HEADQUARTERS
DEPARTMENT OF THE ARMY

FM 3-22.37

JAVELIN
MEDIUM ANTIARMOR
WEAPON SYSTEM

JANUARY 2003

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FIELD MANUAL
NO. 3-22.37

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 23 January 2003

JAVELIN MEDIUM ANTIARMOR WEAPON SYSTEM

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PREFACE

This publication provides technical information, training techniques, and guidance on the Javelin medium antiarmor weapon system. The intended users include: unit leaders, trainers and designated gunners. The users will find this information invaluable in their efforts to successfully integrate this weapon system into their combat operations.

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

The proponent of this publication is the United States Army Infantry School. Send comments and recommendations on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commandant; US Army Infantry School; ATTN: ATSH-ATD; Fort Benning, GA 31905-5596. Internet address is doctrine@benning.army.mil.

CHAPTER 1
INTRODUCTION

The Javelin surface-attack guided missile and launcher is a fire-and-forget, man-portable, medium antiarmor weapon consisting of a command launch unit (CLU) and a round. Its top-attack and direct-attack modes and its 2,000-meter range enable the Javelin to defeat current and projected enemy armor threats. The Javelin is operated by an individual soldier or in crews of two or three. Soldiers can use the Javelin during the day, at night, and during limited visibility conditions.

1-1. WEAPON SYSTEM

The Javelin weapon system consists of a Javelin, a basic skills trainer (BST), a field tactical trainer (FTT), and a missile simulation round (MSR).

a. **Javelin**. The Javelin is a fire-and-forget, shoulder fired, man-portable medium antiarmor weapon that consists of a reusable M98A1 CLU and a round. The CLU houses the daysight, night vision sight (NVS), controls, and indicators. The round consists of the missile and the launch tube assembly (LTA) (Figure 1-1), and the battery coolant unit (BCU). The missile contains the guidance section, mid-body section, warhead section, propulsion section and control actuator section. The LTA serves as the launch platform and carrying container for the missile.

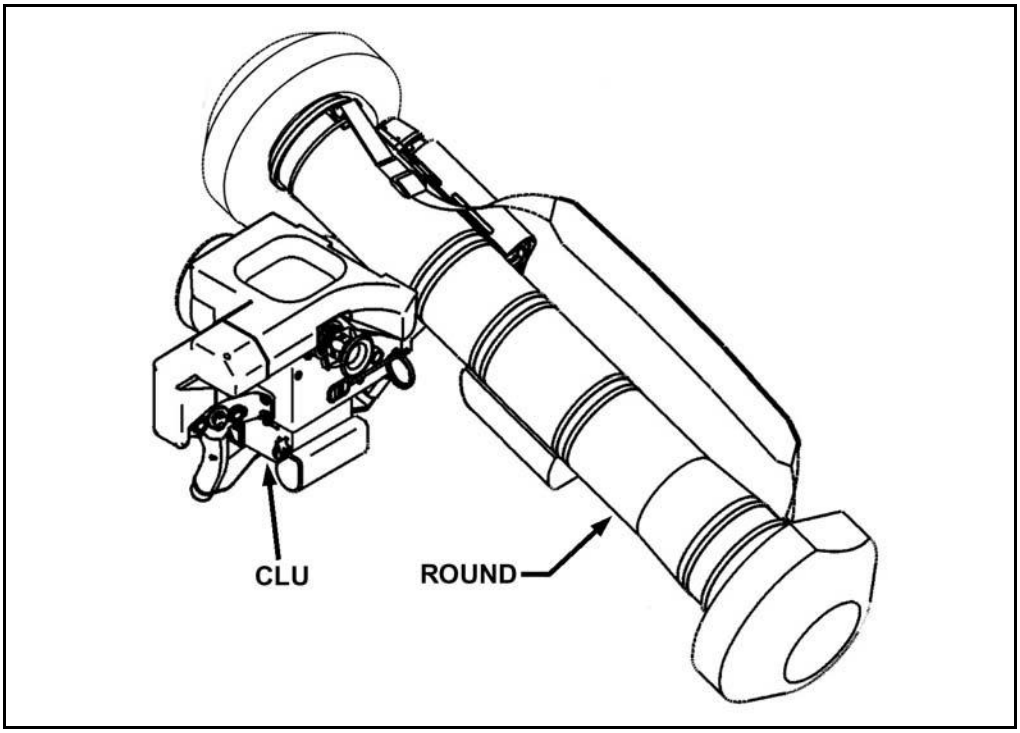


Figure 1-1. Javelin.

b. **Basic Skills Trainer**. The BST is an indoor training device that consists of a student station (SS) and an instructor station (IS) (Figure 1-2, page 1-2). The student

station consists of a simulated command launch unit (SCLU) and an MSR. The IS has a desktop computer, a monitor, a keyboard, a mouse, an interconnect cable, and a surge suppressor. The BST training exercises use real terrain models and actual visible and infrared imagery, and matching three-dimensional target models for natural target movements. The gunner sees a realistic simulated battlefield environment.

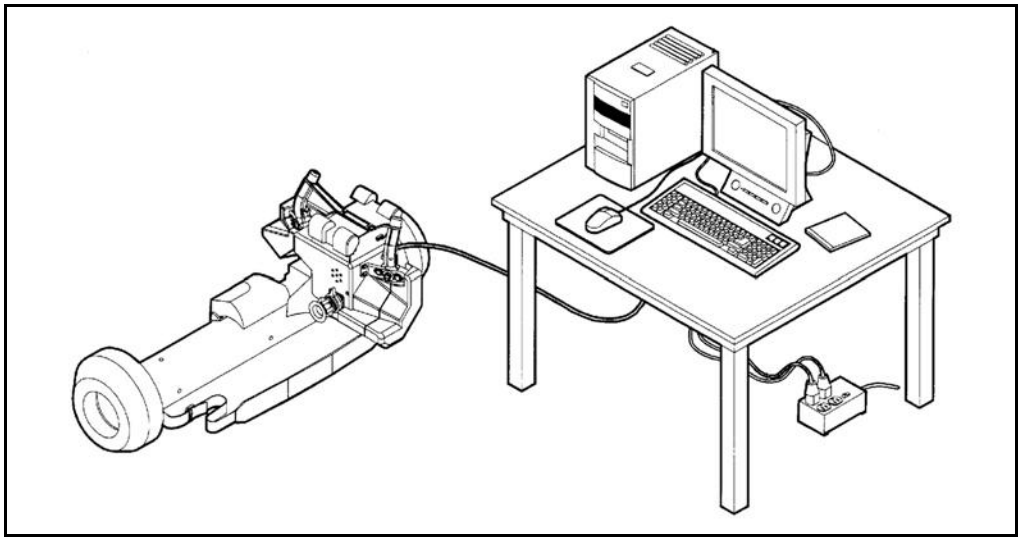


Figure 1-2. Basic skills trainer.

c. **Field Tactical Trainer**. The FTT is an outdoors, force-on-force, trainer used in conjunction with a tactical CLU and a simulated round (SR). The FTT consist of an IS, which is used to monitor the student (Figure 1-3). The SR is equipped with multiple-integrated laser engagement system (MILES).

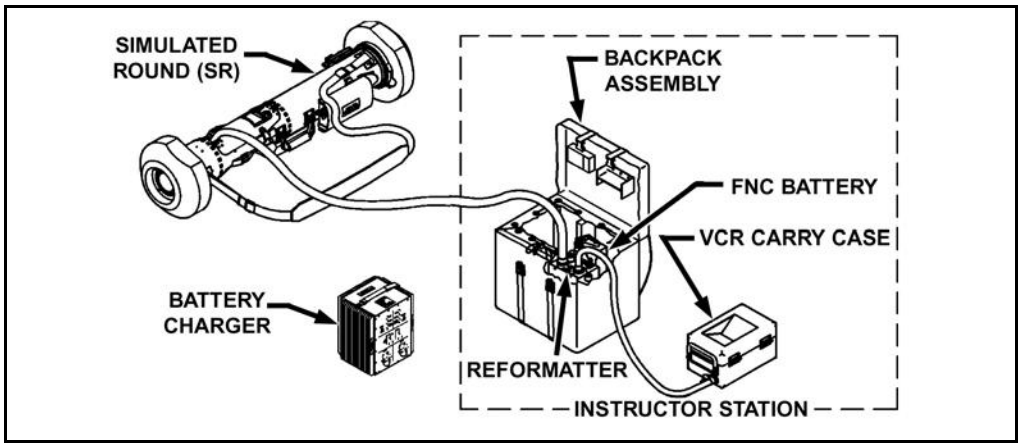


Figure 1-3. Field tactical trainer.

d. **Missile Simulation Round**. The MSR is a field handling round with a simulated launch tube (Figure 1-4). It replicates the weight and balance of the actual round. The FTT contains no instruments or circuitry and is used to train gunners on how to maintain, handle, and carry the round.

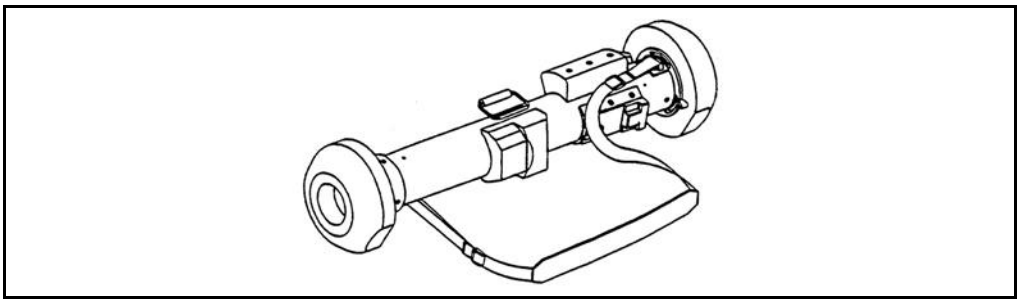


Figure 1-4. Missile simulation round.

1-2. EQUIPMENT DESCRIPTION AND DATA

Tables 1-1 through 1-3 show the Javelin's capabilities and features, the physical characteristics of the CLU, and the physical characteristics of the round.

Javelin Missile System	**Surface Attack Guided Missile and M98A1 Command Launch Unit**	
Type of System	Fire and Forget	
Crew	one- to three-soldier teams based on TO&E	
Missile modes	**Top Attack (default)** **Direct Attack**	
Ranges	**Top Attack Mode minimum effective engagement**	150 meters
	Maximum effective engagement range (Direct Attack and Top Attack modes)	2,000 meters
	Direct Attack Mode minimum effective engagement range	65 meters
Flight Time	About 14 seconds at 2,000 meters	
Backblast Area (See Figure 1-11 and Appendix A for safety factors.)	*Primary danger zone* extends out 25 meters at a 60-degree (cone shaped) angle.	
	Caution zone extends the cone-shaped area out to 100 meters	
Propulsion–Two Stage Motor	*Launch motor* ejects the missile from the LTA	
	Flight motor propels the missile to the target	
Firing From Inside Enclosures	Minimum room length	15 feet
	Minimum room width	12 feet
	Minimum room height	7 feet

Table 1-1. Javelin capabilities and features.

M98A1 Command Launch Unit (CLU)	*With battery, carrying bag, and cleaning kit*	
	Weight	14.16 lb. (6.42 kg)
	Length	13.71 in (34.82 cm)
	Height	13.34 in (33.88 cm)
	Width	19.65 in (49.91 cm)
	Carry bag only	
	Weight	0.60 lb. (0.27 kg)
Sights	*Daysight*	
	Magnification	4X
	Field-of-view (FOV)	4.80° x 6.40°
	Night Vision Sight	
	Wide field-of-view (WFOV) magnification	4.2X
	WFOV	4.58° x 6.11°
	Narrow field-of-view (NFOV) magnification	9.2X
	NFOV	2.00° x 3.00° (approximately)
Battery Type	*Lithium Sulfur Dioxide* ($LiSO_2$) BA-5590/U (Nonrechargeable)	
	Number required	1
	NSN	6135-01-036-3495
	Weight	2.2 lbs. (1.00 kg)
	Life	4.0 hrs below 120°F (49°C)
		3.0 hrs between 50°F to 120°F (10°C to 49°C)
		1.0 hrs between -20°F to 50°F (-49°C to 10°C)
		0.5 hrs above 120°F (49°C)

Table 1-2. Physical characteristics of the command launch unit.

Complete Round (Launch tube assembly with missile and BCU)	*Weight and dimensions*	
	Weight	35.14 lb. (15.97 kg)
	Length	47.60 in (120.90 cm)
	Diameter with end caps	11.75 in (29.85 cm)
	Inside diameter	5.52 in (14.00 cm)
Battery Coolant Unit	*Weight*	2.91 lb. (1.32 kg)
	Dimensions	
	Length	8.16 in (20.73 cm)
	Width	4.63 in (11.75 cm)
	Battery	
	Type	Lithium, nonrechargeable
	Life	4 min of BCU time
	Coolant gas	Argon

Table 1-3. Physical characteristics of the round.

Figure 1-5 shows the Javelin backblast danger area. The primary danger area is a 60-degree sector, with the apex of the sector at the aft end of the missile launch motor. For more safety information, see Appendix A.

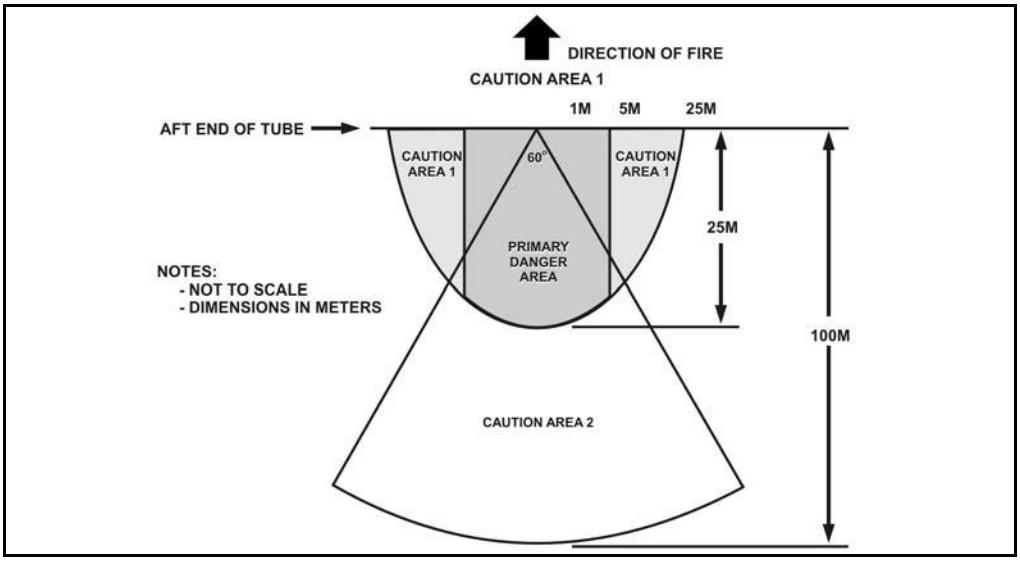


Figure 1-5. Javelin backblast safety zones.

1-3. COMMAND LAUNCH UNIT

The M98A1 CLU is the reusable portion of the Javelin system (Figure 1-6). And contains a daysight, night vision sight, controls, and indicators. The CLU components are a main housing, absorbers, handgrips, battery compartment, daysight, night vision sight, eyepiece, test connector, and round interface connector. The command launch unit attaches to the LTA.

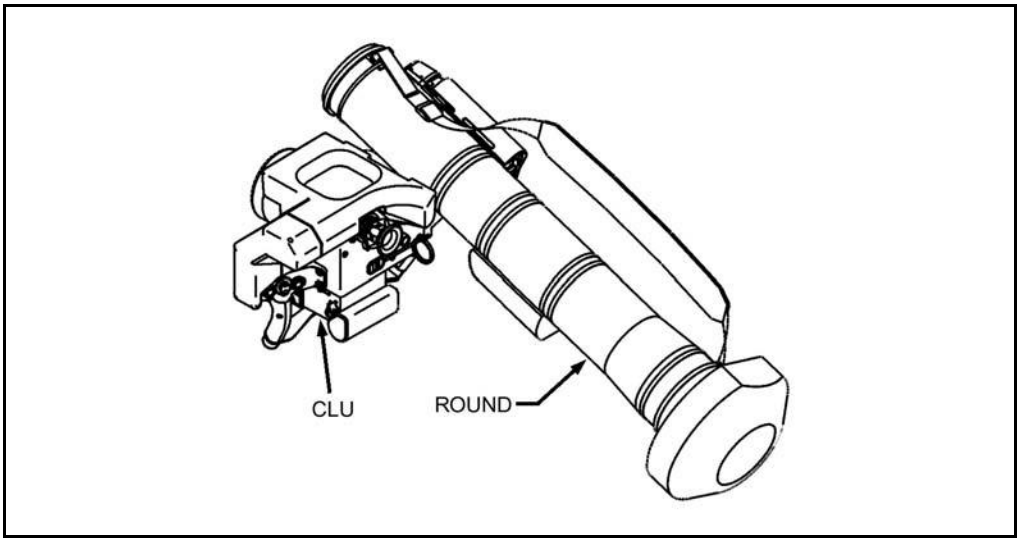


Figure 1-6. Javelin components.

a. **Main Housing**. The main housing (body) of the CLU (Figure 1-7) contains the system's electronics, the display, daysight, and night vision sight.

b. **Absorbers**. The absorbers (Figure1-7) around the main housing of the CLU help protect the equipment during operation. The absorbers are replaceable. One absorber is a face shield that protects the gunner's face during missile launch.

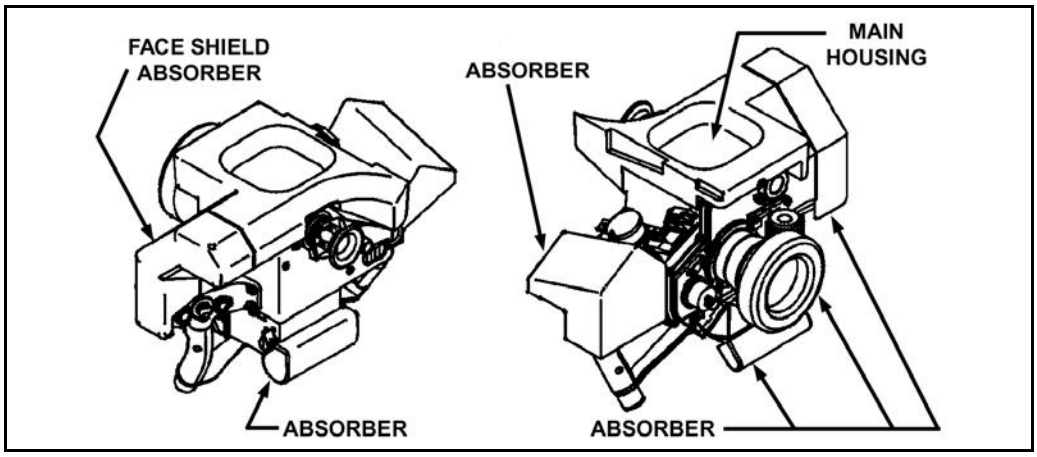


Figure 1-7. Main housing and absorbers.

c. **Handgrips**. The gunner uses the handgrips attached to the sides of the main housing (Figure 1-8) to hold the CLU. The gunner uses the controls on the handgrips for all Javelin operations.

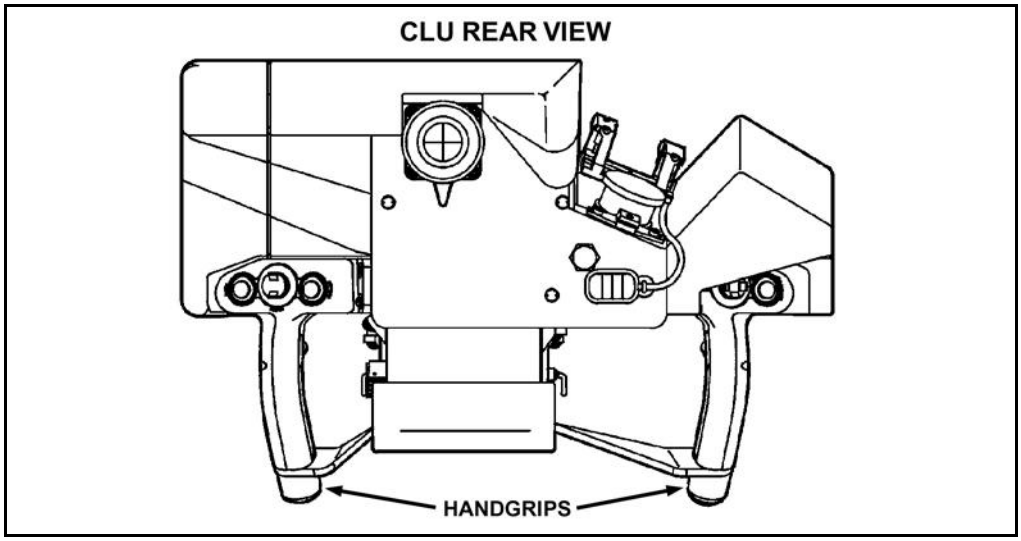


Figure 1-8. Handgrips.

d. **Battery Compartment**. Located on the bottom of the main housing, the battery compartment (Figure 1-9) houses the nonrechargeable BA-5590/U or the rechargeable BB390A battery (*for training use only*). The same battery is used in the single-channel

ground and airborne radio system (SINCGARS) and can be interchanged with the CLU. A connector on the battery compartment joins to a corresponding connector on the battery. A wire bail holds the detachable battery compartment cover in place.

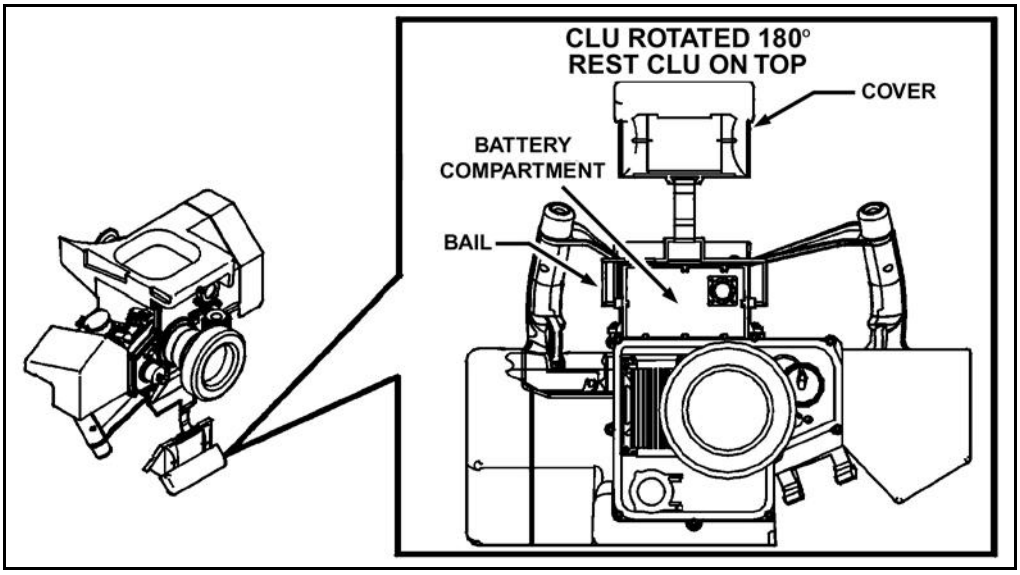


Figure 1-9. Battery compartment.

e. **Daysight**. The daysight works much like a telescope and consists of a lens, status indicators, and an eyepiece (Figure 1-10). The daysight.

(1) Provides the gunner a visible-light image with 4X magnification for target viewing and battlefield surveillance.

(2) Can be used with power off for surveillance only to save battery life.

(3) Is not affected by infrared clutter.

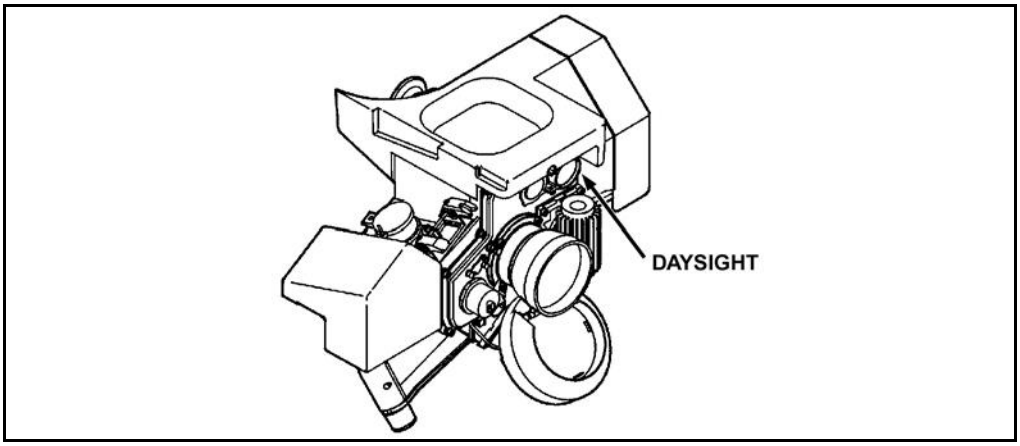


Figure 1-10. Daysight.

f. **Night Vision Sight**. The NVS is the primary sight used by the gunners (Figure 1-11, page 1-8). The NVS is an imaging infrared (I2R) system, used during day

or night. It allows the gunner to see during conditions of limited visibility including darkness, obscuration, smoke, fog, inclement weather, and IR clutter. The NVS operates by converting an infrared target image to a visible-light image for the gunner. The NVS consists of the NVS lens, detector Dewar cooler, CLU display and eyepiece provides the gunner with both a 4X (WFOV) and 9X (NFOV) magnification for scanning and target detection.

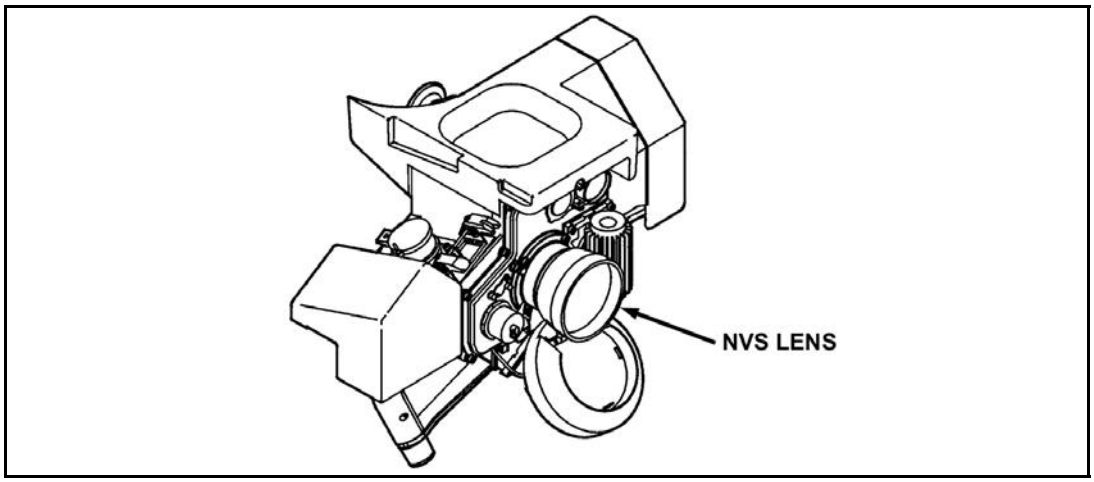


Figure 1-11. Night vision sight lens.

(1) Detector Dewar cooler (DDC) (Figure 1-12) cools the NVS to the proper operating temperature and converts infrared energy to electrical signals. These signals are sent to the CLU display by way of the signal processor to provide the gunner a picture of the target area.

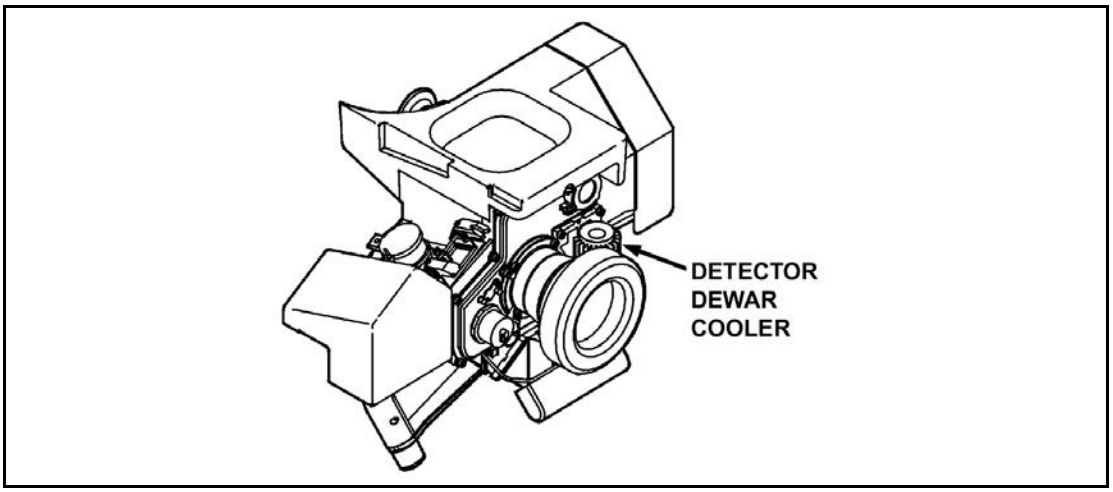


Figure 1-12. Detector Dewar cooler.

(2) The CLU display is like a miniature television, which is used to make the wide field of view (WFOV), narrow field of view (NFOV), and seeker infrared images visible to the gunner. The cathode ray tube (CRT) converts electrical signals from the signal processor into visible images for the gunner.

(3) The CLU status indicators (Figure 1-13) are fourteen icons that surround the CLU display. The icons identify operational modes, conditions, and malfunctions coded in green, amber, and red. The icons give the gunner continuous feedback about the current missile readiness or possible system malfunctions, visible during day and night usage. All indicators will be explained in detailed in Chapter 2.

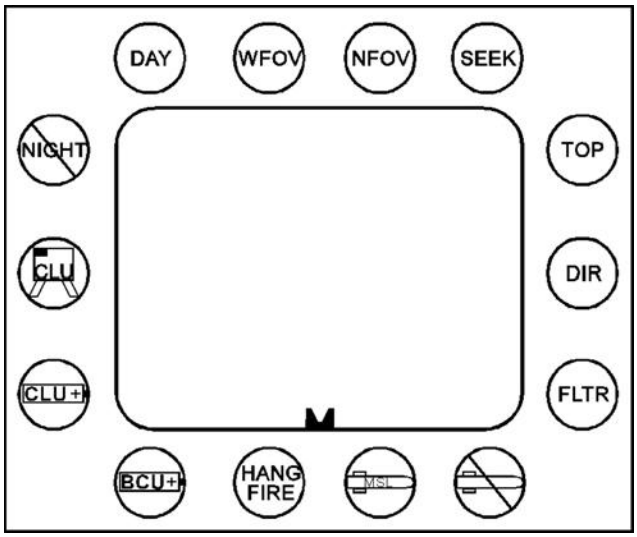


Figure 1-13. Status indicators.

(4) The eyepiece (Figure 1-14) allows the gunner to see the CLU display. Through the eyepiece, the gunner sees the DAY FOV, WFOV, NFOV, seeker FOV, and the status indicators. The eyepiece consists of a lens assembly, eyecup, and diopter adjust ring.

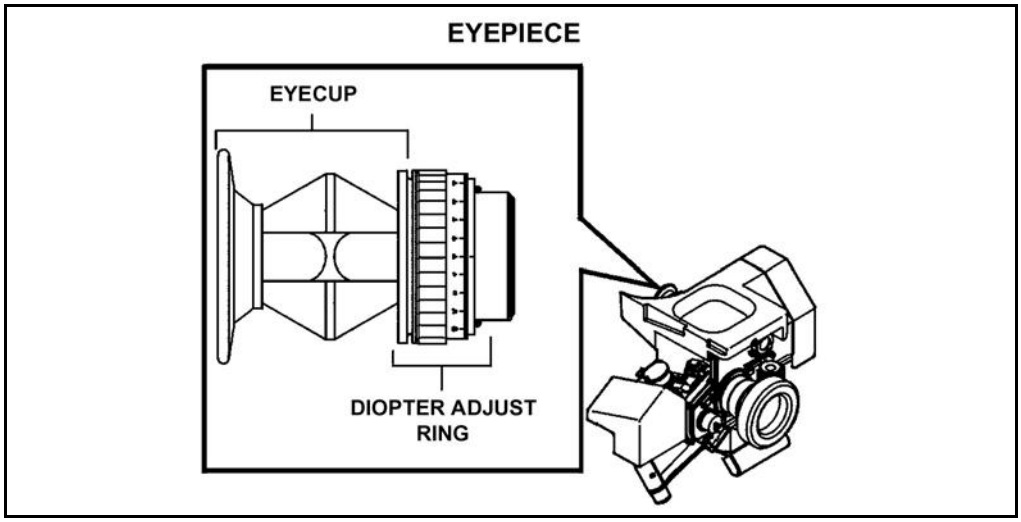


Figure 1-14. Eyepiece.

(5) The test connector (Figure 1-15) is used to perform direct support (DS) or higher-level maintenance and to interface with the FTT.

(6) The round interface connector (Figure 1-15) provides the electrical connection between the CLU and the round.

(7) The humidity indicator (Figure 1-15) displays the quality of the air inside the CLU (white or blue within acceptable levels; pink requires maintenance).

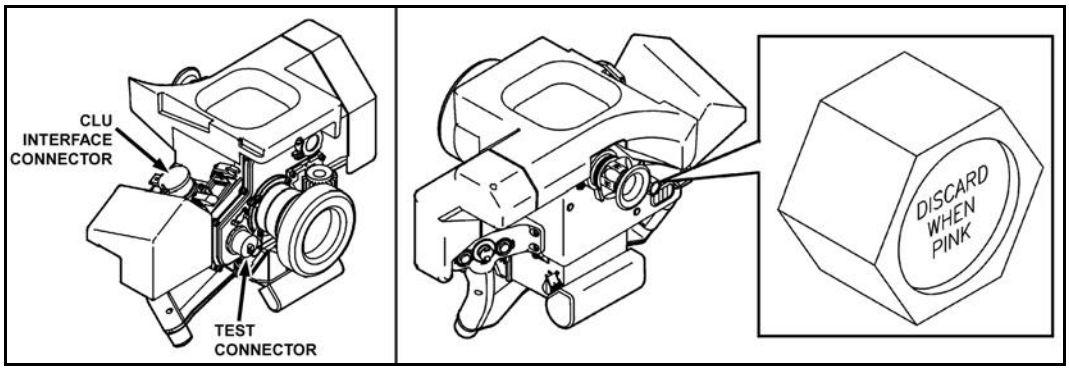


Figure 1-15. Test connector, round interface connector, and humidity indicator.

1-4. ROUND

The round consists of the LTA, the BCU, and the missile (Figure 1-16, page 1-11). The LTA interfaces with the CLU and serves both as a handling container and launch platform for the missile. The LTA consists of a launch tube, forward and aft end caps,

carry handle, shoulder strap, CLU interface connector, and shoulder pad. The round has a 10-year shelf life. The only requirement for maintenance is for stockpile surveillance.

a. **Launch Tube**. The launch tube houses the missile. It is a single-piece, composite graphite/epoxy design. The launch tube protects the missile from the environment before the missile is launched. All other LTA components mount externally on the tube. Once the missile is launched, the LTA is discarded.

b. **End Caps**. Two end caps (forward and aft) protect the missile from damage during transport and handling.

(1) The forward end cap protects the seeker dome from moisture, dust, and other elements that could harm it. The forward end cap is removed when preparing for launch. The pressure release valve is used to reduce the pressure in the LTA so the forward end cap can be removed. If the missile is not fired, replace the forward end cap (Figure 1-16) to protect the seeker dome.

(2) The aft end cap (Figure 1-16) is permanently attached to the LTA. The center of the cap is blown out by the launch motor blast during launch.

c. **Carry Handle**. The carry handle (Figure 1-16) is used to lift and carry the round.

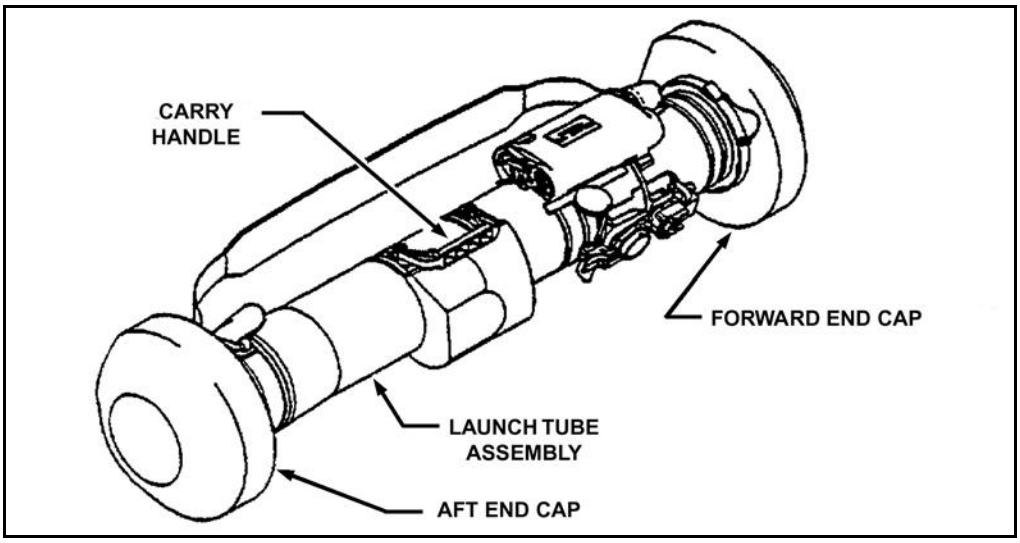


Figure 1-16. LTA, end caps, and carry handle.

e. **Shoulder Strap**. The adjustable shoulder strap (Figure 1-17, page 1-12) provides a means for carrying the round.

f. **Shoulder Pad**. The shoulder pad (Figure 1-17) provides balance and support when the round is placed on the gunner's shoulder.

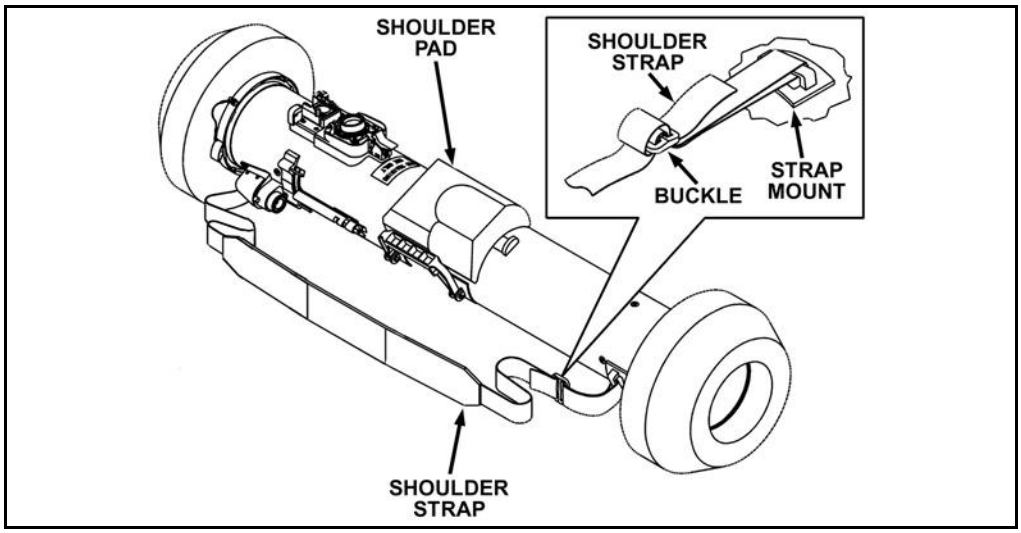


Figure 1-17. Shoulder strap and pad.

f. **Command Launch Unit Interface Connector**. The CLU interface connector (Figure 1-18) provides the electrical interface between the round and CLU. Signals are passed through the connector between the CLU and round, which includes: digital information, power, and seeker image signals.

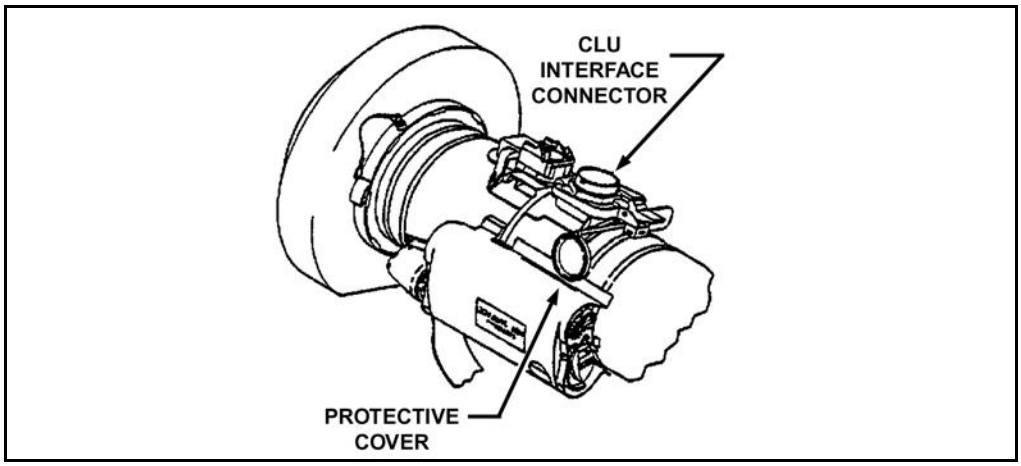


Figure 1-18. CLU interface connector.

g. **Battery Coolant Unit.** The BCU (Figure 1-19) has the battery section and a compressed-gas coolant section. The battery section powers the missile electronics before missile launch. The coolant section cools the missile seeker to its operating temperature before missile launch. The BCU is a single-use unit with 4 minutes of operating time and is not rechargeable. Once the missile has been fired, the spent BCU is discarded with the LTA.

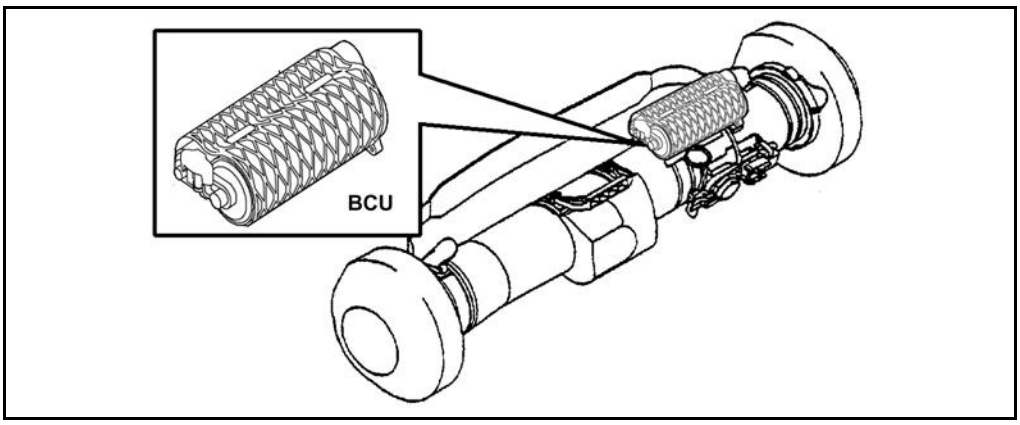


Figure 1-19. Battery coolant unit.

h. **Missile.** The Javelin missile is environmentally sealed in the LTA (Figure 1-20).

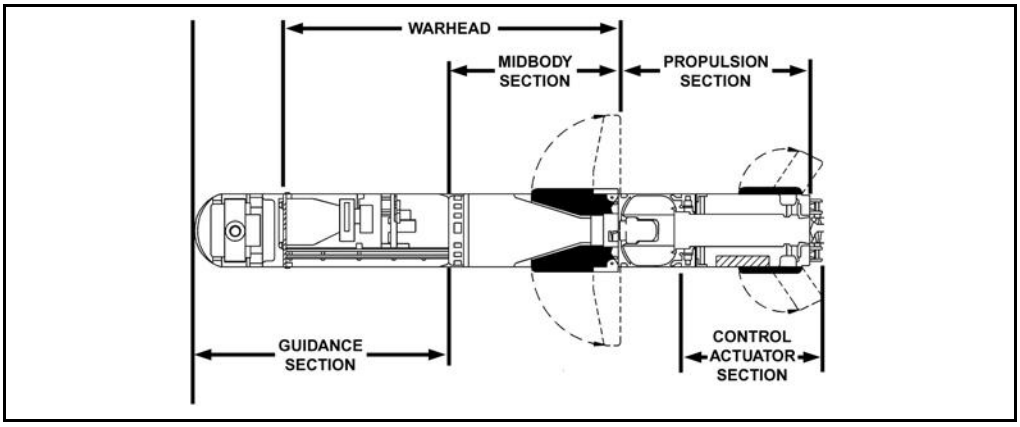


Figure 1-20. Javelin missile.

1-5. MISSILE OPERATION

The missile consists of the guidance section, the mid-body section, the warhead, the propulsion section, and the control actuator section (Figure 1-21, page 1-14).

a. **Guidance Section.** The guidance section (Figure 1-21, page 1-14) provides target tracking and flight control signals. It is the forward section of the missile and includes the seeker head section and the guidance electronics unit.

(1) ***Seeker Head***. The seeker head section, known as the seeker, contains the missile imaging infrared (I^2R) system and the contact switches to detonate the warhead. The missile I^2R system gives the missile its fire-and-forget capability. During flight to the target, the missile I^2R system tracks the target and sends target location information to the on board guidance electronics unit.

(2) ***Guidance Electronics Unit***. The guidance electronics unit (GEU) serves two functions. It controls the seeker head so it *looks* at the target and sends signals to the control actuator section to guide the missile to the target during flight.

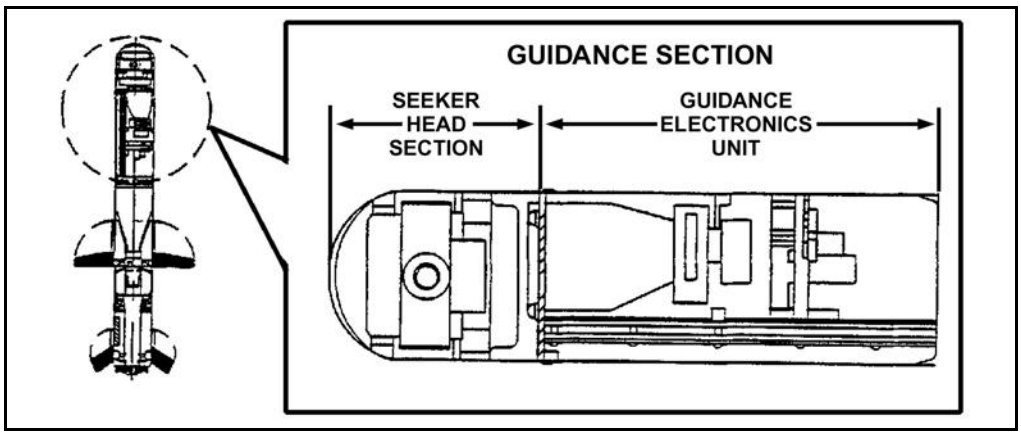


Figure 1-21. Missile guidance section.

b. **Mid-Body Section**. The mid-body section includes the missile skin, electronic safe arm and fire unit (ESAF), wings, and the main charge of the warhead (Figure 1-22).

(1) ***Missile Skin***. The missile skin is a structural part of the missile and provides environmental protection for the internal components during flight.

(2) ***Electronic Safe, Arm, and Fire***. The ESAF is the principal safety device that prevents accidental ignition of the motors and accidental warhead detonation. The ESAF consists of circuits and two detonators (one for the precursor and one for the main charge). The ESAF controls missile launch sequence and warhead detonation. It permits starting the rocket motors in the proper sequence when the gunner pulls the fire trigger and all other firing conditions have been met. When the missile hits the target, the ESAF detonates each warhead charge in sequence.

(3) ***Wings***. The wings provide lift and keep the missile stabilized during flight. The wings fold into slots in the missile skin when the missile is in the LTA and deploy into flight position after clearing the LTA.

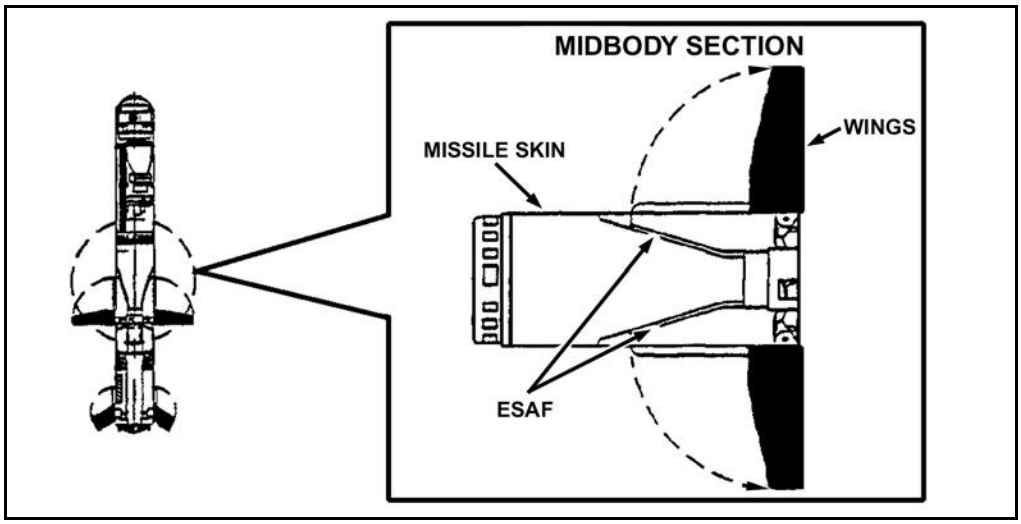


Figure 1-22. Mid-body section.

c. **Warhead Section**. The Javelin missile uses a dual charged warhead (Figure 1-23). The warhead has a precursor charge and main charge.

(1) The precursor charge is a HE antitank shaped charge. Its purpose is to cause reactive armor on the target to detonate before the main charge reaches the armor. Once the reactive armor is penetrated, the target's main hull is exposed to the warhead's main charge. If the target is not equipped with reactive armor, the precursor provides additional explosives to penetrate the main armor.

(2) The main charge is the second charge of a dual-charge warhead and is also an HE antitank shaped charge. The primary warhead charge is designed to penetrate the target's main armor to achieve a target kill.

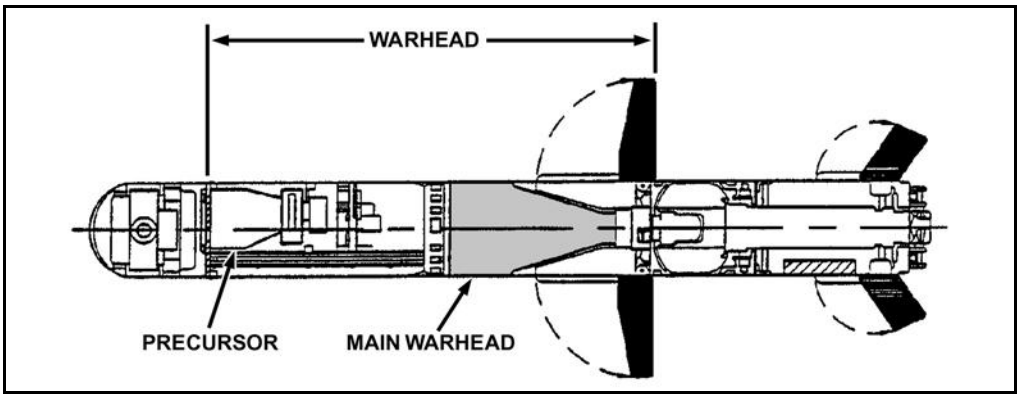


Figure 1-23. Missile warhead.

d. **Propulsion Section**. The propulsion section (Figure 1-24, page 1-16) consists of the launch and flight motors.

(1) ***Launch Motor***. The launch motor propels the missile out of the LTA. It provides the initial force to push the missile a safe distance from the gunner before the flight motor ignites to ensure the gunner's safety. The launch motor is completely spent by the time the missile clears the LTA, this accounts for the low signature after launch.

(2) ***Flight Motor***. The flight motor powers the missile to the target during flight. It ignites when the missile is a safe distance from the gunner, protecting the gunner from hot exhaust gases generated when the motor fires.

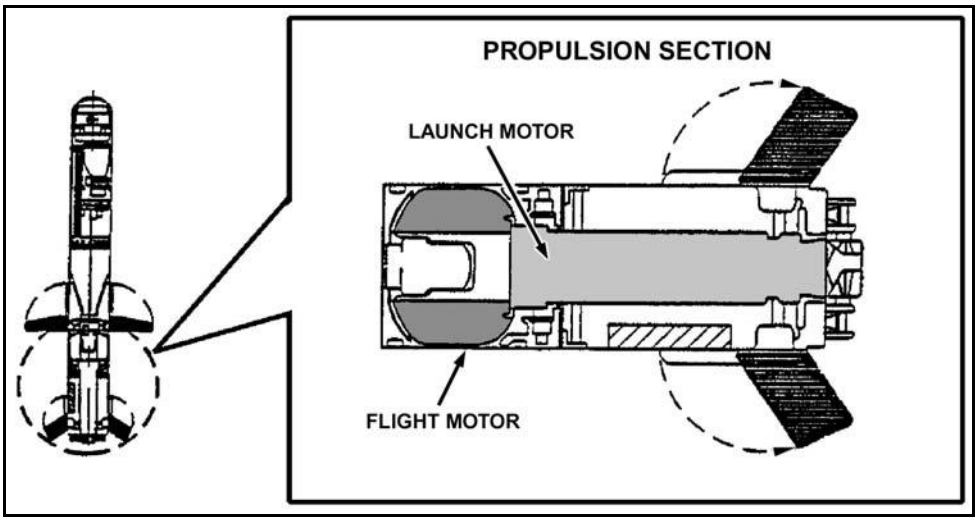


Figure 1-24. Missile propulsion section.

e. **Control Actuator Section**. The control actuator section (Figure 1-25) maneuvers the missile during flight and provides internal electrical power. The control actuator section consists of four control fins, four thrust vector control vanes, and a thermal battery.

(1) ***Control Fins***. The control fins maneuver the missile during flight. The fins are spring-loaded, automatically deploy, and lock into flight position after the missile clears the LTA. During flight, they adjust automatically to guide the missile to the target.

(2) ***Thrust Vector Control***. The thrust vector control (TVC) vanes aid the control fins in maneuvering the missile during flight by deflecting the flight motor exhaust. This control changes the angle of thrust from the flight motor, resulting in a change to the missile's flight path.

(3) ***Thermal Battery***. The thermal battery provides internal electrical power for the missile during flight. It is sealed in the body of the missile.

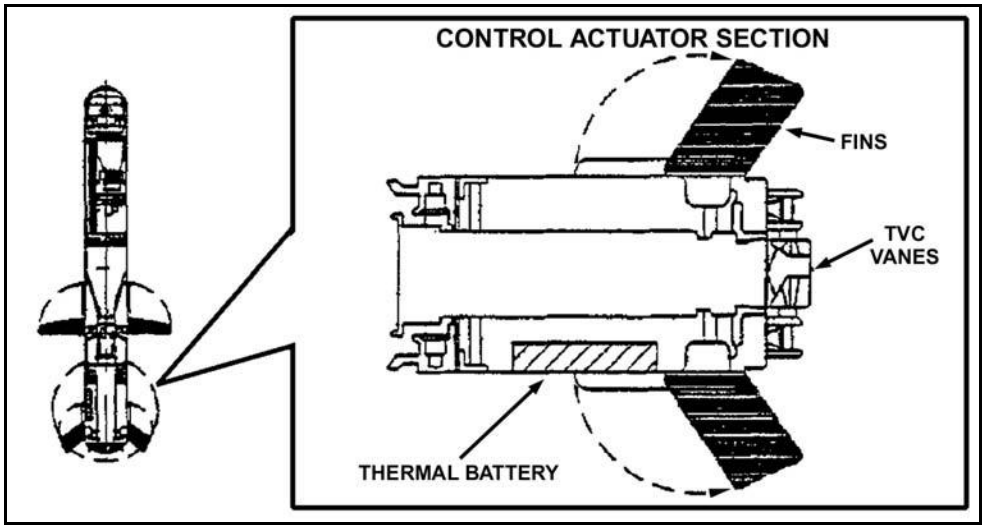


Figure 1-25. Control actuator section.

1-6. CAPABILITIES AND FEATURES

The missile has two gunner-selectable attack modes: top or direct. Each mode has its own flight path or *profile* for reaching the target.

a. **Top Attack Mode.**

(1) The top attack is the default mode when the missile seeker is first activated. In the top attack mode, the missile approaches from above to impact and detonate on the top of the target (Figure 1-26). This capacity allows the gunner to attack a vehicle from the front, rear, or the side and greatly increases the probability of a kill. Armored vehicles usually have less protective armor on top. The minimum engagement distance is 150 meters.

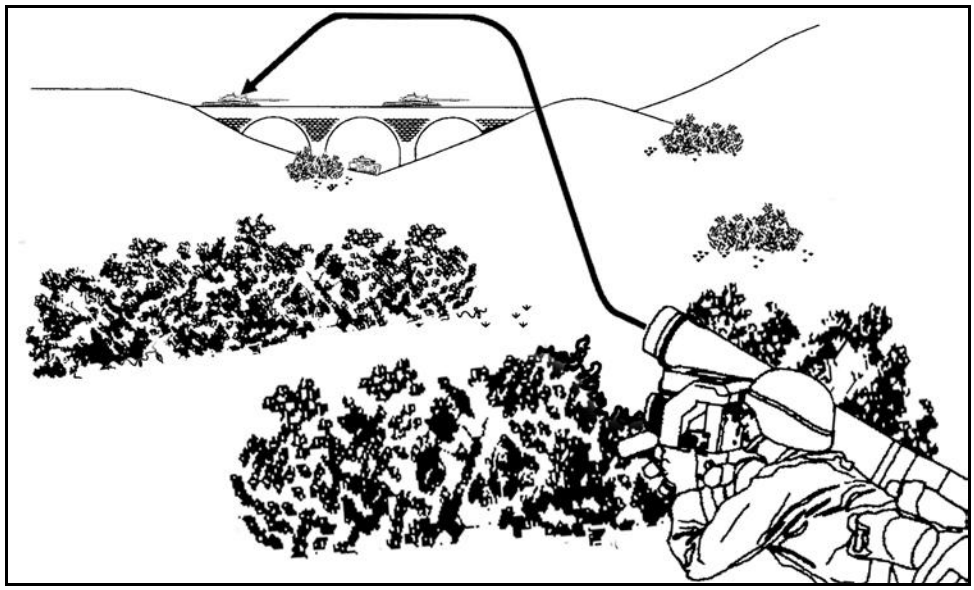


Figure 1-26. Top attack mode.

(2) The exact profile of the missile flight path depends on the range to the target and is determined automatically by the missile's onboard software). When firing at a 2,000-meter target, the missile reaches a height of about 160 meters above the battlefield (Figure 1-27). If the target is under a protective structure, using the top attack mode will cause the missile to detonate on the structure instead of on the target. The gunner can select the direct-attack mode to counter targets hiding under protective cover.

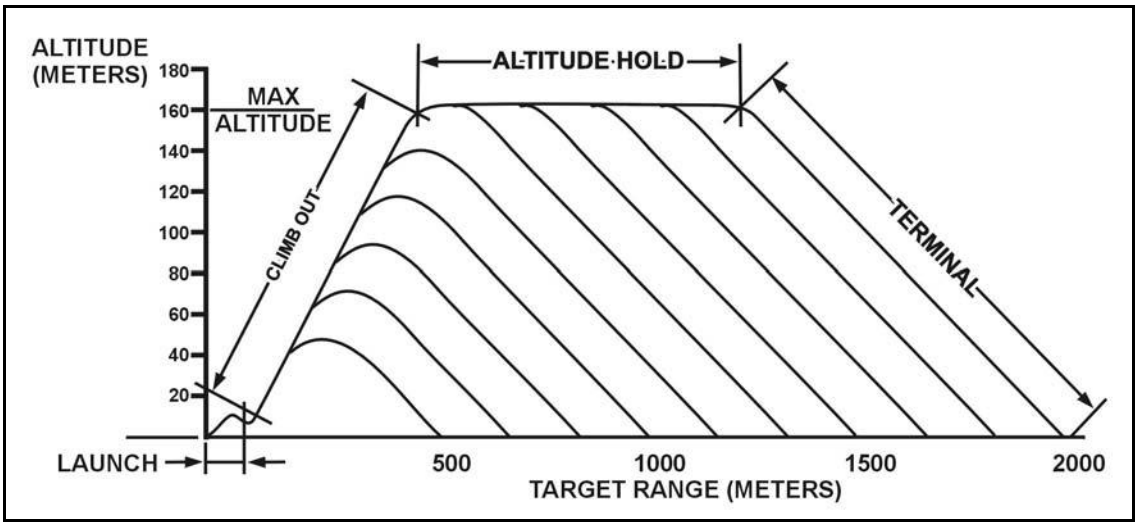


Figure 1-27. Top attack flight path.

b. **Direct Attack Mode.**

(1) The direct attack mode can be selected only after seeker cooldown and before lock-on. The gunner pushes the attack select (ATTK SEL) switch on the right handgrip to change attack modes. In the direct attack mode, the missile flies on a more direct path to the target. The missile impacts and detonates on the side (front, rear, or flank) of the target Figure 1-28). The minimum engagement distance is 65 meters.

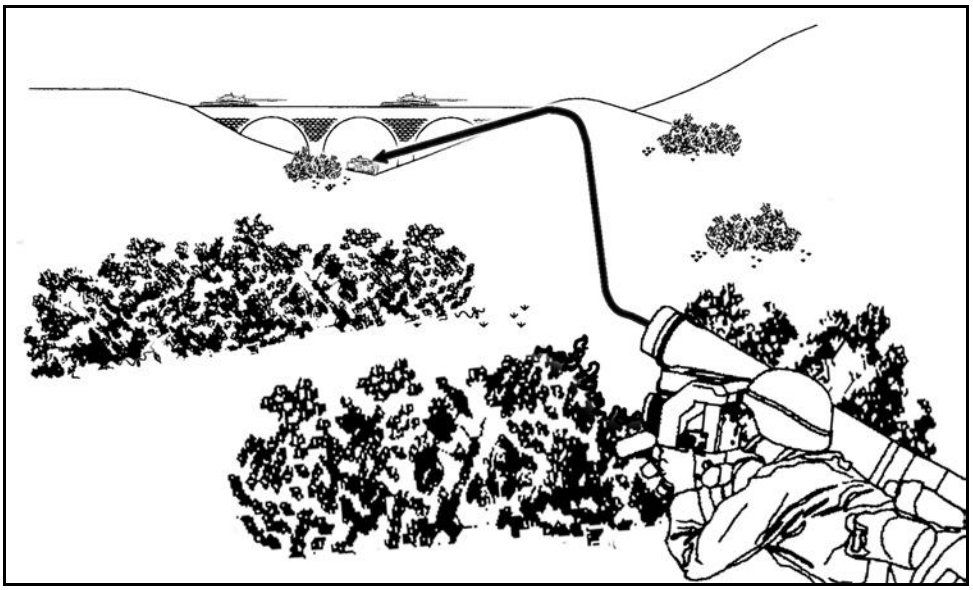


Figure 1-28. Direct attack mode.

(2) The exact profile of the missile flight path shown in a general configuration in Figure 1-29 depends on the range to the target and is determined automatically by the missile's onboard software. With a 2,000-meter target, the missile reaches a height of

about 60 meters above the battlefield. This path allows the missile to reach a target under a protective structure.

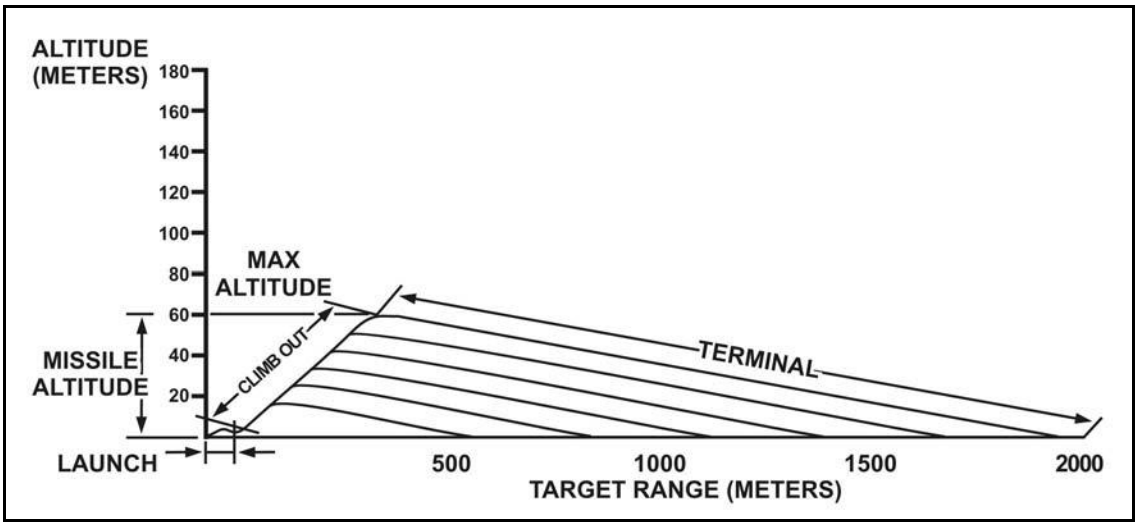


Figure 1-29. Direct attack flight path.

CHAPTER 2

CONTROLS AND OPERATION

This chapter is an overview of the Javelin's controls and indicators, operation of the Javelin, and CLU display indicators.

2-1. CONTROLS AND INDICATORS

The Javelin controls allow the gunner to perform and monitor all operations. The controls are located on the handgrips except for the diopter adjust ring and the power switch.

a. **Diopter Adjust Ring.** The diopter adjust ring is located on the CLU eyepiece assembly (Figure 2-1). The gunner uses the diopter adjust ring to adjust the focus of the image. Any gunner with vision correctable to 20/20 can use the CLU to see an in-focus image without using glasses. The alignment mark is located on the eyepiece. Align the number that corresponds with the adjustment. This adjustment is constant on all CLUs.

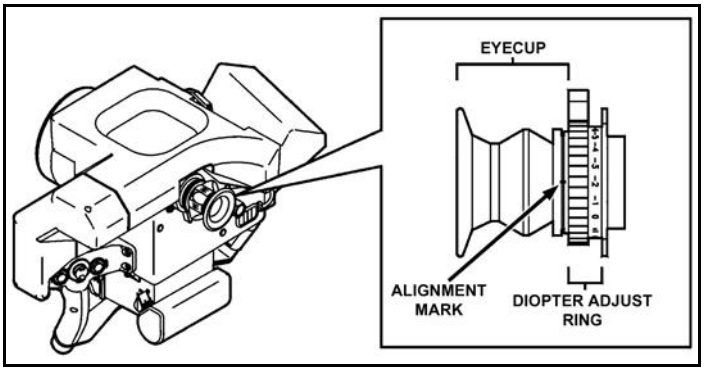


Figure 2-1. Diopter adjust ring.

b. **Power Switch.** The power switch is a rotary switch located on the lower rear corner of the left-hand side of the CLU main housing (Figure 2-2). The power switch controls the Javelin's mode of operation and each position brings different components of the Javelin into operation. The power switch has four positions: OFF, DAY, NIGHT, and TEST.

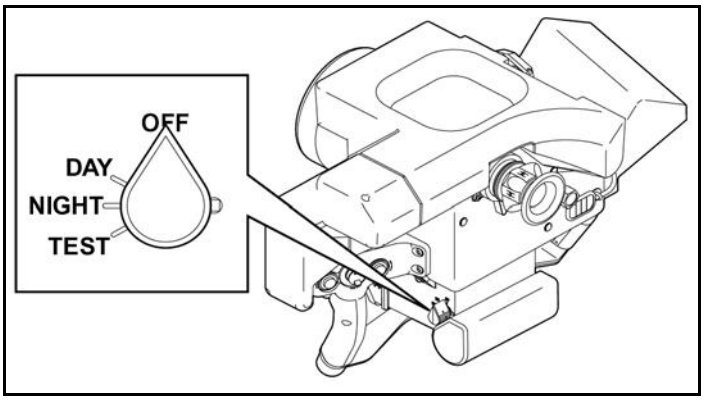


Figure 2-2. Power switch positions.

(1) ***OFF Position***. The Javelin is in the OFF mode when the power switch is in the OFF position. In this mode, no battery power is applied to the Javelin. The day FOV can be used for surveillance and target detection, but the NVS cannot be used and the seeker cannot be activated. The missile cannot be launched.

(2) ***DAY Position***. The Javelin is in the DAY mode when the power switch is in the DAY position. In the day mode, power is applied to the CLU. In the day mode, there is a day FOV but no NVS.

(3) ***NIGHT Position***. The Javelin is in the NIGHT mode when the power swithc is in the NIGHT position. This mode gives the gunner the full Javelin capability. Once the NVS is cooled down (about 2.5 to 3.5 minutes), the gunner selects WFOV, NFOV, and day FOX, which gives him the full missile capability.

(4) ***TEST Position***. The Javelin enters a built-in test (BIT) routine (Figure 2-3) when the power switch in the TEST position. The power switch is spring-loaded when in the test position. When the gunner moves the power switch to the TEST position, it then returns to the NIGHT position upon release.

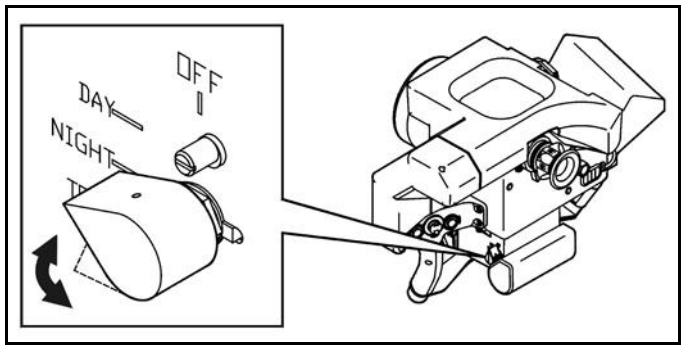


Figure 2-3. Power switch—TEST position.

(5) ***Return to OFF***. Before turning the power switch to OFF, the gunner must leave the power switch at DAY for at least two seconds to allow the flipper mirror time to move to the power switch to the DAY position.

c. **Left Handgrip Controls**. The left handgrip has the following controls: the filter select switch (FLTR), the focus adjust switch (FOCUS), the sight select switch (SGTSEL), and the seeker trigger (Figure 2-4).

(1) ***Function of Controls***. These controls are used to assist the gunner.

- Conduct surveillance.
- Detect, classify, and recognize targets.
- Determine if a target is in range.
- Activate the seeker.
- Reacquire the target in seeker FOV.
- Lock the seeker onto the target.
- Assess battle damage.
- Activate the countermeasure.

(2) ***Filter Select Switch*** (Figure 2-4). The filter select switch (FILTR) is the left switch on the left handgrip. It is a pushbutton switch used to select the NVS filter, this prevents the enemy from detecting the CLU using counter measure.

(3) ***Focus Adjust Switch***. The focus adjust switch (FOCUS) is the center switch on the left handgrip (Figure 2-4). This switch is a self-centering toggle switch used to focus the image on the CLU display during NVS (WFOV or NFOV) operation.

(4) ***Sight Select Switch*** (Figure 2-4). The sight select switch (SGTSEL) is the right switch on the left handgrip. This switch is a pushbutton switch used to select between the day FOV, WFOV, NFOV, and seeker FOV. If the gunner is in seeker FOV and needs to return to the day sight or NVS, he presses the SGTSEL switch.

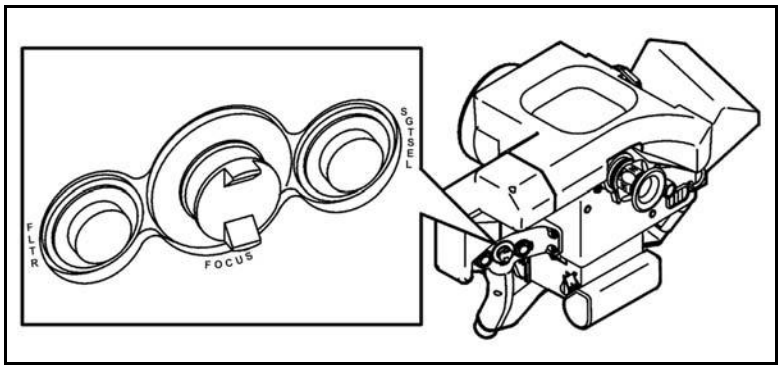


Figure 2-4. Left handgrip controls.

(5) ***Seeker Trigger***. The seeker trigger is the trigger located on the fingergrip (front) side of the left handgrip (Figure 2-5). This trigger activates the seeker, locks the seeker onto the target, and enables the *fire trigger*. A trigger guard protects against accidental activation.

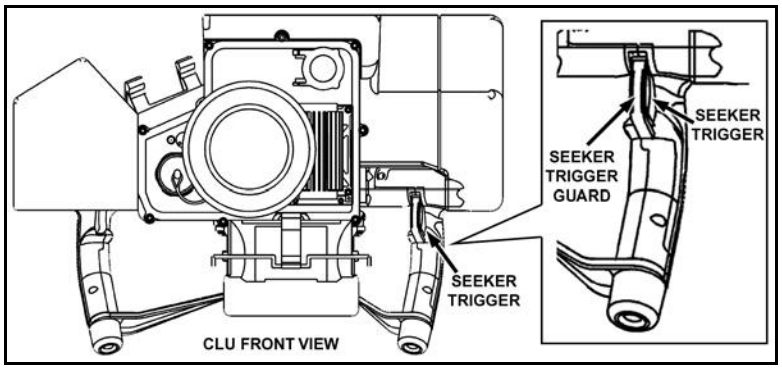


Figure 2-5. Left handgrip controls—seeker trigger.

d. **Right Handgrip Controls.** The right handgrip has the following controls: the attack select (ATTK SEL) switch, the gate adjust/contrast and brightness (GATE ADJ/CTRS & BRT) switch, and the fire trigger (Figure 2-6, page 2-4). The controls on the right handgrip:

- Change the attack mode, if necessary.
- Adjust the track gates so the seeker can lock on the target.

- Adjust NVS contrast and brightness.
- Fire the missile.

(1) ***Attack Select Switch***. The attack select (ATTK SEL) switch is the right switch on the two-switch console on the right handgrip (Figure 2-6). It is a pushbutton switch that toggles between the top attack and direct attack modes. The top attack mode is the default attack mode and is automatically selected when the seeker is activated.

(2) ***Gate Adjust/Contrast and Brightness Switch***. The gate adjust/contrast and brightness (GATE ADJ/CTRS & BRT) switch (Figure 2-6) is the left switch of the two-switch console on the right handgrip. It is a self-centering switch that moves up, down, left, and right. This switch serves two functions depending on whether the CLU display image is from the NVS or the seeker. To change the mode of attack, the gunner must be in Seeker FOV.

(a) ***Night vision sight***. When the CLU displays an image from the NVS (WFOV or NFOV), the gate adjust/contrast and brightness (GATE ADJ/CTRS & BRT) switch is used to adjust the contrast and brightness of the CLU display image. When the NVS first comes up, both the brightness and contrast are electronically adjusted so only a minimum amount of adjustment by the gunner is required.

- *BRIGHTNESS*. Brightness is adjusted by moving the GATE ADJ/CTRS & BRT switch vertically (up and down).
- *CONTRAST*. Contrast is adjusted by moving the GATE ADJ/CTRS & BRT switch horizontally (left and right).

(b) ***Seeker***. When the CLU display shows the seeker (Figure 2-7) FOV, the GATE ADJ/CTRS & BRT switch is used to adjust the size of the track gates (the track gates are the four corners of the open-sided box shown in the seeker FOV).

- UP and DOWN. UP moves the track gates apart vertically; DOWN moves the track gates together vertically.
- LEFT and RIGHT. LEFT moves the track gates together horizontally; RIGHT moves the track gates apart horizontally.

(3) ***Fire trigger***. The fire trigger is on the front side of the right handgrip at the index finger level (Figure 2-6). When the gunner acquires a missile lock-on target squeeze and hold seeker trigger, he squeezes the fire trigger to launch the missile.

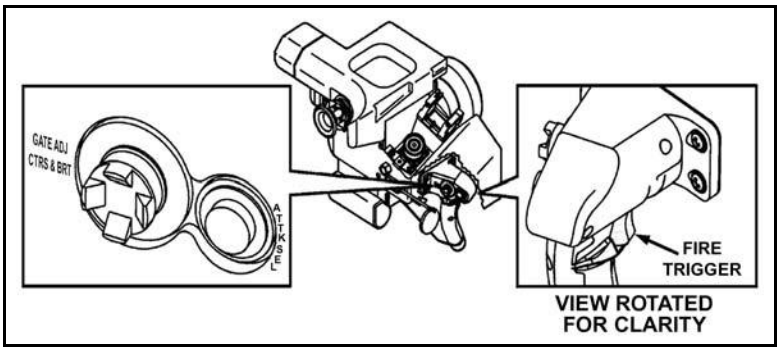


Figure 2-6. Right handgrip controls.

2-2. COMMAND LAUNCH UNIT STATUS INDICATORS

The CLU has status indicators that appear around the CLU display. These status indicators are never all lit at the same time during normal operation. The status indicators (Figure 2-7) surround the CLU display images, whether they are from the daysight (day FOV), from the NVS (WFOV or NFOV), or from the seeker in the missile (seeker FOV). The gunner observes the status indicators by looking into the eyepiece. These indicators identify Javelin operational modes, conditions, and malfunctions. There are fourteen indicators, each coded in colors: green, amber, or red.

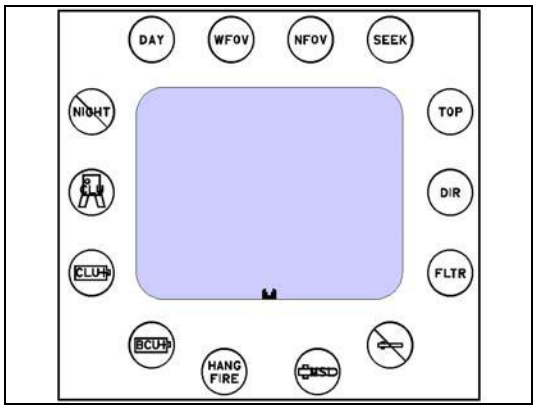


Figure 2-7. CLU display indicators.

a. **Green Status Indicators**. Seven of the fourteen status indicators are green (Figure 2-8). Green signifies the monitored function is in a satisfactory condition and that it is okay to proceed with normal operations.

(1) ***Day (DAY) Indicator*** `. The DAY indicator is located at the top of the CLU display and at the far left. It lights when day FOV is selected when the power switch is in the day or night position.

(2) ***WFOV (WFOV) Indicator*** **1**. The WFOV indicator is located at the top of the CLU display and to the left of center. Solid ON indicates the CLU is in WFOV. When it *flashes*, it indicates the NVS has reached a focus limit.

(3) ***NFOV (NFOV) Indicator*** **2**. The NFOV indicator is located at the top of the CLU display and to the right of center. Solid ON indicates the CLU is in NFOV. When it **flashes**, it indicates the NVS has reached a focus limit.

(4) ***Seeker (SEEK) Indicator*** **3.** The SEEK indicator is located at the top of the CLU display at the far right. It lights within 3 seconds after squeezing the seeker trigger.

(5) ***Top (TOP) Attack Indicator*** **4.** The TOP indicator is located on the right side of the CLU display at the top. It lights when the missile is in the top attack mode.

(7) ***Direct (DIR) Attack Indicator*** **5**. The DIR indicator is located on the right side of the CLU display in the center. It lights when the missile is in the direct attack mode.

(8) ***Filter (FLTR) Indicator*** **6**. The FLTR indicator is located on the right side of the status display at the bottom. It lights when the NVS filter is selected.

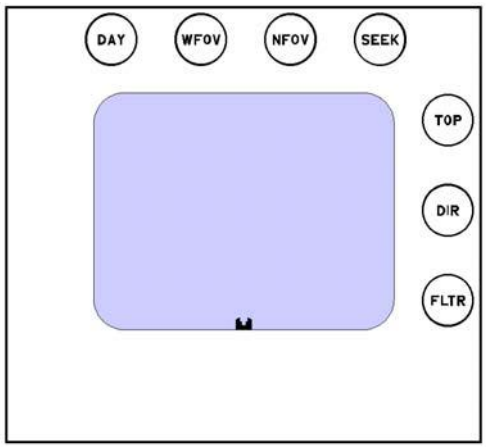


Figure 2-8. Status indicators—green.

b. **Amber Status Indicators.** The two status indicators are amber (Figure 2-9). Amber is used when a marginal condition exists. It also alerts the gunner to situations where caution, a recheck, or an unexpected delay is necessary.

(1) ***NVS Not Cool Indicator*** 7. The NVS NOT COOL indicator is located on the left side of the CLU display at the top. It lights when the CLU is in the night mode, but the DDC has not cooled to its operating temperature. The indicator goes out when the NVS is cooled to its operating temperature. If the DDC warms up again, this indicator comes back on.

(2) ***Missile Not Ready Indicator*** \. The MISSILE NOT READY indicator is located at the bottom of the CLU display at the far right. Solid ON indicates the missile flight information is not downloaded from the CLU, missile BIT is not complete, or seeker is not cooled. A flashing MISSILE NOT READY indicator indicates the missile electronics are close to an overheat condition. The missile shuts down within 30 seconds after the flashing starts.

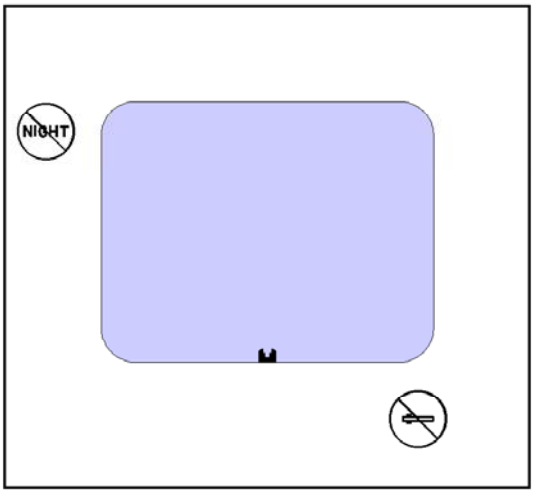


Figure 2-9. Status indicators—amber.

c. **Red Status Indicators**. Five of the status indicators are red (Figure 2-10). There are two types of red indicators. A flashing red indicator warns the gunner of an emergency condition where action must be taken. A solid red indicator alerts the gunner the Javelin is inoperative and a successful missile launch is not possible until corrective action is taken.

(1) ***Missile BIT Failure Indicator*** =. The MISSILE BIT FAILURE indicator is located at the bottom of the CLU display and to the right of center. Solid ON indicates the missile BIT has detected a failure in the missile and flashes to indicate a misfire when the gunner squeezes the fire trigger and the missile does not launch.

(2) ***Hangfire Indicator*** -. The HANGFIRE indicator is located on the bottom of the CLU display and to the left of center. The HANGFIRE indicator flashes to indicate a missile hangfire when the gunner squeezes the fire trigger and the missile does not launch.

(3) ***Battery Coolant Unit (BCU) Indicator*** 0. The BCU indicator is located at the bottom of the CLU display at the far left. After seeker activation, the BCU indicator flashes to indicate the BCU has about 30 seconds of operating time remaining and illuminates solid red when the BCU is spent.

(4) ***CLU Battery Indicator*** 9. The CLU BATTERY indicator is located on the left side of the CLU display at the bottom. The indicator lights to indicate the CLU battery has about 5 minutes of operating time remaining.

(5) ***CLU BIT Failure Indicator***8. The CLU BIT FAILURE indicator is located on the left side of the CLU display in the center. The CLU BIT FAILURE lights to indicate the CLU has failed an automatic built-in test.

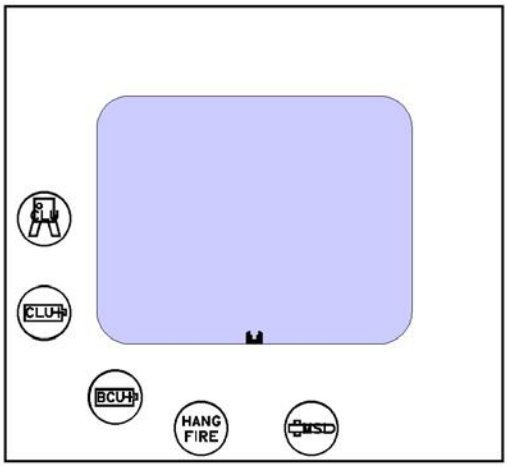


Figure 2-10. Status indicator—red.

2-3. COMMAND LAUNCH UNIT DISPLAY INDICATORS

The command launch unit has display indicators include stadia, reticles, track gates, and crosshairs.

a. **Stadia**. Stadia are seen in all CLU fields of view. They change their appearance, size and location according to the FOV selected. The CLU has three different stadia for each of the three CLU fields of view. The day FOV stadia are seen in all FOVs, but are used only in day FOV. The WFOV and NFOV stadia are present only in their respective fields of view.

(1) Day FOV stadia (Figure 2-11) are attached permanently to and appear at the bottom center of the CLU display.

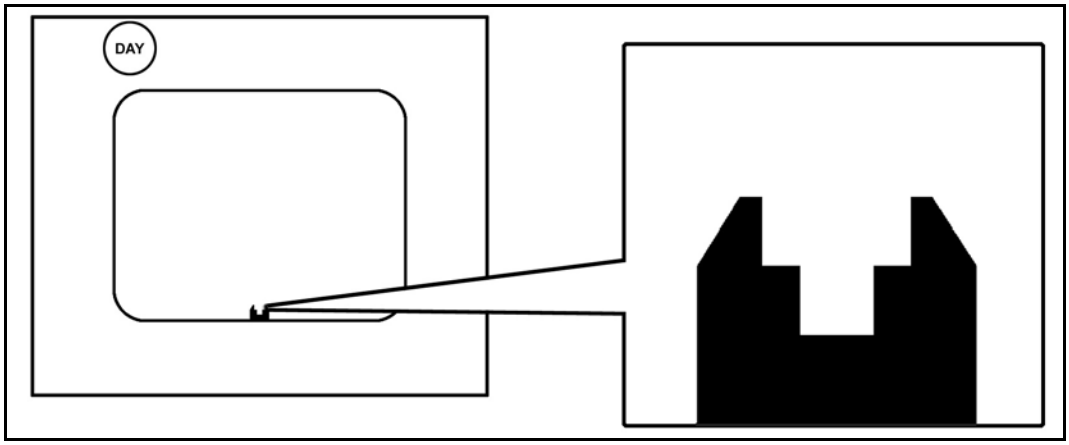


Figure 2-11. Stadia (day FOV).

(2) WFOV stadia consist of two vertical lines centered at the top of the CLU display (Figure 2-12A). The WFOV stadia are visible only in WFOV.

(3) NFOV stadia also consist of two vertical lines centered at the top of the CLU display (Figure 2-12B). The NFOV stadia are visible only in NFOV.

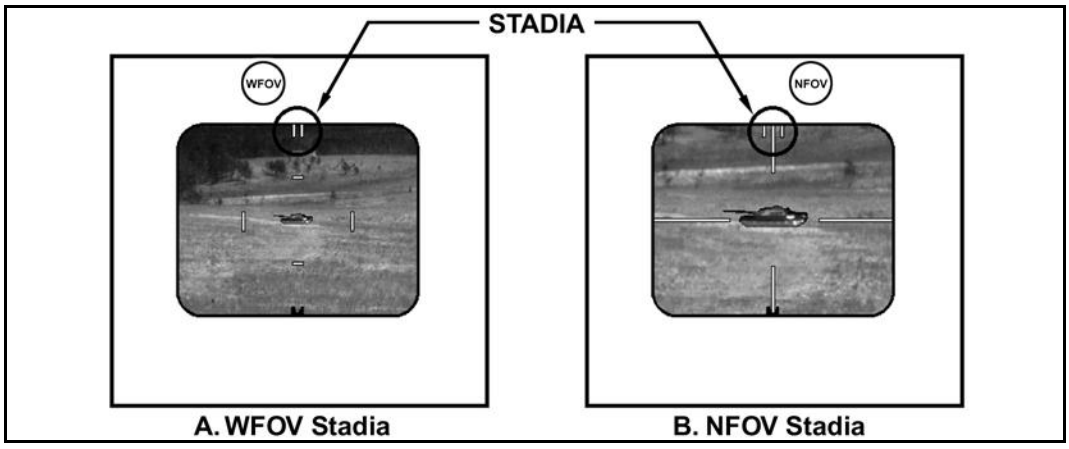


Figure 2-12. NVS stadia comparisons.

b. **Reticles**. In WFOV and NFOV, lines appear on the CLU display, and the configuration of lines in the reticles change from WFOV to NFOV, which allows the gunner to identify the FOV just by looking at the display (Figure 2-13).

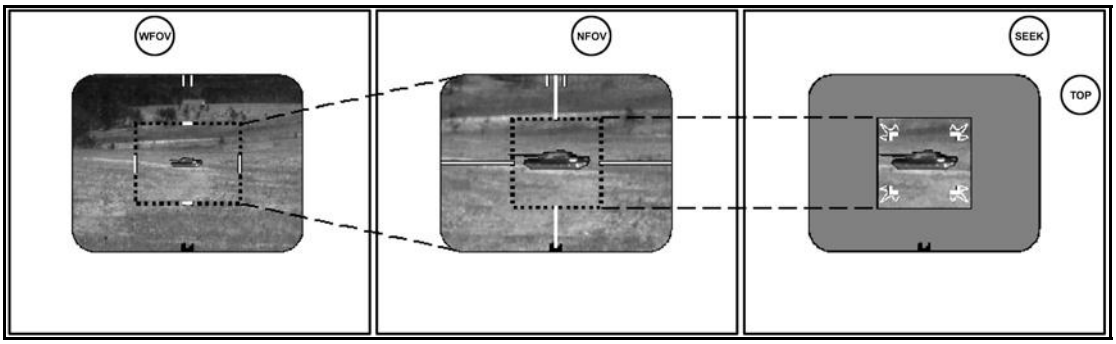


Figure 2-13. Reticle area versus FOV change.

c. **Track Gates**. The track gates (Figure 2-14) are used by the gunner to lock the seeker on target. The gunner activates the seeker and the track gates appear and flash in the CLU display. The track gates are a visual indication the seeker is active but not locked on the target.

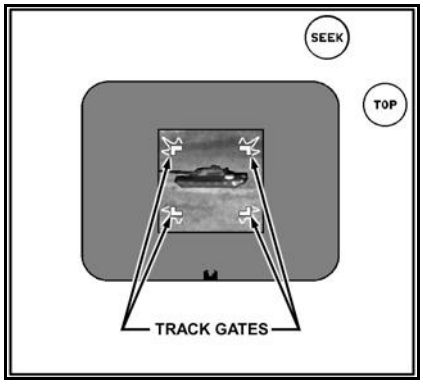


Figure 2-14. Track gates.

d. **Crosshairs**. The gunner uses the crosshairs (Figure 2-15) to designate the center of mass, which the seeker locks on. The crosshairs first appear and are flashing when the gunner squeezes and holds the seeker trigger. After the seeker locks on the target, the track gates and crosshairs become solid.

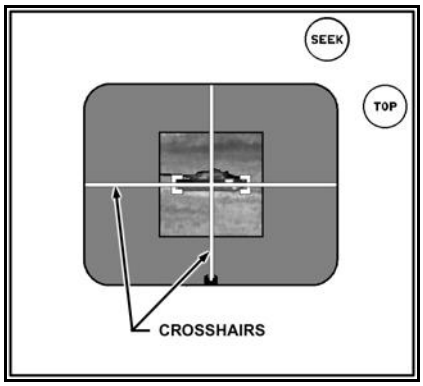


Figure 2-15. Crosshairs.

2-4. PREPARATION FOR FIRING

During preparation, the gunner performs a built-in-test (BIT), inspects the round, and prepares to fire. There are seven steps in preparing the Javelin for firing.

a. **Prepare the Javelin Components**.

(1) Place the round on the ground with the flat sides of the end caps down.

(2) Place the carry bag on the ground on the left side of the round.

b. **Remove the CLU from the Carry Bag**.

(1) Open the carry bag.

(2) Grasp the CLU by the handgrip and remove it from the carry bag.

c. **Install the CLU Battery**. The battery compartment is located on the bottom of the CLU. Take the CLU and turn it 180 degrees (Figure 2-16). The battery compartment cover is held in place by a wire bail. Detach and move the wire bail cover out of the way. The compartment is equipped with a battery connector. This connector mates with the corresponding connector on the battery. Align the two connectors and attach. Replace the battery compartment cover and reattach the wire bail.

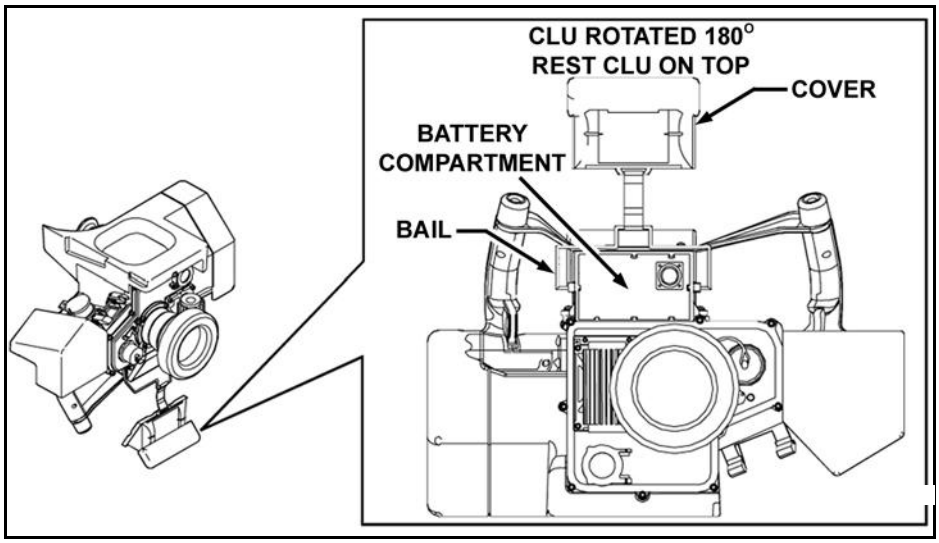


Figure 2-16. Battery compartment.

d. **Connect the CLU to the Round** (Figure 2-17). Kneel on the left side of the round, at the forward end, facing forward.

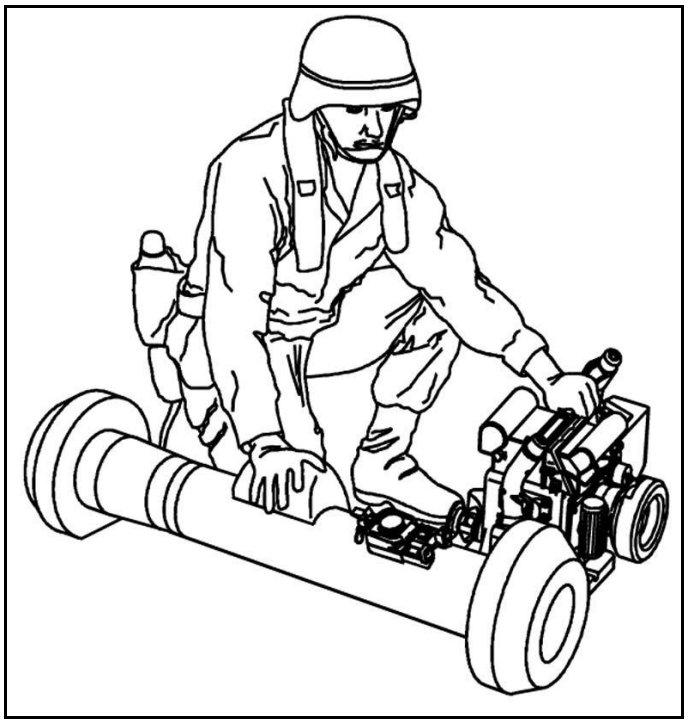


Figure 2-17. Connect the round to the CLU.

(1) Remove the protective cover from the CLU and round interface connectors. Pull on the lanyard tab to snug the protective cover against the side of the round and CLU. Position the protective covers so they do not interfere when the CLU and round are connected.

(2) Grasp the handgrips and lift the CLU into position over the CLU interface connector. Keep the eyecup pointed toward the aft end of the round (Figure 2-18).

(3) Place the round interface bracket in the round hooks.

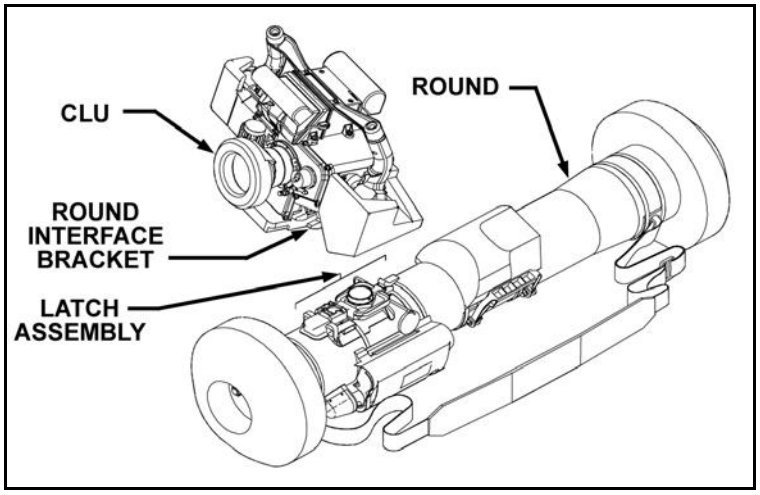


Figure 2-18. Connect the CLU to the round.

(4) Slide the CLU toward the latch release and press down on the CLU to engage the CLU and the round interface connectors. When the latch release snaps into place, the CLU and round are connected (Figure 2-19).

(7) Ensure the CLU and the round are connected correctly by rocking the CLU from side to side before attempting to pick up the Javelin.

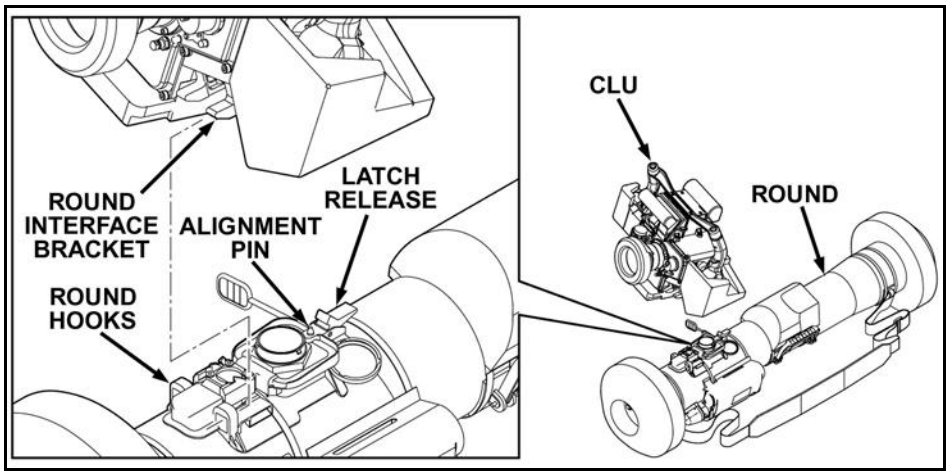


Figure 2-19. Connect the CLU to the round.

e. **Turn the Power Switch from the OFF Position to the NIGHT Position** (Figure 2-20).

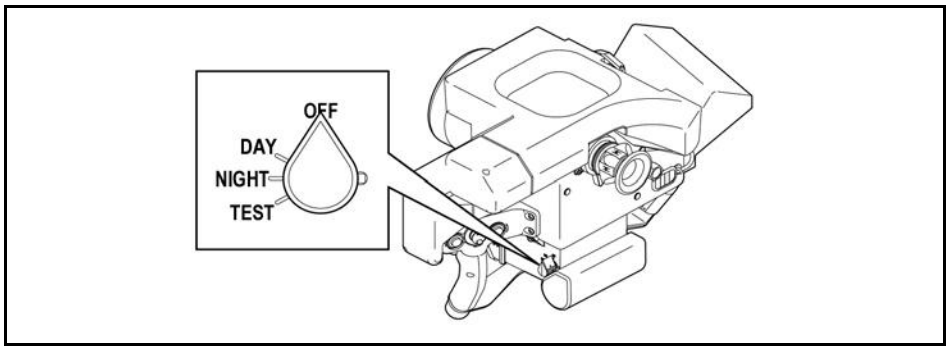


Figure 2-20. Power switch.

f. **Remove the Forward End Cap** (Figure 2-21).

(1) Remove the locking pin from the forward end cap by pulling straight up on the wire rope.

(2) Using the left hand, turn the forward end cap latch release counterclockwise.

(3) Grasp the handgrip with the right hand and lift the front end of the Javelin enough to raise the forward end cap off the ground.

(4) Slide the forward end cap off the round. If the forward end cap does not come off press the manual release button until the hissing stops. Set the open end of the round on the forward end cap to prevent dirt and debris from obstructing the seeker. When the

forward end cap is removed, the gunner must use *extreme caution* not to damage the seeker or allow foreign material to come in contact with the seeker.

CAUTION
With the forward end cap removed, the seeker is exposed. Use extreme caution when tipping the Javelin forward to ensure no foreign material comes in contact with the seeker.

(5) Inspect the open end of the round for dirt and foreign material. Remove any dirt or foreign material that is present.

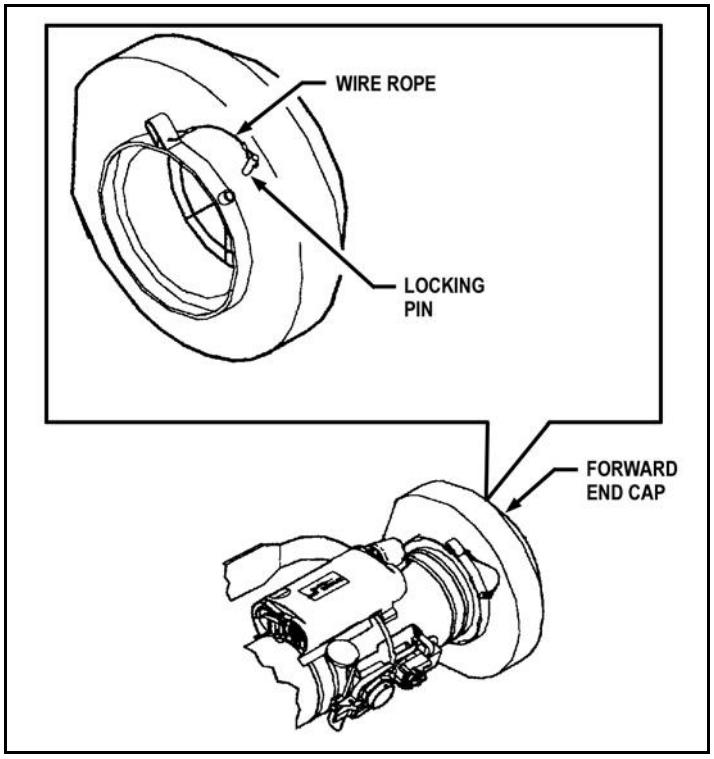


Figure 2-21. Remove the forward end cap.

g. **Open the Lens Covers**. Ensure the daysight and NVS lens covers are completely open.

2-5. FIRING POSITIONS

Firing positions for the Javelin include: sitting (bent knees or legs crossed), the kneeling (using one knee or both knees), standing supported, and the prone supported.

a. **Sitting Position.**

(1) Sit on the left side of the Javelin facing the direction of fire.

(2) Check the backblast area.

(3) Grasp the left handgrip of the CLU with the left hand. Place the right hand under the round near the shoulder pad.

(4) Lift the Javelin in a single, smooth motion and position the shoulder pad on the right shoulder.

(5) Assume a comfortable sitting position with legs crossed (Figure 2-22A) or knees bent (Figure 2-23B).

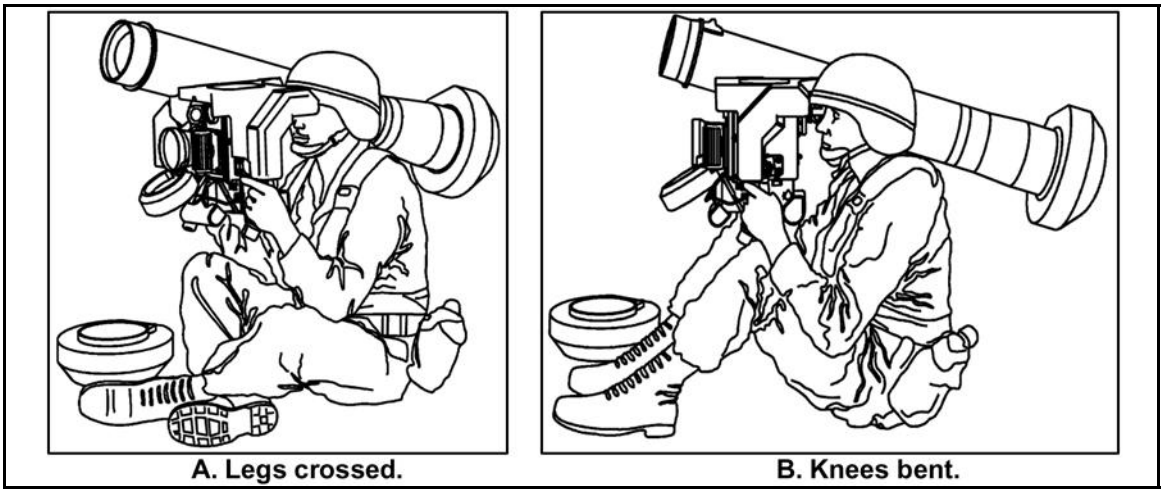


Figure 2-22. Javelin sitting firing position.

(6) Adjust the body while holding the CLU.

(7) Check the overhead flight path between the target and the firing position by sighting along the top of the round. The missile must have a clear flight path once launched.

(8) After assuming the sitting position, ensure the forward end cap is on the ground, in front of and slightly to the right of the right leg or foot. The gunner is prepared.

b. **Kneeling Position**.

(1) Kneel on the left side of the Javelin facing the direction of fire.

(2) Check the backblast area.

(3) Grasp the left handgrip of the CLU with the left hand. Place the right hand under the round near the shoulder pad.

(4) Lift the Javelin in a single, smooth motion and position the shoulder pad on the right shoulder.

(5) Kneel in a comfortable position with one knee (Figure 2-23A) or both knees on the ground (Figure 2-23B).

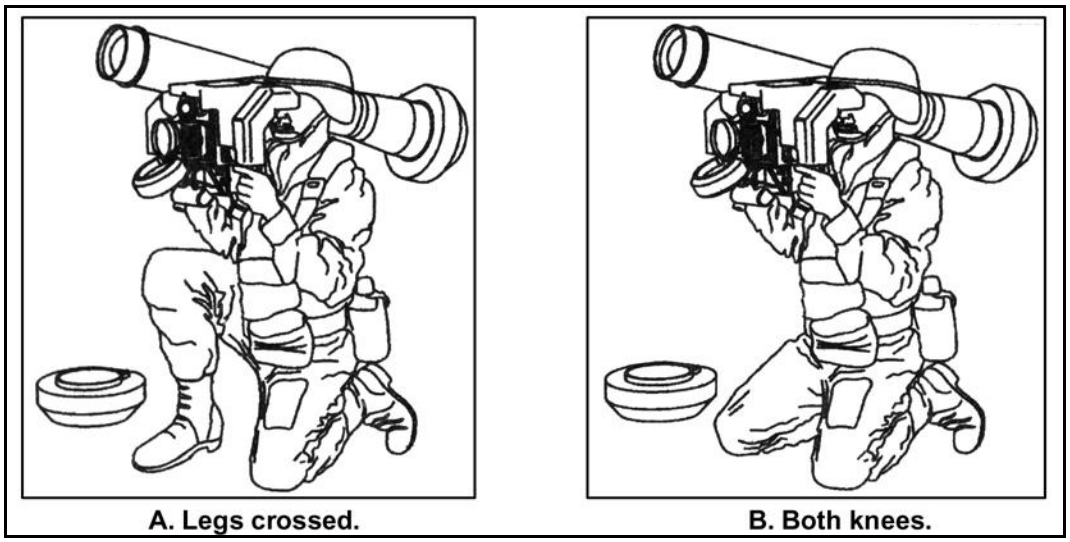


Figure 2-23. Javelin kneeling firing position.

(6) Hold the CLU by the right handgrip and adjust the body until comfortable with the Javelin.

(7) Check the overhead flight path between the target and the firing position. To do this, sight along the top of the round. The missile must have a clear flight path once launched (Figure 2-24).

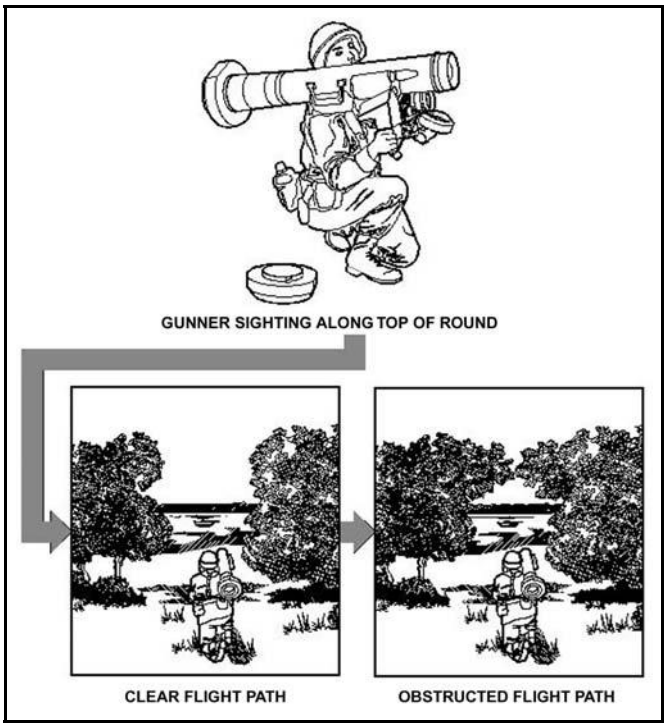


Figure 2-24. Gunner sights along the top of the round for obstructions.

(8) After assuming the kneeling position, ensure the forward end cap is on the ground, in front of and slightly to the right of the right leg or foot.

(9) The gunner is now prepared to fire the Javelin.

c. **Standing Supported Position**.

(1) Stand on the left side of the Javelin facing the direction of fire. Take up a kneeling position with the right knee on the ground.

(2) Check the backblast area.

(3) Grasp the left handgrip of the CLU with the left hand. Place the right hand under the round nearest the shoulder pad.

(4) Lift the Javelin in a single, smooth motion and position the shoulder pad on the right shoulder.

(5) From this one knee position, stand up keeping the back straight and the weight balanced. The gunner keeps his balance by standing with the legs spread a comfortable distance apart (Figure 2-25).

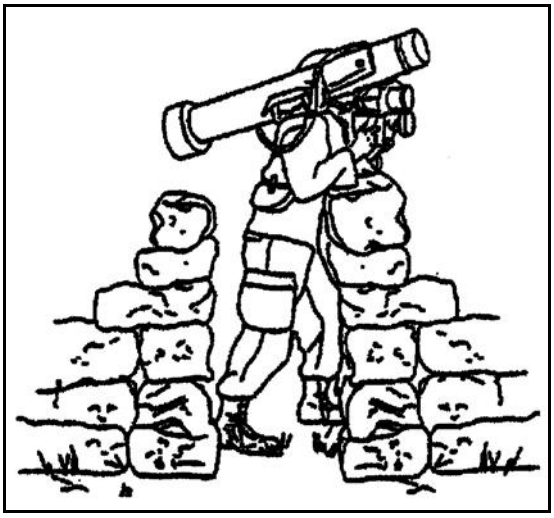


Figure 2-25. Standing supported firing position.

(6) Move the right hand to the right handgrip of the CLU. Place the elbows on the edge or rim of the fighting position or other steady feature to provide support.

(7) Adjust the body until the Javelin feels comfortable.

(8) Check the overhead flight path between the target and the firing position. To do this, sight along the top of the round. The missile must have a clear flight path once launched.

(9) After assuming a firing position, ensure the forward end cap is on the ground, and slightly to the right of the right leg or foot after firing. The gunner is now prepared to fire the Javelin

d. Prone Supported Position.

(1) Set the round on the ground with the flat sides of the end caps face down. The CLU interface connector and latch assembly should be face up.

(2) Ensure the round points toward the target area.

(3) Place the carry bag (with CLU) on the left side of the round by the forward end.

(4) Lay on the left side along the left side of the round next to the carry bag (Figure 2-26). Maintain a low profile to limit observation of movement.

(5) Remove the CLU from the carry bag.

(6) Turn the power switch to the NIGHT position.

(7) Connect the CLU to the round.

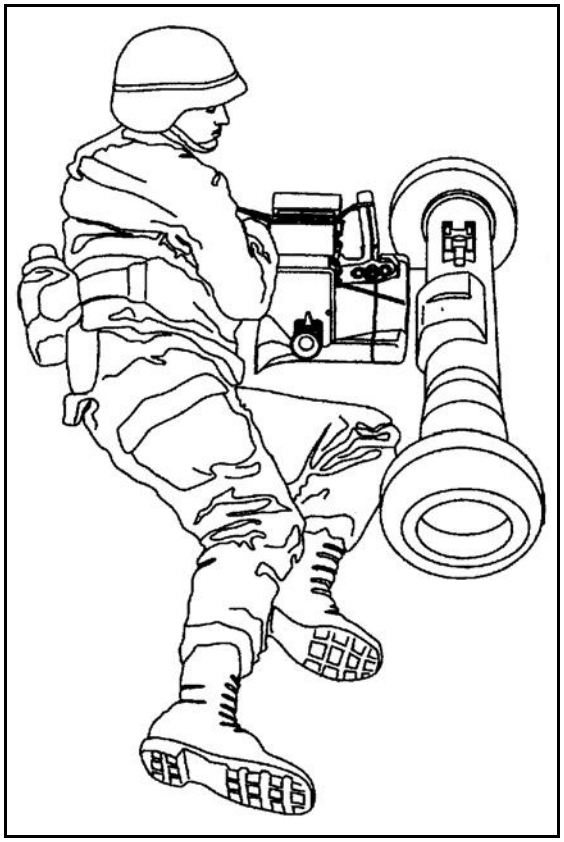


Figure 2-26. Preparing to connect the CLU.

(8) Remove the forward end cap (Figure 2-27).

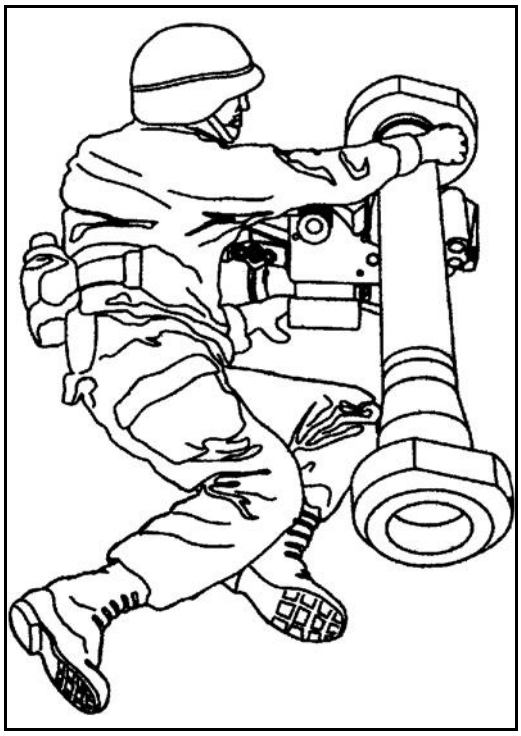


Figure 2-27. Remove the forward end cap.

CAUTION
With the forward end cap removed, the seeker is exposed. Use extreme caution when tipping the Javelin forward to ensure no foreign material comes in contact with the seeker.

(9) Place the forward end cap directly under the open end of the Javelin.

(10) Open the NVS and daysight lens covers.

(11) Check the backblast area. Ensure no personnel are located in the primary danger zone or caution areas.

(12) Position the body so it is parallel with the Javelin with the left hand tightly on the left handgrip. Placing the left hand on left handgrip helps guide the Javelin and maintain control. The right shoulder should be just behind the shoulder pad to balance the weight.

(13) The gunner tilts his body and the Javelin to the left side and, at the same time, reaches out with the right hand to secure the forward end cap (Figure 2-28).

NOTE: The forward end cap supports the Javelin's weight when in the prone position.

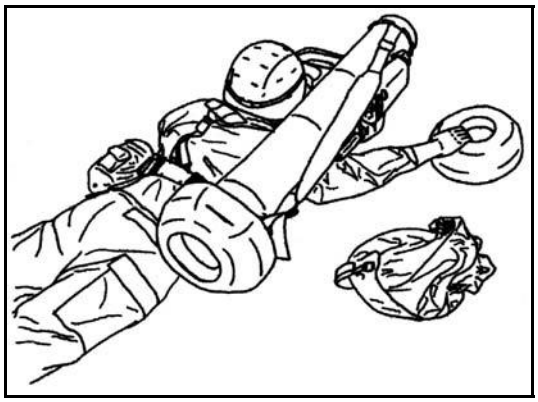


Figure 2-28. Reaching for forward end cap.

(14) Grasp the forward end cap, hold it with the inside of the forward end cap facing toward the CLU, and the flat side of the forward end cap facing up.

(15) Place the flat side of the forward end cap against the round shoulder pad (Figure 2-29).

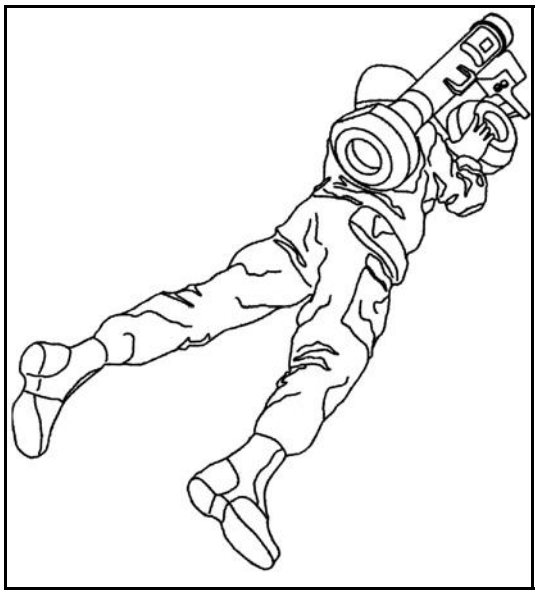


Figure 2-29. Placing end cap.

(16) Slide the forward end cap forward until the forward end cap locking ring contacts the shock absorber on the battery compartment. This wedges the forward end cap into position (Figure 2-30).

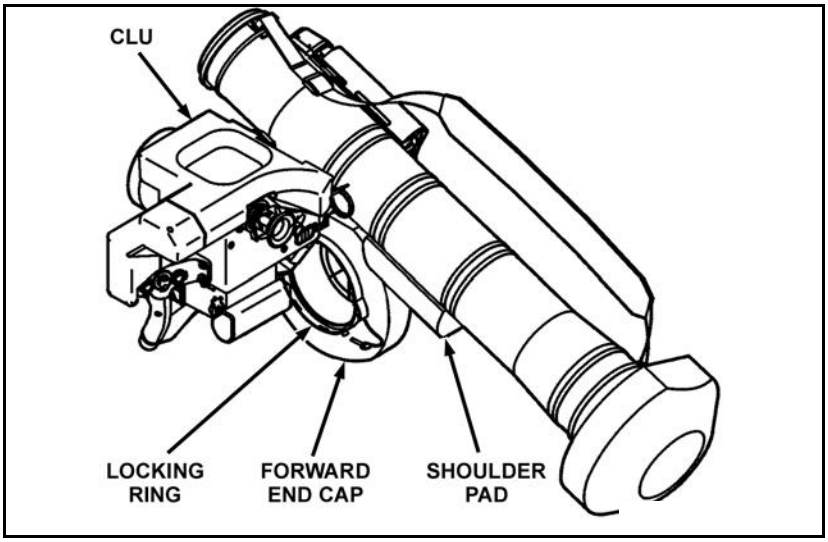


Figure 2-30. Placement of forward end cap in prone position.

(17) Slowly lower the Javelin until it rests on the forward end cap. Slide the body forward so the right shoulder is against the forward end cap.

e. Prone Supported Position Check.

(1) Ensure reaching the right handgrip switches is possible and easy to operate.

(2) Ensure the Javelin is supported by the forward end cap and is not resting on the shoulder (Figure 2-31).

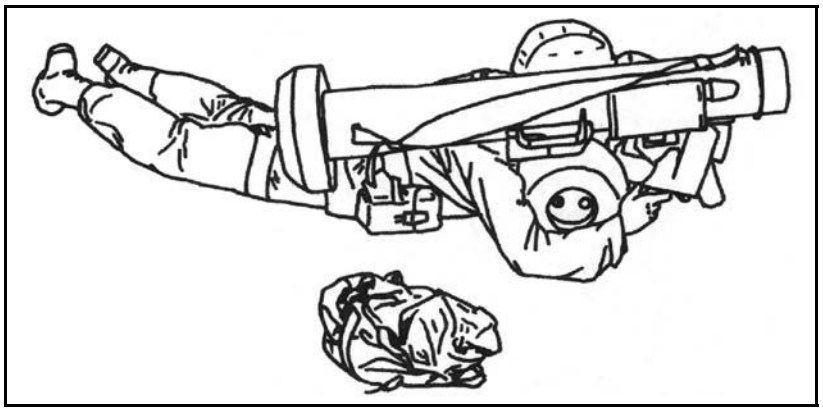


Figure 2-31. Prone supported firing position.

(3) Pull the Javelin tightly into the body until the forward end cap fits against the right shoulder.

WARNINGS

1. **Injury will occur if the body is extended into the backblast area. If injured, seek medical help immediately.**
2. **Keep body at a 30-degree angle away from the round when firing from the prone position.**

(4) Place the body at a 30-degree angle to the length of the round (intended direction of fire) to prevent the legs from extending into the backblast area (Figure 2-32).

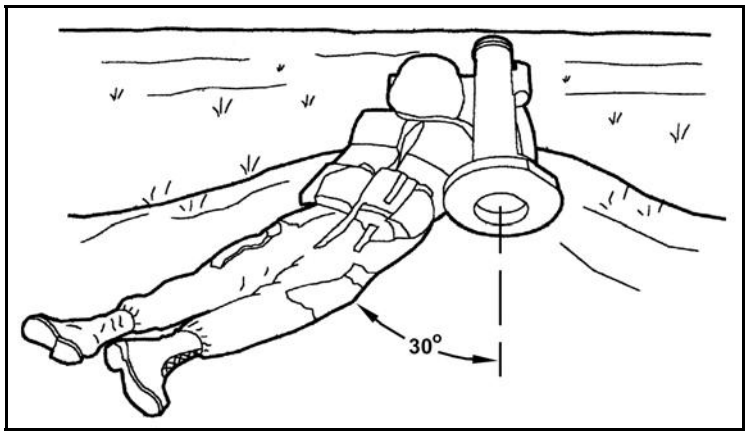


Figure 2-32. Correct prone body position.

(5) Check the overhead flight path between the target and the firing position by sighting along the top of the round. The missile must have a clear flight path once launched.

(6) The gunner is now prepared to fire the Javelin.

2-6. RESTORE TO CARRYING CONFIGURATION

To restore the Javelin to the carrying configuration, the gunner turns the power switch to the OFF position, places the Javelin on the ground, closes the lens cover, replaces the forward end cap, disconnects the CLU from the round. If the seeker has been activated, the gunner replaces the BCU by installing a new one, and places the CLU in the carry bag.

a. **Turn the Power Switch to OFF**. The gunner turns the power switch to the DAY position and waits for the flipper mirror to switch to the day sight position (about 2 seconds), then he turns the power switch to OFF (Figure 2-33, page 2-22).

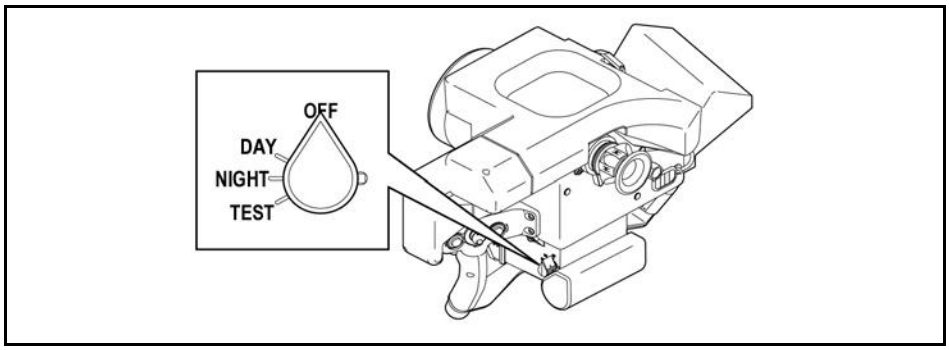


Figure 2-33. Power switch OFF position.

b. **Place the Javelin on the Ground**. When placing the Javelin on the ground, rotate the Javelin so the round rests on the ground and the handgrips of the CLU are pointing skyward.

c. **Close the CLU Lens Covers**. Close the DAY sight and NVS lens cover. Ensure the lens covers are firmly seated in place.

d. **Replace the Forward End Cap**.

(1) Grasp the handgrip with the right hand and lift the forward end of the round off the top of the forward end cap (Figure 2-34).

(2) Check to ensure the forward end cap latch is in the open position.

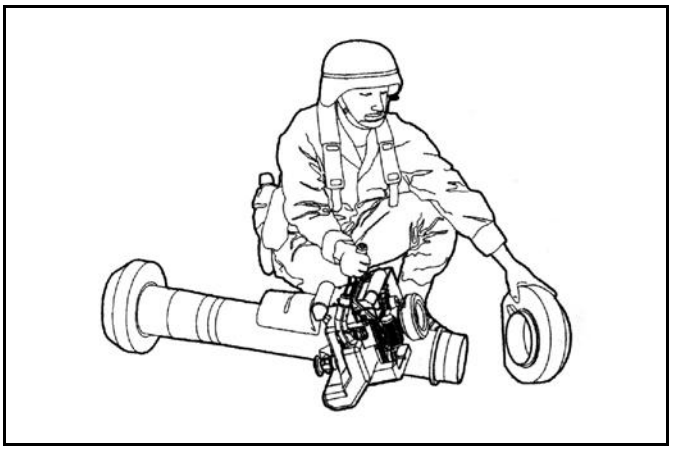


Figure 2-34. Replace forward end cap.

(3) Align the forward end cap latch handle with the BCU pylon.

(4) Slide the forward end cap onto the round and turn the latch clockwise to engage the locks.

(5) Reinstall the locking pin in the hole in the forward end cap (Figure 2-35).

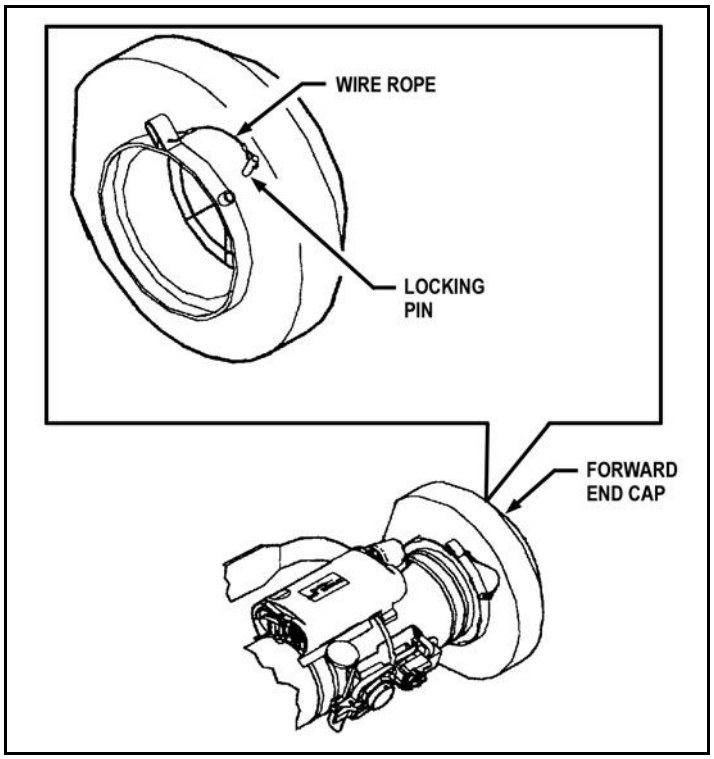


Figure 2-35. Forward end cap locking pin.

e. **Disconnect the CLU from the Round**.

(1) To disconnect the CLU from the round, depress the latch release on the round (Figure 2-36).

(2) Using the handgrip, lift up and rotate the CLU toward the forward end cap. The CLU rotates away from the round interface connector and the round hooks.

(3) Reinstall the connector covers on the interface connectors on the CLU and on the round. If the seeker was activated, replace the BCU.

(4) Place the CLU in the CLU carry bag with the handgrips up and the eyepiece toward the back of the carry bag.

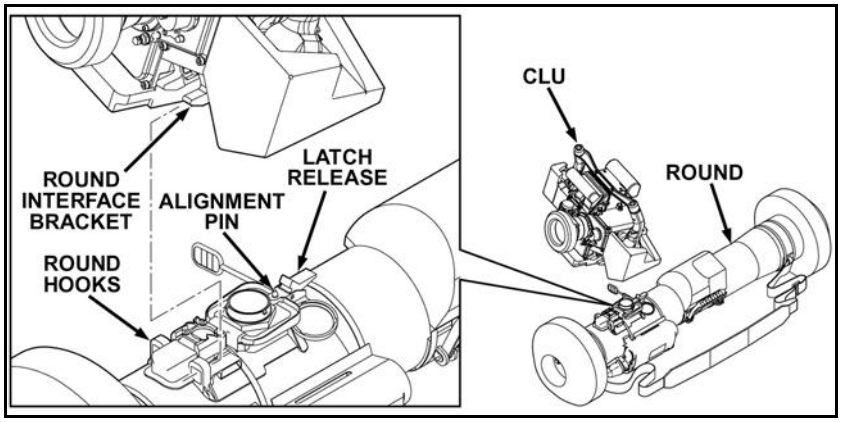


Figure 2-36. Disconnect the CLU from the round.

f. **Replace the BCU**. If the seeker has been activated, replace the BCU. To replace the BCU, the gunner:

(1) Remove the expended BCU.

(2) Kneel on the left side of the round and position the Javelin on the ground so the handgrips point up.

(3) If BCU has solid heat shield (Figure 2-37):

- Lift BCU latch with the thumb.
- Slide the BCU to the rear to release it from the guide pins.

(4) If BCU has grilled heat shield (Figure 2-38):

- Push down on the BCU latch with the thumb.
- Grasp the BCU with the opposite hand and slide it to rear to release it from the guide pins.

g. **Install a New BCU.**

(1) Remove the shipping plug that protects the internal gas bottle.

(2) Inspect BCU status indicator to ensure the replacement BCU is operational.

(3) Place BCU on the round's guide pins with the catch to the rear of round, slide the BCU onto the guide pins. Ensure the BCU snaps into place.

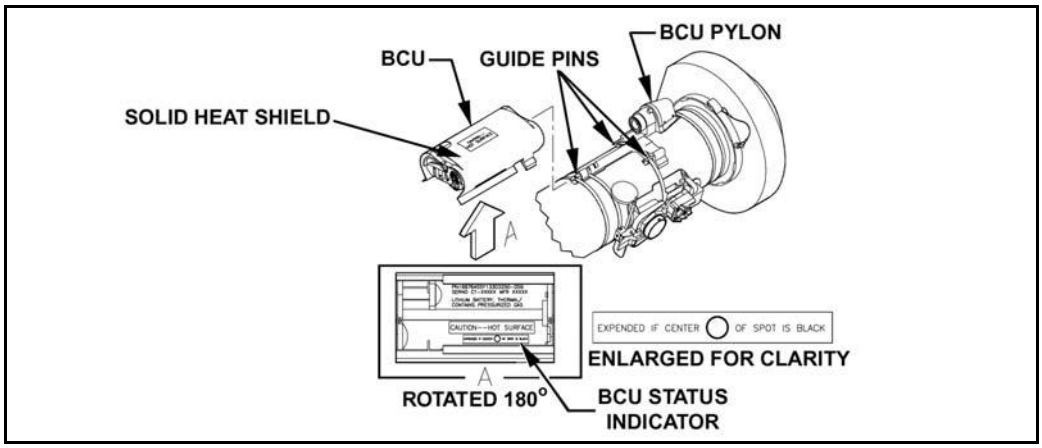


Figure 2-37. Old battery coolant unit.

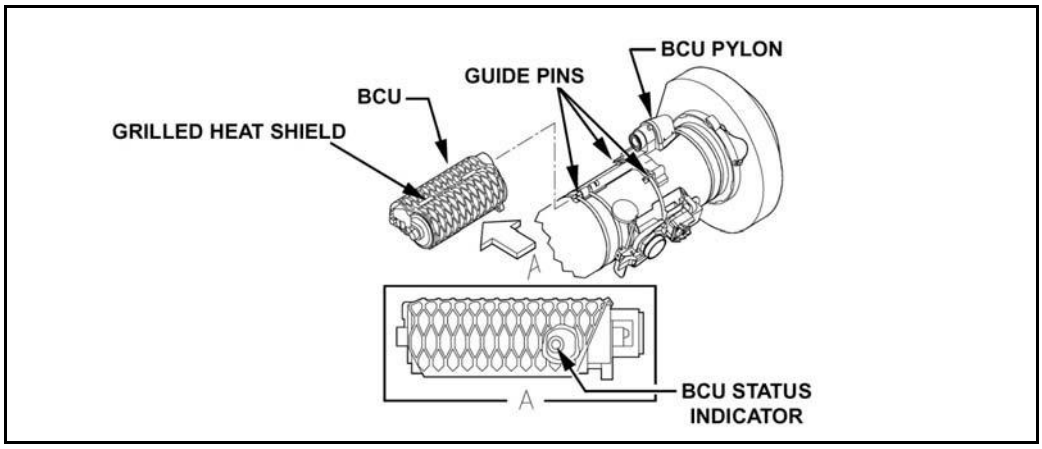


Figure 2-38. New battery coolant unit.

2-7. CARRYING TECHNIQUES

Three techniques are used for carrying the Javelin. The choice is based on the factors of METT-TC situation and the distance to be traveled.

a. **Tactical Carry**. This technique is used when moving into position, between positions, and when enemy contact is likely (Figure 2-39).

(1) The CLU and round are connected. The Javelin is carried on the gunner's right shoulder, balanced on the shoulder pad. The left hand holds the left handgrip and the right hand is on top of the round.

(2) The gunner's assigned weapon is slung across the back.

(3) The round can be cocked to the side so the gunner is able to see. Do not attempt to move while looking through the CLU. The end caps are secured to the round. Remove the forward end cap before firing.

(4) The NVS and day sight lens covers are closed to prevent damage.



Figure 2-39. Tactical carry technique.

b. **Short-Distance Carry**. The short-distance carry technique is used when enemy contact is possible. The rifle is slung over the gunner's left shoulder. The CLU is in the carry bag. The carry bag is carried on the gunner's left side with the shoulder strap over the left shoulder or across the chest. Using the short-distance carry technique, the round can be carried in one of two ways.

(1) ***Round Parallel to Ground***. The round is carried on the gunner's right side with the shoulder strap over the right shoulder. The round is parallel to the ground, waist high with the forward end cap pointed in the direction of movement. The gunner's right hand may be placed on the shoulder strap to keep the round from swaying and to help keep the shoulder strap on the shoulder (Figure 2-40A, page 2-26).

(4) ***Round Forward End Pointed Down***. The round is carried on the gunner's right side with the shoulder strap over the right shoulder. The forward end cap is pointed down with the round behind the right shoulder, parallel to the gunner's body. The gunner's right hand may be placed on the shoulder strap to help keep the strap on the shoulder (Figure 2-40B).

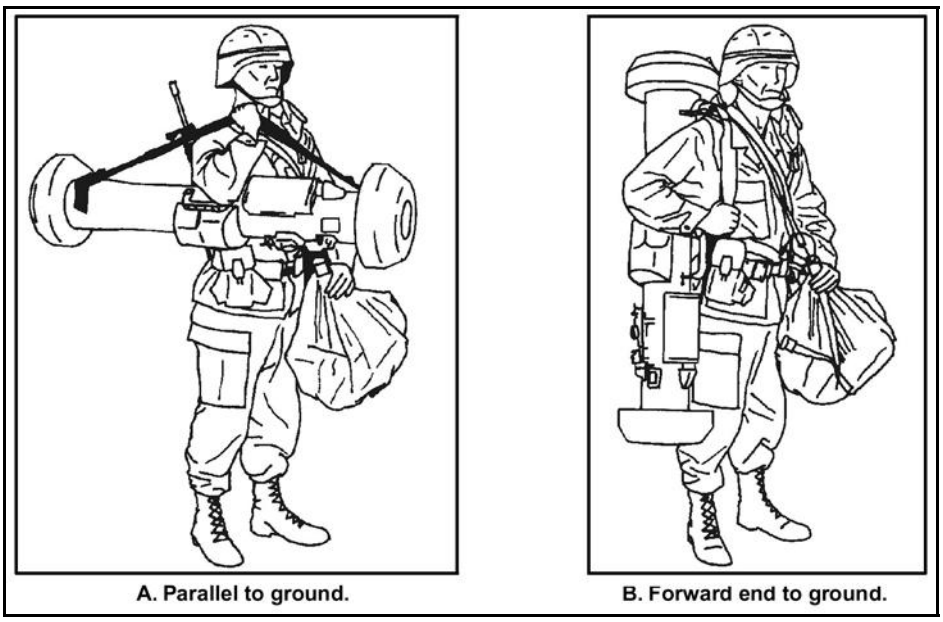


Figure 2-40. Short-distance carry techniques.

c. **Long-Distance Carry**. The long-distance carry technique is used when contact is not likely (Figure 2-41).

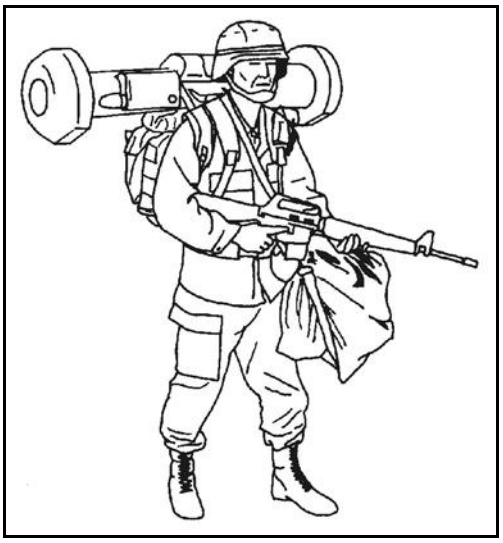


Figure 2-41. Long-distance carry technique.

(1) CLU carry position.

(a) Place the CLU in the carry bag.

(b) Ensure the carry bag is on the gunner's left side with the shoulder strap over the left shoulder or across the chest.

(c) Use a second strap on the carry bag to fasten the CLU to the gunner's waist. This procedure prevents the carry bag from bouncing when the gunner walks.

(2) Stow the round on rucksack.

(a) Place the rucksack on the ground with the frame face down and the top of the pack facing away.

(b) Locate the two long web straps extending from the top of the frame and across the front of the pack (Figure 2-42).

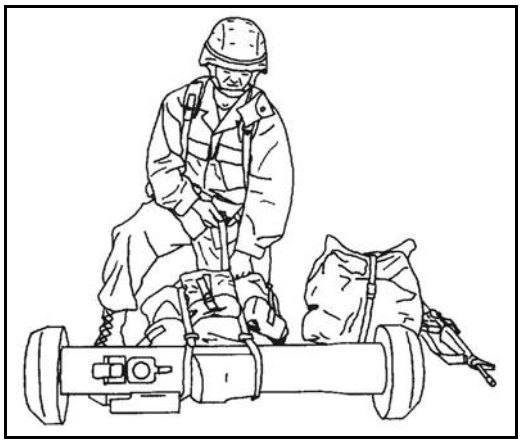


Figure 2-42. Secure the round to the rucksack.

(c) Open the straps to form a loop at the top of the rucksack frame.

(d) Pick up the round and slide it through the strap loops.

(e) Make sure the BCU is facing forward to prevent damage to it when the rucksack is placed on the ground.

(f) Tighten the straps by pulling on the ends. Continue until the straps are tight.

(g) Place the rucksack on the back making sure the round well balanced and evenly distributed across the top of the frame. Make sure the round is parallel to the ground.

CHAPTER 3
TRAINING PROGRAM

The Javelin training program integrates the Javelin into the overall unit-training program to increase combat readiness and ensure trainers and gunners are proficient in operating and maintaining the Javelin.

Section I. GENERAL

The commander needs to know about the current status of Javelin awareness and training in his unit. The commander conducts an accurate assessment to determine what initial and sustainment training is required to maintain the proficiency of the Javelin gunners and to prepare them for the gunner's skill test (GST). The commander is responsible for selecting and training Javelin gunners. The unit's training program includes Javelin gunner training, the unit's battle focus, its METL, and the supporting soldier, leader, and collective tasks.

3-1. TRAINING STRATEGY

The Javelin training strategy is composed of five primary components:

- Initial training.
- Sustainment training.
- Collective training.
- Force-on-force training.
- Leader training.

a. **Initial Training**. Initial gunner training is a prescriptive program of instruction (POI) conducted at the institutions and in the unit. This training consists of two weeks of instruction culminating in the successful completion of the GST.

b. **Sustainment Training**. Sustainment training ensures retaining skills learned during initial training. This training takes place entirely in the unit: monthly, bimonthly, quarterly, and annually. Gunners must retain their skills by practicing engaging targets at least monthly. The gunner fires selected engagements from the monthly sustainment exercises using the BST. The gunner practices field engagements using the FTT every other month. Once a quarter, the gunner completes the entire GST. If the gunner does not perform satisfactorily, he retrains until he qualifies.

c. **Collective Training**. Collective training takes place in the unit to integrate the Javelin into the unit's overall combat power. The Javelin is integrated into collective training using the FTT. Force-on-force training is conducted with the FTT during squad platoon, company, and battalion field training exercises (FTX)/situational training exercises (STX).

d. **Leader Training**. Leader training is conducted in both the institution and the unit. Leaders are taught to train, maintain, and employ the Javelin in courses such as officer and noncommissioned officer education systems (OES and NCOES respectively) This training must continue in units formally through noncommissioned officer (NCO) and officer development classes and informally through personal initiative.

(1) Javelin leadership training begins with the basic understanding of the Javelin, its capabilities and limitations, moves to understanding the fundamentals of Javelin tactical employment, and includes how to integrate the Javelin into company level training.

(2) Leaders must learn and then practice how to employ and integrate Javelin into their units. Using the tactical exercises without troops (TEWT) is an effective way to develop the leader's tactical understanding. (For more information on tactical employment considerations see Chapter 4.) Employing gunners with their squads helps train other squad or fire team members to perform their duties (providing security, locating targets, and so on). After-action reviews (AAR) *must* be conducted after all training exercises so Javelin security, operation, and employment considerations can be more effectively integrated into the unit-training plan.

3-2. PREREQUISITES FOR ADDITIONAL SKILL IDENTIFIER

Normally, the additional skill identifier (ASI) of 2C (Javelin Gunner) is awarded after training at the institution. However, initial gunner training can be conducted by the unit when school trained gunners are not available. Unit personnel qualified as Javelin trainers must conduct this training. The course can be conducted on an as needed basis at battalion level and above to maintain qualified gunners. The course must be conducted IAW the Javelin POI as established by the USAIS. The unit must contact the Javelin course at USAIS for approval to conduct the JGC. USAIS will maintain oversight and monitor all non-resident Javelin courses.

NOTE: Units must provide the qualified instructors who have completed BNCOC and are certified to conduct initial gunner training to award the ASI of 2C, or who have completed the train-the-trainer program.

Section II. TRAIN THE TRAINER

The train-the-trainer program develops selected noncommissioned officers into competent trainers prepared to teach other soldiers how to become Javelin gunners.

3-3. TRAIN-THE-TRAINER PROGRAM

The Javelin gunner qualification program is described in detail in Section III. This program ensures the trainer can teach gunners how to apply the principles of Javelin gunner techniques using Javelin training devices. It allows the unit to develop and maintain a program by which the trainer can sustain individual gunner proficiency in the unit. The train-the trainer program teaches the trainer to:

- Plan training.
- Set up, operate, and maintain training equipment.
- Conduct training.
- Coach gunners on engagement skills.
- Evaluate the gunners' training weaknesses.
- Instill confidence among the gunners while training.
- Maintain training records.
- Qualify gunners on the GST.

a. **Initial Training**. The soldier designated to become a trainer completes the training device course (TDC). This course is designed to provide the trainer with the necessary expertise to train Javelin gunners. It is 40 hours of instruction and taught by the USAIS. The course consists of four modules:

(1) ***Module 1: Introduction to the TDC.*** This module covers the introduction to the TDC and includes the course orientation and applicable training materials. Reviewing this material gives the unit trainer an insight on how the course is laid out.

(2) ***Module 2: Introduction to the Javelin***. This module covers the operational capabilities of the Javelin, its major components, fields-of-views, and controls and indicators.

(3) ***Module 3: Basic Skills Trainer Operating Instructions***. This module covers the use and operation of the BST. The BST is the training device for developing the technical skills required to become a Javelin gunner.

(4) ***Module 4: Field Tactical Trainer Operating Instructions***. This module covers the use and operation of the FTT, which is crucial for developing the Javelin gunner's proficiency. It is the training device used for developing the skills required to engage targets under field conditions.

The trainer assists in conducting at least one initial gunner's course by teaching selected subjects the under supervision of an experienced trainer. The trainer teaches the coaches to assist fellow soldiers in learning and teaching the Javelin basic gunner skills.

b. **Sustainment Training**. After the trainer completes the initial gunner training and the TDC, he is the unit's primary trainer for the gunner's sustainment training program. The sustainment training for the trainer includes practicing the exercises in the BST annex and the FTT exercises. (See Table 3-1, page 3-12, for the required tasks.)

3-4. PROGRAM AUDIENCE

Train-the-trainer program has two target audiences: potential trainers and potential coaches.

a. **Trainers**. Trainers are noncommissioned officers who understand the Javelin and can teach others to become Javelin gunners and coaches. These soldiers are selected from the most highly qualified soldiers in the unit to display their knowledge of the Javelin and are motivated to conduct gunner training.

b. **Coaches**. Coaches are student trainers who assist other soldiers in learning basic Javelin gunnery skills. These soldiers are selected from unit gunners who possess the desire and ability to train other soldiers. Coaching provides the unit a two-fold benefit: (1) the coach learns the subject matter better because he explains it to others and, (2) the gunner gets one-on-one assistance.

3-5. STANDARDS FOR TRAINERS

Javelin instructors have to meet the same standards as Javelin gunners. Successful gunner experience is an asset, but it is not necessarily an indicator of a good instructor. Each instructor must have the confidence, willingness, knowledge, and skills required to train soldiers to be consistent and effective Javelin gunners in combat. Once selected, the instructors must have successfully completed the TDC, they must know the training objectives in this chapter, and they must become proficient in using the training equipment and the training materials. The unit commander periodically evaluates each trainer.

3-6. RESOURCE REQUIREMENTS

When preparing Javelin instructors, the unit trainer determines the number of gunners to be trained, time frame to conduct training, and resources required. The Javelin instructor guide (JIG) provides a checklist of training requirements at the beginning of each training module.

3-7. TRAINING SUPPORT PACKAGES

Javelin training support material is continually reviewed and updated by the Javelin training team at the US Army Infantry School at Fort Benning, Georgia. There are two sets of media packages for the Javelin: TDC and JGC media packages. These packages are designed for computers running Windows 95/98 and Microsoft PowerPoint presentation software, which incorporate sound and video into the presentations. The entire JGC is presented in the media packages. The instructor is provided the most up-to-date information available. The most current version of the training materials can be downloaded from the USAIS web site: (www:benning.army.mil)

3-8. TRAINING DEVICES

The Javelin weapon system includes three training devices: the BST, the FTT, and the MSR. Using the three training devices in combination and as part of a highly skilled Javelin gunner.

a. **Basic Skills Trainer**. The BST is a self-contained, computer-based, indoor training device. Its purpose is to train students and qualify gunners on the Javelin. The BST consists of two major assemblies: an IS and an SS (Figure 3-1). The IS is a personal computer (PC) equipped with special hardware and software, and the SS consists of a SCLU and an MSR. A cable links the SS with the IS for transfer of video, power, switch, and SS motion signals between the two.

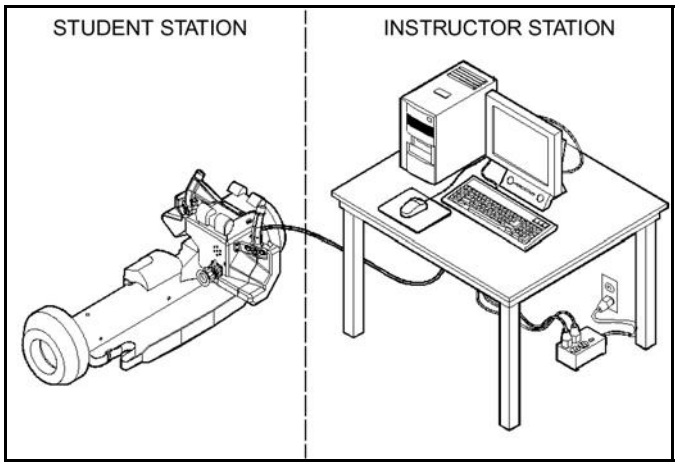


Figure 3-1. Basic skills trainer.

(1) ***Instructor Station Features***. The IS equipment centers around a desktop PC that provides means to install or upgrade software, create and save gunner training records, and monitor gunner performance during an exercise controlled by point-and-click mouse commands with means for entering and saving gunner training record data on a

3.5-inch disk. The IS allows the instructor to monitor the gunner's actions during the exercise. After the exercise is over, the monitor can be used to critique the gunner's performance by replaying the exercise.

(2) ***Training Exercises***. The BST contains training exercises for initial Javelin training and qualification with 2 retest exercises for each qualification exercise. The initial training and qualification exercises are stored in separate directories with expansion directories for sustainment and advanced gunnery training. Exercises contain terrain models, several three-dimensional target models, weather conditions (for example, clear, rain, snow, and so forth), run times (1 to 7 minutes), and malfunctions (for example, hangfire, misfire, and so forth) built into the BST. It is supported by the BST annex.

(3) ***Student Station***. The SS equipment simulates the physical and operational characteristics of the Javelin, including weight, point of balance, dimensions, hardware components, controls and indicators. It reproduces simulated battlefield imagery, visual indicators the gunner uses during target engagement, and operational sounds from a built-in speaker system.

(4) ***Simulated Imagery***. The computer-generated infrared and daylight imagery reflects the magnification and spectral capabilities of the Javelin. The BST training exercises use digital images of real terrain from actual visible light and infrared imagery. As the gunner works through an exercise, identical imagery is displayed on the instructor station.

(5) ***Instructor Station***. The IS allows the instructor to monitor the gunner’s actions during the exercise. After the exercise is over, the monitor can be used to critique the gunner’s performance by replaying the exercise.

(6) ***Simulated BCU Removal and Replacement***. The simulated BCU is fixed to the SR and cannot be removed during normal use. To remove and replace the BCU, the student explains what actions he would take to do so, and the instructor *removes and replaces* the BCU by an in-put at the IS.

b. **Field Tactical Trainer**. The FTT is a fully integrated, three-dimensional force-on-force training device. The FTT combines the Javelin CLU with a SR. The SR incorporates a MILES laser transmitter to allow simulated Javelin engagements during training exercises. The FTT is designed to simulate the operation and engagement parameters of the Javelin (Figure 3-2, page 3-6).

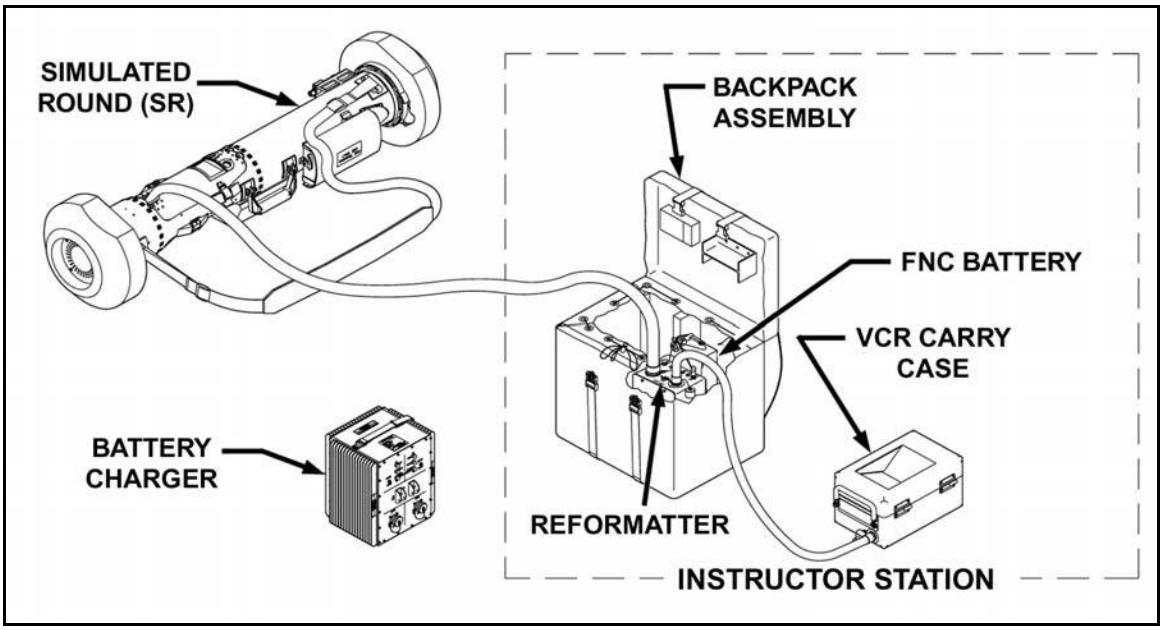


Figure 3-2. Field tactical trainer.

(1) ***Instructor Station***. The IS is a backpack assembly that contains a VCR, reformatter, and fiber-nickel cadmium (FNC) battery. The FTT with IS adds the capability of monitoring, recording, and reviewing gunner activities on 8-mm videotape.

NOTE: A Javelin CLU is required, but it is not a component supplied with the FTT.

(2) ***Command Launch Unit***. Interfaces with the SR through the SR interface connector and the W1 cable. The W1 cable provides an additional signal interface between the CLU and the SR.

(3) ***Simulated Round***. The SR is used to simulate the actual Javelin round and weighs slightly more (about 2 pounds). The SR simulates the Javelin seeker imagery by using the video from the NVS WFOV. The SR inserts crosshairs and track gates, then, it sends the image to the CLU display.

(4) ***Battery Charger***. Charges the FNC battery for use by the SR and IS.

(5) ***Batteries***. BB390 (*for training use only*) for the CLU. FNC battery powers the SR and IS.

c. **Missile Simulation Round**. The MSR is used to train gunners on how to handle, maintain, and carry the round. It consists of a simulated launch tube that contains no instruments or circuitry, but simulates the weight and balance of the live Javelin round.

3-9. BASIC SKILLS TRAINER SETUP OPERATIONS

The BST allows training gunners in a realistic training environment. This training is conducted indoors using computer-generated terrain and target vehicles. The Javelin instructor must have the following knowledge to use the BST effectively:

- Major components, equipment characteristics, capabilities, and features.
- Basic operation of the Javelin.

- Controls and indicators BST/CLU.
- How to prepare the BST for operation.
- How to conduct Daily Readiness Check procedures.
- How to prepare and maintain a Gunner Training Record.
- How to prepare and conduct a BST exercise.
- How to apply BST troubleshooting procedures.
- How to maintain a BST.
- How to prepare a BST for shipment or storage.

a. **Setup Requirements**. The BST is self-contained and comes in two transit cases. One transit case contains an IS and the other a SS. The IS transit case contains the Javelin BST setup instructions. The instructions explain in detail how to set up the BST and include a wiring diagram.

b. **Operations**. Once the IS is turned ON, the BST software icon is selected and the Javelin Main Menu window appears on the monitor. The instructor selects from the following directories:

- Daily readiness check.
- Exercise editor.
- Javelin training.
- IR training.
- Exit.

From this point on, the instructor can decide where he wants to go. The program is menu driven.

c. **Exercises**. There are pre-loaded exercises. Upgrades to the software will be provided periodically on Fort Benning's web page on the Javelin site at www.benning.army.mil. Instructions for downloading and upgrading may also be found on this site.

d. **Coaching Techniques**. The IS gives the coach the ability to ***see*** what the gunner sees. The trainer/coach watches the gunner work through the performance steps. The various exercises work toward one goal—a gunner who can engage enemy armor. The trainer/coach helps the gunner work through the various exercises to develop techniques to engage the enemy. During the entire engagement exercise, the BST records the engagements. This process allows the coach and gunner to review what just took place. The immediate feedback allows the gunner to see what happened and learn what he did right and what steps he needs to practice.

e. **Conduct BST Exercises**. The trainer/coach should understand and perform the tasks listed below.

(1) ***Place the BST into Operation***. The trainer/coach ensures the IS and SS are properly assembled and gives the gunner's briefing.

(2) ***Assume a Good Javelin Firing Position***. The trainer/coach checks the body position of the gunner to ensure he has assumed the best position possible and checks the backblast area. The Javelin is balanced so that the gunner does not have a hard time holding the Javelin steady, acquiring a target, and engaging it. If the position is awkward, the gunner gets tired quickly, making it more difficult for him to hold the Javelin steady. It also makes it more difficult for the gunner to activate the sight select button to begin firing.

(3) ***Adjust the Focus of the CLU Display***. The trainer/coach watches the gunner adjust the focus adjustment ring and ensures the adjustment compensates for the gunners' vision by asking the gunner to scan and identify targets.

(4) ***Brightness and Contrast Adjustments***. As the target scene changes, the brightness and contrast controls must be adjusted for changing conditions. The trainer/coach guides the gunner through making necessary changes.

(5) ***Scan the Sector of Fire***. The trainer/coach watches to see what field of view the gunner selects, what method of scanning he chooses (rapid, slow, or detailed, day or night) and makes notes for the AAR to show the gunner what field of view or scanning techniques the gunner could have used. The gunner is uses the WFOV for scanning.

(6) ***Target Detection***. The trainer/coach follows the gunner as he looks at his sector of fire to ensure the gunner covers the sector completely and detects any sounds or physical evidence that vehicles are near. The gunner uses the WFOV for detection of targets. For example, does the gunner hear any engine noises or see any vehicle exhaust or dust clouds? During limited visibility, the gunner looks for any light sources, such as a lit cigarette, headlights, or flashlights. During the day, the gunner looks for reflected light from shiny surfaces.

(7) ***Classification and Recognition***. Once the gunner detects a potential target, he classifies it as wheeled or tracked and recognizes it as either friendly or enemy. The gunner uses the NFOV for classification and recognition. The coach and gunner talk to each other during this process. For example, the coach asks the gunner questions like—what makes the target friendly or enemy? The gunner may have to identify the types of vehicles.

(8) ***Seeker Lock-on***. To achieve seeker lock-on, the gunner must be able to adjust the track gates (Chapter 4). The coach watches to see where the gunner places the track gates on the target. This adjustment is a critical step. The coach must see if the gunner gets a good lock on the target. The coach observes a smooth transition in locking on the target and follows the gunner during moving target engagements.

(9) ***Target Engagement***. Once the gunner achieves seeker lock-on, the gunner fires.

(10) ***Exercise Critique***. The critique provides feedback to the gunner concerning his performance during the exercise. There are several steps to the critique including providing the score computed by the BST, viewing a replay of the exercise, determining whether or not to override the exercise pass/fail status assigned by the BST. Critique by interpreting the system comments and provide an evaluation IAW paragraph 7 of the exercise summary sheet. Record comments in the instructor's comment area of the EXERCISE CRITIQUE window.

3-10. FIELD TACTICAL TRAINER SETUP OPERATIONS

The FTT allows gunner training to be conducted outdoors in a field environment with actual target vehicles or force on force. To use the FTT effectively, the Javelin trainer must know:

- Major components, equipment characteristics, capabilities, and features.
- Basic Javelin operation.
- Javelin and FTT controls and indicators.
- Preparing the FTT for operation.
- Programming an FTT using training exercise menus.

- Preparing the IS for use with an FTT.
- Conduct daily readiness check procedures.
- Preparing and maintaining a gunner training record.
- Preparing and conducting an FTT exercise.
- How to monitor, record, and playback gunner training.
- How to apply FTT troubleshooting procedures with or without an IS.
- How to maintain an FTT with the IS.
- How to prepare an FTT for shipment or storage.

a. **Setup Requirements Including Boresight Procedures**. See the Training Device Module 4—FTT Operating Instructions. It provides step-by-step instructions on how to set up the FTT and conduct boresight procedures.

b. **Operations**. See Training Device Module 4—FTT Operating Instructions.

c. **Exercises**. The goal of all Javelin training, including field training, is to train the gunner. The FTT training is conducted in the field. How it is executed varies based on the environment and assets at hand.

d. **Coaching Techniques**. The FTT instructor station has the ability to video capture the exercise. This allows the trainer/coach to observe the gunner's actions and record the engagement. The trainer/coach and gunner can review the exercise together and critique each engagement during the AAR.

3-11. GUNNER SKILL TEST EXECUTION

The GST evaluates the gunner's skills and is used to qualify Javelin gunners. It consists of a BST test, an FTT test, and a Javelin range card exercise conducted in any sequence. The GST manual describes what tasks are tested, what equipment is needed, and scoring criteria.

a. **Basic Skill Test**. The BST portion of the GST consists of a series of exercises used to evaluate the following gunner's skills:

- Assume a Javelin firing position and demonstrate how to engage a target.
- Replace a spent BCU.
- Apply Javelin misfire procedures.
- Engage two or more targets.
- Terminate an engagement.
- Re-engage a target after break-lock.
- React to a malfunction or warning indicator.

b. **Field Tactical Trainer**. The FTT portion of the GST consists of five stations. The following skills are evaluated:

- Apply FTT pre-operation.
- Assume a Javelin firing position.
- Apply target acquisition procedures.
- Engage a target.
- Engage two or more targets.
- Terminate an engagement.
- Re-engage a target after break-lock.
- Demonstrate the Javelin carry techniques using an FTT.
- Change missile mode, if necessary.

c. **Range Card**. The gunner is required to correctly fill out an antiarmor range card IAW the given information.

Section III. TRAIN THE GUNNER

The JGC is the base training for the Javelin gunner. The gunner learns the basic skills needed to engage and destroy enemy targets.

3-12. CONDUCT OF TRAINING

Training the gunner begins in the classroom learning the Javelin and its capabilities. The gunner then learns how to engage targets using the BST and reacts to warning indicators and malfunctions. The next step in training the gunner is how to operate the FTT. Using a combination of lecture, demonstration, and hands-on training, the trainer is able to teach the gunner how to become an effective Javelin gunner. The gunner is finally evaluated using a series of tests on the BST, FTT, and range card.

3-13. CENTRALIZED TRAINING

Centralized Javelin training is highly recommended. The decision to use centralized training depends on the available training resources. The unit commander must ensure uniform instruction. The unit METL drives planning and executing training.

a. **Equipment and Facilities**. Control of the BST and FTT should be centralized.

b. **Personnel**. A train-the-trainer program is developed to maintain a pool of trainers for a successful training program at unit level. At least one soldier at the company level should be trainer qualified.

c. **Time**. Until a train-the-trainer program has produced a sufficient number of trained soldiers, centralized training is conducted to save time and resources.

d. **Tasks**. When considering centralized training, the commander identifies the critical tasks required to achieve training objectives and support the unit METL. Tasks that are not critical are taught during individual or unit sustainment training. Centralized training establishes and maintains unit standards but should not replace or undermine the small unit leader. It should maximize the limited resources because the available number of training devices may limit the choice to centralized training.

3-14. PROGRAM EXECUTION

The gunner's training program is designed to be taught in 10 days. Many units may not be able to dedicate personnel and equipment assets for consecutive daily training. If this is the case, the schedule can be modified, but units must avoid reducing the content of any training period. Each POI is unique and plays an important part in the overall performance and understanding of the gunner. Units modifying the schedule should keep the time between training periods as short as possible. When a gap occurs between training events, a review of previous training must be planned at the start of the next training period. Negative results are achieved when the training schedule is shortened. Units must consider the following factors when deciding to modify (lengthen or split training periods/programs) their gunner qualification program:

- Quality of instruction must be maintained.
- Tasks must be taught in a logical sequence.
- Instructor continuity must be maintained.

Normally, the additional skill identifier (ASI) of 2C (Javelin Gunner) is awarded after training at the institution. However, initial gunner training can be conducted by the unit when school trained gunners are not available. Unit personnel qualified as Javelin trainers must conduct this training. The course can be conducted on an as needed basis at battalion level and above to maintain qualified gunners. The course must be conducted IAW the Javelin POI as established by the USAIS. The unit must contact the Javelin course at USAIS for approval to conduct the JGC. USAIS will maintain oversight and monitor all nonresident Javelin courses.

3-15. GUNNER QUALIFICATION PROGRAM

The Javelin gunner is qualified by a series of training events beginning with the JGC. The gunner passes the GST to successfully complete the JGC. In the unit, the GST is conducted quarterly. The gunner/trainer sustainment trainer supports the gunner's qualification program.

a. **Initial Gunner Training**. The initial gunner training develops the basic skills required to carry the Javelin, place it in operation, prepare proper fighting positions, scan for and acquire targets, and fire the Javelin. The degree of proficiency obtained and retained by the Javelin gunner depends on the foundation built during this phase. Correct firing and safety habits must become so ingrained that they become natural. The JGC consists of 80 hours of instruction and nine modules:

(1) ***Module 1: Introduction to the Course***. This module provides course orientation, training support requirements, course description, and schedule. This module is a short module and sets the tone for the upcoming training.

(2) ***Module 2: Introduction to the Javelin Weapons System***. This module provides information on Javelin capabilities, major components, controls, and indicators. The gunners need this information to understand the remainder of the gunner's training course (GTC).

(3) ***Module 3: Preparing, Restoring and Carrying the Javelin***. This module describes how to get the Javelin from one place to another, how to assemble it for use, how to assume a firing position, and how to disassemble it for movement and carrying.

(4) ***Module 4: Imaging Infrared and Target Acquisition***. This module provides an explanation of how the infrared imaging works and describes what the gunner can expect to see when using the Javelin infrared imaging system. It also explains how to scan, classify, and recognize targets.

(5) ***Module 5: Target Engageability***. This module provides information on how to prepare an antiarmor range card (Appendix B) and determines if a moving target is in range and engageable.

(6) ***Module 6: Target Engagement and Malfunctions***. This module provides information on how to engage targets with the Javelin, BST or FTT and how to react to a Javelin malfunction or warning indicator.

(7) ***Module 7: Field Tactical Trainer***. This module provides information on how to prepare, operate, and maintain the FTT.

(8) ***Module 8: Maintain a Javelin***. This module provides information on how to maintain the Javelin.

(9) ***Module 9: Gunner's Skill Test***. This module provides information on how to test gunner proficiency (go to www.benning.army.mil in the Javelin section and follow the directions to download).

b. **Basic Skills Trainer**. The BST is used to develop the gunner skills required to engage targets in a wide variety of situations. The BST is designed to train the gunner in simulated combat situations. The trainer can monitor actions performed by the gunner.

c. **Field Tactical Trainer**. The FTT is used with or without an instructor. The FTT is designed to be used with an IS, allowing the trainer to monitor the actions of the gunner. The gunner can use the FTT (without the IS) during force-on-force training, because of its MILES capabilities.

d. **Range card.** The gunner is required to complete a range card IAW Appendix B.

3-16. RESOURCE REQUIREMENTS

When preparing Javelin instructors, the unit trainer determines the number of gunners to be trained, time frame to conduct training, and resources required. The Javelin instructor guide (JIG) provides a checklist of training requirements at the beginning of each training module.

3-17. SUSTAINMENT TRAINING

The gunners' sustainment training is conducted monthly, quarterly, and annually. The frequency of training may be modified based on the gunner's ability to perform to standards. If a gunner consistently has trouble with a task required quarterly, consider changing that task to a monthly sustainment training program to increase the training frequency and enhance the gunner's ability to perform to standard. The matrix in Table 3-1 identifies the specific tasks and subjects that must be performed by all Javelin gunners and assistant gunners.

TASK	TRAINING FREQUENCY	TIME	REMARKS
Maintain a Javelin Medium Antitank Weapon	M	4 hrs	Practical Exercise MSR/CLU
Prepare a Javelin Medium Antitank Weapon for Firing	M^1	10 min	Practical Exercise MSR/CLU
Restore a Javelin Medium Antitank Weapon to Carrying Configuration	M^1	5 min	Practical Exercise MSR/CLU
Perform Long Distance Carry Technique	Q	2 hrs	CLU and MSR
Perform Malfunction Procedures on a Javelin Medium Antitank Weapon	M^1	15 min	Practical Exercise BST and FTT
Recognize Friendly and Threat Armored Vehicles and Aircraft	M	30 min	Practical Exercise BST
Explain How to Construct a Two-Man Fighting Position with a Javelin Firing Platform	A	NA	Perform as part of an ARTEP or FTX
Prepare an Antiarmor Range Card	M^2	30 min	Practical Exercise
Engage Targets with a Javelin Medium Antitank Weapon ITO—BST ITO—FTT	M/Q	4 hrs	Practical Exercise BST FTT
Explain Immediate decontamination and emergency destruction procedures	Q	30 min.	Perform during BST and FTT training
M = Every month **M^1** = 1st month (odd months) **M^2** = 2nd month (even months) **Q** = Quarterly **A** = Annual			

Table 3-1. Sustainment training matrix.

3-18. COLLECTIVE TRAINING

Collective training integrates the Javelin into the unit-training program and develops an antiarmor resource that the commander and the unit can use to augment their fighting capability. Individual tasks are integrated into collective training and rehearsals. To accomplish this, commanders analyze the collective tasks from their unit METL and the individual tasks supporting the collective tasks. The commander determines, which collective tasks must be practiced, by analyzing the mission outlines in the appropriate mission training plan (MTP). The mission outlines describe the collective tasks required to execute each ARTEP mission. Leaders determine which individual tasks support the collective tasks by referring to the collective task-to-individual task matrix in the appropriate MTP. Some considerations for planning collective tasks are as follows:

- How does a Javelin that is issued at the squad level affect training?
- Who do I assign as designated Javelin gunner?
- Does the Javelin gunner require an assistant gunner or an ammunition bearer?
- If a second round is issued to the gunner or squad, who carries it?
- If the designated Javelin gunner is injured or killed, who replaces him?
- Who else can be trained?

Table 3-2 includes some suggested collective training events.

SEQUENCE	FREQUENCY TIME/YEAR	HOW
Squad, Platoon or Company FTX	4	MILES
Battalion FTX	2	MILES
Platoon/Company Urban Operations Exercise	1	MILES
Gunner LFX	1	Live Round
Externally Evaluated Battalion MTP	1	MILES

Table 3-2. Collective training tasks.

CHAPTER 4
TACTICAL CONSIDERATIONS

This chapter discusses tactical considerations and limitations of Javelin employment during combat operations. To integrate the Javelin into tactics and techniques, the leadership from the company commander down to the squad leader must be familiar with field manuals (FM 7-5, FM 7-7, FM 7-7J, FM 7-8, or FM 7-10) appropriate to the organizations and to the organizational level. This chapter also discusses how to construct a Javelin fighting position, affording the gunner and assistant gunner/ammunition handler good cover and concealment while allowing for the best possible engagement of the enemy.

Section I. ROLE AND FUNDAMENTALS

The role of the Javelin is to destroy enemy armored vehicles out to 2,000 meters. The Javelin replaces the Dragon in selected Infantry, Armor, and Engineer units. Commanders may use the Javelin in various roles from supporting fire to conducting surveillance. Commanders must understand the Javelin's unique capabilities and limitations to enhance the units' combat power.

4-1. ROLE

The Javelin's primary role is to destroy enemy armored vehicles. When there is no armored vehicle threat, the Javelin can be employed in a secondary role of providing fire support against point targets such as bunkers and crew-served weapons positions. In addition, the Javelin CLU can be used alone as an aided vision device for reconnaissance, security operations, and surveillance. In mechanized Infantry units, when Bradley fighting vehicles (BFVs) are part of a combined-arms team with tanks, the Javelin becomes a secondary antiarmor weapons system. It supports the fires of tanks and TOWs, covers secondary armor avenues of approach, and provides observation posts with an antiarmor capability. The Javelin gunner should be able to engage up to three targets in 2 minutes making him very effective against any armor threat.

4-2. CAPABILITIES AND LIMITATIONS

The Javelin has some unique capabilities that provide the unit with an effective antiarmor weapon system. However, the commander should also understand the system's limitation in order to effectively employ this system.

a. **Firepower**.

(1) ***Capabilities***.

(a) The maximum effective range of the Javelin is 2,000 meters.

(b) The Javelin has a fire and forget capability. The missile imaging infrared (I2R) system gives the missile the ability to guide itself to the target when launched by the gunner.

(c) The Javelin has two missile flight paths:

- Top attack fight path is designed to impact on the top of the target.
- Direct attack flight path is designed to impact on the side (front, rear, flank) of the target.

(d) The Javelin gunner is capable of firing up to three missiles within 2 minutes.
(e) The dual-shaped charge warhead is capable of defeating any known enemy armor.
(f) The NVS sees little degradation of the target image.
(g) Countermeasures used by the enemy is countered by the NVS filter.
(2) ***Limitations***.
(a) The CLU sight cannot discriminate targets past 2,000 meters.
(b) The NVS cool down time is from 2.5 to 3.5 minutes.
(c) The seeker's cool-down time is about 10 seconds.
(d) The BCU life, once activated, is about 4 minutes.
(e) During limited visibility (natural or man-made), rain, snow, sleet, fog, haze, smoke, dust, and night are collectively referred to as limited visibility conditions. The day FOV can be rendered useless during these conditions.
(f) Night.

- The day FOV relies on daylight to provide the gunner a suitable target image.
- The NVS uses the infrared naturally emitted from objects. Infrared crossover is the time at dawn and dusk that the terrain and the target are close enough in temperature to cause the target to blend in with its surroundings.
- Natural clutter is when the sun heats objects to a close enough temperature that it causes the target to blend in with the surrounding terrain.
- Artificial clutter occurs when there are man-made objects that emit large amounts of infrared (for example, burning vehicles).
- Heavy fog reduces the capability of the gunner to detect and engage targets.

(g) The flight path of the missile is restricted in wooded, mountainous, and urban terrain.
(h) The gunner must have line of sight for the seeker to lock onto a target.
b. **Maneuver.**
(1) ***Capabilities***.
(a) The Javelin is man-portable.
(b) The fire and forget capability allows the gunner to shoot and move before missile impact.
(c) The soft launch capability of the Javelin allows it to be fired from inside buildings and bunkers.
(d) The Javelin is maneuverable over short distances for the gunners.
(2) ***Limitations***.
(a) The weight of the Javelin makes maneuvering slow over long distances.
(b) The Javelin round is bulky and restricts movement in heavily wooded or vegetative terrain.
c. **Protection**.
(1) ***Capabilities***.
(a) The passive infrared targeting system used to acquire lock-on cannot be detected.
(b) The launch motor produces a small signature.
(c) The fire and forget feature allows the gunner to take cover immediately after the missile is launched.
(2) ***Limitations***.
(a) The gunner must partially expose himself to engage the enemy.
(b) The CLU requires a line-of-sight to acquire targets.

4-3. FUNDAMENTALS OF EMPLOYMENT

The Javelin is employed based on mission, enemy, terrain (and weather), troops, time available and civil considerations (METT-TC). The Javelin's increased range and lethality gives the commander a greater effect on the battlefield. By applying the following fundamentals of antiarmor employment, the gunner and his leaders increase the probability of destroying enemy targets and enhances the survivability of the Javelin gunner.

a. **Standoff**. The gunner strives to engage armored and mechanized infantry vehicles in the 1,000- to 2,000-meter range. The Javelin size and small-launch signature are not easily detected at these distances, and the maximum effective range of most machine guns is about 1,000 meters. Engagement at ranges of less than 1,000 meters exposes the gunner to enemy direct fire weapons and lessens his survivability on the battlefield. By engaging the enemy whenever possible out to 2,000 meters, the enemy armor threat is forced to break formation. Mechanized infantry vehicles are forced to take cover and dismount the infantry. The result is a change in momentum of the battle for both defensive and offensive operations.

b. **Mutual Support**. The Javelin provides mutual support for the other antiarmor assets and for each other. Mutual support is established by employing the Javelin in sections and by overlapping sectors of fire between Javelins.

(1) ***Employing by Sections.*** Employment of Javelins by section establishes mutual support between gunners. If one gunner has engaged and is displacing, the other gunner can continue to cover the assigned sector. To achieve this, the Javelins are positioned so that fires directed at one Javelin do not suppress the other Javelins (Figure 4-1).

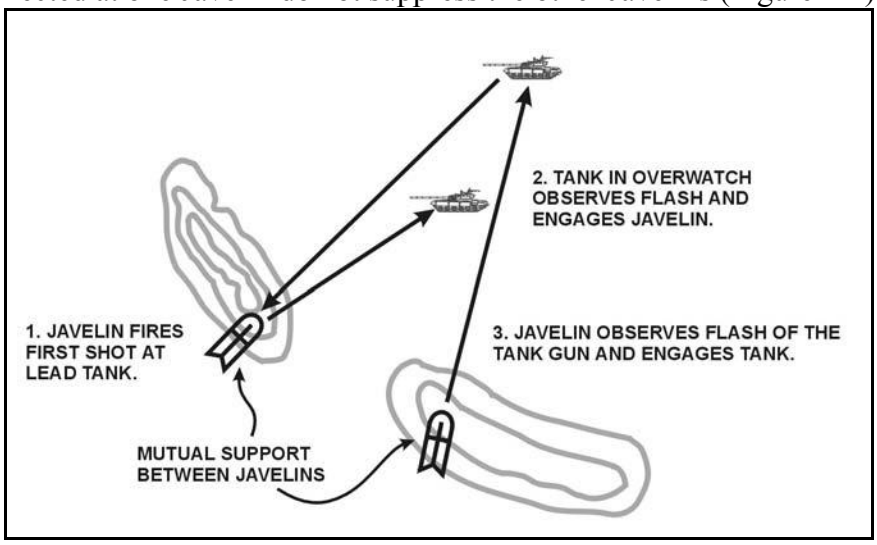


Figure 4-1. Mutual supporting fire.

(2) ***Overlapping Sectors of Fire.*** The gunners may overlap sectors of fire to maximize coverage (Figure 4-2). Overlapping sectors of fire are essential to mutual support.

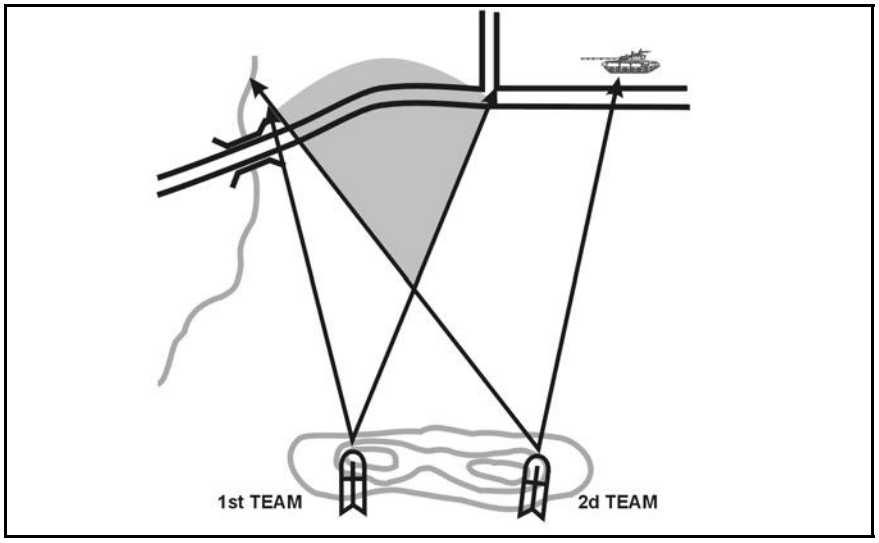


Figure 4-2. Overlapping sectors of fire.

c. **Security**. Antiarmor sections are vulnerable to attack by dismounted Infantry. To protect Javelin sections, position them near friendly Infantry units. The Infantry should be able to cover dismounted avenues of approach to the Javelin position.

d. **Flank Engagements**. The Javelin should be employed to engage enemy vehicles from the flank. Although the Javelin has the unique ability to use a top attack, the gunner should still seek to engage with flank shots.

e. **Cover and Concealment**. The Javelin gunners should use cover and concealment to increase their survivability. Cover is protection from the fire of enemy weapons and from enemy observation. It can be natural or man-made. Concealment is protection from enemy observation. Concealment includes not only camouflage but also light, noise, and movement discipline.

f. **Employ in Depth**. Javelin fire should be employed in depth. By employing the Javelins in depth in conjunction with integrated fires and obstacles, the commander prevents the enemy from easily engaging friendly antiarmor systems and slows and canalizes the enemy advance (Figure 4-3). This increases engagement times for all antiarmor systems and the probability of achieving a hit. Positions are selected to capitalize on the Javelin's 2,000-meter range.

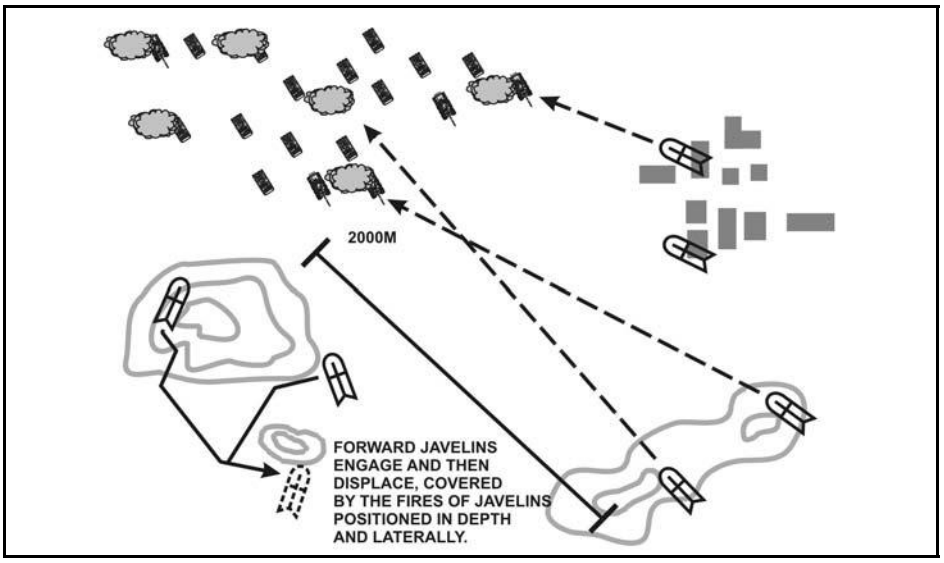


Figure 4-3. Javelins positioned in depth.

g. **Combined Arms**. Skillful integration of Infantry, Armor, Engineer, and indirect fire assets greatly improve the survivability and lethality of antiarmor units. The Javelin can be an integral antiarmor asset as part of the combined arms team.

Section II. DEFENSE

This section describes the Javelin in defensive operations, mechanized company defensive employment, defense in depth, and retrograde operations. The principle factors to consider when positioning the Javelin is gunner protection and optimizing the capabilities of the weapons system.

4-4. DEFENSIVE OPERATIONS

The Javelin is normally the antiarmor weapon system that supports a rifle squad or platoon. In some units these weapons are organic to the platoon. At times, the platoon may be supported by the TOW weapon system. During planning, the leader considers the enemy vehicle threat, then positions antiarmor weapons accordingly to cover armor avenues of approach. He also considers the fields of fire, tracking time, and minimum engagement distance of each weapon. The platoon leader selects a primary position and sector of fire for each antiarmor weapon. He also picks alternate and supplementary positions for them. Each position should allow flank fire and have cover and concealment. The leader should integrate the CLU into his limited visibility security and observation plan. If time permits, the gunner prepares range cards for his primary, alternate, and supplementary positions (Appendix B).

a. **Personnel Duties**. The tasks listed below must be performed to employ the Javelin in the defense successfully (Table 4-1).

TASKS TO BE PERFORMED	AA SECTION --------- SECTION SERGEANT	AA SECTION ---------- TEAM LEADER	GUNNER/ ASSISTANT GUNNER (if assigned)
Integrate Javelin into the Platoon Tactical Plan: • Select general weapons positions. • Assign sectors of fires. • Coordinate mutual support. • Coordinate with adjacent units.	 X X X X		
Reconnoiter For, and Select, Tentative Javelin Firing Positions (Primary, Alternate, and Supplementary) and Routes Between Positions.	X		
Supervise Continual Preparation and Improvement of Positions.	X	X	
Coordinate Security for the Javelin Teams.	X		
Inspect the Selection of Tentative Firing Positions, Confirm or Make Adjustments.	X	X	
Supervise Preparation of Javelin Range Card.	X	X	
Control Movement of Gunners Between Positions.	X	X	
Issue Fire Commands to Gunners.	X	X	
Coordinate Resupply and Collection of Extra Rounds Carried in Platoon.	X		
Identify Enemy Avenues of Approach.	X		
Prepare Fighting Position (Primary, Alternate, Supplementary		X	
Prepare Javelin Range Card.		X	X
Designate Target Reference Points.	X		
Prestock Javelin Rounds.		X	X
Prepare Round for Firing.			X
React to Fire Commands.			X
Engage Targets.			X

Table 4-1. Personnel duties.

b. **Gunner Placement**. The platoon leader selects the fighting position and assigns the sector of fire. Taking into consideration these simple rules will greatly improve the gunner's survivability.

(1) ***Natural Cover and Concealment***. The gunner uses the terrain to his advantage for cover and concealment from enemy ground and aerial observation.

(2) ***Flank or Rear Shots***. It is much more difficult for the enemy to retrace the flight path of a round to its launch site and orient their weapons on the Javelin firing position when the round moves obliquely across the enemy's front.

(3) ***Mutually Supporting Positions***. Javelins should be placed in mutually supporting positions to ensure continuous coverage of the engagement area (Figure 4-1).

(4) ***Integrate with Adjacent Units***. Javelin teams need to coordinate with adjacent units to ensure security.

(5) ***Engage at Maximum Range***. The Javelin's 2,000-meter maximum range makes it difficult for the enemy to engage the Javelin with direct fire. This forces the enemy to deploy earlier than intended. Because of the Javelin's range, it may need to be placed at the flank or rear of the platoon positions.

c. **Positions**. The three types of Javelin positions include primary, alternate and supplementary (Figure 4-4).

(1) ***Primary***. The primary position is one from which a gunner or team can cover the assigned sector of fire. It should have good observation, cover and concealment, and good fields of fire.

(2) ***Alternate***. The alternate position is one from which a gunner or team can either move to the flank or slightly to the rear of the primary position. The gunner or team must be able to cover the same sector of fire as from the primary position. The gunner moves to the alternate position when the primary position can no longer be occupied. The decision to change positions is made by the leader.

(3) ***Supplementary***. The supplementary position is one from which a gunner or team covers avenues of approach and any TRPs not covered by the primary and alternate positions. This position is usually close enough to the primary position to share mutual support with other positions. This position should also have good observation, cover and concealment, and good fields of fire.

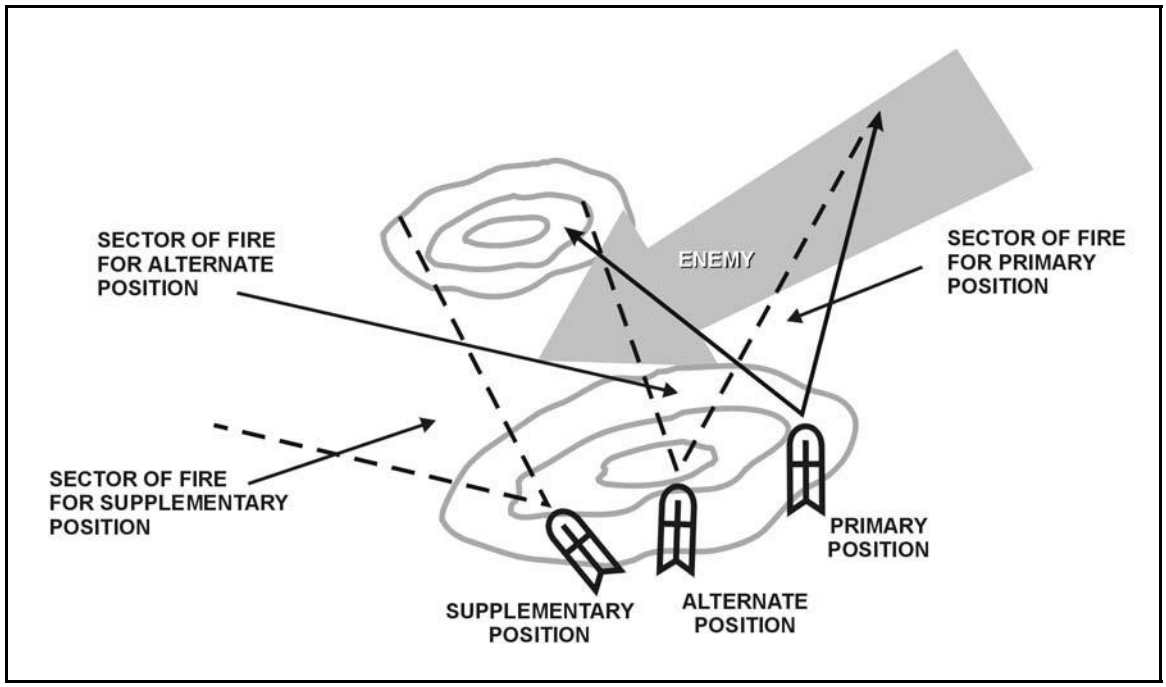


Figure 4-4. Primary, alternate, and supplementary positions.

4-5. MECHANIZED COMPANY DEFENSIVE EMPLOYMENT

Mechanized infantry companies (Heavy or Light) use the Javelin's range and lethality to complement the firepower of the BFV and Stryker Brigade Combat Team (SBCT). This technique creates a much more effective engagement, especially when the company is fighting without tanks. Without the Javelin, BFV-SBCT equipped infantry units have difficulty defending when the enemy attacks with both tanks and Infantry fighting vehicles (IFV). If the commander focuses his BFV fires on the tanks, the IFVs are free to maneuver close enough to engage with their weapons, dismount their infantry, and begin the assault. If the commander focuses all his fires on the IFVs, he risks letting the enemy tanks get close enough to engage his BFVs. The Javelin gives the mechanized company commander the ability to focus effective fires on both tanks and IFVs throughout his engagement area and to destroy enemy IFVs before they can close to assault range (Figure 4-5).

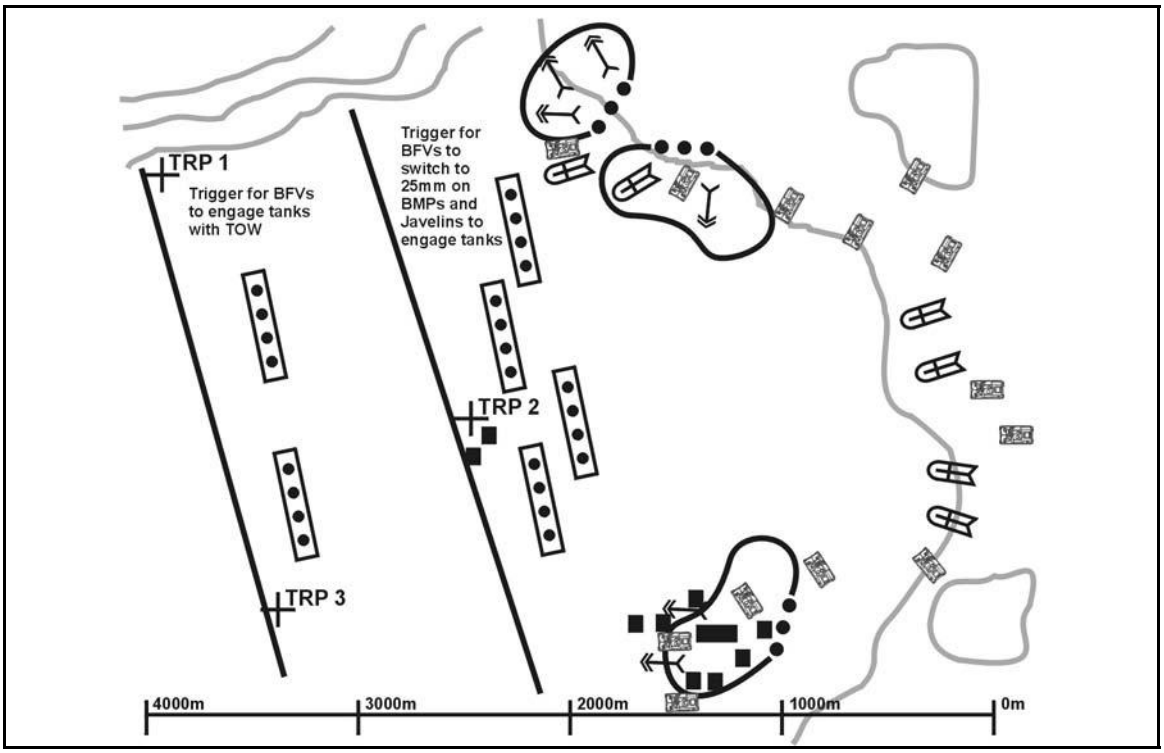


Figure 4-5. Javelin-equipped mechanized company defense.

4-6. DEFENSE IN DEPTH

In the defense, the Javelin team may participate as part of a screen. The Javelin team supports screen operations by assisting in:

- Maintaining continuous surveillance of avenues of approach using the CLU's night vision capability.
- Detecting enemy units and reporting their direction of movement.
- Destroying the pursuing enemy armored vehicles when forced to withdraw.
- Providing antiarmor fires to allow screening units to break contact and withdraw.

4-7. DELAYS AND WITHDRAWALS

Delays and withdrawals involve movement away from the enemy. Against an armored enemy, Javelins and other antiarmor weapons are often positioned so they can cover the movement of the entire force.

a. **Delay**. In a delay, the unit trades space for time without becoming decisively engaged, Javelin teams can be directed to set up antiarmor ambushes, to block avenues of approach, and to slow advancing armored vehicles.

b. **Withdrawal**. In a withdrawal, Javelin teams often overwatch and protect the force as it withdraws.

(1) ***Withdrawal Under Enemy Pressure***. Enemy pressure makes withdrawing more difficult than it would be otherwise (Figure 4-6). The platoon must employ fire and maneuver to fight its way away from the enemy. To ensure continuous antiarmor coverage, both covering and maneuvering elements must have Javelins.

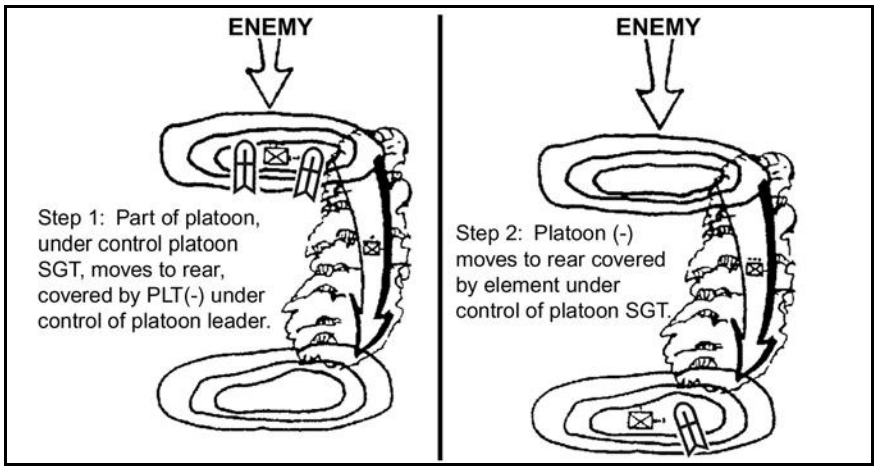


Figure 4-6. Withdrawal under enemy pressure.

(2) ***Withdrawal Not Under Enemy Pressure***. The company can withdraw with speed, secrecy and deception (Figure 4-7). Withdrawal is most effective during the hours of darkness or under limited visibility conditions. Withdrawal is usually conducted in mass. When required, the company leaves a security force to cover a withdrawal by deception and maneuver. The antiarmor section can be split with a portion of the Javelin gunners assigned to the security force and the remainder with the main body.

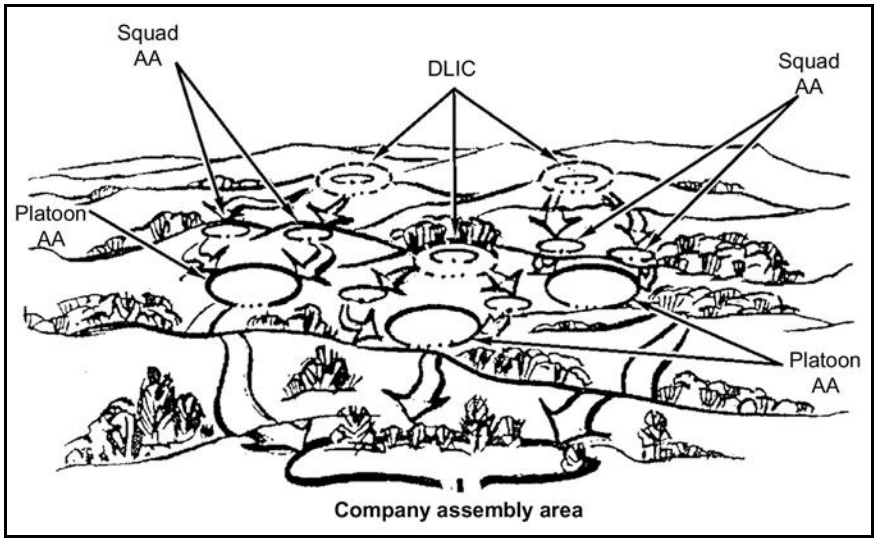


Figure 4-7. Withdrawal not under pressure.

Section III. FIGHTING POSITIONS

This section describes the different fighting positions the gunner uses. The gunner may use a hasty fighting position or a deliberate fighting position.

4-8. HASTY FIGHTING POSITION

A hasty position (Figure 4-8) is prepared when there is little or no time to prepare fighting positions. The gunner positions himself behind whatever cover is available. He digs out the position to use for quick emplacement of the weapons system. The gunner selects a position that allows him to observe and fire around the side of an object and not over the top while covering a sector of fire. The gunner looks for a location that affords him (and his assistant gunner, if assigned): cover, concealment, clear field of view, clear overhead path for the missile, and a clear backblast area.

a. The gunner digs out an area about one to one and a half M16A2s wide by one and a half M16A2s long and one Kevlar helmet deep. In most areas, it is not necessary to dig a backblast area because the two-stage motor provides a soft launch capability with a small backblast. The gunner looks behind his position for debris and clears it. The dirt removed during digging is placed to the front of the position to provide cover for the gunner.

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

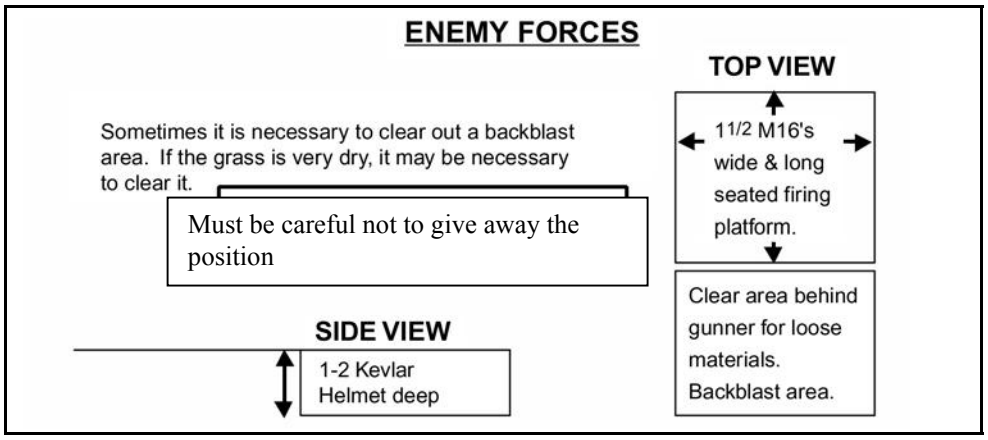


Figure 4-8. A hasty fighting position.

b. The hasty fighting position is constructed for expansion to afford the gunner and the assistant gunner/ammunition handler, if assigned, cover and concealment. This fighting position is based on the gunner firing from the sitting position, which is the preferred firing position. This position affords the gunner a low silhouette, and a steady and comfortable position while maintaining the ability to engage targets in his sector (Figure 4-9).

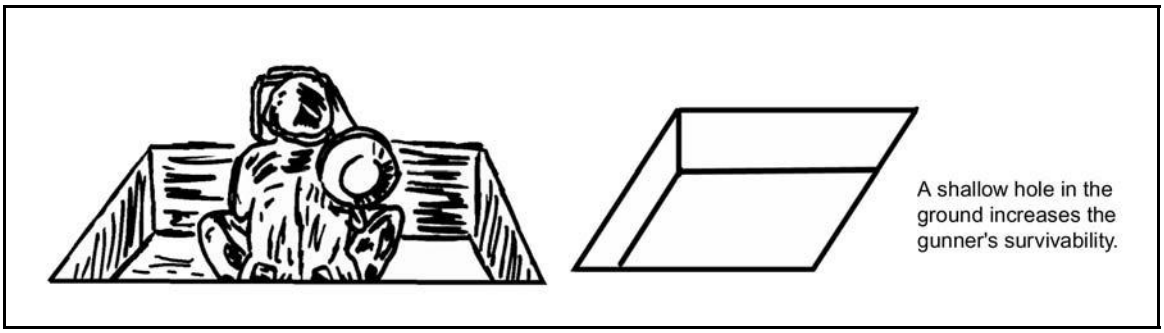


Figure 4-9. Hasty fighting position.

d. The gunner continues to improve the fighting position. The position expands to include cover and concealment for the assistant gunner/ammunition handler, if assigned. Once the fighting position begins to expand, then it becomes a ***firing platform for the deliberate fighting position*** (Figures 4-10 and 4-11).

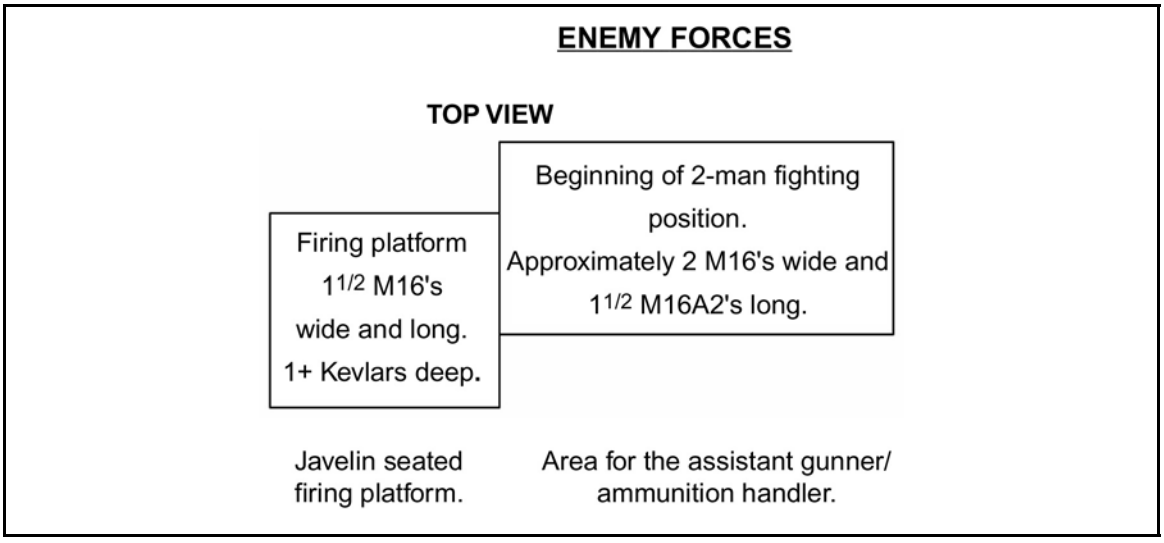


Figure 4-10. Improved hasty fighting position.

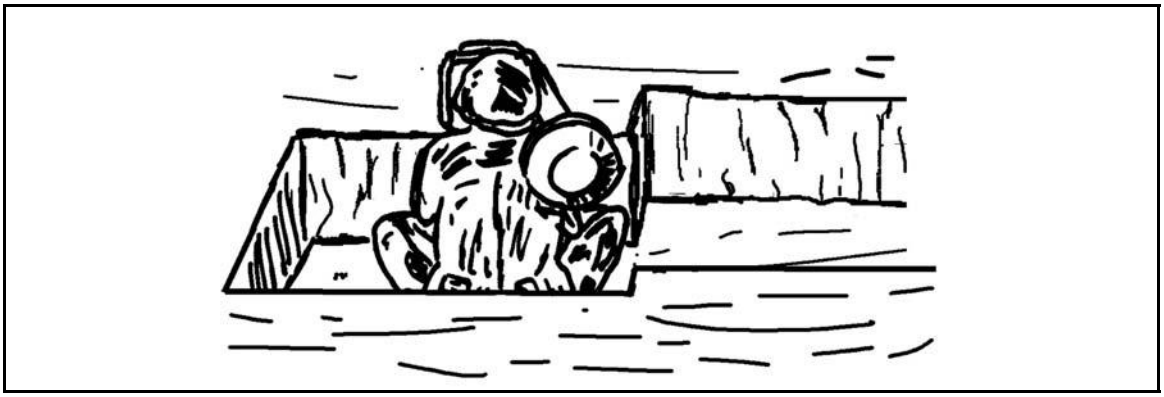


Figure 4-11. Expanded hasty fighting position (gunner sitting on the Javelin firing platform).

e. The gunner now has an expanded hasty fighting position that offers the minimum amount of cover and concealment to the gunner and the assistant gunner/ammunition handler, if assigned. This position is considered the basic fighting position for the Javelin.

4-9. DELIBERATE FIGHTING POSITION

The construction of a deliberate fighting position takes more time. The gunner constructs a two-man fighting position with the Javelin firing platform added to one or both sides, depending on the expected battle situation.

a. **Constructing the Fighting Position**. The gunner constructs the deliberate fighting position in the following sequence:

(1) Trace the outline of the fighting position on the ground.

(2) Check fields of fire. Get down on hands and knees and observe the sector. Make sure the sector is seen well enough to engage the enemy. If not, check for alternate positions and inform the squad leader.

(3) Place the Javelin in operation.

(4) Clear the field of fire, both overhead and ground, while ensuring the sector is under observation.

(5) Mark the outline for a complete fighting position on the ground.

(6) Dig the primary (left side) Javelin seated firing platform. Dig down about one Kevlar helmet deep by one and a half M16A2s wide and one M16A2 long. Use the dirt for the parapets.

(7) Move into the primary firing platform and cover the sector when METT-TC dictates.

(a) Build a parapet to the front and flanks of the position.

(b) Camouflage the front of the position. If possible, move out in front of the fighting position about 35 meters. Observe how well the camouflage is working. Camouflage maintenance is a continuous process. Ensure the position continues to blend into the background.

(c) Dig the standing area of the deliberate fighting position wider than the standard two-man fighting position making room for the Javelin round and the gunner's equipment.

(d) Decide if the secondary sitting firing platform is needed, then dig it. Use the dirt to build the right side parapet.

(e) Improve the position by adding overhead cover. The overhead cover should not restrict the gunner from firing the Javelin. The overhead should not cover the firing platform. This allows the missile to exit the LTA without obstruction.

(f) Improve the position by adding a storage/protective area. The size of this area depends on the space needed for equipment.

(g) Continue improvements as long as the position is occupied.

(h) Check the camouflage and replace them as necessary.

(i) Position camouflage nets, if used, so they do not hang in the backblast area. If any portion of the net is in the backblast area, it will damage the net and could collapse on the position when the missile is launched.

(8) The overall area needed for constructing a Javelin fighting position is about 3 feet (front to rear) by 5 feet (side by side) M16A2s. This includes the space required to

construct the front, sides, and back parapets. The depth of the fighting position depends on the height of the shortest soldier occupying the position.

(9) The standing area is about two M16A2s wide (from side-to-side) and about one and a half M16A2 rifles long (from front-to-rear) (Figure 4-12).

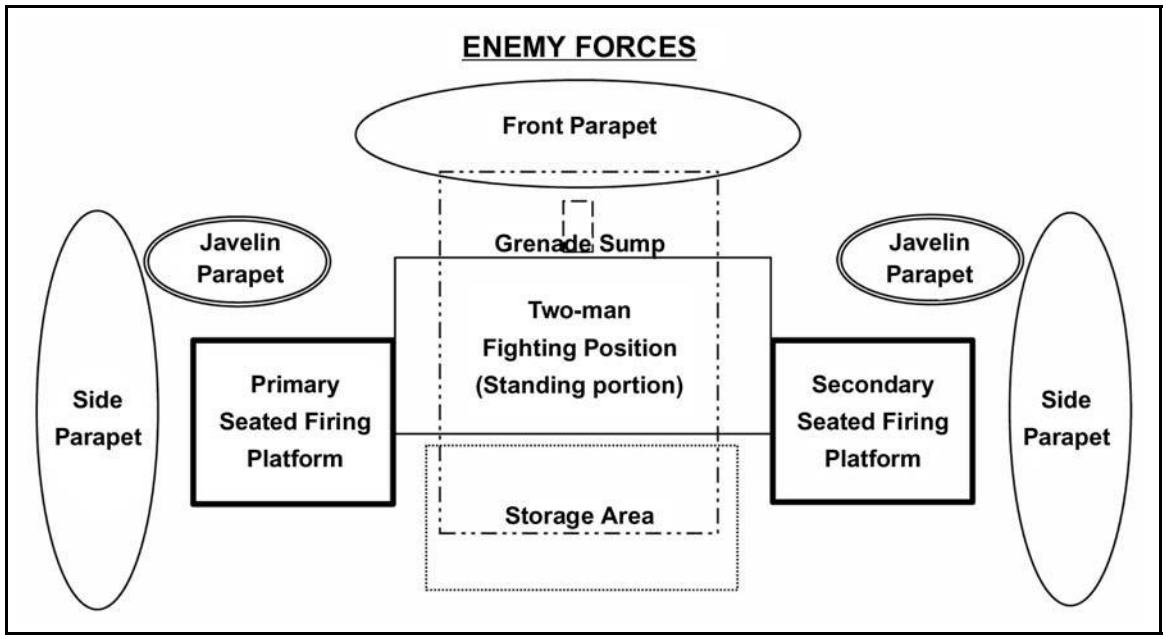


Figure 4-12. Deliberate fighting position.

LEGEND

- Javelin seated firing platform (1-1/2 M16A2s wide by 1 M16A2s long).
- Two-man fighting position (2 M16A2s wide by 1-1/2 M16A2s long).
- Parapet (minimum of 18 inches between you and the enemy and as high as necessary).
- Overhead cover (1-1/2 M16A2s wide by 1-1/2 to 2 M16A2s long) capable of supporting at least 18 inches of dirt.
- Storage area (depends on amount of equipment to be stored, to include extra Javelin rounds).
- Grenade sump (1 entrenching tool in diameter and the length of the entrenching tool deep).
- Backblast berm is about 1 Kevlar helmet thick and 18 inches high. The berm deflects the hot gases and debris up and out. This reduces the amount of clearing required.
- Javelin parapet, sand bags if available, should be used.

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

b. **Views**. The three views of Javelin fighting positions are illustrated in Figure 4-13 but refer to legend above.

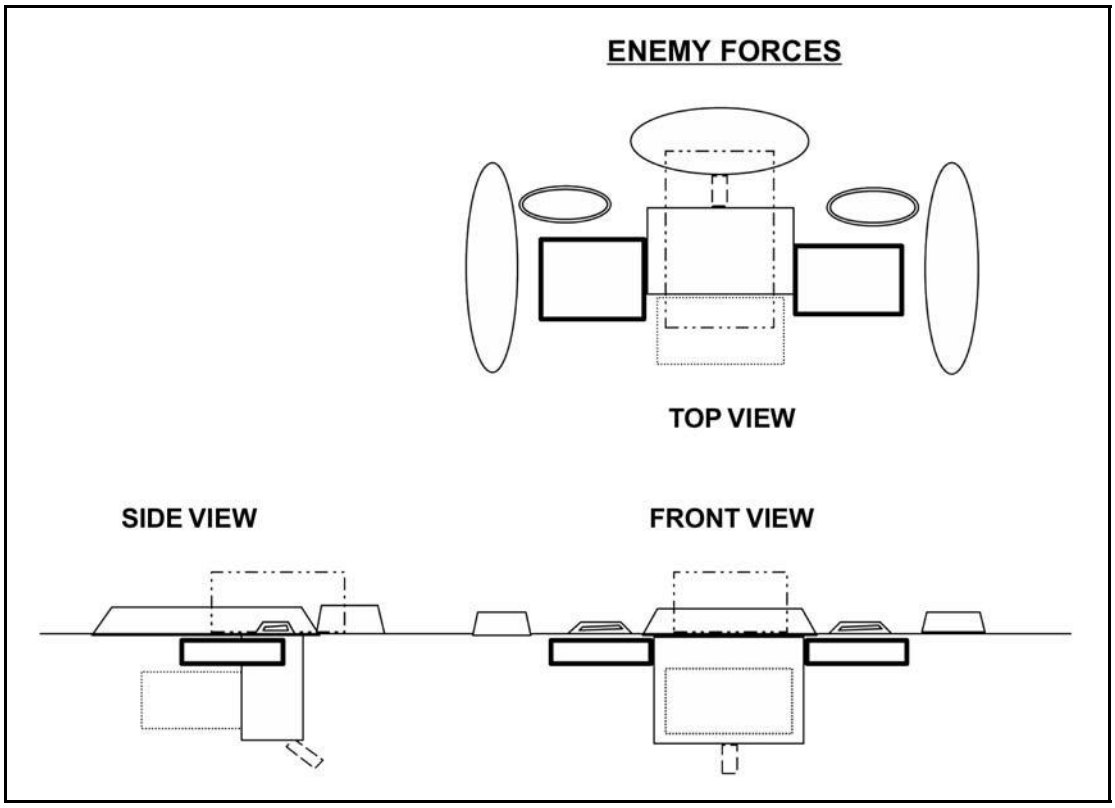


Figure 4-13. Completed deliberate fighting position.

c. **Built-up Javelin Fighting Position**. In a defensive position, with the help of the engineers and an abundant supply of Class IV materials, it is possible to construct a bunker-style fighting position. This position requires a lot of time and material.

(1) ***Front View*** (Figures 4-14 and 4-15). The front of the Javelin defensive fighting position provides considerable protection from small arms and indirect fire. However, the gunner is limited in his ability to engage targets.

(a) When this type position is constructed, it is imperative to examine the front of the position and consider how well the position blends into the background.

(b) When using vegetation, replace it when it begins to die. How long the vegetation remains green depends on the temperature. After the gunner has scanned the sector for any signs of the enemy, the assistant gunner/ammunition handler, if assigned, approaches the front of the position to check its concealment and makes the required improvements, then returns. The gunner continues surveillance until the assistant gunner/ammunition handler, if assigned, has returned to his position.



Figure 4-14. Sketch of the front view of a Javelin defensive fighting position.

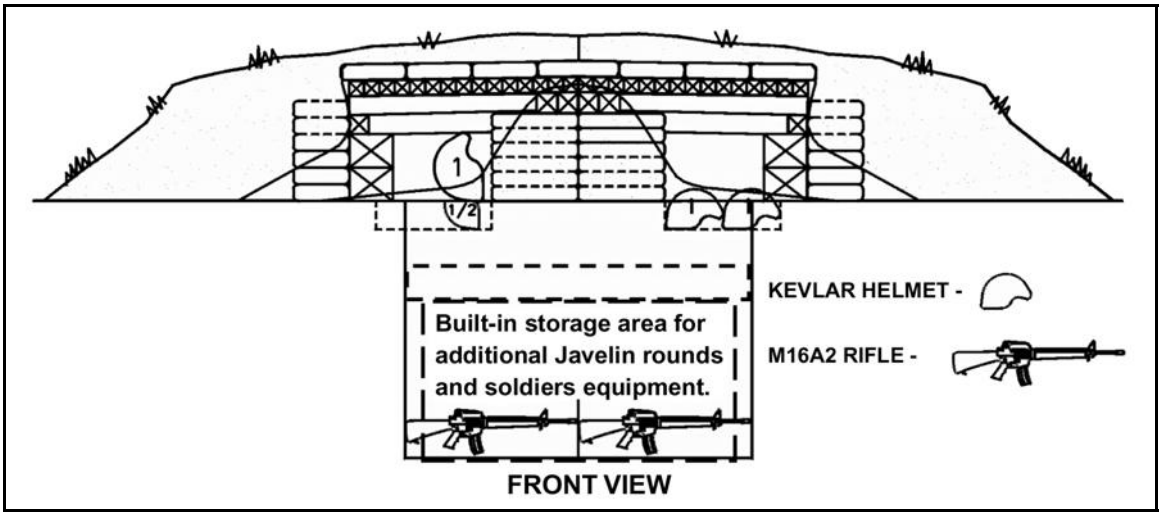


Figure 4-15. Front view of a Javelin defensive fighting position.

(2) ***Side View***. Figure 4-16, page 4-16, shows the side view of the Javelin defensive fighting position.

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

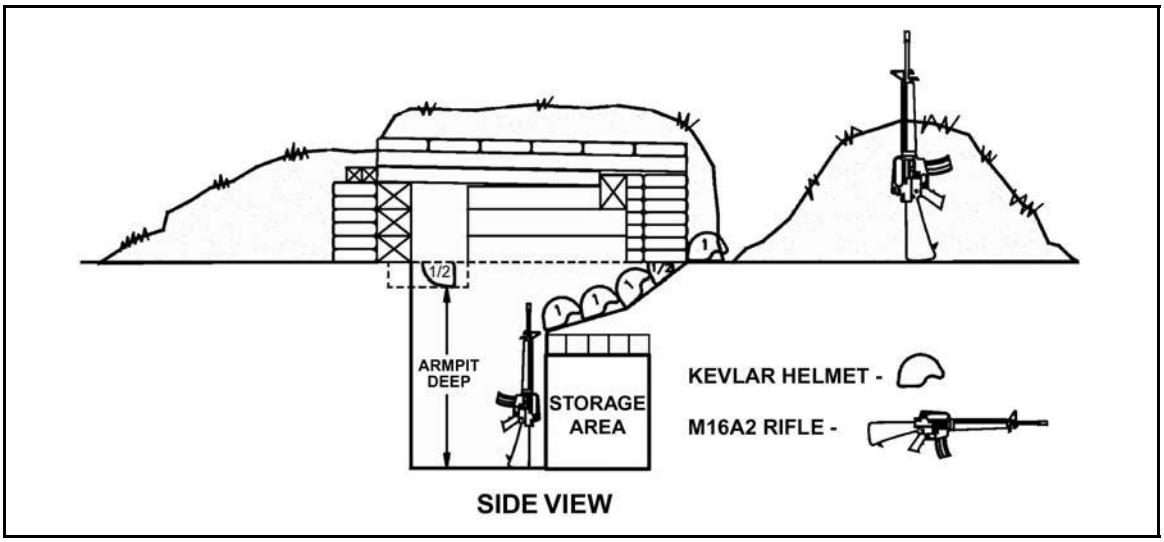


Figure 4-16. Side view of a Javelin defensive fighting position.

(3) ***Top View***. Figure 4-17 shows the top view of a Javelin defensive fighting position.

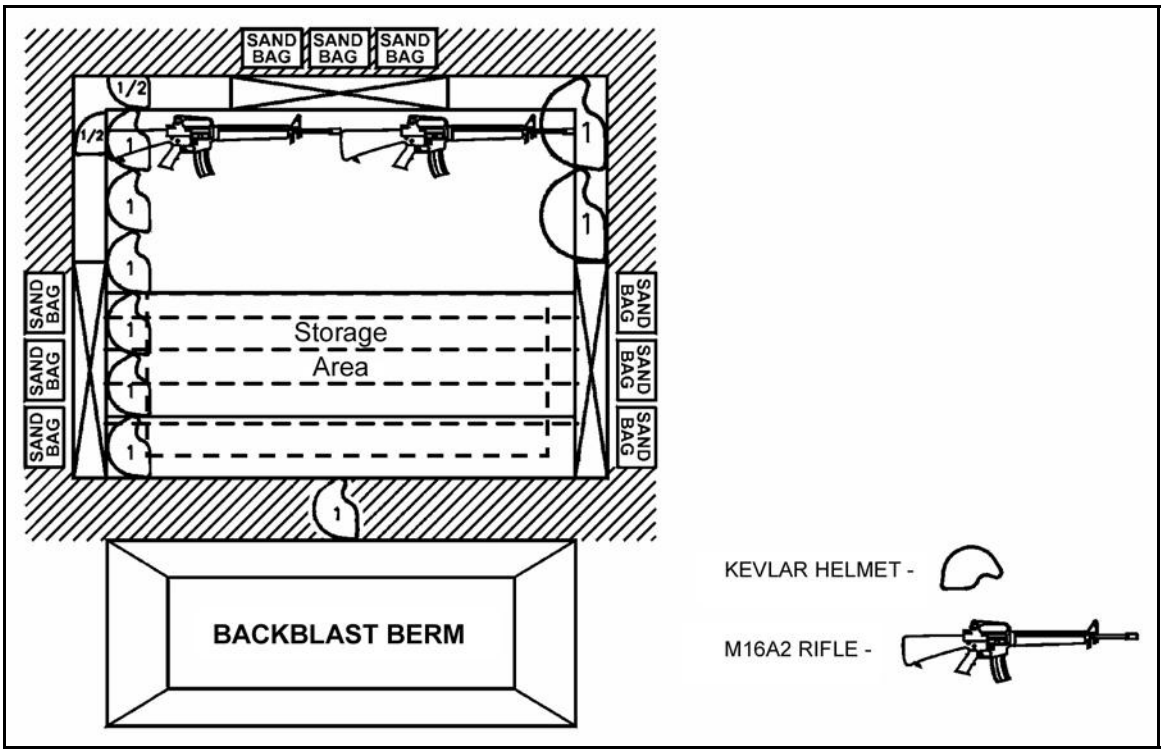


Figure 4-17. Top view of a Javelin defensive fighting position.

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

Section IV. OTHER TACTICAL OPERATIONS

This section describes how the Javelin contributes to offensive operations and the antiarmor ambush role. During stability and support operations, Javelins are not used in their typical roles.

4-10. OFFENSIVE OPERATIONS

The Javelin contributes to offensive operations by providing long-range fires that destroy enemy armor and protect the force from armored counterattacks. In the absence of armored targets, the Javelin can engage enemy fortifications and hovering helicopters. The Javelin is normally used in a support-by-fire role during offensive operations. The primary consideration for such employment is the availability of fields of fire and the armored threat. Javelin teams can, however, effectively protect flanks and the shoulder of penetrations against armored threats and can also provide overwatch for unit movement (Figure 4-18).

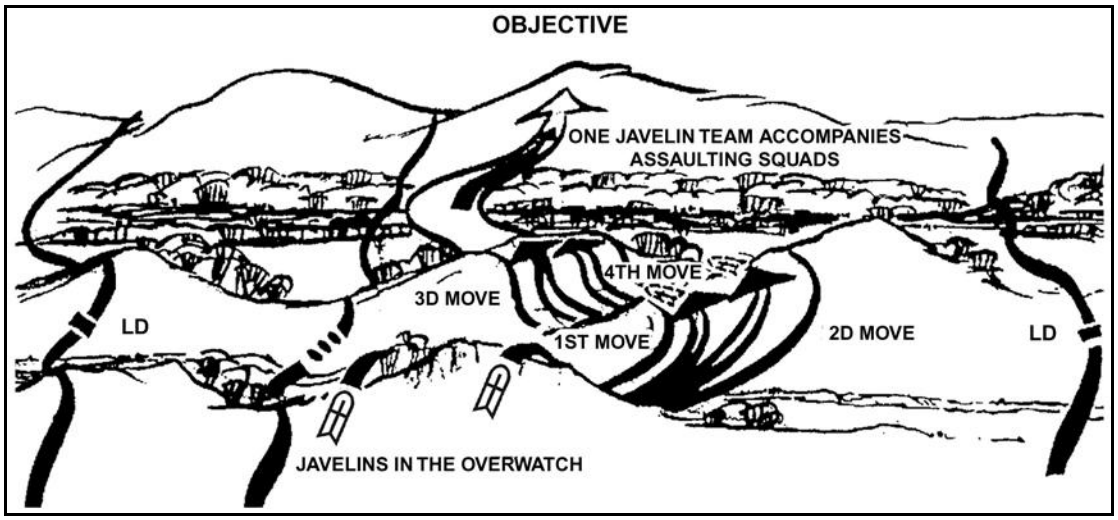


Figure 4-18. Javelin supporting offensive operations.

4-11. ANTIARMOR AMBUSH ROLE

Antiarmor ambushes are usually conducted to destroy small groups of armored vehicles, force the enemy to move more slowly and cautiously, or force the enemy into a choke point. Any unit conducting an antiarmor ambush can use Javelins for this purpose. The Javelin has a slow rate of fire, so other weapons systems must be prepared to engage the vehicles while the Javelin gunners attach the CLU to new rounds. The Javelin's 2,000-meter range allows flexibility in choosing ambush positions. In addition to fires into the kill zones, the Javelin can be employed in a security role to guard high-speed avenues of approach, to slow or stop enemy reinforcements, or to destroy vehicles attempting to flee the kill zone (Figure 4-19, page 4-18).

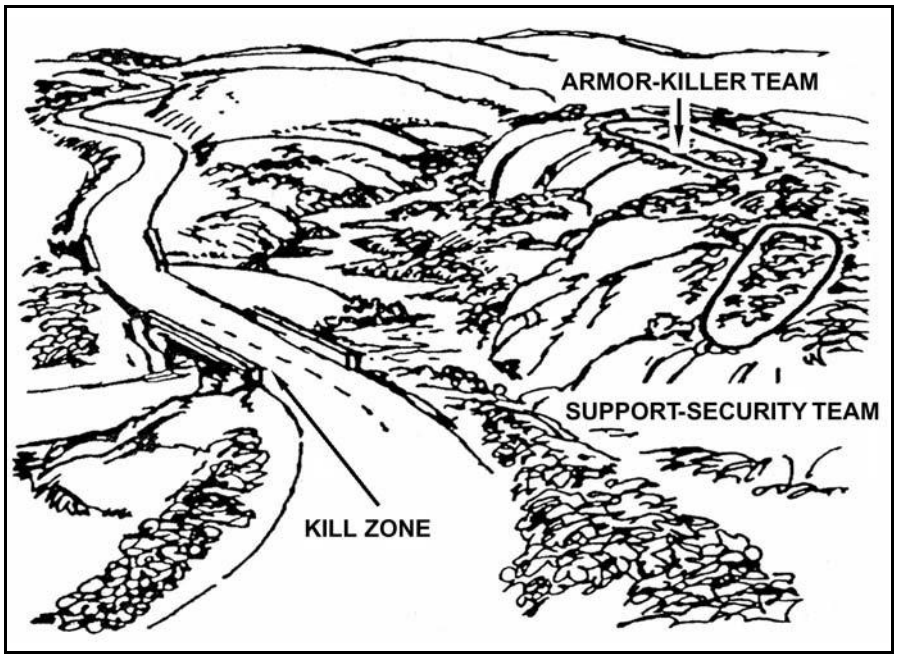


Figure 4-19. Antiarmor ambush.

4-12. STABILITY AND SUPPORT OPERATIONS

During stability operations, Javelin gunners may be used against an armored threat if one exists. If there is no armored threat, the Javelin gunner can expect to provide a surveillance capability. The IR sight is especially useful. In the case of roadblocks, Javelin gunners provide protection against vehicles that attempt to *run* the roadblock. To be effective in this task, the gunner needs to be able to position himself where he has an unimpeded view of the approaches to the roadblock. The gunner must clearly understand the rules of engagement (ROE) to know when he is authorized to engage targets, which may be at minimum range. The observation capability of the Javelin's sight may be useful during support operations, but it is not likely that a missile will ever be fired.

4-13. URBAN COMBAT

The Javelin is primarily used to defeat main battle tanks and other armored combat vehicles. It has a moderate capability against bunkers, buildings, and other fortified targets commonly found during combat in built-up areas. Javelin teams provide overwatching antitank fires during the attack of a built-up area. Within built-up areas, they are best employed along major thoroughfares and from the upper floors of buildings or roofs to attain long-range fields of fire. The minimum engagement distance limits firing opportunities in the confines of densely built-up areas, and the Javelin may not be the weapon of choice in the urban environment (FM 3-06.11 [FM 90-10-1]) where there are additional considerations including: fires (caused by both friendly and enemy) may cause target acquisition and lock-on problems; clutter on the battlefield may cause lock-on problems; and, line-of-sight communications may be limited by the structures.

a. **Obstacles**. The Javelin's unique flight path forces the gunner to think in three dimensions. The urban environment has overhead obstacles such as street signs, light poles, and wires, which could impede the missile's flight path.

b. **Engagement Considerations**. The Javelin's three distinct engagement considerations are: engagement distance, crossover, and time.

(1) ***Engagement Distance***. The Javelin missile has a minimum engagement distance (150 meters in the attack mode and 65 meters in the direct attack mode), which limits its use in built-up areas. Few areas in the inner city permit the gunner to fire much beyond the minimum arming distance. The gunner is usually limited to firing down streets, rail lines, parks, or plazas. The Javelin can effectively fire from upper level stories or roofs of buildings into other buildings.

(2) ***Crossover***. *S*ometimes the seeker will not be able to distinguish between the background and the target because the two have the same temperature (crossover).

(3) ***Time***. When a gunner comes across a target of opportunity, he may not be able to take advantage of it. The cool down time of the NVS is 2.5 to 3.5 minutes. Seeker cool down takes about 10 seconds. Once the BCU is activated, the gunner has a maximum of 4 minutes to engage the target before the BCU is spent. Vehicles crossing the street or moving between buildings (flank shot) are exposed for about 10 to 15 seconds, meaning the gunner may not have enough time to lock-on to the target and fire.

c. **Backblast**. The soft launch capability enables the gunner to fire from inside buildings because there is little overpressure or flying debris. Anyone in the enclosure should wear a helmet, protective vest, ballistic eye protection, and hearing protection.

d. **Weapon Penetration**. The dual charge warhead penetrates typical urban targets. The direct attack mode is selected when engaging targets in a building. Enemy positions or bunkers in the open closer than 150 meters are engaged using the direct attack mode. Positions in the open farther than 150 meters are engaged using either the top or direct attack mode depending on the situation.

e. **Breaching Structural Walls**. The Javelin is not effective when breaching structural walls. The antitank guided missiles (ATGMs) are not designed to breach structural walls effectively. All ATGMs, to include the Javelin, are designed to produce a small hole, penetrate armor, and deliver the explosive charge. Breaching calls for the creation of a large hole. ATGMs are better used against armored vehicles or for the destruction of enemy-fortified fighting positions.

Section V. TARGET ENGAGEMENT TECHNIQUES

Target acquisition is essential for a gunner to be effective on the battlefield. Target acquisition is a four-step process: target detection, target classification, target recognition, and target identification. Target acquisition begins with detection; the gunner uses his senses in conjunction with the CLU to detect targets. Using the CLU to aid in the detection, classification, recognition and identification of the enemy target only enhances the gunner's usage as a valuable tool for the unit. The gunner learns to use different fields of view in scanning for targets.

4-14. TARGET DETECTION

The gunner should listen for the sounds that will alert him to the enemy's presence, it may not pinpoint the exact location but it will alert him. The gunner can see vehicles

moving by dust trails. The gunner's best method of detection is with his eyes. He can also use binoculars, his scope, his night vision sight, and even the command launch unit to aid him in detecting targets. When scanning his sector of fire, the gunner should look for the most likely areas a vehicle may be positioned or approaching from. Look for dust or vehicle exhaust. Look for enemy vehicle movements along high-speed avenues of approach. As a vehicle moves over a terrain feature it may cause what is known as a "flash" this is the thermal signature may be visible for a fraction of a second after the vehicle has moved out of sight. Look for unnatural shapes and shadows. During the daytime, light often reflects off equipment and in the dark, the enemy may not practice good light discipline making them observable by the naked eye allowing the gunner to detect targets quickly and begin the target engagement process. The gunner determines target engageability by changing the fields of view.

a. **Target Images.** There are some differences in the way a target appears in each field of view. (Figure 4-20)

(1) ***Day FOV***: full-color visible light image, 4x magnification of target.

(2) ***WFOV***: black-and-green infrared image, 4x magnification of target.

(3) ***NFOV***: black-and-green infrared image, 9x magnification of target.

(4) ***Seeker FOV***: black-and-green infrared image, 9x magnification of target.

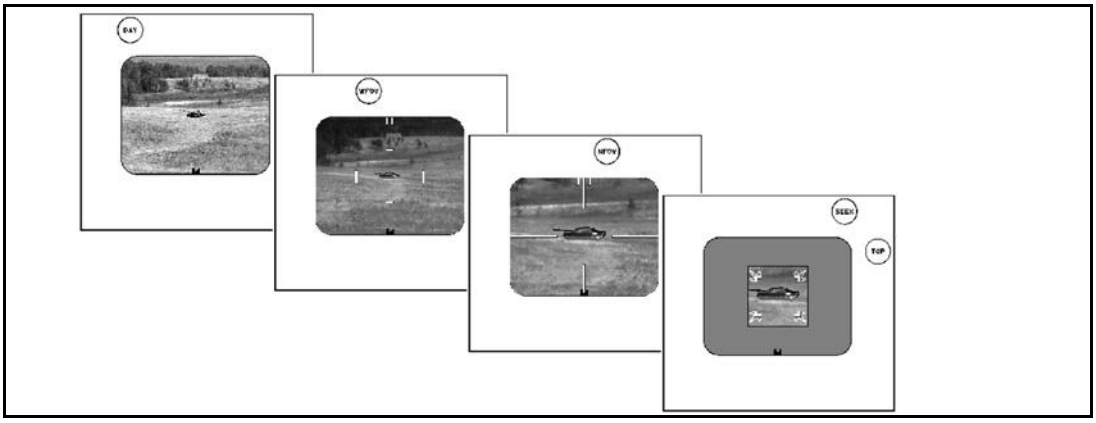


Figure 4-20. Fields of view.

b. **Fields of View**. The day field of view is used during daylight hours to conduct surveillance and target detection. The night vision sight has two fields of view, the wide field of view (WFOV) and the narrow field of view (NFOV) that present a black-and-green image of the terrain and targets. The missile has a field of view (seeker FOV) and is used for target engagement and is available to the gunner once the seeker has been activated. Cold areas appear dark green or black, and hot areas light green. The gunner adjusts the contrast and brightness controls and the focus to better locate enemy targets.

(1) ***WFOV***: Is used as the primary scanning field of view for surveillance and target detection.

(2) ***NFOV***: Is used for target classification, recognition and identification. This field of view has a limited use for target detection and is not used for scanning because of its small area.

(3) ***Seeker FOV***: Is the view that the missile has of the target. Is used to lock the track gates onto the target.

c. **Scan for Targets**. The gunner must scan his sector of fire or area of surveillance at all times for the enemy. The scanning techniques that help to detect targets quickly are rapid scan, slow scan, and detailed search. The gunner observes the following procedures in all three techniques to scan for targets effectively (Figure 4-21). The gunner:

- Scans the entire sector of fire or area of surveillance using WFOV of the CLU.
- Scans in a consistent pattern, slowly and evenly.
- Pays special attention to those positions in which a target would most likely appear, for example, avenues of approach
- Identifies the location of objects, such as trees, roads, buildings, and any man-made infrared signatures.

(1) ***Rapid Scan***. The rapid scan method is used to detect obvious signs of enemy activity. This type of scan is used when first occupying a fighting position. (Figure 4-23). The gunner:

(a) Divides the target area into sections. Uses TRPs or easily recognizable terrain features to divide the area.

(b) Adjusts the brightness of the CLU display so that *the hot spots* (bright green when viewed through the CLU display) standout in the CLU display.

(c) Starts from the gunner's position, scans out to either the left or the right to the farthest point of the gunner's sector and back across the sector to the other side.

(d) Stops and uses the detailed search technique, if the gunner suspects he has spotted a target during the rapid scan.

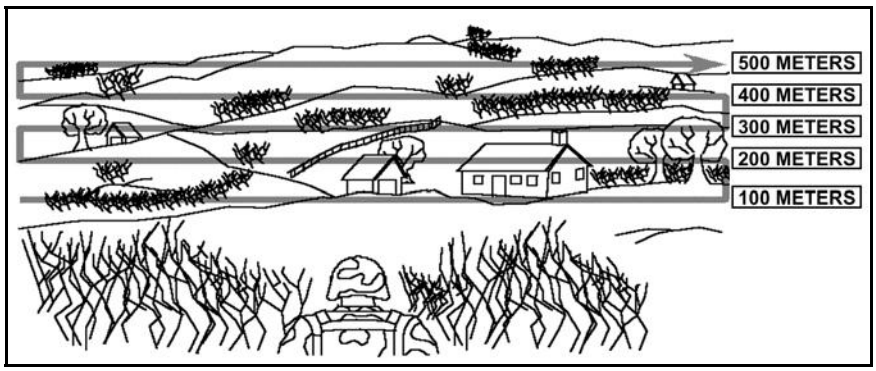


Figure 4-21. Slow/rapid scan.

(2) ***Slow Scan***. If there are no targets detected during the rapid scan, the gunner conducts a slow scan of the sector (Figure 4-21).

(a) Starts from the gunner's position and begins a slow scan of the sector from left to right in short intervals 50 to 100 meters deep, until a scan of the sector is completely covered.

(b) Conducts a more detailed search if a target is detected.

(3) ***Detailed Search***. The detailed search is used when targets are either detected, or other techniques have been used and it has resulted in no enemy activity found. The gunner uses the NFOV to search specific areas of the sector. If a target is detected, the

gunner uses the NFOV to further recognize, classify and identify the target. (Figure 4-22) The gunner:

(a) Concentrates on specific areas that are more likely for targets to be hiding or likely avenues of approach.

(b) Looks for signs that the enemy may have been in the area by looking for tracks and any other signs of enemy activity.

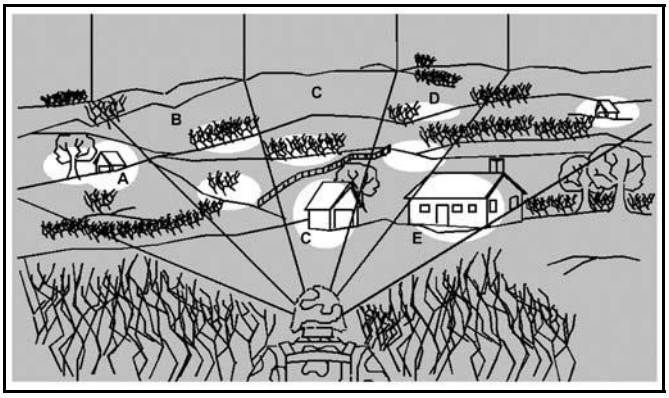


Figure 4-22. Detailed search.

(2) ***Moving Targets***. Moving targets are easier to spot when scanning a sector because movement catches the eye's attention. Moving vehicles also leave signatures that are easily detected by the NVS of the CLU. The following considerations will help gunners detect moving targets.

- Track vehicles leave a distinct pattern on the ground caused by the friction from the tracks in contact with the ground.
- Exhaust plumes are easily seen when the vehicles are moving through low lying areas.
- An IR flash can be seen immediately following a vehicle that moves behind cover.

(5) ***Stationary Targets***. These targets are more difficult to detect than moving targets due to camouflage or its cold status. Targets that have been sitting for long periods of time may appear to blend in with the remainder of the surroundings. However, tanks and other vehicles are started periodically to ensure they remain combat ready. This procedure heats up the vehicle, exhaust, and engine areas.

(a) *Hot, stationary targets*. Tanks, armored personnel carriers (APCs) and other vehicles either remain running for long periods of time or are started to keep their batteries from running low and to keep their electronics operational. These targets have a hot signature when compared to its surroundings. The gunner easily detects these targets when using the CLU (Figure 4-23).

- *Suspension system*. Tracks, wheels and road wheels heat up during movement. It provides a hotter signature than the hull and makes detection easier.
- *Engine compartment*. Once stopped, the vehicle continues to give off a hot signature for several hours. The engine takes longer to cool off than the remainder of the vehicle.

- *Exhaust*. Vehicles are started periodically to charge its engines. The vehicle's exhaust takes time to cool down after being operated.
- *Gun tube*. If the vehicle has been involved in firing, its gun tube gives off a heat signature that will aid in classification.

(b) *Cold, stationary targets.* After a vehicle has been sitting for a long period of time, without the engine or electronics being operated, it appears as darker green or black against the surrounding area. When using the CLU in the night vision mode (WFOV or NFOV), the target is detected based on its appearance in relation to the surrounding objects or Delta-T.

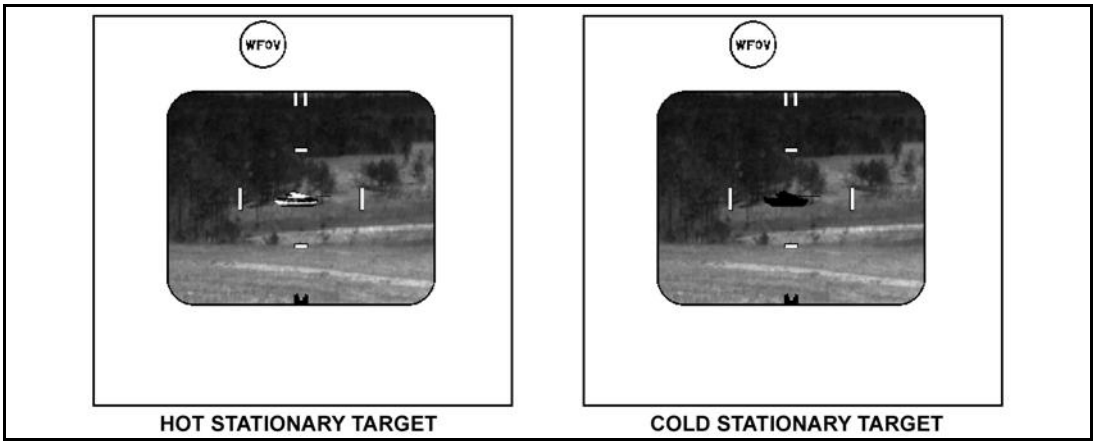


Figure 4-23. Stationary targets.

4-15. TARGET CLASSIFICATION

Once a target is detected, the gunner must classify the target as either a wheeled or tracked vehicle (Figure 4-24, page 4-24). Different parts of the vehicle give off heat signatures making the classification of a vehicle easier. When viewed through the NVS (WFOV or NFOV), a vehicle's wheels or suspension system quickly heats up.

a. **Wheeled Vehicles**. The hubs of wheeled vehicles heat up along with the tires, giving it a distinct heat signature. Based on the vehicles configuration of axles, there may be two or more distinctive round heat signatures just below the hull or body. The engine compartments are normally located at the front of the vehicle. Some wheeled vehicles do not have a gun tube; if it does, the gun tubes are usually small and harder to spot.

b. **Tracked Vehicles**. The suspension system has road wheels that heat up during movement, usually five to seven road wheels based on the type of vehicle. The engine compartment is usually located in the rear on tanks and the front on armored personnel carriers. These signatures are usually hotter for a longer period of time than the remainder of the vehicle. The gun tube when fired heats up and makes classification of the vehicle easier.

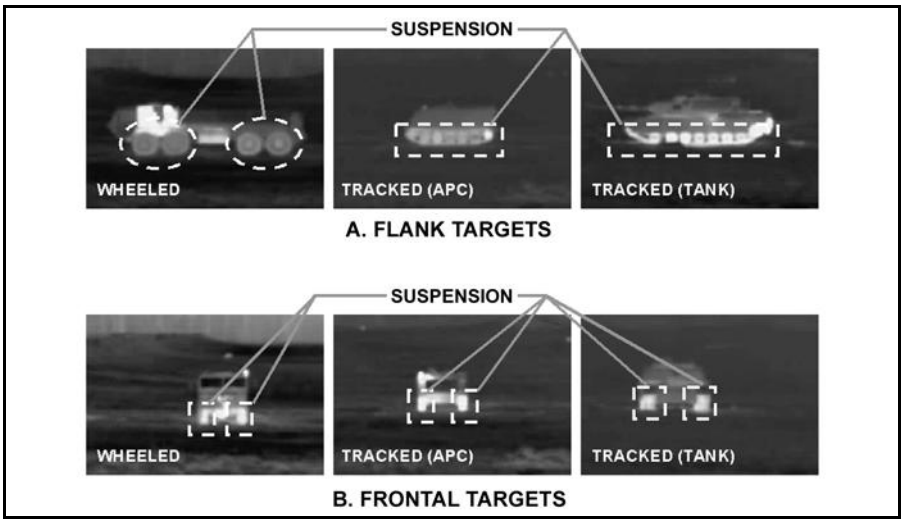


Figure 4-24. Target classification features.

4-16. TARGET RECOGNITION

After a gunner classifies a target as a wheeled or track vehicle, the gunner then determines whether a target is a tank or an APC. Some of the same techniques used to classify a vehicle are used to recognize the vehicle.

a. **Tanks**. The characteristics of a tank make this vehicle stand out from others. The large gun tube, the five to seven road wheels, and the engine compartment being in the rear of the vehicle, all make this easily recognizable as a tank. (Figure 4-25)

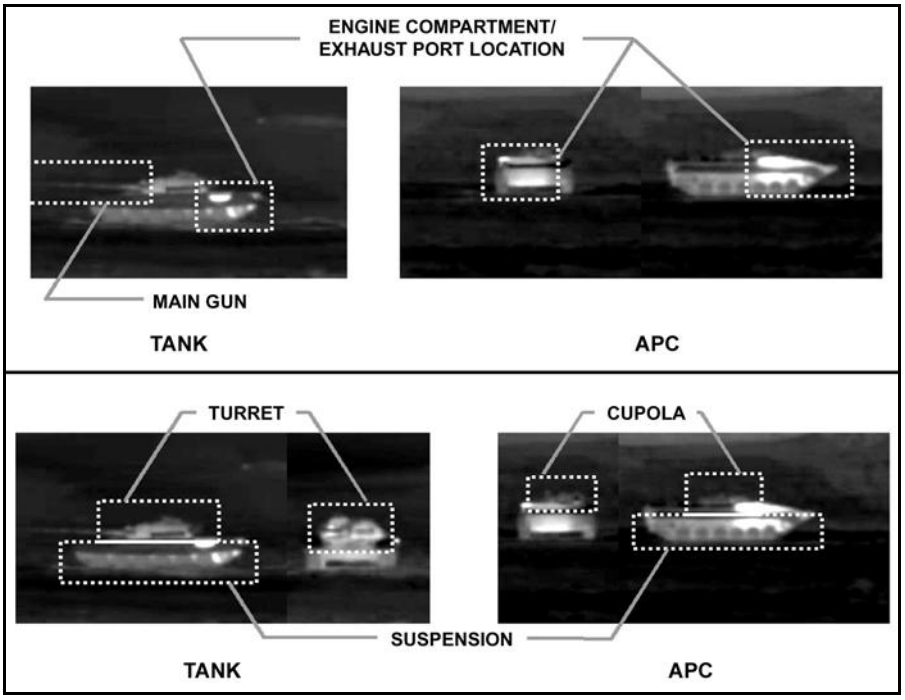


Figure 4-25. Target classification (tank/APC).

b. **Armored Personnel Carriers**. Based on the configuration of an APC, it may be wheeled or tracked. The enemy configures the APC differently based on its use however; there are some common characteristics for them. The engine compartment is located in the front of the vehicle; they may or may not have a turret, and may or may not have a gun tube.

c. **Tank or APC**. Target classification features (Table 4-2).

SIGNATURE	TANK	APC
Engine Compartment	In rear	In front
Exhaust Ports	In rear	In front or side
Main Gun	Long and thick	Short and thin
Turret	Yes and large	Some and usually small
Cupola	New Tanks	No
	Old Tanks	Yes
Size/Shape		Large and sloping

Table 4-2. Target classification features.

4-17. TARGET IDENTIFICATION

Once the gunner has detected, classified and recognized, he may have enough information to engage the target, but the final step in target acquisition is identification. The enemy may have common armored vehicles as our allies and the gunner must be sure of his target. The use of the CLU provides the gunner with a thermal image of a target; therefore the gunner must have a clear understanding of thermal vehicle signatures as well as daylight images. Training aids available to the units come in different forms, from CD-ROM and GTAs to actual photographs. These tools when used prepare the gunner to correctly identify enemy vehicles versus friendly ones.

a. The Night Vision and Electronic Sensors Directorate, PM-FLIR, at ROV-V@nvl.army.mil can be contacted for assistance in vehicle identification. The Recognition of Combat–Vehicles (ROC-V) CD-ROM is available from this directorate.

b. GTA 17-2-11 and GTA 17-2-13 provides the gunner with line drawings and pictures of friendly and enemy vehicles. These are available through the local TASC.

c. For pictures and descriptions of different Soviet made vehicles, see FM 100-2-3.

d. Jane's Defense Combat Armored Vehicle Identification book contains pictures and descriptions of the vehicles currently in service throughout the world.

4-18. TARGET ENGAGEMENT

This paragraph describes the engagement techniques that the gunner might want to use to engage a target.

a. **Time Space Factors**. The gunner must take into consideration the factors that decrease the probability of hitting the target. He considers the following:

- The time it takes for NVS cool down (2.5 to 3.5 seconds).
- The time it takes for seeker activation (10 to 14 seconds).
- The time it takes to adjust track gates, lock-on, and fire.
- The time it takes for the missile to fly the distance to the target (2,000 meters in 14 seconds).

- The speed of the vehicle.
- The location of possible cover that the vehicle may be headed towards.
- Any obstructions in the flight path of the missile.

NOTE: Keep in mind that there is a time delay of about 10 seconds between the time of seeker activation and when the seeker FOV comes on the CLU display.

b. **Track Gate Solution (Seeker Lock-on)**. To achieve a seeker lock-on target, the gunner must ensure he has a good image of the target by adjusting the focus, contrast, and brightness while in the WFOV or NFOV. Once the seeker FOV is available, the gunner keeps the target in the center of the FOV and begins his track gate adjustments.

(1) ***Tanks and Turretless Targets***. To ensure a good seeker lock-on, keep the target's center of mass (the tank's hull but not the gun barrel) centered in the track gates and adjust the track gates as close to the tank's edges as possible (Figure 4-26). To increase the probability of a hit, place the track gates around the hull only. Do not include the turret on flank targets.

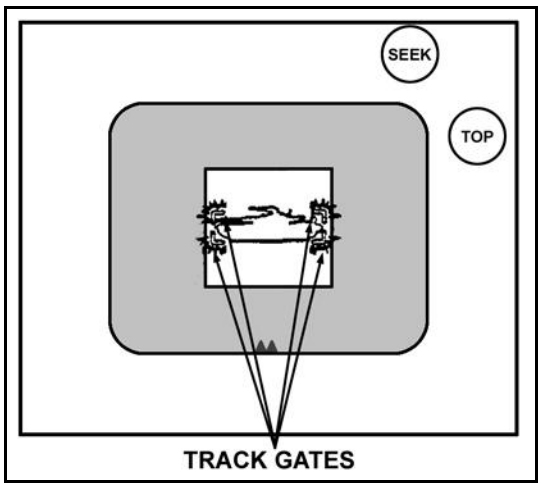


Figure 4-26. Position track gates on target.

(2) ***Stationary Targets***. The lock quality for stationary targets is good when the track gates surround the edges of the target. If they are too large or too small, the gunner breaks lock, readjusts the track gates around the target, and relocks on the target. The gunner continues this procedure until lock-on is achieved.

(3) ***Hull-down Targets***. When engaging hull-down vehicles at the maximum distance (2,000 meters), the CLU is limited by track gate adjustments based on the size of the target. The gunner adjusts the track gates to acquire only the visible portions of the target.

(4) ***Hovering Helicopter***. To ensure an effective engagement, select the direct attack mode only.

(a) *Frontal target*. Adjust the track gates so that they surround only the nose of the fuselage (Figure 4-27). Any appendages (such as armaments, wings, rotor, and so forth) should be ignored.

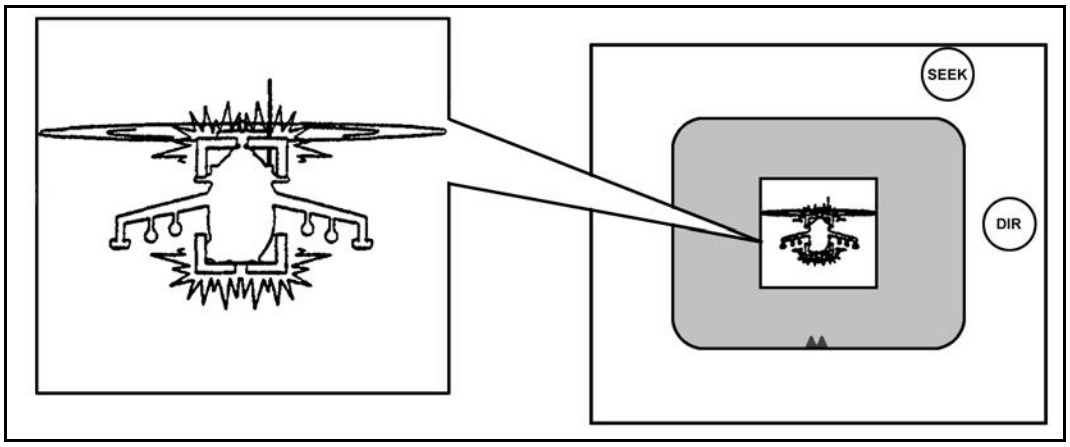


Figure 4-27. Track gate adjustment for helicopters—front.

(b) *Flank target*. Adjust the track gates to surround the passenger/engine compartment or main body (for those helicopters without a passenger compartment) (Figure 4-28). Any appendages, such as the cockpit, tail boom, rotor, and so forth—are ignored.

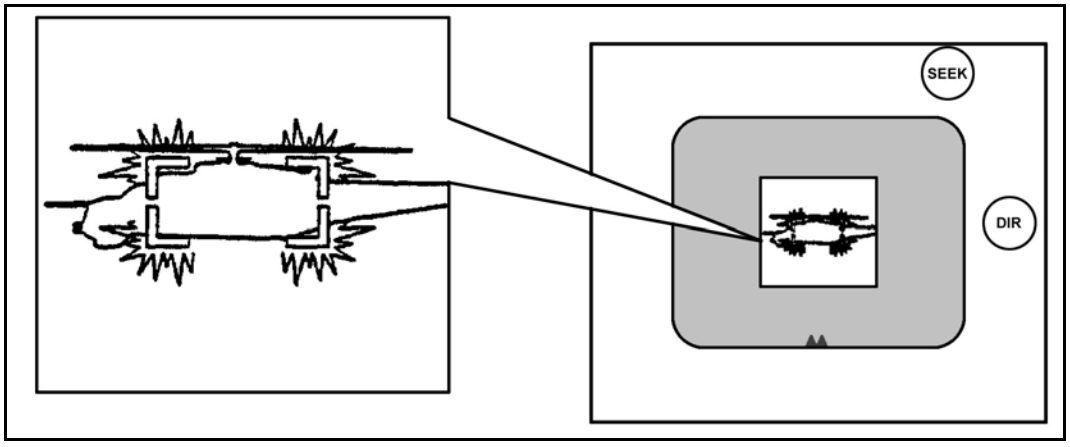


Figure 4-28. Track gate adjustment for helicopters—flank.

(5) ***Bunker***. Track gate adjustment for a bunker involves the perceived size of the bunker's firing port. This adjustment depends on the range to the bunker.

(a) Place the track gates around the internal opening of the firing port (Figure 4-29, page 4-28). The gunner selects the direct-attack mode when engaging this type of target.

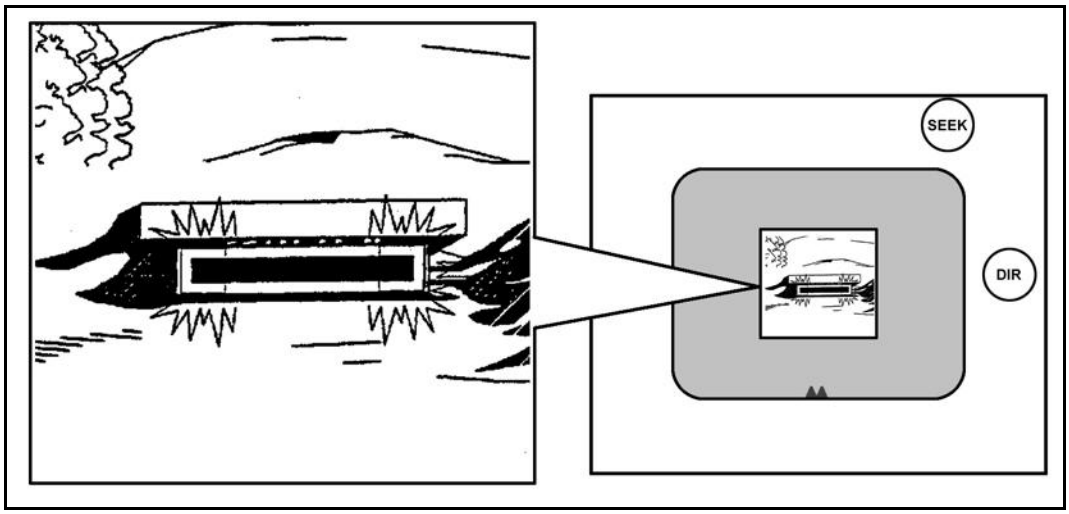


Figure 4-29. Track gate adjustment for bunker.

(b) If the bunker is at a range far enough away that the firing ports cannot be seen, adjust the gates so that they surround the port frame. The gunner selects the direct-attack mode when engaging this type target.

(6) ***Obscured Targets***. The gunner attempts to acquire the entire target when he is engaging targets obscured by dust, smoke, or IR clutter.

c. **Multiple Targets**. The biggest difference between a single-target engagement and a multiple-target engagement is that the gunner removes the CLU from the empty LTA, connects the CLU to a new round, and engages the remaining targets. The sequence of events is:

- Prepare the Javelin for firing.
- Assume a good firing position.
- Determine target engageability.
- Activate the seeker. (Squeeze and hold the seeker until the BCU pop is heard.)
- Change attack mode, if necessary.
- Adjust track gates.
- Lock-on target.
- Check crosshairs and track gates.
- Launch the missile.
- After missile launch, release the fire and seeker triggers.
- Remove the CLU from the empty LTA. Place the empty LTA outside the backblast area.
- Connect the CLU to a new round.
- Repeat until all the targets are engaged and destroyed.

d. **Rapid Engagement Techniques (Day Mode Only)**. This technique is used to engage a target rapidly when time is critical and the gunner does not have the time available for the NVS to cool down. Standard engagement procedures are used except the gunner powers up the CLU in the DAY mode and activates the seeker before he assumes a firing position. This action starts the 10-second seeker cool down. By the time the

gunner gets into a good firing position, he should have seeker FOV. The sequence of events for a rapid engagement are:

(1) Prepare the Javelin for firing.
- Connect the CLU to a round.
- Power up the CLU in the DAY position.
- Activate the seeker. (Hold the seeker trigger and listen for the BCU *pop* before releasing the trigger.)
- Remove the forward end cap.

(2) Assume a firing position. Observe the CLU display and ensure the following:
- Green DAY, SEEK, and TOP indicators are lit (usually 10 to 15 seconds).
- Seeker FOV and flashing track gates are present.
- Change the attack mode, if necessary.

NOTE: The seeker FOV has a very limited area of coverage. The gunner looks over the CLU to locate the target. He aims the CLU in the direction of the target and attempts to acquire the target. If the gunner cannot locate the target, he uses the SEL switch to use the Day FOV to locate the target, then he goes back to the seeker FOV.

(3) Adjust the track gates.
(4) Lock-on the target.
(5) Check crosshairs and track gates.
(6) Launch the missile.
(7) Perform battle damage assessment or displace.

4-19. FIRE PLAN

The Javelin is part of the direct fire plan and is used in conjunction with other weapon systems to cover an engagement area. The platoon leader uses the fire plan to ensure constant coverage by key weapons systems. The fire plan also includes units to the flanks and how their fires interlock to provide mutual support.

4-20. FIRE CONTROL

Well planned and executed fire control measures are critical to the effectiveness of Javelin fires. Javelin positions should not be jeopardized by premature fires in which either the range is excessive or the target is not in position to ensure a high probability of kill. Proper fire control ensures that Javelins engage targets at optimum times and with only the best placed Javelin in relation to the target. Uncontrolled firing decreases the effectiveness of the unit's overall antiarmor capabilities.

a. **Methods**. The primary control methods used to control the fire of one or more Javelins include sectors of fire, TRPs, engagement priorities, fire patterns, and fire commands.

(1) ***Sector of Fire***. A sector of fire refers to an area limited by boundaries and assigned to a unit or weapon to cover by fire (Figure 4-30, page 4-30). The gunner or unit assigned a sector of fire may fire only within that sector. Leaders make sure sectors

overlap to cover all areas and so that the Javelin gunners do not hesitate when enemy vehicles come into range. The gunner records the left and right limit on his range card.

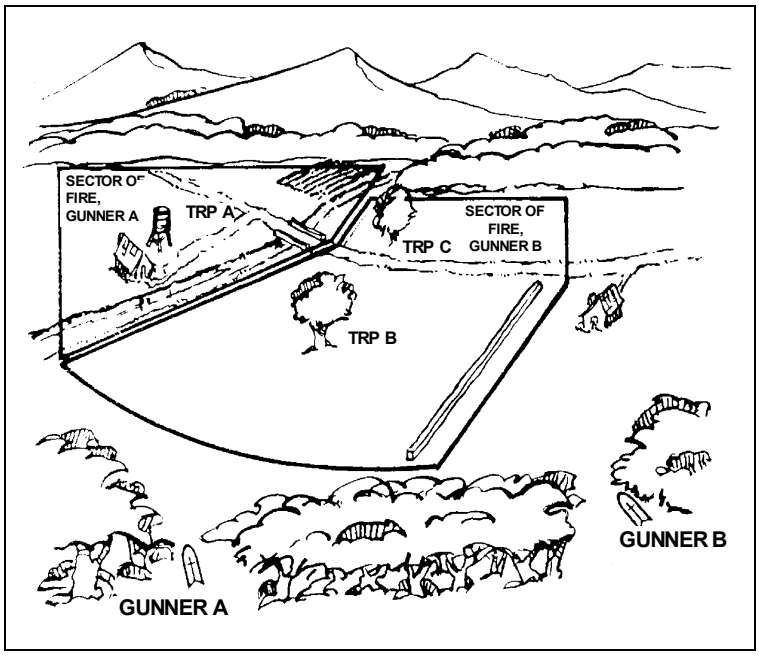


Figure 4-30. Sector of fire.

(2) ***Target Reference Point***. A TRP identifies an easily recognizable, natural or man-made point on the ground. The TRP is used as a reference point for locating and controlling fires. They are referenced by two letters, followed by four numbers (assigned by a higher headquarters). TRPs are also used for shifting fires. The gunner records the location of TRPs on his range card.

(3) ***Engagement Priorities***. Engagement priority means the order in which Javelins engage the various types of vehicles in an enemy formation. The commander designates the engagement priority for each of his units. Table 4-3 is an example list of engagement priority.

1. Command and control vehicles.
2. Tanks/Armored personnel carriers.
3. Antiaircraft vehicles

Table 4-3. Engagement priority.

(4) ***Fire Patterns***. Fire patterns describe the relationship between Javelins and their targets. Firing patterns help leaders control the gunners. These patterns also give gunners specific targets to focus on. Two basic patterns include cross fire and depth fire. Leaders should not fixate on one, but should remain flexible and change the pattern as needed. Within the unit's sector, the leader could use both patterns at the same time.

(a) *Cross fire*. Leaders use cross fire with targets dispersed laterally or when obstructions prevent the Javelin from firing to the front. Gunners must stagger their cross fire. That is, when the first missile hits, only then may the next gunner fire.

- *Flanking targets*. With flanking targets, leaders have each gunner engage the target at a diagonal to his position.
- *Frontal targets*. With a frontal target, that is, a target moving straight at the Javelin, cross fire helps prevent detection.
- *Follow-up*. As they destroy their targets, Javelin gunners shift their fire to the center of the enemy formation (A, Figure 4-31A).

(b) *Depth fire*. Leaders use depth fire when targets are exposed in depth. Javelins on one side engage the nearest targets, while Javelins on the other side engage the farthest targets. The gunners then shift fire toward the center of the formation. This procedure can be specified by unit SOP or in the section leader's order (B, Figure 4-31B).

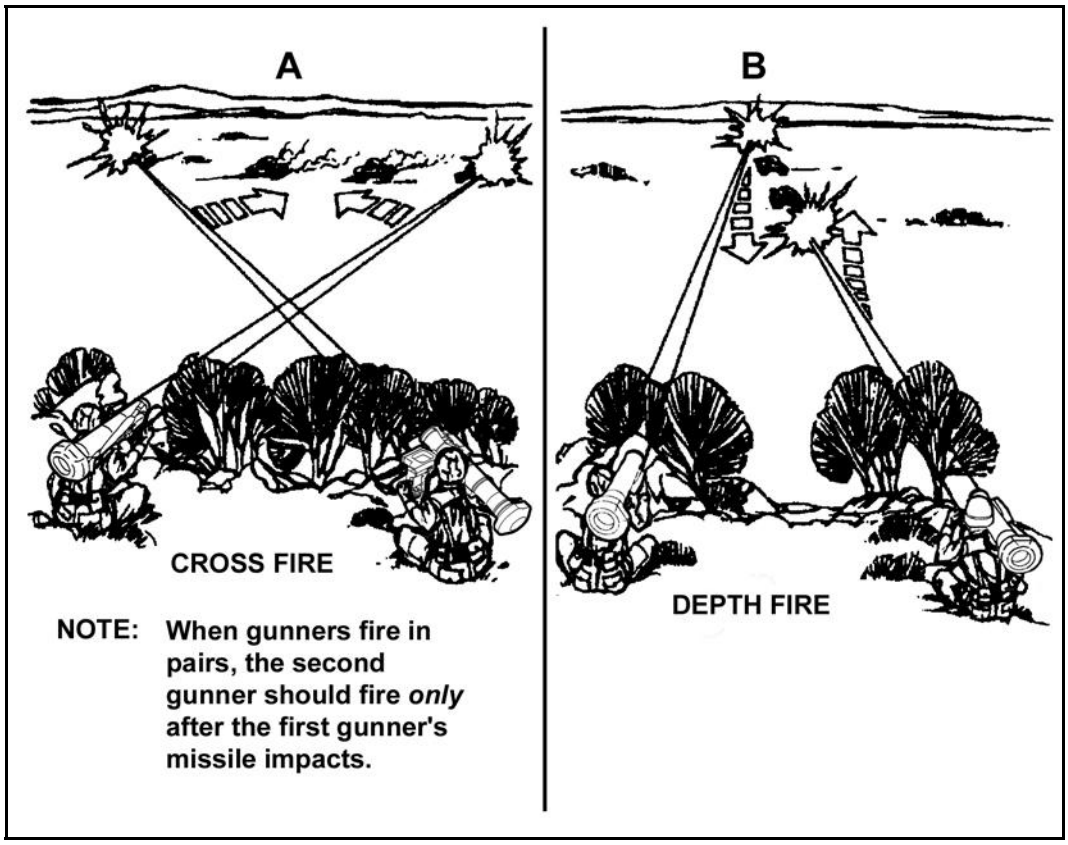


Figure 4-31. Fire patterns.

(5) ***Fire Commands***. The leader uses the fire commands to control the gunner's rate of fire, time of fire, and point of fire. When distance dictates radio delivery of fire commands, the gunner divides his concentration between listening to the radio and firing the Javelin. His assistant, if he has one, listens to the radio and relays the radio commands (Table 4-4).

ELEMENT	DEFINITION	EXAMPLE
ALERT	Warns the gunners of a fire mission.	"Enemy in sector, prepare to fire."
TARGET DESCRIPTION/ LOCATION	Briefly describes the target location relative to a TRP or the gunner.	"BMP, 200 meters right of TRP 1."
METHOD OF ENGAGEMENT	Provides instructions for engaging a formation—fire cross or depth fire, fire front to rear, fire left to right or right to left, and so forth.	Fire from rear to center." Fire from front to center."
EXECUTION	Gives the command to fire	"Team Alpha, fire." "Team Brave, stand by."
CEASE FIRE	Gunner gives battle damage assessment (BDA) and continues the engagement.	One tank (APC) destroyed and continues engagement.

Table 4-4. Fire commands and examples.

b. **Emergency Fire Signals**. Radio communications may be lost. In such cases, control of fire will be difficult at best. Use of sectors of fire and alternate signals with pyrotechnics will often be the best and most rapid method available to control the fire of Javelin gunners. Units must establish SOPs and practice communications procedures.

c. **Range Cards**. In some situations, such as when moving from position to position to cover the movement of an advancing force or during retrograde operations, preparing and using range cards may not work. In that case, TRPs offer the best way to control the distribution of fire. If time and circumstances permit, gunners prepare range cards for primary, alternate, and supplementary positions. These cards help the gunner engage targets successfully.

APPENDIX A
SAFETY

This appendix provides units the necessary information to operate the Javelin missile system safely. Units should develop local directives and SOPs to supplement this appendix with the following information: safety requirements, individual responsibilities, equipment required for handling munitions, location and sequence of operations, protection of soldiers, and clear designations and explanations of responsibilities for operations. Training safety for the Javelin applies to all types of ranges and training sites.

A-1. SAFETY PRECAUTIONS

The backblast of the Javelin comes from the firing of the launch motor and the flight motor. The Javelin has little recoil because the propellant gases escape to the rear of the weapon. This backblast can damage equipment or seriously injure personnel who are too close to the rear of the LTA at time of firing. The Javelin backblast area extends 100 meters to the rear and up to 25 meters to the sides of the launcher and forms a 60-degree danger area. It is divided into a primary danger zone and two caution areas (Figure A-1A, page A-2).

a. **Primary Danger Area.** The primary danger area is a 60-degree included sector, with the apex of the sector at the aft end of the missile launch motor. The primary danger area radius of curvature is 25 meters. Serious injury or fatality is possible for personnel in the primary danger zone during firing. A portion of the primary danger area has been extended forward to the firing line. This portion is within the range of 1 to 5 meters left and right of launch tube centerline.

b. **Caution Area 1**. Caution area 1 is an area extending radially (25 meters) from each side of the primary danger zone to the firing line. Serious hearing impairment or damage from frequent exposure could occur to personnel in this area during firings. Personnel should always wear the approved hearing and eye protection when positioned in Area 1 (Figure A-1A, page A-2).

c. **Caution Area 2.** Caution Area 2 is identified as a 100-meter radius, aft of the launcher and within the 60-degree sector. This area is affected by the activation of the FM pressure relief system. Caution Area 2 is an extension to the rear of the primary danger zone. Hearing impairment and eye damage could occur to personnel that are 10 meters beyond the primary danger zone during firing. Personnel should always wear the approved hearing and eye protection when positioned in Area 2 (Figure A-1A, page A-2).

d**. Area A.** Area A is 500 meters at its widest point for warhead rounds and 200 meters for inert rounds. Area A is measured from the launch point extending 850 meters downrange (Figure A-2B, page A-2). At this point downrange, the flight motor is fully expended. The remaining downrange portion of Area A tapers down to a

200-meter width for warhead rounds and 100-meter width for inert rounds at the maximum range of 4,000 meters. The size of Area A was selected to contain missile and warhead debris from impacts on the boundary and also contain portions of the missile that remain attached to the propulsion section, which may continue to be propelled until FM burnout.

f. **Area B.** Area B contains the debris scatter associated with missile landing at the forward edge of the impact area. This area measures 500 meters deep and about 1,880 meters wide (Figure A-1A).

g. **Area F.** The launcher danger zone (Area F) is the zone aft of the launch tube. Debris, heat, and noise hazards are the major concern within Area F. Figure A-1B also identifies the caution area of the launcher danger zone and related dimensions for normal missile firings.

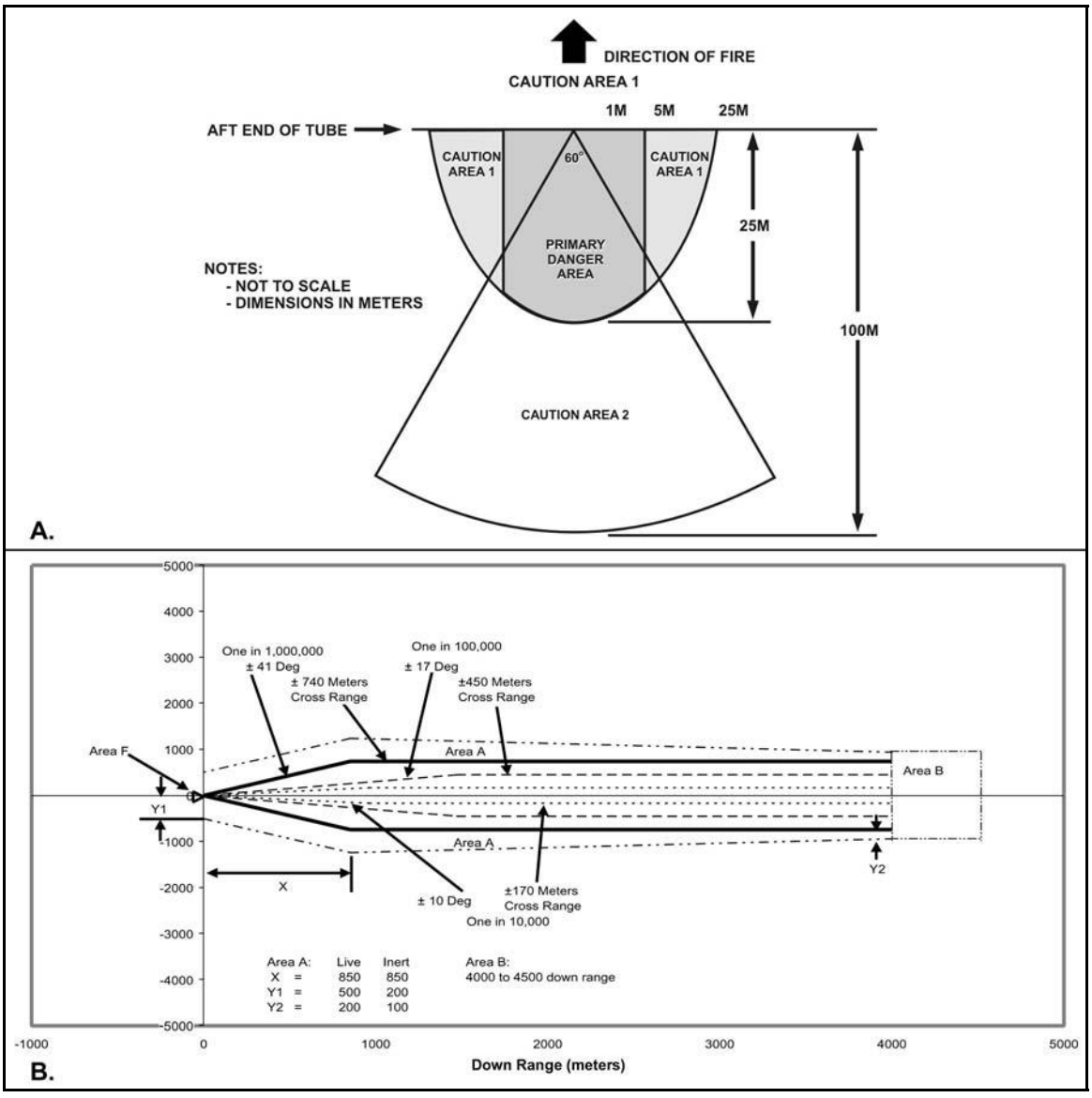


Figure A-1. Backblast area and surface danger zone.

A-2. ROUND HANDLING

Improper or careless handling of the Javelin round can damage its components and cause the missile to malfunction when launched. If the gunner notices any sign that the round may have been dropped or is deformed or fractured, the gunner notifies his supervisor immediately (TM 9-1425-688-12 and TM 9-1300-206).

A-3. FIRING FROM ENCLOSURES

The Javelin can be fired from inside a building provided the room from which it is fired is at least 7 feet high, 12 feet wide, and 15 feet deep. The Javelin has a soft launch system with a two-stage motor. The first motor stage moves the missile out of the tube and downrange a safe distance. The second motor stage fires and propels the missile to the target.

a. **Debris**. Debris and loose objects are cleared from behind the launch site when firing within a confined area.

b. **Venting**. When possible, doors and windows are opened to allow the backblast and overpressure to escape.

c. **Structural Damage**. Escaping gases from the missile's first-stage motor are hot and flammable. The materials that can easily catch fire are removed before firing (for example, some types of curtains and throw rugs). When possible, a fire extinguisher should be present when firing from inside a building.

d. **Hearing Protection**. All personnel within 25 meters of the Javelin must wear hearing protection.

e. **Face Shield**. The face shield protects the gunner's face. It is possible to damage the face shield absorber between the indentation and the CLU main housing. If this part of the face shield is missing, the gunner must switch from firing the Javelin with the right eye to the left eye.

A-4. FIGHTING POSITION

When firing from either a hasty or improved fighting position, the gunner must take into consideration obstructions directly to his front, to his rear, and to the sides of the fighting position. (For more information on fighting positions, see Chapter 4.)

A-5. SAFETY PRECAUTIONS FOR THE MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM TRAINING SYSTEM

Avoid direct eye exposure to MILES laser radiation. The MILES laser is classified as a Class 3A laser. *Do not* point the MILES laser at personnel within 49 feet with the unaided eye or 98 feet with the aided eye (binocular). Personnel within the beam path must wear eye protection since direct exposure to the laser radiation or reflection from the beam could cause serious eye injury. If eye exposure to laser radiation is evident, seek medical attention immediately.

A-6. SAFETY PRECAUTIONS FOR THE BATTERY COOLANT UNIT

Observe the following safety precautions for the BCU:

a. **Heat**. Avoid skin contact with the BCU. The BCU can produce enough heat to cause serious burns. If you experience burns from accidental contact with the BCU, seek medical attention immediately.

b. **Hazardous Waste**. The BCU battery and the BA5590/U contains a lithium-alloy thermal battery considered hazardous waste. Disposal of the BCU and BA5590/Uafter use must be IAW TM 43-0003-44.

A-7. SAFETY PRECAUTIONS FOR LIVE ROUNDS

Observe the following safety precautions when firing live rounds:

a. **Malfunctions**. The gunner performs corrective action when he experiences a malfunction. He notifies his supervisor immediately.

b. **Misfire.** Once a round is declared a misfire and will not launch, the gunner places the round 25 meters from the firing position and keeps it pointed downrange.

c. **Hangfire**. Once a round is declared a hangfire and will not launch, the gunner places the round 25 meters from the firing position and keeps it pointed downrange.

A-8. RISK MANAGEMENT

Risk management is the process of identifying and controlling hazards to conserve combat power and resources. This five-step process is integrated into the military decision-making process. The five steps of risk management are:

- Step 1. Identify hazards.
- Step 2. Assess hazards to determine risks.
- Step 3. Develop controls and make risk decisions.
- Step 4. Implement controls.
- Step 5. Supervise and evaluate.

A-9. ACCIDENT REPORTING

Report accidents involving injury to personnel or damage to materiel on DA Form 285 (Accident Report), IAW AR 385-40. Report explosives and ammunition malfunctions IAW AR 75-1.

APPENDIX B

ANTIARMOR RANGE CARD

This appendix outlines how to prepare a range card because he standard range card (FM 7-8) is slightly modified when employing an antiarmor weapons system. The range card is a sketch of a gunner's assigned sector of fire. It contains information that helps in planning and controlling fires, in detecting and engaging targets, and in orienting replacement personnel. Using range cards allows a gunner or a replacement gunner to find and engage targets quickly.

B-1. DESCRIPTION

A range card (DA Form 5517-R) (Figure B-1) is a record of the firing data for a weapon system on a given sector of fire. This record facilitates target engagement during good or limited visibility conditions. It is divided into three sections: marginal information, sector sketch section, and data section.

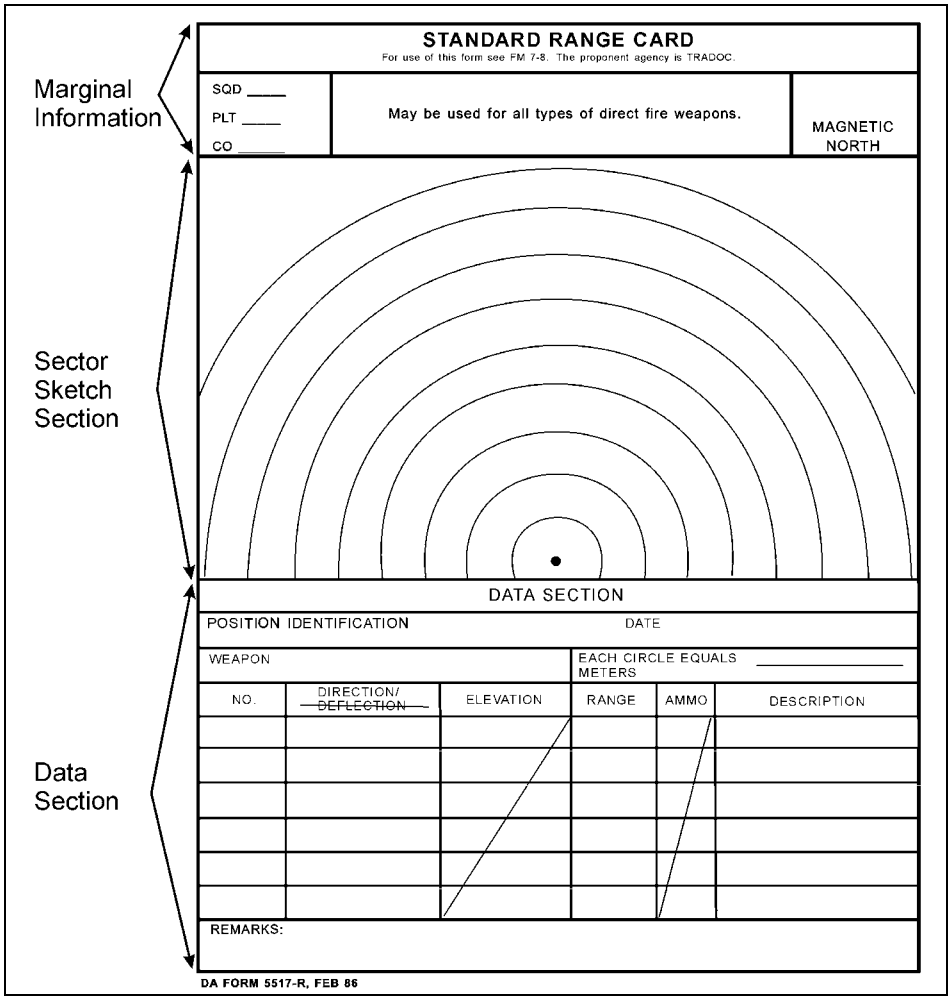


Figure B-1. Example of a three-section range card (DA Form 5517-R).

B-2. GENERAL PROCEDURES

Before a gunner can prepare a range card, he must have certain information provided to him. The leader usually briefs the gunner on that information (Figure B-2) including:

- Firing position.
- Left and right limits of fire.
- Maximum engagement line (MEL).
- Avenues of approach (AAs).
- Target Reference Points (TRPs).

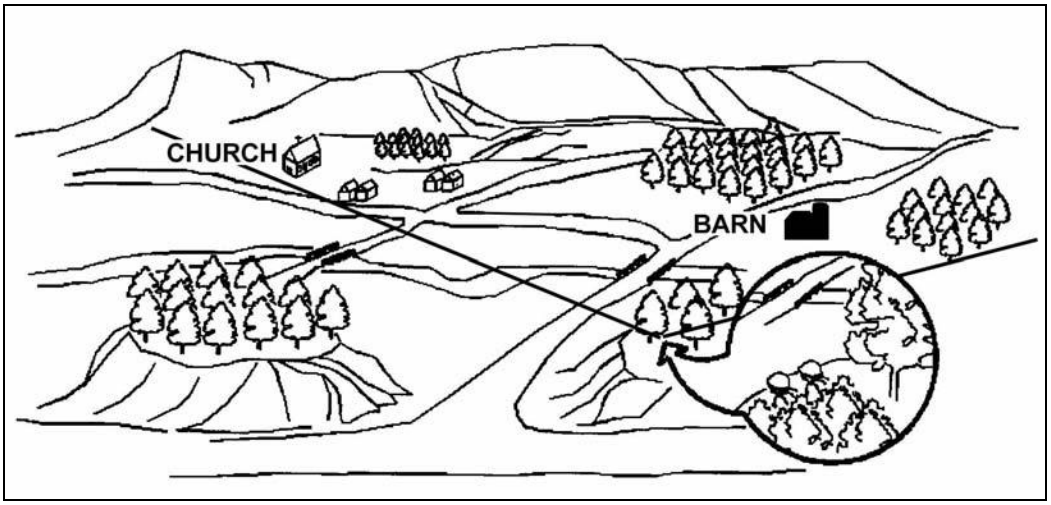


Figure B-2. Gunner's sector of fire.

EXAMPLE OF A SECTION LEADER BRIEFING A GUNNER

"I want you to cover a sector of fire that begins here at your firing position and goes to a point about 500 meters beyond that church on the left, moves to the right along the high ground at 200 meters behind the houses, through the woodline, behind the hill, barn and orchard until it reaches a point about 300 meters beyond the right leading edge of the orchard, and returns to your firing position. The enemy is approaching from the north so they will probably use those two roads to enter your sector. Plan to engage the enemy's armor as soon as it comes within range on the road behind the barn and orchard. Engage the enemy targets as soon as they appear on the second road as they approach from the left side of that large hill. There are two target reference points within your sector so copy them down: the church is TRP AB1670 and the barn is TRP AB1677."

B-3. MARGINAL INFORMATION

Use the following procedures to complete the marginal information at the top of the range card (Figure B-3).

a. **Magnetic North**. Take the range card and orient it with the assigned sector of fire. Use a lensatic compass to determine magnetic north. Keep the range card oriented to the sector of fire and draw the magnetic north symbol in the appropriate direction in the *Magnetic North* box.

b. **Unit Description**. Use squad, platoon, and company designations. Do not list any designation for units higher than company level (Figure B-3).

STANDARD RANGE CARD For use of this form see FM 7-8. The proponent agency is TRADOC.		
SQD 1 PLT 3 CO A	May be used for all types of direct fire weapons.	1 MAGNETIC NORTH

Figure B-3. Marginal information.

B-4. CALCULATE

Calculate EACH CIRCLE EQUALS _____ METERS.

NOTE: Remember, the Javelin's maximum effective range is 2,000 meters.

a. Using a map or leader provided range data, determine the farthest point from the designated firing position to the MEL. (See paragraph B-5d for a discussion on how to determine MEL.)

b. Take the distance and divide it into 9, the number of circles on a range card. Take the results and round the number to the nearest 10 meters. Enter this number in the data section. (See paragraph B-6). The following are examples:

(1) **Example #1**. If the distance to the farthest point from the designated firing position to the MEL is 2,000 meters then: 9 intervals into 2,000 meters = 222 meters. Round 222 down to 220. Therefore, each circle equals 220 meters (Figure B-4).

(2) **Example #2**. If the distance to the farthest point from the designated firing position to the MEL is 1,500 meters then: 9 intervals into 1,500 meters = 166.667 meters, round up to 170 meters.

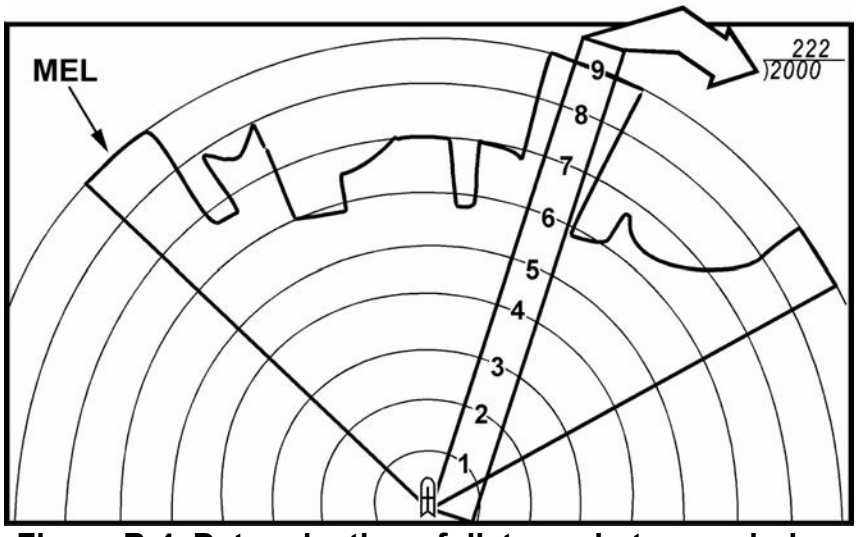


Figure B-4. Determination of distance between circles.

B-5. SECTOR SKETCH SECTION DEVELOPMENT

The sector sketch section is a graphic representation of a gunner's sector of fire (Figure B-5). The sector sketch of the terrain should be a good representation since it becomes vital during periods of limited visibility

NOTE: A gunner may be assigned more than one sector of fire. A separate range card is prepared for each sector.

a. **Sketches**. The sketch should cover the entire assigned sector if possible. Make the sketch as large as possible, but do not exceed the limits of the largest circle. When depicting large natural objects (forests, hills, and so forth) or man-made objects (buildings, bridges, and so forth), draw the outline of the object and label it appropriately (Figure B-5). When sketching objects in the sector, locate them on or near the corresponding circle to denote range to the object.

NOTE: Do not attempt to depict contour lines on the sector sketch section.

b. **Gunner's Firing Position**. The gunner's firing position is designated by the black dot in the center of the smallest circle of the range card. Draw a symbol of the Javelin over the black dot to designate that this range card is for a Javelin.

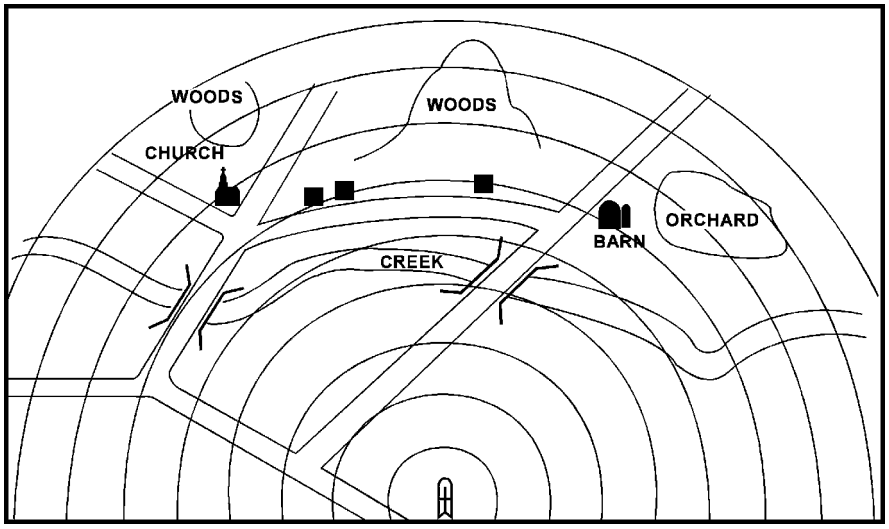


Figure B-5. Sector sketch.

c. **Left Limit and Right Limit.** Left and right limits are imaginary lines from the gunner's firing position to a designated point on the ground (Figure B-6). Use terrain features when possible to designate left and right limits. Other recognizable objects such as a building or other man-made structures can be used. The area between the left and right limits depicts the gunner's sector of fire or area of responsibility. Lines are drawn from the designated firing position to the MEL in the area of the designated limits. Number the left limit as *No. 1*, number the right limit *No. 2*, and place a circle around each number. ***Record the azimuth and distance of each limit in the data section***.

d. **Maximum Engagement Line**. The MEL designates the maximum effective range of a weapon (Javelin) and the gunner's line-of-sight limitations due to the terrain in his given sector of fire (Figure B-6).

(1) If there are no limitations, draw the MEL along the last circle in the sector sketch section. The line should connect with the left and right limit labels.

(2) If there are limitations, starting at the left limit, draw the MEL in front of the limiting terrain features. The MEL should extend in front of and follow the limitations until it reaches the right limit.

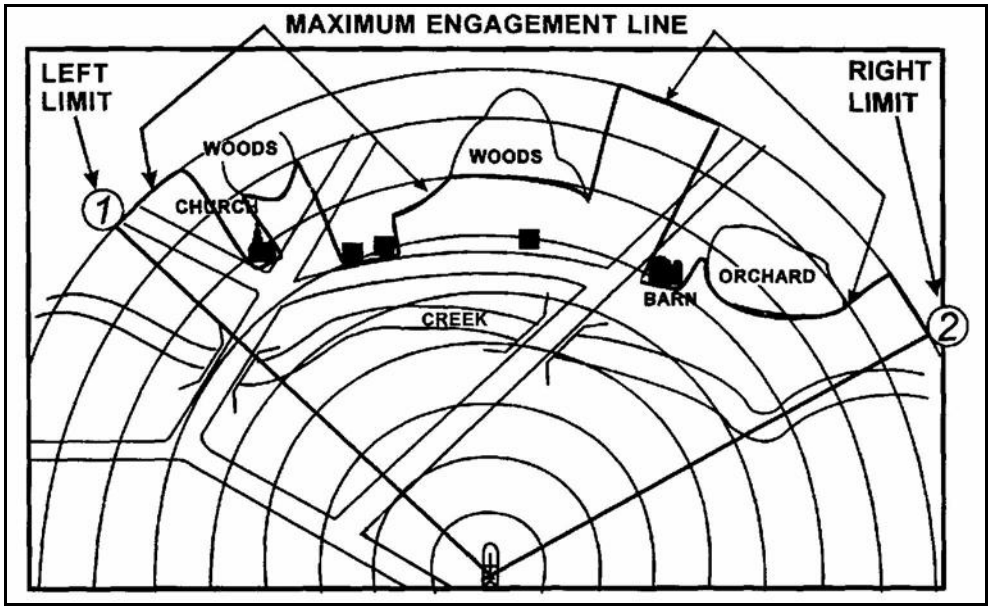


Figure B-6. Sector of fire and maximum engagement line.

e. **Avenues of Approach.** Avenues of approach are areas where a target is most likely to appear or most likely to travel. This area can be a natural line of drift or a road. Tracked and wheeled vehicles may or may not use the same AA. Starting from the left and working to the right, number the areas where targets are likely to appear. Start with the number three since the numbers one and two have already been used to mark the left and right limits. Place a circle around each number. Continue until all identified AAs have an assigned number (Figure B-7). ***Record the azimuth and distance to each AA in the data section***.

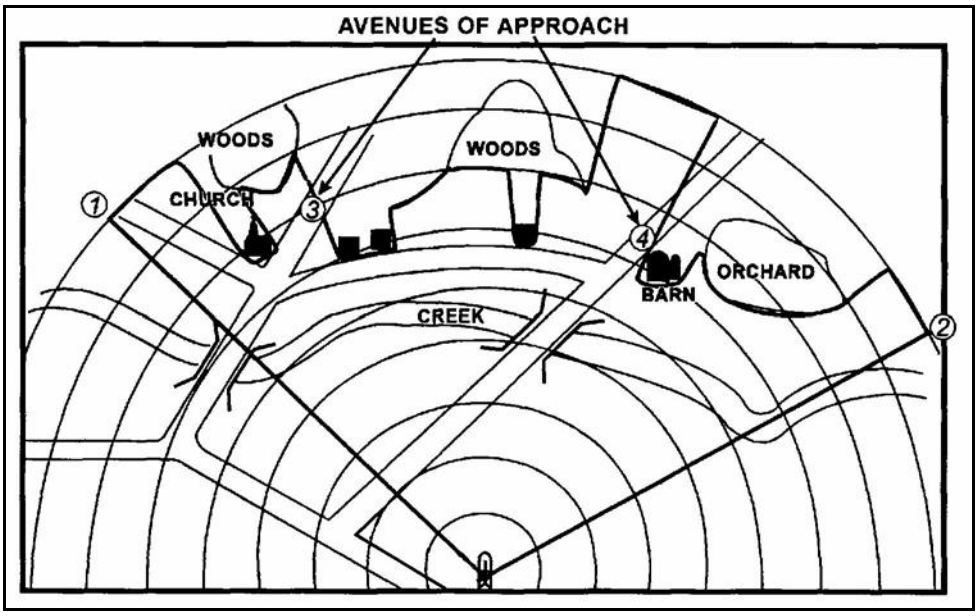


Figure B-7. Avenues of approach.

f. **Target Reference Points**. Prominent terrain features and or easily recognizable man-made objects (for example, road intersections, buildings, bridges, and so forth) are used as TRPs (Figure B-8). TRPs are used to locate targets and adjust direct or indirect fires. Normally, the sector has at least one TRP in a sector, but no more than three. Number each TRP and place a circle around each number starting with the next available number after AA numbers. In the Figure B-8 below, there are two AA and two TRPs, numbers 5 and 6 are assigned to the TRPs for this example. ***Record the azimuth and distance to each TRP in the data section.***

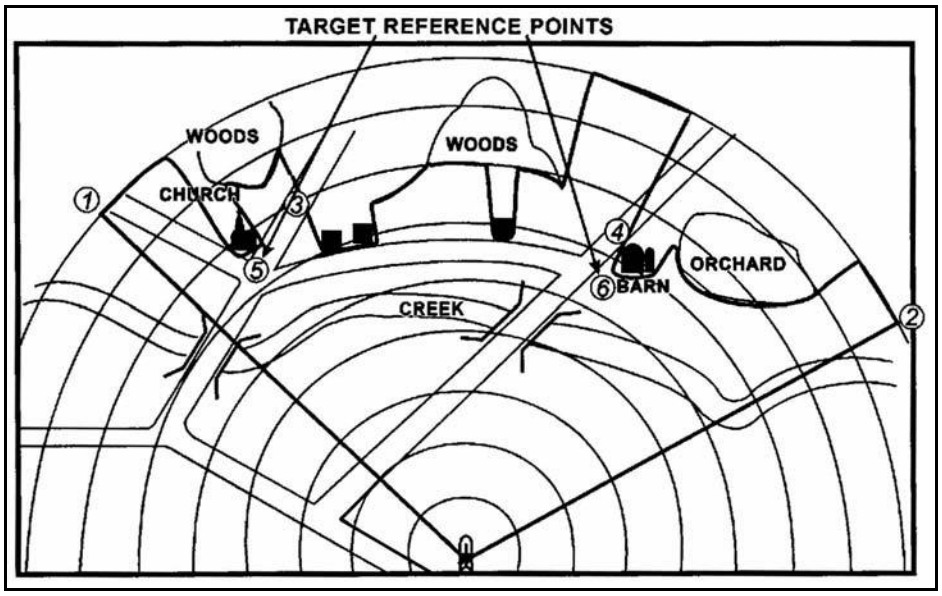


Figure B-8. Target reference points.

g. **Dead Space**. Dead space is an area inside a gunner's sector of fire and inside the range of his weapons system where he can neither observe nor place direct fire. Any area in which a gunner does not have line of sight is considered dead space (Figure B-9). Buildings, trees, hills, or other terrain features can cause dead space. Shade these areas using diagonal lines to indicate significant dead space in the sector. These areas can then be identified as areas for indirect fire weapons.

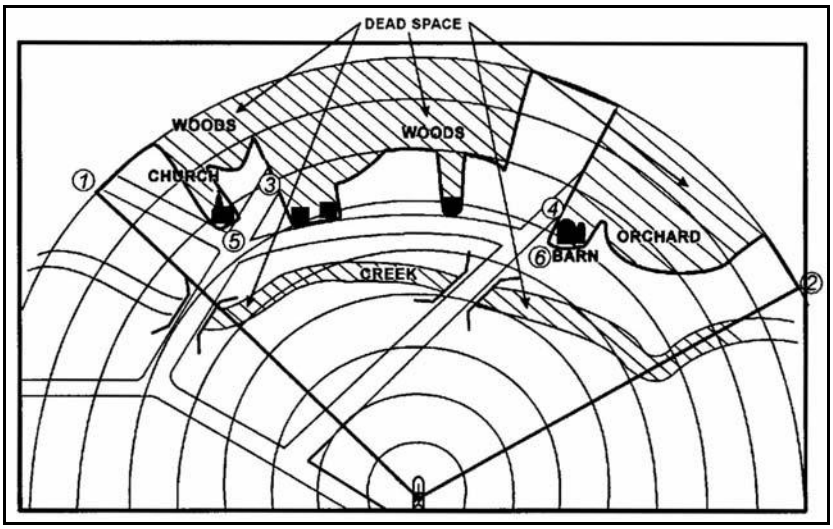


Figure B-9. Dead space.

h. **Gunner's Reference Point**. The gunner's reference point (GRP) serves as a point of reference when one unit is being replaced by another (Figure B-10). The gunner locates a nearby recognizable terrain feature (such as hilltop, road junction, and so forth) to the right, left, or rear of his firing position to use as his GRP. Label the GRP and draw an arrow between it and the firing position to the terrain feature. The direction of the arrow determines which azimuth to use. ***Record the azimuth and distance in the data section.***

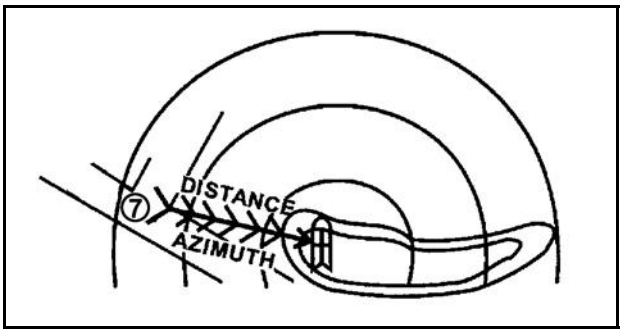


Figure B-10. Gunner's reference point and firing.

B-6. DATA SECTION

Fill in the DATA SECTION (Figure B-11) as follows. Figure B-12 shows a sample completed range card for a Javelin position:

a. **POSITION IDENTIFICATION**. Designate as either primary, alternate, or supplementary.

b. **DATE**. Indicate only the day and month.

c. **WEAPON**. Enter Javelin.

d. **NO**. (number). Use the numbers 1 and 2 to represent the left and right limits. Starting with the subsequent numbers designate AAs and then TRPs as designated in the sector sketch section.

e. **DIRECTION/DEFLECTION**. List only the DIRECTION, in degrees for the appropriate item in the number (NO.) column. Line through the word DEFLECTION since it is not applicable.

f. **ELEVATION**. Line through the word ELEVATION since it is not applicable. Draw a diagonal line through the boxes pertaining to ELEVATION.

g. **RANGE**. Distance is measured in meters from the designated firing position to the target or target engagement area. The most accurate way to measure distance is the laser range finder.

h. **AMMO**. Line through the word AMMO since it is not applicable. Draw a diagonal line through the columns pertaining to AMMO.

i. **DESCRIPTION**. List the name of the item listed in the corresponding *NO*. column (for example, road intersection, barn, church, and so forth). If the object is a TRP, list the TRP number, if left limit or right limit enter LL or RL.

j. **REMARKS:**

(1) Enter any information that is considered useful in helping understand the range card.

(2) Enter the GRP data here if there is not sufficient room in the data section. **(Record the data.)**

DATA SECTION

POSITION IDENTIFICATION: PRIMARY — DATE:

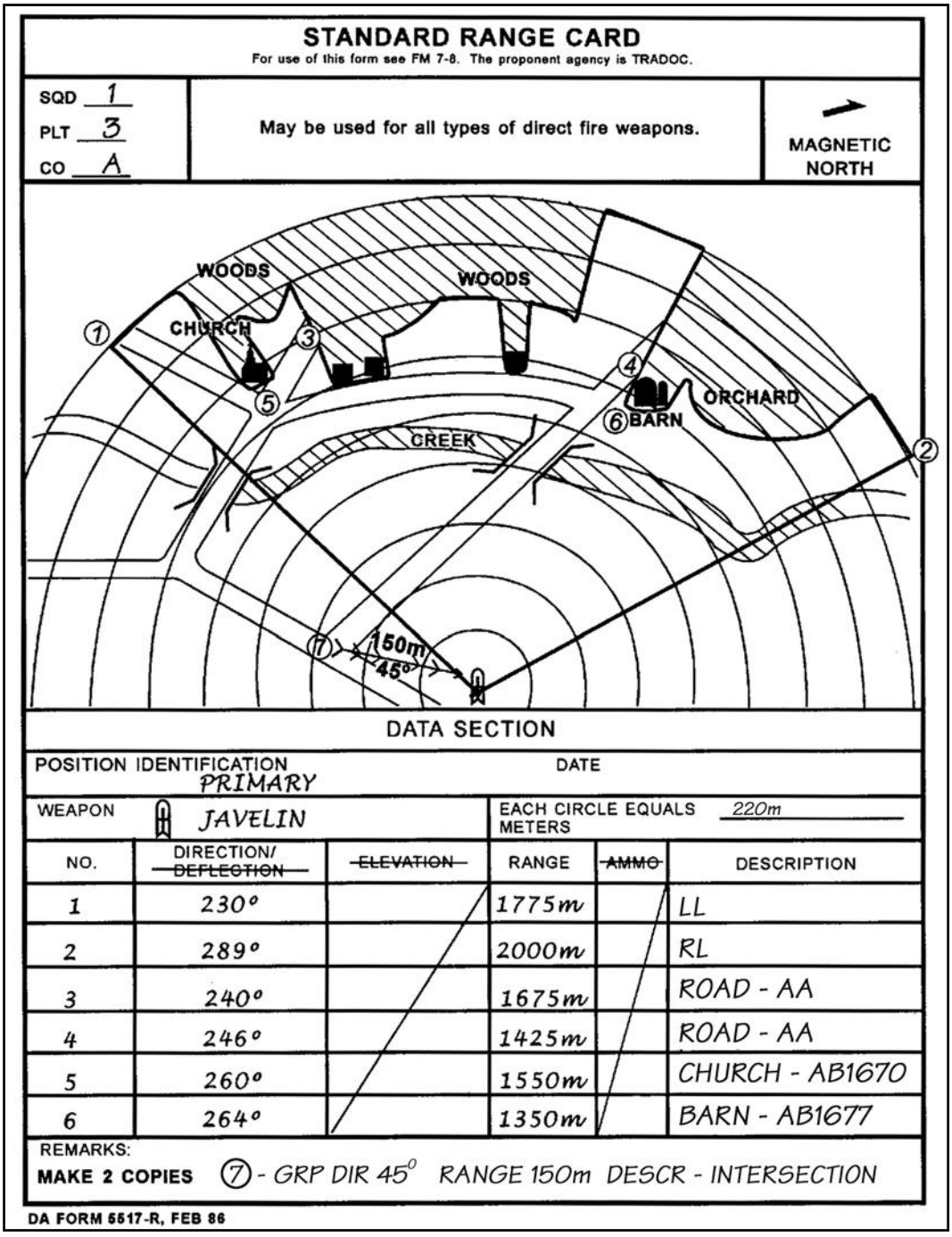
WEAPON: JAVELIN — EACH CIRCLE EQUALS METERS: 220m

NO.	DIRECTION/ ~~DEFLECTION~~	~~ELEVATION~~	RANGE	~~AMMO~~	DESCRIPTION
1	230°		1775m		LL
2	289°		2000m		RL
3	240°		1675m		ROAD - AA
4	246°		1425m		ROAD - AA
5	260°		1550m		CHURCH - AB1670
6	264°		1350m		BARN - AB1677

REMARKS:
MAKE 2 COPIES ⑦ - GRP DIR 45° RANGE 150m DESCR - INTERSECTION

DA FORM 5517-R, FEB 86

Figure B-11. Javelin range card—data section.



STANDARD RANGE CARD

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

SQD 1
PLT 3
CO A

May be used for all types of direct fire weapons.

MAGNETIC NORTH

DATA SECTION

POSITION IDENTIFICATION: PRIMARY
DATE:

WEAPON: JAVELIN
EACH CIRCLE EQUALS METERS: 220m

NO.	DIRECTION/ ~~DEFLECTION~~	~~ELEVATION~~	RANGE	~~AMMO~~	DESCRIPTION
1	230°		1775m		LL
2	289°		2000m		RL
3	240°		1675m		ROAD - AA
4	246°		1425m		ROAD - AA
5	260°		1550m		CHURCH - AB1670
6	264°		1350m		BARN - AB1677

REMARKS:
MAKE 2 COPIES ⑦ - GRP DIR 45° RANGE 150m DESCR - INTERSECTION

DA FORM 5517-R, FEB 86

Figure B-12. Example completed Javelin range card (DA Form 5517-R).

B-8. FIELD-EXPEDIENT RANGE CARD

A field-expedient range card is used when DA Form 5517-R is not available. Preparation of a field-expedient range card follows basically the same guidelines as a standard range card. The gunner can use just about anything to draw on as long as the data is recorded. As one example, a discarded MRE box works well (Figures B-13 and B-14).

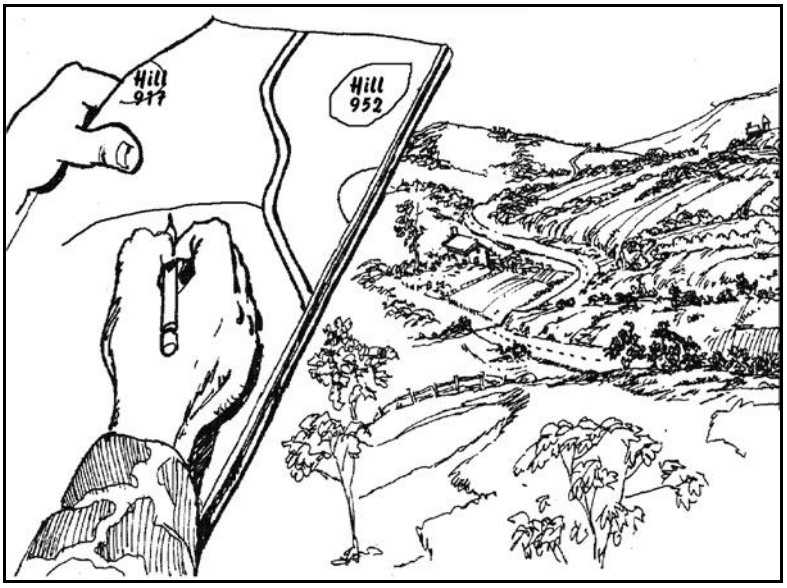


Figure B-13. Terrain presentation.

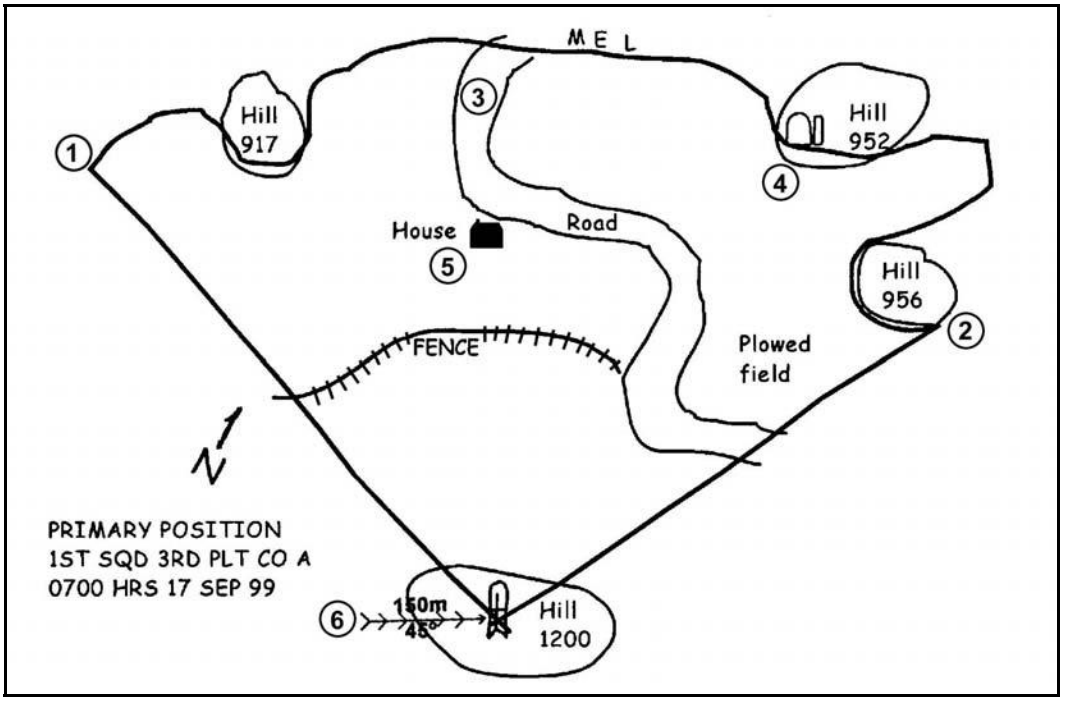


Figure B-14. Field-expedient range card showing the terrain. (Record the data.)

APPENDIX C

IMMEDIATE DECONTAMINATION AND DESTRUCTION PROCEDURES

On the modern battlefield, it is important for the soldier to understand how to perform decontamination on himself and his equipment. To accomplish this, decontamination procedures are accomplished IAW FM 3-4 and FM 3-5 and the unit's SOP so the units can accomplish their missions in NBC environments. In combat situations, it is conceivable the Javelin team could be ordered to destroy the Javelin system to prevent its capture or use by the enemy.

C-1. DECONTAMINATION PRINCIPLES

Once a soldier is aware of chemical or biological contamination, he initiates immediate decontamination techniques by using his personal skin decontamination kit (SDK) or individual equipment decontamination kit (IDEK). To remove radiological contamination from equipment and personnel, brush it off and or use soap and water. Decontamination means the removal or reduction in the hazardous level of NBC contamination from personnel, weapons, and materiel. To perform this, the soldier can use his M291 IEDK or the M295 IEDK kit to remove H-series, G-series, and V-series agents. FM 3-5 and TM 3-4230-216-10 provide more information about decontamination procedures for equipment and weapons. The following procedures reduce the spread/transfer of liquid contamination. The steps for immediate decontamination for the round and the CLU are:

IMMEDIATE	
ROUND	**COMMAND LAUNCH UNIT**
Step 1. Decontaminate your gloves using the IEDK. Step 2. Decontaminate the round by patting it with the IEDK, working from the front to the rear until the entire round is covered. **NOTE: When the shoulder strap is grossly contaminated, discard it.** Step 3. Repeat step 1. Step 4. Discard the IEDK.	Step 1. Decontaminate your gloves using the IEDK. Step 2. Decontaminate the CLU by patting it with the IEDK, Pay special attention to the handgrips, CLU carrying handle, battery cover, round interface-connector protective cover, and switch boots, and absorbers. Step 3. Use a knife to cut the protective-cover lanyard from the protective cover and remove it. Step 4. Repeat step 1. Step 5. Discard the IEDK.

WARNING

Do not apply an IDEK to any optic lens. The abrasive effect of the charcoal inside the IEDK will cause damage to the lens.

C-2. DESTRUCTION GUIDANCE

Unless otherwise instructed, the destruction of the Javelin only occurs when the commander gives the order. If the Javelin cannot be evacuated, the unit launches the round and destroys the CLU. Destroying the same component in all weapons systems prevents the enemy from assembling a complete system. The unit SOP must address this procedure.

a. **Destruction of the CLU and Round**. The Javelin can be destroyed in several ways. Only the soldiers trained in the proper use of explosives should attempt to destroy the CLU and round. Each unit that uses, maintains, or stores Javelin missiles must have an SOP for destroying them. The destruction plan should be flexible enough to cover any situation. It should state priorities and methods of destruction and it should provide clear instructions on how to conduct each method of destruction.

- The easiest and quickest way to destroy the CLU is its optics. Smash the CLU optics with an axe, pick, crowbar, or run over it with a tracked vehicle. The optics can be destroyed using small arms fire.
- The best way to get rid of the round is by launching the round toward the enemy.

WARNING

Do not use mechanical methods to destroy live missiles.

b. **CLU Battery and BCU**. Before the destruction of the CLU, remove the battery. If it is possible, keep both the BCU and the CLU battery for the next re-supply time.

WARNINGS

1. The BA-5590/U battery contains pressurized sulfur dioxide gas. This gas is highly toxic, irritating, and flammable. If the battery catches fire

- **DO NOT USE A HALON FIRE EXTINGUISHER.**
- **DO dispose of the BA-5590/U battery IAW the unit SOP.**

2. Remember, if you use the equipment, you must know the SOP.

APPENDIX D

WARNING INDICATORS AND MALFUNCTIONS

Understanding the proper procedures to correct malfunctions is an essential gunner skill. There are nine different indicators on the CLU display requiring the gunner to perform some type of action. Five indications occur or can occur during normal Javelin operation. The remaining four indicate some sort of Javelin malfunction for which there are immediate action procedures for the gunner to follow.

Section I. WARNING INDICATORS

The warning indicators come on during normal Javelin operation. These warning indicators indicate a system failure can occur if actions are not taken to correct the warning indicator. The five warning indicators are: **NVS NOT COOL, NVS FOCUS ADJUSTMENT LIMIT, CLU BATTERY LOW, BCU LOW**, and **MISSILE NOT READY**.

D-1. NIGHT VISION SIGHT NOT COOL

The following describes what the **NVS NOT COOL** indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is an amber warning indicator (Figure D-1).

b. **Possible Reasons**. When the CLU power switch is placed in the NIGHT position during the initial power up of the Javelin, the **NVS NOT COOL** indicator comes on. It alerts the gunner that the DDC has not cooled down the NVS to its normal operating temperature. The time for the DDC to cool is normally 2.5 minutes. When the DDC has cooled down, the **NVS NOT COOL** indicator automatically turns off. If the **NVS NOT COOL** indicator comes back on after the NVS cool down, the gunner places the power switch in the DAY position and uses the day FOV to complete the mission.

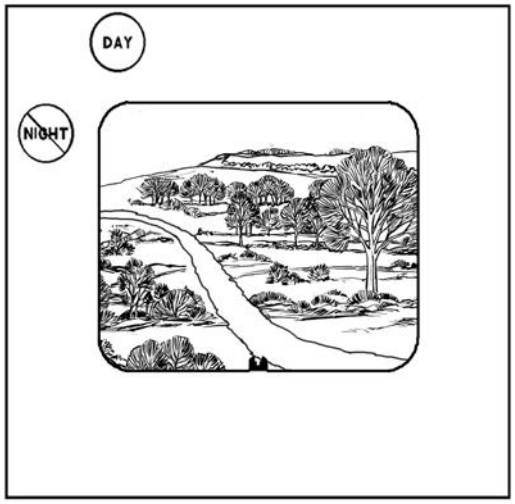


Figure D-1. Amber NVS NOT COOL indicator ON.

c. **Gunner's Corrective Action**. See Table D-1.

INDICATOR AMBER	MEANING	EFFECT	CORRECTIVE ACTION
ON	NVS Not Cool	WFOV and NFOV are not available for 2.5 minutes after setting power switch to NIGHT.	Use day FOV until NVS reaches cooldown.
ON	Does not go out after 2.5 minutes.	DDC not operating WFOV and NFOV not available.	Replace the CLU or use day FOV for target engagement.
OFF	Goes out after NVS reaches cooldown in 2.5 minutes.	After cooldown, WFOV and NFOV are available for use.	Use WFOV and or NFOV as desired.
ON	DDC not cooling NVS.	NVS target image may be degraded.	Place power switch in the DAY position. If problem persists, replace the CLU.

Table D-1. Gunner corrective actions for NVS NOT cool indicator.

D-2. NIGHT VISION SIGHT FOCUS ADJUSTMENT LIMIT

The following describes what the NVS focus adjustment limit indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is green and is a warning indicator (Figure D-2).

b. **Possible Reasons**. The **WFOV** or **NFOV** flashes when the NVS reaches a focus limit (near or far).

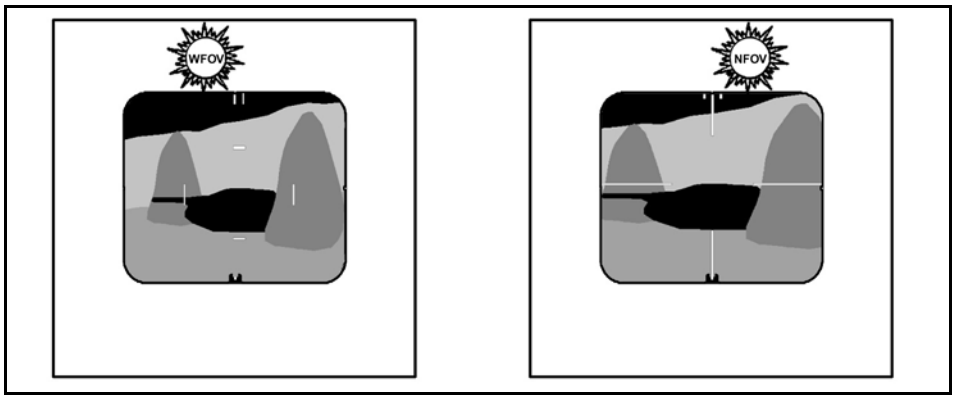


Figure D-2. WFOV or NFOV indicator—flashing.

c. **Gunner's Corrective Action**. The respective **WFOV/NFOV** indicator flashes when the gunner moves the FOCUS switch in the direction of the focus limit. The gunner stops moving the switch and reverses the direction (Table D-2).

INDICATOR GREEN	MEANING	EFFECT	CORRECTIVE ACTION
Green WFOV (Flashing)	NVS Focus Limit (WFOV)	Adjust focus in the other direction.	Move the FOCUS switch in the opposite direction.
Green NFOV (Flashing)	NVS Focus Limit NFOV)	Adjust focus in the other direction.	Move the FOCUS switch in the opposite direction.

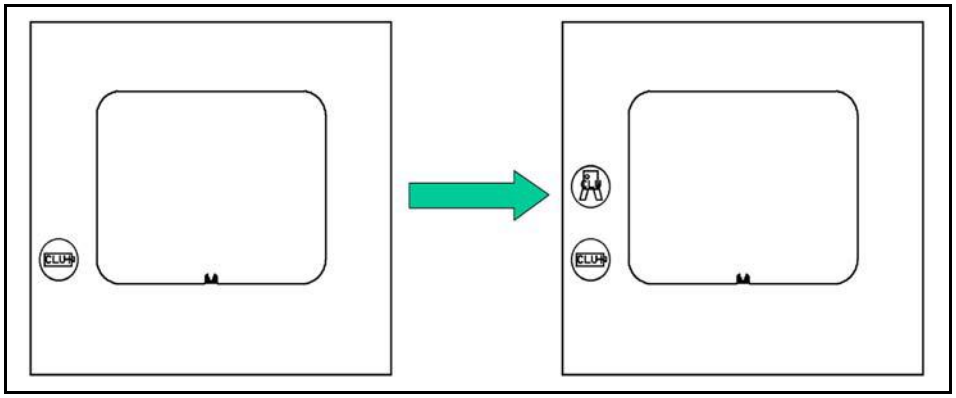
Table D-2. Gunner corrective action for flashing WFOV and NFOV indicators.

D-3. COMMAND LAUNCH UNIT BATTERY LOW

The following describes what the **CLU BATTERY LOW** indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is red and is a warning indicator (Figure D-3).

b. **Possible Reasons**. The **CLU BATTERY LOW** indicator comes on when the gunner has operated the Javelin about 4 hours. The **CLU BATTERY LOW** indicator alerts the gunner that he has about 5 minutes of operating time remaining. If the gunner continues to operate the Javelin, the CLU display automatically reverts to the day FOV.



A. 5-minute warning. **B. CLU shut down.**

Figure D-3. CLU BATTERY indicator—ON.

c. **Gunner's Corrective Action**. The gunner immediately removes the spent battery when the **CLU BIT FAILURE** indicator comes on (Table D-3).

INDICATOR RED	MEANING	EFFECT	CORRECTIVE ACTION
ON	CLU Battery Low About 5 minutes until CLU power shut-down.	Seeker can be activated and missile can be launched.	Complete engagement (if in progress). If engagement is not in progress, turn CLU off, replace CLU battery, resume mission.
ON	CLU power shut-down.	CLU automatically switches to day FOV. The CLU BIT FAILURE indicator comes on. If the spent CLU battery is not removed immediately, other indicators around the CLU display will start flashing and a clicking sound can be heard by the gunner. The missile cannot be launched.	Replace CLU battery.

Table D-3. CLU BATTERY LOW indicator.

D-4. BATTERY COOLANT UNIT (BCU) LOW

The following describes what the **BCU LOW** indicator looks like (Figure D-4) and the reason the light comes on (Table D-4). The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is red and is a warning indicator.

b. **Possible Reasons**. The gunner has a target in sight and is preparing to launch the missile. The gunner activates the seeker and attempts to engage the target. The BCU has about 4 minutes of life once the gunner activates it. The BCU indicator flashes when the BCU has about 30 seconds of operating time remaining. At this point, the gunner can still launch the missile. When the BCU battery is spent, the BCU indicator stops flashing and remains ON. The missile powers down, and the CLU display automatically reverts back to the previous FOV.

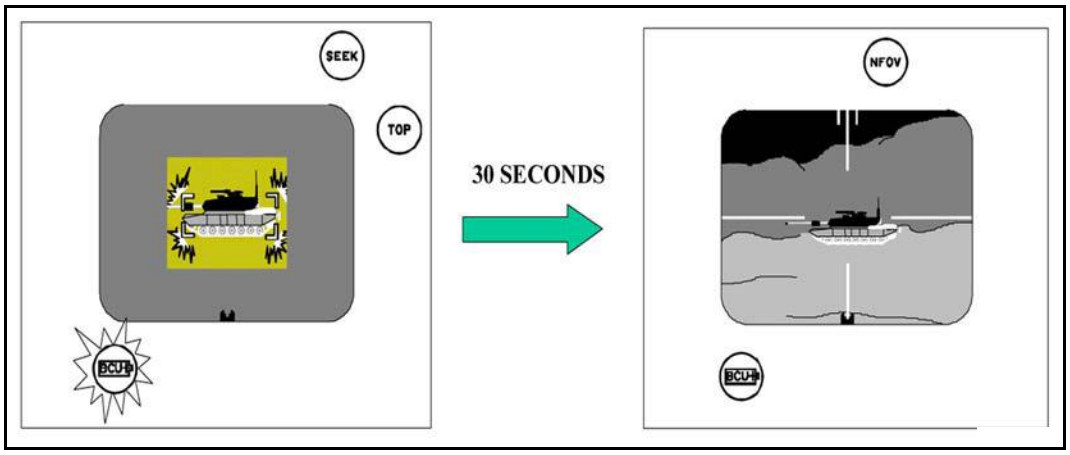


Figure D-4. BCU indicator—flashing/ON.

c. **Gunner's Corrective Action**. See Table D-4.

INDICATOR RED	MEANING	EFFECT	CORRECTIVE ACTION
FLASHING	BCU Low: BCU has about 30 seconds of operating time remaining.	Missile launch still possible before indicator stops flashing.	
ON (Solid)	BCU is expended.	Missile has no power and cannot be launched. CLU display reverts to previous FOV.	Replace the BCU. Resume the mission.

Table D-4. BCU Low indicator—flashing and solid.

D-5. MISSILE NOT READY

The following describes what the **MISSILE NOT READY** indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is a multipurpose warning indicator. It can indicate a normal operation or a malfunction condition.

b. **Possible Reasons**.

(1) ***Normal Operation***. When the gunner squeezes the seeker trigger and the **MISSILE NOT READY** indicator lights stays on for 10 to 15 seconds, the software download to the missile is not complete, missile BIT is not complete, seeker is not cooled down, or seeker video is not ready. After the seeker is cool and the software download is complete, the **MISSILE NOT READY** indicator goes off, and the seeker FOV is displayed on the CLU display (Figure D-5, page D-6).

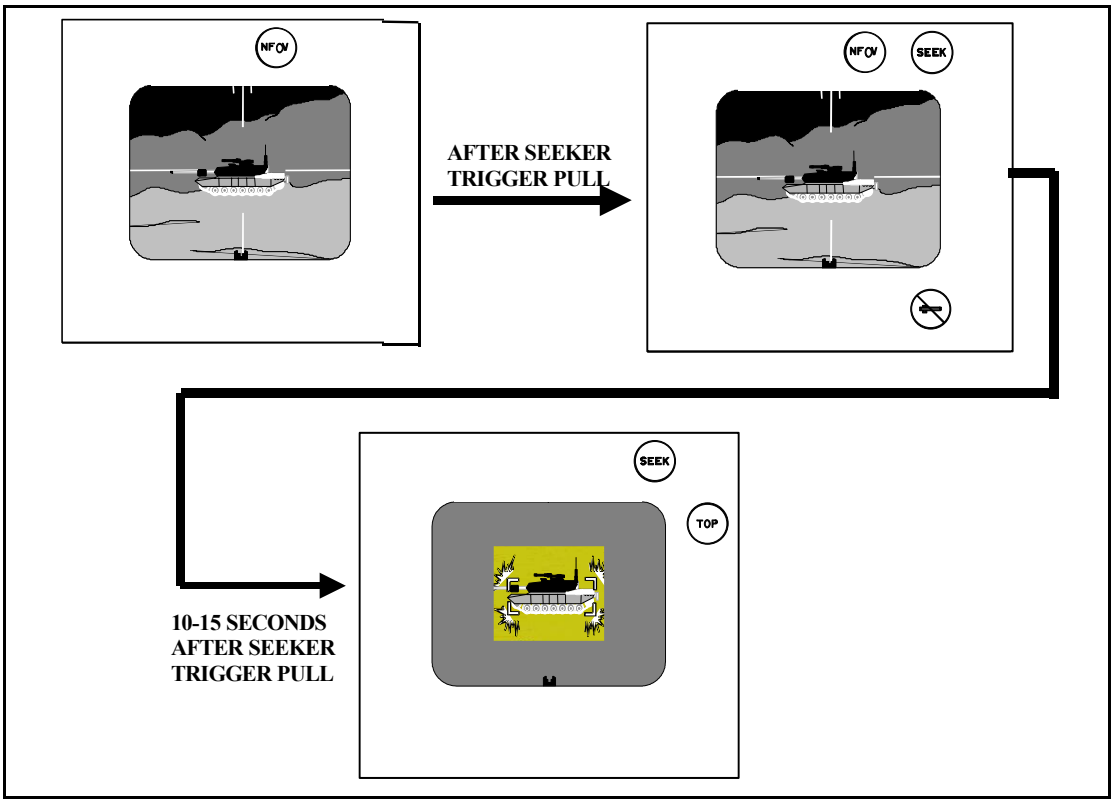
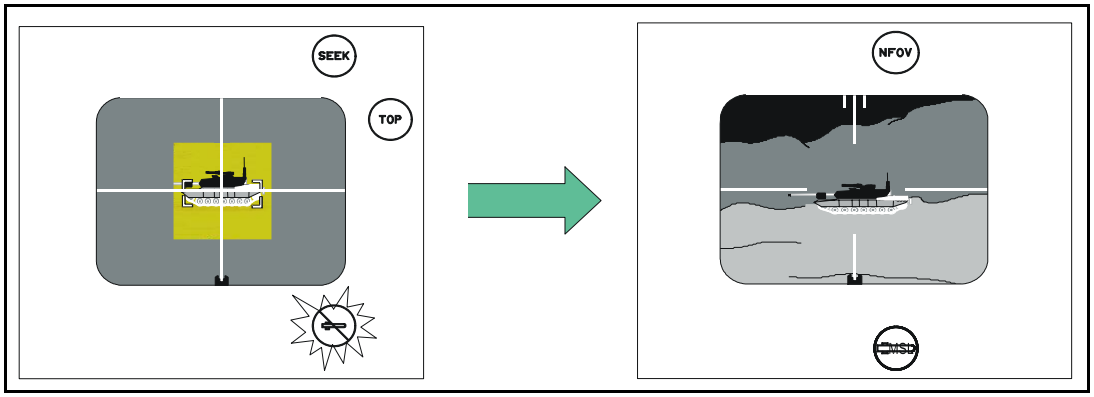


Figure D-5. NFOV to seeker FOV sequence.

(2) ***Malfunctions***. If the gunner has activated the seeker and not launched the missile, it is possible that the missile will overheat when the BCU is replaced (Figure D-6).

(a) After seeker cooldown and seeker FOV is available, attempt to re-engage the target. If the BCU and the **MISSILE NOT READY** indicators start to flash, the missile is approaching an overheat condition.

(b) When the **MISSILE NOT READY** indicator goes off, the missile cannot be launched. The missile powers down, the CLU reverts to the previous FOV, and the **MISSILE BIT FAILURE** indicator comes on as a solid light.



Flashing **On Solid**

Figure D-6. MISSILE NOT READY indicator.

c. **Gunner's Corrective Action**. See Table D-5.

INDICATOR AMBER/RED	MEANING	EFFECT	CORRECTIVE ACTIVE
Amber ON	Missile Not Ready After pulling the seeker trigger. Software download begins.	Missile cannot be launched until indicator goes off.	Wait for indicator to go off before attempting any track gate adjustment.
Stays ON	One or all of the following may have occurred: 1. Software download not completed. 2. Missile BIT not completed. 3. Seeker not cool. 4. Seeker video not ready.	Missile cannot be launched until indicator goes off.	Wait for indicator to go off before attempting any track gate adjustment. If indicator remains on longer than 15 seconds, replace the round.
OFF	1. Software download completed. 2. Missile BIT completed. 3. Seeker video available.	Missile launch available.	Track gate adjustment possible.
FLASHING	After the seeker is activated, the missile begins to overheat.	Missile launch is still possible.	
OFF		**MISSILE NOT READY** indicator goes off, the missile cannot be launched. Missile powers down, the CLU reverts to previous FOV, and the **MISSILE BIT FAILURE** indicator comes on solid.	
Red = (Solid)	Missile has overheated.	Missile cannot be launched. Missile powers down, the CLU reverts to previous FOV, and the **MISSILE BIT FAILURE** indicator comes on solid.	Turn off CLU. Replace the round.

Table D-5. MISSILE NOT READY indicator—ON.

Section II. MALFUNCTION INDICATORS

There are four malfunction indicators for which the gunner takes immediate action. These malfunction indicators are **CLU BIT FAILURE, MISSILE BIT FAILURE, MISFIRE**, and **HANGFIRE**.

D-6. COMMAND LAUNCH UNIT BUILT-IN (CLU BIT) TEST FAILURE

The following describes what the **CLU BIT FAILURE** indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is red and is a malfunction indicator.

b. **Possible Reasons**. The **CLU BIT FAILURE** indicators light up if any or all of the following conditions exist:

(1) CLU fails continuous BIT.

(2) CLU does not initiate software download to the missile.

(3) CLU battery is spent and CLU reverts to day FOV (Figure D-7).

NOTE: If the **CLU BIT FAILURE** indicator comes on after seeker activation, attempt to launch the missile (if appropriate) and report it.

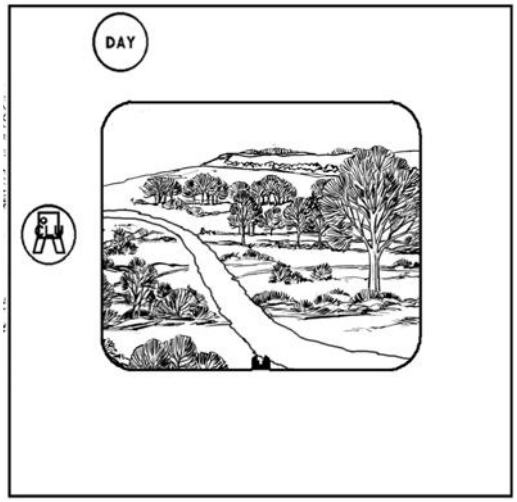


Figure D-7. CLU BIT failure.

c. **Gunner's Corrective Action**. If the gunner is engaging a target and has activated the seeker, complete the target engagement, if possible (Table D-6). If the gunner is not engaging a target or cannot complete the engagement, he performs the following:

(1) Turns the power switch to the OFF position.

(2) Removes the Javelin from the shoulder and places it on the ground with the CLU handgrips pointing up.

(3) Keeps the Javelin pointed in the direction of the enemy target. Ensures the backblast area remains clear at all times.

(4) Presses the latch release and disconnects the CLU from the round for use with a new CLU.

(5) Obtains a new CLU and connects the new CLU to the round.

(6) During training situations, turns power switch, disconnects the CLU from the round, and notifies the squad leader or range safety personnel.

INDICATOR RED	MEANING	EFFECT	CORRECTIVE ACTION
ON	CLU BIT Failure		
	1. CLU failed continuous BIT.	Missile launch not possible.	Replace the CLU.
	2. CLU did not initiate software download to missile.	Missile launch not possible.	Replace the CLU.
	3. CLU did not complete software download to missile.		
	4. CLU battery spent.	Missile launch not possible.	Replace the CLU battery.
		CLU powers down and switches to day FOV.	Replace the CLU battery.

Table D-6. CLU BIT Failure indicator—ON.

D-7. MISSILE BUILT-IN TEST FAILURE

The following describes what the **MISSILE BIT FAILURE** indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is red and is a malfunction indicator.

b. **Possible Reasons**. The missile BIT software has detected a failure in the missile (Figure D-8). When the missile fails BIT, the **MISSILE BIT FAILURE** indicator lights up, the missile powers down, and the CLU display reverts to the previous FOV. The missile must be replaced.

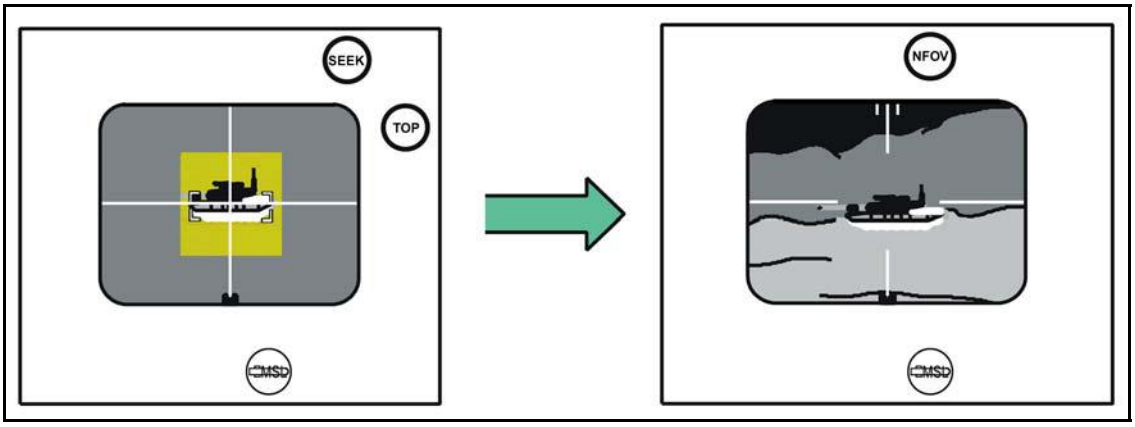


Figure D-8. MISSILE BIT FAILURE indicator—solid ON.

c. **Gunner's Corrective Action**. See Table D-7.

INDICATOR RED	MEANING	EFFECT	CORRECTIVE ACTION
Red (Solid) On	Missile BIT Failure Missile BIT has detected a fault within the missile or CLU is not communicating with the missile.	Missile launch not possible, CLU display reverts to previous FOV.	Replace round.

Table D-7. MISSILE BIT FAILURE indicator—solid ON.

D-8. MISFIRE

The following describes what the **BIT FAILURE** indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is a red and is a malfunction indicator. The missile **BIT FAILURE** indicator may or may not be flashing.

b. **Possible Reasons**. A misfire occurs when the gunner locks onto a target, squeezes the trigger and the missile does not launch. One of two things will happen with the status indicator: no malfunction indicators or a red MSL flashes (Figure D-9). In either case the seeker FOV remains on the CLU display and the green SEEK and TOP indicators remain lit.

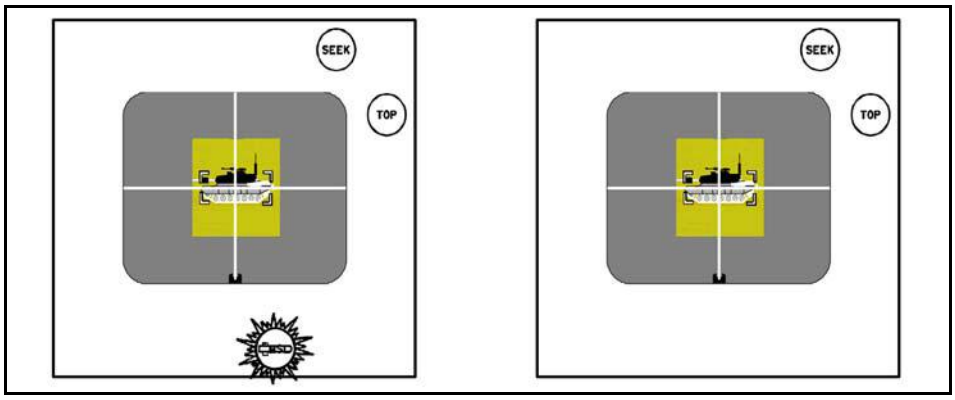


Figure D-9. Misfire—with and without warning indicators.

c. **Gunner's Corrective Action**. (See Table D-8.) When a misfire happens after the trigger squeeze occurs with or without warning indicators, the missile does not launch. The gunner performs immediate action procedures for a misfire:

(1) Attempts to engage the target again.

- Releases the seeker and fire triggers.
- Acquires the target again, if necessary.
- Attempts to lock-on again.
- Attempts to fire the Javelin again.

(2) If the Javelin misfires again, the gunner:
- Turns off the CLU.
- Places the Javelin on the ground with the CLU handgrips pointing up.
- Keeps the Javelin pointed in the direction of the enemy target while keeping the backblast area clear.

(3) Checks the interface connectors:
- Presses the latch release, disconnects the CLU from the round, and checks for dirt and debris.
- Reconnects the CLU to the same round.
- Turns ON the CLU.

(4) Attempts to engage the target again. Repeats the procedures for step D-8c(1). If the Javelin still fails to fire:
- Turns off the CLU.
- Grounds the Javelin, again keeping the missile pointed toward the enemy.
- Disconnects the CLU from the round.
- Moves at least 25 meters away from the round or moves the round 25 meters away from the firing position.
- Stays clear of the forward and aft ends of the round at all times.
- Obtains a replacement round and connects CLU to the new round.
- Continues the mission.

(5) If the misfire continues on the new round, the gunner obtains a new CLU. Always remember to replace the BCU on the round.

INDICATOR RED	MEANING	EFFECT	CORRECTIVE ACTION
Flashing or None Red (On)	Misfire	Missile may not launch.	Refer to paragraph D-8c(1).

Table D-8. Missile Misfire indicator—with or without indicator.

d. **Misfire During Training Situations**. The gunner—

(1) Announces "Misfire" loud enough for all soldiers in the immediate area to hear.

(2) Attempts to engage the target again.
- Releases the seeker and fire triggers.
- Acquires the target again, if necessary.
- Attempts lock-on again.
- Attempts to fire the Javelin again.

(3) If the Javelin continues to misfire:
- Turns off the CLU.
- Places the Javelin on the ground with the CLU handgrips pointing up.
- Keeps the Javelin pointed in the direction of the enemy target while keeping the backblast area clear.

(4) Checks the interface connectors:

- Presses the latch release and disconnects the CLU from the round.
- Checks the CLU and round interface connector for foreign objects.
- Connects the CLU again to the same round.
- Turns on the CLU.

(5) Attempts to engage the target again. Repeats the procedures for step D-8d(1). If the Javelin still fails to fire:

- Turns off the CLU.
- Grounds the Javelin, again keeping it facing toward the target.
- Disconnects the CLU from the round.
- Moves the round 25 meters away from the firing position.

(6) Notifies the range safety officer/NCO of the type of malfunction.

D-9. HANGFIRE

The following describes what the **HANGFIRE** indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

a. **Indicator**. This light is red and is a malfunction indicator.

b. **Possible Reasons**. A hangfire occurs when the gunner squeezes the fire trigger but the missile does not launch and the **HANGFIRE** indicator flashes on the CLU display (Figures D-10). If a hangfire occurs during a combat situation, release the fire and seeker triggers. Continue pointing the missile in the direction of the enemy target for at least 60 seconds. After waiting 60 seconds, perform the following procedures (Table D-9).

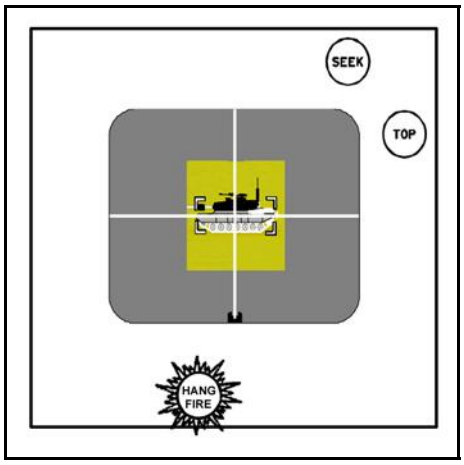


Figure D-10. HANGFIRE indicator.

c. **Gunner's Corrective Action**. The gunner—

(1) Turns off the CLU.

(2) Removes the Javelin from the shoulder and places it on the ground with the CLU handgrips pointing up.

(3) Keeps the Javelin pointed in the direction of the enemy target. Ensures the backblast area remains clear.

(4) Removes the CLU. Presses the latch release and disconnects the CLU from the round.

(5) Moves at least 25 meters away from the round. If in a firing position, moves the round to a position at least 25 meters from the firing position. Stays clear of the forward and aft end of the round at all times.

(6) Obtains a replacement round and connects the CLU to the new round.

INDICATOR RED	MEANING	EFFECT	CORRECTIVE ACTION
Flashing	HANGFIRE Missile does not fire.	Activated missile in LTA, could still possibly launch.	Refer to paragraph D-8c(1).

Table D-9. HANGFIRE indicator—flashing.

d. **Actions During Training Exercises**. The missile did not fire. The gunner—

(1) Announces "Hangfire" loud enough for everyone to hear.

(2) Keeps the missile pointed down-range. Releases the seeker and fire triggers.

(3) Waits 5 minutes before completing **HANGFIRE** procedures:

- Turns off the CLU.
- Removes the Javelin from the shoulder and places it on the ground with the CLU handgrips pointing up.

(4) Disconnects the CLU from the round.

(5) Moves at least 25 meters away from the round. If in a firing position, moves the round to a position at least 25 meters from the firing position. Stays clear of the forward end and aft end of the round at all times.

(6) Obtains a replacement round and connects the CLU to the new round.

D-10. GENERAL PRACTICAL EXERCISES FOR WARNINGS AND MALFUNCTIONS

The BST is designed to reproduce all the warning conditions and malfunctions. Trainers should include in their training exercises with as many warnings and malfunctions as time will allow. It is essential that the gunner understand exactly what is going on at all times. Battlefield conditions do not allow for hesitation; therefore, the gunner's reaction must be automatic.

APPENDIX E
FORWARD LOOKING INFRARED

The purpose of this appendix is to provide the gunner with a greater understanding of how the Javelin acquires its' target. Visible light is seen either directly from a light source or indirectly as the light reflects from an object into the eye. On the other hand, the Javelin is able to create images using the infrared part of the spectrum in a process referred to as Imaging Infrared or I²R.

E-1. INTRODUCTION

The Javelin allows the gunner to see a target at night and during light rain, fog, haze, or dusty atmospheric conditions by taking advantage of a type of energy similar to visible light, known as "infrared."

E-2. ELECTROMAGNETIC SPECTRUM

The electromagnetic spectrum (Figure E-1) contains various forms of energy including radio and television transmission spectrums, x-rays, and visible light humans can see. Visible light is a very small portion of the overall electromagnetic spectrum. Each type of energy is assigned a place in the spectrum according to its frequency—from lowest to highest. As the frequency changes, the characteristics change, so types of energy are bundled into groups of frequencies, or bands, which have similar characteristics. The Javelin uses the infrared band for its sights (NVS and seeker).

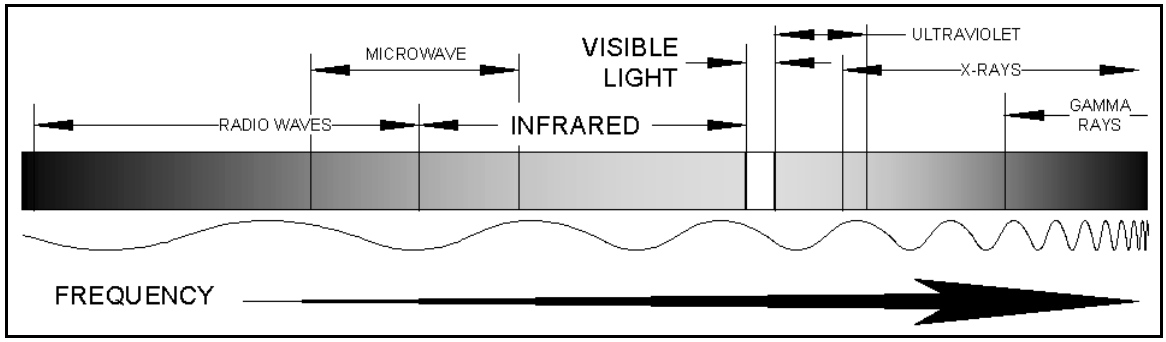


Figure E-1. Electromagnetic spectrum.

a. The Javelin operates, using frequencies in only a small part of the IR band (Figure E-2, page E-2). Other weapon systems operate in this same area, such as the TOW and Dragon, which means the gunner should be able to see anything with the TOW and the Dragon that he can see with the Javelin.

b. Other systems operate using frequencies in other parts of the IR band. This operation includes such equipment as the commander's ground pointer (CGP) and night vision goggles (NVG). Using the CGP and NVGs as an example, when the platoon leader points to a target with the CGP, the gunner can see what the platoon leader points at because the NVGs that the gunner wears operates at the same IR frequency as the CGP.

Using the Javelin, the gunner cannot see where the CGP points because it emits a beam outside the IR band that the Javelin uses.

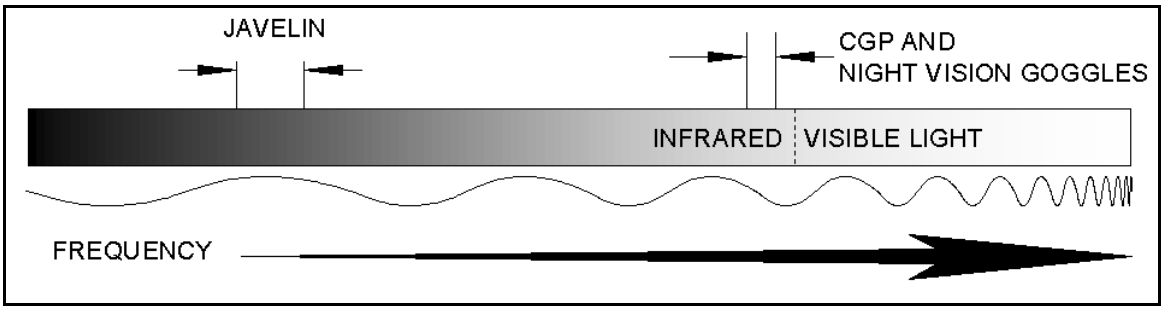


Figure E-2. Infrared band.

E-3. INFRARED WAVES

The IR waves are a ***radiant***, an electromagnetic form of heat. Heat creates IR waves and IR waves create heat. For instance, the heat lamps at fast-food restaurants are above the food, yet they keep the food warm even though heat rises. The reason is that the lamps radiate IR waves down onto the food, and when the IR strikes the food, the food warms up. IR can be emitted in any direction.

a. **Infrared Sources**. Everything on the face of the earth emits IR in the IR band used by the Javelin. Hotter objects emit more IR, and cooler objects emit less. Some objects are classified as IR sources meaning they are able to stay hot by themselves using another form of energy—such as nuclear energy, combustion, and friction—to generate heat energy.

(1) ***Nuclear energy***. Nuclear energy is produced either by splitting atomic particles (called fission) or combining atomic particles together in different forms (called fusion). The sun uses a nuclear reaction to generate heat and is our primary source of IR energy.

(2) ***Combustion*** (Figure E-3). Combustion means there is heat produced by a slow (such as a bonfire) or very quick (such as a controlled explosion) burning. Vehicle engines generate heat due to combustion.

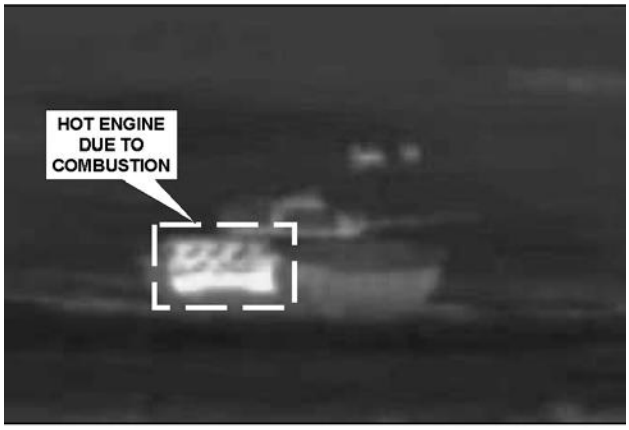


Figure E-3. Heat caused by combustion.

(3) ***Friction***. Friction produces heat by rubbing objects together. For example, when you rub your hands together very quickly, friction causes your hands to warm up, which causes them to give off more IR. The same reaction occurs when a vehicle moves. Its suspension and motion mechanism (tires or tracks) creates friction moving against themselves or against the ground causing the suspension parts to warm up and produce IR (Figure E-4).



Figure E-4. Heat caused by friction.

b. **Infrared Characteristics**. All objects have the IR characteristics of reflection (if IR energy is reflected as in a mirror), absorption (if IR energy is absorbed as in friction), and emission (if IR energy comes from an IR source as in combustion). Like visible light, IR is affected by being transmitted through the atmosphere.

(1) ***Reflecting versus absorbing***.

(a) All objects reflect and absorb IR energy in varying amounts. What is not absorbed is reflected. Objects that reflect IR well do not absorb it well. Plant life, such as trees and grass, reflects IR well. This reflection makes the plants appear to heat up instantly when the sun strikes them and to cool off instantly when the sun blocks the plants.

(b) Absorbing is the opposite of reflecting. Objects that absorb IR well do not reflect it well. Objects such as tanks and rocks absorb IR well. When the sun comes up, this absorption makes these objects stay cold or cool for a longer time when everything else is warm. When the sun goes down, these objects stay hot much longer than other objects in the target scene. For example, illumination tape that becomes dimmer the longer it glows.

(2) ***Emitting IR***. Emitting is closely associated with absorbing. Just like illumination tape that absorbs light before it glows, objects are heated to emit IR. For example, an emitting source is like a combustion engine that generates heat or the human body. When an object absorbs IR, it warms up. As it warms up, it emits more IR. When the heat source is removed, the object continues to emit IR, which causes it to cool off, and the amount of IR that it emits steadily decreases.

(3) ***Transmitting IR***.

(a) Just like light, IR is affected by particles in the atmosphere known as ***obscurants*** because they obscure the gunner's view of the target scene. Obscurants include such things as dust, snow, hail, sleet, fog, and so forth. The effect these obscurants have on IR is noticeably less than their effect on light. Unlike light, some obscurants have no effect on the ability to see an IR image

(b) Obscurants with large-sized particles—snow, sleet, rain, fog, and some forms of smoke—affect the amount of IR that reaches the NVS. As these obscurants become thicker or heavier, the amount of IR that reaches the NVS decreases, which decreases the range at which a gunner can see a target with the NVS.

c. **Physical Properties**. When the sun comes up, some objects heat up faster than others do because they have different IR characteristics. An object's IR characteristics are determined by its physical properties—its mass, density, color, and texture. These properties combine to enhance an object's ability to reflect or absorb the IR that comes into contact with it.

(1) ***Color***. Light colored objects, such as a vehicle with desert camouflage, reflect more IR than they absorb, and heat slowly in the sun (Figure E-5). Dark colored objects, such as a vehicle with woodland camouflage, absorb more IR than they reflect, and heat quickly in the sun.

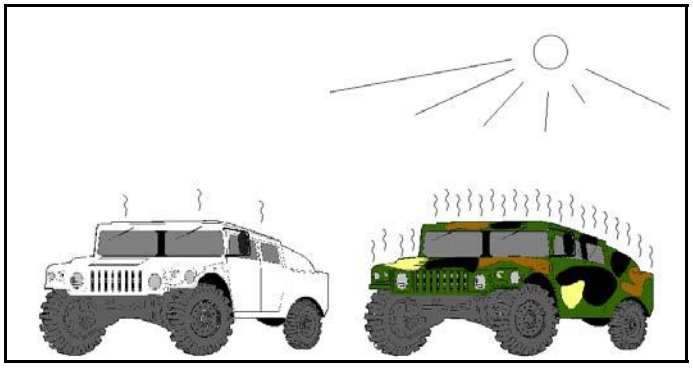


Figure E-5. Infrared affected by color.

(2) ***Density***.

(a) When objects such as trees and grass are exposed to sunlight, they do not become too hot to touch because they do not absorb IR well. As a result, they do not emit IR well, either. The reason is because the material they are made of is not very dense or heavy.

(b) When objects such as vehicles and rocks are exposed to sunlight, they can become too hot to touch because they absorb and emit IR well. The reason is because these objects are denser or heavier than the trees and grass.

(3) ***Surface texture***. Although a military HMMWV and the civilian version (Hummer) both become hot when exposed to sunlight, the Hummer does not heat up as fast as the HMMWV does. The reason for this is the difference in the surface texture, or finish, on the two vehicles. The Hummer has a smooth, waxed surface which tends to reflect well, whereas the HMMWV has a rough surface due to the chemical-agent resistant coating (CARC) paint that tends to absorb well (Figure E-6).

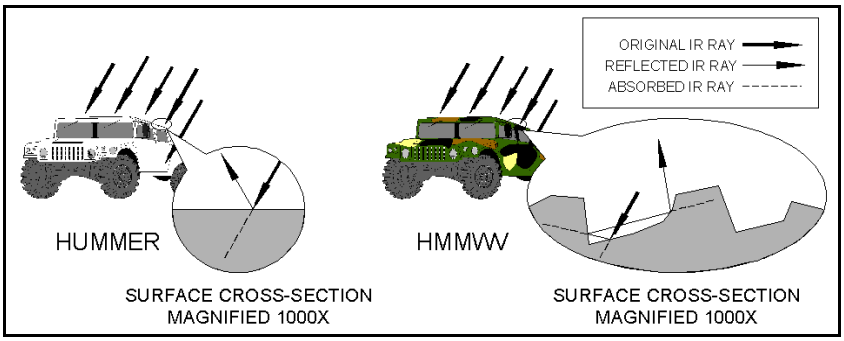


Figure E-6. Smooth versus rough surface texture.

(4) ***Mass***.

(a) The more mass an object has, the more IR it can absorb, the longer it takes to heat up, the longer it can emit IR, and the longer it takes to cool off.

(b) When both a tank and an M16 are in the sun, the armor plates on the tank take longer to heat up than the barrel of the M16 because they have more mass. As a result, the armor plates absorb more IR, and they take longer to heat up to the same temperature as the M16 barrel. Once they are hot, the armor plates emit IR for a much longer time than the barrel of the M16 and they take longer to cool off.

E-4. INFRARED SYSTEMS

There are two types of IR systems: nonimaging and imaging.

a. **Nonimaging Systems**. Nonimaging systems, such as the Stinger surface-to-air missile, are known as ***heat seekers***. Heat seekers do not provide an IR image of the target.

b. **Imaging Systems**. The imaging systems convert IR into a visible-light image. The Javelin is an imaging system providing an IR image that can be used to engage a target. When the missile is launched, it uses a similar image to guide it to the target.

E-5. DELTA-T

The NVS and seeker use IR to create images regardless of visible light levels. The images they display are made possible by the presence of Delta-T's (ΔT's). ΔT's allow us to distinguish between one part of the target scene and another—whether it is different parts of the same object or different objects in the target scene. The gunner can use the Javelin's IR imagery during the day as well as at night.

a. **Definition**. ΔT is an abbreviation for ***change in temperature*** or ***difference in temperature***. Delta (Δ) is a Greek letter that stands for ***change*** or ***difference***. ***T*** stands for temperature.

b. **Temperature/Infrared Relationship**. As the temperature of an object increases, so does the amount of IR it emits. For example, the engine compartment on a tank with its engine running emits more IR than the front of the hull.

c. **Display of Infrared Levels**. The NVS and seeker display IR levels as a change in brightness, according to each object's temperature. The coldest objects in a target scene appear black; the hottest appear bright green. Everything in between appears as increasingly brighter shades of green as each object's temperature increases.

For example, the engine compartment on a tank with its engine running appears bright green (Figure E-7). Since the hull generally is the coldest part of a tank, it appears black. The suspension, which is hotter than the hull but cooler than the engine compartment, appears in a different shade of green.

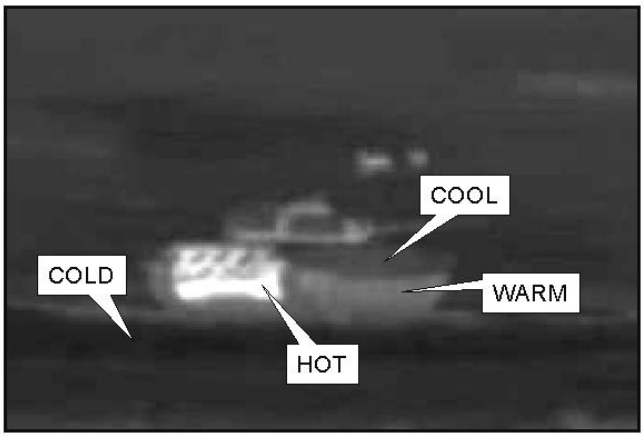


Figure E-7. Display of IR levels.

NOTE: In the figures shown, the coldest objects appear black and the hottest appear white (bright green in the CLU). Everything in between appears as increasingly brighter shades of gray (shades of green in the CLU).

d. **ΔT to Visible Image**.

ΔT's occur between different objects in the target scene and between the different parts of a target. This technique allows the gunner to see different objects in the target scene, and to distinguish between different parts of a target (Figure E-8). For the gunner to see a target with the Javelin, a measurable ΔT which, for Javelin, is a difference between objects of 1 degree Fahrenheit or greater must exist between the target and its background (Figure E-9).

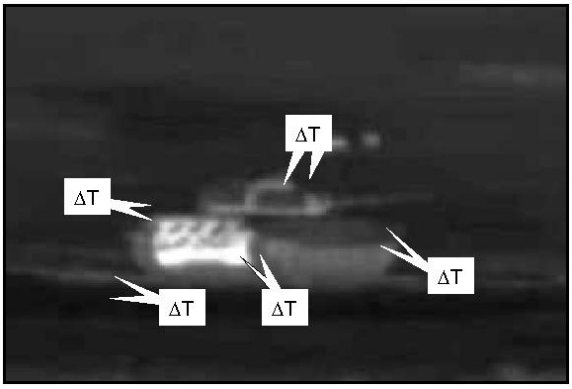


Figure E-8. Delta-T's.

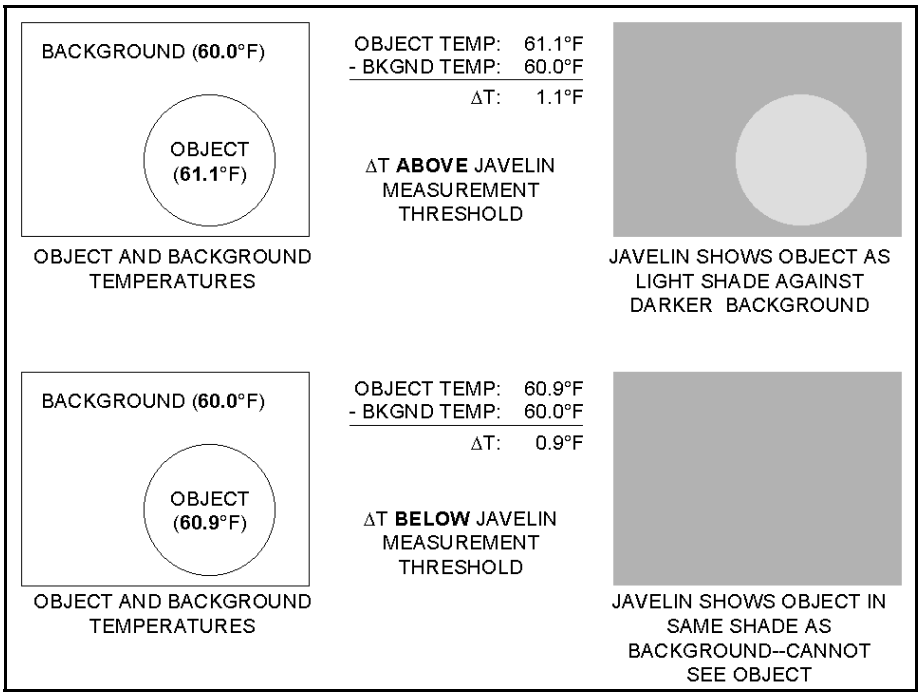


Figure E-9. Measurable Delta-T.

e. **ΔT's Over a 24-Hour Period**.

(1) The temperature relationship between one object and another changes during the day due to heating and cooling as the sun rises and sets.

(2) The gunner knows that vehicles, buildings, and asphalt roads get hot in the sun. Grass and trees become warm but not so hot they cannot be touched. Large bodies of water do not warm up noticeably in one day. Objects that heat up the most during the day tend to become the coldest at night. Objects that heat up very little during the day tend to cool off very little at night (Figure E-10). To illustrate, two images are seen on the same terrain (one at noon and the other at midnight).

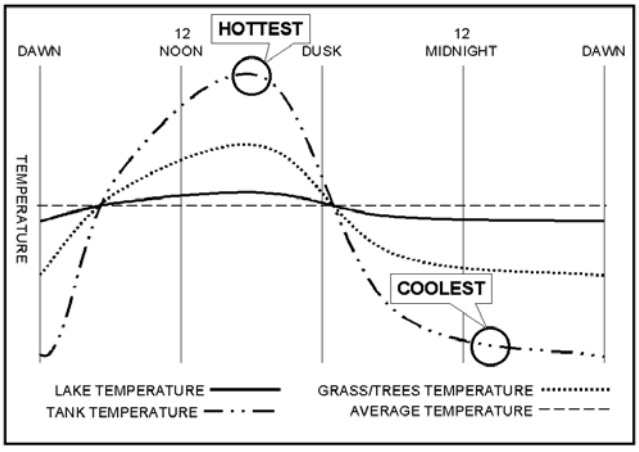


Figure E-10. Temperatures of objects during 24-hour period.

(a) In the noon example (Figure E-11A), notice the buildings, roads, and vehicles are the hottest objects in the scene. The grassy areas and trees are shaded to indicate they are warm, and the river is black, which indicates it is the coolest object in the target scene.

(b) In the midnight example (Figure E-11B), notice how the ΔT's changed. Now, the river is the warmest, the grass and trees are next, with the roads and vehicles being the coolest, with the exception of the engine compartment and exhaust on the vehicles. This example shows how the relationship of ΔT's changes among objects in a target scene over the course of a day.

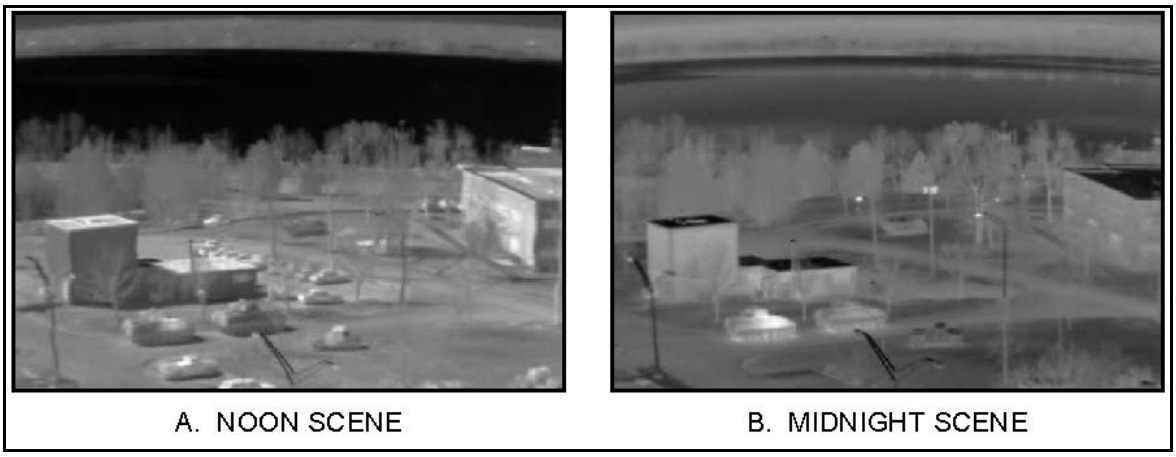


Figure E-11. ΔT changes from day to night.

(3) **Infrared Cross Over.** Twice a day, around dawn and dusk, the temperatures of the tank, grass, and trees cross over from being hotter than the river to being cooler (Figure E-12). These two periods are known as *IR cross over* because of the change in the temperature relationships and the visual effect that it produces. During these two periods, everything in the target scene is about the same temperature, which means there are few, if any measurable ΔT's. As shown earlier, when there is no measurable ΔT, the gunner cannot distinguish a target from its background.

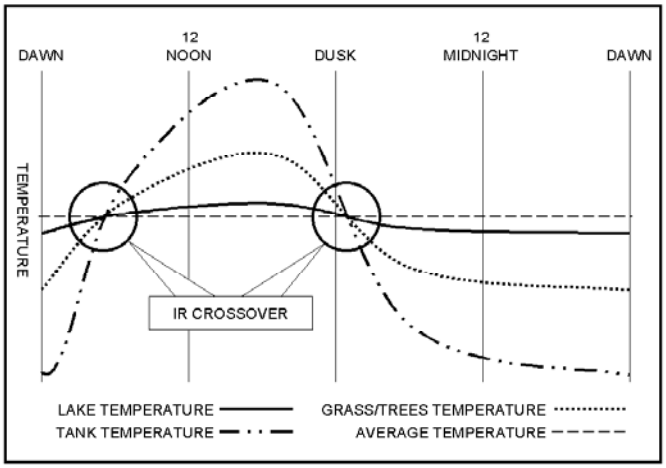


Figure E-12. Crossover periods.

f. **Infrared Image Adjustment**. Proper image adjustment is vital to accomplish the mission because it allows the gunner to see targets that may otherwise be hidden. There is no *perfect* image adjustment. Image adjustment is subjective and should be done according to what the gunner prefers.

(1) ***Focus***. The FOCUS switch adjusts NVS image focus. (An object is in focus when the gunner can easily identify its details or features.) Just like a camera, when an object is in focus in the NVS, anything closer or further away appears out of focus. When the gunner first uses the NVS after cool down, he adjusts the focus before he adjusts the contrast and brightness. Otherwise, the edges of objects in the target scene are blurred, and the gunner is not able to adjust contrast and brightness properly (Figure E-13).

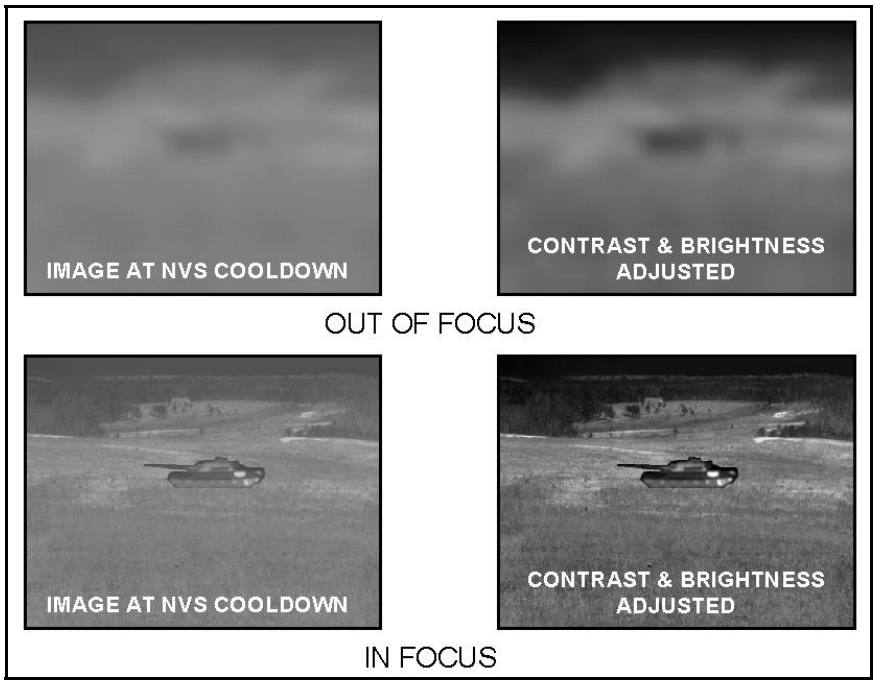


Figure E-13. Focus adjustments.

NOTE: Before focusing the NVS image, focus the CLU display with the diopter adjust ring.

(a) *Initial adjustment*. To adjust focus initially:

- Pick an object in the target scene, such as a far tree line.
- Press the FOCUS switch in either direction until the tree line is in focus (Figure E-14, page E-10).

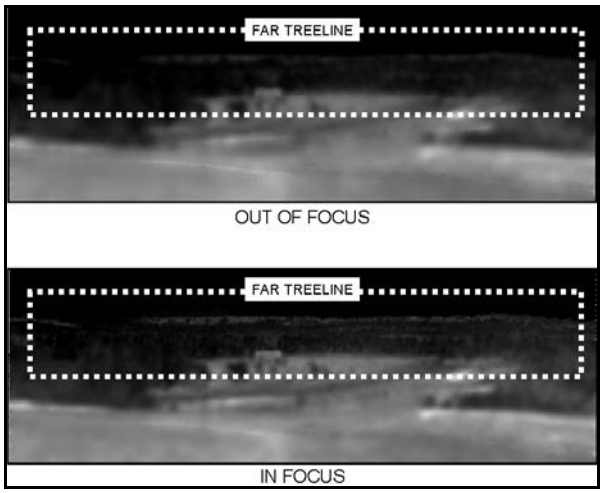


Figure E-14. Focus on far tree line.

- If the tree line becomes more blurred, release the FOCUS switch and press it in the other direction.

NOTE: If adjusting the focus to either limit, the applicable FOV indicator (WFOV or NFOV) flashes to indicate the NVS is at a focus limit. Release the FOCUS switch and adjust it in the other direction.

- When the tree line comes into focus, release the FOCUS switch. If the focus adjustment overshoots, press the FOCUS switch back and forth to make minor adjustments.

(b) *Adjustment speed*. The NVS focus adjustment has two speeds available (press and release or press and hold).

- Minor adjustments. When the gunner presses and releases the focus switch in either direction, the focus adjusts at slow speed (Figure E-15). This procedure allows for fine tuning the focus for a specific object.

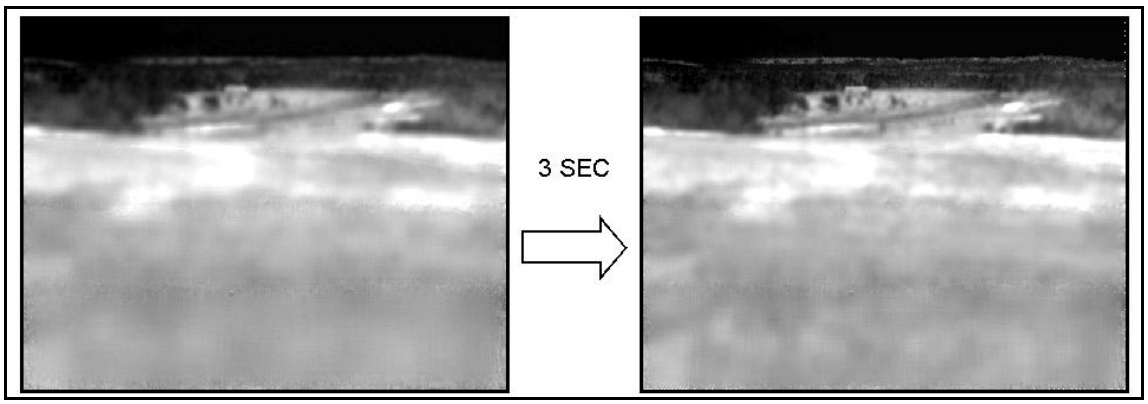


Figure E-15. Slow focus adjustment.

- Major adjustments. When the gunner presses and holds the FOCUS switch in one direction, the focus adjusts at a slow speed for the first three seconds. After that, focus automatically changes to high speed until the gunner either releases the switch or reaches a focus limit (Figure E-16). The high adjustment speed lets him focus quickly on another object that is much closer or much farther away.

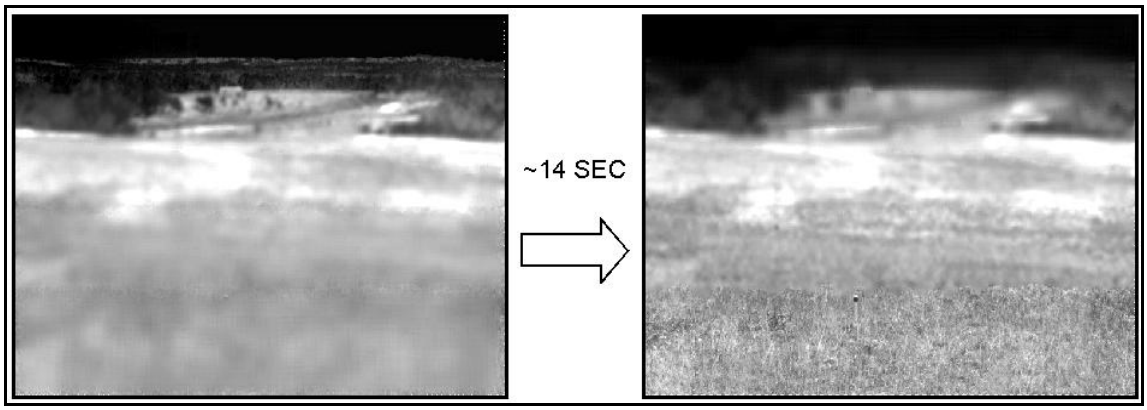


Figure E-16. Fast focus adjustment.

(c) *Focus direction*. To focus on objects farther away, press the FOCUS switch up (Figure E-17). To focus on objects that are near, press the FOCUS switch down.

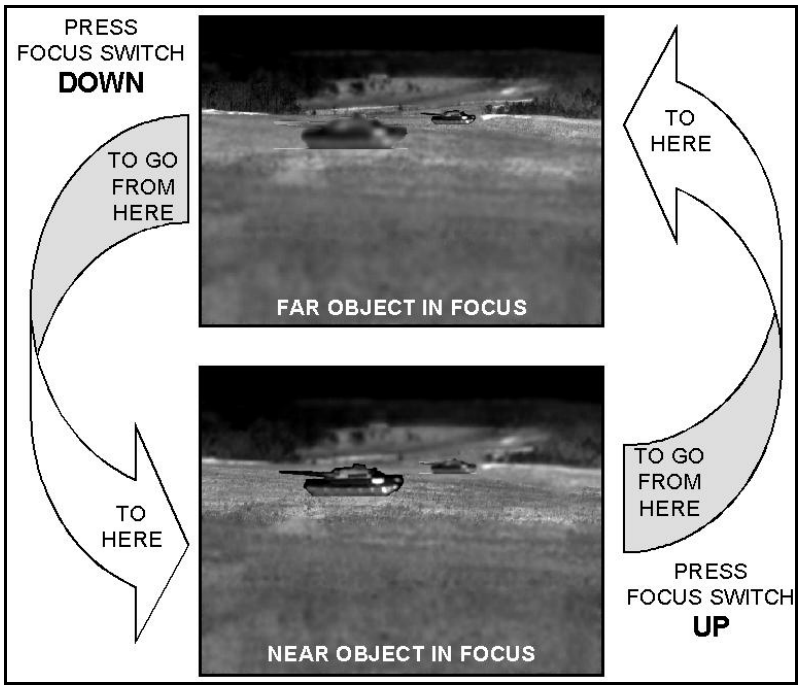


Figure E-17. Focus direction.

(2) ***Contrast and Brightness Adjustment***. Once the image is in focus, it may be necessary to adjust the contrast and the brightness. As the situation changes, the gunner adjusts the focus, the contrast, and the brightness to help in target acquisition.

(a) *CLU power-up*.

- When the power switch is turned to NIGHT and the NVS reaches cool down, the NVS automatically adjusts contrast and brightness for the IR in the target scene (Figure E-18). This gives the gunner a baseline image for making an initial focus adjustment only. He still needs to fine tune the contrast and brightness according to the task.

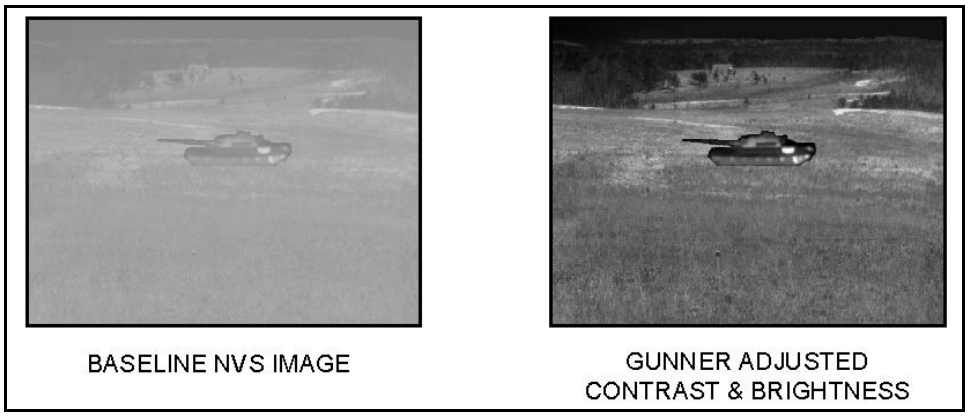


Figure E-18. NVS initial contrast and brightness baseline.

- Contrast and brightness. The gunner adjusts the contrast and the brightness to an extreme (all black or all bright green) and cannot readjust to obtain a usable image.
- Corrective action. The gunner takes corrective action by turning the power switch to DAY, then back to NIGHT. The NVS adjusts itself to the baseline image (Figure E-19).

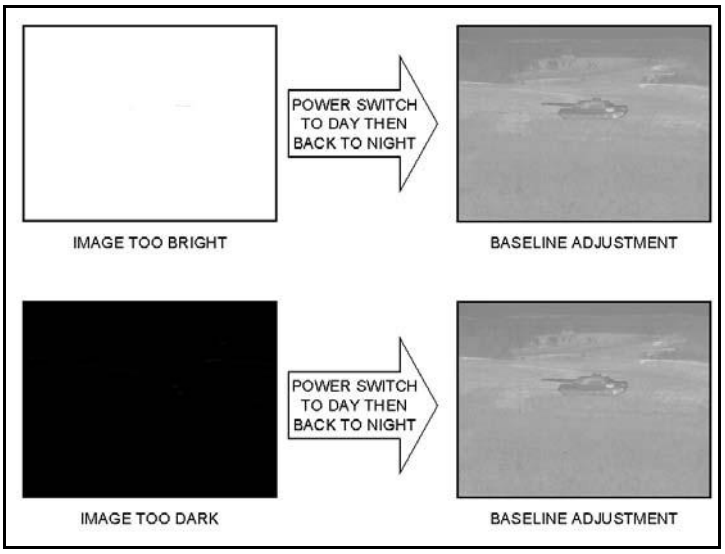


Figure E-19. Return to baseline from an extreme contrast/brightness adjustment.

(b) *Good adjustment*. A properly adjusted target image is one in which the gunner sees a few black spots (the coldest objects) and a few bright green spots (the hottest objects) (Figure E-20). Everything else should be distributed across the shades of green.

- Adjusting the brightness affects the contrast, and adjusting the contrast affects the brightness. The gunner adjusts one, then the other, in small increments, until he has a target image that looks good to him for the task he is doing.
- If the gunner cannot tell whether to adjust the contrast or the brightness first because the entire screen appears bright green or the entire screen appears black, he adjusts the brightness first. If the gunner can see everything in the target scene, he adjusts the contrast first.



Figure E-20. Properly adjusted contrast and brightness.

(c) *Contrast adjustment*. Contrast adjusts the difference between the bright green objects and the black objects with respect to the middle shades of green.

NOTE: In this manual, bright green objects in the CLU appear white in the figures used here. Objects that are shades of green in the CLU appear in shades of gray in the figures.

- Contrast too high (Figure E-21, page E-14). When contrast is too high, all objects are adjusted away from the shades of green in the middle toward the two extremes, so they appear either bright green or black.
- Corrective action. The gunner takes corrective action by decreasing the contrast by moving the GATE ADJ/CTRS & BRT switch left. This decrease brings objects back from the two extremes into the shades of green.



Figure E-21. High versus good contrast adjustments.

- Contrast too low (Figure E-22). When contrast is too low, all objects are adjusted into the shades of green in the middle away from the two extremes, so nothing appears black or bright green.
- Corrective action. The gunner takes corrective action by increasing the contrast by moving the GATE ADJ/CTRS & BRT switch right. This increase spreads the objects out from the middle shades of green back toward the extremes of bright green and black.



Figure E-22. Low versus good contrast adjustments.

(d) *Brightness adjustment*. Adjusting the brightness changes the intensity, or brightness, of the objects in a target scene in the same direction. Increasing brightness makes all objects brighter, and decreasing it makes them darker.

- Brightness too high (Figure E-23). When the brightness is too high, almost all objects in the target scene appear bright green, a few appear in shades of green, and none are black.
- Corrective action. The gunner takes corrective action by decreasing the brightness by moving the GATE ADJ/CTRS & BRT switch down. This decrease drives down the intensity of all objects until some of them appear black.

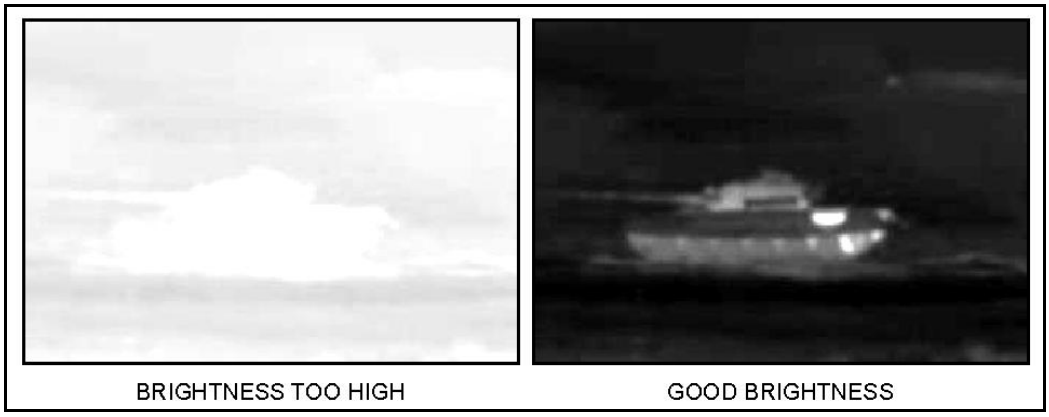


Figure E-23. High versus good brightness adjustments.

- Brightness too low (Figure E-24). When brightness is too low, almost all objects appear black, a few appear as shades of green, and none appear bright green.
- Corrective action. The gunner takes corrective action by increasing the brightness by moving the GATE ADJ/CTRS & BRT switch up. This increase drives up the intensity of all objects until some areas appear bright green.



Figure E-24. Low versus good contrast adjustments.

E-6. FACTORS THAT AFFECT INFRARED TARGET IMAGES AND ΔT's

Conditions that affect the gunner's ability to acquire a target include limited visibility conditions, solar heating, human activity, and range to the target.

a. **Limited Visibility Conditions (Natural and Man-Made)**.

(1) Rain, snow, sleet, fog, haze, smoke, dust, and darkness are referred to collectively as limited visibility conditions. These conditions affect the gunner's ability to acquire and engage targets with the Javelin especially when using day FOV (Figure E-25, page E-16). The gunner uses the NVS to overcome darkness, haze, and some smoke systems.

(2) The NVS can see through low levels of these obscurants better than the daysight. Its capability is restricted at higher levels of obscurations (Figure E-25). The effect on the NVS image is a decrease in contrast.

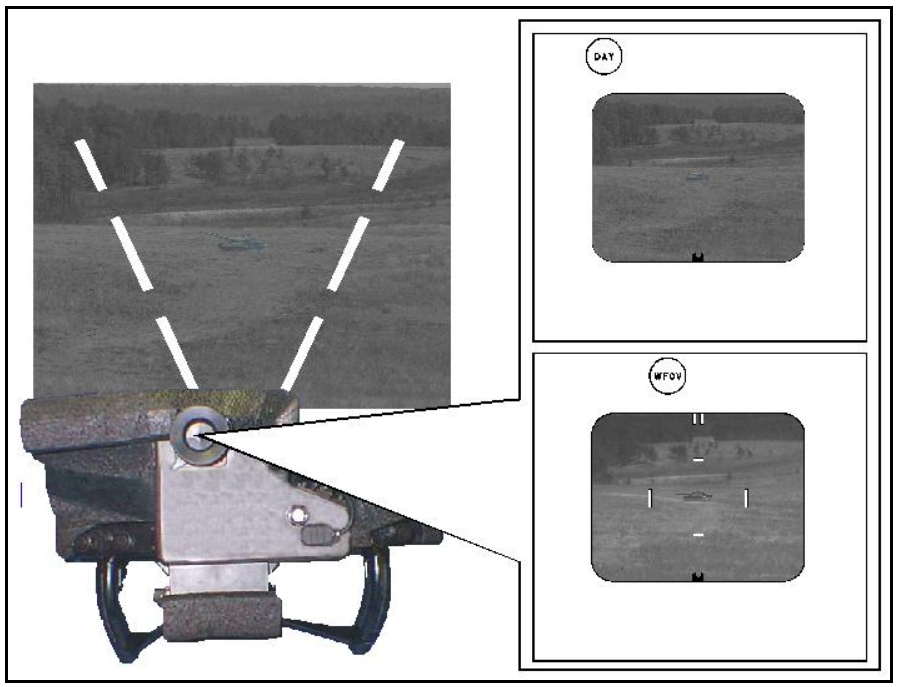


Figure E-25. Day FOV versus NVS operationduring High levels of obscuration.

b. **Solar Heating**. Solar heating is the single greatest influence on the target scene ΔT changes. Solar heating also causes IR clutter and IR crossover, both of which can restrict the gunner's ability to engage a target.

(1) ***Weather***. Weather can greatly change the amount of solar heat on objects. Objects observed during clear weather have good ΔT's due to the high amount of solar heating. In addition, the objects can change their appearance during a 24-hour period. During periods of precipitation (snow, rain, sleet, and so forth), there is little solar heating and the ΔT's are low.

(2) ***Infrared Clutter***. IR clutter is a term used to describe a pattern of ΔT's in the target scene that prevents the gunner from distinguishing a target from its background. This pattern is similar to the effect that is attempted when a soldier wears the battle-dress uniform (BDU). The reason BDUs have a certain color pattern is the BDU pattern blends with the background, cluttering the gunner's outline and making it difficult for an enemy to see him.

(a) IR clutter can be natural or man-made, and there are several differences between the two including cause or origin, effect on the target scene, area of coverage, time and location of appearance, and temperature of the clutter objects relative to the target.

(b) The sun creates natural IR clutter, which generally covers large areas of terrain, such as a field, scattered rocks, or a hillside, which is a disadvantage when trying to engage a target. (This clutter can prevent the gunner from seeing a target and its

movement with the NVS, but not with the daysight.) Natural clutter is unpredictable, so the gunner cannot tell if or when the target is visible. The gunner needs to pay attention to areas of clutter so he can keep track of moving targets that enter these areas. Natural clutter is caused either by solar heating or by IR reflecting off objects in the target scene.

- Clutter from solar heating. When solar heating causes clutter, the clutter stays in the same place and keeps the same appearance for a long time. ΔT's are present in the target and in the background, but the two ΔT patterns match so closely that the gunner may not be able to distinguish the target from the background (Figure E-26). In addition, the range of temperatures in the clutter is the same as those in the target.
- Corrective action. The gunner can first adjust the contrast and the brightness. He may find that contrast and brightness adjustments do not bring out the target from its background. In that case, the gunner must wait for the target to move out of the clutter or wait for the ΔT's to change.

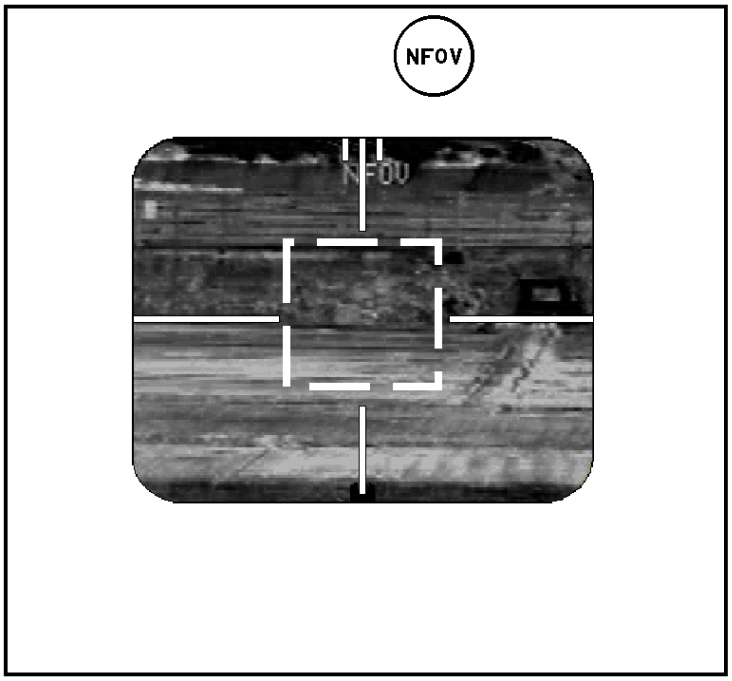


Figure E-26. Infrared clutter—background ΔT pattern matches target ΔT pattern.

- Clutter from reflected IR. When reflected IR causes IR clutter, the clutter comes and goes randomly with the appearance of the sun, and at different locations. (This can cause the gunner to suddenly lose a target that was visible or make a target appear suddenly that was hidden from him.) Its appearance is such that the target and the clutter look like one large area of uniform temperature (Figure E-27, page E-18).
- Corrective action. Generally, a gunner can defeat this type of clutter by increasing the contrast and decreasing the brightness. If not, he must wait for the target to move out of the clutter or wait for the ΔT's to change.

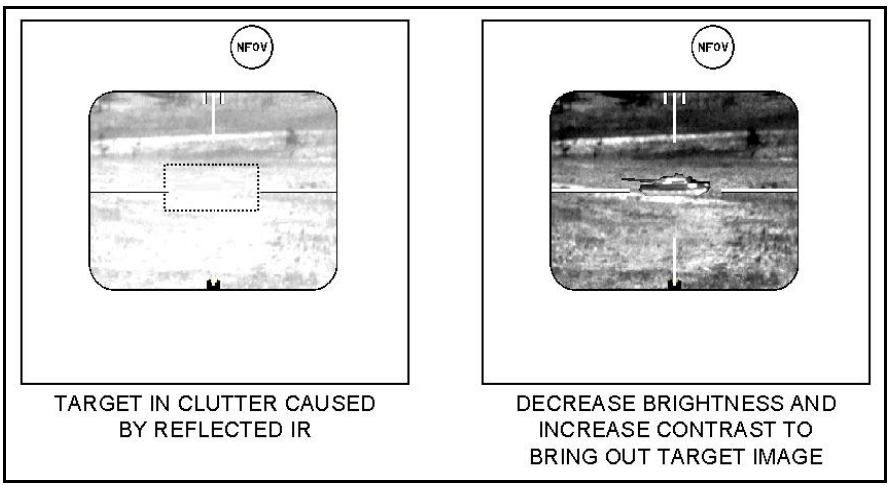


Figure E-27. Defeating clutter caused by reflected IR.

- Although natural IR clutter can prevent the gunner from seeing the target, it usually occurs during the day when the daysight sight works well for surveillance. However, if he cannot see the target with the NVS, the gunner will not be able to see it with the seeker either.
- Man-made infrared clutter. Man-made clutter is when conditions exist that are influenced by human activity that affects objects in the target scene. When the target is in the area that has flames (burning vehicles or buildings), this can work for the gunner and, at the same time, against him. The enemy vehicle may be able to use the flames to hide, thus making it difficult for the seeker to obtain a lock on. However, based on the ΔT's, the gunner may be able to detect the target (Figure E-28).
- Corrective action. The gunner must change the contrast and brightness based on the appearance of the target. The gunner should start by adjusting the brightness first (Figure E-29), then the contrast (Figure E-30, page E-20). The gunner does this until he has a good target scene. Although the gunner may be able to counter the effects of IR clutter in the NVS (WFOV or NFOV) by adjusting the contrast and brightness, he may not be able to see the target in seeker FOV. If the corrective action does not work the target scene and allow the gunner to acquire the target, he should do the following:
  - —Wait for the target to leave the area of IR clutter.
  - —Wait for the target to change in temperature, then try to engage the target.
  - —Wait for the objects causing the IR clutter to change in temperature, then try to engage the target.

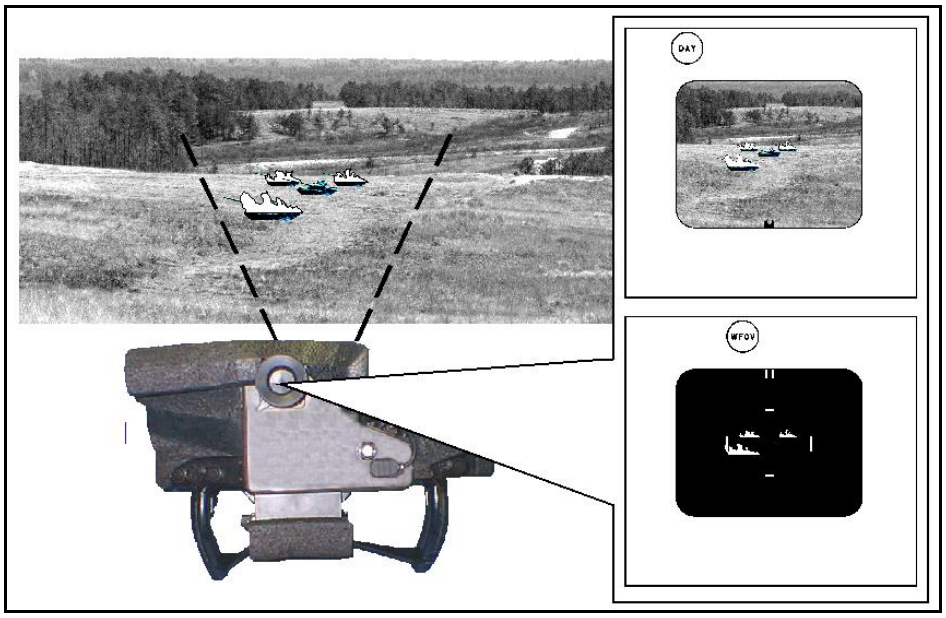


Figure E-28. Effects of man-made clutter on NVS target scene.

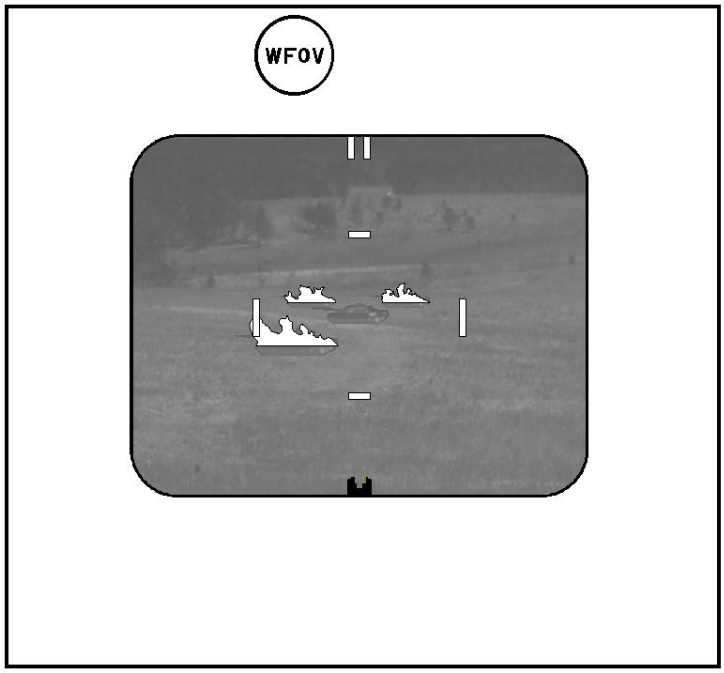


Figure E-29. Counteracting man-made clutter Step 1—adjust brightness.

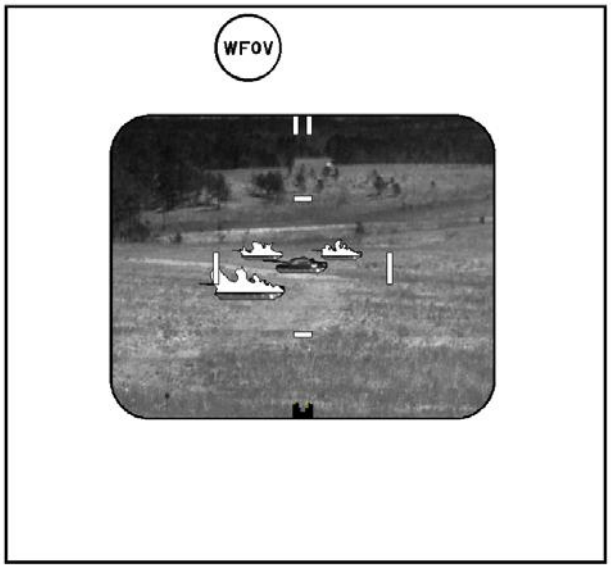


Figure E-30. Counteracting man-made clutter Step 2—adjust contrast.

- Infrared crossover. IR crossover prevents the gunner from seeing the target because everything in the target scene (the background terrain and the target) is about the same temperature. This occurs twice in a 24-hour period at dawn and again at dusk. During this time, the target is nearly the same temperature as its background, so the ΔT between the target and its background is low (Figures E-31). The Javelin detects ΔT's as low as 1-degree Fahrenheit.

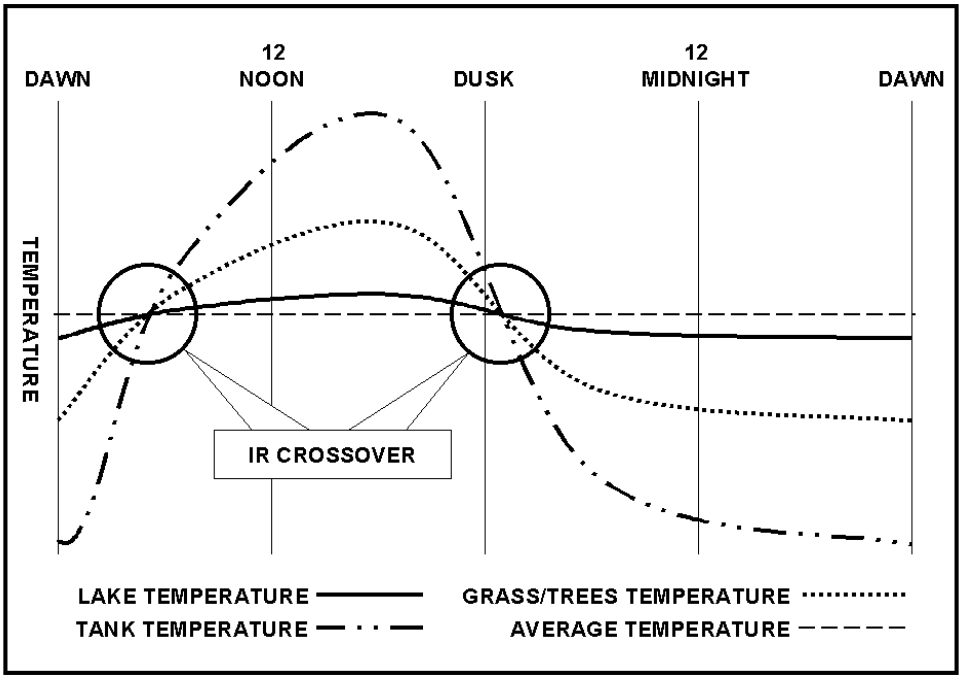


Figure E-31. IR crossover times.

- Corrective action. The gunner can use this capability to overcome the effects of crossover by adjusting contrast and brightness. In addition, crossover will not occur for all parts of the target at the same time. Part of the target will always have a measurable ΔT between it and the background so the gunner can determine the target's location (Figure E-32).

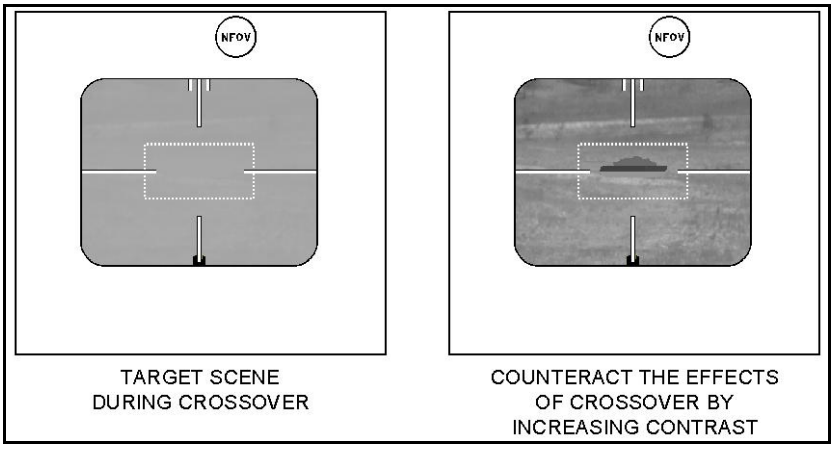


Figure E-32. Infrared crossover effects.

- Human activity. Human activity has an effect on the amount of IR in objects in the target scene, which disrupts the natural changes that should occur in their IR images. For example, at night, vehicles and asphalt roads should appear dark green. When a vehicle is driven for a while, it appears bright green around the engine, exhaust, and suspension as a direct result of human activity. When enough vehicles drive on a road, it will appear as light green where wheel or track friction causes the road surface temperature to increase (Figure E-33).



Figure E-33. Road temperature increases due to friction from vehicle tracks.

- Range to target. The gunner's ability to distinguish a target at maximum range from its background is restricted due to limitations of the NVS magnification, image resolution, and obscurants. When the target moves toward the gunner, the clarity of target details increases as range to the target decreases (Figure E-34).

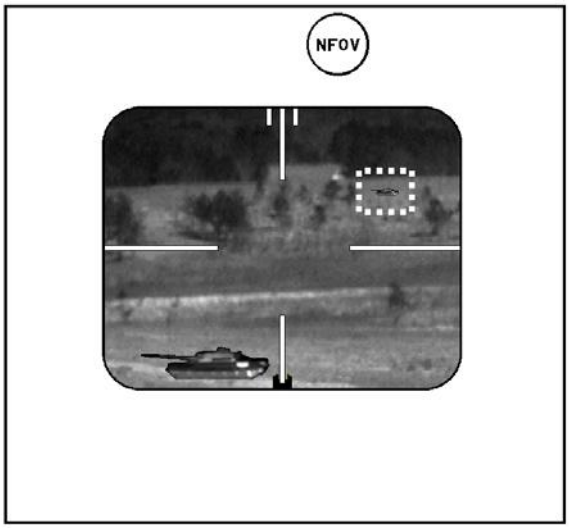


Figure E-34. Effects of range on target details.

E-7. TARGET ACQUISITION

Target acquisition consists of target detection, classification, recognition, and identification, (Figure E-35). Each step has a specific FOV associated with it. These FOV steps allow the gunner to progress efficiently into target engagement. The first three steps are discussed in the target acquisition process only. Target identification is taught at the unit level. Various media is available to assist the unit in this training.

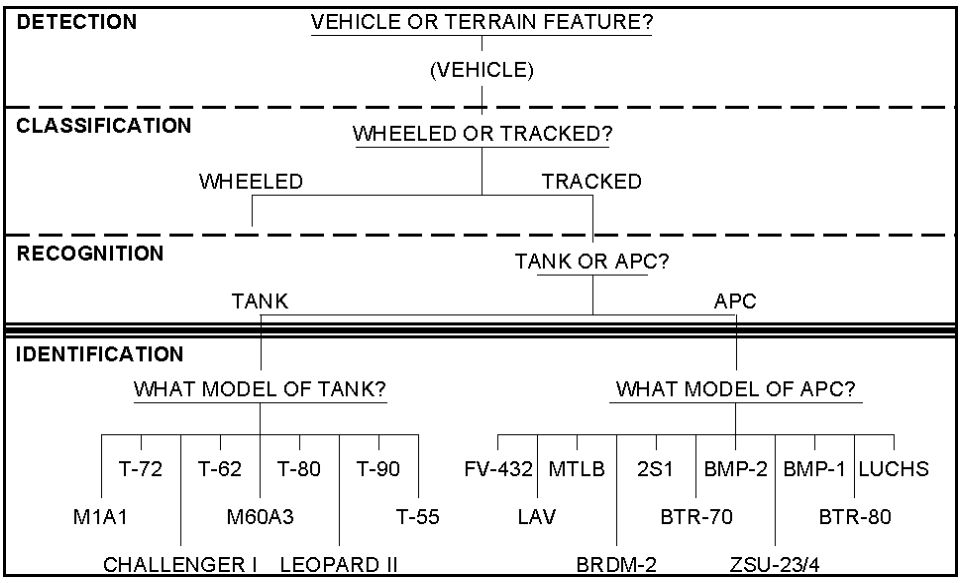


Figure E-35. Target acquisition steps.

a. **Field-of-View Sequence**. As the gunner detects, classifies, and recognizes a target, then, determines its engageability, he must change the FOV, as the task requires. The FOV sequence is day FOV, WFOV, NFOV, and seeker FOV (Figure E-36).

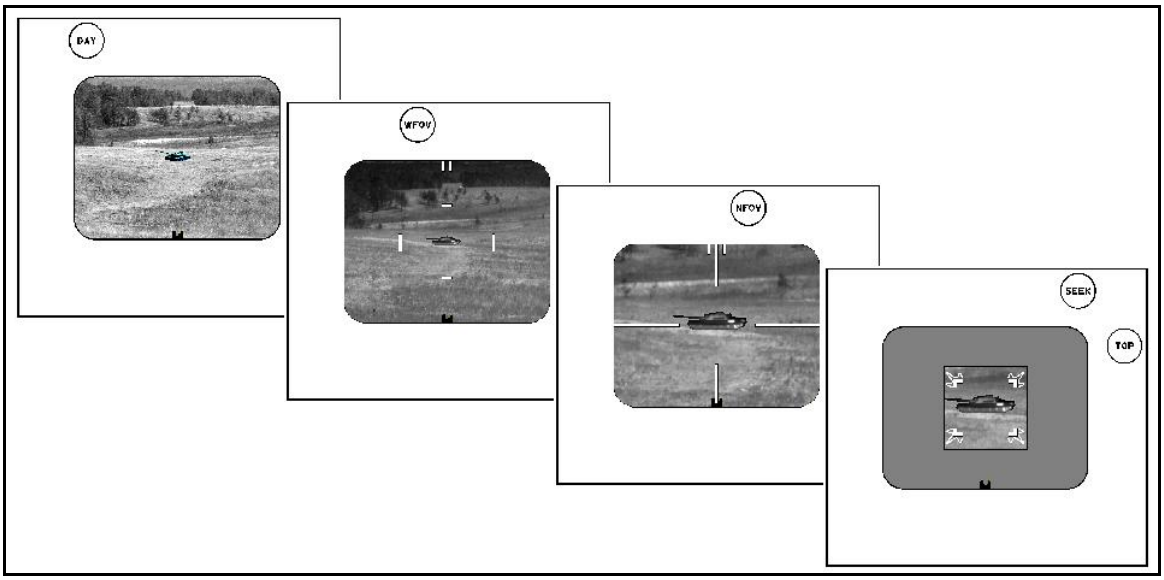


Figure E-36. Target engagement FOV sequence.

(1) ***Day Field-of-View***. Day FOV provides a full-color, visible-light target image with 4x magnification (Figure E-37). Day FOV imagery is only useful during daylight hours with clear weather. The gunner should use it primarily during NVS cool down or when the IR conditions make it difficult for him to see the target in the NVS. Day FOV covers a large area and is used primarily for surveillance and target detection. The 4x magnification limits the gunner's ability to make out target details that are required for target classification, recognition, and identification. However, the gunner may activate the seeker in this FOV to perform a quick engagement.

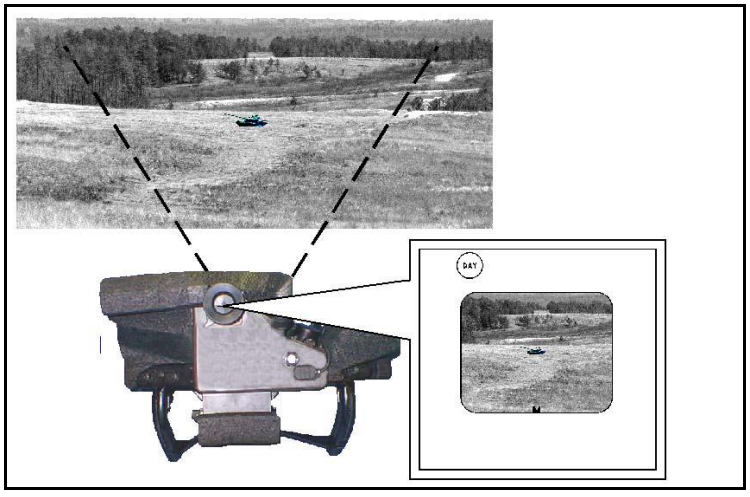


Figure E-37. Day field-of-view image and area of coverage.

(2) ***Night Vision Sight***. The NVS provides two fields of view: WFOV and NFOV. Both provide IR images and can be used at any time of day under any weather conditions. The NVS is the gunner's primary sight.

(a) *Wide field-of-view*. WFOV provides 4.2x magnification of the target scene (Figure E-38). WFOV is ideal for use during surveillance and target detection due to its large area of coverage. The low magnification means the gunner cannot see the target details very well, which makes it a poor tool for target classification, recognition, and identification.

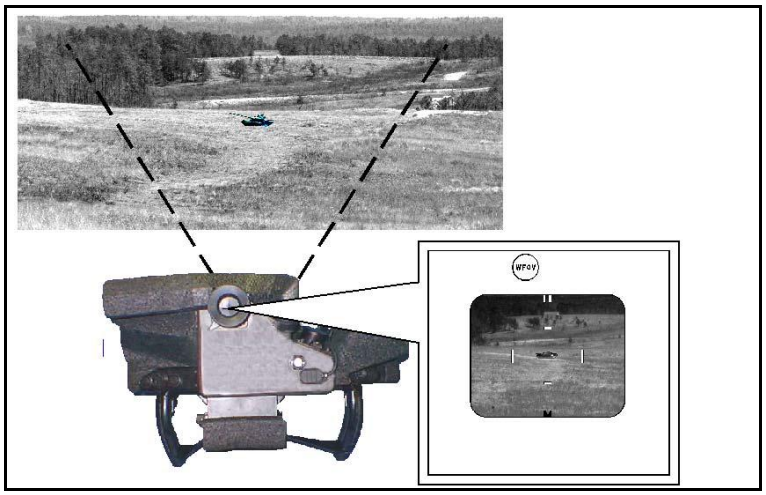


Figure E-38. Wide field-of-view image and area of coverage.

(b) *Narrow field-of-view*. NFOV provides about 9x magnification of the target scene (Figure E-39). Its higher magnification means that NFOV is useful for seeing target details for target classification, recognition, and identification. At the same time, the restricted area of coverage makes it difficult to use for target detection.

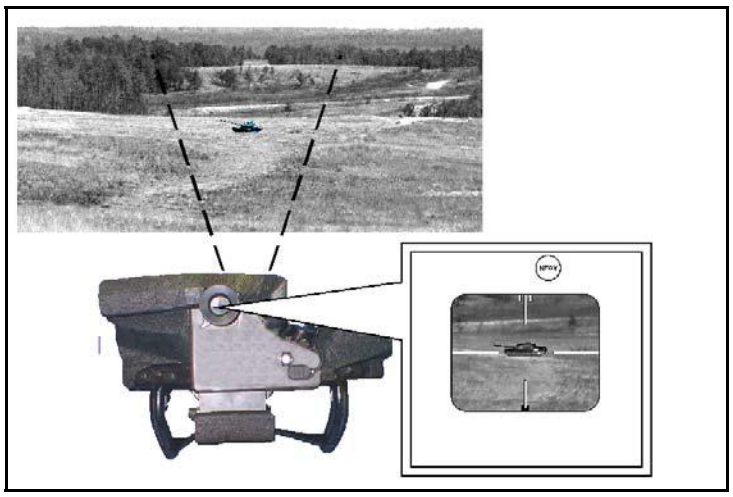


Figure E-39. Narrow field-of-view image and area of coverage.

(3) ***Seeker Field-of-View***. Seeker FOV provides an IR image with about 9x magnification (Figure E-40). The seeker FOV has a limited coverage area and image resolution, and should be used only for engaging targets

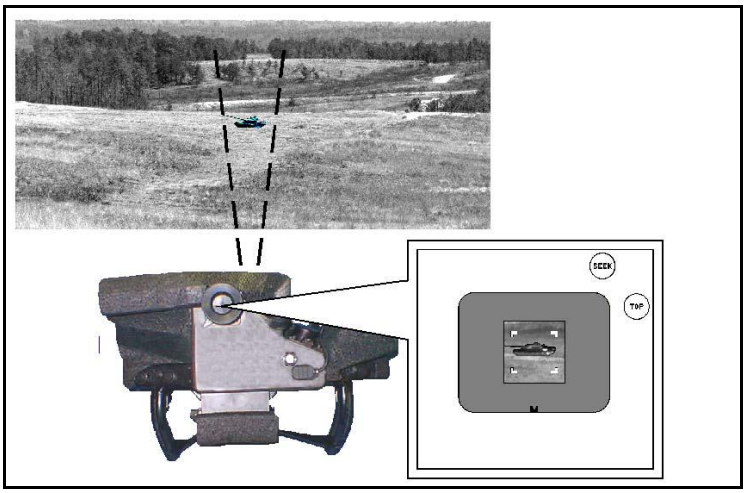


Figure E-40. Seeker field-of-view image and area of coverage.

b. **Target Detection**. The first step in the target acquisition process is target detection (Figure E-41). During this step, the gunner scans his sector of fire to find or acquire a target using the CLU, mainly the NVS. Some techniques that help detect targets are discussed below.

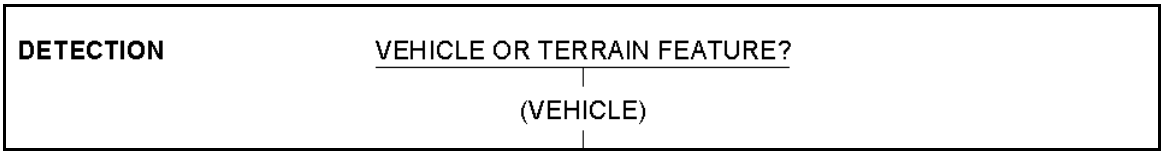


Figure E-41. Target acquisition—detection.

(1) ***Definition***. Target detection describes the process by which the gunner visually locates and distinguishes the features of a vehicle from the surrounding terrain features.

(2) ***Scanning for Targets***. The gunner should—

(a) Scan the entire sector of fire using WFOV.

(b) Scan slowly and steadily in a consistent, systematic pattern.

(c) Pay special attention to those positions in which a target might appear.

(d) Identify the location of objects, such as TRPs, trees, roads, buildings, and previously killed targets that have a distinct IR signature. This procedure enables the gunner to quickly locate targets in his sector of fire.

(e) Look for man-made shapes that have straight lines and block angles.

(3) ***Scanning Techniques***. The gunner must scan his sector of fire at all times for the enemy using rapid scan, slow scan, and detailed search.

(a) *Rapid scan*. (See Figure E-42.) Used to detect obvious signs of enemy activity. It is usually the first method the gunner uses. To conduct a rapid scan, do the following:

- Search a strip of terrain about 100 meters deep, from left-to-right, pausing at short intervals.
- Search another 100-meter strip farther out, from right-to-left, overlapping the first strip scanned, pausing at short intervals.
- Continue this method until the entire sector of fire has been searched.

(b) *Slow scan*. The slow scan search technique uses the same process as the rapid scan but much more deliberately, which means a slower side to side movement and more frequent pauses. When a possible target has been detected, stop and search the immediate area thoroughly using the detailed search.

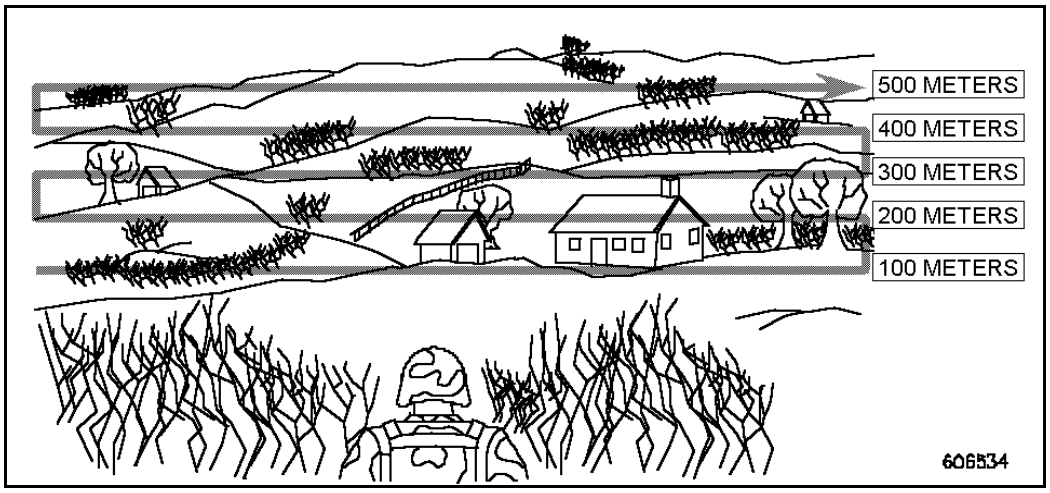


Figure E-42. Rapid/slow scan pattern.

(c) *Detailed search*. If the gunner finds no targets using either the rapid or slow scan techniques, he makes a careful, detailed search of the target area using NFOV (Figure E-43). The detailed search is like the slow scan, but searching smaller areas with frequent pauses and almost incremental movement. The detailed search, even more than the rapid or slow scan, depends on breaking a larger sector into smaller sectors to ensure everything is covered in detail and no possible enemy positions are overlooked.

- Concentrate on likely vehicle positions and suspected armor avenues of approach.
- Look for target signatures around prominent terrain features, such as road junctions, hills, and lone buildings. Also, look at areas with cover and concealment, such as tree lines and draws.

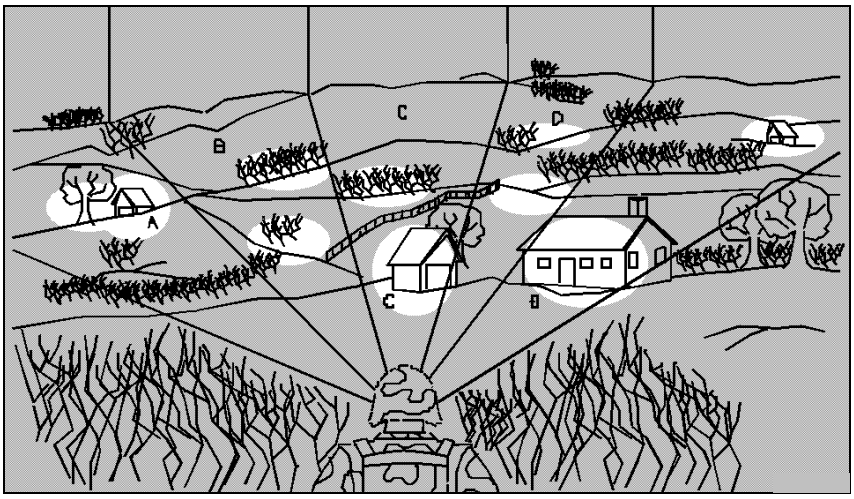


Figure E-43. Detailed search.

c. **Defensive Operations (Moving Targets*)***. When trying to detect the enemy, the gunner should look and listen for signs of enemy presence:

(1) ***Dust or Vehicle Exhaust***. Moving vehicles often raise dust. Stay alert for dust because it can be spotted at long ranges (Figure E-44).



Figure E-44. Dust cloud from moving vehicle.

(2) ***Vehicle Movement***. Look for enemy movement along high-speed avenues of approach. Search along terrain features that offer masking, such as tree lines and draws.

(3) ***Flashing Hot Spots***. As a vehicle moves over small gullies and hills at a distance, its hot spots appear to be flashing and appear to become visible, then invisible as the vehicle drops below the observation line.

(4) ***Sounds***. Equipment or vehicle sounds can alert the gunner to the direction or general location of the enemy. These sounds may not pinpoint the enemy's exact location, but if a sound alerts the gunner to a general area, he is more likely to spot the enemy in that area using the detailed search technique.

(5) ***Image Adjustment***. The gunner can spot moving targets easily due to the hot IR signatures from the suspension, engine compartment, and exhaust, and due to the changes in the target aspect as the target moves in his sector of fire. When the gunner is in a defensive position, he adjusts the image so he can see all of the terrain features (Figure E-45). This procedure helps him locate any targets moving in his sector of fire.

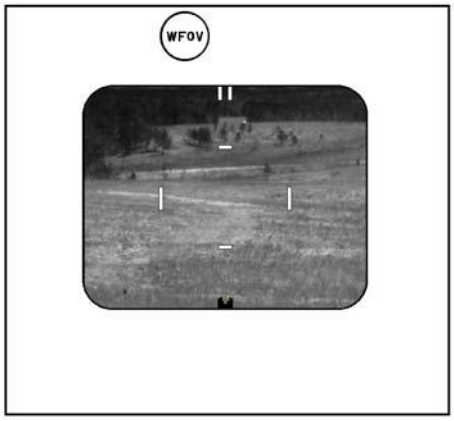


Figure E-45. Image adjustment for defensive position.

d. **Offensive Operations (Stationary Targets)**. During offensive operations, the gunner may encounter stationary targets. A stationary target is more difficult to detect than a moving target, because it does not give away its location by moving, but can be partly or completely concealed by a terrain feature. Key IR signatures may be cold. Depending on how long the target has been stationary, the gunner may see hot, cold, or partly cool signatures. The IR image of a hot, stationary target is much easier to detect than that of a cold, stationary target (Figure E-46). The gunner can augment his visual search to find an enemy emplacement. The difficulty in detecting a target is directly affected by the temperature of the surrounding terrain.



Figure E-46. Hot and cold stationary targets.

(1) ***Sounds***. Listen for equipment and vehicle sounds.

(2) ***Vehicle Exhaust***. Be alert to the presence of vehicle exhaust. Tanks need their engines started every few hours to charge the batteries, which creates a large plume of exhaust (Figure E-47) and a distinctive smell, which may linger even after the engine has been turned off.



Figure E-47. Vehicle exhaust.

(3) ***Dismounted Troops*** (Figure E-48). The human body is a good IR source, and appears as a hot image. Watch for dismounted troop movement that can give away the position of a mechanized force.



Figure E-48. Dismounted troops as IR source.

(4) ***Vehicle Positions***. Look for enemy positions in obvious places, such as road junctions, hilltops, and lone buildings. Observe areas with cover and concealment, such as wood lines and draws.

(5) ***Image adjustment***. The gunner may have to adjust the image several times to detect stationary targets due to various circumstances and examine the following:

- In what aspect (frontal or flank) the gunner sees the targets, which affects what IR signatures he is able to see.
- If the targets are partly hidden by a terrain feature, such as when it is in defilade or in a tree line.

- Whether targets are hot from recent activity or solar heating, partly cool due to reduced activity, or cold due to long inactivity.

e. **Hot Stationary Targets**. Hot stationary targets are the easiest to detect. When a stationary target has hot signatures, the gunner can assume there has been recent activity or solar heating. To find hot signatures easily, adjust contrast up and brightness down so that only the hottest signatures appear in the FOV, and the rest of the scene is black (Figure E-49). When the gunner thinks he has detected a target, he adjusts the contrast and brightness so he can see the rest of the target's features. Depending on the target's exposure and aspect, some of the signatures to look for include the suspension system, engine compartment/exhaust, gun tube or barrel, and an indirect signature called backlighting.

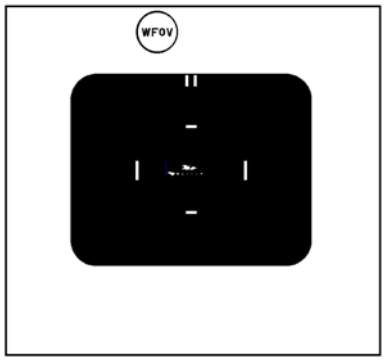


Figure E-49. Image adjustment for detecting hot stationary targets.

(1) ***Suspension System***. When a target has moved recently, its suspension presents a hot IR signature.

(a) The track area presents hot spots due to heating from friction.

(b) When viewed from the front, the tracks are normally visible as two IR signatures on either side of and below a larger dark area (the hull) (Figure E-50). If viewed from the flank, the tracks and road wheels normally are visible as a hot signature beneath a larger dark area (the hull).

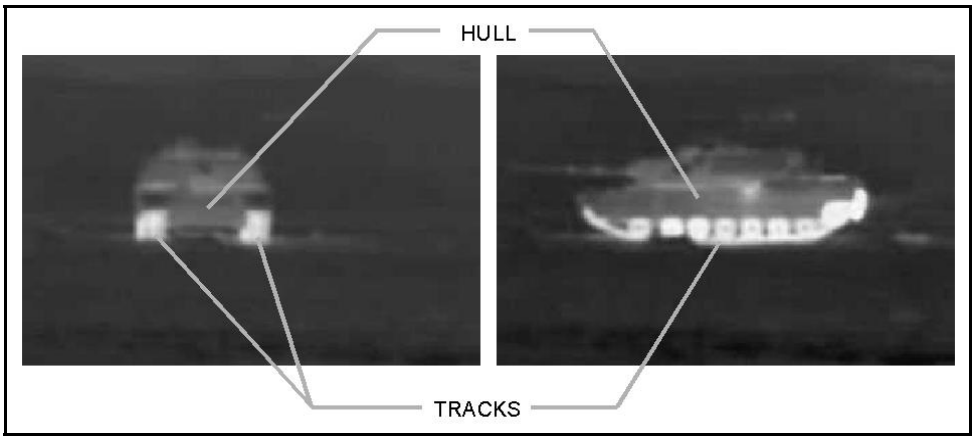


Figure E-50. Track and hull signatures.

(2) ***Engine Compartment*** (E-51). The engine compartment is usually a reliable IR signature for the following reasons:

(a) Due to the extreme heat generated by the engine and the large mass of metal of which it is made, a stationary vehicle's engine compartment gives off a hot IR signature for several hours after the vehicle is stopped. The engine takes longer to cool than the rest of the hull.

(b) A stationary vehicle engine must be started after long periods of inactivity to keep its battery charged. This situation keeps the IR image hot.

(3) ***Gun Tube/Barrel***. The gun tube or barrel is another area to look for heat (Figure E-51). When the gun has been fired recently, it appears hotter than its background.

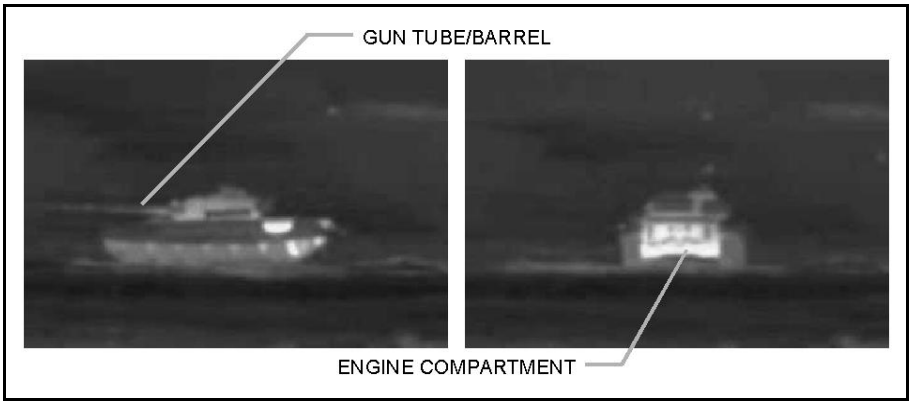


Figure E-51. Engine compartment and gun tube/barrel.

(4) ***Backlighting***. Backlighting is an indirect IR signature that indicates the presence of a target. It is called an *indirect IR signature* because, though it is not physically part of the target, it is caused by heat from the target—usually, from the exhaust. Backlighting occurs when an IR source, such as a tank's exhaust, emits IR, which reflects off another object, such as a tree. Even though the gunner may not see a vehicle, backlighting warns him of its presence (Figure E-52A). When the target is between the gunner and the backlighting, the target may appear as a silhouette (Figure E-52B, page E-32).

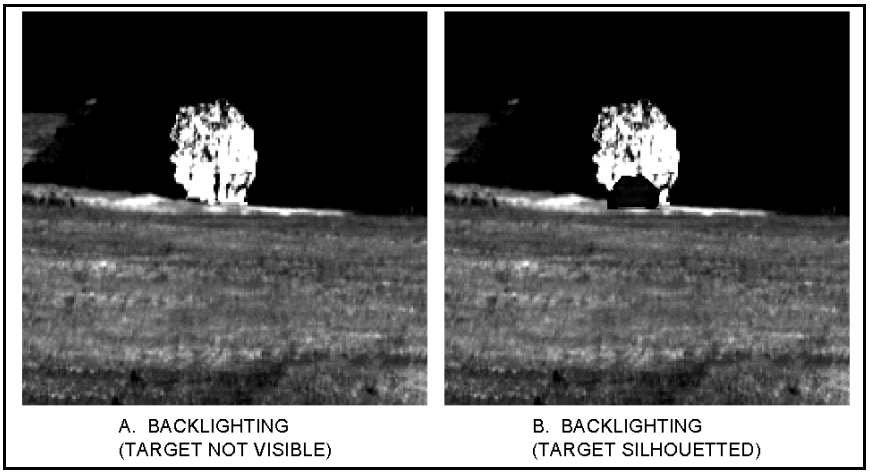


Figure E-52. Backlighting.

f. **Cold Stationary Targets**. When the gunner sees a cold stationary target, he can assume there has been no recent activity. A cold target is cooler than its background. It appears as a dark green or black image against a lighter green background. Look for an IR signature that resembles a silhouette of a wheeled or tracked vehicle (Figure E-53).

(1) To find cold targets easily, adjust contrast up and brightness up so only the coldest signatures appear in the gunner's FOV and the rest of the scene is bright green.

(2) When the gunner thinks he has detected a target, he adjusts the contrast and the brightness so he can see the rest of the target's features.

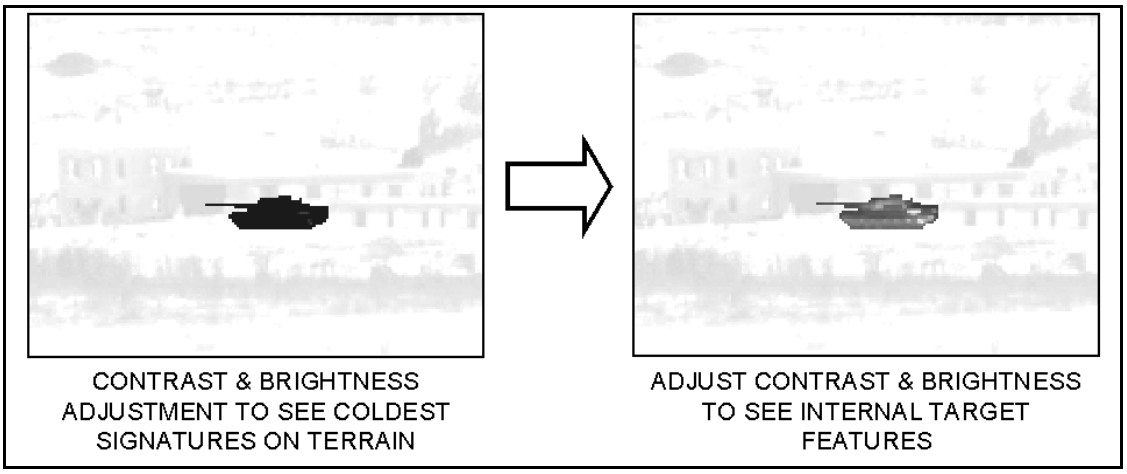


Figure E-53. Image adjustment for detecting cold, stationary targets.

g. **Partially Cool Stationary Targets**. When stationary targets are partially cooled, the gunner can assume there has been some activity. Partially cool stationary targets are especially difficult to detect because their signatures are closer to the same temperature as the surrounding terrain. Their signatures also become distorted and incomplete as they cool. This procedure causes the signatures to blend with the background. To find partially cool targets, the gunner has to adjust the contrast and the brightness in various combinations while he scans his sector of fire.

h. **Hull Defilade Targets (Tanks)**. Hull defilade targets are the most difficult to detect because they are not visible at all times. When a tank is in defilade, it moves back-and-forth between a firing platform and its hide position.

(1) ***Firing Platform Position*** (Figure E-54A). The tank stays on the firing platform long enough to fire its main gun. During the short period of time that it is in this position, the gunner sees only the turret and gun tube. As soon as the tank fires, it moves to its hide position.

(2) ***Hide Position*** (Figure E-54B). When a tank is in its hide position, the gunner cannot see the target, but he may be able to see the tank commander's head.

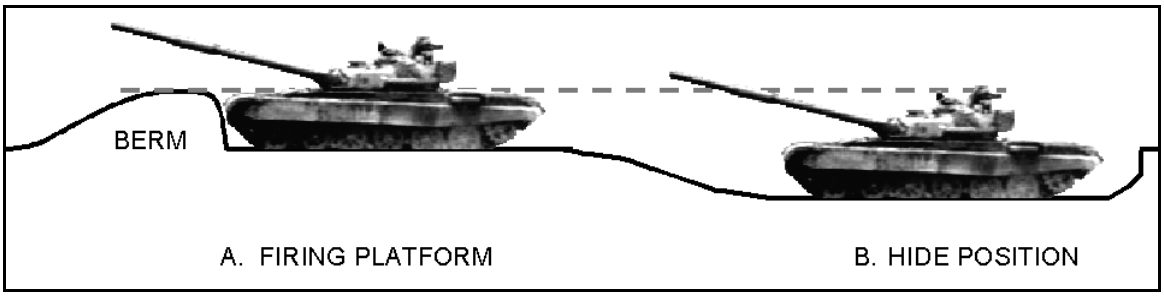


Figure E-54. Tank in defilade.

E-8. TARGET CLASSIFICATION

Once the gunner detects a potential target, he begins the process of elimination to determine the target's classification (Figure E-55).

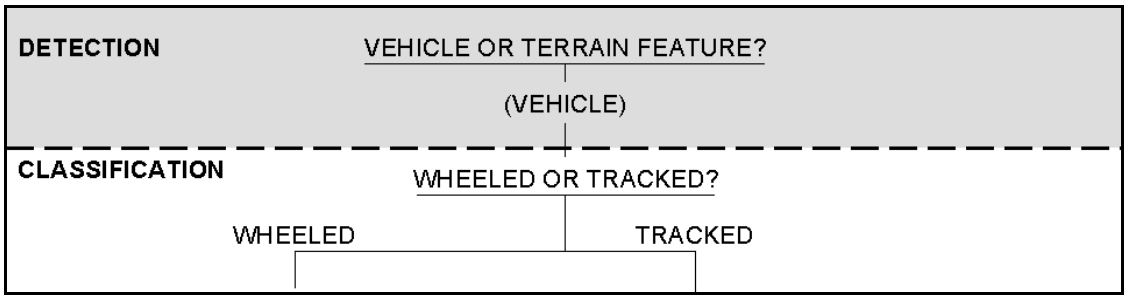


Figure E-55. Target acquisition process—classification step.

a. **Classification Features**. There are specific features that the gunner looks for to classify a vehicle. These features include the suspension system, location of the engine compartment, and presence of a gun tube. Whether or not a feature is visible depends on the target aspect (frontal or flank).

(1) ***Suspension System***. The suspension type defines the target's classification.

(a) *Wheeled vehicle (flank)*. A wheeled vehicle has two- to five-round hot spots at its base that appear large compared to the rest of the vehicle (Figure E-56A, page E-34).

(b) *Tracked vehicle (flank)*. A tracked vehicle has five- to seven-round hot spots created by the road wheels that look small compared to the rest of the vehicle. The tracks may be visible, and depending on the vehicle configuration, the gunner may see return rollers or skirts (Figure E-56A).

(c) *Wheeled and tracked vehicles (frontal)*. On frontal targets, the suspensions for wheeled and tracked vehicles look similar in the NVS (Figure E-56B, page E-34).

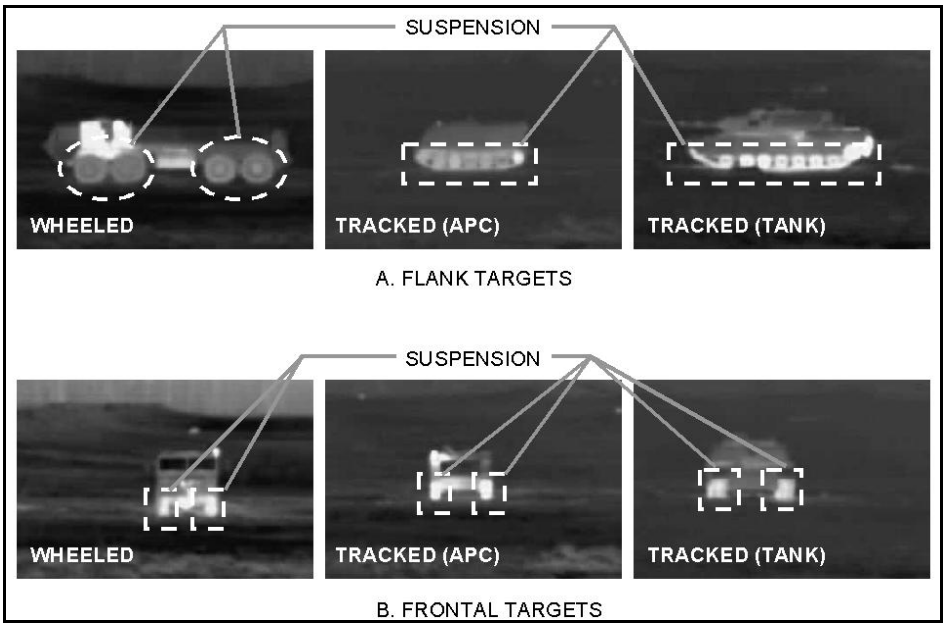


Figure E-56. Classification features—suspension system.

(2) ***Engine Compartment*** (Figure E-57).

(a) *Wheeled vehicles*. Generally, the engine on a wheeled vehicle is located at the front.

(b) *Tracked vehicles*. The location of the engine on a tracked vehicle depends on whether the vehicle is a tank or an APC. Tanks have engine compartments located at the rear. APC's generally have engine compartments located at the front.

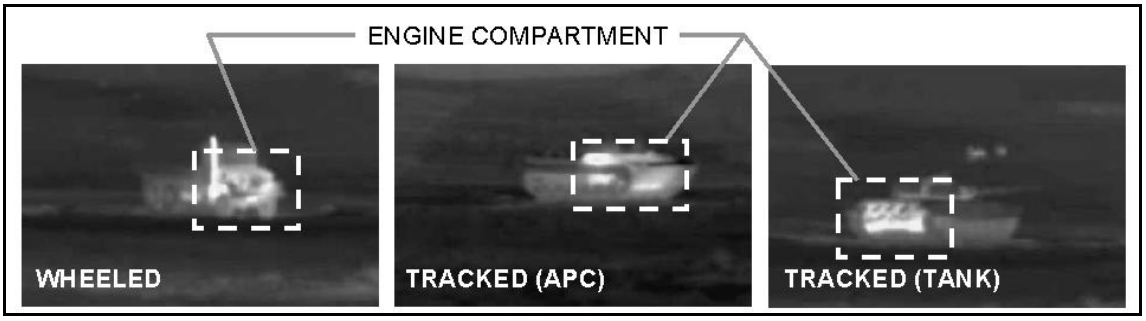


Figure E-57. Classification features—engine compartment location.

(3) ***Gun Tube/Barrel***. When a gun tube or barrel is mounted on a turret or cupola, the Javelin gunner may or may not be able to see it, depending on turret orientation.

(a) *Wheeled vehicle*. In most cases, wheeled vehicles do not have a gun tube, but they may have some type of smaller support gun (machine gun) mounted.

(b) *Tracked vehicle*. When the turret is oriented to the proper angle, the gun tube signature stands out from the turret (Figure E-58).

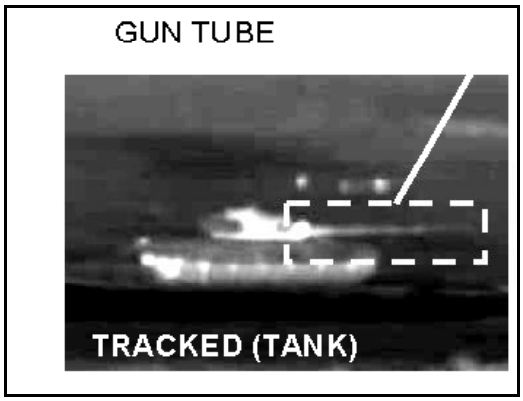


Figure E-58. Classification features—gun tube/barrel.

NOTE: Proper adjustment of focus, contrast, and brightness enables the gunner to classify and recognize targets. Adjust the image so the target features stand out from the surrounding terrain features. It may be necessary to make several adjustments for the same target. See Figure E-59 for examples of poorly adjusted and properly adjusted target images for classification and recognition.

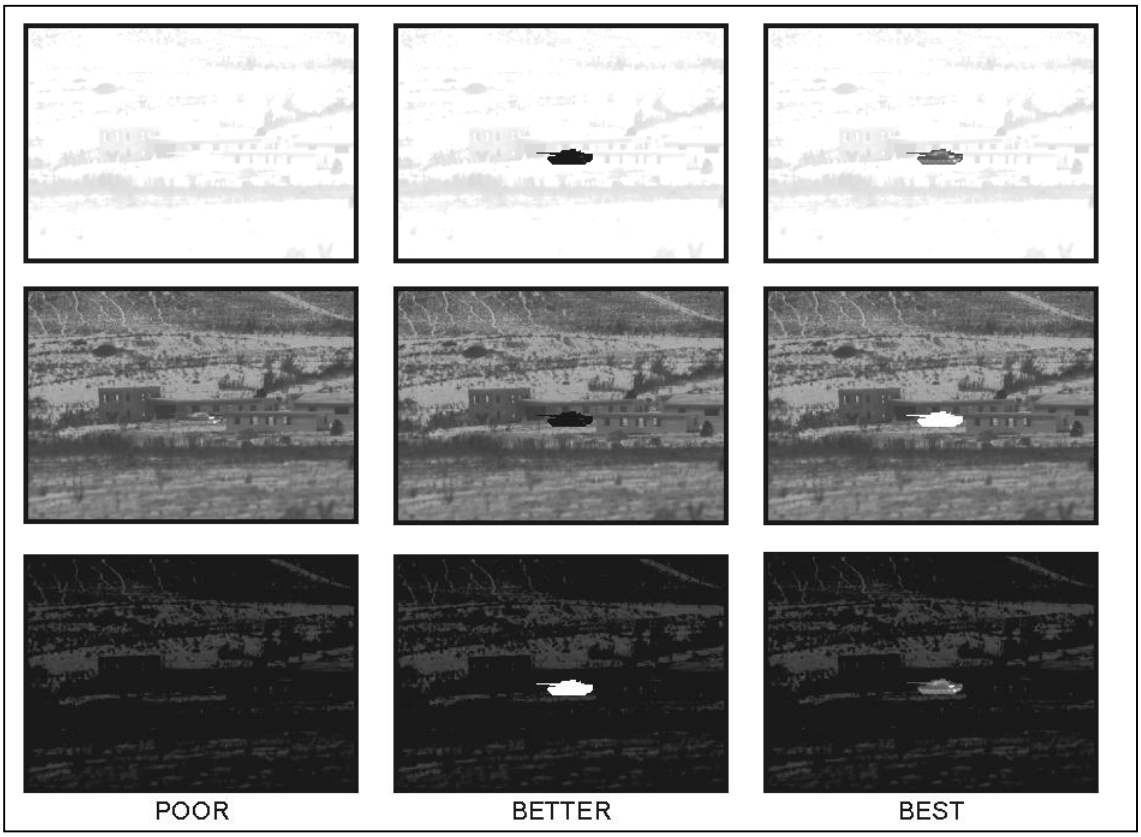


Figure E-59. Image adjustments for target classification and recognition.

c. **Defensive Operations (Moving Targets)**. Some targets may be easier to classify and recognize than others for the following reasons:

(1) ***Range to the Target***. Even under ideal conditions, classifying and recognizing a target at long ranges is difficult due to the NVS magnification and image resolution. As range to the target decreases, target details become clearer, which makes classification and recognition easier.

(2) ***Target Aspect***. Flank targets are easier to classify and recognize than frontal targets (Figure E-60). The profile exposes the suspension and other distinctive features, such as turrets, engine compartments, gun tubes, or other armament.

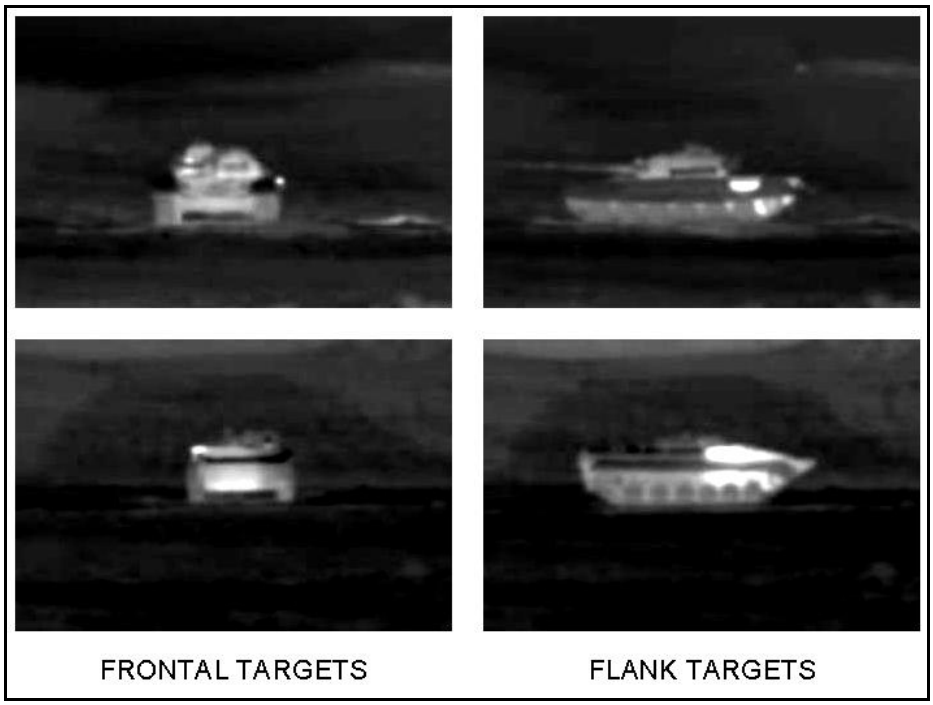


Figure E-60. Classification and recognition features of flank versus frontal target (label APC AND TANK).

(3) ***Target Movement***. A moving target allows the gunner to see it from more than one aspect making it easier to classify and recognize than a frontal target moving in a straight line.

(4) ***Terrain***. Targets try to remain hidden from the gunner by staying in cover and concealment, or by using the terrain to mask their movement. Depending on the amount of terrain masking, the gunner may see only one or two features from which to classify, and recognize a target.

d. **Offensive Operations (Stationary Targets)**. The gunner's ability to detect, classify, and recognize a stationary target depends on:

- Position of the target with respect to the gunner's location.
- Enemy activity.
- Proper image adjustment.
- Amount of target exposure.

E-9. TARGET RECOGNITION

Target recognition is the next step in the process of elimination whether a tracked vehicle is a tank.

a. **Definition**. Target recognition: to determine whether a tracked vehicle is a tank or an APC (Figure E-61).

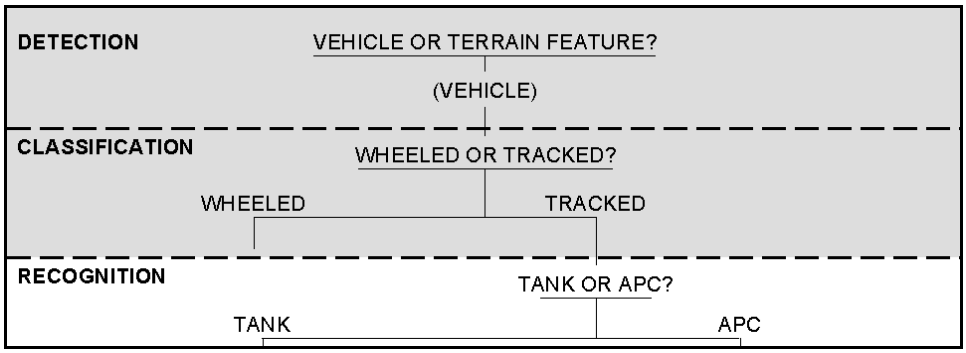


Figure E-61. Target acquisition process—recognition step.

b. **Image Adjustment**. Image adjustment for target recognition is the same as for classification. The gunner should make image adjustments so the target features stand out from the surrounding terrain features. The gunner may have to keep adjusting contrast and brightness to bring out different target details as he tries to attempts target recognition.

c. **Recognition Features**. The major differences between tanks and APCs are shown below (Figure E-62 and Table E-1, page E-38):

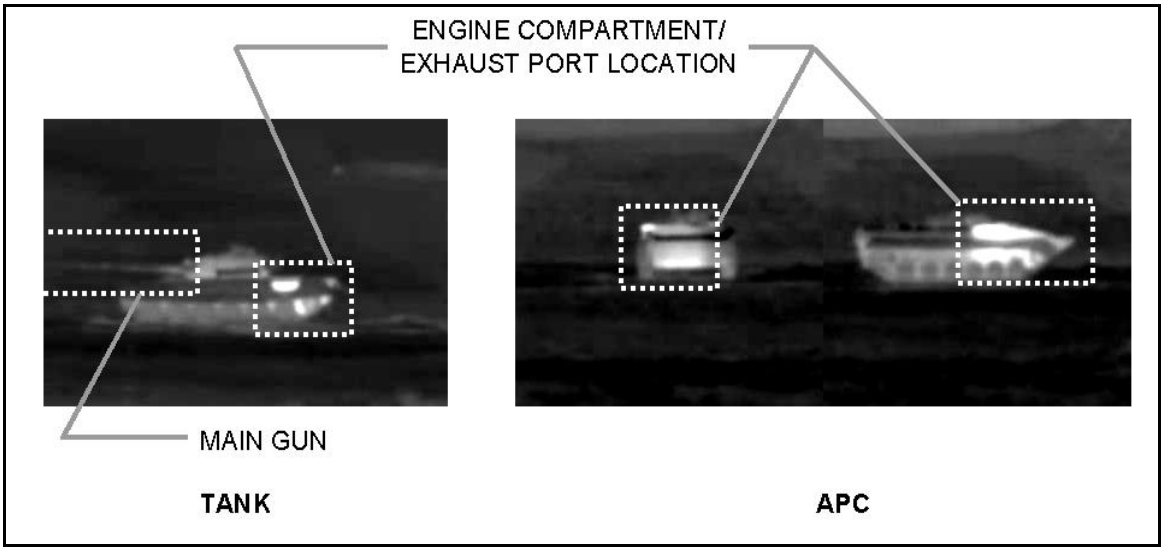


Figure E-62. Target recognition features (ADD FRONTAL AND FLANK LABELS).

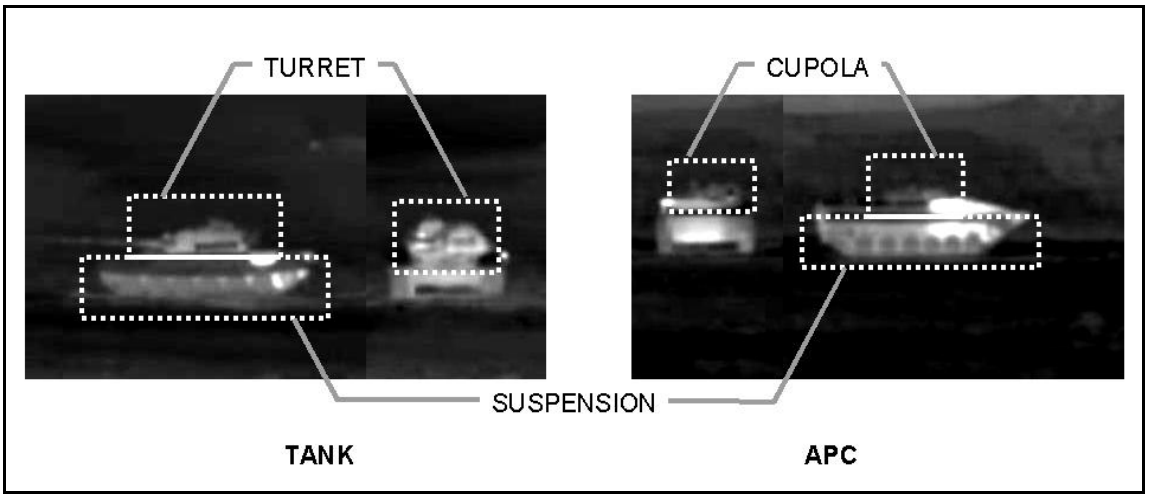


Figure E-62. Target recognition features (ADD FRONTAL AND FLANK LABELS) (continued).

SIGNATURE	TANK	APC
ENGINE COMPARTMENT	LOCATED IN REAR	LOCATED IN FRONT
EXHAUST PORTS	LOCATED IN REAR	LOCATED IN FRONT OR ON THE SIDE
MAIN GUN	LONG AND THICK	SHORT AND THIN
TURRET	YES - AND LARGE	YES, MOST HAVE TURRETS
CUPOLA	NEW TANKS—NO OLD TANKS—YES	YES—USUALLY SMALL
SIZE/SHAPE	LARGE AND SLOPING	SMALL AND RECTANGULAR

Table E-1. Target recognition features.

GLOSSARY

ACRONYMS AND ABBREVIATIONS

AA	avenue of approach
AAR	after-action review
advn	advance
ALES	antitank launch effects simulator
amp	ampere
APC	armored personnel carrier
ARTEP	Army Training and Evaluation Program
ASI	additional skill identifier
asst	assistant
ATGM	antitank guided missile
az	azimuth
batt	battery
BCU	battery coolant unit
BDU	battle-dress uniform
BFV	Bradley fighting vehicle
BIT	built-in test
BMP	fighting vehicle manufactured by the former Soviet Union
BRDM	scout car manufactured by the former Soviet Union
BST	basic skills trainer
BTR	personnel carrier manufactured by the former Soviet Union
CARC	chemical-agent resistant coating
cbt	combat
CCW	counterclockwise
CGP	commander's ground pointer
CLU	command launch unit
CTRS	contrast
CU	control unit
CVI	combat vehicle identification
DC	direct current
DDC	Detector Dewar Cooler
dir	direction
DKIE	decontamination kit individual equipment
DS	direct support
DTR	data terminal ready
ECU	environmental control unit
ETM	elapsed time meter
EM	electromagnetic
EOD	explosive ordnance disposal

ESAF	electronic safe, arm and fire
FERC	field-expedient range card
fltr	filter
FM	field manual
FNC	fiber-nickel-cadmium
FO	forward observer
FOV	field of view
FPF	final protective fire
FPL	final protective line
FPS	feet per second
FSO	fire support officer
FTT	field tactical trainer
FTX	field training exercise
GCU	guidance control unit
GEU	guidance electronics unit
gnr	gunner
GRP	gunner's reference point
GST	gunner's skills test
GTA	graphic training aid
GTC	gunner's training course
HE	high explosive
HEAT	high-explosive antitank
IAW	in accordance with
IFV	Infantry fighting vehicle
IR	infrared
I²R	imaging infrared
IS	instructor station
JGC	Javelin gunner's course
JIG	Javelin instructor guide
kmph	kilometers per hour
LAW	light antitank weapon
LCD	liquid crystal display
LOS	line of sight
LTA	launch tube assembly
LTD	laser target detector
MEL	maximum engagement line
METL	mission essential task list
METT-T	mission, enemy, terrain, troops, and time available

MILES	multiple, integrated, laser engagement system
MITS	Multiple integrated targeting system
MOPP	mission oriented protective posture
MOUT	military operations on urbanized terrain
MRE	meals ready-to-eat
msl	missile
MSR	missile simulation round
MTP	mission training plan
NBC	nuclear, biological, chemical
NFOV	narrow field of view
NSN	national stock number
NVD	night vision device
NVG	night vision goggle
NVS	night vision sight
OES	officer education system
OPFOR	opposing force
OPORD	operation order
OPTIC	optical element
PDF	principal direction of fire
PE	practice exercise
PMCS	preventive maintenance checks and services
POI	program of instruction
ROE	rules of engagement
RPG	rocket-propelled grenade manufactured by the former Soviet Union
RSTA	reconnaissance, surveillance, and target acquisition
SBCT	Stryker brigade combat team
SBCU	simulated battery coolant unit
SCLU	simulated command launch unit
SG	student guide
SINCGARS	Single-Channel Ground and Airborne Radio System
SMR	simulated missile round
SOP	standing operating procedure
SR	simulated round
SS	student station
STP	soldier's training publication
STRAC	standards in training commission
STRAP	system training plan
STX	situational training exercise
TDC	Training Device Course

TM	technical manual
tng	training
TOW	tube-launched, optically tracked, wire-guided missile
TRP	target reference point
VCR	video camera recorder
vert	vertical
VOA	visible optics assembly
WFOV	wide field of view

DEFINITIONS

ΔT (Delta-T)	Delta (**Δ**) is a Greek Letter that stands for change or difference. **T** stands for temperature.
absorbers	Protect CLU from damage during handling and movement
aft end cap	Protects the round from damage during handling and movement; permanently attached to round.
ATTK SEL	attack select. switch between the top attack mode and the direct attack mode.
backlighting	Indirect IR signature that indicates the presence of a target.
battery coolant unit	Provides electrical power and seeker cooling for the missile.
basic skills trainer	An indoor/shipboard training device that can train and test the gunner's skills in a wide variety of situations.
carry handle	Used to lift and carry the round.
CLU interface connector	Provides electrical interface with the round.
CTRS	contrast. The contrast is adjusted by moving the GATE ADJ/CTRS and BRT switch horizontally (left and right).

DFOV	day field of view. The power switch is in the DAY position, the Javelin is in mode. The status indicator located on the CLU display. This appears as a green indicator light when the day FOV is selected.
daysight	Optical system that works similar to a telescope. Develops a magnified, visible-light target image for the gunner.
desiccant	Used to prevent moisture from gathering in the missile and causing possible missile malfunctions. It is located inside forward end cap.
DIR	Direct attack mode. When the DIR indicator light is lit the direct attack mode is selected.
elapsed time meter	Records total operating hours of CLU. It is located in battery compartment.
electronic safe, arm and fire	Controls arming and ignition of the missile motors, arming, and detonation of the warhead charges.
eyepiece	Allows viewing of CLU display image. Contains diopter adjust ring that gunner uses to focus CLU display image, eyecup.
face shield absorber	Shields gunner's face from possible launch debris and helps protect CLU from damage during handling and movement.
FLTR SEL switch	filter select. The filter select switch is used to select the night vision sight (NVS) filter. The NVS filter prevents the CLU from being detected by enemy countermeasures.
fire trigger	Used to initiate missile firing sequence
FOC ADJ switch	focal adjust. Used to adjust the focus of the CLU display image during NVS (NFOV or WFOV) operation.
forward end cap	Protects the round from damage during handling and movement. It provides environmental and electromagnetic interference (EMI) protection for the missile. It is removed prior to missile firing.

field tactical trainer	Designed to be used as an outdoor trainer and is equipped with the MILES.
GATE ADJ/CTRS and BRT	gate adjust/contrast and brightness. It serves two functions depending on whether the CLU display image is from the NVS or the seeker. In the NVS mode the controls adjusts the brightness and contrast. In the seeker mode the controls control the track gates by moving them in or out horizontally and vertically.
humidity indicator	Displays status of relative humidity inside CLU. It is located on right side of CLU. It displays the status of relative humidity inside LTA. Located on the forward end cap.
latch assembly	Latch assembly together with the alignment fork and latch release provide the mechanical interface with the CLU.
launch tube assembly	Serves as a handling container and launch platform for the missile. Provides environmental and electromagnetic interference (EMI) protection for the missile.
left handgrip controls	Consists of focus adjust (FOC ADJ), sight select (SGT SEL), and filter select (FLTR SEL) switches.
lock-on	Simulated seeker lock-on has been commanded.
locking pin	Locks the forward end cap latch in place and prevents movement.
missile simulation round	Simulates the weight and balance of the round and has CLU and BCU connectors.
night vision sight	Optical system that converts an IR target image into a visible-light target image for the gunner.
power switch	Four-position rotary switch used to place the Javelin into operation.

right handgrip controls	Consists of gate adjust (GATE ADJ), contrast and brightness (CTRS and BRT), and attack select (ATTK SEL) switches.
round interface bracket	Round interface bracket together with the alignment pin and round interface catch provide the mechanical interface with round.
round interface connector	Provides electrical interface with the CLU.
seeker trigger	Used to initiate seeker mode of operation and seeker lock-on.
shoulder pad	Provides point of balance and support when round is placed on gunner's shoulder.
shoulder strap	Provides a means of carrying the round. Can be placed on gunner's shoulder or diagonally across chest.

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PIN: 080639-000