONDITIONS: Indoors, using the TGT. The gunner will fire a minimum of two 10-shot events using the TGT. The 10-shot events will be selected from Table 4-4 (page 4-15).

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 4-5, page 4-14). 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 10-shot event from Table 4-4 (page 4-15). The sequence of missions in each 10-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 4-5, page 4-14).

(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 4-4, page 4-15) determines the gunner's ranking.

(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 and or 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.

TOW GUNNERY TABLES 3 AND 4: ADVANCED GUNNERY						
<input type="checkbox"/> PRACTICE <input checked="" type="checkbox"/> QUALIFICATION						
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.						
DATA REQUIRED BY PRIVACY ACT OF 1974 AUTHORITY: 10 USC 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	SSN		UNIT	
HEIDER, R.		SPC	000-01-0000		C 7/2 IN	
DATE			DISK#			
30 AUG 03			10			
MISSION#	INDIVIDUAL GUNNERY TASK TESTED		SIGHT	SCORE	SUCCESSFUL	
# 1	EVASIVE TARGET		05	81	<input checked="" type="checkbox"/> YES	NO
# 7	TARGET ENGAGEABILITY		05	78	<input checked="" type="checkbox"/> YES	NO
# 12	FIRE CONTROL METHODS		TS	73	<input checked="" type="checkbox"/> YES	NO
# 14	EVASIVE/OBSCURE TARGET		TS	66	<input checked="" type="checkbox"/> YES	NO
# 22	TARGET PRIORITY		TS	81	YES	<input checked="" type="checkbox"/> NO
# 24	TARGET ENGAGEABILITY		05	83	<input checked="" type="checkbox"/> YES	NO
# 28	EVASIVE TARGET		05	91	<input checked="" type="checkbox"/> YES	NO
# 29	TARGET PRIORITY		05	78	<input checked="" type="checkbox"/> YES	NO
# 26	TARGET PRIORITY		05	80	<input checked="" type="checkbox"/> YES	NO
# 13	FRATRICIDE		05	100	<input checked="" type="checkbox"/> YES	NO
TOTAL TRACKING SCORE				811	SUCCESSFUL MISSIONS: 9	
GUNNER CLASSIFICATION EXPERT / 875 - 1,000 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 MISSION 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 DOES 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.						

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

DISK NO.	MISSION NO.
DFT 10	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
DFT 12	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 15 Evasive Target/Thermal 11 Evasive Target/Thermal
DFT 13	30 Target Engageability/Daysight Tracker 7 Target Priority/Daysight Tracker 26 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
DFT 15	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 4-4. 10-shot events for advanced gunnery tables.

- NOTES:**
1. In the mission descriptions in Table 4-4, 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 soldier assigned to a TOW-equipped unit 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 TFFT Gunnery Practice.

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

TASK: Qualify 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 4-4.

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.

(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 4-5, TOW Gunnery Tables 3 and 4, Advanced Gunnery Practice and Qualification Scorecard, is used to score the table.

4-8. 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 4-16, 4-35). 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 (75 meters by 90 degrees) 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 TFFT Gunnery.** TOW Gunnery Table 5 reacquaints crews with TFFT and allows them to troubleshoot the equipment. It refreshes crews on TFFT gunnery and target engagement techniques to prepare the crews for the practice and qualification tables that follow.

TASK: Conduct baseline TFFT gunnery practice (day and night).

CONDITIONS: On an MPRC or in the field, given a TOW weapon system, its organic carrier, TFFT system, M80 blast simulators, and either pop-up moving targetry or tactical vehicles equipped with TFFT 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 TFFT 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).

(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 TFFT 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 TFFT retroreflectors may be 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 TFFT Gunnery Practice and Qualification Scorecard, Figure 4-6) 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 AN/PRC-119 radio per squad evaluator.
 - Two AN/PRC-119 radios 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:
 - TFFT system.
 - Sufficient TFFT retroreflectors to cover targets. (Use of MILES harness and LTIDs is optional.)
- Ammunition: Ten M80 blast simulators per TOW, per iteration.
- Key references: FM 3-21.91(FM 7-91), FM 3-22.34(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 TFFT 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 TFFT Gunnery Practice and Qualification Scorecard, Figure 4-6) is used to score the table.

TOW GUNNERY TABLES 5 AND 6: BASELINE TFFT GUNNERY			
<input type="checkbox"/> PRACTICE		<input checked="" type="checkbox"/> QUALIFICATION	
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.			
SQUAD <i>1ST</i>	SECTION <i>1ST</i>	PLATOON <i>1ST</i>	COMPANY <i>C 3/00 IN</i>
DATE <i>3 SEP 03</i>		DAY <i>X</i>	NIGHT
ENGAGEMENT	TARGET DESCRIPTION	HIT/MISS/TIME	GO/NG GO
TARGET 1	STATIONARY T72/FLANK/ 1,000 - 1,500 METERS	<u>HIT</u> TIME: <i>21 SEC</i>	<i>GO</i>
TARGET 2	STATIONARY T72/FLANK/ 2,100 - 3,750 METERS	<u>HIT</u> TIME: <i>25 SEC</i>	<i>GO</i>
TARGET 3	STATIONARY T72/FRONTAL/ 2,100 - 3,750 METERS	<u>HIT</u> TIME: <i>23 SEC</i>	<i>GO</i>
TARGET 4	STATIONARY T72/OBLIQUE/ 2,100 - 3,750 METERS	<u>HIT</u> TIME: <i>24 SEC</i>	<i>GO</i>
TARGET 5	STATIONARY T72/DEFILADE/ 800 - 1,500 METERS/NBC	HIT TIME: <u>MISS</u> <i>21 SEC</i>	<i>NG</i>
TARGET 6	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	<u>HIT</u> TIME: <i>28 SEC</i>	<i>GO</i>
TARGET 7	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	<u>HIT</u> TIME: <i>26 SEC</i>	<i>GO</i>
TARGET 8	MOVING T72/FLANK/ L-R, 5 KPH 1,000 - 1,500 METERS	<u>HIT</u> TIME: <i>27 SEC</i>	<i>GO</i>
TARGET 9	MOVING T72/FLANK/ L-R, 10 KPH 2,100 - 3,750 METERS	<u>HIT</u> TIME: <i>26 SEC</i>	<i>GO</i>
TARGET 10	MOVING T72/FLANK/ L-R, 40 KPH 1,000 - 1,500 METERS	<u>HIT</u> TIME: <i>23 SEC</i>	<i>GO</i>
		OVERALL GO/NO GO:	<i>9</i>
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 TFFT" AND A "GO" ON AT LEAST 6 OUT OF 10 TARGET ENGAGEMENTS, BOTH DAY AND NIGHT.			

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APD V1.00

Figure 4-6. Example of completed DA Form 7335-R, TOW Gunnery Tables 5 and 6: Baseline TFFT Gunnery Practice and Qualification.

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 4-7, page 4-22). 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.

(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 kilometers per hour.

(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. All 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 4-8, page 4-23) 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 score is determined by the time taken to kill the target using the live-fire point calculation sheet (Figure 4-16, page 4-35). Any crew or leader cuts are deducted from this score (Table 4-5, page 4-21 and Table 4-6, page 4-26).

(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 and or 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 4-5. 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 4-7, page 4-22). 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 4-9, page 4-24).

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 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 nonpersistent 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 120mm 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 4-7. Example squad gunnery practice and qualification scenario.

TOW GUNNERY TABLE 7: SQUAD GUNNERY PRACTICE						
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.						
TC: <u>SSG MARK LDR: 2D</u>		GNR: <u>SPL ERLICKSON DVR: SPL MAXWELL</u>		DATE: <u>5 AUG 03</u>		TIME: <u>1645</u>
PLATOON: <u>2D</u>		COMPANY: <u>B</u>		BATTALION: <u>2/2 IN. LAB</u>		
TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRE FROM BASELINE. 3,000 - 3,750 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	①	ST TK-17	92	92
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 2,500 METERS 1 - ST TANK, 1 - MV TANK, 1 - MV BMP	TFTT HMMWV12:30	② ③	ST TK-18 MV TK-40 MV BMP-35	86 83 24	64
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 3. 2,500 - 3,000 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV1:40	②	ST TK-0 ST BMP-18	0 86	38
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,500 - 3,000 METERS 1 ST TANK, 1 - MV TANK (NBC)	TFTT HMMWV1:40	②	ST TK-18 MV TK-34	86 94	90
5. ENGAGE MULTIPLE TARGETS	FIRE FROM BASELINE. 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV1:40	②	MV TK-34 MV BMP-18	94 86	60
NOTES:						TOTAL SCORE
1. ENGAGEMENT TIMES ARE CALCULATED FROM THE TIME THE TARGET 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 BEGINS WHEN THE VEHICLE OCCUPIES ITS FIRING POSITION (STOPS MOVING) AND ENDS WHEN THE TARGET IS HIT.						244
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. CREWLEADER CUTS: SEE FM 3-22.34, CH 4.						
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 POSSIBLE TOTAL OF 1,000 POINTS. SQUADS MUST ACHIEVE A MINIMUM TOTAL OF 700 POINTS TO VERIFY ON TABLE 7 AND PROGRESS TO TABLE 8.						

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Figure 4-8. Example of completed DA Form 7336-R, TOW Gunnery Table 7: Squad Gunnery Practice.

TOW GUNNERY TABLE 8: SQUAD GUNNERY QUALIFICATION									
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.									
TC: <u>SSA Maxwell</u> LDR: <u>1 ST</u> GNR: <u>SPL Cook</u> DVR: <u>PEC Ashley</u> DATE: <u>6 AUG 03</u> TIME: <u>1945</u>		PLATOON: <u>1 ST</u> COMPANY: <u>D</u> BATTALION: <u>1502 IN</u>							
TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS		
1. ENGAGE A SINGLE TARGET	FIRE FROM BASELINE 1,500 - 2,000 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	①	ST TK - 20	74		74		
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 1. 2,000 - 2,500 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV1:40	① ②	MV TK - 34 ST BMP - 18	94 86		90		
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 3,000 - 3,750 METERS 2 - MV TANK, 1 - ST BMP	TFTT HMMWV2:45	① ② ③	MV TK - 30 MV TK - 25 ST BMP - 0	94 48 0	-5 IMPROPER FIRE COMMAND	60		
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 1. 1,500 - 2,000 METERS 1 - ST TANK, 1 - MV TANK (NBC)	TFTT HMMWV1:40	① ②	ST TK - 20 MV BMP - 19	74 84		79		
5. ENGAGE MULTIPLE TARGETS	FIRE FROM BASELINE 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV1:40	① ②	MV TK - 34 MV BMP - 18	94 86	-5 IMPROPER FIRE COMMAND	85		
							TOTAL SCORE	388	
NOTES: 1. TABLE 8 IS CONDUCTED AND TIMED 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. CREWLEADER CUTS: SEE FM 3-22.34, CH 4. 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 POSSIBLE TOTAL OF 1,000 POINTS. SQUADS ARE RATED ON THE FOLLOWING BASIS: DISTINGUISHED: 800 - 1,000 POINTS SUPERIOR: 600 - 899 POINTS QUALIFIED: 700 - 799 POINTS UNQUALIFIED: 0 - 599 POINTS									
DA FORM 7337-R, AUG 2003 APR 01 00									

Figure 4-9. Example of completed DA Form 7337-R, TOW Gunnery Table 8: Squad Gunnery Qualification.

4-9. 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 4-16, page 4-35). 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 4-10, page 4-27). 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.

(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 kilometers per hour.

(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 4-16, page 4-35). Deductions will be made from this point score when a major or minor crew cut error (Table 4-5, page 4-21) or a section leader cut error (Table 4-6, page 4-26) 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 4-11, page 4-28) 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 4-6. 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 AN/PRC-119 radio per section and squad evaluator.
 - Two AN/PRC-119 radios 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:
 - TFFT system.
 - Sufficient TFFT 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 3-21.91(FM 7-91), FM 3-22.34(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 4-10, page 4-27). 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 4-12, page 4-29).

OPERATION ORDER	
SITUATION:	
<i>Enemy.</i> 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 nonpersistent chemical agents in recent engagements.	
<i>Friendly.</i> 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 has constructed some firing positions and barriers. Our platoon will have priority of fires from one section of our battalion 120mm 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:	
<i>Concept of the operation.</i> 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 4-10. Example section gunnery practice and qualification scenario.

TOW GUNNERY TABLE 9: SECTION GUNNERY PRACTICE									
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.									
SECTION	TC: <u>SSA HEIDER</u>	LDR: _____	GNR: <u>SPLCOWLER</u>	DVR: <u>PFC BROWN</u>	DATE: <u>15 AUG 03</u>				
SQUAD	TC: <u>SST QUEEN</u>	LDR: _____	GNR: <u>PFC MARRAS</u>	DVR: <u>PFC WILSON</u>	TIME: <u>0900</u>				
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	FIRE FROM BASELINE. 3,000 - 3,750 METERS 1 - ST TANK, 1 - ST BMP	TFTT 40 SECS ALL VEHICLES	0	ST - 20 SB - 30	74 35		55		
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 2,750 METERS 1 - ST BMP	TFTT 25 SECS ALL VEHICLES	0	SB - 20	74		74		
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 3. 1,000 - 1,500 METERS 2 - MV BMPs, 1 - ST TANK	TFTT HMMWV1:40	0 0 0	MB - 14 MB - 18 ST - 13	91 87 100		93		
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,500 - 3,000 METERS 2 - MV TANKS, 2 - ST TANKS (NBC)	TFTT HMMWV2:38	0 0 0 0	MT - 19 MT - 21 ST - 20 ST - 22	100 99 74 64	-10 NORREY FIRE COMMAND	74		
5. ENGAGE MULTIPLE TARGETS	FIRE FROM BASELINE. 1,000 - 1,500 METERS 1 - ST TANK, 1 - ST BMP (NBC)	TFTT 25 SECS ALL VEHICLES	0 0	ST - 14 SB - 17	85 92		84		
NOTES:						TOTAL SCORE			
1. TABLE 9 IS CONDUCTED AND TIMED IN EXACTLY THE SAME MANNER AS TABLES 7 AND 8.						TOTAL SCORE		785	
2. SCORING TABLE 9 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 POSSIBLE TOTAL OF 1,000 POINTS. TABLE 9 IS A PRACTICE TABLE. 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.									

AFD 11.00

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Figure 4-11. Example of completed DA Form 7338-R, TOW Gunnery Table 9: Section Gunnery Practice.

TOW GUNNERY TABLE 10: SECTION GUNNERY QUALIFICATION									
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.									
SECTION	TC: <u>SGT BERRY</u>	LDR: <u>PFC KIM</u>	GNR: <u>SFC MARKS</u>	DVR: <u>PFC SMITH</u>	DATE: <u>28 AUG 03</u>				
SQUAD	TC: <u>Sgt WATT</u>	LDR: <u>PFC LUGS</u>	GNR: <u>SFC COLEMAN</u>	DVR: <u>PFC RICHARDS</u>	TIME: <u>1600</u>				
PLATOON:	<u>Z-D</u>	COMPANY: <u>E</u>	BATTALION: <u>Z/16 IN</u>						
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 BMPs	TFTT HMMWV/2:38	① ② ③ ④	MT-30 MT-37 SB-17 SB-16	96 93 92 100	-10 INCORRECT ENGAGEMENT TECH.	85		
2. ENGAGE MULTIPLE TARGETS	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 TARGETS	FIRED FROM PHASE LINE 3. 1,000 - 1,500 METERS 1 - MV BMP, 1 - ST TANK	TFTT 25 SECS ALL VEHICLES	① ②	ST-64 MB-59	64 59		62		
4. ENGAGE MULTIPLE TARGETS	FIRED FROM PHASE LINE 2. 2,500 - 3,000 METERS 1 - ST BMP, 2 - MV TANKS (NBC)	TFTT HMMWV/2:40	① ② ③	SB-18 MT-34 MT-24	86 94 98		93		
5. ENGAGE MULTIPLE TARGETS	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-D	74 0		37		
NOTES:							TOTAL SCORE	360	
1. TABLE 10 IS CONDUCTED AND TIMED IN EXACTLY THE SAME MANNER AS TABLE 8 AND 9. 2. SCORING TABLE 10 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 POSSIBLE TOTAL OF 1,000 POINTS. TABLE 10 IS A QUALIFICATION TABLE. TO PROGRESS TO TABLE 11, THE SECTION MUST ACHIEVE A MINIMUM COMBINED SCORE OF AT LEAST 700 POINTS.									

APR 11, 00

DA FORM 7339-R, AUG 2003

Figure 4-12. Example of completed DA Form 7339-R, TOW Gunnery Table 10: TOW Section Gunnery Qualification.

4-10. 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 4-16, page 4-35). 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 4-13, page 4-32). 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.

(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 kilometers per hour.

(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 4-16, page 4-35). Deductions will be made from this point score when a major or minor crew cut error (Table 4-5, page 4-21) or a platoon leader cut error (Table 4-7) is made. The evaluator in the range tower will score day engagements. Both evaluators will score night engagements. DA Form 7340R (TOW Gunnery Table 11, Platoon Gunnery Practice Scoresheet, Figure 4-14, page 4-33) 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 4-7. 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 AN/PRC-119 radio per platoon, section, and squad evaluator.
 - Two AN/PRC-119 radios 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:
 - TFFT system.
 - Sufficient TFFT 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 3-21.91(FM 7-91), FM 3-22.34(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 4-13, page 4-32). 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 4-15, page 4-34).

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 nonpersistent 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 has constructed some firing positions and barriers. Our platoon will have priority of fires from one section of our battalion 120mm 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 4-13. Example platoon gunnery practice and qualification scenario.

TOW GUNNERY TABLE 11: PLATOON GUNNERY PRACTICE										
For use of this form, see FM 3-22.34. The proponent agency is TRADOC.										
SECTION 1:	TOW CREW 1:	TC: <u>SSE CAMPBELL</u>	LDR: _____	GNR: <u>SPL COOKS</u>	DVR: <u>PFC BROWN</u>	DATE: <u>15 AUG 93</u>				
SECTION 2:	TOW CREW 2:	TC: <u>SGT HAMMOND</u>	LDR: _____	GNR: <u>SPL ADAMS</u>	DVR: <u>PFC GONZALES</u>					
SECTION 3:	TOW CREW 1:	TC: <u>SSE QUEEN</u>	LDR: _____	GNR: <u>SPL MCLOY</u>	DVR: <u>PFC PALAS</u>					
	TOW CREW 2:	TC: <u>SGT WEBB</u>	LDR: _____	GNR: <u>SPL COOKS</u>	DVR: <u>PFC SMITH</u>	TIME: <u>1100</u>				
	TOW CREW 1:	TC: <u>SSE PAINE</u>	LDR: _____	GNR: <u>SPL ERVIE</u>	DVR: <u>PFC FOWLER</u>					
	TOW CREW 2:	TC: <u>SGT MILLER</u>	LDR: _____	GNR: <u>SPL SHULT</u>	DVR: <u>PFC ANDERSON</u>					
PLATOON:	<u>3RD</u>	COMPANY:	<u>D</u>	BATTALION:	<u>2/503 IN</u>					
TASK	CONDITIONS/ TARGETS/ SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/ LDR CUTS	TOTAL POINTS			
1. ENGAGE A SINGLE TARGET	FIRE FROM BASELINE. 3,000 - 3,750 METERS 4 - MV TANKS, 2 - ST BMPS	TFTT HMMWV326	① ② ③ ④ ⑤ ⑥	MT-33 MT-29 MT-37 MT-31 SB-22 SB-17	95 97 93 90 94 92		90			
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 3,000 METERS 4 - MV BMPS 2 - ST BMPS	TFTT HMMWV226	① ② ③ ④ ⑤ ⑥	MB-20 MB-19 MB-23 MB-25 SB-17 SB-0	73 93 84 82 92 0		71			
3. ENGAGE MULTIPLE TARGETS	FIRE 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 ST-21 SB-26	92 79 68 47		72			
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 3,000 METERS 2 - MV TANKS, 2 - MV BMPS (NBC)	TFTT BNP43 SEC TANK1:03	① ② ③ ④	MT-17 MT-22 MB-23 MB-19	100 99 96 93	-10 WARRANT FIRE COMMAND	85			
5. ENGAGE MULTIPLE TARGETS	FIRE 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 ST-24 SB-0	108 108 55 0		56			
NOTES:							TOTAL SCORE	374		
1. TABLE 11 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLES 7 THRU 10.										
DA FORM 7340-R, AUG 2003										

APV100

Figure 4-14. Example of completed DA Form 7340-R, TOW Gunnery Table 11: Platoon Gunnery Practice.

TOW GUNNERY TABLE 12: PLATOON GUNNERY QUALIFICATION

For use of this form, see FM 3-22.34. The proponent agency is TRADOC.

SECTION 1:	TOW CREW 1:	TC: <u>SSG COOKS</u>	LDR: <u>SPL SMITH</u>	GNR: <u>SPL BROOKS</u>	DVR: <u>REC MIDDLEBROOK</u>	DATE: <u>15 AUG 03</u>
SECTION 2:	TOW CREW 2:	TC: <u>CPL YORKS</u>	LDR: <u>SPL WALTER</u>	GNR: <u>SPL CARTER</u>	DVR: <u>REC PRATER</u>	
SECTION 3:	TOW CREW 1:	TC: <u>SSG ASHLEY</u>	LDR: <u>SPL HART</u>	GNR: <u>SPL JORDAN</u>	DVR: <u>REC JOHNSON</u>	
	TOW CREW 2:	TC: <u>SGT OH</u>	LDR: <u>REC CLAY</u>	GNR: <u>SPL PRICE</u>	DVR: <u>REC GARDEN</u>	TIME: <u>1400</u>
	TOW CREW 1:	TC: <u>SGT BLAIR</u>	LDR: <u>SPL OLIVER</u>	GNR: <u>SPL SEEL</u>	DVR: <u>REC DELE</u>	
	TOW CREW 2:	TC: <u>SGT WALKER</u>	LDR: <u>REC HARRIS</u>	GNR: <u>SPL NOEL</u>	DVR: <u>SPL PETAHA</u>	
PLATOON: <u>2D</u>		COMPANY: <u>E</u>		BATTALION: <u>5/16 LN</u>		

TASK	CONDITIONS/TARGETS/SITUATION	TOTAL TARGET EXPOSURE TIME	HITS	ENGAGEMENT TIMES	POINTS	CREW/LDR CUTS	TOTAL POINTS
1. ENGAGE A SINGLE TARGET	FIRE FROM BASELINE 3,000 - 3,750 METERS 2 - MV TANKS 2 - ST BMFS	TFTT BMP/25 SECS TANK1:13	① ② ③ ④	MT-38 MT-0 SB-19 SB-23	92 74 59		58
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 3,000 METERS 3 - ST BMFS 3 - MV TANKS	TFTT HMMWV12:28	① ② ③ ④ ⑤ ⑥	SB-20 SB-17 SB-14 MT-23 MT-33 MT-0	74 92 44 90 0	INCORRECT FIRE COMMAND -10	59
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 3. 1,000 - 2,000 METERS 3 - ST TANKS 3 - MV BMFS	TFTT HMMWV1:08	① ② ③ ④ ⑤ ⑥	ST-17 ST-19 ST-24 MB-31 MB-24 MB-0	42 74 47 57 61 0		56
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 1,500 - 2,500 METERS 2 - MV TANKS 2 - MV BMFS (NBC)	TFTT BMP/24 SECS TANK1:03	① ② ③ ④	MT-23 MT-24 MT-15 MT-0	96 95 100 0		73
5. ENGAGE MULTIPLE TARGETS	FIRE FROM BASELINE. 3,000 - 3,750 METERS 2 - ST TANKS 2 - ST BMFS (NBC)	TFTT 25 SECS ALL VEHICLES	① ② ③ ④	ST-15 ST-17 SB-17 SB-23	100 92 42 54	-10 NO 91 REP 58.07	76
TOTAL SCORE							322

NOTES:

- TABLE 12 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLES 7 THRU 10.

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Figure 4-15. Example of completed DA Form 7341-R, TOW Gunnery Table 12: TOW Platoon Gunnery Qualification.

MOVING TARGET							
TIME SEC	STATIONARY TARGETS	BMP 85-900 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 4-16. 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 4-16. Example of TOW live-fire point calculation sheet (continued).

4-11. 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 daysight 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 crosshairs on a target may be affected under these conditions, especially if he has not been properly trained. Distractors should be used in

training to accustom gunners to such conditions and to minimize flinching. Grenade and artillery simulators are effective distractors. 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. Any 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 17-02-011. 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 5

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.

5-1. 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 nightsight 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 and horizontal crosslines (Figure 5-1, page 5-2). 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 5-2, page 5-2).

(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 5-3, page 5-2).

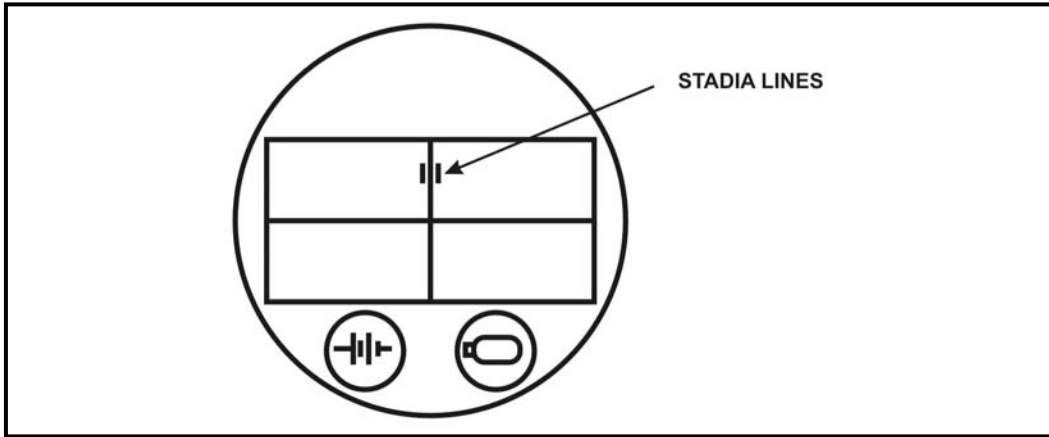


Figure 5-1. Stadia lines.

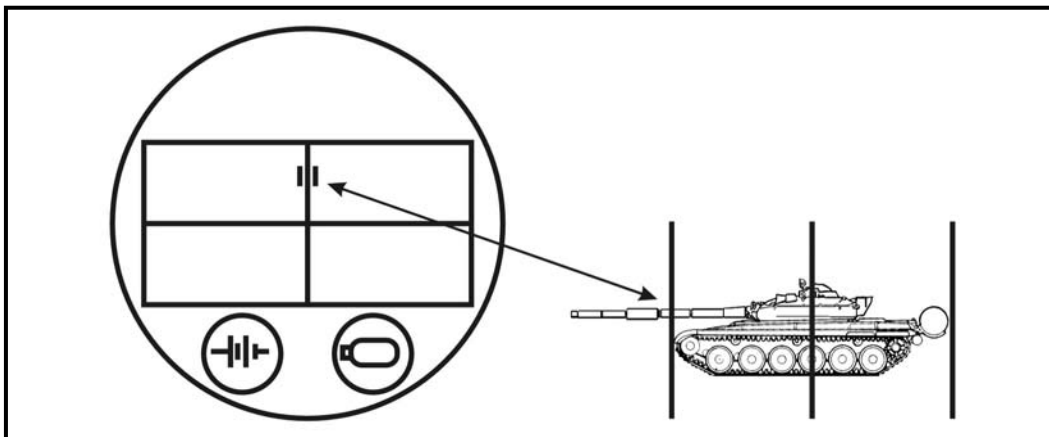


Figure 5-2. Target within range.

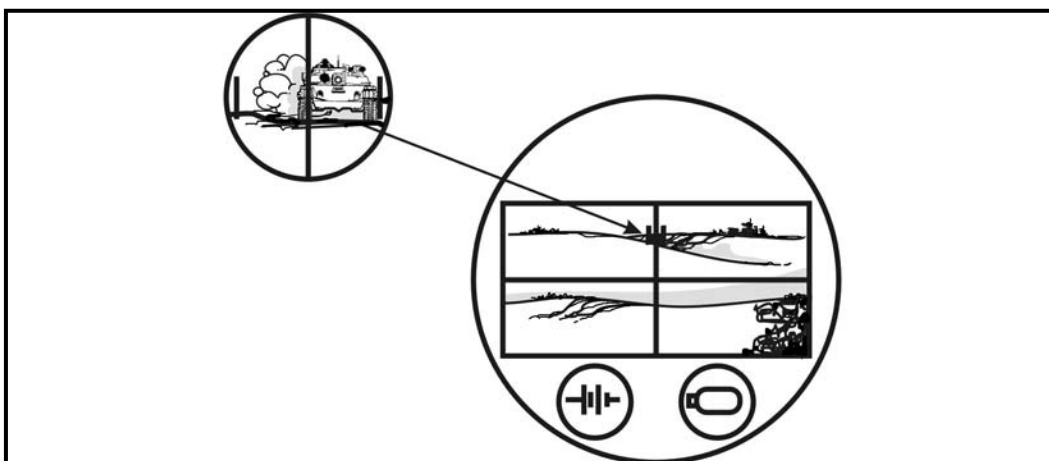


Figure 5-3. Target moving straight toward or away from position within range.

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 reticles 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 5-4). 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.

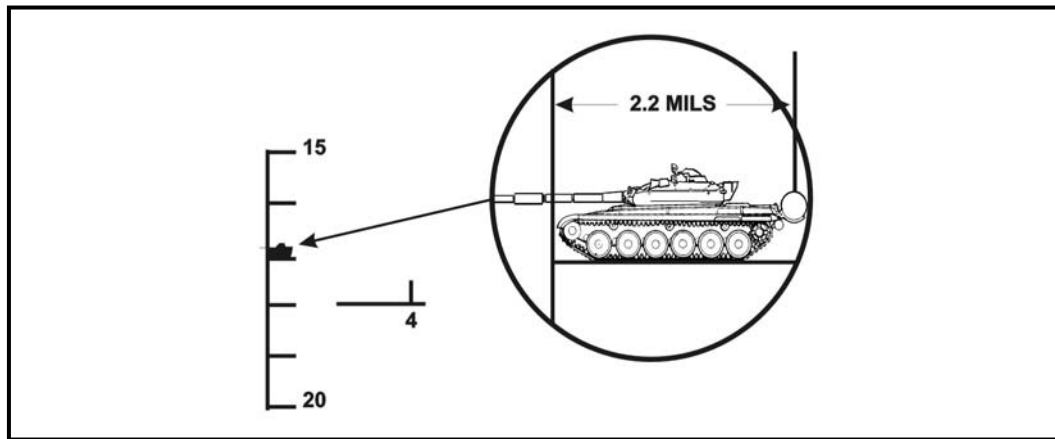


Figure 5-4. Target within range (flank or oblique) using M17 binoculars.

(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 5-5, page 5-4). 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 5-6, page 5-4).

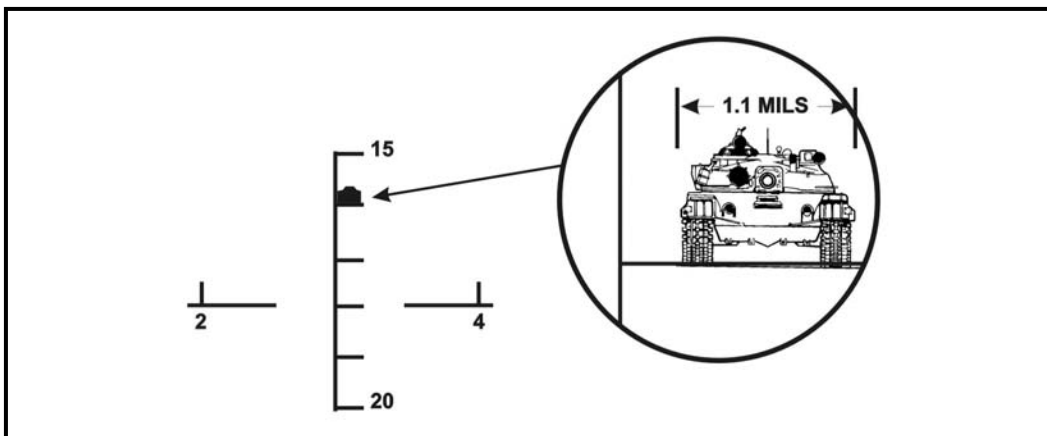


Figure 5-5. Target within range (frontal or rear) using M17 binoculars.

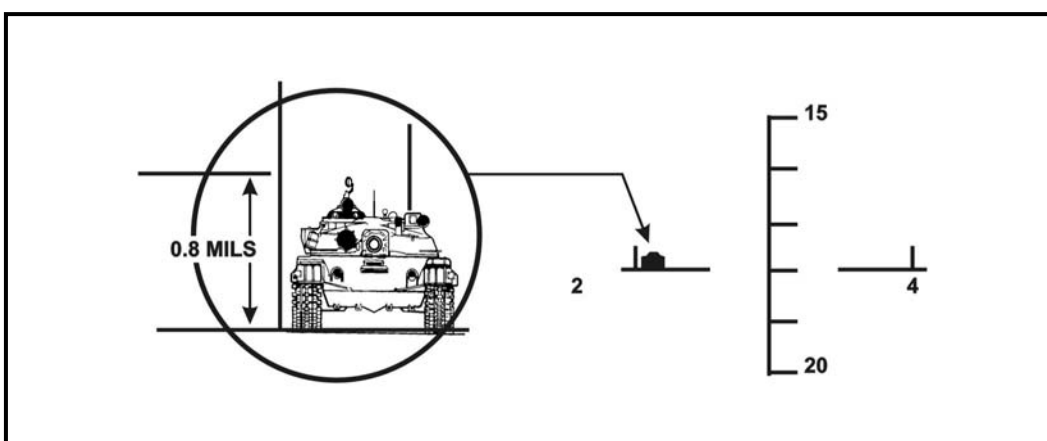


Figure 5-6. Target within range based on height.

NOTE: This method cannot be used 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.

b. **Determine Exposure Time.** The half-sight method of determining exposure time is based on a vehicle speed of 35 kilometers per hour (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 5-7).

(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 5-7).

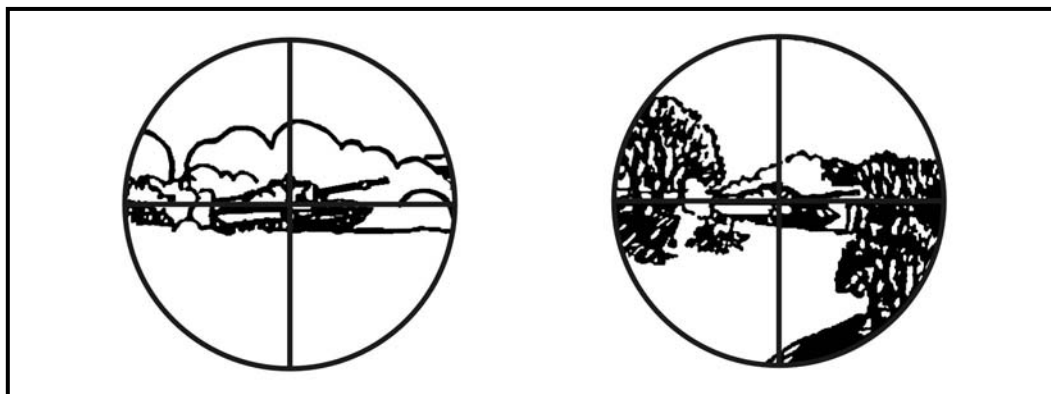


Figure 5-7. Obstruction.

(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 5-8).

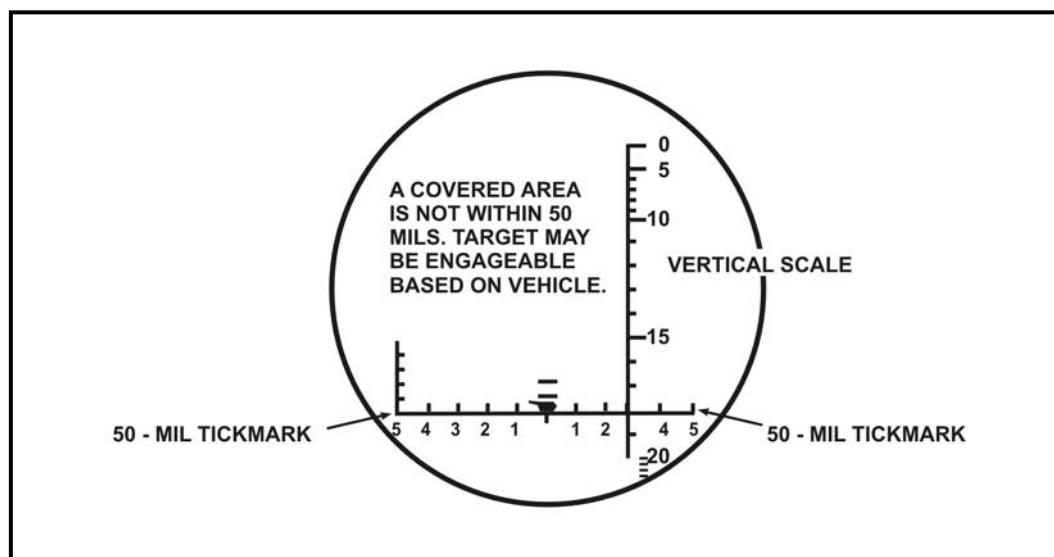


Figure 5-8. Binocular reticle method.

5-2. 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 5-9, page 5-6, 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 5-9. 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 5-1. Targets that are combinations of the ones listed in Table 5-1, 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. (See Appendix H for information on OPFOR/Threat counterpart systems.)

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	ANTITANK
Any other target	A short word or phrase that clearly describes the target.

Table 5-1. 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) 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 mil scale on the binoculars; 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 is a preparatory command that warns the gunner not to fire until given the command of execution.

(2) FIRE 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.

5-3. 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 electrooptical 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 reticles 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.

5-4. 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 5-10). 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.

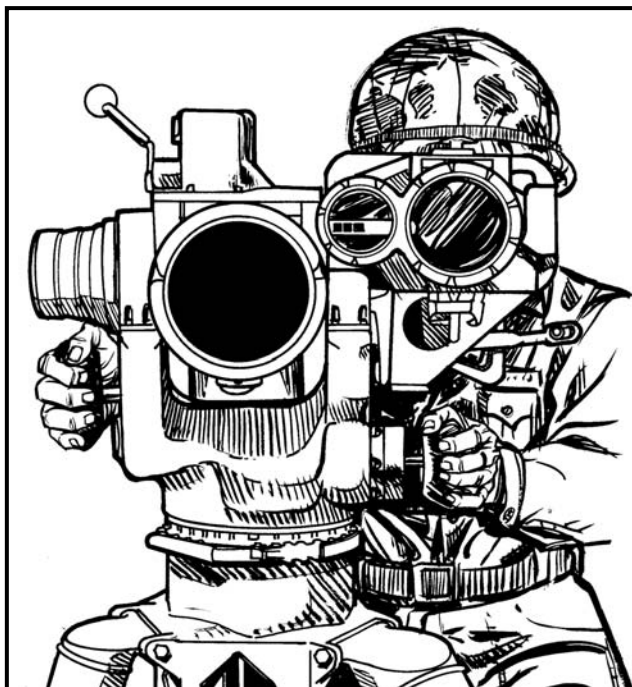


Figure 5-10. Control knobs.

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 crosshairs on the center of visible mass of the target (Figure 5-11).

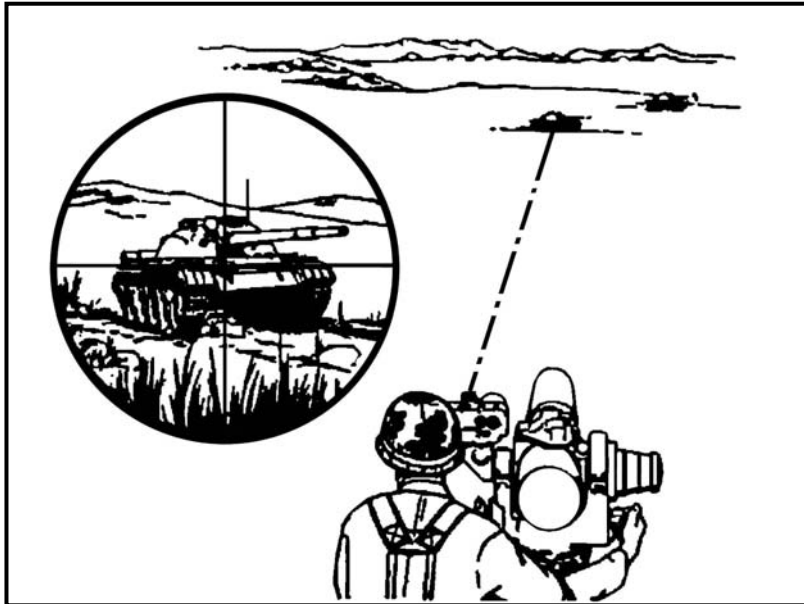


Figure 5-11. Crosshairs on the center of visible mass of the target.

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 crosshairs on the center of visible mass until missile impact (Figure 5-12).

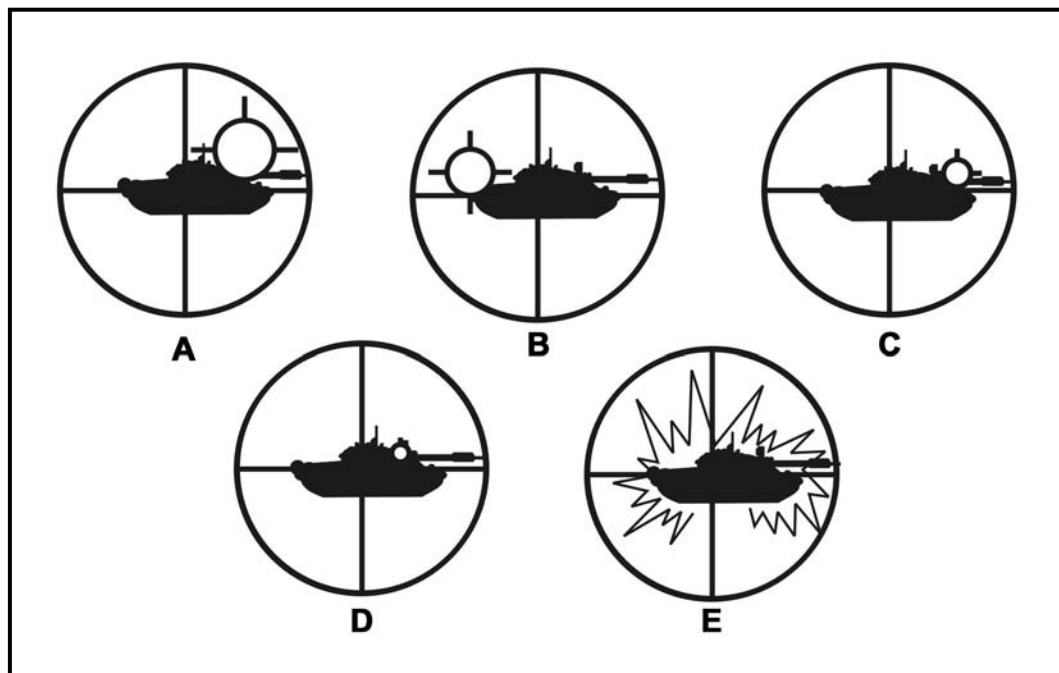


Figure 5-12. Keep crosshairs on the center of visible mass.

5-5. 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 crosshairs are in focus. (To see the crosshairs clearly, set RETICLE LIGHT switch to ON.) Position the crosshairs 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 visibility 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. Cool down 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 cool down 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 5-4, page 5-9).

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.

5-6. OPERATIONAL CONCEPT

Engaging helicopters with the TOW 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.

5-7. 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 TFFT and a helicopter mounted with TFFT 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 TFFT.

Section III. NBC AND LIMITED VISIBILITY CONDITIONS

Specific procedures are followed to operate the TOW during NBC and limited visibility conditions.

5-8. 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.)

5-9. 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 stand out 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 200°F, 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. An overcast sky can cause warmer thermal reflections. Generally, surface reflections are diffuse in nature and do not usually cause problems.

5-10. 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.

5-11. 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.

5-12. 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 with tanks produced in the U.S. and other nations indicates that 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?

NOTE: Refer to FM 100-65 for primary recognition cues.

Section IV. ELECTROOPTICAL COUNTERMEASURES

TOW crews may encounter electrooptical countermeasures on the battlefield. Therefore, the following procedures should be used as engagement criteria and not as maintenance checks.

5-13. 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 crosshairs 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.

5-14. TOW 2 LAUNCHER

TOW 2 launchers firing TOW 2-series missiles are not vulnerable to electrooptical 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 crosshairs 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 crosshairs 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 loader releases the switch only after the green boresight light appears, signifying that it is safe to engage that target.

APPENDIX A
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 10-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 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 crosshairs 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. 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 H, Table H-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).

16. 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 true.

17. 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 A-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.

		HEIGHT OF LINE OF SIGHT ABOVE THE GROUND		
		18 INCHES	20 INCHES	30 INCHES
RANGE TO TARGET	200M	.98	.98	1.0
	300M	.95	.95	1.0
	400M	.91	.91	.98
	500M	.86	.91	.98
	1,000 TO 3,000/3,750M	.56	.61	.93

Figure A-1. Probability of survival for the TOW (meters).

18. TOW Missile Time-Of-Flight Versus Range. Figure A-2 (page A-4) and Figure A-3 (page A-5) 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.

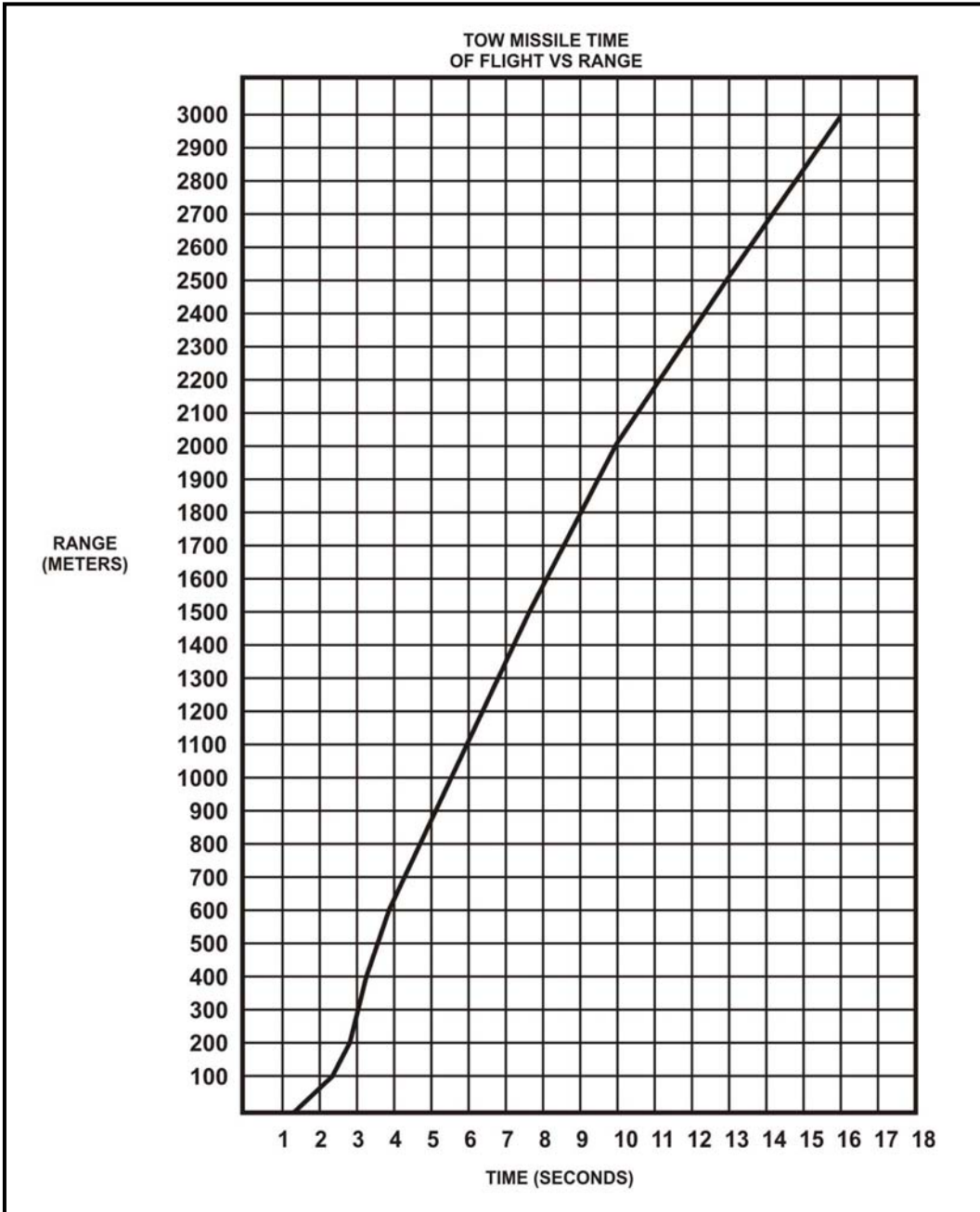


Figure A-2. TOW missile time-of-flight versus range.

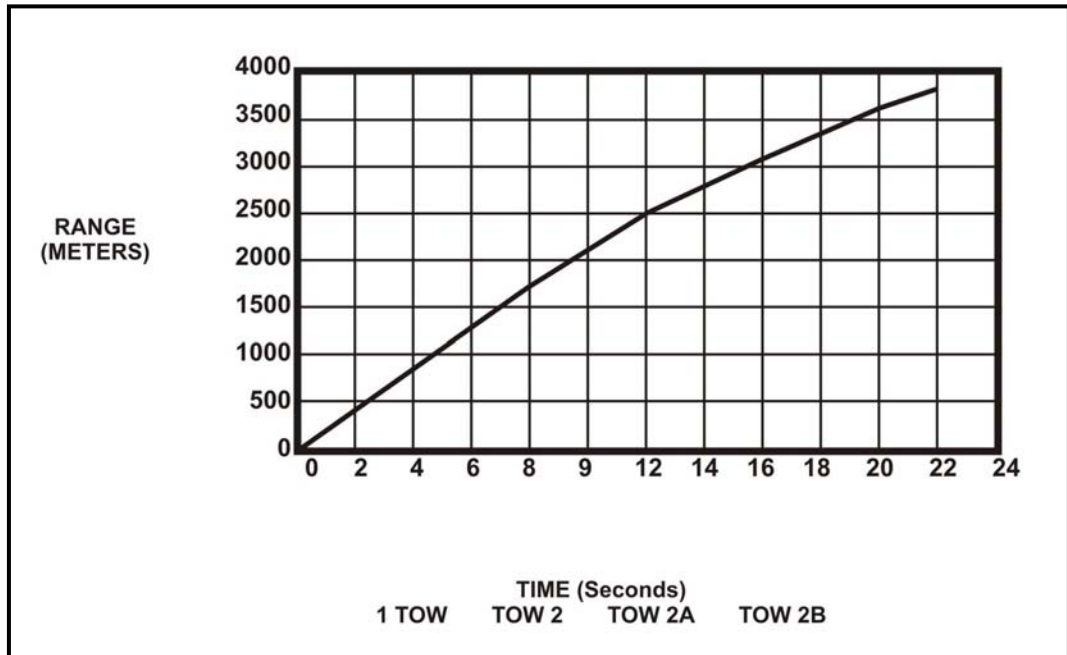


Figure A-3. TOW missile time-of-flight versus range (kilometers).

APPENDIX B
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.

B-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 11B 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 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.

B-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.

B-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.

B-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.

B-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.

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.

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.

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.

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.

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 (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 (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 (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 17).

c. TOW Field Tactical Trainer.

TASK: Assemble the TFFT and install the retroreflector.

CONDITIONS: Outdoors, given a complete TOW system and a complete TFFT with retroreflector.

STANDARDS: Correctly install the TFFT and retroreflector IAW TM 9-6920-453-10 (M966).

TASK: Power up the TFFT and align the laser to the retroreflector.
CONDITIONS: Outdoors, given an assembled TFFT and an installed retroreflector.
STANDARDS: Correctly power up the TFFT and align the laser to the retroreflector IAW TM 9-6920-453-10 (M966).

TASK: Conduct operational procedures for the TFFT.
CONDITIONS: Outdoors, given an assembled, operational, aligned TFFT, and an installed retroreflector.
STANDARDS: Correctly conduct operational procedures for the TFFT to include setting target size and obscuration time, loading the M80 blast simulator, and preparing the TFFT for firing IAW TM 9-6920-453-10 (M966).

TASK: Conduct system checks and test procedures for the TFFT.
CONDITIONS: Outdoors, given an assembled, operational, and aligned TFFT.
STANDARDS: Correctly perform all system checks and test procedures for the TFFT to include visual checks, cable checks, power checks, computer checks, alignment checks, and system and operational checks IAW TM 9-6920-453-10 (M966).

B-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 11B Individual Soldier Tasks.** Each trainer must be tested on each individual 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 Collective Tasks.** Trainers should be tested in all 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 B-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 C FIGHTING POSITIONS

TOW fighting positions may be mounted or dismounted, depending on the situation. A camouflage net can be used with either configuration.

C-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 C-1.

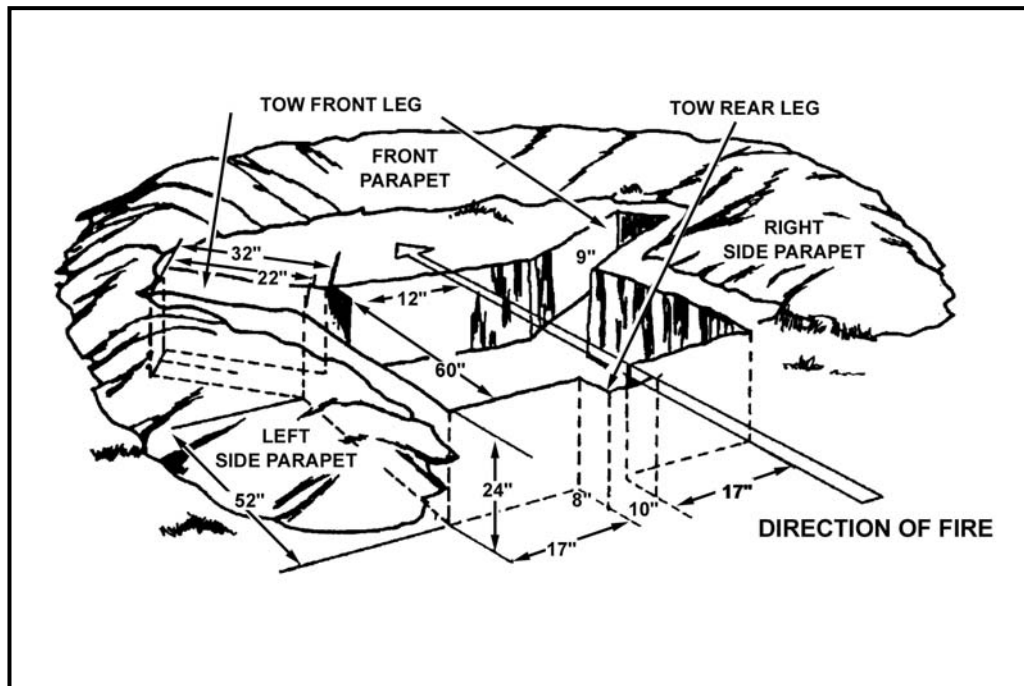


Figure C-1. Tripod-mounted TOW fighting position.

- (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.
- (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 C-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.)

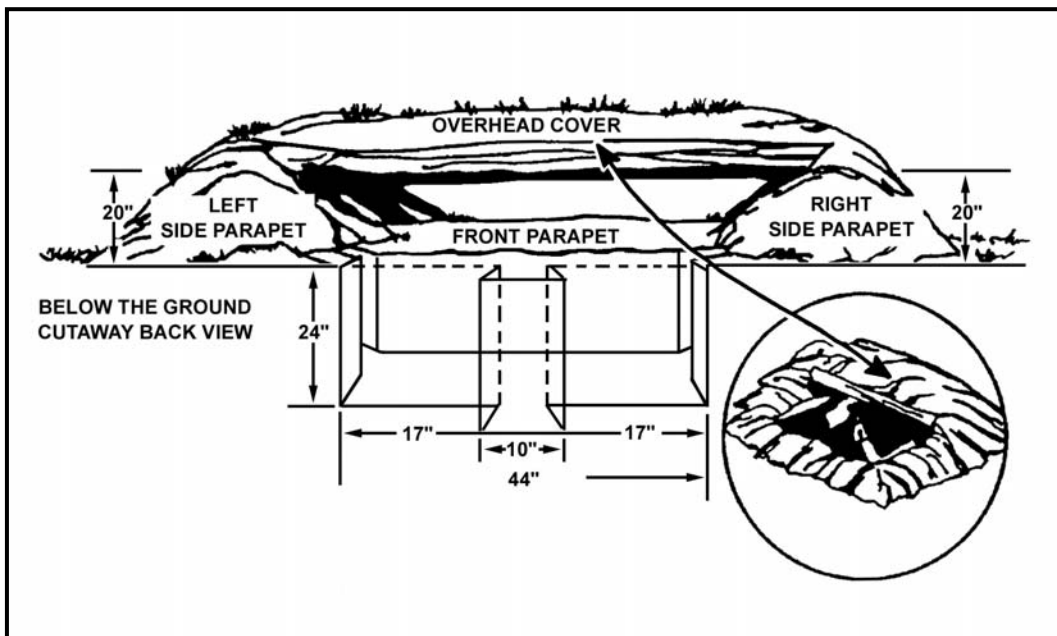


Figure C-2. Storage/protective area.

C-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 C-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.

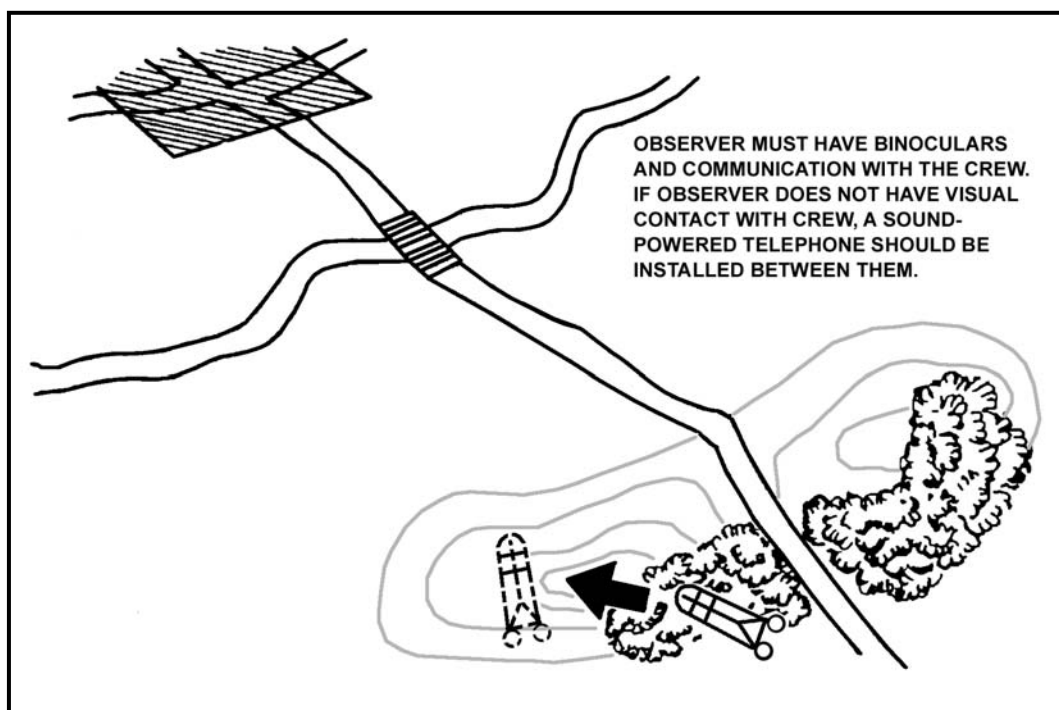


Figure C-3. TOW hide position.

C-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 D

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.

D-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 or 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 and or 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 response.

D-2. PREPARATION PROCEDURES

The section/squad leader's briefing provides the necessary information for the gunner to begin 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.

EXAMPLE OF SECTION OR 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 junction is 633 meters on an azimuth of 85 degrees." (See Figure D-1.)

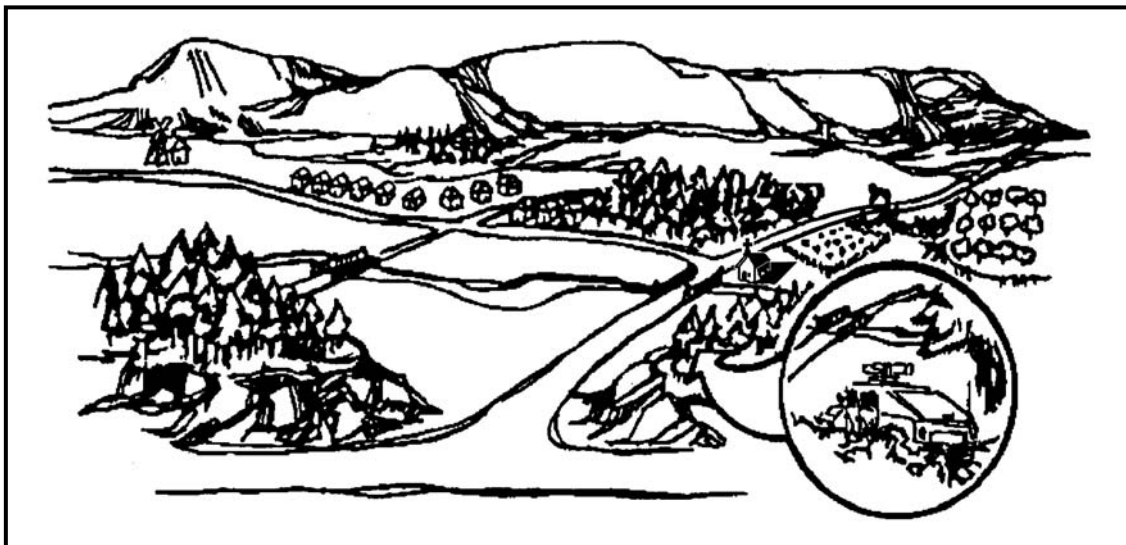


Figure D-1. Section or squad leader's briefing.

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 label the area; for example, "woods" or "orchard" (Figure D-2).

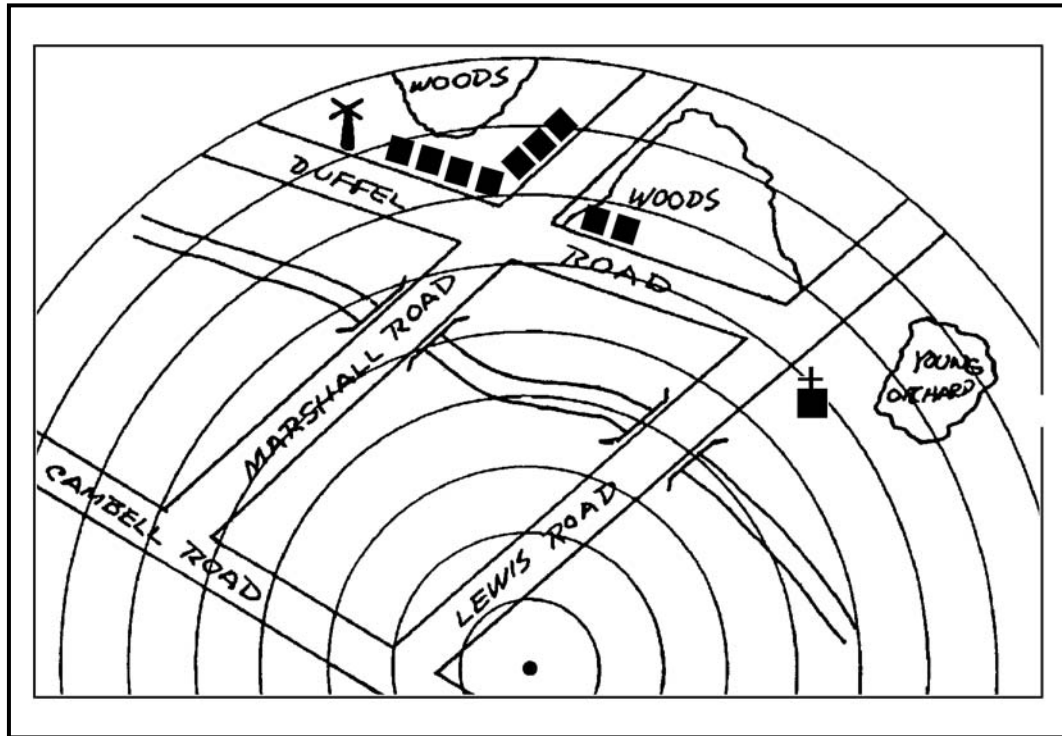


Figure D-2. Sketch of area on range card.

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 D-3, page D-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 D-4, page D-4). If there are limitations, the maximum engagement line is drawn in front of the limiting terrain feature.

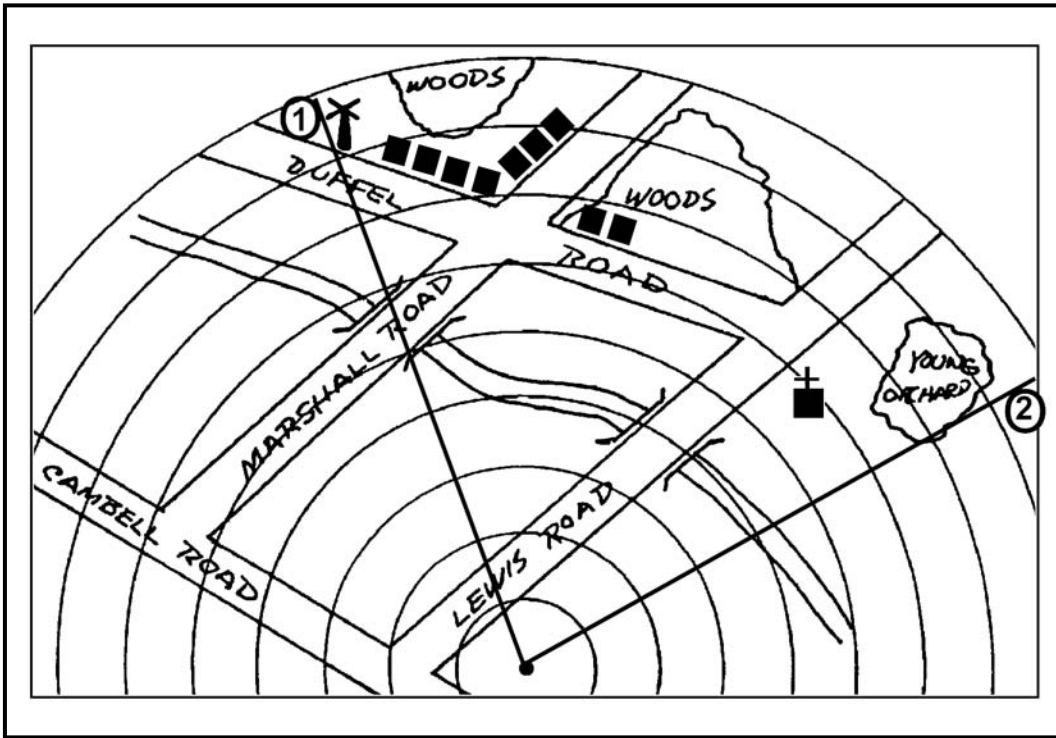


Figure D-3. Labeling sector of fire.

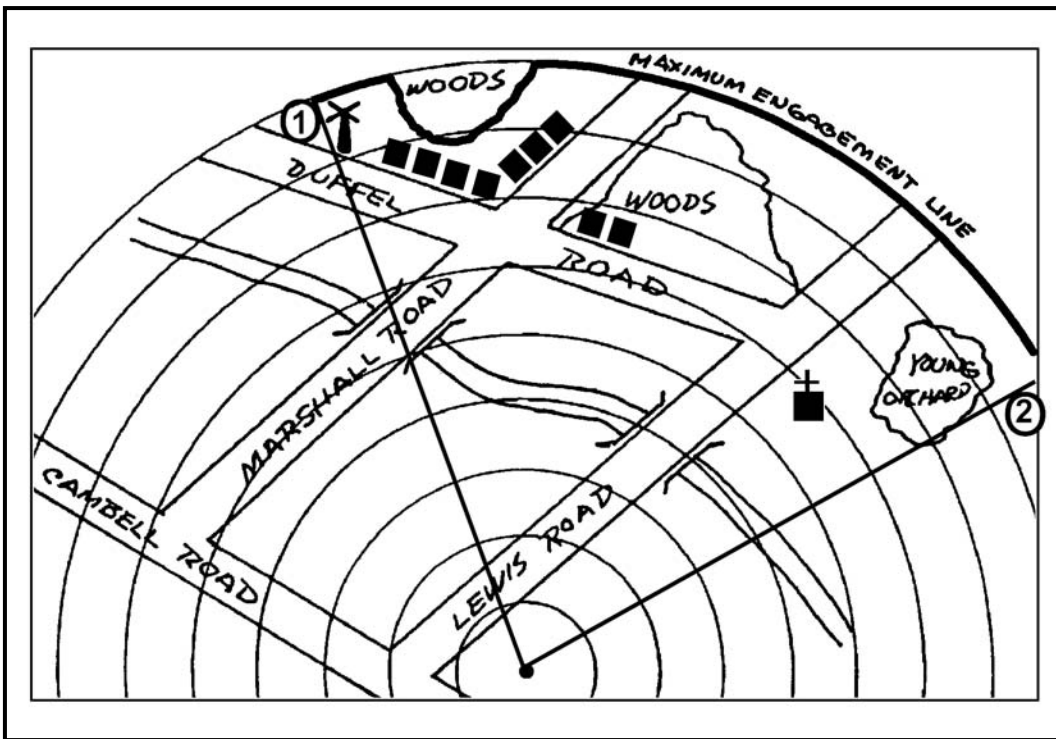


Figure D-4. Placement of maximum engagement line.

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 D-5, page D-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 D-6, page D-6).

f. Place diagonal lines, or the words “dead space,” where dead space occurs (Figure D-7, page D-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 D-8, page D-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 D-9 (page D-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 D-10, page D-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.

(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.

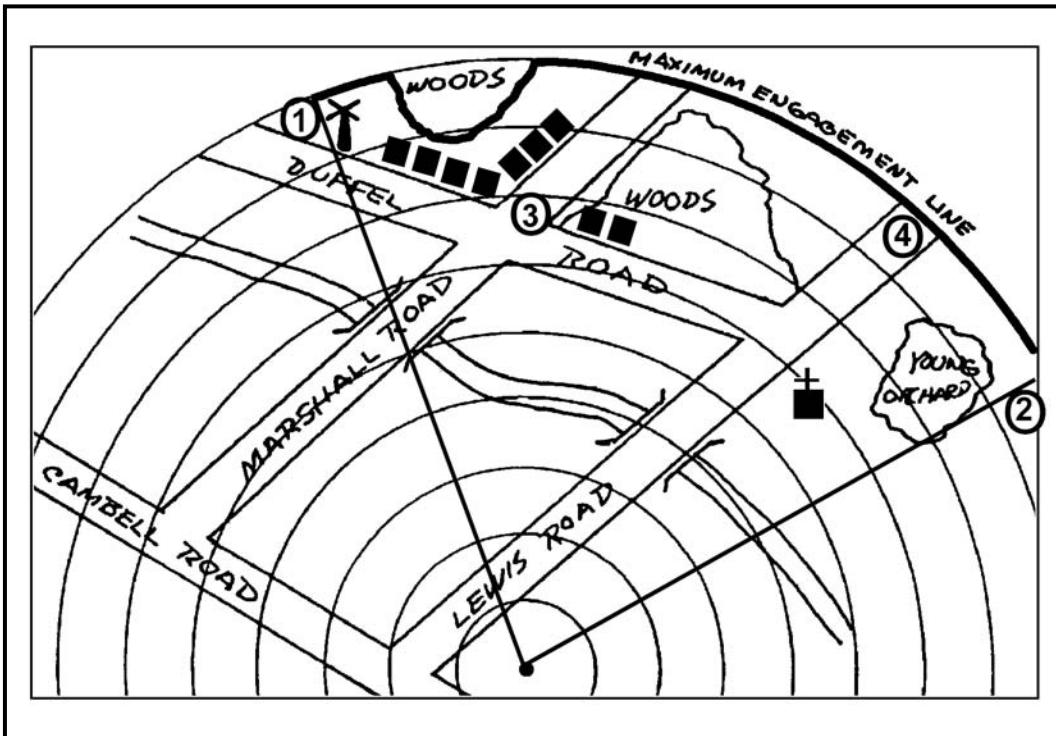


Figure D-5. Numbered target engagement locations.

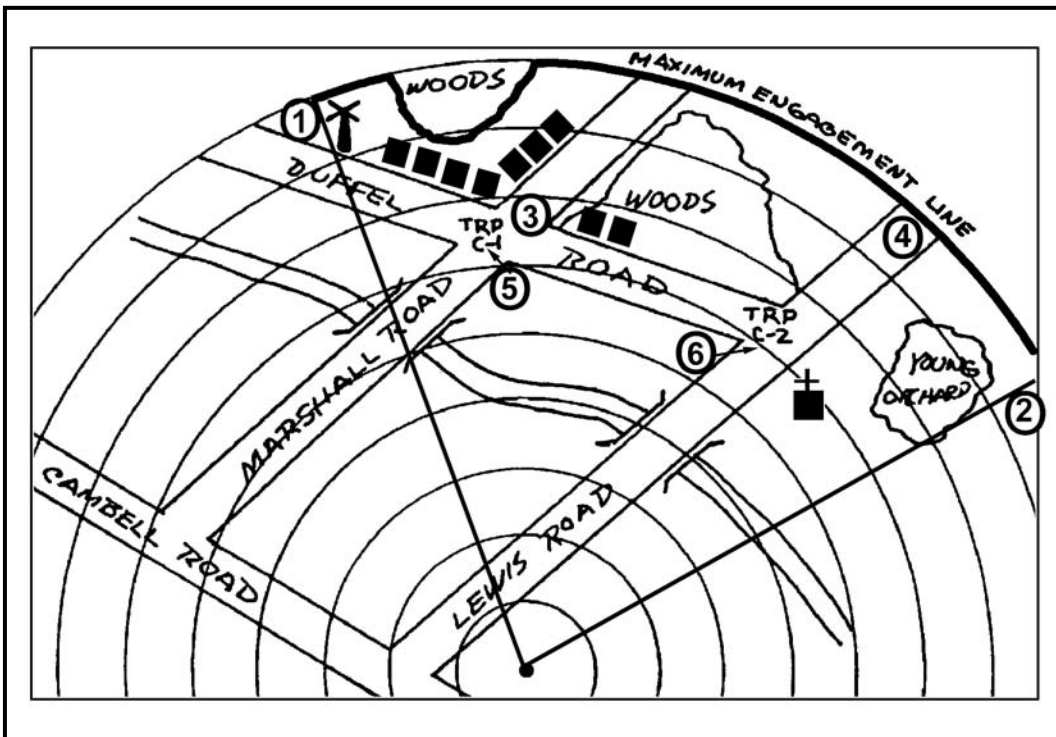


Figure D-6. Target reference points and numbers.

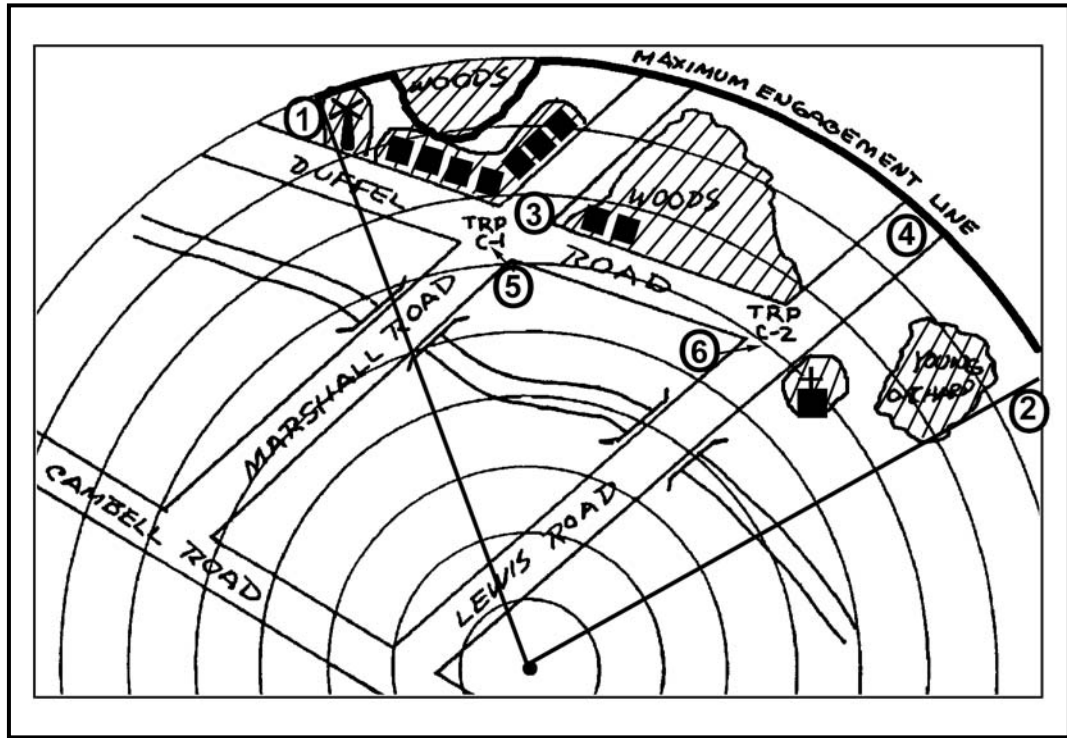


Figure D-7. Dead space indicated.

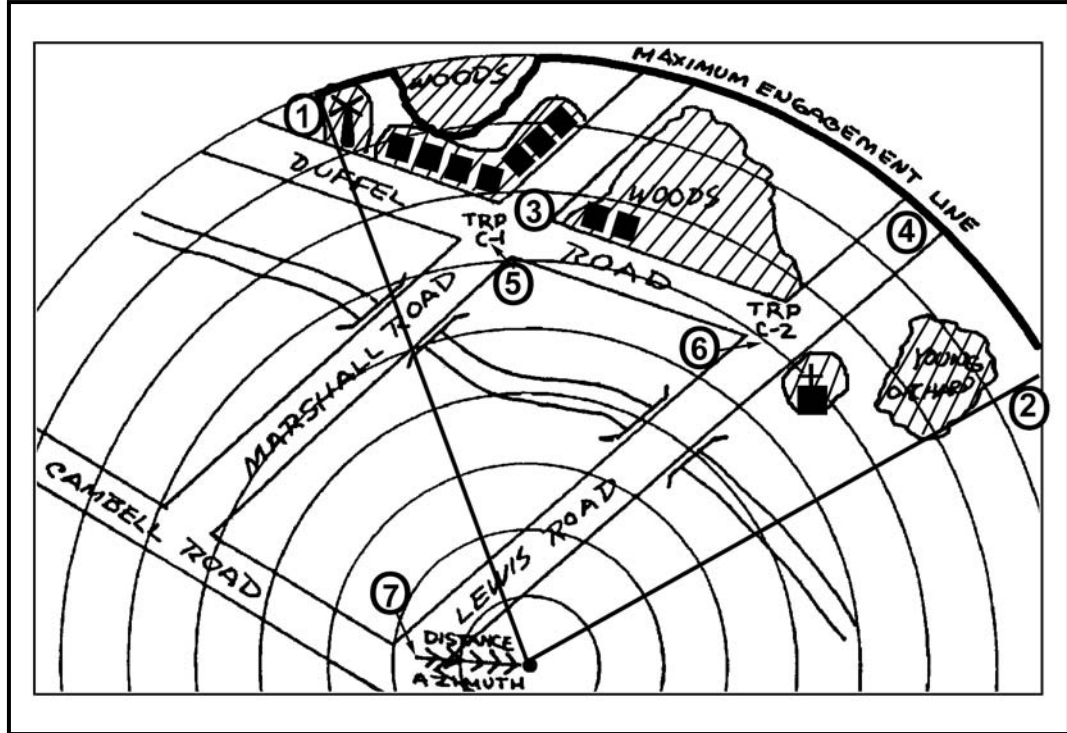


Figure D-8. Placement of distance and azimuth from a known point.

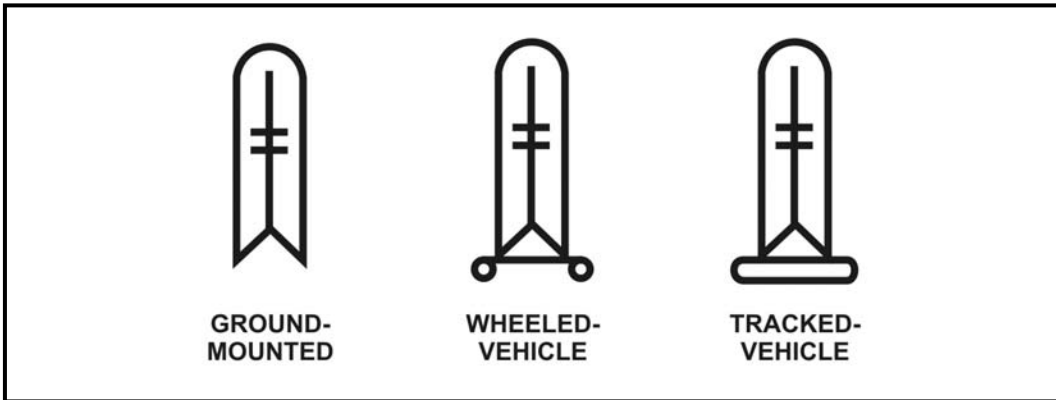


Figure D-9. Weapon symbols.

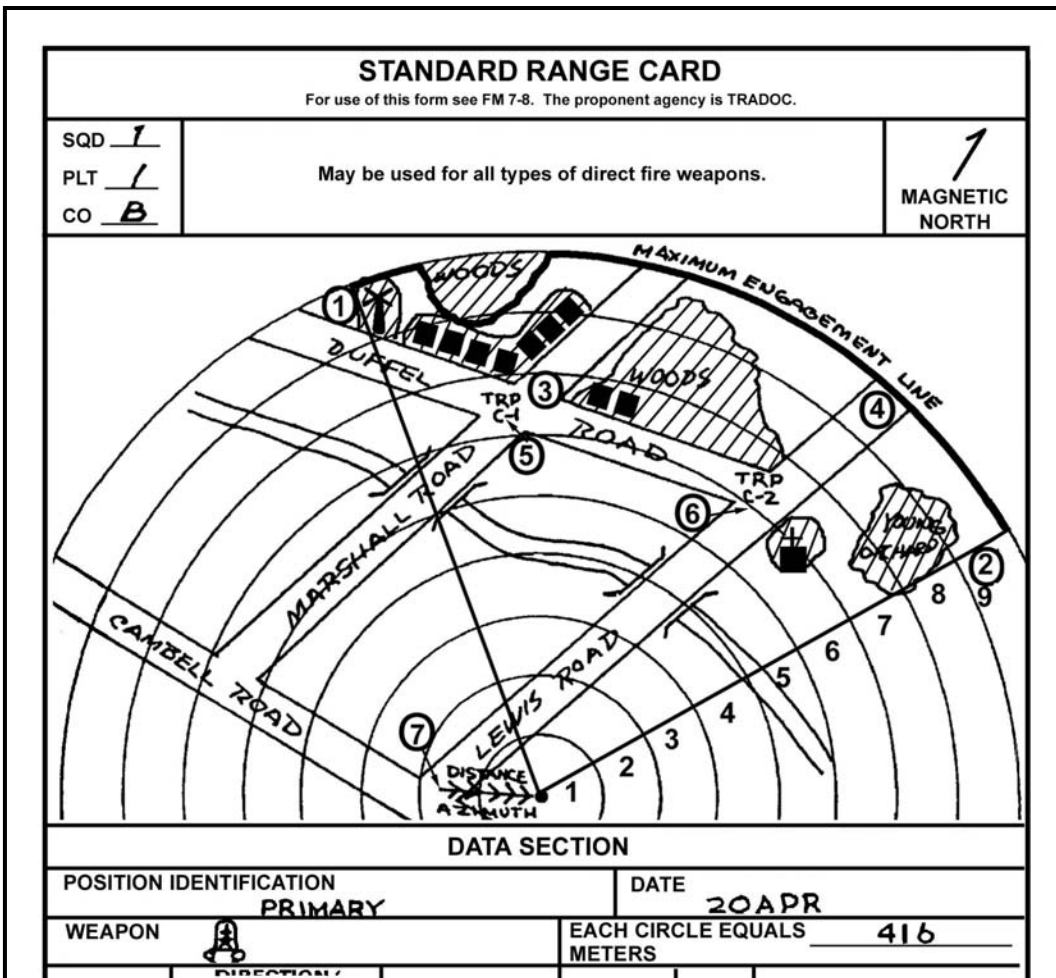


Figure D-10. Determining range interval on range card.

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 D-11 for a completed TOW range card.)

STANDARD RANGE CARD
For use of this form see FM 7-8. The proponent agency is TRADOC.

SQUAD <u>I</u>	May be used for all types of direct fire weapons.	MAGNETIC NORTH
PLATOON <u>I</u>		
COMPANY <u>B</u>		

DATA SECTION					
POSITION IDENTIFICATION PRIMARY	DATE 20 APR				
WEAPON	EACH CIRCLE EQUALS <u>416</u> METERS				
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 96

Figure D-11. Example of a completed DA Form 5517-R, Standard Range Card for TOW.

D-3. 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 D-12, page D-10). 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.

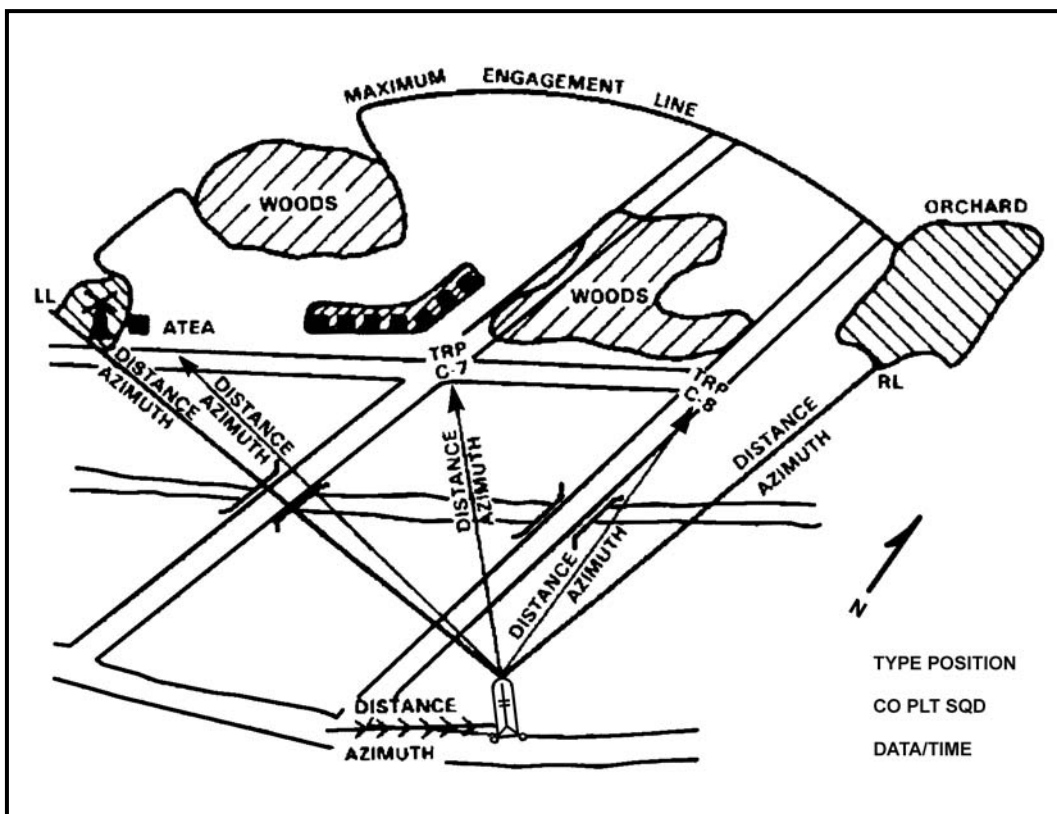


Figure D-12. Expedient range card.

APPENDIX E SAFETY

Units should develop local directives and SOPs that 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 handling ring and dust cover.

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.

E-1. SAFETY PRECAUTIONS

The surface danger zone for any firing range consists of a firing area, a target area, impact area, and danger areas surrounding these locations (Figure E-1). 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 DA Pam 385-63 for dimensions.)

a. The primary danger area is a 90-degree cone with a 50-meter radius. The apex of the cone is centered at the rear of the missile launcher. Serious casualties or fatalities are likely to occur to anyone in the area during firing. Hazards include launch motor blast, high noise levels, overpressure, and debris.

b. *Caution area 1* extends radially from each side of the primary danger area to the firing line with a radius of 50 meters. Permanent hearing damage could occur to personnel without adequate hearing protection in this area during firing. The hazards are high noise levels and overpressure.

c. *Caution area 2* is an extension of the primary danger area with the same associated hazards and personnel protection required. The radius of this area is 75 meters.

d. The *200-meter zone* is the danger area for aerial firings 15.25 meters or more above ground level.

e. TOWs will not be fired from buildings or bunkers, or within 100 meters of a vertical or nearly vertical backstop (IAW DA Pam 385-63).

WARNING

All crew members must wear V-51R (or equivalent) earplugs that have been fitted by qualified medical personnel. Failure to use the proper earplugs during missile firing could cause serious injury.

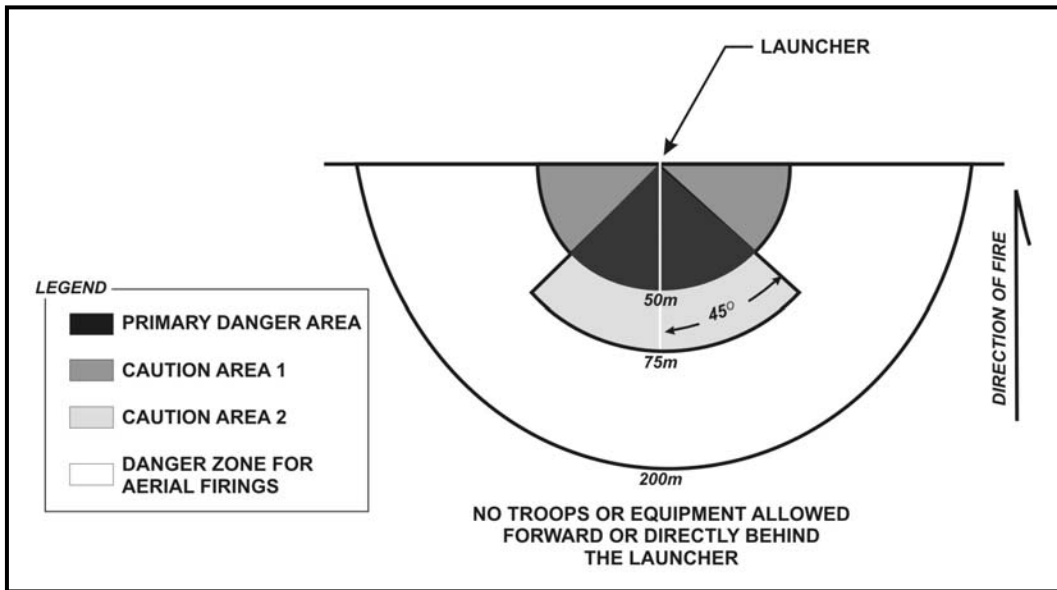


Figure E-1. Surface danger zone for firing basic TOW, TOW 2A, and TOW 2B missiles.

E-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.

E-3. SIGHTING AND AIMING 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.

E-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 are as shown in Figure E-2.

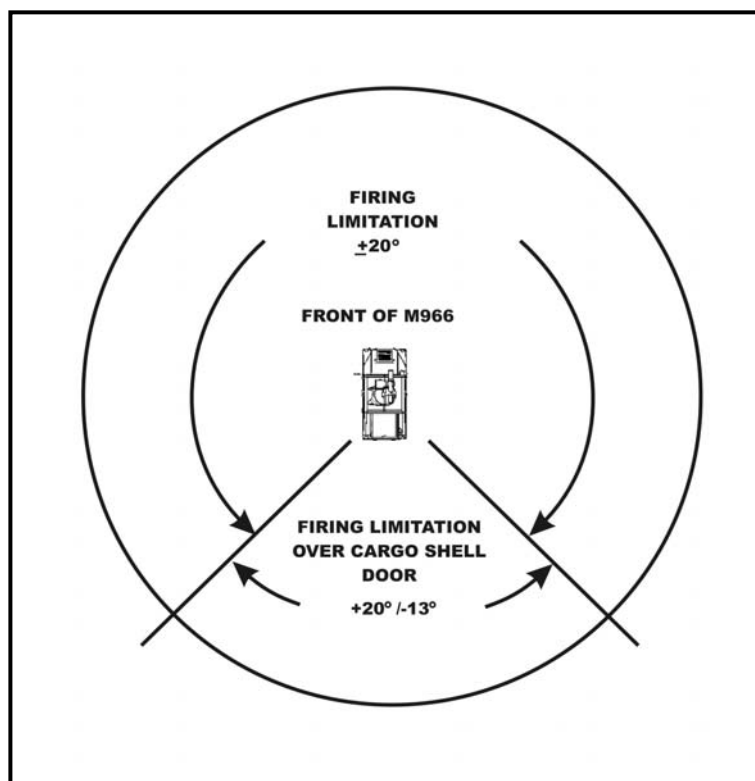


Figure E-2. M966-mounted TOW firing angle limitations.

E-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. (Gloves are recommended when loading or unloading the ATWESS cartridge.)

b. Before pulling the PULL-TO-ARM switch, always check to ensure no personnel or equipment (antennas) are in the ATWESS danger zone. This zone extends for 75 meters behind the ATWESS firing chamber and covers an arc 90 degrees wide (Figure E-3).

c. Never view the laser being fired through stabilized optics, such as binoculars or telescopic weapon sights, when within 75 meters of the transmitter.

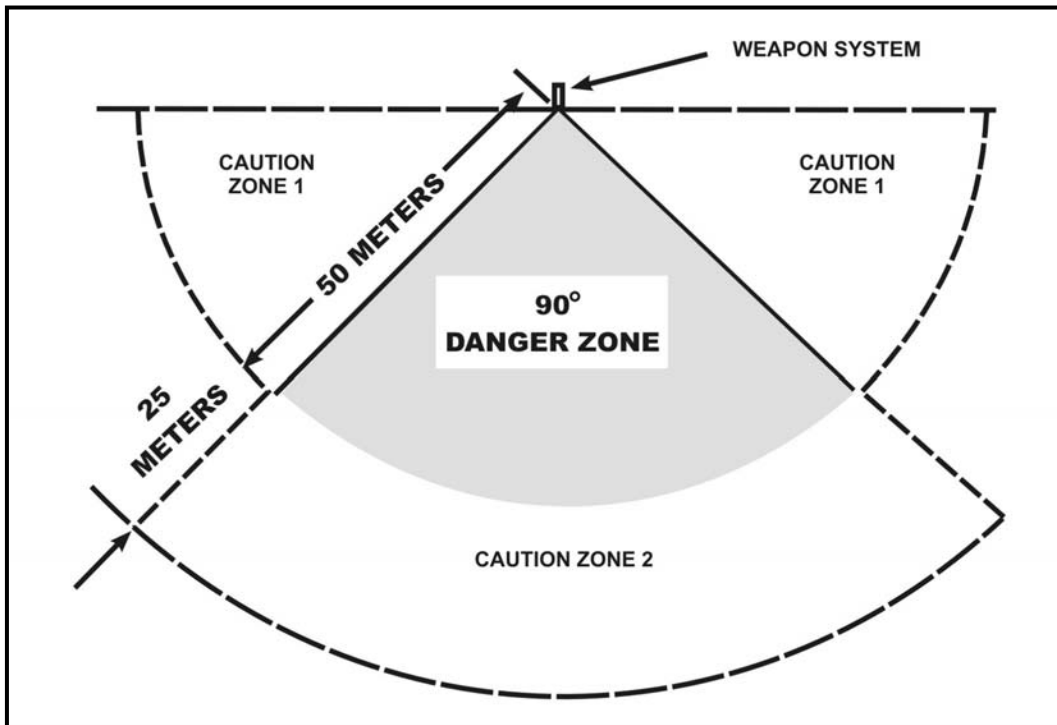


Figure E-3. ATWESS danger zone.

E-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.

E-7. SAFETY PRECAUTIONS FOR THE TOW FIELD TACTICAL TRAINER

The following safety precautions must be observed when using the TFFT.

- a. The laser light emitted by the TFFT 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 and the laser range safety procedures in DA Pam 385-63 and TB MED-279 discuss these precautions.
- b. The M80 blast simulator used with the TFFT 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.

DANGER

THIS EQUIPMENT USES HIGH VOLTAGE TO OPERATE. DEATH ON CONTACT MAY RESULT IF PERSONNEL FAIL TO OBSERVE THE SAFETY PRECAUTIONS LISTED IN TM 9-6920-453-10.

APPENDIX F

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) was fielded. PGTS consists of two systems: an indoor trainer and an outdoor trainer. The TOW Gunner Trainer (TGT) is the indoor system and the TOW Field Tactical Trainer (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 needed. 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 4 for target arrays.)

F-1. COMPONENTS AND FEATURES

This paragraph discusses the different components, features, and capabilities of MILES.

a. Components.

(1) The following are the nine components in the MILES TOW transit case:

- Operator's manual.
- Two man-worn laser detector sets (halo and harness).
- Two yellow keys.
- TOW laser transmitter/tracker head simulator.
- Missile guidance set adapter.
- Miscellaneous hardware.
- Hook-pile tape pads.
- Control console mounting bracket.
- Collimator adapter 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.

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: IAW unit SOP, ATWESS comes packed 12 to a box.

Backblast area: 75 meters at 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 and or weak batteries. The M60 machine gun is effective against lightly armored MILES-equipped vehicles and personnel. The TOW 2 is effective against armored MILES-equipped vehicles.

NOTE: Training soldiers to assemble, utilize, and maintain the MILES will greatly decrease down time due to MILES malfunctions.

F-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. (Gloves are recommended when loading or unloading the ATWESS.)

b. Before pulling the PULL-TO-ARM switch, always check to ensure no personnel or equipment (antennas) are in the ATWESS danger zone. This zone extends for 75 meters behind the ATWESS firing chamber and covers an arc 90 degrees wide (Figure F-1).

c. Never view the laser being fired through stabilized optics, such as binoculars or telescopic weapon sights, when within 75 meters of the transmitter.

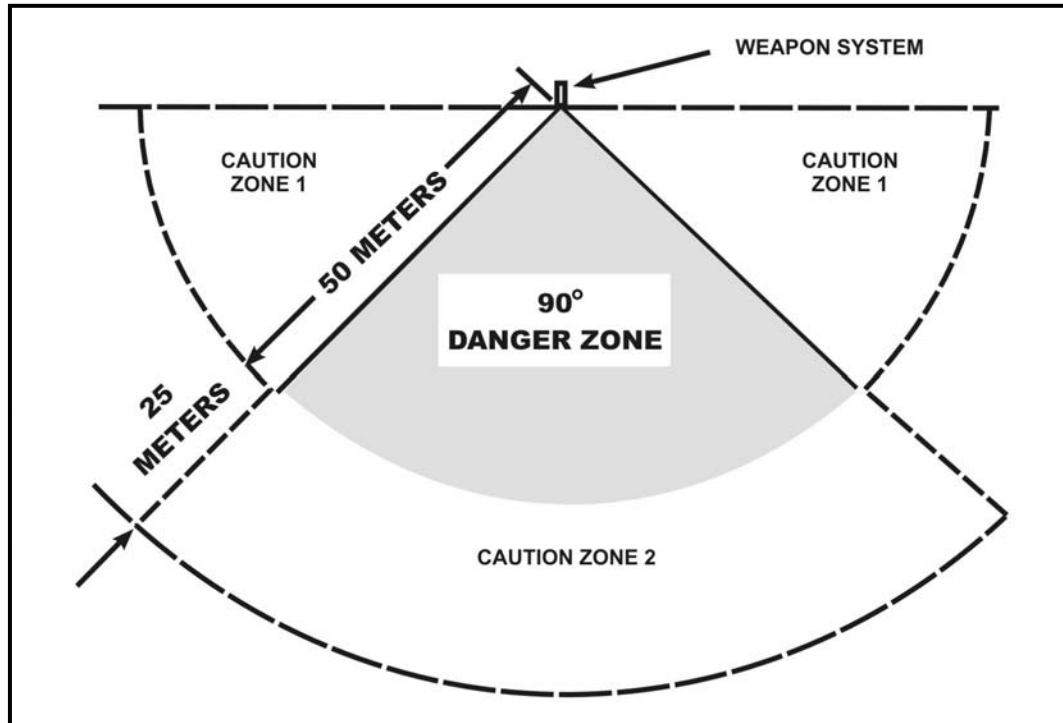


Figure F-1. MILES TOW backblast area.

Section II. TOW GUNNERY TRAINER

The TGT is a new trainer used indoors for individual advanced gunnery tables. It provides realistic gunnery training, not crew drills.

F-3. COMPONENTS AND FEATURES

The TGT consists of TGT-unique components and TOW 2 components. The major TGT-unique components are the instructor station (Figure F-2, page F-4) and the student station (Figure F-3, page F-4). The TOW 2 components are the traversing unit, tripod, and the launch tube.

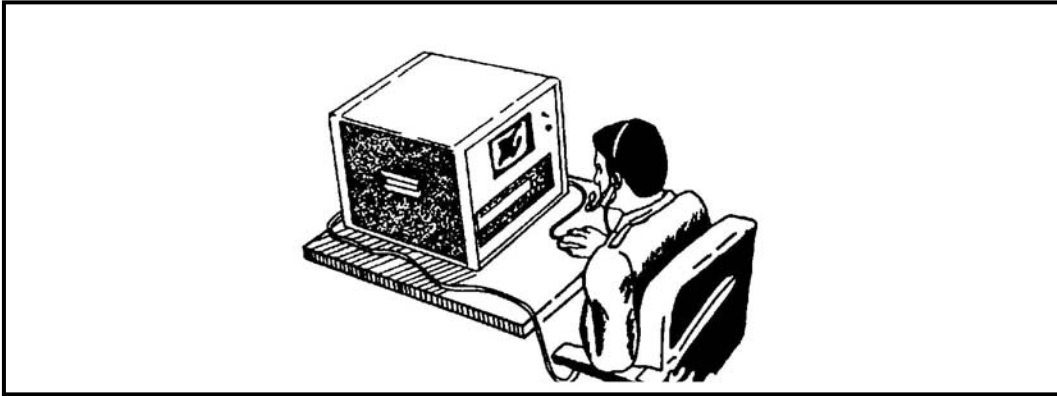


Figure F-2. Instructor station.

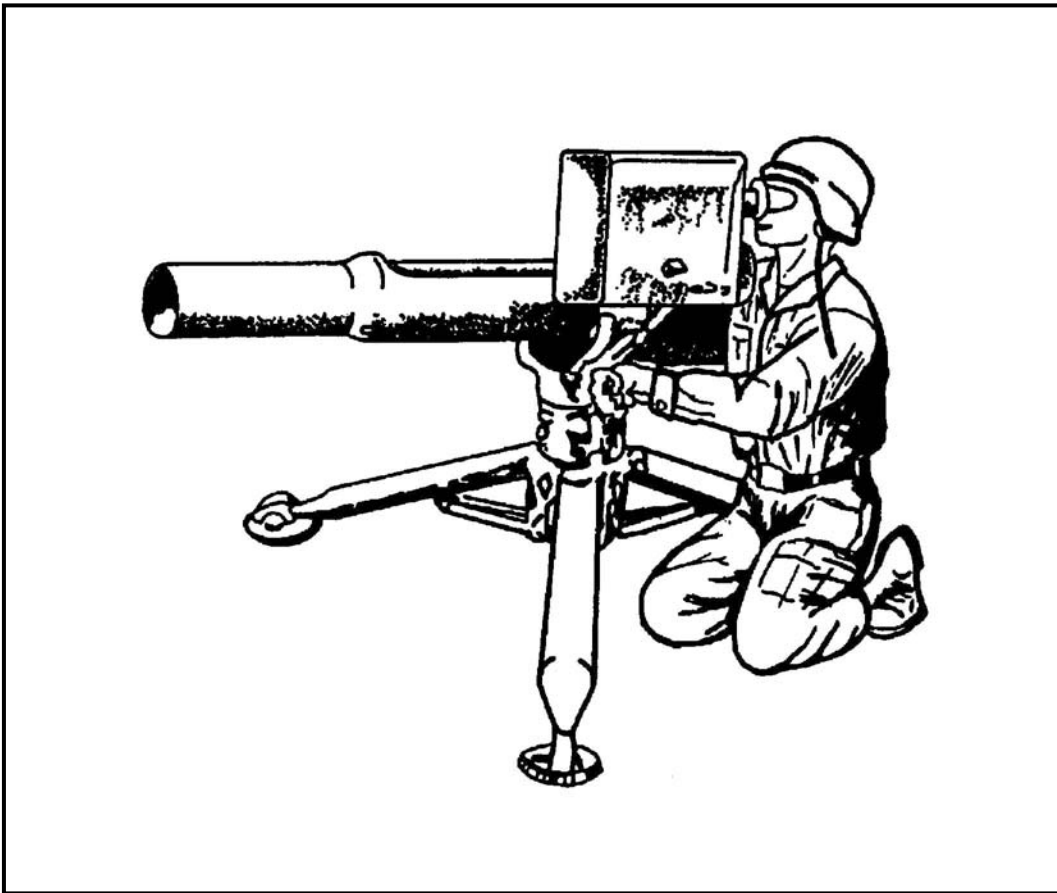


Figure F-3. Student station.

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 that 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.
- Fire commands.

F-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 and or 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.

F-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 TFFT 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 TFFT 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 TFFT.

F-6. COMPONENTS AND FEATURES

The TFFT consists of TFFT-unique components and a TOW 2 weapon system. The TFFT attaches to the TOW 2 and replaces some of its components. The TFFT can be either tripod mounted or HMMWV mounted and can be configured for the M966 (Figure F-4).

a. The TFFT uses the TOW 2 weapon system equipment to enhance training realism. In addition, most of the TFFT components are designed to resemble actual weapon system equipment. The TFFT 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 TFFT.

b. The TFFT 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.

F-7. ASSEMBLY AND OPERATION

The following manuals are used for proper assembly and operation of the TFFT.

a. TM 9-6920-453-10 (M966), Chapter 2, Section 1, discusses procedures for unpacking, assembly, disassembly, and repacking of the TFFT.

b. TM 9-6920-453-10 (M966), Chapter 2, Section 2, discusses procedures for preliminary inspection, power-up, and operational checkout of the TFFT.

c. TM 9-6920-453-10 (M966), Chapter 2, Section 3, discuss procedures for operating the TFFT.

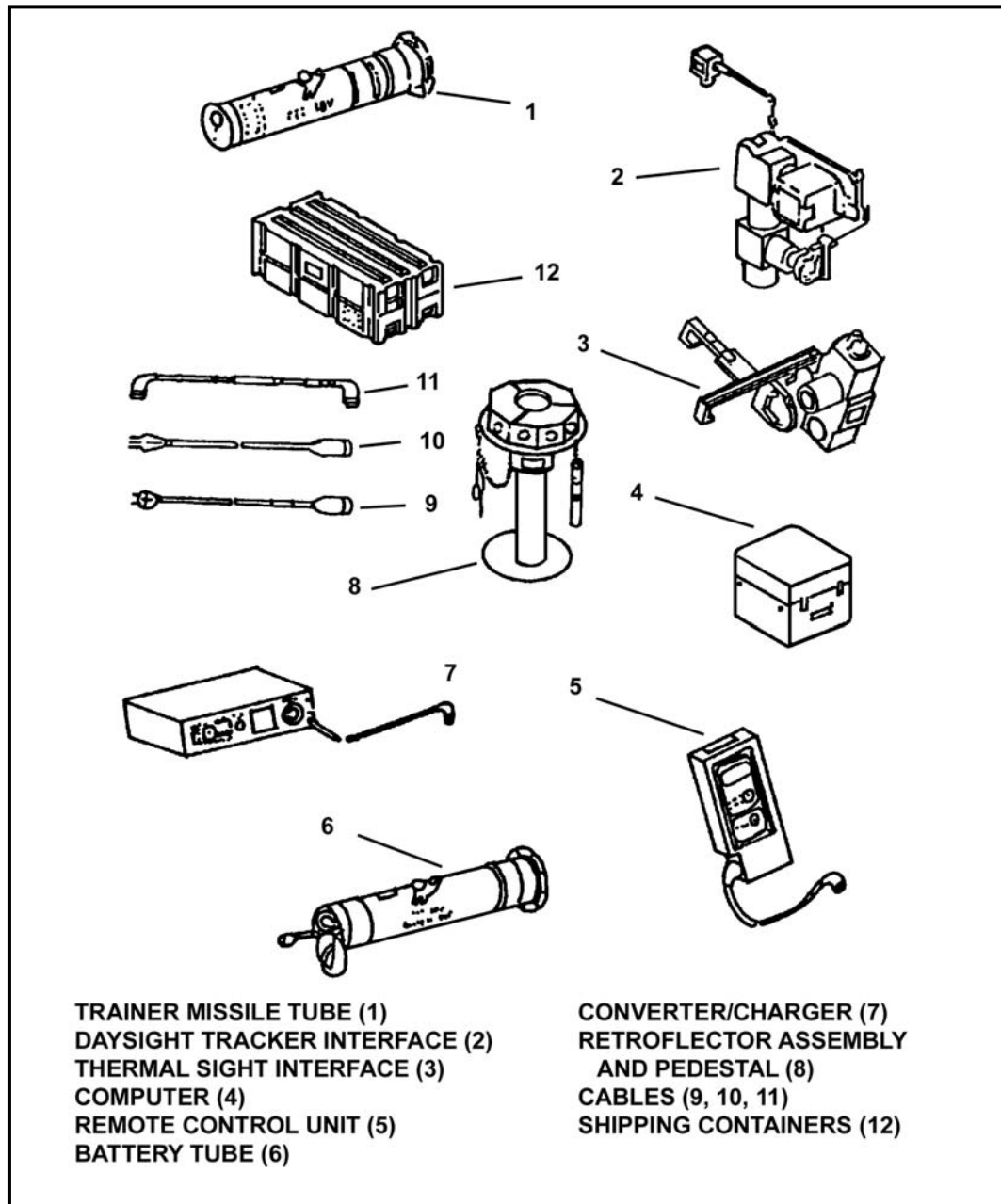


Figure F-4. TOW field tactical trainer components (M966).

F-8. SAFETY PRECAUTIONS

The laser light emitted by the TFFT 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 DA Pam 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 9-6920-453-10 (M966).

DANGER

THE M80 BLAST SIMULATOR USED WITH THE TFFT CAN CAUSE DEATH OR INJURY. OBSERVE THE PRECAUTIONS LISTED IN THE PREFACE OF TM 9-6920-453-10.

APPENDIX G
COMBAT VEHICLE IDENTIFICATION

Skill Level 1 11B soldiers must be able to identify combat vehicles according to the conditions and standards listed in this appendix.

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 Support Center for the combat vehicle slides.)

STANDARDS: Given a 12-second exposure time for each slide, the soldier will identify 36 of 40 vehicles by nomenclature.

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.

a. **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.

b. **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.

PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED:

- Qualified 11B sergeant or above.
- Forty 35-mm slides of combat vehicles. The 30 required vehicles for this test are included in the list in Figure H-1 and are indicated by an asterisk. The balance will be taken from the other vehicles listed in Figure G-1 (page G-4). (Recognition of Combat Vehicles [ROC-V] compact discs may also be used.) (For more information, see GTA 17-02-013.)
- Classroom.
- Slide projector with screen.
- Stopwatch.
- Performance checklist (one per soldier).
- Chair, desk or clipboard (one per soldier).
- Pencil (one per soldier).

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.

- a. Select 30 required vehicle slides to be used along with 10 slides selected by the commander.
- b. Ensure the slide projector is operational.
- c. Ensure the slides can be recognized from all locations in the classroom.

PRETEST CONDITIONS FOR EACH EXAMINEE: The slide projector will be on, but slides will not be exposed.

TEST PLANNING TIME:

Administrative: 5 minutes
Test: 15 minutes
Total: 20 minutes

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	15. M60A1	29. T64K
2. AMX30	*16. M60A3	*30. T72
3. AMX30 SA	*17. Merkava	31. T72 M84
4. JP Kanone	18. PT76	32. T72M1
5. Centurion	19. PT76 Type 60	*33. T80
6. Centurion 15	20. T80U	34. Type 59
7. Centurion RE	21. T34 Medium	35. Type 62
* 8. Challenger	22. T54	36. Type 69
* 9. Chieftain	23. T55	37. Type 79
10. Leopard 1	24. T55K	38. Type 80
*11. Leopard 2	*25. T62	39. Type 90
*12. M1 Abrams	26. T64	*40. Le Clerc
13. M48A5	27. T64A	
14. M551 Sheridan	28. T64B	
LIGHT-ARMOR—APC/IFV/RECONNAISSANCE		
1. AML	25. BRM	49. M3 APC (Fr)
2. AMX10	26. BRM1	*50. Marder
3. AMX10P	27. BTR152	51. MCT (S)
4. AMX10RC	28. KM900	52. Ferret MK 1
5. BMD1	29. BTR50PK	53. Ferret MK 2
6. BMD 1979/3	30. BTR60PA Cmd	54. MTLB
* 7. BMD2	*31. BTR60PB	55. NFV-1
* 8. BMP1	*32. BTR70	56. NVH-1
9. BMP1K	33. BTR80	57. OT64
10. BMP1KSH	34. BTRD	58. OT65
*11. BMP2	35. Charrua	59. PSZH-IV
*12. Bradley M2/M3	36. Condor	60. Ratel
13. AMX VCI	37. Cougar	61. Rooikat
14. Bradley M2A2	38. EE-9 Cascavel	62. Saxon
15. LVTP7 (AAV7A1)	39. EE-11	*63. Scimitar
16. Bradley M3A1	40. Fox	*64. Scorpion
17. Bradley M3A2	41. FV432	65. Striker
*18. BRDM1	42. IPR	*66. VAB
*19. BRDM2	43. IRM	*67. Warrior
20. BRDM2 AT3	44. Jaguar 1	68. WZ523
21. BRDM2 AT5	45. Jaguar 2	69. WZ551
22. BRDM2 RKH	*46. Luchs	70. YW531
23. BRDM2 SA9	*47. M113	71. YW534
24. BRDM2 U	48. M113A3	

*Required for test.

Figure G-1. Combat vehicle slide list.

ANTITANK SYSTEMS

- | | |
|---------------------|-------------------------------------|
| 1. ASU57 | 12. Milan ATGM |
| 2. ASU85 | 13. MT12 |
| 3. AT1 Snapper | 14. RPG2 |
| 4. AT2 Swatter | 15. RPG7 |
| 5. AT3 Sagger | 16. SPG9 |
| 6. AT4 Spigot | 17. SS11 Harpoon ATGM |
| 7. AT5 Spandrel | 18. Swingfire ATGM |
| 8. AT6 Spiral | 19. Type 52 75-mm Recoilless Rifle |
| 9. B10 | 20. Type 56 RPG-2 |
| 10. PANHARD VCR HOT | 21. Type 70-1 62-mm Rocket Launcher |
| *11. ITV M901 | 22. Type 86 |

ANTI-AIRCRAFT

- | | |
|------------------|-------------|
| 1. AMX DCA 30-2 | 7. ZPU4 |
| 2. Chaparral | 8. 2S6 |
| *3. Gepard | *9. ZSU23-4 |
| 4. M163A1 VULCAN | 10. ZSU57-2 |
| 5. Roland | 11. ZU23 |
| 6. S60 | |

SELF-PROPELLED MORTAR

- | | |
|-------------------|------------------|
| 1. M106 107-mm | 5. Type 85 82-mm |
| 2. M125 81-mm | 6. YW304 82-mm |
| 3. T54 160-mm | 7. YW381 120-mm |
| 4. Type 85 120-mm | |

*Required for test.

Figure G-1. Combat vehicle slide list (continued).

SELF-PROPELLED AND TOWED ARTILLERY	
1. 2S1	21. M109A3
2. 2S3	22. M109A6
3. 2S4	23. M110A2
4. 2S5	24. M1972 122-mm
5. 2S7	25. M1973 152-mm
6. 2S9	26. M1974 152-mm (SP)
7. AL FAO 210-mm	27. M1975 130-mm (SP)
8. Astros (MRL) 127-mm	28. M1977 122-mm (SP)
9. Astros (MRL) 180-mm	29. M1978 170-mm (SP)
10. Astros (MRL) 300-mm	30. M1981 122-mm (SP)
11. BM21	31. M1985 MRL 122-mm (SP)
12. CGT F1	32. M1985 MRL 240-mm (SP)
13. Dana 152-mm (SP)	33. M1989 170-mm
14. G-5 155-mm towed	34. Majnoon 155-mm (SP)
15. G-6 155-mm (SP)	35. MKF3
16. GCT 155-mm (SP)	36. MLRS
17. GHN-45 155-mm towed	37. Type 54-1 122-mm
18. M107	38. Type 59 130-mm
19. M109A1	39. Type 85 122-mm
20. M109A2	
MISCELLANEOUS	
1. Artillery Command and Reconnaissance Vehicle	5. M728 CEV
2. AVLB	* 6. M88A1
3. Fox, NBC Reconnaissance M93	7. M9 ACE
* 4. LAV-25	8. PRP-3

*Required for test.

Figure G-1. Combat vehicle slide list (continued).

APPENDIX H
OPFOR/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 two years ago, or even one year 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.

H-1. OPFOR/THREAT ARMORED VEHICLES

Armored vehicle identification in the past was a simple matter of distinguishing between vehicles manufactured by Eastern Bloc and Rest of the World (ROW) 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 nations of the former Soviet Union in battle, but more likely that we will fight the military of a third world nation equipped with a wide variety of equipment. 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 H-1).

COUNTRY	TYPE	ORIGIN
Iran	Type 59 Type 69 Chieftain M48A5 M60A1 T62 T72 EE-9 Cascavel M113	China China United Kingdom USA USA Russia Russia Brazil USA
Iraq	Type 59 AMX-30 Chieftain T62 T72 EE-11 Urutu Walid MOWAG Roland M113A1	China France United Kingdom Russia Russia Brazil Egypt Switzerland USA

Table H-1. Select armored vehicle types and countries of origin.

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. In the future, the antiarmor crewman will probably face armored vehicles produced in the U.S. as well as in other friendly nations. The trend of the U.S. to fight with a coalition means that, on future battlefields, both friendly and enemy forces may have identical equipment.

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.

(1) **British Main Battle Tank, Chieftain Mk 5** (Figure H-1).

- Date of introduction: 1967 original Chieftain
- Proliferation: At least six countries
- Automotive performance:
 - Engine type: 750-hp diesel
 - Cruising range: 400 to 500 km
- Speed:
 - Max road: 48 km/h
 - Max off-road: INA
 - Average cross country: 30 km/h
 - Max swim: INA
- Fording depths: 1.1 meters unprepared
- Main armament ammunition:
 - Caliber type name: 120-mm high L11A5
 - Rate of fire: 8 to 10 rounds per minute first minute; 6 sustained
 - Maximum aimed range: 5,000 meters
 - Maximum effective range:
 - Day: 3,000 meters
 - Night: INA
 - Armor penetration: INA

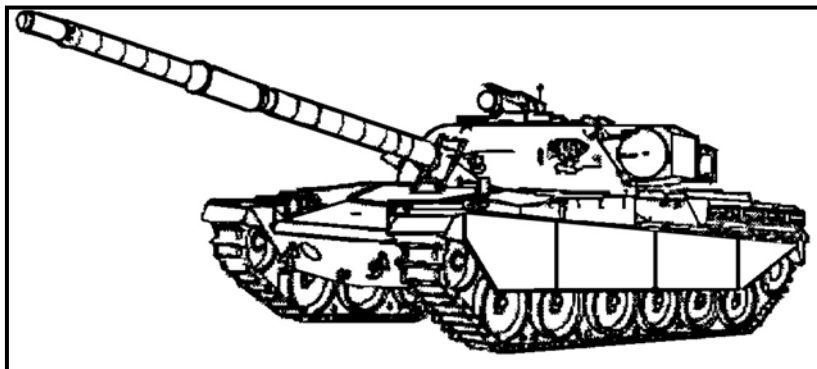


Figure H-1. British main battle tank, Chieftain Mk 5.

(2) **German Main Battle Tank, Leopard 2** (Figure H-2).

- Date of introduction: 1979
- Proliferation: At least seven countries
- Automotive performance:
 - Engine type: 750-hp diesel
 - Cruising range: 400 to 500 km
- Speed:
 - Max road: 48 km/h
 - Max off-road: INA
 - Average cross country: 30 km/h
 - Max swim: INA
- Fording depths: 1.1 meters unprepared
- Main armaments ammunition:
 - Caliber type, name: 120-mm APFSDS-T, DM43
 - Rate of fire: INA
 - Maximum aimed range: 3,500 meters
 - Day: INA
 - Night: INA
 - Armor penetration: 450 to 2,000 mm

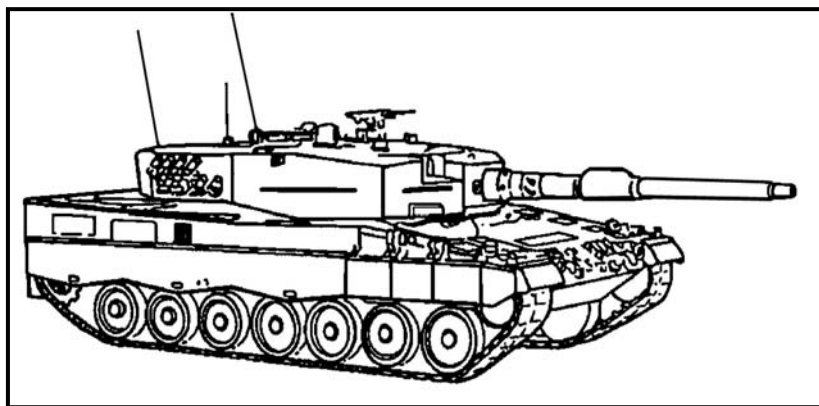


Figure H-2. German main battle tank, Leopard 2.

(3) **Polish/Czechoslovakian Main Battle Tank, T-72M1** (Figure H-3, page H-4).

- Date of introduction: 1975
- Proliferation: At least seven countries
- Automotive performance:
 - Engine type: 780-hp diesel
 - Cruising range: 460 to 700 km with extra tanks
- Speed:
 - Max road: 60 km/h
 - Max off-road: 45 km/h
 - Average cross country: 35 km/h
 - Max swim: INA
- Fording depths: 1.2 meters unprepared; 5 meters with snorkel

- Main armaments ammunition:
Caliber type, name: 125-mm APFSDS-T, BM-42M
Rate of fire: INA
Maximum aimed range: 2,000 to 3,000 meters
 Day: 2,000 to 3,000 meters
 Night: 850 to 1,300 meters
Armor penetration: 590 to 630 rounds per min at 2,000 meters

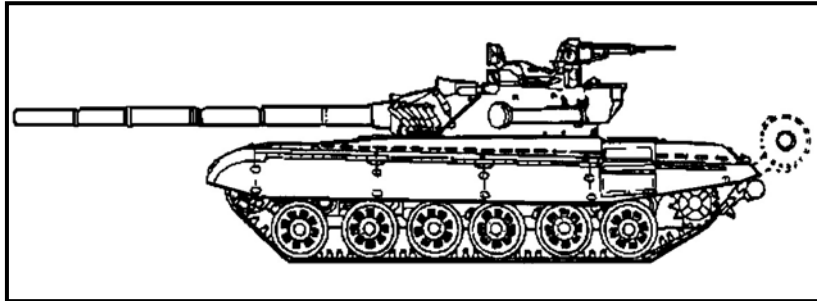


Figure H-3. Polish/Czechoslovakian main battle tank, T-72M1.

(4) *Russian Main Battle Tank, T-80U* (Figure H-4).

- Date of introduction: 1987
- Proliferation: At least three countries
- Automotive performance:
Engine type: 1250-hp gas turbine (multi-fuel); diesel on T-80UD
Cruising range: 335 km; 600 km with extra tanks
- Speed:
Max road: 70 km/h
Max off-road: 48 km/h
Average cross country: 40 km/h
Max swim: INA
- Fording depths: 1.8 meters unprepared; 5 meters with snorkel; 12 meters with BROD-M system
- Main armaments ammunition:
Caliber type, name: 125-mm APFSDS-T, BM-42M
Rate of fire: INA
Maximum aimed range: 2,000 to 3,000 meters
 Day: 2,000 to 3,000 meters
 Night: 800 to 1,300 meters
Armor penetration: 560 to 630 mm at 2,000 meters

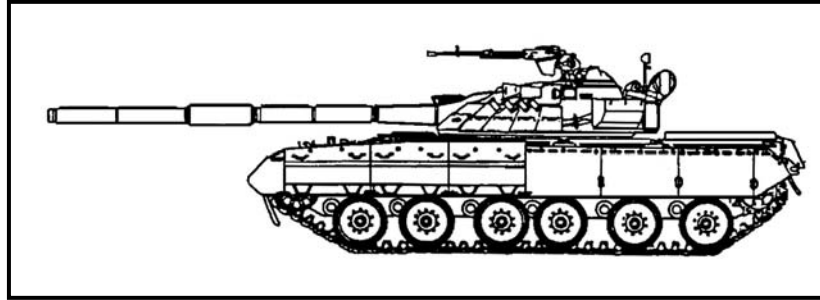


Figure H-4. Russian main battle tank, T-80U.

(5) *Chinese Main Battle Tank, Type 85-IIM* (Figure H-5).

- Date of introduction: 1991
- Proliferation: At least two countries
- Automotive performance:
 - Engine type: 750-hp diesel
 - Cruising range: 700 km; 900 km with external tanks
- Speed:
 - Max road: 57 km/h
 - Max off-road: 45 km/h
 - Average cross country: 35 km/h
 - Max swim: INA
- Fording depths: 1.4 meters unprepared; 2.4 meters with snorkel
- Main armaments ammunition:
 - Caliber type, name: 125-mm HEAT-MP, BK-29M
 - Rate of fire: INA
 - Maximum aimed range: 3,000 meters
 - Day: INA
 - Night: 850 to 1,300 meters
 - Armor penetration: 560 to 750 mm

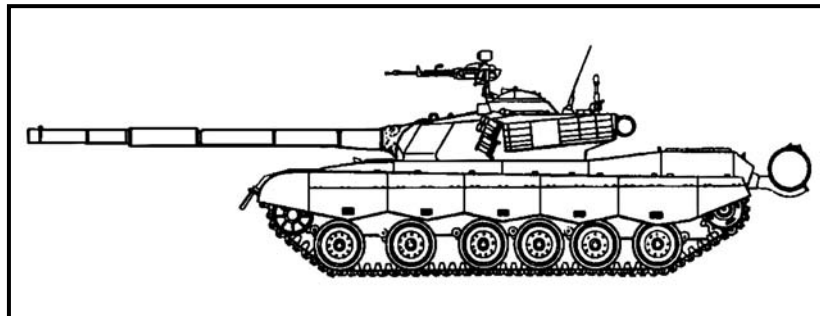


Figure H-5. Chinese main battle tank, Type 85-IIM.

H-2. THREAT RIFLE-PROPELLED GRENADES

The most prolific threat now is the hand-held RPG. The following are some of the RPGs that U.S. forces will encounter.

a. **Russian 40-mm Antitank Grenade Launcher, RPG-7V** (Figure H-6).

- Date of introduction: 1962
- Proliferation: At least 40 countries
- Ammunition: PG-7V
Caliber: 85 mm
Type: Heat
Range:
 Effective: 500 meters
 Minimum: N/A
 Moving: 300 meters
Armor penetration: 330 mm



Figure H-6. Russian 40-mm antitank grenade launcher, RPG-7V.

b. **Swedish 84-mm Recoilless Rifle, Carl Gustav M2** (Figure H-7).

- Date of introduction: INA
- Proliferation: At least 20 countries
- Ammunition: FFV 751
Type: Heat (tandem)
Range:
 Effective: 500 meters
 Minimum: N/A
Armor penetration: +500 mm

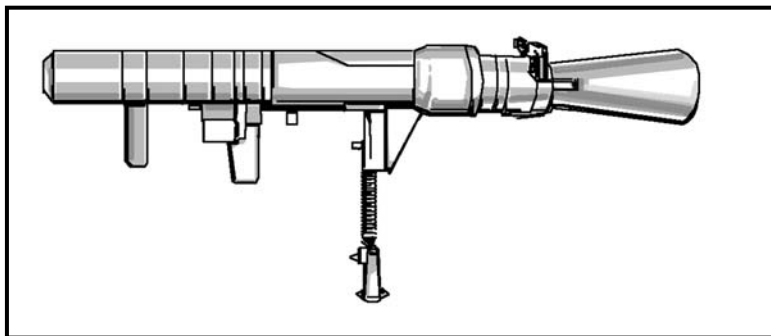


Figure H-7. Swedish 84-mm recoilless rifle, Carl Gustav M2.

c. **German 60-mm Antitank Grenade Launcher, Panzerfaust-3** (Figure H-8).

- Date of introduction: 1990
 - Proliferation: At least eight countries
 - Ammunition: INA
- Caliber: 110 mm
 Type: Heat
 Range:
 Effective (moving): 300 meters
 Effective (stationary): 500 meters
 Armor penetration: 500 mm

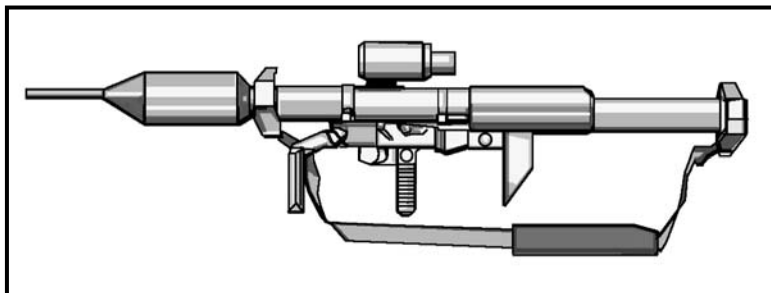


Figure H-8. German 60-mm antitank grenade launcher, Panzerfaust-3.

d. **German 67-mm Disposable Antitank Grenade Launcher, Armbrust** (Figure H-9, page H-8).

- Date of introduction: INA
 - Proliferation: At least seven countries
 - Ammunition: INA
- Type: Heat
 Range:
 Maximum: 1500 meters
 Effective AT: 300 meters

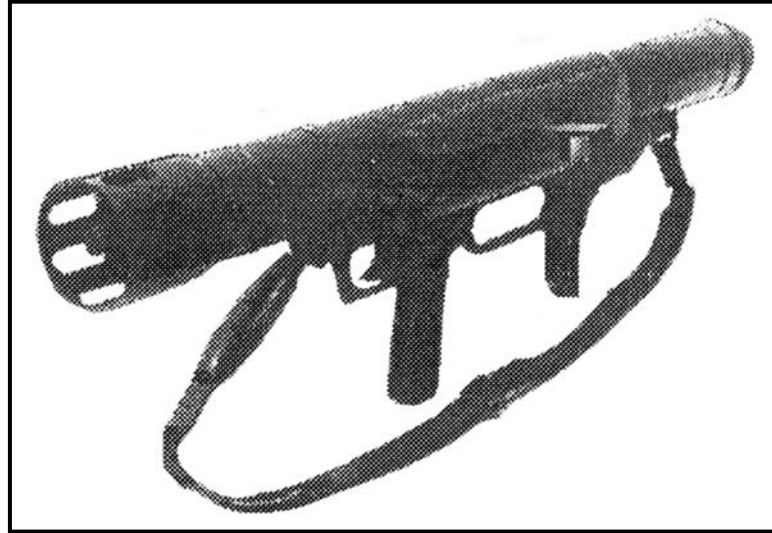


Figure H-9. German 67-mm disposable antitank grenade launcher, Armbrust.

e. **Russian 105-mm Antitank Grenade Launcher, RPG-29** (Figure H-10).

- Date of introduction: Late 1980s
- Proliferation: Former Soviet Union
- Ammunition: PG-29V
Caliber (warhead): 105 mm
Type: Heat (tandem)
Range:
Effective: 500 meters
Minimum: N/A
Armor penetration: +750 mm

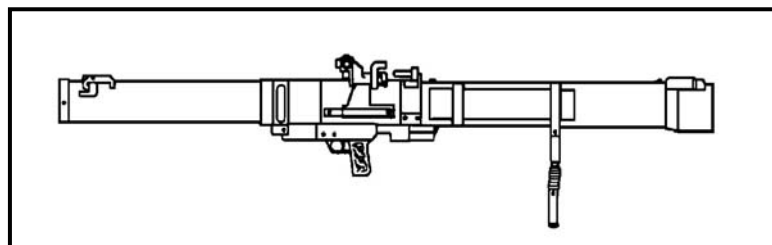


Figure H-10. Russian 105-mm antitank grenade launcher, RPG-29.

H-3. ANTITANK GUIDED MISSILE LAUNCHER VEHICLES

Although there are unique ATGM launcher vehicles with unique ATGMs, most launcher vehicles are military and commercial vehicles adapted with pintel mounts for portable ground launchers, with ATGMs manually loaded and launched. The systems described in this paragraph are the more common threat systems or represent the spectrum of antitank systems that can threaten U.S. Army forces in the world today.

a. **French ATGM Launcher Vehicle, AMX-10 HOT** (Figure H-11).

- Date of introduction: INA
 - Proliferation: At least one country
 - Guidance system: SALCOS
 - Command link: Wire
 - Ammunition: ATGM
- Name: HOT
- Warhead type: shaped charge (HEAT)
- Armor penetration: 800 mm
- Minimum/maximum range: 75 to 4,000 meters
- Name: HOT 2
- Warhead type: tandem shaped charged (HEAT)
- Armor penetration: 900 mm
- Minimum/maximum range: 75 to 4,000 meters
- Name: HOT 2
- Warhead type: tandem shaped charged (HEAT)
- Armor penetration: 1,250 mm
- Minimum/maximum range: 75 to 4,000 meters
- Probability of hit: INA
 - Time of flight to max range: 17.3 seconds

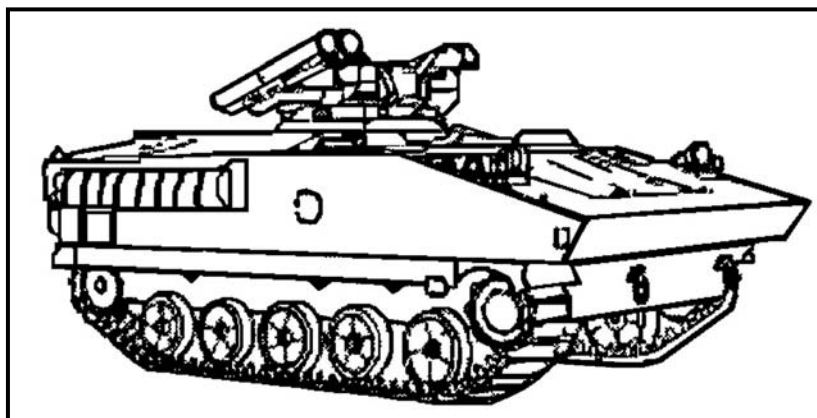


Figure H-11. French ATGM launcher vehicle, AMX-10 HOT.

b. **Russian ATGM Launcher Vehicle, 9P148** (Figure H-12, page H-10).

- Date of introduction: 1977
 - Proliferation: At least six countries
 - Guidance system: SALCOS
 - Command link: Wire
 - Ammunition
 - ATGM:
- Name: AT-5/SPANDREL
- Warhead type: shaped charge (HEAT)
- Armor penetration: 650 mm
- Minimum/maximum range: 75 to 4,000 meters

- Probability of hit: 90 percent
- Time of flight to max range: 20 seconds

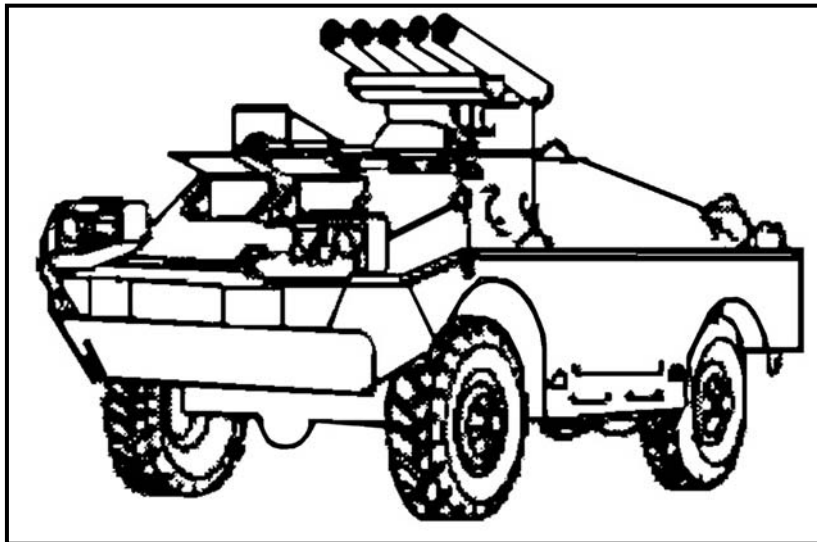


Figure H-12. Russian ATGM launcher vehicle, 9P148.

c. **Russian ATGM Launcher Vehicle, 9P149** (Figure H-13).

- Date of introduction: 1990
 - Proliferation: At least nine countries
 - Guidance system: SALCOS
 - Command link: radio frequency
 - Ammunition: ATGM
- Name: AT-56a/SPIRAL
Warhead type: shaped charge (HEAT)
Armor penetration: 750 mm
Minimum/maximum range: 400 to 5,000 meters
- Probability of hit: 90 percent
 - Time of flight to max range: 14.5 seconds

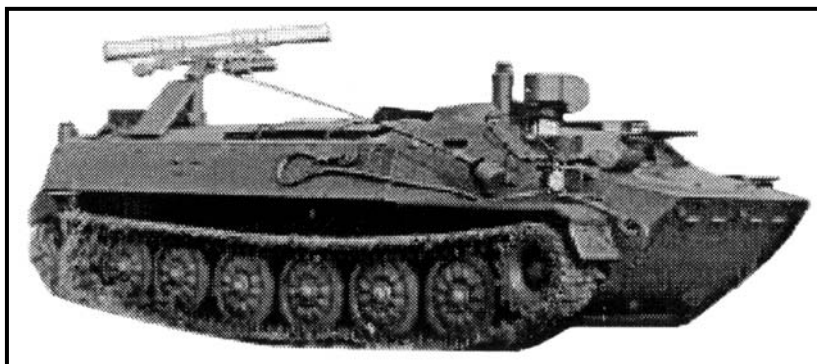


Figure H-13. Russian ATGM launcher vehicle, 9P149.

H-4. ANTITANK GUIDED MISSILE LAUNCHER

As the levels of armor protection and the lethality of antitank weapons continue to rise, armor protection for many modern tanks has outpaced most AT weapons. However, ATGMs have been able to increase their range and warhead configurations to threaten even the heaviest tanks. Among notable trends in ATGMs is the worldwide proliferation and variety of man-portable and portable antitank ballistic missiles (ATBMs).

a. **French ATGM Launcher, Eryx** (Figure H-14).

- Date of introduction: 1991
- Proliferation: At least five countries
- Guidance: SACLOS
- Command link: Wire
- Beacon type: infrared laser diode
- Ammunition:
Name: Eryx
Warhead type: tandem shaped charge (HEAT)
Armor penetration: 900 mm
Minimum/maximum range: 50 to 600 meters
- Probability of hit: 90 percent
- Time of flight to max range: 3.7 seconds



Figure H-14. French ATGM launcher, Eryx.

b. **Russian ATGM Launcher, AT-4/AT-5** (Figure H-15, page H-12).

- Date of introduction: 1973
- Proliferation: At least 25 countries
- Guidance: SACLOS
- Command link: Wire
- Beacon type: Incandescent infrared bulb
- Ammunition:

Name: AT-5B/SPANDREL-B

Warhead type: tandem shaped charge (HEAT)

Armor penetration: 925 mm

Minimum/maximum range: 75 to 4,000 meters

Probability of hit: 90 percent

Time of flight to max range: 10 seconds

Name: AT-5B/SPANDREL

Warhead type: shaped charge (HEAT)

Armor penetration: 650 mm

Minimum/maximum range: 75 to 4,000 meters

Probability of hit: 90 percent

Time of flight to max range: 20 seconds

Name: AT-4/SPIGOT

Warhead type: shaped charge (HEAT)

Armor penetration: 480 mm

Minimum/maximum range: 70 to 4,200 meters

Time of flight to max range: 11 seconds

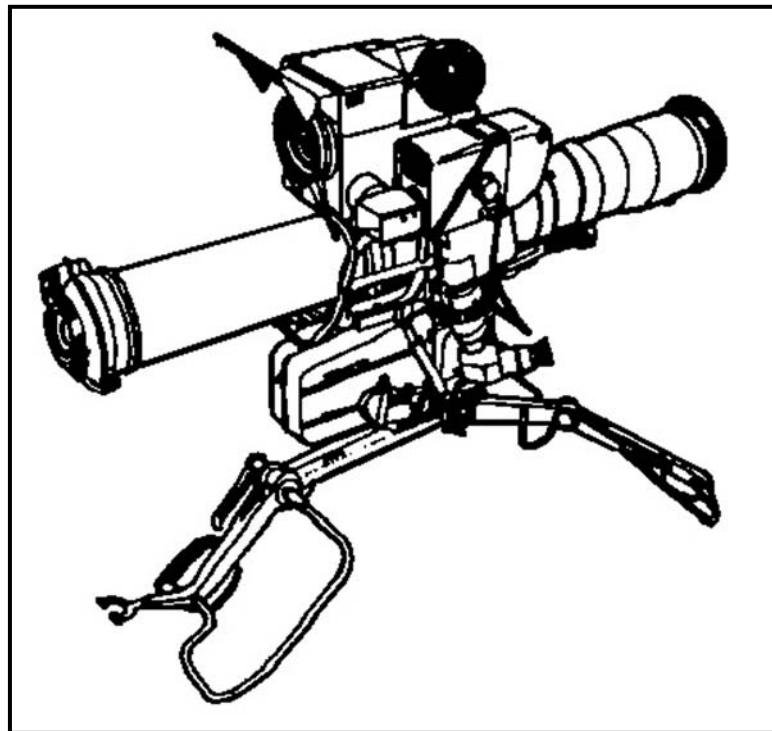


Figure H-15. Russian ATGM launcher, AT-4/AT-5.

c. **Russian ATGM Launcher, AT-3** (Figure H-16).

- Date of introduction: 1963
- Proliferation: At least 45 countries
- Guidance: MCLOS
- Command link: Wire

- Beacon type: Incandescent infrared bulb (SACLOS)
- Ammunition:
 - Name: AT-3, 3a, 3b/SAGGER
 - Warhead type: tandem shaped charge (HEAT)
 - Armor penetration: 400 mm
 - Minimum/maximum range: 500 to 3,000 meters
 - Probability of hit: 70 percent
 - Time of flight to max range: 26 seconds

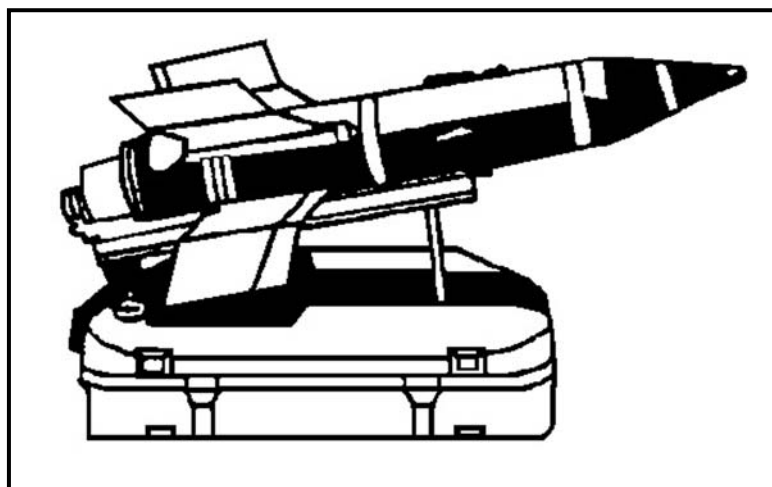


Figure H-16. Russian ATGM launcher, AT-3.

H-5. THREAT INFANTRY ARMOR COUNTERMEASURES

Historically, the deployment of thick belts of ATGMs has been the foundation of U.S. antiarmor defense planning. Potential enemies have developed countermeasures to these antiarmor measures, which any enemy we may face may employ.

a. **Reconnaissance.** A high priority for enemy reconnaissance elements is to locate our ATGM sites before their main body enters our engagement areas. Methods of reconnaissance can include aircraft, drones, signals intelligence, and conventional ground reconnaissance elements. 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 enemy reconnaissance to be effective, their reconnaissance elements must spot our weapon systems and survive to report their location.

b. **Artillery.** Once enemy reconnaissance elements have spotted our ATGM positions, the weapon of choice to destroy them is artillery. Since ATGMs are a high-priority target for artillery, these positions will be subjected to intense indirect fire. 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.

d. **Direct Fire.** Enemy forces will attempt to suppress or destroy friendly ATGM systems with direct fire.

e. **Grenade Launcher.** This weapon is very effective against a tripod- or HMMWV-mounted TOW, and is somewhat effective against lightly armored vehicles such as the Bradley.

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. Laser weapons, such as the PRC-produced ZM-87, or even frequency agile laser weapons may be encountered on the future battlefield. Many countries, such as China, Russia, and France, have extensive laser development and procurement programs.

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.

h. **Combined Arms.** Enemy 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 kilometers per hour, and the infantry will closely follow the tanks. The fighting vehicles will follow the infantry and provide supporting fire.

H-6. INFANTRY ANTITARMOR COUNTER-COUNTERMEASURES

United States forces must have counter-countermeasures against reconnaissance, artillery, helicopters, direct fire, grenade launchers, 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 5 for more detailed information.)

d. **Direct Fire.** TOW squads must maximize their chances of winning engagements with tanks and fighting vehicles 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. **Grenade Launcher.** TOW squads must try to choose positions where it is difficult for enemy grenade launcher teams to get in range without being detected and

engaged. Where the terrain is too close to permit this, TOW squads must emplace behind friendly infantry, and let the infantry engage the grenade launcher team.

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. Enemy smokescreens normally end about 1,000 meters from our positions, so gunners should be prepared to engage targets immediately when 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 integrated into a combined arms defense that includes overwatching dug-in infantry, fighting vehicles, 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.

H-7. 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 electrooptical devices (generally thermal sights and image intensifiers). (For means of defense, see paragraph H-4 of this appendix. See FM 7-91, Appendix F for a more detailed discussion.)

H-8. 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, 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 enemy 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.

H-9. 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 travelling 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 H-2).

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.

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 H-2. Missile selection priority chart.

GLOSSARY

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
BFV	Bradley fighting vehicle
BNCOC	Basic noncommissioned officer course
BPC	battery power condition
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
IVD	interactive video disk
km	kilometers
km/h	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	Multiple Integrated Laser Engagement System
MOPP	mission-oriented protective posture
MOS	military occupation specialty
MPRC	multipurpose range complex
MSR	missile simulation round
MV	moving
MWLD	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
ROW	rest of the world
rpm	revolutions per minute
SACLOS	semiautomatic command-to-line-of-sight guidance
SDZ	surface danger zone
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
STBY	standby
STRAC	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

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GUNNER'S SKILL TEST - PART 1

For use of this form, see FM 3-22.34. 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	071-035-0008	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		
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-SERIES LAUNCHER SYSTEM (SEE FM 3-22.34, CH5)		
11	071-317-0000	PREPARE AN ANTIARMOR RANGE CARD		
12	NO TASK NUMBER	ASSEMBLE AN M220-SERIES LAUNCHER SYSTEM		

GUNNER'S SKILL TEST - PART 2

For use of this form, see FM 3-22.34. The proponent agency is TRADOC.

NAME		RANK	UNIT	DATE
TEST#	TASK NUMBER	TASK TITLE		GO/NO GO
1	NO TASK NUMBER	PLACE THE M966 VEHICLE IN THE READY-TO-FIRE CONFIGURATION (SEE FM 3-22.34 CH 3)		
2	071-056-9932	CONDUCT DISMOUNTING AND REMOUNTING OF AN M220A1 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A1 - EQUIPPED UNITS ONLY)		
3	071-056-0034	CONDUCT DISMOUNTING AND REMOUNTING OF AN M220A2 LAUNCHER SYSTEM ON AN M966 VEHICLE (M220A2 - EQUIPPED UNITS ONLY)		
4	071-034-0001	LOAD AN M243 OR M259 SMOKE GRENADE LAUNCHER		
5	071-034-0002	UNLOAD AN M243 OR M259 SMOKE GRENADE LAUNCHER		

TOW GUNNERY TABLES 1 AND 2: INDIVIDUAL GUNNERY

PRACTICE **QUALIFICATION**

For use of this form, see FM 3-22.34. 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	SSN	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: _____
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GUNNER CLASSIFICATION

EXPERT / 875 - 1,000

1ST CLASS / 750 - 874

2ND CLASS / 625 - 749

SCORING INDIVIDUAL GUNNERY TABLES

IN THE INDIVIDUAL GUNNERY TABLES, THE GUNNER'S RATING IS DETERMINED BY HIS TOTAL POINT SCORE FOR 10 MISSIONS WITH 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.

TOW GUNNERY TABLES 3 AND 4: ADVANCED GUNNERY

PRACTICE QUALIFICATION

For use of this form, see FM 3-22.34. 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	SSN	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: _____
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GUNNER CLASSIFICATION

EXPERT / 875 - 1,000

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 MISSION 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 **DOES** 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.

TOW GUNNERY TABLES 5 AND 6: BASELINE TFFT GUNNERY

PRACTICE QUALIFICATION

For use of this form, see FM 3-22.34. The proponent agency is TRADOC.

SQUAD	SECTION	PLATOON	COMPANY	
DATE		DAY	NIGHT	
ENGAGEMENT	TARGET DESCRIPTION	HIT/MISS/TIME		GO/NG GO
TARGET 1	STATIONARY T72/FLANK/ 1,000 - 1,500 METERS	HIT TIME:	MISS	
TARGET 2	STATIONARY T72/FLANK/ 2,100 - 3,750 METERS	HIT TIME:	MISS	
TARGET 3	STATIONARY T72/FRONTAL/ 2,100 - 3,750 METERS	HIT TIME:	MISS	
TARGET 4	STATIONARY T72/OBLIQUE/ 2,100 - 3,750 METERS	HIT TIME:	MISS	
TARGET 5	STATIONARY T72/DEFILADE/ 800 - 1,500 METERS/NBC	HIT TIME:	MISS	
TARGET 6	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	HIT TIME:	MISS	
TARGET 7	MOVING T72/FLANK/ L-R, 30 KPH 1,600 - 2,000 METERS/NBC	HIT TIME:	MISS	
TARGET 8	MOVING T72/FLANK/ L-R, 5 KPH 1,000 - 1,500 METERS	HIT TIME:	MISS	
TARGET 9	MOVING T72/FLANK/ L-R, 10 KPH 2,100 - 3,750 METERS	HIT TIME:	MISS	
TARGET 10	MOVING T72/FLANK/ L-R, 40 KPH 1,000 - 1,500 METERS	HIT TIME:	MISS	
		OVERALL GO/NO GO:		
<p>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 TFFT" AND A "GO" ON AT LEAST 6 OUT OF 10 TARGET ENGAGEMENTS, BOTH DAY AND NIGHT.</p>				

TOW GUNNERY TABLE 7: SQUAD GUNNERY PRACTICE

For use of this form, see FM 3-22.34. 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	FIRE FROM BASELINE 3,000 - 3,750 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	1				
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 2,500 METERS 1 - ST TANK, 1 - MV TANK, 1 - MV BMP	TFTT HMMWV/2:30	1 2 3				
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 3. 2,500 - 3,000 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV/1:40	1 2				
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,500 - 3,000 METERS 1 ST TANK, 1 - MV TANK (NBC)	TFTT HMMWV/1:40	1 2				
5. ENGAGE MULTIPLE TARGETS	FIRE FROM BASELINE. 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV/1:40	1 2				
NOTES:							TOTAL SCORE
<p>1. ENGAGEMENT TIMES ARE CALCULATED FROM THE TIME THE TARGET 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 BEGINS WHEN THE VEHICLE OCCUPIES ITS FIRING POSITION (STOPS MOVING) AND ENDS WHEN THE TARGET IS HIT.</p> <p>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.</p> <p>3. CREW/LEADER CUTS: SEE FM 3-22.34, CH 4.</p> <p>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 POSSIBLE TOTAL OF 1,000 POINTS. SQUADS MUST ACHIEVE A MINIMUM TOTAL OF 700 POINTS TO VERIFY ON TABLE 7 AND PROGRESS TO TABLE 8.</p>							

TOW GUNNERY TABLE 8: SQUAD GUNNERY QUALIFICATION

For use of this form, see FM 3-22.34. 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	FIRE FROM BASELINE. 1,500 - 2,000 METERS 1 STATIONARY TANK	TFTT 25 SECS ALL VEHICLES	1				
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 1. 2,000 - 2,500 METERS 1 - MV TANK, 1 - ST BMP	TFTT HMMWV1:40	1 2				
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 3,000 - 3,750 METERS 2 - MV TANK, 1 - ST BMP	TFTT HMMWV2:45	1 2 3				
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 1. 1,500 - 2,000 METERS 1 - ST TANK, 1 - MV TANK (NBC)	TFTT HMMWV1:40	1 2				
5. ENGAGE MULTIPLE TARGETS	FIRE FROM BASELINE. 2,500 - 3,000 METERS 1 - MV TANK, 1 - MV BMP (NBC)	TFTT HMMWV1:40	1 2				
NOTES:							TOTAL SCORE

1. TABLE 8 IS CONDUCTED AND TIMED 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. CREWLEADER CUTS: SEE FM 3-22.34, CH 4.
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 POSSIBLE TOTAL 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

TOW GUNNERY TABLE 9: SECTION GUNNERY PRACTICE

For use of this form, see FM 3-22.34. 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	FIRE FROM BASELINE 3,000 - 3,750 METERS 1 - ST TANK, 1 - ST BMP	TFTT 40 SECS ALL VEHICLES	1 2				
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 2,750 METERS 1 - ST BMP	TFTT 25 SECS ALL VEHICLES	1				
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 3. 1,000 - 1,500 METERS 2 - MV BMP'S, 1 - ST TANK	TFTT HMMWV/1:40	1 2 3				
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,500 - 3,000 METERS 2 - MV TANKS, 2 - ST TANKS (NBC)	TFTT HMMWV/2:38	1 2 3 4				
5. ENGAGE MULTIPLE TARGETS	FIRE 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 AND TIMED IN EXACTLY THE SAME MANNER AS TABLES 7 AND 8.
2. SCORING TABLE 9 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 POSSIBLE TOTAL OF 1,000 POINTS. TABLE 9 IS A PRACTICE TABLE. 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.

TOW GUNNERY TABLE 10: SECTION GUNNERY QUALIFICATION

For use of this form, see FM 3-22.34. 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	FIRE FROM BASELINE 3,000 - 3,750 METERS 2 - MV TANK, 2 - ST BMPs	TFTT HMMWV/2:38	1 2 3 4				
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2, 2,000 - 2,500 METERS 1 - MV TANK	TFTT 40 SECS ALL VEHICLES	1				
3. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 3, 1,000 - 1,500 METERS 1 - MV BMP, 1 - ST TANK	TFTT 25 SECS ALL VEHICLES	1 2				
4. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2, 2,500 - 3,000 METERS 1 - ST BMP, 2 - MV TANKS (NBC)	TFTT HMMWV/2:40	1 2 3				
5. ENGAGE MULTIPLE TARGETS	FIRE 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 AND TIMED IN EXACTLY THE SAME MANNER AS TABLE 8 AND 9.
2. SCORING TABLE 10 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 POSSIBLE TOTAL OF 1,000 POINTS. TABLE 10 IS A QUALIFICATION TABLE. TO PROGRESS TO TABLE 11, THE SECTION MUST ACHIEVE A MINIMUM COMBINED SCORE OF AT LEAST 700 POINTS.

TOW GUNNERY TABLE 11: PLATOON GUNNERY PRACTICE

For use of this form, see FM 3-22.34. 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: _____	
	TOW CREW 2:	TC: _____	LDR: _____	GNR: _____	DVR: _____	TIME: _____
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	FIRE FROM BASELINE 3,000 - 3,750 METERS 4 - MV TANKS 2 - ST BMPS	TFTT HMMWV/3:26	1 2 3 4 5 6				
2. ENGAGE MULTIPLE TARGETS	FIRE FROM PHASE LINE 2. 2,000 - 3,000 METERS 4 - MV BMPS 2 - ST BMPS	TFTT HMMWV/2:26	1 2 3 4 5 6				
3. ENGAGE MULTIPLE TARGETS	FIRE 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 TARGETS	FIRE 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 TARGETS	FIRE FROM BASELINE. 3,000 - 3,750 METERS 2 - ST TANKS, 2 - ST BMPS (NBC)	TFTT 25 SECS ALL VEHICLES	1 2 3 4				
NOTES:							TOTAL SCORE
1. TABLE 11 IS CONDUCTED, TIMED, AND SCORED IN EXACTLY THE SAME MANNER AS TABLES 7 THRU 10.							

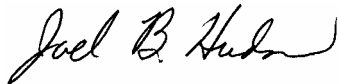
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28 NOVEMBER 2003

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:



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