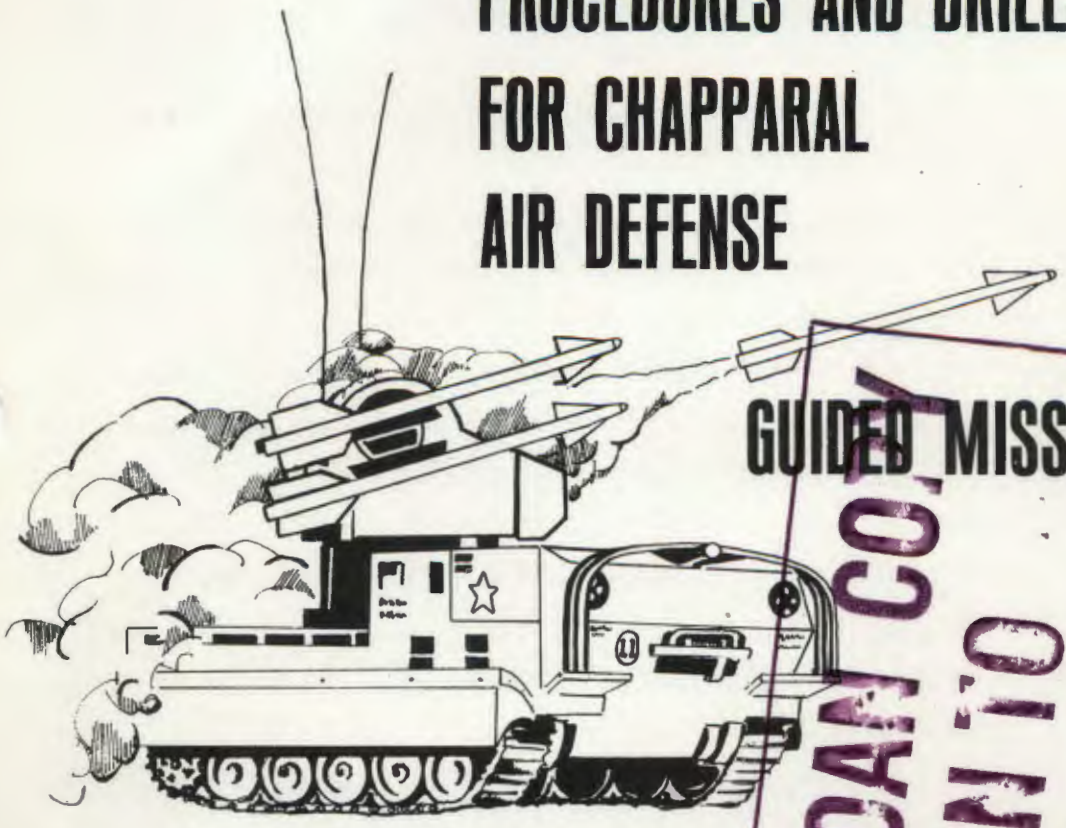
FM 44-4

FIELD MANUAL

PROCEDURES AND DRILLS FOR CHAPPARAL AIR DEFENSE GUIDED MISSILE SYSTEM



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FIELD MANUAL
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HEADQUARTERS
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PROCEDURES AND DRILLS FOR CHAPARRAL AIR DEFENSE GUIDED MISSILE SYSTEM

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*This manual supersedes FM 44-4, 30 January 1969 and rescinds FM 44-4A, 8 August 1969.

CHAPTER 1

GENERAL

1-1. Purpose and Scope

a. This manual provides guidance for squad, platoon, and battery level personnel concerned with the operation and tactical employment of the Chaparral air defense guided missile system.

b. The manual describes the organization of the Chaparral battery, major components of the system, squad drill, and system operating procedures. Also covered are visual detection and identification of targets, target selection criteria, and conduct of fire.

c. The manual is restricted to the presentation of unclassified data on the Chaparral system. Classified information can be found in FM 44-1A. Additional guidance for the employment of Chaparral is presented in FM 44-1-1 and FM 44-3.

d. The material contained in this manual is applicable to both nuclear and nonnuclear warfare.

1-2. Recommended Changes and Comments

Users are encouraged to submit recommended changes and comments to improve this manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared, using DA Form 2028 (Recommended Changes to Publications), and forwarded direct to Commandant, US Army Air Defense School, ATTN: ATSAD-DL, Fort Bliss, Texas 79916.

1-3. References

Publications used as references for this manual and those offering further technical information on subjects contained herein are listed in appendix A.

1-4. Abbreviations

Abbreviations are defined the first time they appear in the text and are also listed in appendix B.

CHAPTER 2

UNIT ORGANIZATION AND MISSION

2-1. General

The Chaparral guided missile system is the combat element of the air defense artillery battery, Chaparral, self-propelled. The Chaparral battery is deployed with air defense artillery battery, Vulcan, self-propelled (or towed) to form Chaparral/Vulcan air defense artillery battalions. These battalions are employed at division, corps, and field army level to provide combat units and installations with an effective defense against low-altitude hostile aircraft.

2-2. Organization of Chaparral Battery

The Chaparral battery (fig 2-1) is organized to provide channels for command, control, and supervision. It can perform its assigned mission either as a unit or by the assignment of separate missions to platoons. The battery has essentially two major subdivisions; a headquarters element that provides command and control, and administrative, maintenance, and supply services for the entire unit; and the firing platoons that provide fire units and platoon command and control capability.

★2-3. Battery Mission and Capability

a. The mission of the Chaparral battery is to provide air defense against low-altitude, hostile aircraft for forward area combat elements, vital areas, and designated installations.

b. Chaparral battery capabilities consist of:

(1) Delivery of fire against low-altitude, hostile aircraft.

(2) Local defense of unit installations.

(3) Storage and transportation of basic load of missiles.

(4) Communications within the battery, and with parent organization and supported units.

(5) Operator and organizational maintenance of all battery equipment.

(6) One hundred percent mobility with organic transportation.

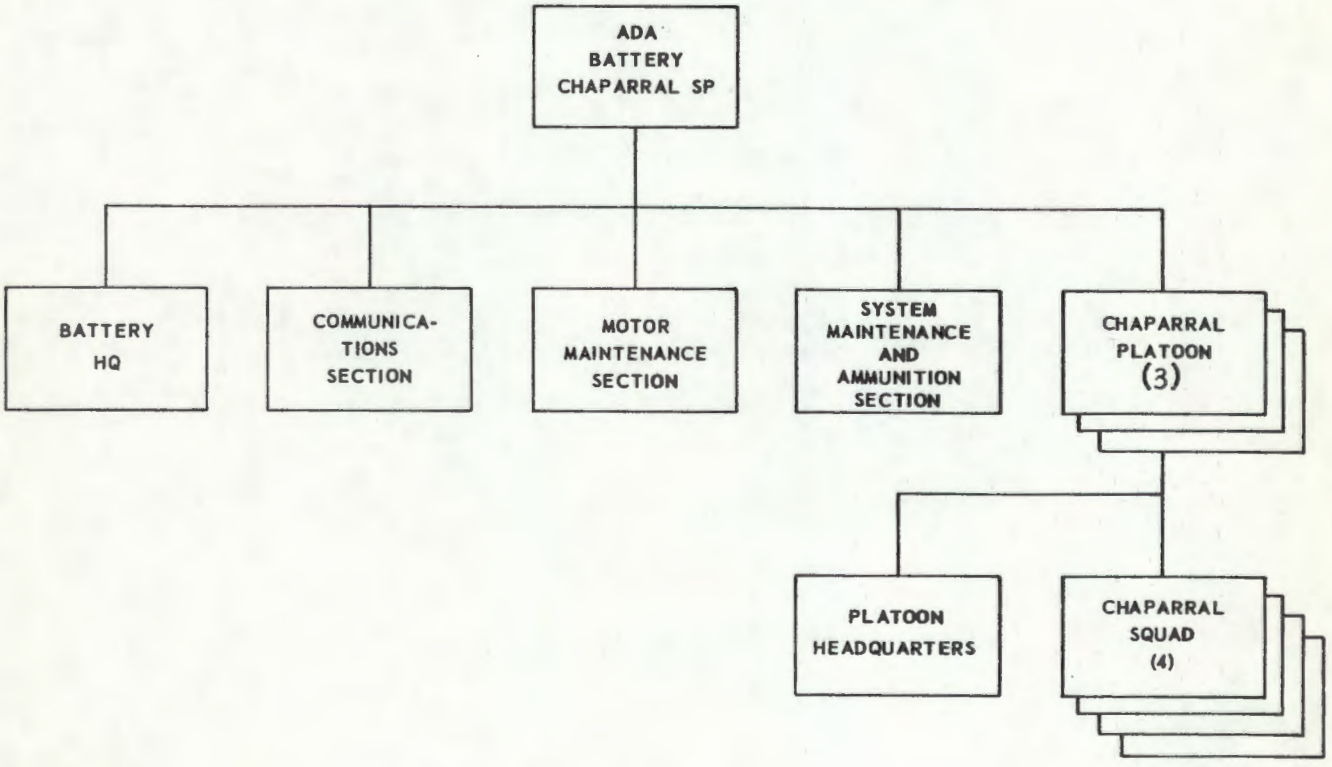


Figure 2-1. Air defense artillery battery, Chaparral (self-propelled organization chart.

2-4. Chaparral Platoon

Each Chaparral battery consists of three firing platoons (fig 2-1), each consisting of a platoon headquarters and four Chaparral fire units. The platoons provide the capability necessary to fulfill the battery's firing mission. The platoon headquarters exercises direct control of the Chaparral fire units. The platoon normally operates as an element of the Chaparral battery, but may, if required, operate independently, and is provided the communications capability for fully decentralized operation.

2-5. Chaparral Squad

The Chaparral squad operates the Chaparral system to provide the firing capability necessary for accomplishment of the battery mission. The squad consists of five men: a squad leader, senior gunner, prime mover driver, and two gunners.

Note. For clarity throughout the remainder of this manual, the crew members will be designated as squad leader (SL), gunner (No. 1), driver (No. 2), and two observers (No. 3 and No. 4). The squad leader exercises command over the squad and is responsible to the platoon leader or platoon sergeant for effective operation of the fire unit in support of the assigned mission, training of squad members, and operation and maintenance of assigned equipment. The gunner is the primary operator of the Chaparral during engagement and is responsible for the delivery of effective fire. The gunner is second in command of the squad and assumes the duties and responsibilities of command when the squad leader is absent. The driver operates and maintains the Chaparral vehicle and performs duty as an observer when required. The two observers man the observation posts, search for enemy aircraft, and assist the other squad members in maintaining the Chaparral equipment.

CHAPTER 3

SYSTEM DESCRIPTION

Section I. GENERAL

3-1. Introduction

Chaparral is a self-propelled, surface-to-air, guided missile system fielded to protect the forward area of the field army against hostile aircraft operating at low altitudes. Since visual target detection, tracking, and recognition are required for the conduct of effective fire by Chaparral, it is considered to be a fair-weather system; i.e., capable of operation only during periods of good visibility.

3-2. Major Subsystems

The Chaparral (guided missile system, intercept-aerial, carrier mounted, M48) (fig 3-1) consists

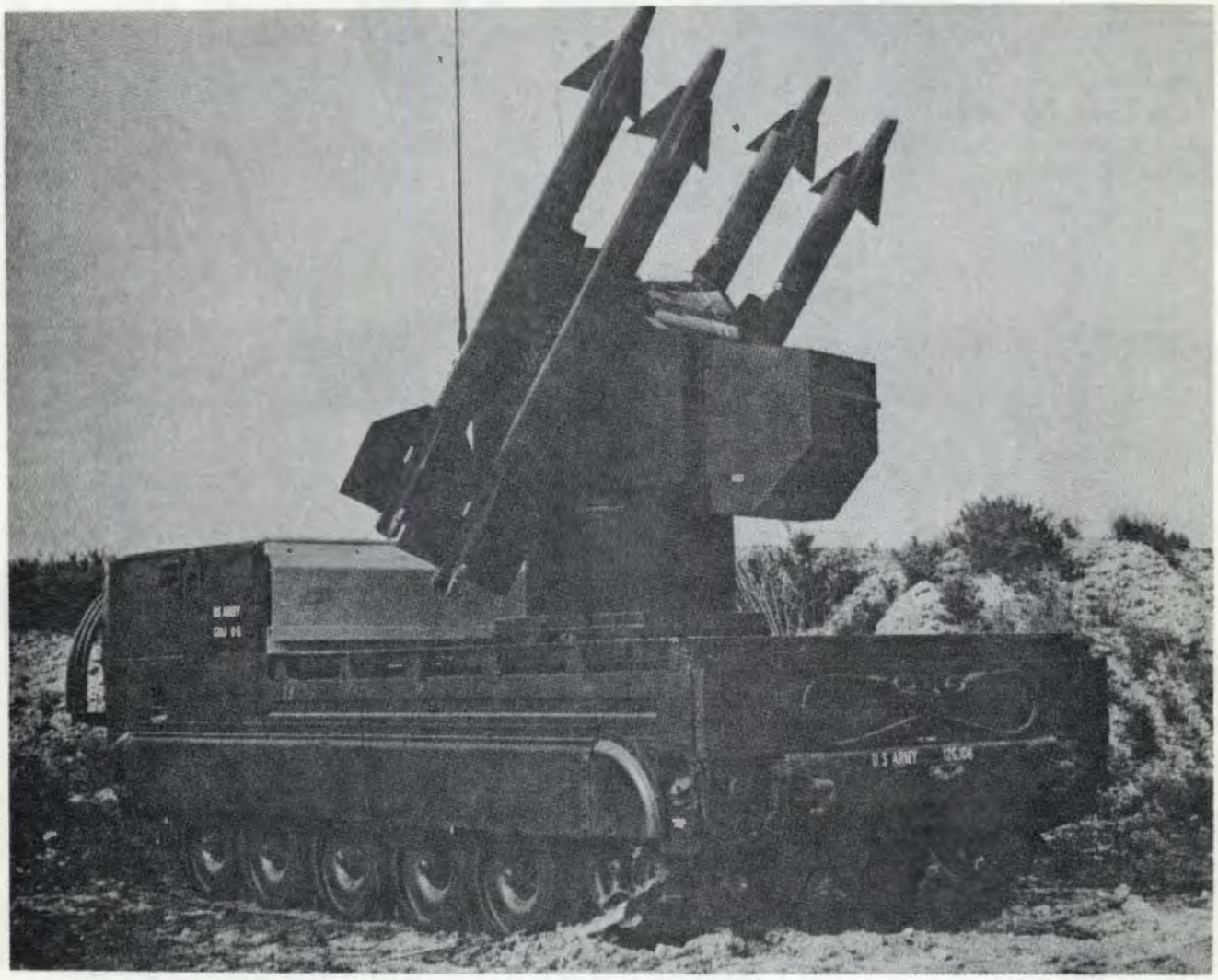


Figure 3-1. Chaparral air defense guided missile system, self-propelled, M48.

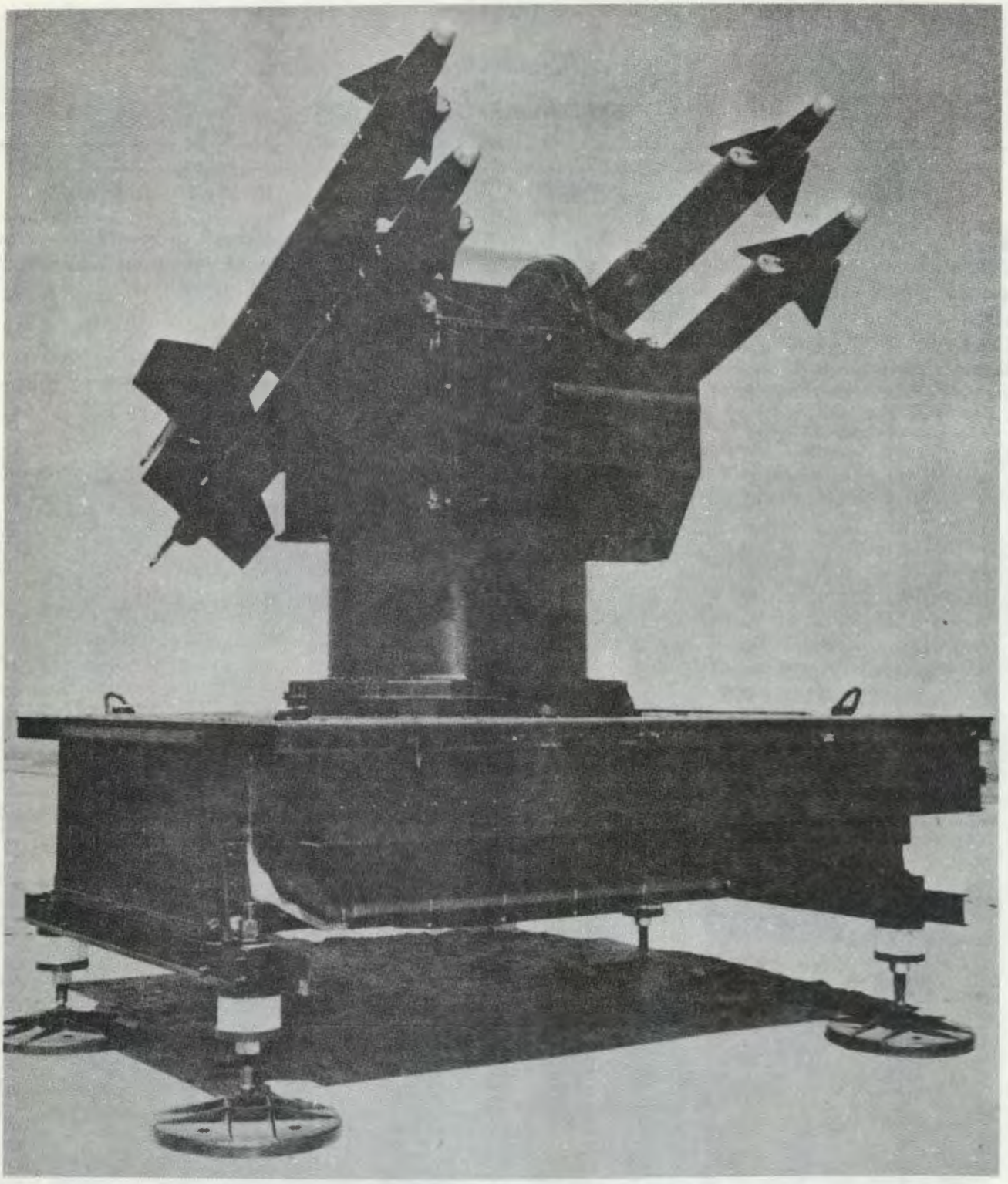


Figure 3-2. Chaparral ground emplacement configuration.

of two major subsystems; carrier, guided missile equipment, self-propelled, M730 (carrier), and a guided missile system, intercept-aerial, M54 (launching station). The system carries four guided missiles (guided missile, intercept-aerial, MIM-72A) on its launch rails and eight addi-

Figure 3–3. Airlifting launching station M54.

tional missiles in storage compartments on the launching station. The carrier M730 provides mobility for the system; however, the launching station is a complete, self-contained weapon system and may be removed from the carrier and operated in a ground-emplaced mode (fig 3–2). The launching station M54 can also be airlifted by helicopter (fig 3–3). Important dimensions of the system are shown in figure 3–4.

Section II. CARRIER, GUIDED MISSILE EQUIPMENT SELF-PROPELLED, M730

3–3. General

System mobility has been achieved by mounting the missile launching station on the cargo platform of a 6-ton, full-tracked, cargo carrier M730.

3–4. Description

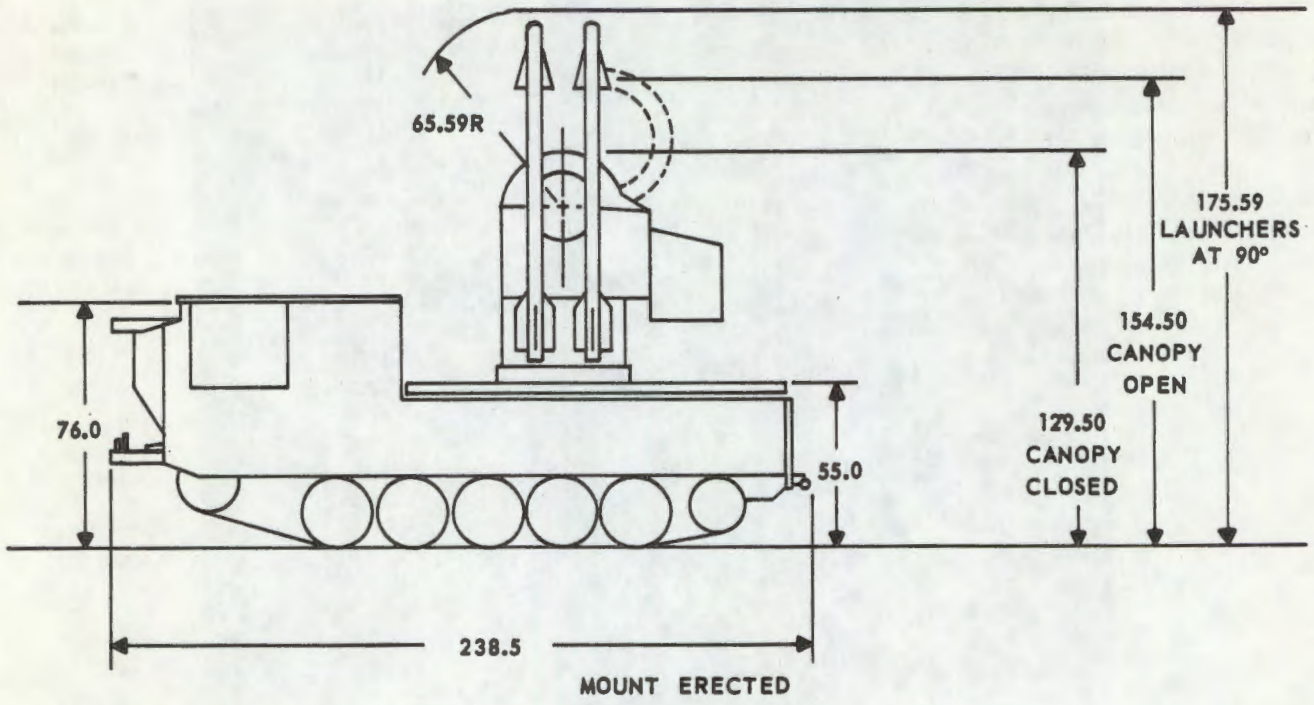
a. The M730 is a lightweight, unarmored, full-tracked vehicle. The vehicle, with the launching station installed, has a maximum road speed of 38 miles per hour (mph), has a cruising range of about 300 miles, and is capable of cross-country travel.

b. The vehicle cab has a seat the full width of the vehicle and will accommodate four passengers and a driver. The cab is normally open but a soft cloth or hard fiberglass cover can be installed to provide the crew protection from the elements. The cab cover must be removed before firing Chaparral missiles. Blast covers, coated with an ablative (erosion- and heat-resistant) material, are folded over the cab and engine compartments when missiles are to be launched. These covers protect the engine compartment and cab interior from the heat and blast of the missile rocket-motor exhaust generated at missile launch.

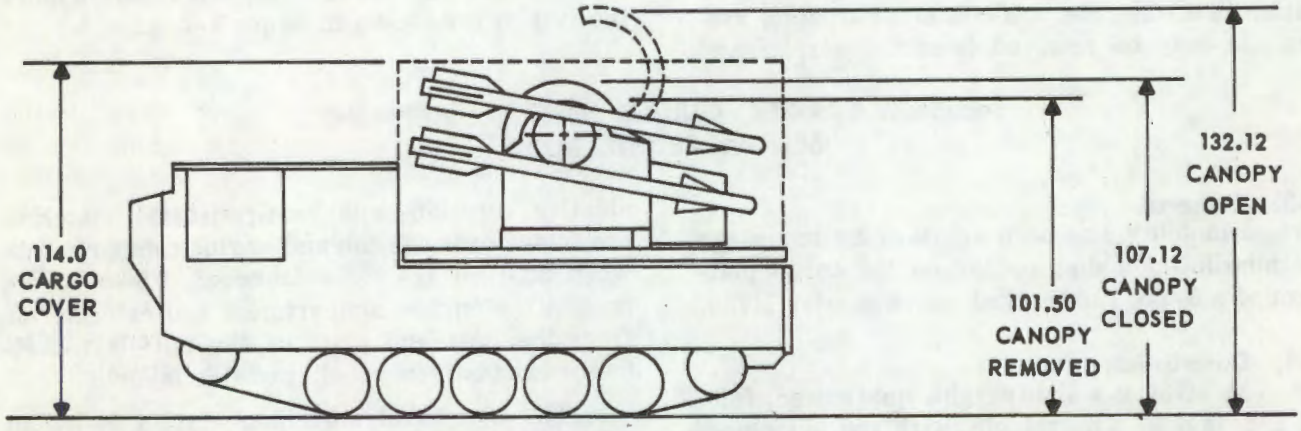
c. The Chaparral launching station is mated to the M730 by mounting it in the carrier cargo bed. Four bolts hold the launching station to the carrier and a single cable connects the launching station communications system to the communications system in the carrier cab. A cargo cover may be installed to provide the launching station protection from the elements during road travel outside the combat zone.

Note. The outboard wings on the upper left and upper right missiles, and the radio antennas must be removed to allow installation of the cargo cover.

d. The M730 can ford streams up to 40 inches



NOTE. DIMENSIONS ARE IN INCHES.



VEHICLE: LENGTH 238.5, WIDTH 105.75, HEIGHT (CARGO COVER) 114.0

MISSILE LENGTH: 114.5

ERECTION TRAVEL: 22.38

Figure 3-4. Self-propelled Chaparral, linear dimensions.

deep at speeds up to about 8 mph. The 40-inch depth limitation includes the height of waves and splashes. A swim kit can be installed that will enable Chaparral to cross water barriers deeper than 40 inches, provided wave height does not exceed 1 foot.

e. A winch holding 200 feet of 5/8-inch wire rope is mounted on the front of the vehicle. Maximum line pull of the winch is 20,000 pounds and it has a maximum line recovery speed of 15 feet per minute under full load.

3–5. Tabulated Data: Carrier, Guided Missile Equipment, Self-Propelled, M730

a. General.

(1) *Weight.*

(a) Net (less launching station and missiles)	14,691 pounds
(b) Gross (w/launching station)	27,508 pounds
(c) Classification No. (cross-country)	13

(2) *Dimensions.*

(a) Length	19 feet, 10½ inches
(b) Width	8 feet, 9¾ inches
(c) Height (w/o cab cover)	6 feet, 4 inches
(d) Ground Clearance	1 foot, 4 inches
(e) Length of ground contact	9 feet, 3 inches
(f) Rated ground pressure (combat-loaded)	7.5 pounds psi

b. Performance.

(1) Maximum speed forward	55 kmph (38 mph)
(2) Cruising range (25 mph)	483 km (300 miles)
(3) Fuel consumption	5.48 km/gal (3.4 mpg)
(4) Turning radius:	
(a) Differential steering	24 feet
(b) Pivot steering	14 feet
(5) Maximum grade:	
(a) Forward slope	60 percent
(b) Side slope	30 percent
(6) Trench-crossing ability	5 feet, 6 inches
(7) Vertical obstacle ability	2 feet
(8) Angle of approach	57°
(9) Angle of departure	35°
(10) Maximum fording depth	40 inches
(11) Fuel capacity (diesel):	
(a) Refill	97 gallons
(b) Dry	112 gallons

Section III. GUIDED MISSILE SYSTEM, INTERCEPT-AERIAL, M54 (LAUNCHING STATION)

3–6. General

Guided missile system, intercept-aerial, M54 is the official nomenclature assigned to the Chaparral launching station. For brevity, the term, launching station, will be used throughout the remainder of this manual.

3–7. Description

a. The Chaparral launching station is an independent weapon system capable of launching Chaparral missiles when the station is mated to, or separated from, the carrier. The launching station carries 12 missiles, four on launch rails and eight in integral storage compartments. The launching station consists of two major units, a base structure and a mount (fig 3–5). Located on the base structure and mount are components comprising seven functional subsystems: power, mount erection-retraction, mount drive, missile control and launch, missile air, environmental control, and communications.

b. The base structure houses various items of the functional subsystems, supports the mount, provides storage space for missiles, and provides for the interface between the launching station and either the Chaparral carrier or ground-emplacement jacks. The top deck of the base structure is coated with an ablative material to provide protection against heat and blast when launching missiles. Access to the components mounted within the base structure is provided by three doors in the top deck and one door at the rear of the structure. One missile storage compartment, with bins for four missile storage cases, is mounted on each side of the structure. A storage compartment for missile fins and wings is provided in the rear of the structure.

c. The mount is the movable part of the launching station. It provides the gunner with the means for aiming and launching missiles. It provides an inclosed, environmentally controlled compartment for the gunner and carries four missiles on its launch rails. The mount can be rotated 360° in azimuth and its launch rails can be rotated in the vertical plane from −9° to +90°. For road travel, the mount is retracted into the base structure and must be erected before firing missiles.

d. The seven functional subsystems contribute to the operation of the launching station as follows:

(1) *Power subsystem.* The power subsystem is a completely self-contained power generating and distributing system which produces all of the electrical power required to operate the launching station. The major components of the system are a gasoline engine, electric generator, storage battery system, and electronic power conversion, control, and distribution system.

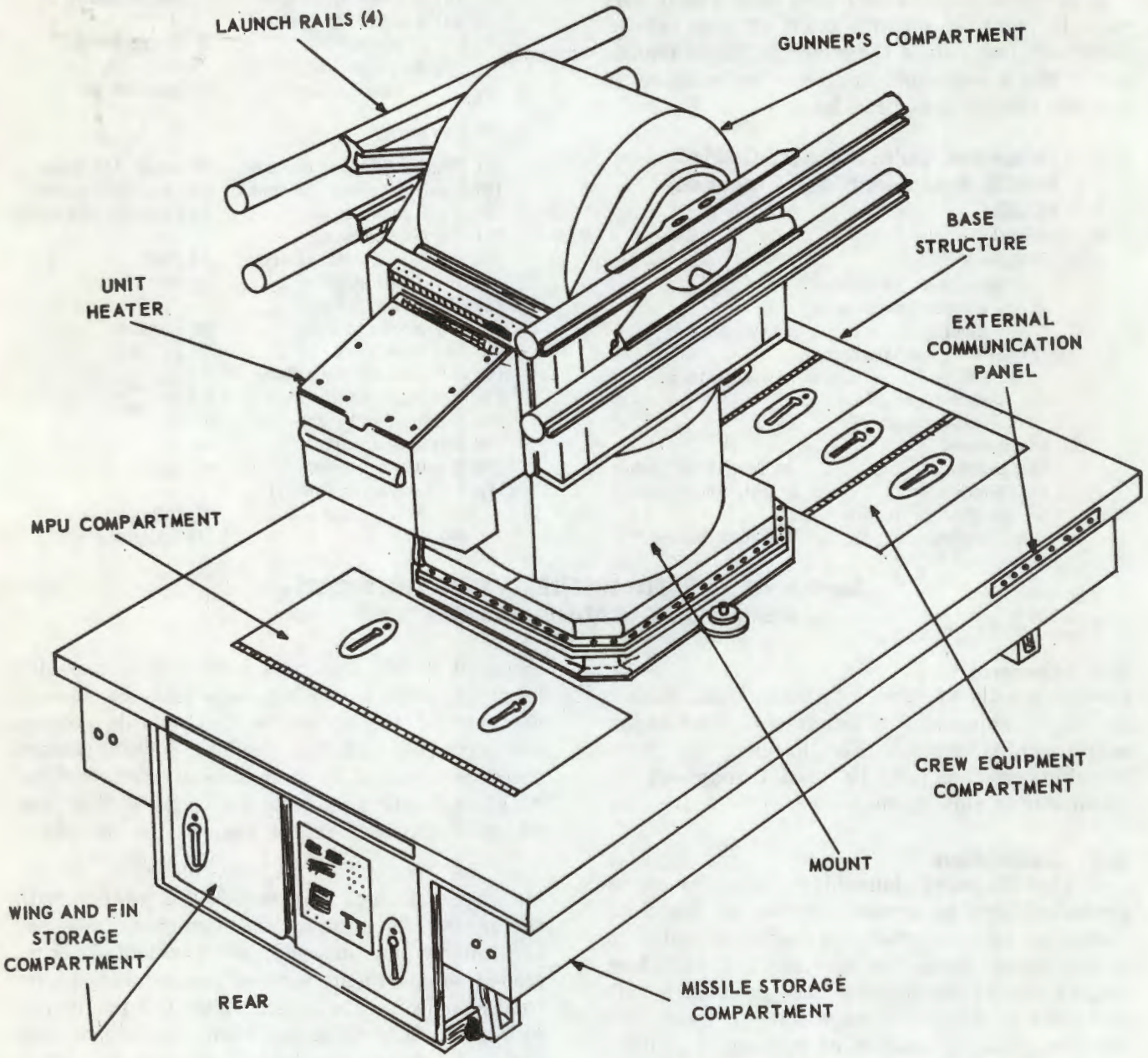


Figure 3–5. Chaparral launching station.

(2) *Mount erection-retraction subsystem.* The mount erection-retraction subsystem provides the means for raising the mount into firing position or lowering the mount to load missiles or travel. The mount can be raised or lowered approximately 22 inches by this electrically operated subsystem.

(3) *Mount drive subsystem.* The mount drive subsystem is a hydraulic-powered servosystem that drives the mount in azimuth and the launch rails in elevation. It consists of an electrically driven hydraulic pump, hydraulic azimuth and elevation drive assemblies, and electronic control system. The gunner's movement of the hand control provides signals to this servosystem that are translated into mount and launch rail movement in the direction and at the rate desired by the gunner.

(4) *Missile control and launch subsystem.* This subsystem provides the controls and indicators necessary for the activation of the system, missile selection and sequencing, and missile launching. It consists of three control panels in the gunner's compartment, the gunner's hand-

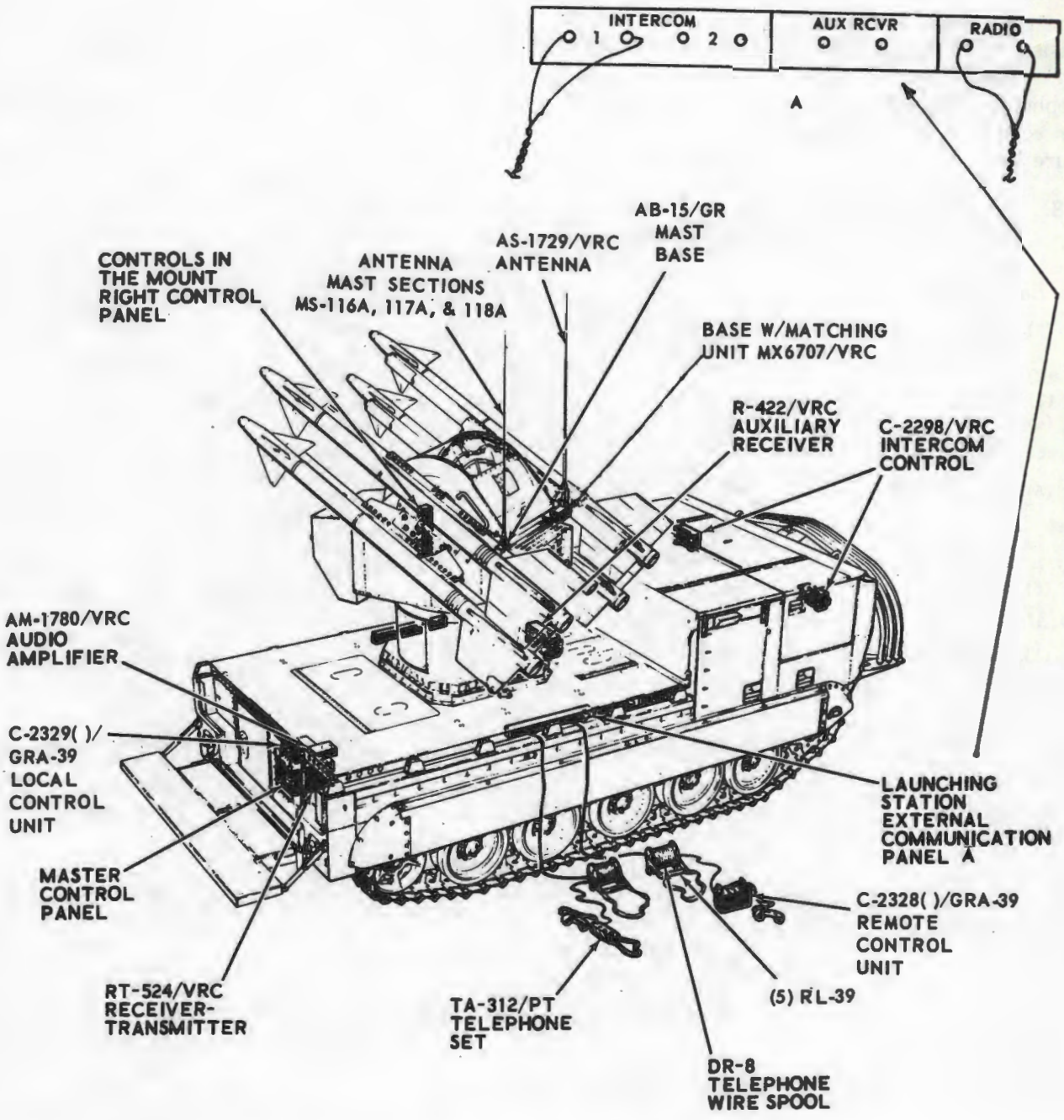


Figure 3–6. Communications subsystem components.

control assembly, and a missile control electronic assembly.

(5) *Missile air subsystem.* The missile air subsystem provides purified air at 3,000 pounds per square inch (psi) pressure for use in cooling the infrared (IR) detectors in the missiles. The major components of the subsystem are an electrically powered air compressor and an air purification assembly.

(6) *Environmental control subsystem.* The environmental control subsystem maintains a comfortable temperature in the gunner's compartment, provides fresh filtered air for the gunner, and maintains a slight positive air pressure within the compartment to exclude toxic gases generated during missile firings (hydrogen-chloride). The subsystem consists of an air filtering system, heating system, air conditioner, blowers, and operating controls and switches.

(7) *Communications subsystem.* The communications subsystem provides facilities for radio communications between the Chaparral squad and platoon headquarters, for voice communications between squad members, and for re-

mote operation of communications. The system consists of radio set AN/VRC-47, intercom system, radio set control group, AN/GRA-39, and telephone equipment. The major components of the communications subsystem are shown in figure 3-6.

3-8. Tabulated Data, Launching Station M54 and Missiles MIM-72A and M30

a. Base Structure.

(1) Weight (w/o missiles)	10,000 pounds (approx)
(2) Length	10.7 feet
(3) Width	7.8 feet
(4) Storage	8 missiles, crew equipment, missile wings and control fins.
(5) Subassemblies	Main power unit, system batteries, air compressor, communications.
(6) Armor	None

b. Mount.

(1) Weight	4,138 pounds
(2) No. of launch rails	4
(3) Traverse.	
(a) Limits	None (360°)
(b) Rate	90° per second
(4) Elevation.	
(a) Limits	−9° to 90°
(b) Rates	60° per second (max)
(5) Sight.	
(a) Type	Reflex
(b) Model	M75
(c) Magnification	Unity
(6) Communications	Radio set AN/VRC-47, radio set control group, AN/GRA-39, intercom, field telephones.

c. Missile.

(1) Type	Supersonic, passive homing.
(2) Model	MIM-72A
(3) Weight	190 pounds
(4) Length	9.5 feet
(5) Diameter, body	5 inches
(6) Control fin span	16.4 inches
(7) Wing span	24.8 inches
(8) No. of major groups	7
(a) Guidance section.	
1. Type	Passive infrared sensing
2. Model	MK28
3. Weight (w/fins)	35 pounds
4. Length	24.3 inches
5. Seeker	Gyro-stabilized telescope, IR detector.
(b) Warhead.	
1. Type	Continuous rod
2. Model	MK 48
3. Weight	25 pounds
4. Length	12.2 inches
(c) Target-detecting device.	
1. Type	Radio frequency
2. Model	MK15
3. Length	6.75 inches
(d) Safety and arming device.	
1. Model	MK13
2. Safety features	Launch latch, time interval, sustained acceleration.
3. Activation	180 to 340 meters from launch point.
(e) Rocket motor.	
1. Type	Single chamber
2. Model	MK50
3. Weight	96.7 pounds
4. Length	72.4 inches
(f) Control fins.	
1. Number	4
2. Location	Mounted on the guidance sections (detachable for storage).
(g) Wings.	
1. Model	MK4 (2); MK5 (2)
2. Types	MK4 wings are roller-on; MK5 wings are flat plate.
3. Use	The MK4 wings are to reduce the roll rate and all four wings provide aerodynamic stability.

Section IV. CHAPARRAL GUIDED MISSILE, INTERCEPT-AERIAL, MIM-72A

3-9. General

The Chaparral guided missile MIM-72A (fig 3-7) is a supersonic, surface-to-air missile using passive IR target detection, proportional navigation guidance, and a torque-balance control system.

3-10. Description

The missile is composed of seven major groups: guidance section, target detecting device, safety and arming device, warhead, rocket motor, wing assembly, and control fin assembly.

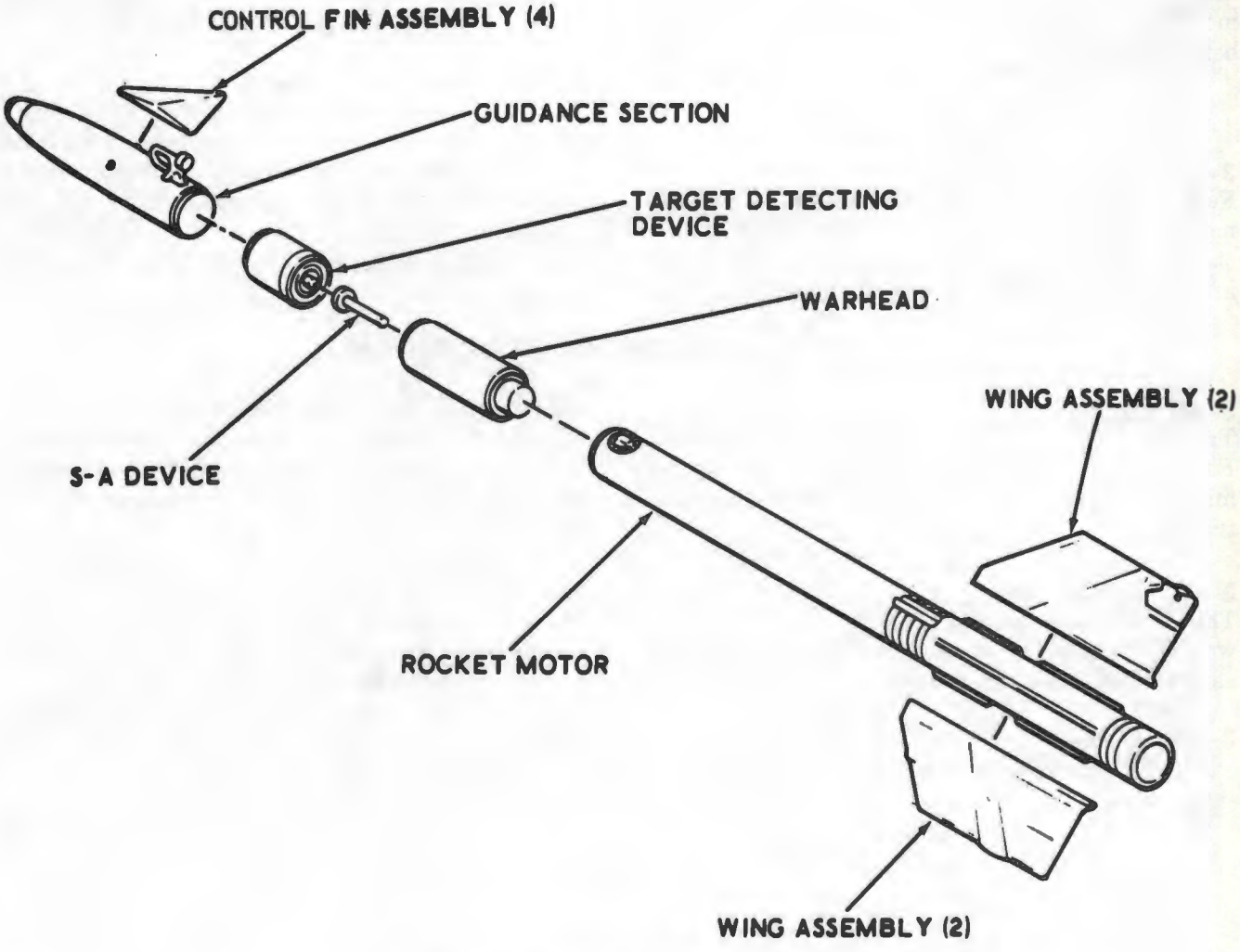


Figure 3-7. Guided missile, intercept-aerial, MIM-72A.

3-11. Guidance Section
The guidance section, located at the forward end of the missile, performs the functions of sensing IR radiations of the target, determining the direction of the target with respect to the missile's axis, and generating signals that move the control fins to guide the missile along a proportional navigation course to target intercept. The guidance section also produces an audio signal that informs the gunner that the target's IR radiations are being received.

3-12. Target Detecting Device
The target detecting device (TDD) functions as a proximity fuze. It also provides a path for the signals that cause self-destruct or destruction on contact. The TDD is powered by a thermal battery.

3-13. Safety and Arming Device
The safety and arming (S&A) device prevents arming and detonation of the warhead during missile assembly and handling operations, and for the initial portion of missile flight.

3-14. Warhead
The warhead, located behind the TDD, is of the continuous-rod type and provides Chaparral with the capability of destroying its target. The warhead consists of an explosive charge and a series of interconnected steel rods. The rods expand into a large ring on detonation and then break up into individual projectiles and can easily cut through the structural members of most aircraft.

3-15. Rocket Motor
The rocket motor provides the thrust to launch

the missile and propel it to target intercept. The motor propels the missile to supersonic speeds before burning out.

3-16. Wing Assembly

Four wings, mounted near the rear of the rocket motor, provide the missile with aerodynamic stability and reduce roll during flight. The wings are of two types, flat-plate and rolleron. Rolleron assemblies on two wings function as automatic trim tabs for controlling the missile roll rate.

3-17. Control Fin Assembly

Four control fins, mounted near the center of the guidance section, provide the control surfaces that guide the missile in flight. Guidance orders, generated in the guidance section, cause the fins to deflect into the airstream, thereby changing the missile heading as required to intercept the target.

Section V. GUIDED MISSILE, TRAINING, M30

3-18. General

Training missile M30 is a completely inert missile. Each Chaparral fire unit is issued one training missile to be used as a handling missile for troop training.

3-19. Description

The Chaparral training missile has the same weight, number of components, and dimensions as the MIM-72-series missiles.

3-20. Uses

a. Handling Round. The M30 missile can be used to train crewmen in assembly, disassembly, and loading procedures. Since the round is inert, it is safe to handle, and is realistic because the size, shape, and weight are identical to the live missile.

b. Target Tracking Practice. The M30 training missile may be used for tracking practice if the inert guidance section is removed and replaced with an MK28 guidance section. To preclude activating the gas-grain generator in the MK28 guidance section, an adapter is installed on the umbilical cable plug before it is attached to the umbilical receptacle on the rail.

CHAPTER 4

CHAPARRAL SYSTEM OPERATION

Section I. COMMUNICATIONS SUBSYSTEM

4-1. General

The Chaparral communications subsystem consists of an intercom for voice communications between squad members and radio set AN/VRC-47 for two-way communications between the fire unit and platoon headquarters or other designated headquarters. A target alert data display set (TADDS) is furnished as an additional item of communications equipment. The TADDS is completely self-contained and receives and displays target early alerting information furnished through a radiofrequency data link (RFDL) by the forward area alerting radar (FAAR). Chaparral communications is divided into three interconnected subdivisions and one independent subdivision. The three interconnected subdivisions are vehicle, base structure, and mount communications. The TADDS is treated as an independent subdivision of the communications system.

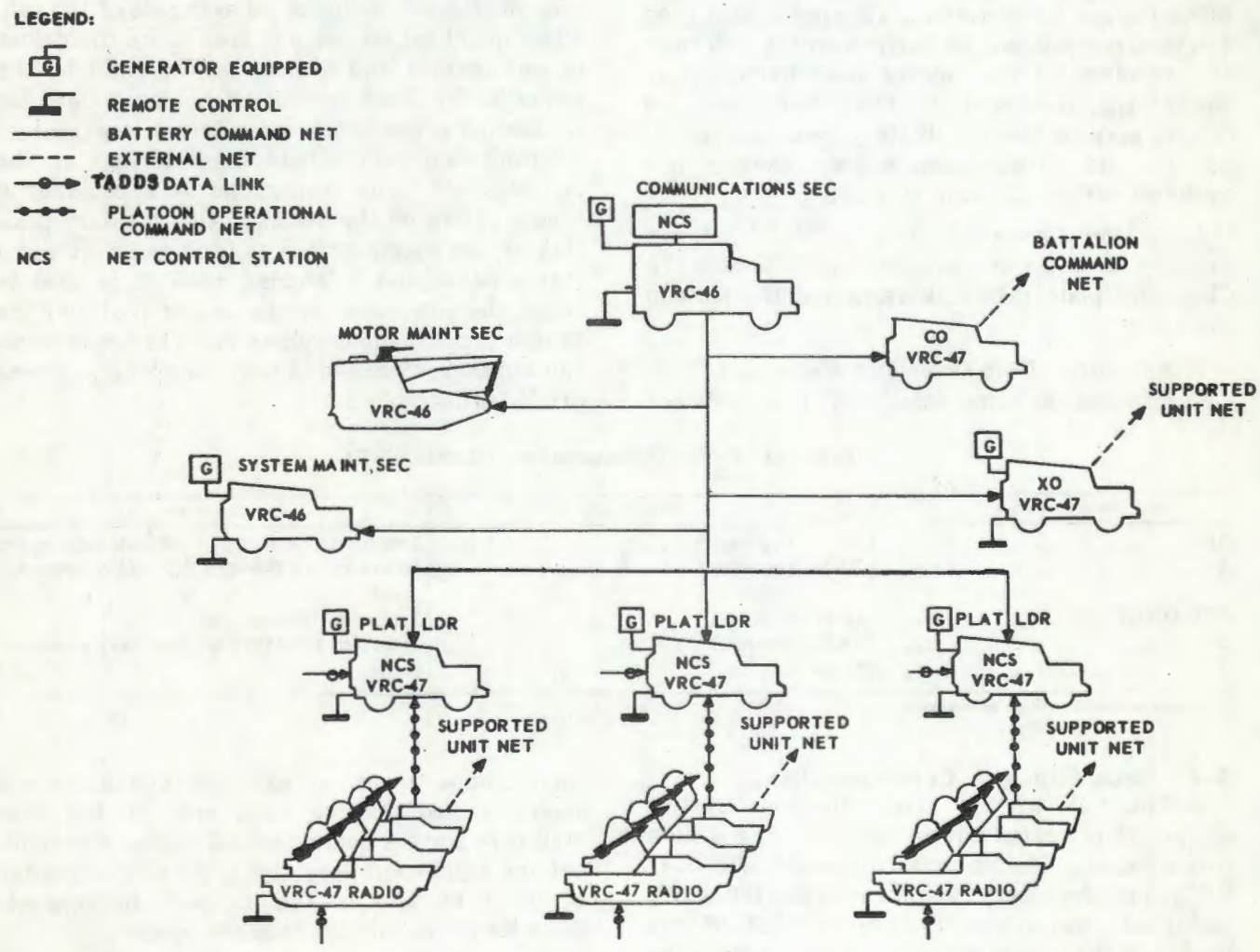


Figure 4-1. Chaparral battery radio nets.

4–2. Communication Nets

The primary means of communication between elements of the Chaparral battery is frequency-modulated (FM) radio. In addition, the battery is equipped to install backup wire communications whenever the tactical situation permits. Radio communication is conducted over the following radio nets (fig 4–1):

a. Battalion Command Net (FM). This net provides the communications link between the Chaparral battery and the Chaparral/Vulcan battalion headquarters. The Chaparral battery commander has the capability of operating in this net and simultaneously monitoring the battery command net, or vice versa, as the situation requires. The battery executive officer also has the same capability.

b. Battery Command Net (FM). This net is used for internal communications between the elements of the battery headquarters and the firing platoon headquarters. This net is also used for the transmission of early warning information obtained at the battery headquarters over the battalion command net. The battery executive officer, platoon leaders, battery communications section, and system maintenance sections are equipped for operation in this net.

c. Platoon Command Nets (FM). This net provides a two-way command link between a Chaparral platoon headquarters and the platoon fire units.

d. Supported Unit Command Net (FM). This net provides a communications link between Chaparral battery elements and any unit they may be required to support. The platoons and fire units are equipped to either operate in this net or monitor the net as required. The battery executive officer is equipped to monitor this net.

e. Radiofrequency Data Link. This is a one-way radiofrequency data link (RFDL) from the FAAR to the TADDS located at platoon headquarters and the Chaparral fire units. The RFDL provides the fire units with early warning in the form of target position, direction, and tentative identification displayed on the TADDS.

4–3. Vehicle Communications

When the Chaparral launching station is mated with carrier M730, the vehicle cab communications subdivision becomes an integral part of the overall communications subsystem. This capability is provided by two C–2298( )/VRC intercom control sets, one mounted on each side of the cab. The control set on the left is used by the driver or an observer and the one on the right by the squad leader. Each control set has provisions for connecting a headset or an external loudspeaker. Transmission over either the intercom or the AN/VRC–47 radio transmitter is selected by a toggle switch on the headset. A momentary position of the toggle switch is used to select radio transmission and a latching position is used to select the intercom. In the center position, the switch turns the microphone off. The communications options available to both operating positions are listed in table 4–1.

Table 4–1. Vehicle Communications (C–2298/VRC)

Monitor Switch	Talk To	Listen To
ALL	Radio/Intercom*	Intercom (field phones, mount, cab) radio.
A	Radio/Intercom*	Intercom (RT–524/VRC radio, mount, cab).
INT ONLY	Intercom	Intercom (mount, cab).
B	Radio/Intercom*	Intercom (R–442/VRC auxiliary receiver).
C	None	None.

*Option selected by switch on headset.

4–4. Base Structure Communications

a. The bulk of the communications system equipment is located within the launching station base structure. The receiver-transmitter RT–524/VRC, audiofrequency amplifier AM–1780/VRC, and local control unit C–2329( )/GRA–39 are located in the equipment compartment behind the system master control panel. The auxiliary receiver R–442/VRC is located in the crew equipment compartment. An external communications panel is provided on each side of the base structure for the connection of remote communications equipment into the system. The master control panel also has binding posts for connecting a telephone into the intercom system.

b. Power is supplied to the communications subsystem, with the exception of local control

unit C–2329( )/GRA–39 and remote control unit C–2328( )/GRA–39, by setting the COMM switch on the master control panel at ON. Self-contained dry cell batteries supply power for operating the local and remote control units.

c. Each external communications panel has identical sets of binding posts to service remote operation of the communications subsystem. Binding post pairs 1 and 2 on the INTERCOM portion of both panels allow for the connection of field telephones TA–312/PT into the intercom system. Two cleats are attached to each panel for field wire strain relief. A pair of terminals, labeled AUX, on each panel provide for connecting the auxiliary receiver output to a field telephone for remote monitoring. The remote control unit is connected to the pair of terminals labeled RADIO.

4–5. Mount Communications

a. A group of switches and controls, located on the right control panel (RCP) (fig 4–2), and a headset provide the gunner with the capability of communicating with the squad or platoon and of monitoring missile tone. The top selector switch on the RCP has three positions used to select the gunner's communications options as shown in table 4–2.

b. Two controls, labeled RADIO INTERCOM and MISSILE TONE, are volume controls that set sound levels on separate earphones of the gunner's headset. The headset connects to the panel jack marked HEADSET. The radio and/or intercom signals are applied to one earphone and missile tone and an interlock warning signal to the other. The sound levels of the two signals are controlled independently by their respective volume controls.

c. The gunner's headset microphone is controlled by either the knee switch or the MIKE switch (fig 4–2). The MIKE switch on the RCP has a momentary ON position and an OFF position.

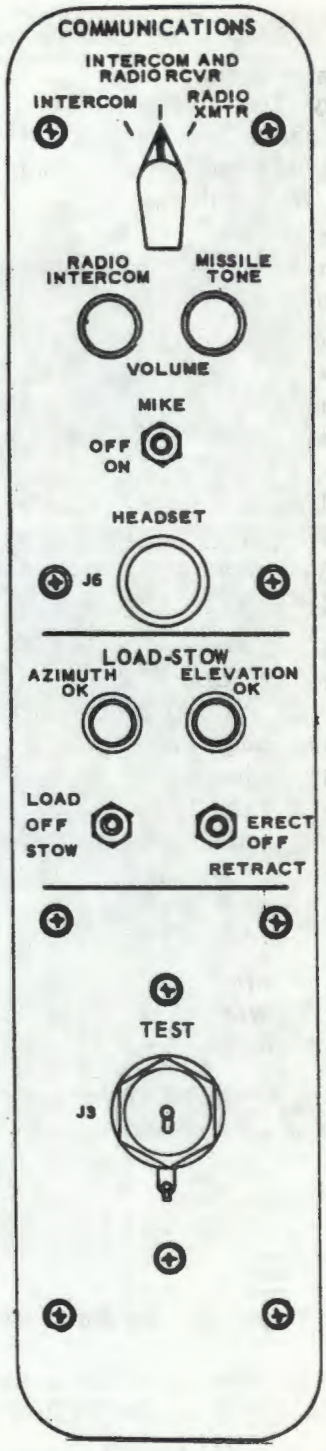


Figure 4–2. Right control panel.

4–6. Target Alert Data Display Set

a. The target alert data display set (TADDS) (fig 4–3) is an ancillary item to the Chaparral communications system. The TADDS provides each squad with a display of coarse target location and tentative target identification. Source of in-

Table 4–2. Mount Communications

Selector Switch Position	Listen To	Talk To
INTERCOM	Intercom	Intercom.
INTERCOM AND RADIO RCVR	RT–524/VRC	Intercom.
RADIO XMTR	RT–524/VRC	RT–524/VRC.

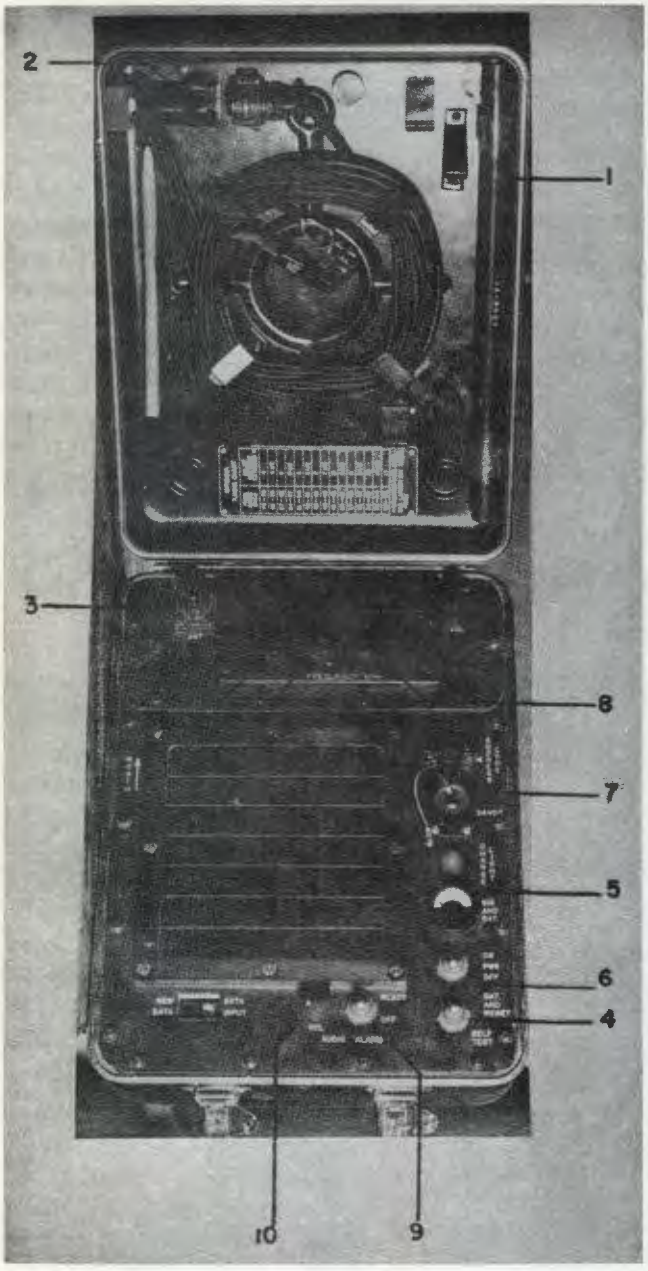


Figure 4-3. Target alert data display set (TADDS).

formation is the FAAR which transmits the information via RFDL to the TADDS for display.

b. The TADDS consists of a frequency modulated (FM) radio receiver, display matrix, magnetic compass, RF field strength meter, telescoping antenna, and a rechargeable battery-pack power supply. The radio receiver will receive the signal from FAAR over the data link or, if the data link is inoperable, will receive voice communications.

(1) The display consists of a matrix of grid lines forming 49 squares (7 squares x 7 squares) with each square containing two target indicators. The indicators are two-color disks (green-black and red-black) that indicate targets by exposing a green side for a friendly target or a red side for a target of unknown identity. If no target is within the area of a square, the indicators display the black sides of the two-color disks. The unit has the capability of displaying 49 friendly and 49 unknown targets simultaneously, a friendly and an unknown target in each of the 49 squares. The FAAR, as the source of data, is represented as being located at the center of the display and target position is displayed with respect to the location of the FAAR. The location of the Chaparral fire unit with respect to the FAAR is plotted and marked on the display by the TADDS operator. Target location with respect to the fire unit may then be read directly from the display.

(2) A telescoping antenna attaches to the TADDS by means of an insulated mount on the unit front panel. When not in use, the antenna is removed and stored in the unit cover.

(3) An RF field-strength meter mounted in the unit front panel provides an indication of the strength of the received RFDL signal. The meter is useful in emplacing the TADDS for the best data reception.

(4) A standard compass is mounted on the unit panel for the purpose of orienting the unit to magnetic north. Orientation to magnetic north is necessary to aline the display matrix with the FAAR display.

(5) An audible alarm is provided to alert the operator that a change has taken place in the data display. When a change in the displayed data occurs, a pulsating audible tone is generated; if a loss of signal occurs, a steady tone is generated.

(6) An indicator for remaining battery life is provided on the set. A cable and receptacle are also provided so that the battery can be charged from the electrical system of any Army vehicle. A fully charged battery-pack provides sufficient power for 24 hours of operation.

4-7. Operating the Communications Subsystem

a. Energizing the Subsystem. The communications subsystem (less the TADDS and local/remote control units) is powered by the launching station prime power system. The subsystem is energized by setting the COMM switch, located on the launching station master control panel, at ON. Prior to energizing the subsystem,

Table 4-3. Communications Subsystem Control Settings (Preenergizing)

Unit	Control	Setting
Audiofrequency amplifier AM-1780/VRC.	MAIN POWER	NORM.
	INT ACCENT	ON.
	RADIO TRANS	CDR & CREW.
	POWER CKT BKR	ON.
	INSTALLATION SWITCH	OTHER.
Receiver-transmitter RT-524/VRC.	POWER	HIGH.
	SPEAKER	ON or OFF (as desired).
	VOLUME	½ turn clockwise.
	BAND	A or B*.
	MC TUNE	*
	KC TUNE	*
	SQUELCH	ON or OFF (as required).
Receiver R-442/VRC	POWER	ON-RESET.
	VOLUME	½ turn clockwise.
	BAND	A or B*.
	MC TUNE	*
	KC TUNE	*
	SQUELCH	ON or OFF (as required).
Control, Intercommunications set, C-2298/VRC.	MONITOR	ALL, A, or B.
	VOLUME	½ turn clockwise.
Control, radio set C-2328( )/GRA-39 remote.	VOLUME ON/OFF switch	ON, ½ turn clockwise.
	TEL-RAD-RAD/SPKR	RAD/SPKR.
	BUZZER VOLUME	(control not used).
	RINGER	(control not used).
Control, radio set C-2329( )/GRA-39 local.	POWER	ON.
	TEL-REMOTE-RADIO	REMOTE.
	BUZZER VOLUME	(control not used).
	RINGER	(control not used).
Telephone set TA-312/PT	CIRCUIT SELECTOR	LB.
	BUZZER VOLUME CONTROL	(control not used).
	INT/EXT switch	INT.
	RINGING CRANK	(do not use).

*Set to desired frequency of operation.

switches and controls on the subsystem components should be set as shown in table 4-3.

b. Connections for Remote Operation. In normal field deployment, Chaparral squad members (except the gunner) are stationed at operating positions at distances of 200 feet to one-fourth mile from the system. Communications between squad members and between the squad leader or gunner and platoon headquarters can be established through connections to the launching station external communications panel. Normally, two remote operating positions are required, a forward observation post occupied by two squad members, and the squad leader's command post, occupied by the squad leader and one other squad member. The gunner occupies the gunner's compartment of the mount and uses the mount communications subsystem.

(1) The two squad members deploying to the forward observation post obtain one telephone set and one reel with field wire from storage. The field wire is connected to one of the binding post pairs marked 1 or 2 on the INTERCOM portion of either the right or the left external communications panel (fig 3-6). The field wire is then laid to the observation post and connected to the terminal pair marked LINE 1-2 on the telephone. The telephone should be inspected to insure that the two dry cell batteries that power the telephone are in place and that the telephone is operational.

(2) The squad leader obtains the remote control unit C-2328( )/GRA-39, a reel unit with field wire, and the TADDS from storage. He connects the field wire to the pair of terminals labeled RADIO, on either the right or left external communications panel, and lays field wire to the selected command post. At the command

post, the field wire is connected to the line terminals of the remote control unit. This unit gives the squad leader the capability of operating the receiver-transmitter from the remote location. The squad leader also emplaces, orients, and energizes the TADDS when he arrives at the command post, and plots the fire unit position on it.

(3) The remaining squad member obtains two field telephones and two reel units with field wire from storage. One field wire is connected to terminal pairs 1 or 2, on either the right or left external communications panel (fig 3-6), and the other to the pair of terminals labeled AUX. The field wire is laid to the command post and connected to the line terminals of each telephone. The telephone connected to the AUX terminals provides the means of monitoring the adjacent or supported unit radio net by means of the auxiliary receiver while the other provides a means of communicating over the system intercom.

c. Operation of the Intercom. Voice intercommunication between squad members is provided by an audiofrequency amplifier AM-1780/VRC, the field telephones emplaced at the remote positions, and the communications selector switch in the gunner's compartment. The gunner uses the intercom system by setting the selector switch on the RCP at INTERCOM. He talks over the intercom by pressing the knee switch and speaking normally. When the selector switch is set at INTERCOM, the gunner listens to all intercom stations simultaneously on one earphone of his headset. The forward observation post and command post communications equipment are connected into the intercom system by means of field wire between a field telephone located at the position and the launching station external communications panels. Personnel at remote stations talk to the gunner and each other by pressing the press-to-talk switch on the telephone handset and speaking into the transmitter. Release of the press-to-talk switch enables station personnel to hear all other station personnel.

d. Operation of Radio Set AN/VRC-47.

(1) *Receiver-transmitter RT-524/VRC.*

(*a*) Set the COMM switch on the master control panel (MCP) at ON. Open the door to the rear electrical compartment where the RT-524/VRC is located.

Note. Refer to key numbers on figure 4-4 for location of the controls and indicators.

Verify that the POWER switch (1) is turned to HIGH, power LIGHT switch (2) is turned to ON, and that the SPEAKER switch (3) is turned to OFF. The BAND switch (4) is turned to the desired position (A or B). Verify that the TUNE controls (5) (MC and KC) are set at the designated frequency. Check that the SQUELCH switch is turned to the proper position for desired operations.

(*b*) When a change in radiofrequency is required, turn the MC and KC controls (5) to the new frequency, turn the SPEAKER switch (3) to ON and adjust the VOLUME control (6) until a rushing noise is heard in the background, then turn the speaker off.

Note. The speaker is not used in the Chaparral system; headphones and radio set control group AN/GRA-39 are used instead.

(2) *Receiver, radio R-442/VRC.*

(*a*) Set the COMM switch on the MCP at ON. Open the door to the crew equipment compartment where the auxiliary receiver is located.

Note. Refer to key numbers on figure 4-5 for location of controls and indicators.

Set POWER switch (1) at ON. Turn BAND switch (2) to A or B as required by the signal operating instructions (SOI). Verify that the MC and KC TUNE switches (3) are set at the correct frequency. Attach a headset to one of the AUDIO jacks (4), turn the SQUELCH switch to OFF, and adjust the VOLUME control (5) until a rushing noise is heard in the headset. Turn the SQUELCH switch to the desired operating position.

(*b*) When a change in frequency is required, turn the MC and KC TUNE switches (3) to the required frequency. (The BAND switch (2) may require a change.) Call the net control station (NCS) on the RT-524/VRC and request a transmission over the auxiliary receiver to verify the correct frequency setting. Disconnect the headphones and close the crew equipment compartment.

(3) *Remote control unit, AN/GRA-39.* The remote control unit (fig 4-6) is used by the squad leader for radio transmission/reception.

Note. Refer to key numbers on figure 4-6 for location of controls and indicators.

(*a*) Connect the telephone wire from the external communications panel to the LINE posts (1) of the unit.

(*b*) Attach the handset to the AUDIO jack (2).

(*c*) Turn BUZZER VOLUME (3) to OFF.

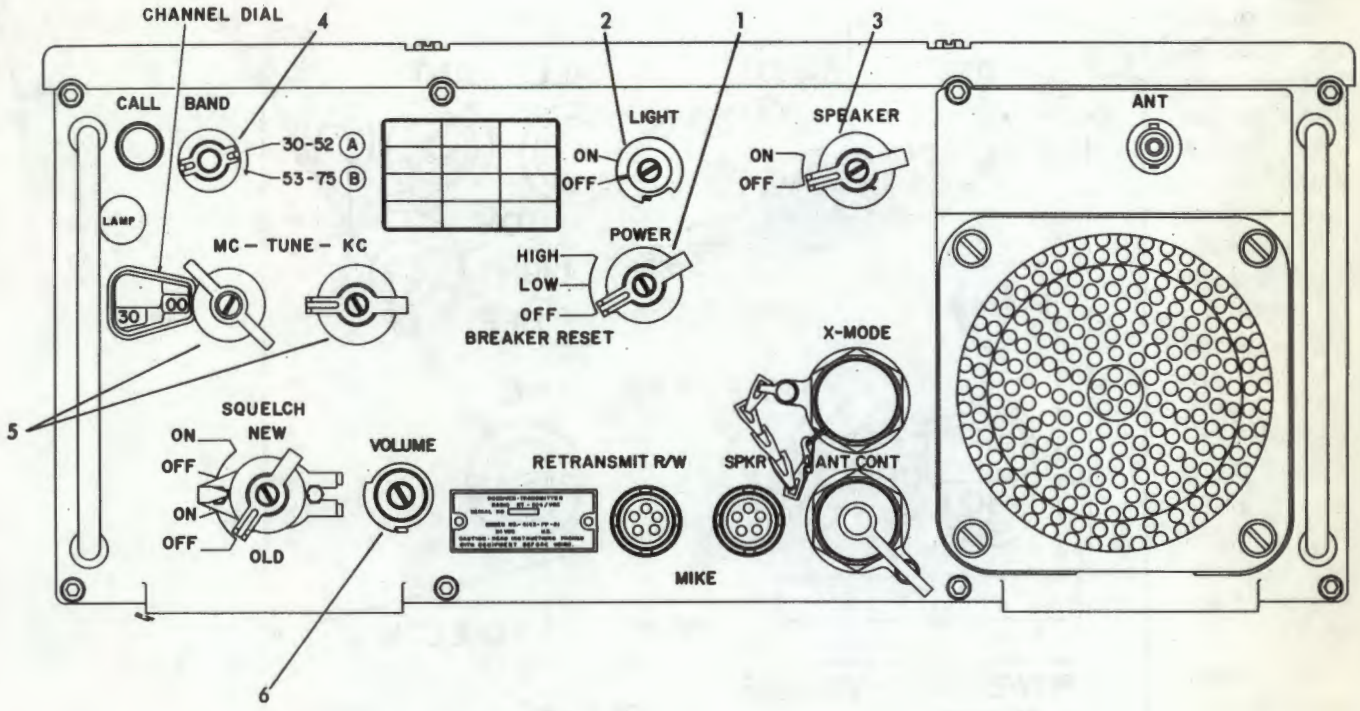


Figure 4–4. RT–524/VRC controls and indicators.

(d) Turn the TEL-RAD-RAD/SPKR control (4) to RAD/SPKR.

(e) Adjust the VOLUME control (5) to approximately midrange.

(f) Press the mike switch and call the net control station. Release the mike switch and listen for reception. Adjust volume for the desired audio. (For detailed operation of the radios, refer to TM 11–5820–401–10 and TM 11–5820–477–12.)

Warning: **Do not press the RINGER control when attaching telephone wire to binding posts.**

e. Operation of Target Alert Data Display Set. The squad leaders and platoon leaders are responsible for emplacing and operating the target alert data display set (TADDS). The FAAR position will be in the center of the display matrix. The fire unit/platoon leader position must be marked on the display matrix with a china marking pencil. (For detailed operation of the TADDS, refer to *FM 44–6.)

*To be published.

Note. Refer to key numbers on figure 4–3 for location of the controls and indicators.

(1) Emplace and orient the TADDS, using a map and the compass. The compass is in the cover of the TADDS.

(2) Remove the antenna (1), antenna adapter (2) from the TADDS cover, mate together and attach to ANT connector (3).

(3) Set the BAT AND RESET/SELF TEST switch (4) to BAT AND RESET. The S-METER (5) will indicate the battery strength. Return the switch to midposition.

(4) Set the PWR switch (6) at ON.

(5) Set the ADDRESS CONTROL (7) to the number of the FAAR used to furnish the TADDS information.

(6) Turn FREQUENCY MHz controls (8) to the correct frequency to receive RFDL transmissions.

(7) Set the READY/OFF switch (9) at READY.

(8) Adjust the VOLUME control (10) for a rushing sound over the speaker.

Note. The operating frequencies and the ADDRESS CONTROL setting will be in the communications-electronics operation instructions (CEOI).

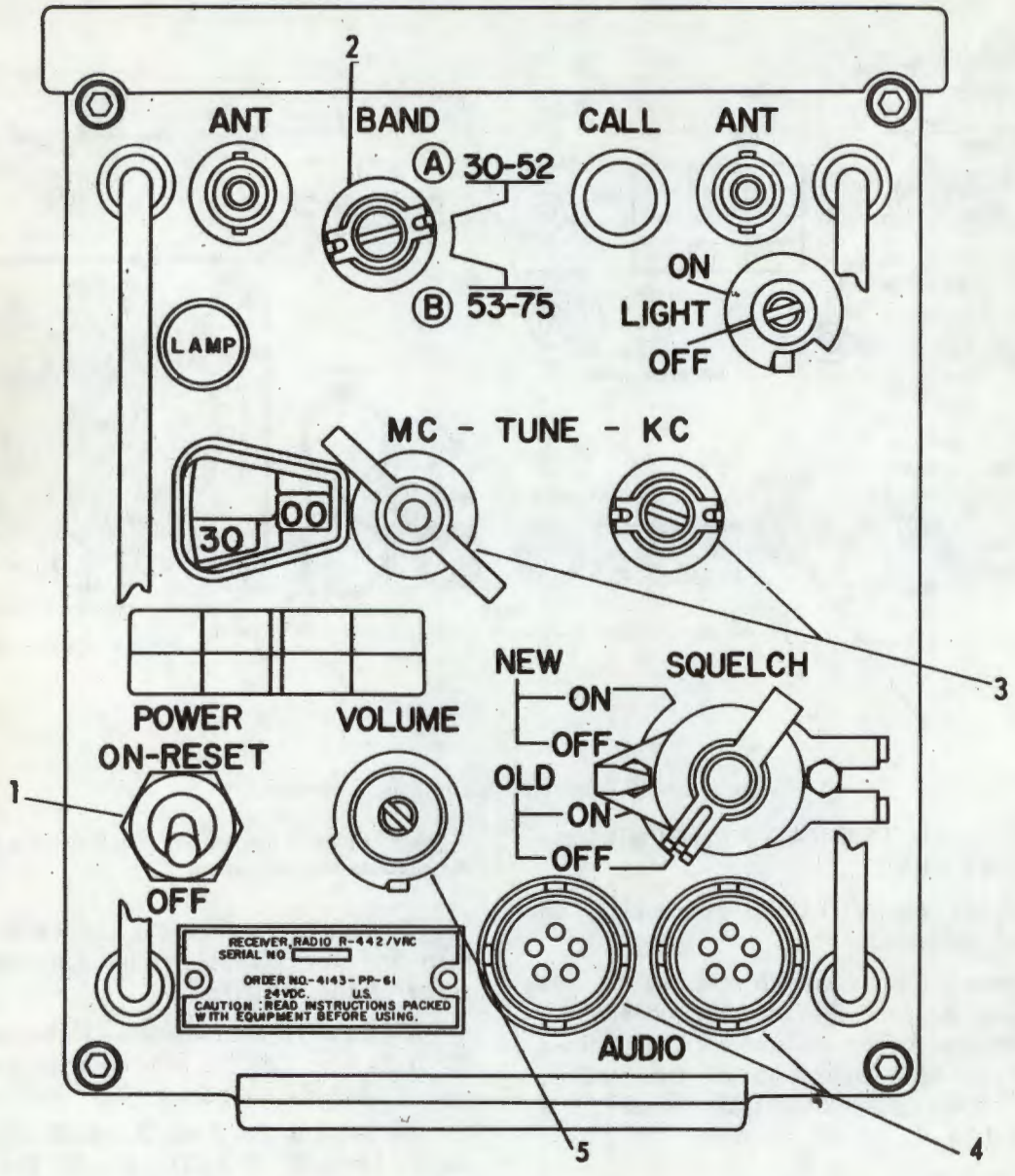


Figure 4–5. R–442/VRC controls and indicators.

Section II. LAUNCHING STATION

4–8. General

This section describes system controls and indicators and the procedures necessary to operate the Chaparral launching station in the engagement of aerial targets.

★4–9. Controls and Indicators

a. Description and Location. The Chaparral launching station has two major sets of controls and indicators. One set, the master control panel (MCP), is in the base structure. The other set, left control panel (LCP), center control panel (CCP), and right control panel (RCP), is in the mount and works as one set of controls. The relationship between base structure controls and mount controls is explained in *b* below.

b. Major Units.

(1) *Master control panel.* The master control panel (fig 4–7), located at the rear of the launching station base structure, contains the following switches, controls, and indicators:

(a) MASTER POWER switch. This switch, when set at ON, enables all system circuits except communications, prime power manual starting, and the battery heater, and lights the MASTER POWER indicator lamp to the left of the switch.

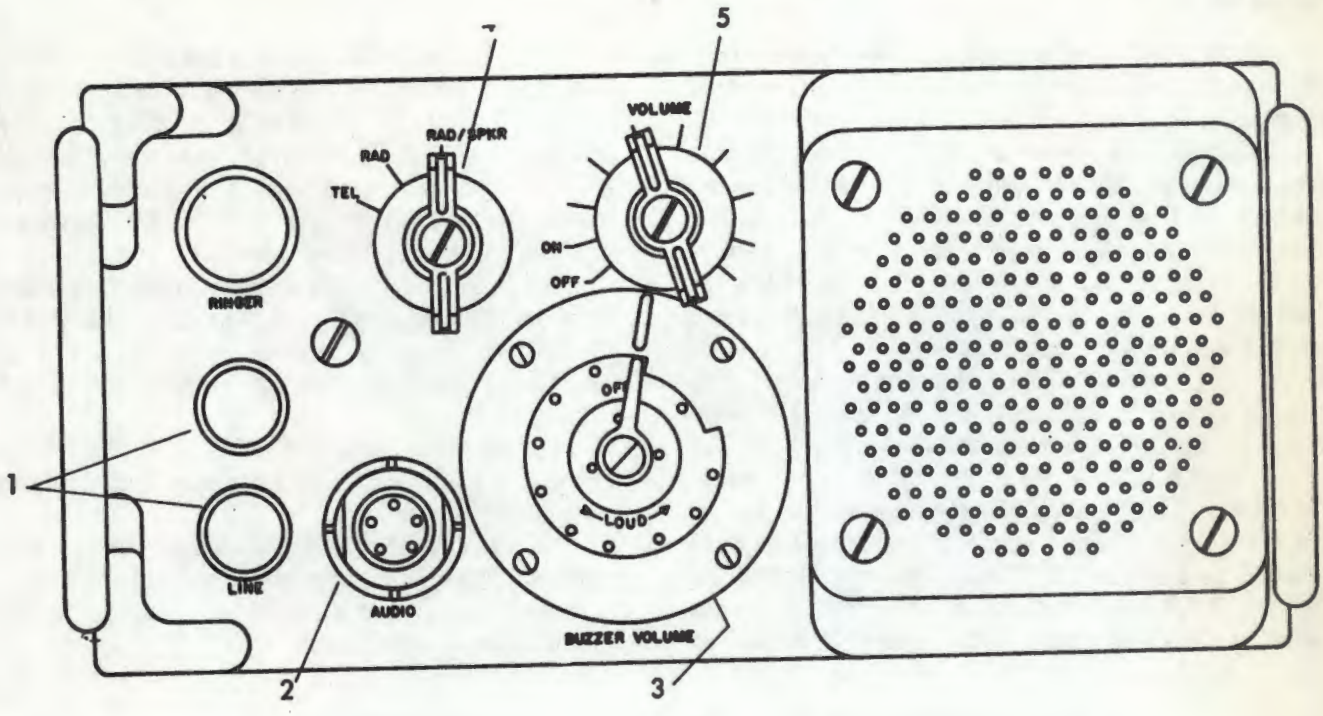


Figure 4–6. C–2328( )/GRA–39 controls and indicators.

(*b*) *COMM switch.* This switch, when set at ON, connects battery power to the radio and intercommunication subsystem.

(*c*) *PRIME POWER switch.* This switch has three positions, MAN (manual), OFF, and AUTO (automatic). When turned to MAN, the switch enables ignition of the gasoline engine of the main power unit (MPU), connects power to the vent fan to purge the launching station base structure of dangerous fumes or vapors, and enables the manual start switch after a delay of 1 minute. This 1-minute delay will allow the purging of the base structure and establish a safe condition for starting the MPU or battery heater. The door which contains the MCP must be kept closed during this time. When turned to OFF, the switch disables the MPU ignition, vent fan, and manual start switch. When turned to AUTO, the switch provides for the automatic on-off cycling of the MPU when the MODE switch in the gunner's compartment is turned to STANDBY, and continuous operation when the MODE switch is turned to TEST, READY, or OPERATE.

(*d*) *MAN START switch.* This is a push-button switch which, when pressed, connects power to the MPU starting motor.

(*e*) *BATTERY HEATER switch.* This switch has three positions, ON, OFF, and PRIME. The ON position starts the battery heater and applies power to the fuel pump after a 1-minute delay during which the vent fan purges the base structure of dangerous fumes or vapors. When set at PRIME, the fuel pump operates and injects fuel into the heater. The OFF position turns off the heater and also disables the fuel pump if the MPU is not operating.

(*f*) *LOADING SAFETY switch.* This two-position toggle switch is spring-loaded to the PWR ON position (up). When at PWR ON (indicated by the lighting of an indicator lamp located directly above the switch), the switch enables power distribution through the MOUNT POWER switch (located in the gunner's compartment) to the servo heaters of missiles on the launch rails and in the storage compartments. When set at SAFE (down) (the switch will magnetically latch in the SAFE position when the mount is retracted), the switch disables the MOUNT POWER switch in the gunner's compartment, disables the heater circuits in the missile storage compartments, lights the indicator lamp (located directly below the switch), and causes the PWR ON lamp to go out.

(*g*) *LOAD/OFF/STOW switch.* This toggle switch is spring-loaded to the OFF position. In the OFF position, it enables the mount LOAD/OFF/STOW switch and enables the azimuth and elevation gear-train brakes. In the LOAD position, it releases the gear-train brakes, positions the mount for retraction by causing the

mount to slew to 6 o'clock and the launch rails to depress to −9° with respect to the launching station deck (provided the mount is fully erected), and overrides the gunner's hand control. Setting the switch at STOW produces the same results as at LOAD except the launch rails move to the horizontal position with respect to the vehicle deck. When set at either LOAD or STOW, the switch overrides the LOAD/OFF/STOW switch in the gunner's compartment.

(*h*) *ERECT/OFF/RETRACT switch.* This toggle switch is spring-loaded to the OFF position. In the OFF position, it enables the ERECT/OFF/RETRACT switch on the gunner's compartment. The ERECT position causes the mount to elevate approximately 22 inches after a 1-second delay. The RETRACT position causes the mount to retract into the base structure 22 inches after a 1-second delay. When set at ERECT or RETRACT, the switch disables the ERECT/OFF/RETRACT switch in the gunner's compartment.

(*i*) *ERECT-RETRACT BREAKER.* The ON position of this circuit breaker enables the erect/retract control circuit and provides overload protection for the circuit. The OFF position disables the erect/retract circuits.

(*j*) *LAMP TEST switch.* This is a manually operated toggle switch, spring-loaded to the off position. The ON position tests the lamps on the master control panel by lighting lamps not already lit.

(*k*) *MISSILE HEATER BREAKERS.* These are electric circuit breakers that function as follows:

1. LEFT STORED. When set at ON, connects power and provides overload protection to the servo heater circuits of missiles in the left storage compartment.

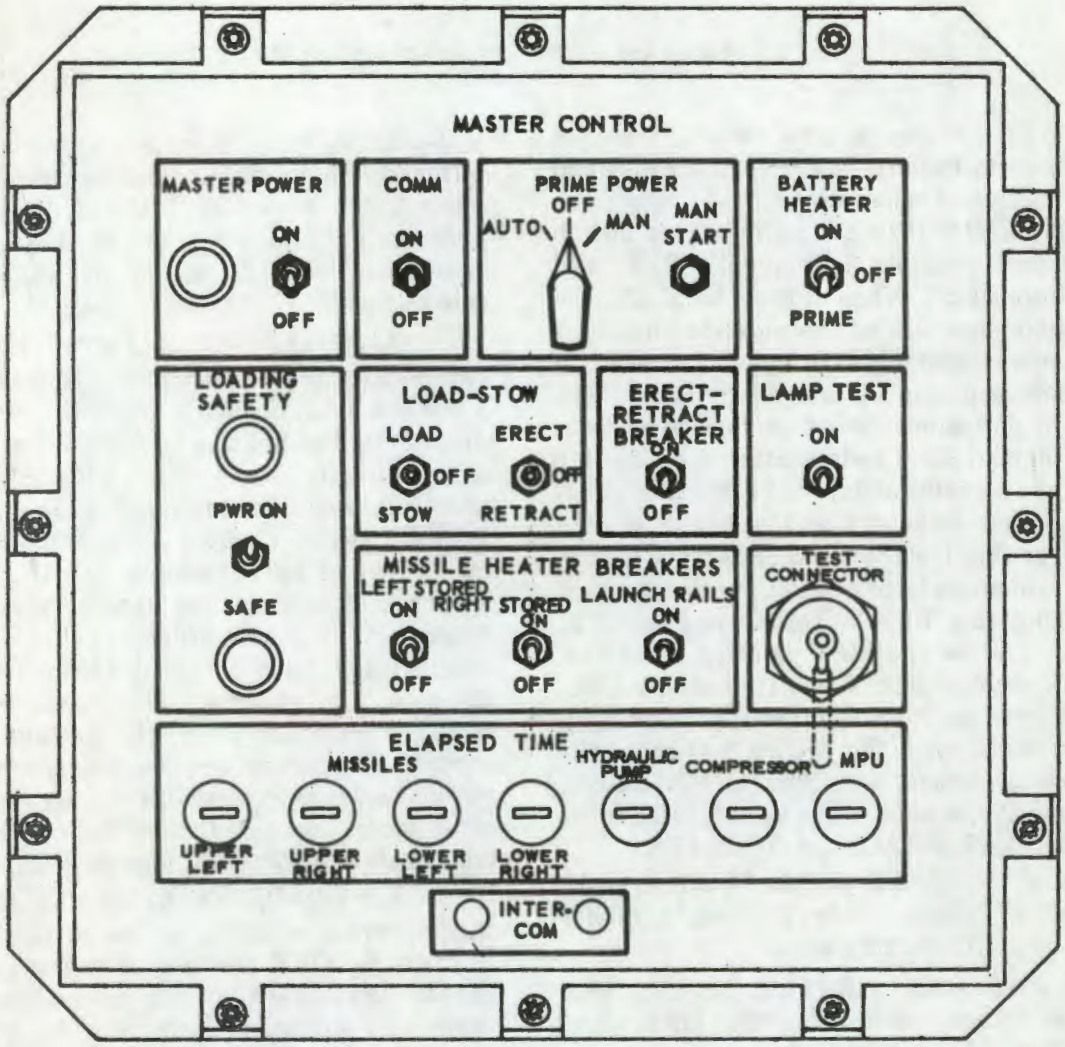
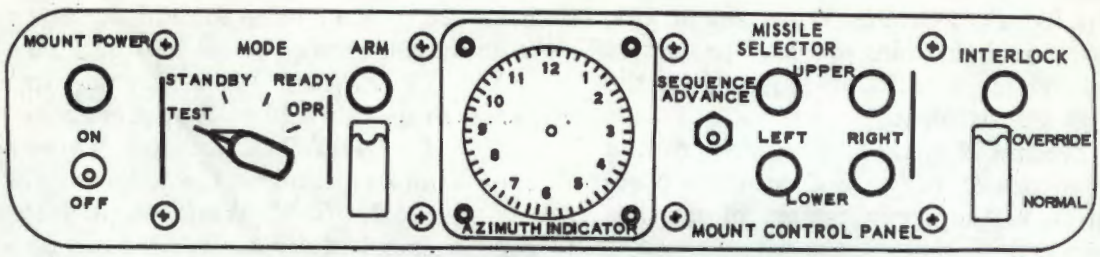
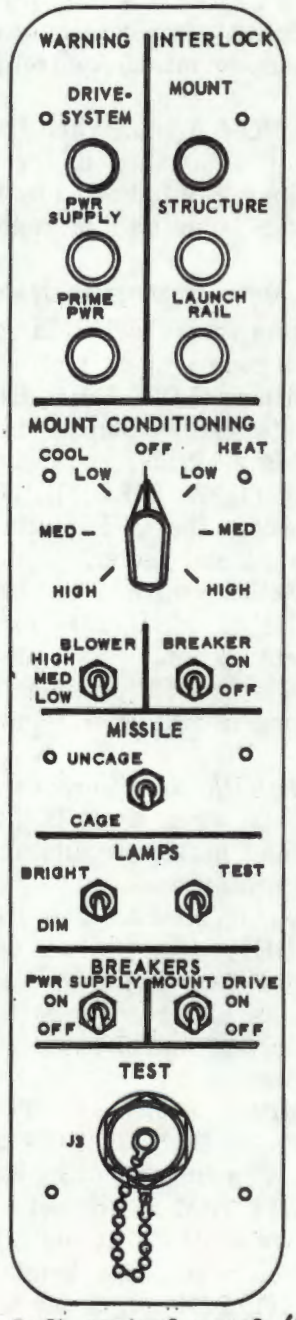


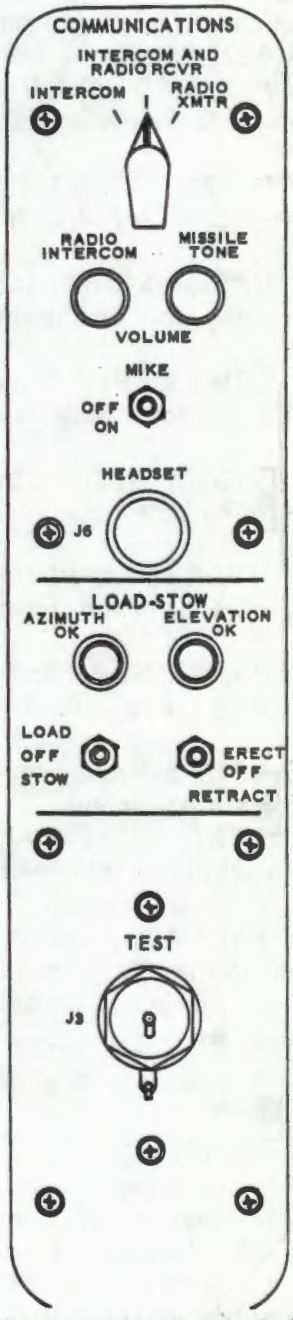
Figure 4–7. Master control panel.



Center control panel (CCP)



Left control panel (LCP)



Right control panel (RCP)

Figure 4-8. Mount control panels.

2. RIGHT STORED. When set at ON, connects power and provides overload protection to the servo heater circuits of missiles in the right storage compartment.

3. LAUNCH RAILS. The ON position connects servo heater power and provides overload protection to the servo heaters of missiles on the launch rails.

Note. The OFF position of all three circuit breakers removes power from their associated circuits.

(*l*) *TEST CONNECTOR.* Provides for the connection of organizational maintenance test set AN/TSM–85 into the system.

(*m*) *ELAPSED TIME meters.* Seven elapsed time meters provide information as follows:

1. UPPER LEFT. Indicates cumulative gyro running time for missile on upper left launch rail.

2. UPPER RIGHT. Indicates cumculative gyro running time for missile on upper right launch rail.

3. LOWER LEFT. Indicates cumulative gyro running time for missile on lower left launch rail.

4. LOWER RIGHT. Indicates cumulative gyro running time for missile on lower right launch rail.

5. HYDRAULIC PUMP. Indicates cumulative running time of the servosystem hydraulic pump.

6. COMPRESSOR. Indicates cumulative running time of the missile air subsystem compressor.

7. MPU. Indicates cumulative running time of the main power unit.

(*n*) *INTERCOM.* Provides terminals for connecting a telephone into the intercom system.

(2) *Left control panel.* The left control panel (LCP) (fig 4–8), located in the gunner's compartment to the left of the gunner's seat, has the following controls and indicators:

(*a*) *WARNING lamps.* Three *yellow* warning lamps indicate malfunctioning subsystems as follows:

1. DRIVE SYSTEM. Lights when serosystem hydraulic pump pressure is less then 1,300 psi and stays lit until pressure is greater than 1,700 psi; also lights when hydraulic fluid temperature is greater than 230° F., and when hydraulic fluid is low (less than 10 cubic inches in reservoir with pump operating).

2. PWR SUPPLY. Lights when regulated power supply voltage is above 26 volts or below 22 volts, or when the 175-volt power supply is above 190 volts or below 160 volts.

3. PRIME PWR. Lights when prime power drops below 17 volts or exceeds 31 volts.

(*b*) *INTERLOCK lamps.* Three *red* indicator lamps light under the following conditions:

1. MOUNT. When lit, indicates mount canopy is not fully closed, mount is not fully erect, or the air conditioner housing is not fully closed.

2. STRUCTURE. When lit, indicates that crew equipment compartment doors, MPU compartment doors, or master control panel door are not closed.

3. LAUNCH RAIL. When lit, indicates that a safety pin is installed in the detent assembly of the launch rail indicated by the missile selection indicator lamp on the center control panel.

(*c*) *MOUNT CONDITIONING switch.* This seven-position rotary switch is used to control the gunner's compartment temperature. The three COOL positions (LOW, MED, HIGH) operate the air conditioner evaporator fan at three speeds to provide selectable cooling. The three HEAT positions (LOW, MED, HIGH) operate the heater elements. The OFF position disables both air conditioner and heater.

(*d*) *BLOWER switch.* This three-position toggle switch (HIGH, MED, LOW) controls the volume of air circulation in the gunner's compartment. There is no OFF position. The blower operates continuously whenever mount power is on.

(*e*) *BREAKER circuit breaker.* This electric circuit breaker, when set at ON, enables the air conditioner and heater circuits and provides circuit overload protection.

(*f*) *MISSILE switch.* This two-position (CAGE/UNCAGE) toggle switch controls the caged condition of the gyro of a selected missile on the launch rails whenever the MODE selector switch on the center control panel is turned to TEST.

(*g*) *LAMPS switches.* Two toggle switches are labeled BRIGHT/DIM and TEST, respectively. TEST switch is spring-loaded to off. With the BRIGHT/DIM switch set at BRIGHT and the TEST switch held at on, all lamps on the three control panels are brightly lighted. With the BRIGHT/DIM switch set at DIM and the TEST switch held at on, all lamps except INTERLOCK (LCP), INTERLOCK OVERRIDE (CCP), and LOAD/STOW (RCP) will be dimly lighted.

(*h*) *BREAKERS.* Two circuit breakers are labeled PWR SUPPLY and MOUNT DRIVE, respectively. The ON position of the PWR SUPPLY breaker enables power distribution to mount circuits and provides circuit overload protection. The ON position of the MOUNT DRIVE breaker enables power distribution to the servosystem hydraulic power unit and provides overload protection to these circuits.

(*i*) *TEST connector.* This connector provides a means of connecting the organizational maintenance test set AN/TSM–85 to the LCP.

(3) *Center control panel.* The center control panel (CCP) (fig 4–8), located in the gunner's compartment directly in front of the gunner's seat, contains controls necessary for operating the system. The panel has the following controls and indicators:

(*a*) *MOUNT POWER indicator and switch.* The MOUNT POWER switch is a two-position (ON/OFF) switch that enables all mount circuits when set at ON and disables all mount circuits when set at OFF. The MOUNT POWER indicator is a *white* lamp that lights when the MOUNT POWER switch is set at ON.

(*b*) *MODE selector switch.* This four-position rotary switch connects power to the system as follows:

1. TEST position.

(a) Connects gyropower and filament voltage to a selected missile, activates the missile air valve (when a missile or test equipment is mounted on the launch rail), connects the supercage amplifier to the selected missile, enables the UNCAGE switch on the LCP, and disables the ARM switch on the CCP.

(b) When this switch is set at TEST, one missile on the launch rail is conditioned to full operational status. The remaining missiles are conditioned to standby status.

2. STANDBY position. Connects reduced filament voltage and servo heater power to missiles on the launch rails, and servo heater power to missiles in the storage compartments. Lights AZIMUTH OK and ELEVATION OK lamps when the mount is positioned for retraction, and disables the ARM switch.

3. READY position.

(a) Provides for the automatic cycling of launch-rail-mounted missiles through full readiness in 16-minute cycles and disables the ARM switch.

(b) In the READY position, two missiles are supplied with reduced filament voltage and servo heater power. Another missile is supplied with servo heater power, full filament voltage, and high-pressure air. The remaining missile is at full readiness and is supplied with servo heater power, full filament voltage, high-pressure air, and gyro power. The missiles are cycled every 16 minutes, so that the missile at full readiness drops to the lowest state of readiness and all other missiles advance one step.

4. OPR position. All launch rail missiles are conditioned to full readiness and the ARM and SEQUENCE ADVANCE switches are enabled.

(*c*) *ARM switch.* This magnetic latch switch is positioned automatically to OFF when the switch cover is closed. When in the ON position, the *white* indicator lamp mounted directly above the switch lights and the trigger and firing circuits are enabled. The switch will latch in the ARM position only when the MODE switch is turned to OPR.

(*d*) *AZIMUTH INDICATOR.* This indicator indicates launch rail pointing direction in terms of clock position measured from the front of the carrier.

(*e*) *SEQUENCE ADVANCE switch.* This spring-loaded switch bypasses automatic missile sequencing when held at on, and advances missile selection one step each time it is set at on provided the MODE switch is set at TEST or OPR.

(*f*) *Missile selection indicators.* These four *green* indicator lamps indicate which missile on the launch rails has been selected.

(*g*) *INTERLOCK switch.* This two-position switch, when set at NORMAL, prevents generation of a fire command if an interlock condition exists (*b*(2)(*b*) above) and allows the generation of an interlock warning tone. When set at OVERRIDE, it bypasses the interlock, enables the generation of the fire command, and disables the interlock warning tone.

Warning: **The INTERLOCK switch will not be used to override an interlock condition except in the case of a tactical emergency.**

(*h*) *INTERLOCK indicator lamp.* This lamp, when lit, indicates that an interlock condition is present in the structure or mount, or that a safety pin is installed in the selected missile launch rail.

(4) *Right control panel.* The right control panel (RCP) (fig 4–8) contains the controls and indicators necessary to control mount commuications, missile and interlock tone, and mount erection and retraction. These controls and indicators function as follows:

(*a*) *COMMUNICATIONS controls.*

1. Selector switch. This three-position rotary switch is used to select mount communications options as follows:

(a) *INTERCOM.* Enables gunner to listen and talk over the system intercom.

(b) *INTERCOM AND RADIO RCVR.* Enables gunner to listen to the RT-424/VRC and talk over the system intercom.

(c) *RADIO XMTR.* When held in this position (spring loaded), enables gunner to talk over the RT-524/VRC.

2. VOLUME controls. Two volume controls function as follows:

(a) *RADIO INTERCOM.* Enables the gunner to control the volume of the radio or intercom signal on one earphone of the gunner's headset.

(b) *MISSILE TONE.* Enables the gunner to control the volume of the missile tone or interlock warning tone on the other earphone of the gunner's headset.

3. MIKE switch. This two-position switch provides a means of controlling the gunner's microphone. The microphone may be activated manually by setting and holding the switch at ON. The switch deactivates the microphone when set at OFF.

4. HEADSET jack (J6). Provides a means for connecting the gunner's headset into the mount communications system.

(b) LOAD/STOW controls and indicators.

1. AZIMUTH OK indicator lamp. This *green* lamp lights when the MODE switch is turned to STANDBY and the LOAD/OFF/STOW switch is held at LOAD or STOW, and when

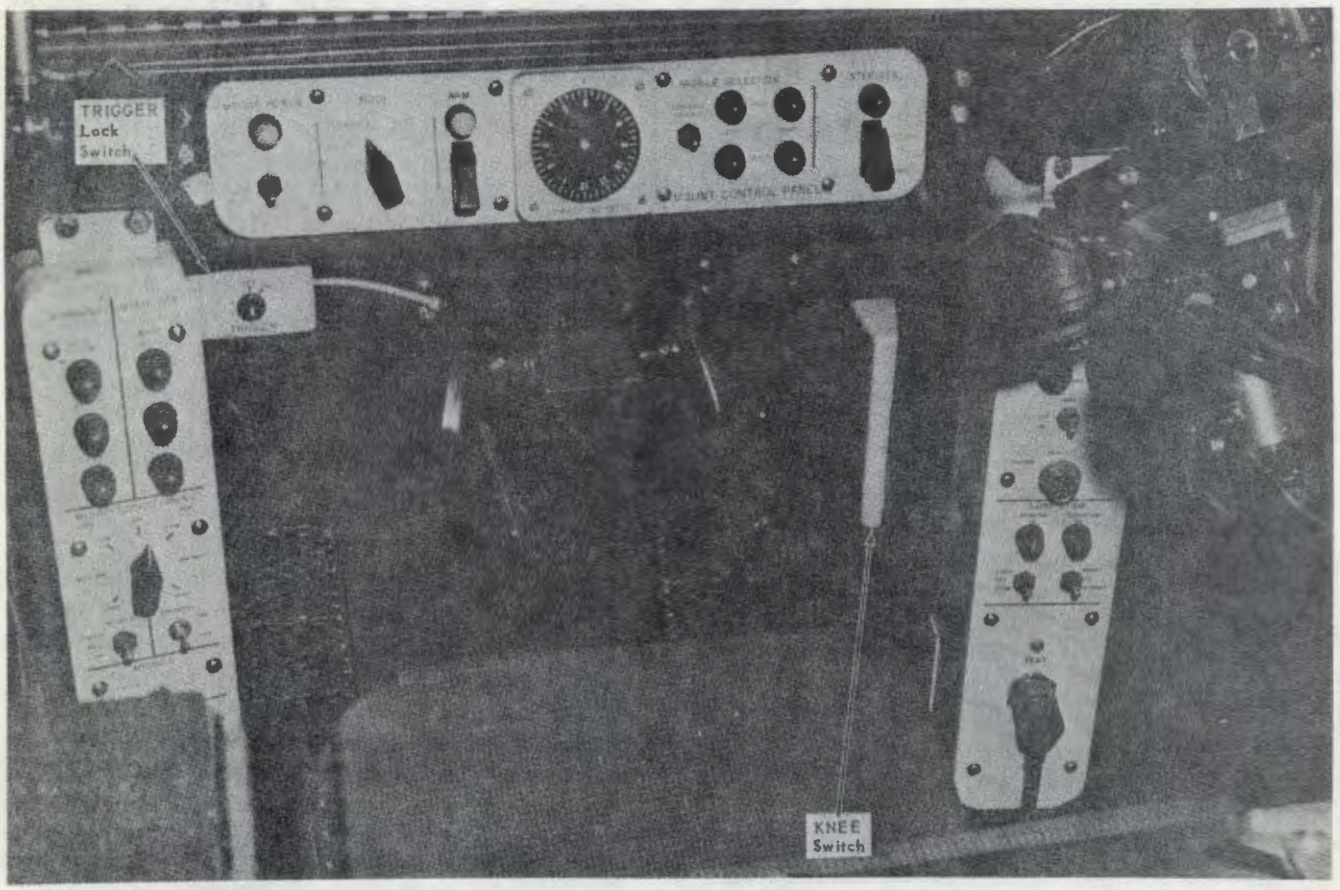


Figure 4-9. Trigger lock switch and knee switch.

the azimuth position of the mount reaches 6 o'clock.

2. ELEVATION OK indicator lamp. This *green* lamp lights when the MODE switch is turned to STANDBY and the LOAD/OFF/STOW switch is held at LOAD or STOW, and the launch rails are at 0° or less elevation.

3. LOAD/OFF/STOW switch. This three-position switch is spring-loaded to the OFF position. When held at LOAD, the mount slews to 6 o'clock and the rails depress to −9°. When held at STOW, the mount positions to 6 o'clock and the rails position to 0°. The LOAD/OFF/STOW switch on the MCP overrides this switch.

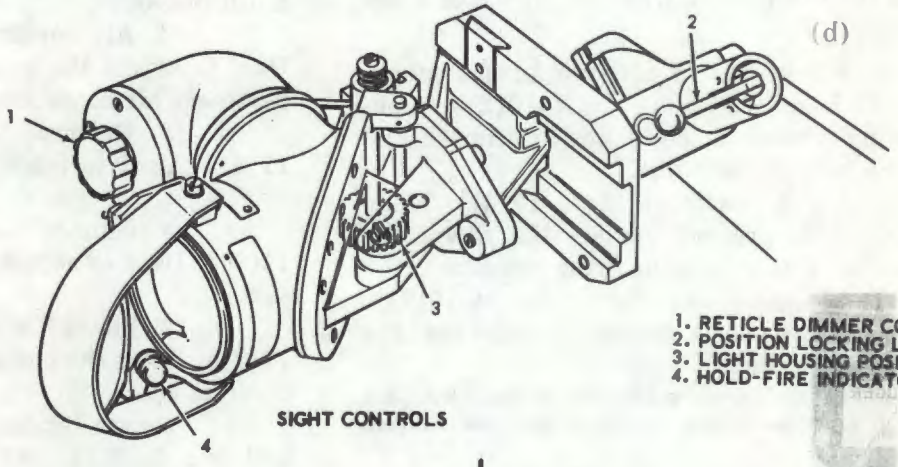
4. ERECT/OFF/RETRACT switch. This three-position switch is spring-loaded to the OFF position. When held at ERECT, the mount moves to a fully erected position. When held at RETRACT, the mount retracts. The ERECT/OFF/RETRACT switch on the MCP overrides this switch.

(c) *TEST connector.* Provides a means for connecting organizational maintenance test set AN/TSM-85 to the RCP.

(5) *Trigger lock switch and knee switch.*

(a) *TRIGGER lock switch (fig 4-9).* This two position switch, when turned to OFF, interrupts the firing circuit and prevents inadvertent firing of a missile.

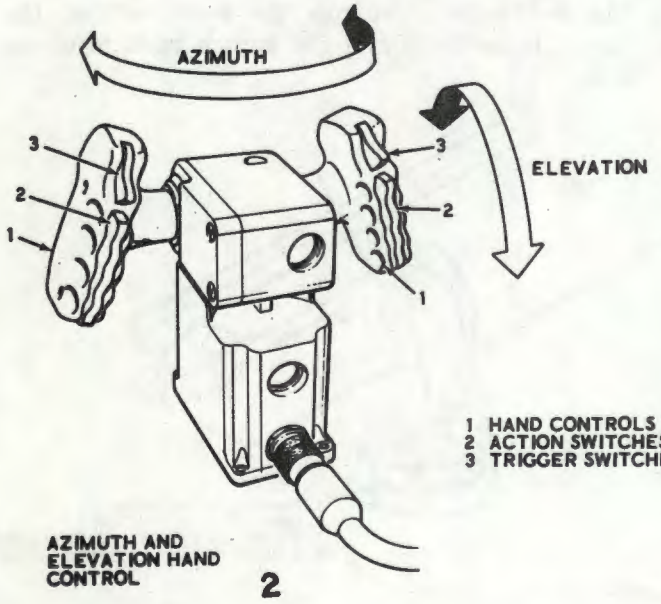
(b) *Knee switch (fig 4-9).* This switch,



1. RETICLE DIMMER CONTROL
2. POSITION LOCKING LEVER
3. LIGHT HOUSING POSITION KNOB
4. HOLD-FIRE INDICATOR

SIGHT CONTROLS

1



1 HAND CONTROLS (2)
2 ACTION SWITCHES (2)
3 TRIGGER SWITCHES (2)

AZIMUTH AND ELEVATION HAND CONTROL

2

Figure 4-10. Elevation and azimuth hand controls and sight controls.

when pressed, activates the gunner's microphone for intercommunication or radio transmission.

(6) *Miscellaneous controls and indicators.* In addition to the controls and indicators located on the four control panels, the following controls and indicators are necessary for operation of the system:

(*a*) *Sight.*

1. Reticle dimmer control (fig 4–10(1)). Controls the brightness of the sight reticle lamp.

2. Position locking lever (fig 4–10(1)). Locks the sight in action or travel position.

3. Light housing position knob (fig 4–10(1)). Used to select either daylight or lamp illumination of the sight reticle.

4. Hold-fire indicator (fig. 4–10(1)). This *red* indicator lamp, when lit, indicates a low kill probability.

(*b*) *Elevation and azimuth hand controls.*

1. Hand controls (fig 4–10(2)). Controls the movement of the mount in azimuth and the launch rails in elevation.

2. Action switches (fig 4–10(2)). When either switch is pressed, enables the power for the hydraulic system and the firing circuits.

3. Trigger switches (fig 4–10(2)). When either switch is pressed, sends the fire signal to the missile.

Note. Action switch must be pressed and the TRIGGER lock switch must be turned to ON before the triggers will function.

(*c*) *Launch rail components.*

1. Umbilical receptacle (fig 4–11(1)). Provides for electrical and high-pressure air connection between the missile and the launch rail.

2. Umbilical retractor (fig 4–11(2)). Holds the umbilical cable prior to launch. Shears and retracts the cable at launch.

3. Firing safety pin and streamer (fig 4–11(3)). When installed in the launch rail detent assembly, prevents firing of the missile. A red streamer is attached to the pin.

4. Missile detent latching lever (fig 4–11(4)). Provides a means of retracting the missile detent during missile loading and unloading.

(*d*) *Mount controls and indicators.*

1. Sight (fig 4–12(1)).

2. Remote canopy latch handle (fig 4–12(2)). Used to latch the canopy from the inside.

3. Limit stop flags (4) (fig 4–12(3)). Indicates the condition of the elevation/depress crush blocks.

4. Air conditioner knob (fig 4–12(4)). Used to adjust the temperature of gunner's compartment air conditioner.

5. External canopy latch handle (fig 4–12(5)). Used to latch the canopy from the outside.

6. Gunner seat height control (fig 4–12(6)). Used to adjust the height of the gunner's seat.

7. Stowed wing locking clamp (fig 4–12(7)). Holds the outboard wings when the cargo cover is used.

8. Air intake control; gunner's air control (fig 4–12(8), (9)). Controls the volume of fresh air entering the gunner's compartment.

9. Azimuth and elevation hand control (fig 4–12(10)). Controls the movement of the mount in azimuth and the launch rails in elevation.

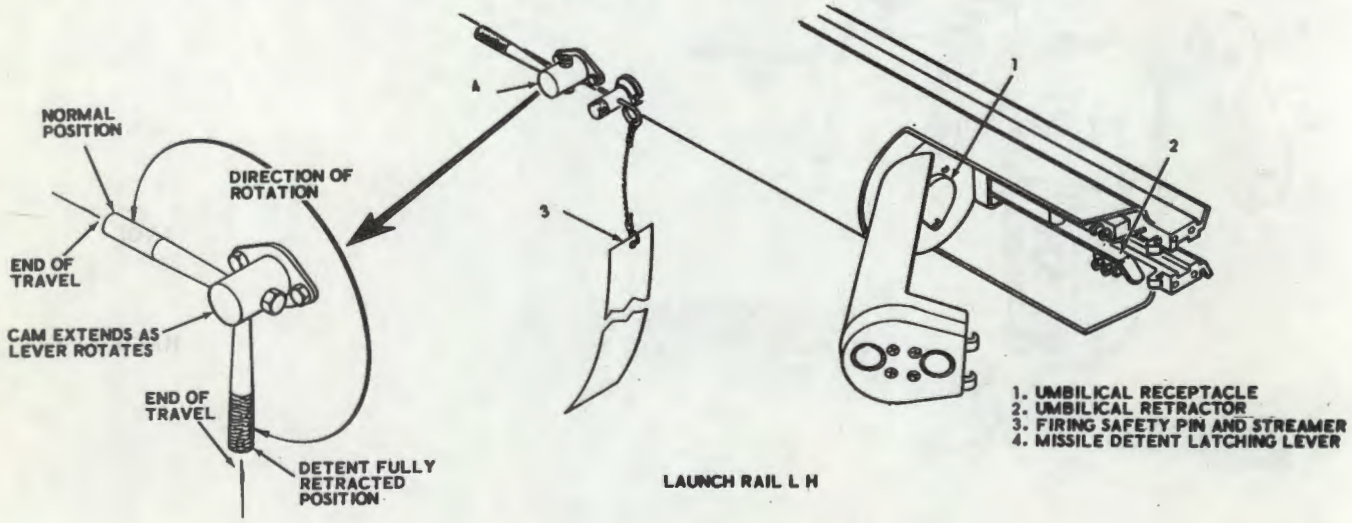
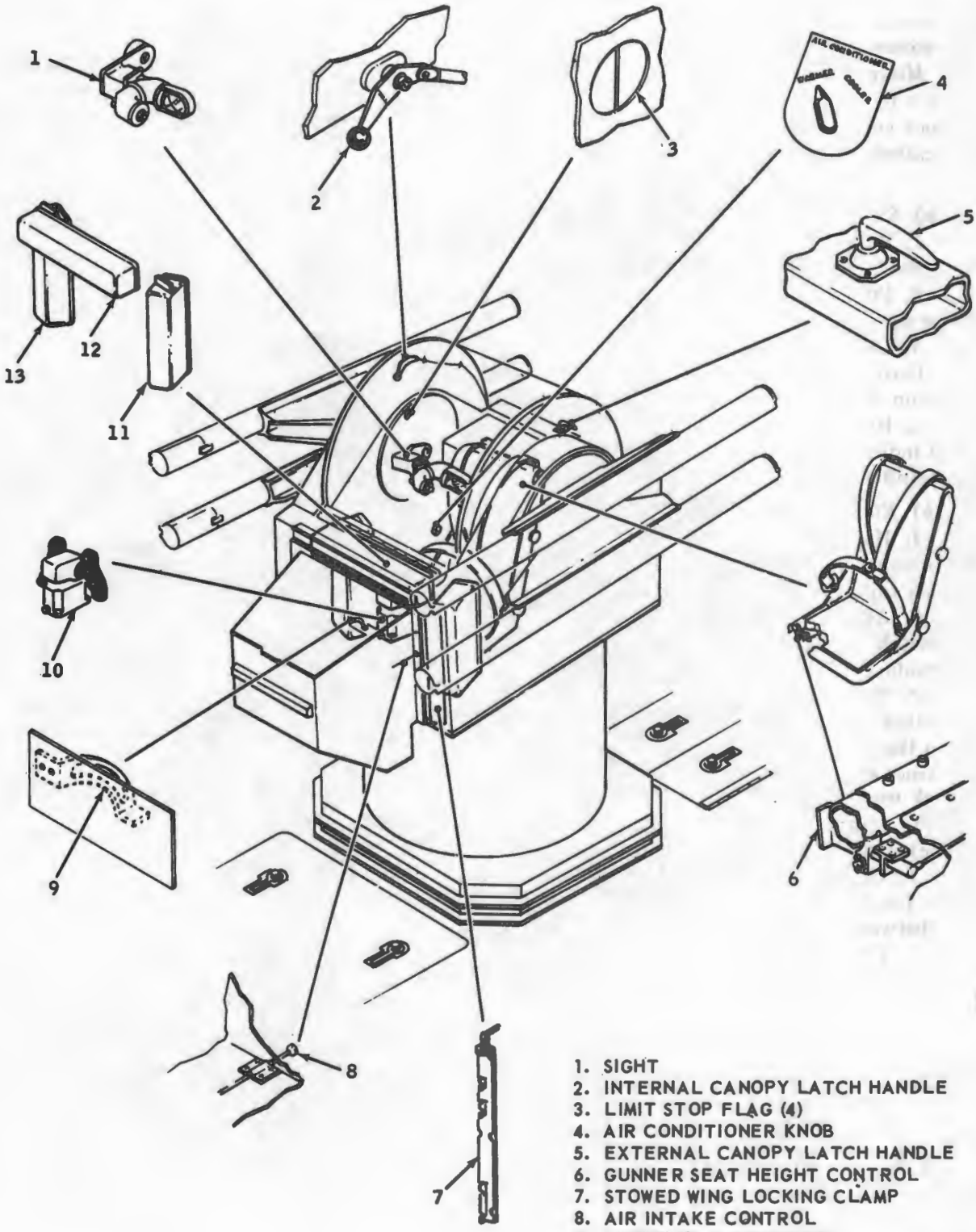


Figure 4–11. Launch rail components.



1. SIGHT
2. INTERNAL CANOPY LATCH HANDLE
3. LIMIT STOP FLAG (4)
4. AIR CONDITIONER KNOB
5. EXTERNAL CANOPY LATCH HANDLE
6. GUNNER SEAT HEIGHT CONTROL
7. STOWED WING LOCKING CLAMP
8. AIR INTAKE CONTROL
9. GUNNER'S AIR CONTROL
10. AZIMUTH AND ELEVATION HAND CONTROL
11. LEFT CONTROL PANEL
12. CENTER CONTROL PANEL
13. RIGHT CONTROL PANEL

Figure 4–12. Miscellaneous mount controls and indicators.

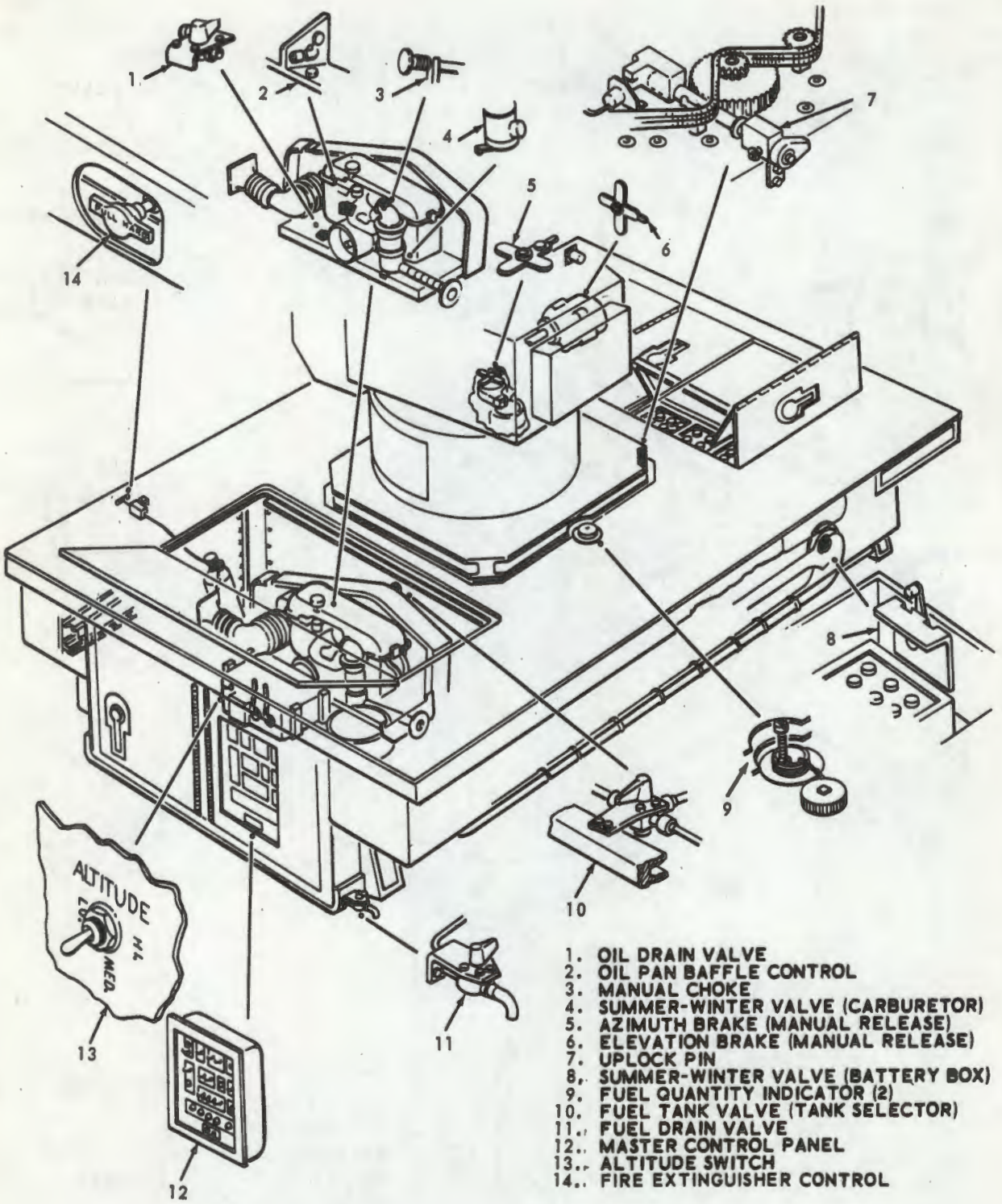


Figure 4–18. Base structure controls and indicators.

10. Left control panel (fig 4–12(11)).
11. Center control panel (fig 4–12(12)).
12. Right control panel (fig 4–12(13)).

Note. Panels identified in *10–12* above contain the controls outlined in *b*(2)–(5) above.

(*e*) *Base structure controls and indicators.*

1. Oil drain valve (fig 4–18(1)). Drain valve for the MPU.

2. Oil pan baffle control (fig 4–18(2)). Used to adjust air around crank case during extreme cold weather operations.

3. Manual choke (fig 4–18(3)). Used when starting the MPU.

4. Summer-winter valve (carburetor) (fig 4–13(4)). Used to regulate heat for the MPU carburetor.

5. Azimuth brake (manual release) (fig 4–13(5)). Used to release the azimuth drive motor brake.

6. Elevation brake (manual release (fig 4–13(6)). Used to release the elevation drive motor brake.

7. Uplock pin (fig 4–13(6)). When engaged, removes the voltage from the erect/retract motor and locks the mount in the UP position.

8. Summer-winter valve (battery box) (fig 4–13(8)). Used to control heating of the system batteries.

9. Fuel quantity indicator (2) (fig 4–13(9)). Used to indicate the amount of gasoline in each fuel cell for the MPU.

10. Fuel tank selector valve (fig 4–13 (10)). Switches the left, right, or both tanks into the MPU.

11. Fuel drain valve (fig 4–13(11)). Used to drain the fuel cells when required.

12. Master control panel (fig 4–13 (12)).

13. Altitude switch (fig 4–13(13)). Used to regulate the air intake for the MPU at different altitudes.

14. Fire extinguisher control (fig 4–13 (14)). Controls the fire extinguisher for the launching station base structure.

4–10. Energizing and Deenergizing Launching Station

a. Preenergizing Checks. Before energizing the Chaparral launching station, the following checks should be made by the squad member:

Table 4-4. Launching Station Control Setting (Preenergizing)

Location	Control	Setting
Master control panel	MASTER POWER switch	OFF.
	COMM switch	OFF.
	PRIME POWER switch	OFF.
	BATTERY HEATER switch	OFF.
	LOADING SAFETY switch	PWR ON.
	LOAD-STOW switch	OFF.
	ERECT-RETRACT BREAKER switch	OFF or ON.
	LEFT STORED circuit breaker	OFF or ON.
	RIGHT STORED circuit breaker	OFF or ON.
	LAUNCH RAILS circuit breaker	OFF or ON.
	MISSILE HEATER BREAKERS will be on only at temperature 40° F., or below.	
Left control panel	MOUNT CONDITIONING switch	OFF.
	BREAKER circuit switch	OFF/ON.
	BLOWER switch	LOW.
	MISSILE switch	CAGE.
	TEST switch	Off.
	BRIGHT/DIM switch	DIM.
	PWR SUPPLY circuit breaker	ON.
	MOUNT DRIVE circuit breaker	ON.
Center control panel	MOUNT POWER switch	OFF.
	MODE switch	STANDBY.
	ARM switch	OFF.
	INTERLOCK	NORMAL.
	TRIGGER lock switch	OFF.
Right control panel	COMMUNICATONS switch	INTERCOM AND RADIO RCVR.
	RADIO INTERCOM knob	Midrange.
	MISSILE TONE knob	Midrange.
	MIKE switch	OFF.
Azimuth gear train box	Azimuth manual brake	NORMAL.
Elevator gear train box	Elevation manual brake	NORMAL.
MPU compartment	Fuel cell selector valve	BOTH.
	SUMMER/WINTER valve	as directed.
Crew equipment compartment	Air purifier circuit breaker	ON.
	SUMMER/WINTER valve	SUMMER or WINTER.
	Air purifier blowdown valve	Closed (CW).

(1) Verify that fuel cells contain fuel and caps are installed and tight.

(2) Verify that battery electrolyte is at the prescribed level.

(3) Insure that no objects will interfere with erecting, retracting, or rotating the mount.

(4) Verify that all controls and switches are set to the positions shown in table 4–4.

★*b. Energizing Procedure.* The launching station is energized by performing the following steps:

(1) *Energizing the prime power subsystem.*

(a) For temperatures above 40° F.

1. Open the MPU compartment and:

(a) Turn FUEL SELECTOR valve to BOTH.

(b) Turn SUMMER/WINTER valve to SUMMER.

2. Lower vehicle tailgate.

3. Turn PRIME POWER switch to MAN.

Note. Base structure ventilating fan and the 1-minute delay start when PRIME POWER switch is turned to MAN. Keep the MCP door closed during the 1-minute delay so the base structure may be cleared of dangerous fumes.

4. Press MAN START switch and start MPU. If the engine does not start in 10 seconds, power will be removed from the switch. If this occurs, release switch and press again.

5. If the MPU is to be operated with the PRIME POWER switch turned to AUTO, run in the MAN position for at least 10 minutes before turning the switch to AUTO.

(b) For temperatures of 40° F. or below.

1. Open the MPU compartment and:

(a) Turn FUEL SELECTOR valve to BOTH.

(b) Turn SUMMER/WINTER valve to WINTER.

2. Lower vehicle tailgate.

3. Turn PRIME POWER switch to MAN. The structure vent fan starts.

4. Set BATTERY HEATER switch at PRIME, hold for 10 to 20 seconds, and then set switch at ON.

Note. Do not proceed further until the battery heater cycles off. This will indicate that battery operating temperature has been reached.

5. Press MAN START switch and start MPU.

6. When MPU has run for 10 minutes, turn PRIME POWER switch to AUTO.

(2) *Energizing the launching station.*

(a) Energize the prime power subsystem as described in (1) above.

(b) Set MASTER POWER switch at ON.

(c) Set ERECT-RETRACT BREAKER at ON.

(d) Set MISSILE HEATER BREAKERS at ON (if temperature is 40° F. or below).

(e) Verify that PRIME POWER switch is turned to AUTO.

(f) Set COMM switch at ON.

(g) Close and latch tailgate.

(h) Open the canopy and enter the gunner's compartment.

(i) Set MOUNT POWER switch at ON.

(3) *Deenergizing the launching station.* Set all controls to the deenergized position in accordance with table 4–4.

4–11. Erecting and Retracting the Mount

a. General. The mount is retracted into the base structure for normal road travel or missile loading. The mount may be erected or retracted from either the MCP or from the gunner's compartment.

b. Erecting Mount from MCP. The mount is erected from the MCP as follows:

(1) Energize the prime power subsystem as described in paragraph 4–10*b*(1).

★(2) Verify that uplock lever is unlocked.

(3) Set and hold ERECT/OFF/RETRACT switch at ERECT until mount movement stops. Release switch.

c. Retracting Mount from MCP. The mount is retracted from the MCP as follows:

★(1) Be sure that the uplock lever is unlocked.

(2) Energize the prime power subsystem as described in paragraph 4–10*b*(1).

(3) Set and hold LOAD/OFF/STOW switch at either LOAD or STOW until mount movement stops. Release switch.

(4) Set and hold ERECT/OFF/RETRACT switch at RETRACT until mount movement stops. Release switch.

d. Erecting Mount from Gunner's Compartment. The mount is erected from the gunner's compartment as follows:

(1) Energize the launching station as described in paragraph 4–10*b*(1) and (2).

★(2) Verify that uplock lever is unlocked.

(3) Set and hold the ERECT/OFF/RETRACT switch at ERECT until the amount stops. Release switch.

e. Retracting Mount from Gunner's Compartment. The mount is retracted from the gunner's compartment as follows:

★(1) Be sure the uplock lever is unlocked.

(2) Energize the launching station as described in paragraph 4–10*b*(1) and (2).

(3) On the RCP, set and hold the LOAD/OFF/STOW switch at either LOAD or STOW until mount movement stops, and ELEVATION OK and AZIMUTH OK lamps light. Release switch.

(4) Set and hold the ERECT / OFF / RETRACT switch at RETRACT until mount movement stops. Release switch.

Note. The mount may be erected or retracted on battery power. When this is to be done, disregard the part of paragraph 4–10*b* pertaining to energizing the MPU.

4–12. Operating Launching Station

a. Preparing for Action. The launching station is prepared to engage targets by performing the following steps:

(1) Move the system into the selected position.

(2) Position the blast shields as described in paragraph 4–19.

(3) Lower the vehicle tailgate.

(4) Check that communication equipment switches are positioned as shown in table 4–3.

(5) Perform the preenergizing checks described in paragraph 4–10*a*.

(6) Energize the launching station as described in paragraph 4–10*b*.

(7) Raise and lock tailgate.

(8) Enter the mount.

(9) Erect the mount as described in paragraph 4–11*d*.

(10) Check that STRUCTURE INTERLOCK lamp is out.

(11) Close and latch the canopy. The mount interlock lamp should go out.

(12) Turn MOUNT CONDITIONING switch and set BLOWER switch as desired.

(13) Set air intake control and air control levers as desired.

(14) Set reticle housing handle to select desired illumination.

(15) Turn COMMUNICATIONS switch to INTERCOM AND RADIO RCVR. Establish communications with other squad members.

(16) Press the action switch on the hand control assembly, rotate assembly up/down/right/left, observe that drive system WARNING lamp goes out and mount responds to commands.

(17) Perform missile test sequence as follows:

(a) Verify that all safety pins are installed in the rails, and missile protective covers are removed.

(b) Position the mount and rails so that the missiles are pointing away from the sun.

(c) Turn the Mode switch to TEST and observe that a MISSILE SELECTION lamp on the CCP lights. Allow the missile to cool for 1 minute before proceeding with test.

(d) Hold an IR flashlight about 1 foot in front of, and slightly off center of, the missile seeker. Missile tone should be heard in the gunner's headset.

(e) Set the MISSILE—CAGE/UNCAGE switch at UNCAGE. The missile tone should null, indicating the seeker in tracking the IR source.

(f) Set the MISSILE—CAGE/UNCAGE switch at CAGE.

(g) Hold the SEQUENCE ADVANCE switch at ON to select a new missile. Repeat procedure in *(a)* through *(g)* above until the four missiles have been checked.

(h) If preparing to engage targets, remove the safety pins. When pins are removed, the INTERLOCK—LAUNCH RAIL lamp will go out and the warning tone will cease.

(18) Unlatch and raise canopy. The INTERLOCK lamp on the CCP and the INTERLOCK—MOUNT lamp on the LCP will light and the warning tone will be heard in the earphone. Lower and lock canopy.

(19) Turn MODE switch to READY.

b. Target Engagement. The following procedures should be followed by the gunner in conducting a target engagement (see chap. 6 for additional information). When warning of an impending attack is received:

(1) Slew mount to expected direction of target approach.

(2) Turn MODE switch to OPR and set ARM switch at ARM; turn TRIGGER lock switch to ON.

(3) When target is detected visually, position mount and launch rails to place target in inner circle of sight reticle and track target smoothly.

(4) Track target slightly off the reticle pattern center and listen for a missile tone.

(5) When a missile tone is heard, observe the target size in the sight reticle and determine if the target can be engaged.

Note. Check the sight for a RED hold-fire lamp. The hold-fire lamp will be lit if elevation is below 35° and the azimuth tracking rate exceeds 10° per second. If the hold-fire lamp is lit, continue tracking until the lamp goes out.

(6) Track target at a position in the sight reticle pattern that produces the best missile tone.

Note. A null in missile tone indicates that the gunner is tracking the center of the IR source.

(7) Press the firing trigger to initiate missile launch, then release trigger. When the trigger is released, the missile selector lamp should automatically sequence to indicate that the next missile is selected.

(8) Reestablish tracking and prepare to repeat the missile launch sequence above.

c. Emergency Emplacement and Preparation for Action. The situation may arise when Chaparral comes under aerial attack while in a road march configuration and must prepare for action under emergency conditions. In this situation time is of a prime importance. Only those actions absolutely essential to condition for firing will be taken. Target engagement procedures will be accomplished by the squad leader and the gunner. The other personnel will provide ground security for the system. While the immediate threat is removed, the squad personnel will prepare the system for action in the normal manner or will resume their original mission. The minimum requirements for emergency emplacement and preparation for action are listed below.

(1) *From a march column (fire unit in normal travel configuration).*

(a) Move vehicle to a location at least 200 feet away from the column.

(b) Lower the vehicle tailgate and set MASTER POWER switch at ON; turn PRIME POWER switch to AUTO; and set ERECT/RETRACT BREAKER switch at ON. Close and latch tailgate.

(c) Unfold the blast shields; close and latch vehicle cab doors.

(d) Gunner enters mount; energizes and erects the mount; closes and latches canopy.

(e) Remove dome protectors from all missiles; remove the safety pins and streamers.

(f) Open crew equipment compartment, remove one reel of wire and a field telephone; store the safety pins and streamers and dome protective covers; close and latch compartment doors.

(g) Attach end of field wire to external communications panel; lay wire to squad leaders command post (at least 200 feet from the weapon); attach telephone; and establish communications with gunner.

(h) Driver and one observer take a position at least 200 feet from the Chaparral and furnish ground security protection.

(i) Gunner arms the system and prepares to engage targets.

Note. Time required for emplacement should not require more than 90 seconds.

(2) *From an emergency march order configuration.*

(a) Move vehicle to position at least 200 feet from other vehicles or personnel.

(b) Unfold blast shields; close cab doors.

(c) Connect telephone wire to a pair of intercom jacks on the external communication panel.

(d) Remove the rest of the communications equipment from the launching station deck.

(e) Driver and one observer take position at least 200 feet from the vehicle and furnish ground security protection.

(f) Establish communications via intercom between squad leader command post and gunner.

(g) Gunner arms system and prepares to engage targets.

Note. Time required for emplacement should not require more than 60 seconds.

d. Securing System. Following an engagement, the system is secured as follows:

(1) Turn MODE switch to STANDBY.

(2) Check that ARM switch is set at OFF; turn TRIGGER lock switch to OFF.

(3) Check that INTERLOCK switch is set at NORMAL.

(4) Set and hold LOAD/OFF/STOW switch at STOW until mount is positioned for stow and AZIMUTH OK and ELEVATION OK lamps light.

(5) Set and hold the ERECT/OFF/RETRACT switch at RETRACT until the mount is fully retracted.

(6) Set RCP, CCP, and LCP controls as shown in table 4–4.

(7) Rotate the sight to the stow position and latch in place.

(8) Remove headset, open canopy, and leave the mount; close and latch the canopy.

(9) Install firing safety pins, missile dome protectors, and rolleron covers on all missiles mounted on the launch rails.

(10) Set MCP switches as shown in table 4–4.

(11) Close and latch vehicle tailgate.

(12) Stow blast covers by performing the procedures listed in paragraph 4–19*b*.

4–13. Missile Loading and Unloading

a. Missile Loading Procedures. Missiles are loaded on the launch rails as follows:

(1) Lower vehicle tailgate.

(2) Energize prime power subsystem.

(3) Erect the mount by holding ERECT/OFF/RETRACT switch at ERECT until mount movement stops. Release switch.

(4) Set and hold LOAD/OFF/STOW switch at LOAD until launch rails are depressed to −9°.

(5) Retract mount by holding ERECT/OFF/RETRACT switch at RETRACT until mount is fully retracted. Release switch.

Note. If mount is retracted at the start of loading operations, the launch rails can be depressed to the loading position manually by releasing the elevation gear-train brake and physically pulling the launch rails down. In this case, no power need be applied to the system.

(6) Set MASTER POWER and PRIME POWER switches at OFF.

(7) Install safety pin(s) in launch rail(s) to be loaded.

(8) If two or more missiles have been fired from the rail(s) to be loaded, clean the rail(s) before proceeding.

(9) Open umbilical latch access door and remove sheared umbilical cables from rails from which missiles have been fired. Replace the umbilical connector dust cover.

(10) Inspect launch rail detent to make certain the detent is in the retracted position (fig. 4–11).

(11) Open missile storage compartment door and select missile to be loaded.

(12) Disconnect heater cable from storage compartment and place a cover over the receptacle.

(13) Pull the missile case extractor handle to the down position and pull the container to the rear until the warning stripe appears.

Note. The missile and case weigh over 200 pounds. Four men are required to support and handle this weight when it clears the storage compartment.

(14) Pull missile case to the rear until it clears the storage compartment. When missile case is clear, rest one end of the case on the tailgate and support the other end clear of the ground.

(15) Free the heater cable from the clips on the case and disconnect heater cable from the umbilical cable.

(16) Remove lid from missile case and place case lid lengthwise on the launching station deck.

(17) Tilt case and remove missile.

(18) Rotate the missile until the missile hangers are generally oriented to engage the launch rail, then raise the rear end of the missile to the height of the launch rail.

(19) Engage the rear missile hanger and slide the missile to the rear until the forward hanger lug engages the rail.

(20) Carefully slide the missile to the rear and push the missile against the butt plate to engage the detent and rear snubber. Locking should be checked by applying a forward pressure and observing if slippage occurs.

(21) Engage the umbilical retractor assembly to the umbilical housing, remove the umbilical cable dust cover, and connect the umbilical cable to the launch rail umbilical connector.

(22) Using the torque wrench stored on the wing compartment door, attach the missile wings.

(23) Attach the control fins.

(24) Repeat steps (8) through (23) above for each missile to be loaded.

(25) Energize the system as outlined in paragraph 4–10*b*(1).

(26) Replace lid on missile case and fasten clasps.

(27) Slide empty case into empty bin of storage compartment.

(28) Lock case in bin.

(29) Stow tools in holders on wing storage compartment door.

(30) Close and lock missile storage compartment door and wing storage compartment door.

(31) Perform missile checkout as described in paragraph 4–12*a*(17).

b. Missile Unloading Procedures. Missiles are unloaded from the launch rails as follows:

***Warning:* Prior to removing a missile from a launch rail, make certain the ARM switch is set at OFF, the MODE switch is turned to STANDBY, and TRIGGER lock switch is turned to OFF.**

(1) Set and hold LOAD/OFF/STOW switch at LOAD until mount is positioned for loading.

(2) Retract the mount.

(3) Set MASTER POWER and PRIME POWER switches at OFF.

(4) Insure that safety pins are installed on each launch rail.

(5) Open missile storage compartment and wing compartment doors.

(6) Obtain torque wrench and adapter tool from wing compartment door and place on launching station deck.

(7) Remove empty missile case from missile storage compartment and rest end of case on tailgate.

(8) Remove lid from case and lay lid lengthwise on launching station deck.

(9) Rest unsupported end of empty case on ground.

(10) Disconnect the umbilical cable from the launch rail umbilical connector and disengage cable from the retractor assembly.

(11) Remove the missile wings and fins.

(12) Check that missile dome protector is installed.

(13) Rotate the detent latching lever until the detent latch is in the retracted position.

(14) Slide the missile forward until missile hanger lugs are clear of the launch rail. Replace the umbilical dust cover.

Warning: **Use extreme care when sliding the missile off the launch rail. As the forward hanger clears the rail, the missile will be free of support and can drop down and injure personnel or damage equipment.**

(15) After the missile is clear of the rail, attach heater cable and return it to the empty missile case. Four men are required to place missile in the case. One man picks up the unsupported end of the case, and three men support the missile weight and place the missile in the case.

(16) Replace lid on case and place case in storage compartment bin. Insure that extractor handle is in the down position.

(17) Close and lock missile storage compartment door.

(18) Store missile wings and fins in wing and fin storage compartment.

(19) Store tools, close and lock wing storage compartment door.

4–14. Ground Emplacement of the Launching Station

Under the supervision of the squad leader, the squad will prepare the launching station for ground emplacement as follows:

a. Retract the mount in the *load* position, remove the missiles and place them in shipping containers, raise and latch the tailgate.

b. Disconnect the communications cable (W57) from the launching station and remove the radio antennas.

c. Using the torque wrench from the demating kit, remove the four bolts that lock the launching station to the carrier.

d. Disconnect the blast shield at the rear of the engine compartment from the base structure.

e. Close and latch the canopy.

f. Verify that crew equipment and MPU compartment doors are latched.

g. Attach hoisting rings and bases to the launching station deck.

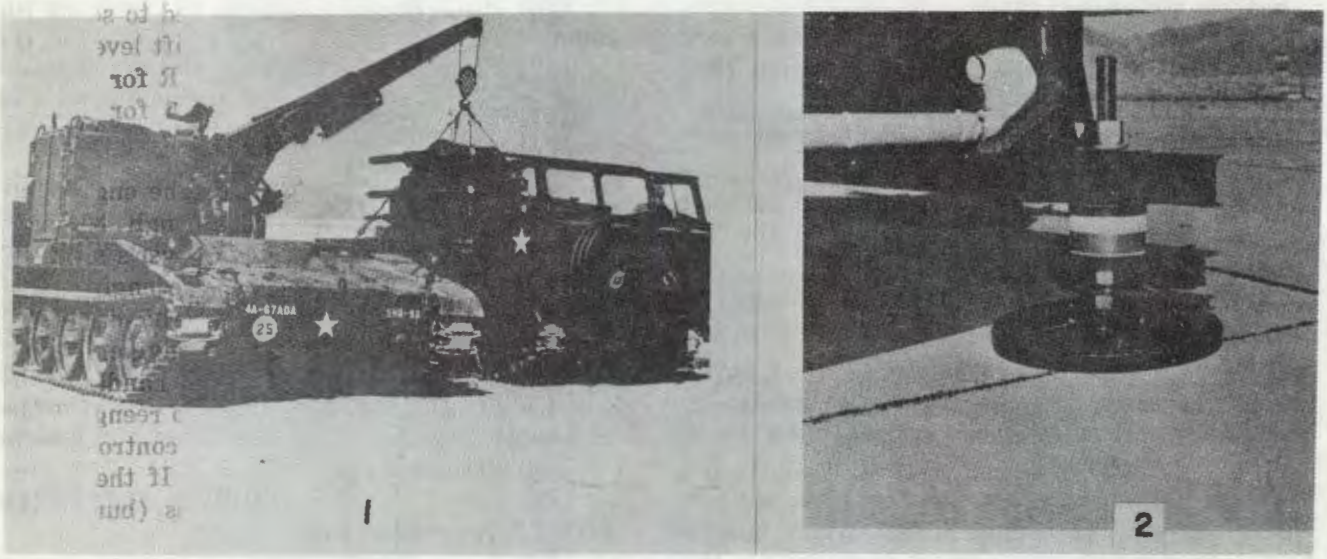


Figure 4–14. Preparing the launching station for ground emplacement.

h. Connect the hoisting sling to the boom of the M578 recovery vehicle, move the vehicle into position and attach the clevises from the sling to the hoisting rings on the deck.

i. Raise the launching staton and move the carrier (fig 4–14(1)).

j. Attach the beams, crushblocks, and jack stands to the launching station (fig 4–14(2)).

k. Lower the launching station until the weight is supported on the jack pads. Disconnect the hoisting sling.

Note. To prepare the launching station for airlifting, perform the ground emplacement procedures (para 4–14). Release the azimuth and elevation brakes, rotate the mount to 3 o'clock, position the launch rails at 0°, and lock the brakes. Place the fabric cover over the canopy and lock it in place.

Section III. VEHICLE

4–15. General

This section describes the procedures necessary to operate carrier M730, prepare the vehicle for the engagement of targets, operate the winch, and prepare the vehicle for fording or swimming water barriers. A description of the major controls and instruments of the vehicle is included. (For a detailed listing, refer to TM 9–1450–585–10.)

4–16. Major Controls and Instruments

a. Differential Steering Levers. Two differential steering levers, located in front of the driver's seat, are used to steer and stop the vehicle. When the left lever is pulled, the vehicle turns to the left; when the right lever is pulled, the vehicle turns to the right. The radius of turn depends on the amount of pressure applied to the levers. When both levers are pulled at the same time, the vehicle slows or stops. The vehicle brakes may be locked by pulling both levers back and pressing the brake-locking buttons located on top of the levers.

b. Pivot Steering Levers. Two pivot steering levers, located below and on each side of the instrument panel, are used at low speed and low gear range for short radius turns and emergency stops. Pulling the left lever causes the vehicle to pivot sharply to the left; pulling the right lever causes the vehicle to pivot sharply to the right. Pulling both levers at the same time causes the vehicle to stop. Pivot steering levers and differential steering levers are never used at the same time.

c. Accelerator Pedal. The accelerator pedal, located near the floor under the right pivot steering lever, is used to control engine speed and transmission detent. The pedal is depressed to increase engine speed and released to reduce speed. When pressure is completely released, the engine runs at idle speed. Depressing and holding the pedal all the way down puts the transmission into detent. When the transmission is in detent, it remains in the selected range or downshifts to a lower range and remains there until the pedal is released.

d. Hand Throttle Control. The hand throttle control, located to the upper right of the instrument panel, is used to set the engine at a selected number of revolutions per minute (rpm). To set the rpm, depress the accelerator until the tachometer indicates the desired rpm, then pull the hand throttle out and turn clockwise to hold the desired engine rpm. To release, turn the control counterclockwise and push in.

e. FUEL CUTOFF Control. The FUEL CUTOFF control, located to the upper left of the instrument panel, is used to cut off the fuel supply and stop the engine. When operating the engine, the control remains pushed in against the stop. To stop the engine, pull the control out as far as possible until the engine stops, and then push the control in again.

f. Transmission Range Selector. The transmission range selector, located to the right and forward of the driver's seat, is used to select the proper transmission range. The shift lever of the selector has six marked positions: R for reverse; N for neutral; 2–3, 1–3, 1–2, and 1 for forward driving ranges.

g. Engine Disconnect Control. The engine disconnect control is accessible through the passenger seat support next to the driver's seat and enables the driver to disengage the engine from the power train before starting the engine in cold weather. To disengage the engine, release the lock latch and push the control handle to the rear until the engine disengages. To reengage the engine, stop the engine and pull the control handle forward until the engine engages. If the engine does not engage, momentarily press (bump) the START switch. Lock the lock latch.

Caution: **Never move the engine disconnect control when the engine is running.**

h. START Switch. The START switch, located on the upper left of the instrument panel, is used to start the engine. When pressed, the switch closes the starter circuit, causing the starter motor to crank the engine. The master switch must be turned to ON and the transmission range selector in N before the switch will operate the starter.

i. Warning Lamps. Three warning lamps, located at the top center of the instrument panel, when lit, indicate major item malfunctions.

***Caution:* Lamps should go out within seconds after starting engine. Stop engine immediately if any of these warning lamps light during operation.**

(1) *ENGINE OIL.* Lights when engine oil pressure is below safe operating pressure (9 to 13 psi).

(2) *TRANS OIL.* Lights when transmission oil temperature rises above safe operating temperature (300° to 310° F.).

(3) *DIFF OIL.* Lights when differential oil temperature rises above safe operating temperature (300° to 310° F.).

j. FUEL PUMP Switch. The FUEL PUMP switch, located on the lower right of the instrument panel, is used to turn on two electric fuel pumps that transfer fuel from the fuel compartment to the air separator tank.

k. Vehicle Light Switches.

(1) *Driving light selector switch.* The driving light selector switch, located on the lower right of the instrument panel, controls the vehicle driving lights. This is the standard light switch for all Army tactical vehicles. The main switch lever has five positions: B.O. DRIVE, B.O. MARKER, OFF, STOPLIGHT, and SER DRIVE. A two-position locking lever, spring-loaded to the LOCK position, must be held to the UNLOCK position to move the main light switch. A panel light selector lever has four positions: PANEL BRT, DIM, PARK, and OFF, that control the instrument panel lights. The PARK position of this switch is not wired.

(2) *Infrared-blackout selector switch.* The I.R./B.O. SELECT switch, located at the center of the instrument panel, is used to select either infrared or blackout lights.

l. BILGE PUMPS Switch. The BILGE PUMPS—ON/OFF switch, located at the lower center of the instrument panel, is used to control the bilge pumps when operating in water.

m. Tachometer. The tachometer, located on the left of the instrument panel, measures engine speed in revolutions per minute. An engine hour meter, included as part of the tachometer, indicates accumulated hours of engine operation.

n. Coolant Temperature Indicator. The coolant temperature indicator, located at the lower left of the instrument panel, indicates the engine operating temperature in degrees Fahrenheit.

o. Fuel Level Indicator. The fuel level indicator, located at the left center of the instrument panel, indicates the amount of diesel fuel in the fuel compartment.

Note. Caution must be exercised because the vehicle uses diesel fuel and the main power unit (MPU) uses gasoline.

p. Battery-Generator Indicator. The battery-generator indicator, located at the upper left of the instrument panel, indicates battery or generator voltage. The dial is divided into three color zones: *red* (left) for low voltage, *yellow* (center) for medium voltage, and *green* (right) for high voltage. When the master switch is on and the engine not running, the indicator shows battery voltage. When the engine is running, the indicator shows generator voltage. Normal indications are in the *yellow* or *green* zones.

q. AIR BOX HEATER Switch. The AIR BOX HEATER—ON/OFF switch, located at the center of the instrument panel, is used to aid starting of the engine in cold weather.

r. Master Switch. The master switch, mounted on the driver's seat forward support, is used to turn electrical power on and off in the vehicle. To turn power on, the master switch handle is pulled out and turned 45° to the vertical ON position. To turn the power off, the handle is pulled out and turned 45° (from the ON position) in either direction to OFF.

s. Winch Controls.

(1) *Winch power takeoff control handle.* The winch, located on the front of the vehicle, is engaged to, or disengaged from, the transmission by a push-pull handle mounted on the transmission range selector housing in the vehicle cab. To engage the winch, pull the handle out. Push the handle in to disengage the winch.

(2) *Winch clutch control.* The winch clutch control handle, located on the left side of the winch, is used to control movement of the winch drum. To engage the drum, pull the clutch handle lock out and pull the clutch handle to the left. To disengage, pull the clutch handle lock out and pull the handle to the right.

(3) *Winch drum lock control.* The winch drum lock control, located on the left side of the winch, locks the winch drum when the lock is engaged. To unlock the drum, pull the lock handle down and to the left. To lock the drum, pull the handle to the right.

t. Fixed Fire Extinguisher Controls. The fixed fire extinguisher bottle is located to the driver's left on the hull bulkhead. Controls consist of an interior actuating control handle on the fire extinguisher bottle head and an exterior actuating control handle on the left side of the hull directly to the rear of the driver's door. Both controls are secured by safety wire to prevent accidental discharge of the extinguisher. To discharge the extinguisher, pull either control handle hard enough to break the safety wire.

4–17. Operating the Vehicle

***Caution:* Open blast covers; never operate engine with blast covers over intake and exhaust grills.**

a. Starting Engine in Normal Weather (40° F. and Above).

(1) Perform before-operation services.

(2) Apply and lock brakes.

(3) Position transmission range selector at N.

(4) Turn lamps off.

(5) Turn master switch to ON.

(6) Turn FUEL PUMP switch on.

(7) Check instrument panel warning lamps and instruments for normal indications:

(*a*) Engine oil low pressure lamp should be lit and all other warning lamps should be out.

(*b*) Battery-generator indicator should indicate in *yellow* or *green* zone and fuel level indicator should indicate quantity of fuel.

(8) Push in FUEL CUTOFF control.

(9) Press START switch.

***Caution:* Do not crank engine for more than 15 seconds. If engine does not start within 15 seconds, wait 30 seconds before pressing START switch again. If engine does not start after fifth attempt, notify organizational maintenance personnel. Engine oil low pressure lamp should go out within 10 seconds after engine starts; other warning lamps should be out. If any warning lamp lights, stop engine immediately and notify organizational maintenance personnel.**

(10) Allow engine to warm up 3 to 5 minutes at 800 to 1,000 rpm.

Note. After engine has warmed up, all warning lamps should be out, battery-generator indicator should indicate in the *green* zone, coolant temperature indicator should indicate 120° to 200° F., tachometer should indicate 550 to 600 rpm idle speed, and fuel level indicator should indicate quantity of fuel in fuel compartment.

b. Starting Engine in Cold Weather (40° to −25° F.).

(1) Perform before-operation services.

(2) Perform steps *a*(2) through *a*(8) above.

(3) Using engine disconnect control, disengage engine from transmission.

(4) Check engine accumulator pressure indicator and recharge to *yellow* zone, using hand pump.

(5) Pull FUEL CUTOFF control all the way out.

(6) Press AIR BOX HEATER switch for 1 to 2 seconds immediately prior to pressing START switch.

(7) Press START switch for 4 to 6 seconds.

(8) Push FUEL CUTOFF control in and continue cranking engine while cycling AIR BOX HEATER switch on for 3/4 to 1 second and off 1 to 1 1/2 seconds until engine is cranking 300 to 350 rpm. Release START switch but continue to cycle air box heater until engine is running smoothly at normal idle (550 to 600 rpm).

Note. If engine does not start within 30 to 45 seconds, stop cranking and notify organizational maintenance personnel.

(9) Check warning lamps.

(10) Run engine for 3 to 5 minutes at 550 to 800 rpm.

(11) Set hand throttle control for an engine speed of 1,200 to 1,500 rpm, and run engine for 5 minutes.

(12) Push hand throttle all the way in and stop engine.

(13) Using engine disconnect control, engage engine to transmission.

Note. Brakes should be set on and the driver should remain in the driver's seat until the completion of step (16) below.

(14) Perform normal weather start procedure in *a* above.

(15) Place transmission range selector lever in the 2–3 range.

(16) Set hand throttle control for 800 to 1,000 rpm and run engine for a minimum of 10 minutes to warm up transmission.

c. Stopping Engine.

(1) Apply and lock brakes.

(2) Position transmission range selector at N.

(3) Adjust hand throttle control for engine speed of 1,000 rpm and operate engine for 2 minutes.

(4) Push hand throttle control all the way in.

(5) Pull FUEL CUTOFF control all the way out.

(6) Turn accessories and lights off.

(7) Turn master switch to OFF.

d. Placing Vehicle in Motion.

(1) Start engine.

(2) Push hand throttle control in.

(3) Select proper transmission range.

(4) Set shift lever to selected transmission range.

(5) Sound horn to alert personnel.

(6) Pull on differential steering levers to release brakes (keep thumbs clear of lock button), then release levers.

(7) Depress accelerator pedal slowly and evenly.

(8) Control speed with accelerator and direction with differential steering levers.

e. Driving Vehicle.

(1) *Transmission range selection.*

(*a*) *Level terrain.* Use 1–3 range for operation on level roads or hilly terrain where maximum speed is required and can be maintained without excessive shifting.

(*b*) *Rough terrain.* Use 1–2 range for cross-country travel over rough terrain and when traveling up and down long gradual or moderately steep grades.

(*c*) *Steep grades.* Use 1 range for climbing and descending steep grades.

(*d*) *Water operation.* Use 1 range for entering or leaving water, and 1–2 range for operation in water.

(2) *Steering vehicle.*

(*a*) *Differential steering.*

Caution: **Never use pivot steering levers and differential steering levers at the same time or differential may be severely damaged.**

Caution: **Never touch lock buttons on top of differential steering lever hand grips when steering vehicle.**

Caution: **When operating in loose sand, dirt, or rock, especially on side slopes, steer in a series of short turns, rather than one long even turn, to allow debris to feed out of track. If debris accumulates, damage to suspension or a thrown track may result.**

1. To turn left when traveling forward or in reverse, pull left lever until turn is complete, then release lever.

2. To turn right when traveling forward or in reverse, pull right lever until turn is complete, then release lever.

(*b*) *Pivot steering.*

Caution: **Do not use pivot steering at speeds above 15 miles per hour. Shift lever should be in 1–2 range for maneuvering with pivot steering levers.**

1. To turn right when traveling forward or in reverse, pull right lever until turn is complete, then release lever.

2. To turn left when traveling forward or in reverse, pull left lever until turn is complete, then release lever.

f. Driving Precautions.

(1) Use 1–2 transmission range until thoroughly familiar with vehicle.

(2) When driving on hard pavement, avoid oversteering at high speeds that may cause vehicle to go out of control.

(3) Decelerate when vehicle approaches brink of trench or ditch, and at crest or on downgrade of hill.

(4) Accelerate when vehicle bottoms in trench or ditch, and when climbing a hill.

(5) Approach the bottom of a hill or ditch cautiously to avoid digging in and damaging final drives or tracks. Downshift before starting downhill and descend slowly.

(6) Never shift to reverse when the vehicle is moving forward.

(7) Do not attempt to use the transmission to hold carrier on an incline at any time, whether engine is running or stopped. If engine is running, the transmission will overheat and be damaged. If engine is stopped, the transmission has no braking power.

(8) Do not operate vehicle solely with hand throttle except in an emergency.

(9) Do not steer or stop vehicle by using pivot steering levers and differential steering levers at the same time.

4–18. Operating Winch

a. Pay Out Cable.

(1) Place drum lock handle in disengage position.

(2) Place drum clutch control in disengage position.

(3) Pull cable manually to desired distance, or attach cable hook and back vehicle to the desired distance.

b. Reel in Cable.

Caution: **Cable loads in excess of 20,000 pounds will shear winch propeller shaft pin.**

(1) Place drum clutch handle in engage position.

(2) Disengage drum lock handle.

Caution: **Keep cable taut at all times so cable will wind evenly and not kink.**

(3) Idle engine in neutral and apply brakes.

(4) Place transmission range selector in 2–3 range.

(5) Engage power takeoff by pulling control handle.

Note. The cable will not reel in with the vehicle stopped in gear.

(6) If it is desired to reel in cable with the vehicle stopped, place transmission range selector in N.

(7) If it is desired to reel in cable with the vehicle moving, place transmission range selector in the 1 range and release brakes.

Note. If carrier cannot be moved and cable is tight, cable may be slackened by turning hex nut protruding from winch transfer gearcase in power-plant compartment in a clockwise direction.

(8) To stop winch, idle engine and set brakes or disengage power takeoff.

c. Storing Cable. To store the cable, secure cable chain and hook to vehicle towing eye and reel in cable until slack is removed from chain.

4–19. Positioning Blast Covers

a. Positioning Blast Covers for Missile Launch. Before launching missiles, the blast covers must be positioned over the vehicle power plant and cab area to protect them from the heat and blast effects of the missiles. The blast covers are positioned for missile launch as follows:

(1) Open both cab doors.

(2) Fold driver's backrest down, lift blast seal channel from stowed position alongside driver's seat, and install channel across top of seat back.

(3) Unfasten overcenter latches holding power plant grills in place.

(4) Unfasten two straps, one on left side and one on right side of stowed covers.

(5) Using straps ((4) above), unfold upper section of blast covers toward front of vehicle until it rests on frame.

(6) Secure two bolt fasteners under front center cover.

(7) Pull lanyard to release pin fastener holding side over in folded position.

(8) Unfold left and right sections of rear cover.

(9) Unfold left and right sections of front covers.

(10) Secure one bolt fastener and overcenter fastener under each front side cover.

(11) Close cab doors.

(12) Secure two overcenter fasteners on side of each rear side cover.

b. Stowing Blast Covers. To stow the blast covers when they are positioned for missile launch, proceed as follows:

(1) Unfasten two overcenter fasteners from each rear side cover section.

(2) Open cab doors.

(3) Unfasten one bolt fastener and one overcenter fastener under each front side cover and fold both covers over front center cover.

(4) Secure pin fastener holding front side covers in folded position.

(5) Fold both rear side covers over rear center cover.

(6) Unfasten two bolt fasteners under front center cover and fold center cover with front side covers over center rear cover.

(7) Fasten two straps, one on left side and one on right side of covers, to hold covers in stored position.

(8) Remove blast seal channel and stow alongside driver's seat.

4–20. Installation of the Swim Kit

Before the Chaparral vehicle can cross water barriers in excess of 40-inch depth, the swim kit must be installed. The swim kit is installed as follows:

a. Lower the tailgate.

b. Pull out both the left and right storage trays.

c. Remove the flotation curtain and the stanchions from the left storage tray and lay them on the launching station deck. Restore the tray.

d. Remove the end beam, brackets, and beam mounting hardware from the right storage tray and place them on the launching station deck. Restore the tray.

e. Inspect the seal between the hull and the tailgate. Close the latch tailgate.

f. Remove the tailgate strips, side strips, and vertical strips. Place strips and bolts on the cab seats.

g. Check the bilge pumps for correct operation.

h. Emplace the stanchions, securing each one with the pin provided.

i. Attach the end beam and brackets securing them with the hardware provided.

j. Unfold the flotation curtain, keeping the adhesive edge clear of the ground.

k. Hang the flotation curtain, by looping the rope over the top of the stanchions, starting at the right front corner of the launching station.

l. Starting at the right front, aline the holes in the curtain with the bolt holes in the hull. Emplace the vertical strip and bolt it down tight.

Note. **The mounting strips have a lip along one edge. Be sure the lip on the vertical strips is toward the front of the vehicle and the lip on the tailgate and side strips is at the bottom edge of the curtain.**

m. Attach the side strips, tailgate strips and vertical strip on the left side.

n. Pull the curtain taut, vertically, take up the slack in the rope loops.

o. Remove the existing exhaust extension, replacing it with the exhaust from the swim kit.

CHAPTER 5

RECONNAISSANCE, SELECTION, A ND OCCUPATION OF POSITION

5-1. General

The purpose of reconnaissance, selection, and occupation of position (RSOP) is to facilitate rapid movement of Chaparral fire units into position when establishing an air defense of a new area. The platoon leader must keep himself and his squad leaders informed of the current situation and anticipated future operations to effect timely RSOP. Position area, route, and critical time element information is usually received from the Chaparral battery commander or from the Chaparral/Vulcan battalion S3 and serves as the basis for planning and conducting the RSOP. Procedures to be followed by the platoon generally parallel the procedures outlined in FM 44-3.

5-2. Reconnaissance

a. Position reconnaissance involves a search for locations for the various elements of the platoon, to include the platoon headquarters, fire units, and observation posts. The smoke signature of the Chaparral missile can be expected to disclose the fire unit's position during each engagement; therefore, frequent shifting of position is required. Consequently, in addition to the primary position, alternate and supplementary positions must be reconnoitered and selected as soon as possible. Routes into and out of these positions must also be selected and prepared as necessary. The reconnaissance party should be limited to the personnel and vehicles actually required.

b. The platoon leader usually delegates reconnaissance for the selection of individual fire unit positions to a squad representative designated by the squad leader. Map positions for fire units are assigned by the order directing the reconnaissance and should be adhered to as closely as possible. Variations in siting greater than 100 meters from the assigned position may degrade the overall air defense. The platoon leader reconnoiters the platoon area and selects the site for the platoon headquarters. If time permits, he visits each proposed fire unit position and supervises and assists the squad representative in selecting the ground location of the weapon and observation posts. Squad representatives reconnoiter the positions assigned to their fire units and select tentative locations for the weapons and observation posts. These tentative locations are submitted to the platoon leader for approval. After approving the fire unit locations, the platoon leader informs the battery commander or battalion S3, as appropriate, of the location of the fire units and platoon headquarters.

5-3. Selection of Position

a. Platoon Headquarters. The position selected for the platoon headquarters should be centrally located so as to provide the shortest possible lines of communication with the fire units. If practicable, the headquarters should be collocated with a fire unit to provide a radio communication backup capability and increase local security capability.

b. Fire Unit Positions. In selecting fire unit positions, the following technical requirements must be considered:

(1) *Accessibility.* The position selected must be accessible to the Chaparral system. Routes into and out of the position cannot require movement over forward slopes exceeding 60 percent or side slopes exceeding 30 percent. Vertical obstacles higher than 24 inches or deep ditches wider than 66 inches cannot be negotiated. Water obstacles up to 40 inches in depth can be forded, but deeper water requires installation of the swim kit. Terrain that will not support the rated ground pressure (7.5 psi) of the system cannot be safely crossed. In addition, concealment from observation by enemy ground troops or observation aircraft should be considered in selecting routes into and out of the position.

(2) *Slope.* Chaparral can be fired from slopes that do not exceed 10°. The position selected should be as level as possible.

(3) *Personnel and equipment safety.* The blast and noise produced during missile launch cause safety hazards that bear directly on site selection. The missile exhaust striking stones, branches, or other debris can cause these objects

to become secondary missiles that are dangerous to a distance of about 200 feet. Large vertical obstructions, within 50 feet or less of the weapon, can deflect missile blast and debris into the weapon system and cause damage. The noise generated during missile launch can harm the ears of personnel closer to the system than 200 feet. The gunner is protected from noise hazards by noise-absorbent material inside the gunner's compartment and the head set. Dry grass and other combustile material near the system can be ignited by the missile exhaust. Consequently, Chaparral should be emplaced in a level, clear area with no large vertical obstructions closer than 50 feet from the system. For safety reasons, personnel positions should not be closer than 200 feet from the system. The gunner is protected from blast effects by a sealed canopy and heavy walls of the gunner's compartment.

(4) *Fields of view.* Chaparral depends on the visual detection and tracking of targets. Consequently, the fields of view afforded personnel are a prime consideration in selecting locations of the observation posts and weapon system.

(*a*) *Forward observation post.* The forward observation post should offer virtually unrestricted visibility along the expected avenues of target approach and *must* afford visibility to a distance of at least 2.5 kilometers from the ground position of the weapon. Since the distance between the observation post and the weapon is limited by the length of communications wire (one-fourth mile) available, this consideration, together with visibility, may restrict possible weapon locations. It is also desirable that there be visual contact between the forward observers, gunner, and squad leader's command post.

(*b*) *Squad leader's command post.* The squad leader's command post should be situated so as to provide a field of view along the expected direction of target approach that includes the weapon system and the gunner's field of view. This is necessary to provide early visual acquisition and identification of targets by the squad leader and to allow correlation between the squad leader and gunner as to the specific target being engaged. Also, because most targets will be engaged after crossover, a clear field of view to the rear of the position should be assured so that the squad leader can observe the engagement and assess target damage.

(*c*) *Weapon mount.* The gunner in the mount should have a clear field of view to a distance of at least 2.5 kilometers in the expected direction of target approach and to a distance of about 4 kilometers to the sides and rear of the weapon position.

(5) *Survivability.* While mission accomplishment is the prime consideration in site selection, survivability should be considered when a choice of sites is available. Survivability considerations include screening the fire unit from observation by enemy ground and aerial forces and protection of personnel and equipment from artillery, mortar, and aerial attack. The silhouette of Chaparral (fig 3–1) presents a problem in concealment. Sites that place a ground rise or tree line between the weapon and the enemy are useful in screening the weapon from observation. Because of visibility requirements, the site screen, or mask angle, should be no more than 6°; therefore, the weapon should be emplaced no closer than 150 meters from a terrain mask or tree line of 15 meters in height. The observation and command posts should be selected to take maximum advantage of natural concealment and fortifications. These positions can also be improved by excavation and the use of additional natural and artificial camouflage materials.

(6) *Communications.* The platoon leader exercises command and control of the Chaparral fire unit by FM radio. If radio contact with platoon headquarters and between the FAAR and TADDS cannot be established and maintained, the site normally should be considered unsatisfactory. Large terrain masks may greatly influence the ability to establish and maintain radio communications. Wherever possible, direct line-of-sight communications should be obtained.

5–4. Occupation

During the reconnaissance and selection of position, the platoon leader must formulate a plan for occupying the positions selected. This plan must be coordinated with the plan for the occupation of battery and battalion positions if these elements are involved in the move. The platoon leader must consider the time that the platoon is required to be operational in the new positions, routes and travel time from the old positions, communications during the displacement, and security during the move and occupation. Once the plan is formulated, the platoon leader issues the orders necessary for its execution. The displacement and occupation should be accomplished as rapidly as possible to minimize the time that fire units are out of action. When occupying platoon positions, first priority should be given to emplacing the fire units and bringing them to a ready-for-action condition (para 7–8).

This condition should be achieved by each fire unit within 15 minutes after arriving at the selected position. When all fire units have reported that they are ready, the platoon leader will report the platoon ready for action.

5–5. Improvement of Position

Improvement of the Chaparral position should be started as soon as possible after the fire units become operational and should continue during the period of occupation. Since the Chaparral can be fired at elevations from −9° to +90° and has a 360° traverse, the use of camouflage nets is not feasible. The nets would hamper vision, impair the missile flight (if not removed prior to firing), and would be burned by missile backblast. Sandbag or earth revetments can be constructed around the Chaparral vehicle provided they do not exceed the height of the launching station deck. (The missile backblast would destroy higher obstacles.) Personnel at the forward observation post and squad leader's command post should continually improve their positions. The tracks made by the vehicles entering the position should be erased. (Additional field fortification and camouflage information is contained in FM 5–15 and FM 5–20.)

CHAPTER 6

★CHAPARRAL TARGET ENGAGEMENT AND EMPLOYMENT PROCEDURES

Section I. RULES OF ENGAGEMENT

6–1. Introduction

The mission of Chaparral is to protect areas, units, or installations from low-altitude aerial attack. The protection provided should be as complete as possible; i.e., no enemy aircraft should be allowed to penetrate the defense. This requires that all aircraft entering the defended airspace be regarded as a threat until determined to be friendly. Lacking sophisticated electronic sensors and identification equipment, Chaparral depends upon visual target detection and identification to accomplish its mission. The control of Chaparral fires is delegated to the squad leader operating under the guidance of rules contained in standing operating procedures (SOP).

6–2. Responsibilities

The procedures contained in the SOP reflect established air defense doctrine modified by theater and lower level air defense commanders to meet local situations. The Chaparral squad leader, as the fire unit tactical commander, makes the engagement decision in the light of the developing threat in accordance with the SOP. The decision is restricted exclusively to the squad leader and includes collateral responsibilities for identification of the potential target as friendly or hostile; selection and designation of the specific target to be engaged; and the designation of the method of fire to be employed.

6–3. Rules of Engagement

a. The conduct of Chaparral squad operations is based on the concepts that the right of self-defense against air and ground attack is never denied in peace or war and that air defense artillery squads normally make air defense engagement decisions based on the rule that aircraft positively identified as hostile will be engaged. The following rules of engagement are typical of those that will be contained in unit SOP:

(1) During conditions short of war, engagements are conducted only in self-defense or as ordered by designated commanders.

(2) During wartime, engagements are conducted in accordance with the prevailing ADA weapons control status (para 6–4) and prescribed hostile criteria (para 6–5).

b. The implementation of the above rules by Chaparral squads requires that visual determination be made of the friendly or hostile character of each aircraft; therefore, the engagement decision must be based on detailed visual identification criteria.

6–4. Air Defense Artillery Weapons Control Status

a. The degree of freedom to engage targets will be specified by the receipt of a weapons control status from the platoon leader or other specifically designated source. The exact definition of the degree of freedom to engage under a weapons control status may vary from command to command but will always be explicitly explained in the SOP. Weapons control status may be combined or compounded; e.g., complete freedom to engage jet aircraft may be granted with helicopters excluded from engagement. Examples of ADA weapons control status and the degree of freedom to engage are as follows:

(1) *Weapons free.* Fire at any aircraft not identified as friendly. Under this status, unknowns may be engaged.

(2) *Weapons tight.* Fire only at aircraft positively identified as hostile. This should be the normal ADA weapons control status for Chaparral fire units during wartime. The SOP will specify exact criteria for declaring an aircraft hostile when operating under this status. Examples of hostile criteria are presented in paragraph 6–5.

(3) *Weapons hold.* Do not fire. This status may be imposed within an area in terms of time and aircraft type; e.g., "weapon hold 1400–1430, rotary wing" or "weapon hold 1600–1645, F–105 strike." The imposition of this status does not preclude exercising the right of self-defense.

b. When communications with higher headquarters has been lost, Chaparral squads may continue to engage targets under the weapons control status imposed by the rules for autonomous operation contained in the unit SOP.

6-5. Target Identification

a. Responsibility. The responsibility for target identification rests exclusively with the squad leader and may not be delegated. In case of the absence or incapacity of the squad leader, the squad member next in rank assumes leadership of the squad and consequently the responsibility for target identification.

b. Hostile Criteria. Target identification as hostile, as a prelude to engagement, must be based on visual inspection of the target and its assessment against specific hostile criteria. The exact criteria prevailing may vary with the tactical situation, from command to command, and in terms of time. For example, the SOP may classify as hostile those aircraft that are performing acts as follows:

(1) *Attacking friendly elements.* Any aircraft observed to be actively engaged in attacking the fire unit or friendly troops, areas, or installations, may be identified as hostile.

(2) *Responding improperly to electronic IFF interrogation.* A TADDS presentation of an aircraft as an "unknown" is based on the failure of the aircraft to properly respond to the FAAR electronic IFF interrogation. The squad leader may accept a TADDS "unknown" presentation as a first assumption of hostility but must successfully apply at least one additional hostile criterion based on visual observation of the suspected aircraft before making a final identification of the aircraft as a hostile.

(3) *Performing the following acts over friendly troops or territory without prior coordination.*

(a) Discharging smoke or spray.

(b) Dropping flares.

(c) Discharging parachutists or unloading troops in excess of normal aircraft crew.

(d) Engaging in mine-laying operations.

(e) Dropping electronic countermeasures devices such as chaff or reflectors. Due to the possibility of a communications lag, wherein "prior coordination" to squad level may not be accomplished prior to friendly aircraft engaging in the above acts, the squad leader should apply this criterion with care. Generally, at least one additional criterion should be successfully applied before an identification as hostile is made.

(4) *Unauthorized or improper entry into an area designated as restricted, prohibited, or as an ADA battle zone.* Care should be exercised in the application of this criterion to avoid identifying as hostile a friendly aircraft that has been damaged and is returning to the rear of our lines or has inadvertently strayed into the restricted area due to a navigation error.

(5) *Operating at prohibited speeds, altitudes, or in prohibited directions.* The determination of aircraft speed and altitude by ground observers is difficult. Extreme care should be exercised in applying this criterion.

(6) *Departing improperly from an area or corridor designated as safe.* The possibility of aircraft mechanical trouble, navigational error, or defensive maneuver should be considered in the application of this criterion.

(7) *Bearing the military insignia or having the configuration of an aircraft employed by a known enemy nation.* This is the criterion most likely to be used by the Chaparral squad leader and probably the most difficult to apply. Application of this criterion must be based on visual inspection of the aircraft and requires the squad leader to be expert in the field of visual aircraft recognition. Since aircraft markings are not usually visible at long distances, most identifications must be based on recognition of the physical features of the aircraft. To eliminate any element of doubt the squad leader must be capable of recognizing friendly as well as enemy aircraft. Also, since all Chaparral squad members are potential squad leaders, all squad members must be expert in the field of aircraft recognition. (For a detailed discussion of aircraft recognition refer to FM 44-30.)

6-6. Target Selection

Fire distribution within a Chaparral air defense is usually achieved by assigning each Chaparral squad a primary sector of fire and a primary target line. Targets appearing in the squad's primary sector of fire receive priority over targets in any other area. As a general rule targets will be selected for engagement in order of their proximity to the primary target line if they apparently do not threaten the defended asset or the fire unit. If a threat to the defended asset or the fire unit is apparent, the target presenting the most immediate threat, i.e., the target that will arrive first or deliver ordnance

first, will be engaged first. In all cases the squad leader will evaluate the threat, select and designate the target to be engaged, and designate the order of engagement for multiple targets.

Section II. CHAPARRAL FIRING TECHNIQUE

6-7. General

The engagement of targets by Chaparral requires two types of decisions: command decisions to determine if a potential target satisfied the rules for engagement and technical decisions to determine if the potential target is within the engagement capability of the weapon. The squad leader, as the tactical commander, makes all command decisions including designation of the target as hostile, selection of the target to be engaged, and determination of the method of fire to be used. The gunner, as the operator of the weapon, makes the technical decision to fire. The squad leader's command to engage is permissive, rather than directive, in that it releases the gunner to fire if the gunner decides that the target meets the technical requirements for a successful engagement.

6-8. Chaparral Firing Technique

The Chaparral firing technique presented in table 6-1 provides guidance for the squad leader in directing the engagement and simple rules to aid the gunner in making the technical decision to fire. The effective use of the technique requires that the squad leader and gunner have a common understanding of the terms used in the table and the application of the technique to the engagement problem. These items are explained below.

Table 6-1. Chaparral Firing Technique

Target Category	Method of Engagement		Requirements for Engagement
	Raid Size		
	Single Target	Multiple Target	
Category I (Low performance propeller and helicopter).	SHOOT-LOOK-SHOOT Fire subsequent missiles on squad leader's command.	SHOOT-NEW TARGET-SHOOT As many targets as possible.	Note only.
Category II (Small size medium/high performance propeller or jet).	SHOOT-LOOK-SHOOT Fire subsequent missiles on squad leader's command.	SHOOT-NEW TARGET-SHOOT As many targets as possible.	Note and ½ crosshair gap or larger (fig 6-5).
Category III (Large size medium/high performance multiengine propeller or jet).	SHOOT-LOOK-SHOOT Fire subsequent missiles on squad leader's command.	SHOOT-NEW TARGET-SHOOT As many targets as possible.	Note and 1 crosshair gap or larger (fig 6-6).

Note. All engagements are subject to the following prerequisites:
a. Target must be declared hostile.
b. Visual target tracking must be established.
c. IR acquisition, as evidenced by an audible tone, must be established.
d. Hold fire lamp on gunner's sight must be out.

a. Target Category. To simplify the Chaparral engagement problem all aircraft expected to be operating within Chaparral's capability have been classified according to their operational speeds and sizes, and divided into three categories. The squad leader, during his visual inspection of the target for identification, will determine the target category according to the following definitions and include a category statement in his initial engagement command.

(1) *Category I.* This category is a low-performance category and includes small, propeller-driven, fixed-wing aircraft (usually used as artillery spotter, reconnaissance, and liaison aircraft), and all helicopters. Operational speeds for this category aircraft range from zero for a hovering helicopter to a maximum of about 200 knots. Average dimensions for category I fixed-wing aircraft are fuselage length 11 meters, wingspan 11 meters. The average length of helicopters is 15 meters and average cabin width is 3 meters.

(2) *Category II.* This category includes all *small* size, medium- and high-performance, jet and propeller-driven aircraft expected to be operating at low altitudes over the forward combat area. This category includes fighters and close-support attack aircraft. Normal operating speeds for category II range from 300 to 500 knots. Average fuselage length is 15 meters and average wingspan is 11 meters.

(3) *Category III.* This category includes all *large* size multiengine propeller-driven and jet

aircraft such as medium bombers, fighter-bombers, and cargo/troop transports. Operational speeds at low altitude range from 300 to 500 knots. Average fuselage length is 26 meters and average wingspan is 28 meters.

b. Method of Engagement.

(1) The second and third columns of table 6–1 specify the method to be used in engaging targets as a function of raid size, i.e., single target of multiple target raid. A multiple target raid is defined as a raid by two or more aircraft flying the same course, at the same speed, separated by a distance of less than 1,000 meters. All raids not meeting the above definition will be engaged as single target raids.

(2) All single-target raids are engaged using a SHOOT-LOOK-SHOOT technique of fire; all multiple-target raids are engaged using a SHOOT-NEW TARGET-SHOOT technique.

(*a*) *SHOOT-LOOK-SHOOT.* This method of fire requires the firing of a first missile (SHOOT) as soon as the technical requirements for engagement are met; an evaluation (LOOK) of the performance of the first missile to assess its success; and the firing of a second (or as many as necessary) missile (SHOOT) if the first is determined to be unsuccessful. If a missile leaves the launch rail and appears to be on a guided course toward the target, the missile will be assessed as successful and a second missile will not be fired until a kill evaluation can be made. If the missile fails to leave the launch rail or appears to have failed to achieve guided flight, it will be assessed as unsuccessful and a command to fire a second missile will be given immediately. If an otherwise successful missile fails to kill the target, a command to fire another missile will be given immediately following the kill evaluation. When using the SHOOT-LOOK-SHOOT method of fire, each missile fired must be preceded by a fire command and each missile fired must meet the technical requirements for engagement. Upon firing the first missile, the gunner re-establishes visual tracking and IR acquisition as rapidly as possible in preparation for the launch of a second missile. *The gunner does not watch the flight of the missile; the squad leader observes the missile's flight and commands the launch of a second missile as explained above.*

(*b*) *SHOOT-NEW TARGET-SHOOT.* This method of fire is used for engagement of multiple target raids and requires the launching of as many missiles as possible at successive targets in the raid formation. The squad leader specifies the order in which individual targets are to be engaged; e.g., "FRONT TO REAR" or "REAR TO FRONT" (of the formation). The gunner will engage targets in the order specified, firing one missile on each target in rotation as rapidly as possible. Separate commands are not required for each missile fired and no kill evaluation is required between successive launches. Each launch, however, must meet the technical requirements for engagement as listed in table 6–1.

c. Requirements for Engagement. This column of the Chaparral firing technique table lists the requirements that must be met before the gunner can make the technical decision to fire. Failure to meet any single requirement precludes the firing of a missile.

(1) *Category I targets.* The requirements for engaging category I targets are stated as *"Note only"* (table 6–1). The note at the bottom of the table lists four prerequisites for engagement.

(*a*) *Target must be declared hostile.* The reponsibility for determining the identity of a target in terms of friendly, hostile, or unknown rests exclusively with the squad leader. The gunner will not respond to a command to engage that does not specifically contain a clear verbal declaration that the target is *hostile.*

(*b*) *Visual target tracking must be established.* Before firing a missile, the gunner must see the target within the inner circle of the Chaparral sight reticle pattern and must track the target smoothly.

(*c*) *IR acquisition, as evidenced by an audible tone, must be established.* Before firing, the gunner must determine that the missile can track the target after launch by listening for and determining the presence of an unmistakable missile tone.

(*d*) *Hold fire lamp on gunner's sight must be out.* Before firing a missile, the gunner must visually note the hold fire lamp and assure himself that the lamp is not lit. If the lamp is lit, he will delay firing until it goes out.

(*e*) *Application of the prerequisites listed in the note, table 6–1.* These are the only requirements for engaging category I targets and are based on the following. The small size of these targets will assure that visual acquisition and tracking will not occur before the target is within the outer performance boundary of the missile. The presence of IR tone will assure that the target is within the IR tracking capability of the missile. The hold fire lamp *out* prerequisite assures that the target is not inside the inner performance boundary of the missile.

(2) *Category II targets.* The requirements for engaging category II targets are stated in table 6–1, "Note and 1/2 crosshair gap or larger." This means that the prerequisites of the note must be met as explained above and that the size of the target image in the sight reticle pattern must be one-half the width of the gap between the horizontal crosshairs (fig 6–5) or larger. This additional requirement precludes out-of-boundary launches and is based on the image size of the average category II target as it crosses the missile's outer performance boundary.

(3) *Category III targets.* The requirements for engaging category III targets are stated in table 6–1, "Note and 1 crosshair gap or larger." This means that the prerequisites of the note must be met and that the size of the target image, as seen in the sight reticle, must be equal to the width of the gap between the horizontal crosshairs (fig 6–6) or larger.

Section III. OBSERVER PROCEDURES

6–9. Factors Affecting Visual Detection

The first step in a Chaparral engagement sequence is visual detection of the target. This may be accomplished by any member of the squad, but in every case the target location must be made known to both the gunner and squad leader. The ranges at which aircraft are visually detected by observers vary greatly with the conditions under which detection is attempted. Important factors that influence detection are mask; target characteristics, including size of profile, speed, altitude, heading, and color; meteorological visibility; observer characteristics, including alertness and visual acuity; and search sector size.

a. Terrain Masking. Since Chaparral observers are ground-based, the local terrain will influence the distance at which low-altitude targets will unmask; i.e., not be hidden behind a hill or other terrain feature. Terrain masking should be considered in selecting a Chaparral site. Sites should be selected that provide commanding fields of view and, if possible, provide overlapping visual coverage between adjacent fire units.

b. Target Characteristics. The important characteristics of an aircraft that influence detection range are size, color, speed, altitude, and heading.

(1) *Size.* Visual detection range increases with an increase in target size. Apparent target size varies with the type of aircraft and the aspect from which the aircraft is viewed. A jet fighter flying a course directly toward or away from an observer presents a small profile and can approach quite close to the observer before being detected. The same aircraft flying a crossing course presents a much larger profile to the observer and thus can be detected at greater ranges.

(2) *Color.* The color of an aircraft influences detection range because color affects the degree with which the aircraft contrasts with the background against which it must be viewed. An aircraft that contrasts with its background is visible at greater distances that one that blends with its background. The contrasts ratio of most aircraft is reduced when the aircraft must be viewed against a mountain background. The background in the direction from which targets are expected to approach should be considered in selecting observer positions. Many jet aircraft leave a dark smoke trail that can be used as an aid in detection at long ranges.

(3) *Speed.* Target speed also affects the range of visual detection of aircraft. In general, detection range decreases as target speed increases.

(4) *Altitude and heading.* Both the altitude and heading of aircraft influence visual detection range. Targets flying at altitudes between 150 and 1,200 feet are detected at longer ranges than targets flying either higher or lower. The heading of the aircraft affects the size of the profile presented to the observer and thereby affects detection range as explained in (1) above.

c. Meteorological Visibility. Elements of the environment such as rain, snow, dust, fog, smoke, and haze tend to reduce meteorological visibility and therefore tend to reduce the range of visual detection of aircraft.

(1) *Visual acuity.* Observers are required to visually detect, recognize, and identify small objects at long ranges; therefore, observers are required to have good visual acuity. Binoculars have little effect in increasing detection ranges because they have narrow fields of view and consequently increase the time required to search a given area of space. However, binoculars may be helpful in identifying a target.

(2) *Search sector size.* In general, the range of visual aircraft detection increases with a decrease in the size of the search sector assigned an observer. Search sectors should be as small as possible and still provide good coverage to both sides of the expected avenues of target approach. Upon receiving an alert of target approach, the

Figure 6-1. Scanning technique for flat terrain.

search sector should be reduced and concentrated in the direction of expected target approach.

(3) *Observer fatigue.* Long periods of observer duty may degrade visual search performance due to fatigue. Observer duties should be rotated as often as possible. Warning of the expected approach of an aircraft tends to increase alertness of observers and can result in detection ranges considerably greater than in the case of unwarned observers.

6-10. Visual Search and Scan Procedures

The probability of visually detecting targets at long ranges is increased if systematic search procedures are followed by observer personnel. The procedure suggested here is called *scanning*. Two methods of scanning are suggested, one for use in flat terrain and the other for hilly terrain. In both methods, the observer should focus his eyes on a distant object, cloud, or terrain feature every few seconds so that his eyes will remain focused for distant vision. If this is not done, his eyes will relax and distant objects will become blurred.

a. Flat Terrain. To discern detail, an observer's eyes must stop and focus on an object. When moving the line of vision rapidly across flat terrain, the observer will see almost no detail. When an observer moves his line of vision in short steps from point to point, he is more likely to see detail. When observing over flat terrain, use the scanning technique illustrated in figure 6-1.

b. Hilly Terrain. When observing over hilly terrain, use the horizon as a starting point and scan as illustrated in figure 6-2. Use prominent terrain features as reference points to insure complete and systematic coverage of the assigned search sector. The observer should focus his eyes on the selected starting point and scan slowly across the search sector, using an up-and-down scanning technique. After a small portion of the sector has been scanned, the observer should refocus his eyes and then continue scanning across the search sector. The search must be systematic so that no area escapes inspection. The area between the horizon and the observer should also be searched to detect low-altitude aircraft between the observer and the mask.

6-11. Chaparral Search Procedure

a. Chaparral Position. A Chaparral position has three occupied posts, weapon system, squad leader's command post, and forward observation post. It is desirable that the command post and forward observation post be situated near the primary target line with the observer post for-

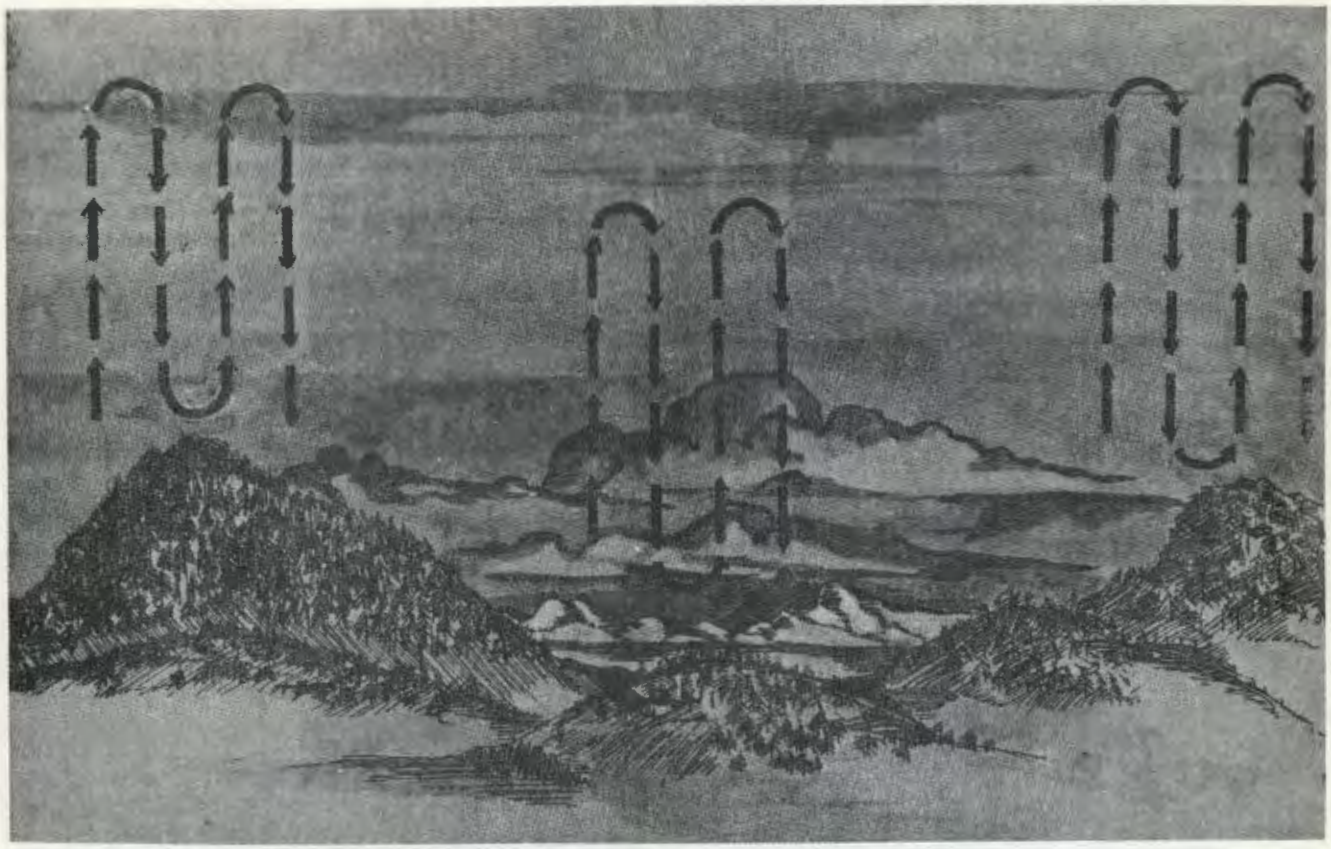


Figure 6-2. Scanning technique for hilly terrain.

ward of the weapon. The observation post should be located on commanding terrain to provide a maximum field of view in the direction of expected target approach. The squad leader's command post should be situated to the rear of the weapon and as near the weapon as safety from the blast effects of missile launch will allow. The position of the command post should be selected to provide the same field of view as that of the gunner because the squad leader must have visual contact with the target being tracked by the gunner for target correlation and identification prior to issuing the engagement command.

b. Observers. The forward observation post is manned by two squad members and the command post is manned by the squad leader and one squad member. The remaining squad member, the gunner, is located in the weapon system. Placing two men at each observer position provides for local ground security and observer relief. Each observer will search for aircraft for approximately 2 hours and then switch to ground observing. Binoculars are provided at each observer position; however, observers will search for aircraft with the unaided eye. The binoculars will be used only after an aircraft is detected and then only as an aid in establishing target identification and category.

c. Procedures for Observers When Not Alerted.

(1) When the squad has not been alerted to the approach of an aircraft, the observation procedure illustrated in figure 6-3 will be used. In this situation, one observer at the forward observation post will search a 180° sector as shown. He will place emphasis on a 90° sector, 45° to each side of the primary target line. The observer at the command post will search a 270° sector as shown. The gunner will not act as an observer unless so directed by the squad leader during optimum times for aircraft attack; e.g., early morning or late afternoon. He will then search a 90° sector as shown in figure 6-3. The observer at each position, not actively engaged in aerial search, is responsible for maintaining surveillance of the surrounding terrain to prevent surprise ground attack.

(2) When an aircraft is sighted by an observer, he immediately notifies the squad leader by announcement over the intercom system. He will continue to report target position until the

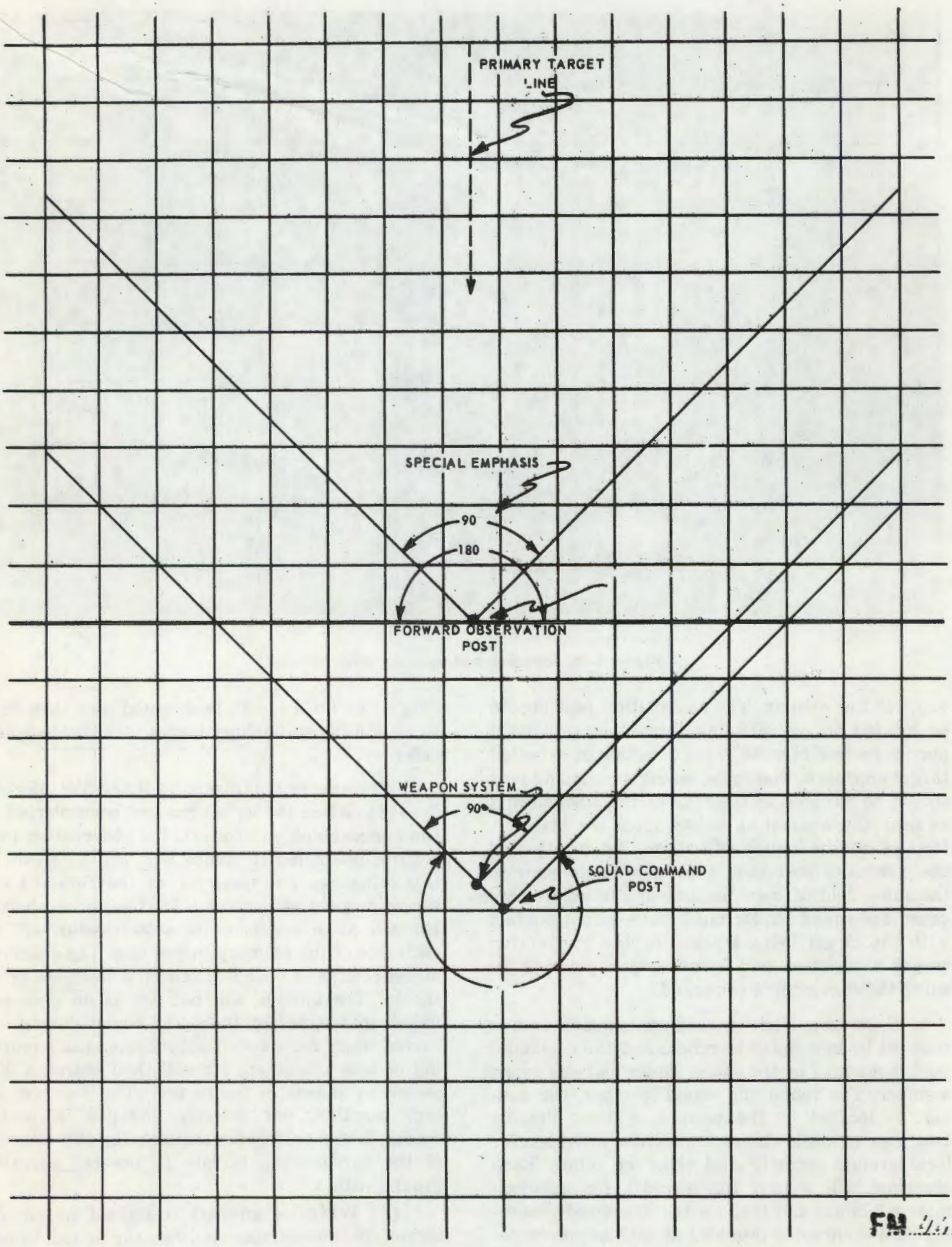


Figure 6–3. Search sectors when observers not alerted.

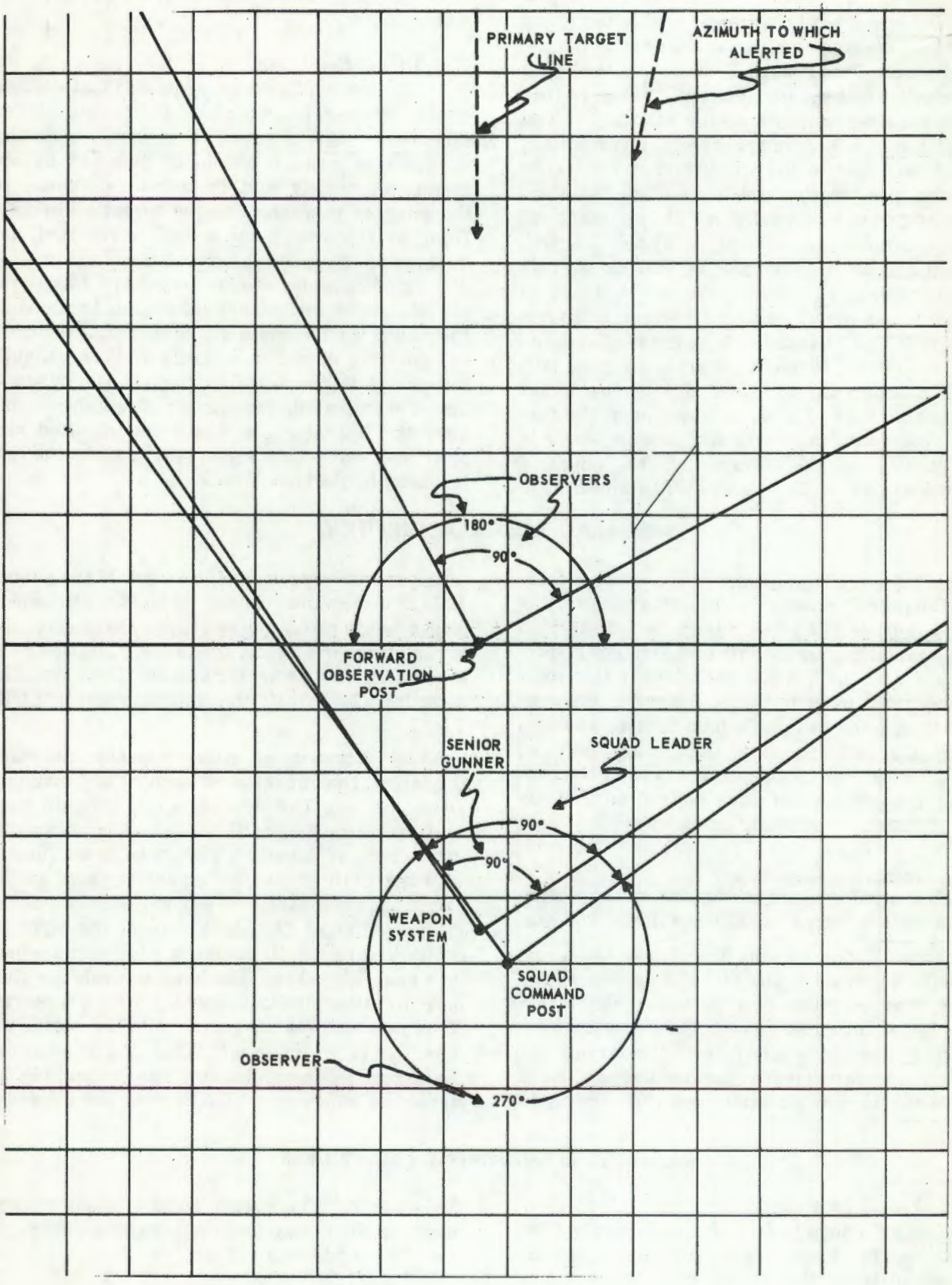


Figure 6–4. Search sectors when observers alerted.

squad leader has visually acquired the target. *When the target has been transferred to the squad leader, the observer will resume search of his assigned scctor.* Upon acquiring the target, the squad leader will direct the gunner until he is sure that he has acquired and is tracking the target. The squad leader will attempt target identification immediately upon visual acquisition and will continue the identification process until he has identified the target as friendly, hostile, or unknown.

d. Procedures for Observers When Alerted. When the squad has been alerted that an aircraft is approaching, all squad personnel will act as observers and search assigned sectors as shown in figure 6-4. The squad leader, gunner, and one observer at the forward observation post will search a sector 45° to either side of the target approach azimuth. The other observer at the forward observation post will continue to search a 180° sector, and the observer at the command post will search a 270° sector. When an aircraft is detected, the procedure outlined in *c*(2) above will be followed.

e. Target Reporting.

(1) The rapid visual acquisition of targets by the gunner is important to the success of Chaparral engagements. To reduce acquisition time, target position should be reported by observers accurately and in terms referenced to the gunners position; i.e., the target's direction from the reference point should be reported, not its direction from the observer.

(2) The center of coordinates of a Chaparral position is the weapon system mount. Included in the mount is an azimuth dial that indicates launch rail pointing direction in terms of clock azimuth referenced to the front of the vehicle. When a target is reported, the gunner slews the mount until the indicator dial reads the reported azimuth and commences visual search along the line indicated by the launch rails.

Section IV. TARGET ACQUISITION

6-12. Infrared Radiation

The Chaparral missile is an infrared-sensitive homing missile; i.e., the missile is sensitive to energy radiations in the infrared frequency spectrum and uses the target's radiations in this spectrum to guide itself to target intercept. Infrared acquisition prior to missile launch is an absolute prerequisite to a successful engagement because, once launched, the missile passes beyond the control of the gunner and must depend on the target's radiations to generate guidance orders.

6-13. Infrared Acquisition

The Chaparral gunner accomplishes acquisition of a target's infrared radiations (IR) as follows:

a. Visual Detection. The first step in the target acquisition process is the visual detection of the target. The observer first detecting the target gives verbal instructions over the intercom until the squad leader visually detects the target. The gunner, upon hearing the observer's report, slews the mount to the direction reported and commences visual search for the target. If the gunner fails to make visual contact by the time the squad leader has located and accepted the target, the squad leader will report the target's position until acquisition has been established. Upon visually detecting the target, the gunner reports, CONTACT.

b. IR Acquisition. After visually detecting the target, the gunner must acquire and maintain IR acquisition. The evaluation and azimuth hand control is adjusted until the target is within the inner circle of the sight. The controls are further adjusted until an audible signal is heard in the earphones. The target is not necessarily tracked in the center of the sight. Should the sight be centered over the IR source, a null occurs where no signal is received. The hand controls are then moved until a signal is heard. *To have a correct IR acquisition, the IR source must be within the inner circle of the sight.* When the gunner has the target in the sight and has an audible IR signal, he announces, TONE, over the intercom

Section V. ENGAGEMENT PROCEDURES

6-14. Order of Events

The successful engagement of targets by the Chaparral requires teamwork in performing the action essential to the engagement. Each squad member participates and has specific duties and responsibilities to discharge at specific times in the sequence. The events normal to an engagement and their usual order of occurrence are:

a. Visual Search and Scan.
b. Target Detection.
c. Target Transfer to Squad Leader and Gunner.

d. Target Selection.
e. Target Identification.
f. Engagement Command.
g. Gunner Visual Acquisition.
h. IR Acquisition.
i. Fire Decision.
j. Missile Launch.
k. Kill Evaluation.

6–15. Responsibilities and Duties

a. Observers. The duty of conducting visual search and scan (para 6–14*a*) is shared by all squad members and is accomplished according to the procedures outlined in section III of this chapter. The observer first detecting a target (para 6–14*b*) assumes responsibility for the accomplishment of "transfer of the target to the squad leader." When this is accomplished, he returns to visual search and scan of his assigned sector.

b. Squad Leader. The squad leader has exclusive responsibility for the accomplishment of events listed in paragraph 6–14*d*, *e* and *f*.

c. Gunner. The gunner has exclusive responsibility for the accomplishment of events listed in paragraph 6–14*g*, *h*, *i*, and *j*.

6–16. Procedures

a. The speed of modern combat aircraft is such that the total time involved in a complete engagement may be only 15 to 20 seconds. Accomplishment of all the necessary events of the engagement within this time requires orderly procedures applied by well-trained personnel. Messages passed between squad members over the intercom system must be short, precise, and restricted to essentials only. Squad members not directly involved at a particular moment will remain silent unless they have an urgent new situation to report.

b. The exact procedures to be followed will vary slightly from situation to situation but will follow the general format listed below:

(1) *Target detection.* The squad member first detecting a target will announce, TARGET, over the intercom followed by a location statement. The location statement will include the clock azimuth to the target, its altitude in terms of high or low, and if a multiple target the statement, MULTIPLE TARGET.

(2) *Target transfer.* Upon hearing the target detection report, the squad leader and gunner will immediately commence visual search for the target. The gunner will slew the mount to the azimuth of approach and, upon locating the target, will begin visual track and attempt IR acquisition. The gunner will not make any statement on the intercom until addressed by the squad leader. The squad leader will communicate with the observer as necessary until he has located the target at which itme he will announce that he has detected the target and command the observer to resume search. The observer will resume search and scan of his sector and remain silent. After accepting the target from the observer, the squad leader will report target position to the gunner until the gunner has acquired the target.

(3) *Target selection.* If more than one target is visible, the squad leader will select the target to be engaged according to the criteria in paragraph 6–6.

(4) *Target identification.* Target identification is made by the squad leader as early as possible in the engagement sequence by application of prescribed hostile criteria similar to the criteria contained in paragraph 6–5. If the identification is friendly, the squad leader commands the gunner to abandon target; if hostile, the squad leader commands the gunner to engage provided a weapons tight control status is in effect, or to continue tracking provided a weapons hold is in effect. If the identification is "unknown" and a weapons free status in effect, the squad leader may order the target engaged; if any other status is in effect, he will order, CONTINUE TRACKING, and will continue the identification process.

Note. Target identification may be changed at any point in the target engagement.

(5) *Engagement command.* When the squad leader has made a firm engagement decision, he will issue an engagement command to the gunner. The command must include the word "engage," specify the target to be engaged and its category (from table 6–1), include the term, "hostile" (unknowns will be declared hostile in the engagement command). When the target is a single aircraft, the method of engagement will be SHOOT-LOOK-SHOOT (para 6–8*b*(2)). When a multiple target is to be engaged, SHOOT-NEW TARGET-SHOOT method (para 6–8*b*(2)(*b*)) is used and the sequence of target engagement will be a part of the engagement command.

(6) *Gunner visual acquisition.* The gunner commences visual search for the target upon hearing the initial detection report over the intercom. After the squad leader has accepted the target from the observer, if the gunner has visual acquisition, he reports, CONTACT. If he

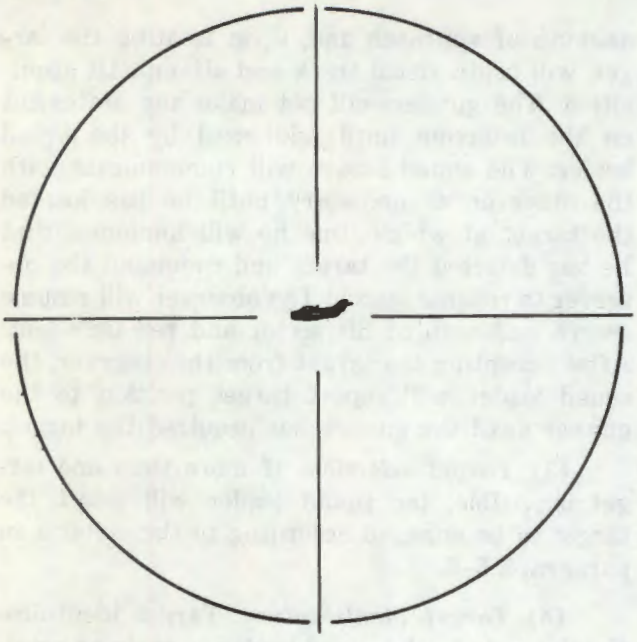


Figure 6–5. Sight picture, small aircraft.

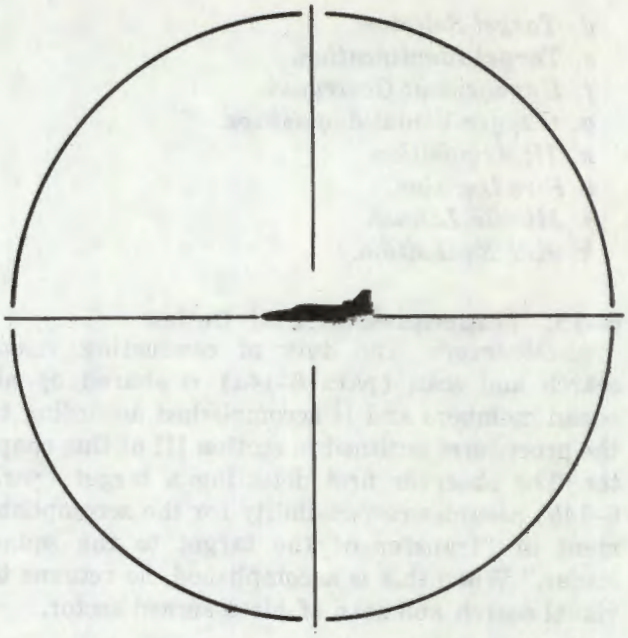


Figure 6–6. Sight picture, large aircraft.

does not have visual contact, he follows the squad leader's directions until he can report contact.

(7) *IR acquisition.* Immediately following visual contact with the target, the gunner establishes smooth tracking, adjusting the hand controls (in accordance with para 6–13*b*), until a discernible signal is received from the IR source. *He maintains the target IR source within the inner circle of the sight reticle.* Upon hearing the missile tone, the gunner announces, TONE, over the intercom.

(8) *Fire decision.* The gunner makes his fire decision by evaluating the situation with respect to the requirements for engagement contained in table 6–1. If all requirements are met, he presses the firing trigger.

(9) *Missile launch.* Following missile launch the gunner immediately attempts to reacquire the target (visual and IR) and makes a second fire decision if required by the engagement command.

(10) *Kill evaluation.* The squad leader watches the flight of the missile and orders the firing of additional missiles according to the technique outlined in paragraph 6–8.

Section VI. ENGAGEMENT COMMUNICATIONS

6–17. General

Because the time for target engagement is limited, communications between squad members must be brief.

6–18. Engagement Vocabulary

The words and phrases defined below, used singly or in combinations, are adequate conversation for an engagement. Squad conversation will be held to the minimum essential to conduct a successful engagement.

WORDS/PHRASES	USED BY	DEFINITION/ACTION
ABANDON TARGET	SL (squad leader)	Discontinue tracking or searching for target. Resume search of assigned sector.
CAT ONE, CAT TWO, or CAT THREE	SL	Category I, II, or III targets as defined in paragraph 6–8.
CONTACT	SL or Gunner	SL/gunner has sighted correct target.
ENGAGE	SL	Authority for the gunner to fire.
FIRE TWO	SL	Tells gunner to launch second missile at the same target.
FRIENDLY	SL	Determines the target to be friendly.
FRONT-TO-REAR/REAR-TO-FRONT/ RIGHT-TO-LEFT/LEFT-TO-RIGHT	SL	Order of target engagement for multiple targets. Delivered as part of the engagement order.
HIGH	All (all crewman)	Target is in excess of 1,000 feet altitude above the terrain.
HOLD FIRE	SL	Gunner does not launch a missile; continues to track target.
HOSTILE	SL	Target visually identified as enemy; given as part of the engagement order.
LOW	All	Target is at less than 1,000 feet altitude above the terrain.
MULTIPLE	SL	A target or raid consisting of more than one aircraft.
ONE O'CLOCK through TWELVE O'CLOCK	All	Indicates the direction of the target.
ROGER	All	"I understand."
SAY AGAIN	All	Repeat last transmission.
SHOOT-LOOK-SHOOT	SL	Technique used for single aircraft raids (para 6–8*b*–(2) *(a)*).
SHOOT-NEW TARGET-SHOOT	SL	Technique used for multiple aircraft raids (para 6–8*b*(2) (*b*)).

b. Examples.

HOSTILE, CAT ONE, TWO O'CLOCK ENGAGE	SL	Enemy aircraft, low performance at 2 o'clock. Gunner will fire, SL will evaluate first missile, gunner will reacquire target, and be prepared to fire a second missile at same target if SL commands.
HOSTILE, CAT THREE, TEN O'CLOCK, FRONT-TO-REAR, ENGAGE	SL	Enemy aircraft, medium high performance, large, 10 o'clock, more than 1. Gunner will engage as many targets as possible, beginning with front target.
TARGET TWO O'CLOCK, LOW	All	Target sighted at 2 o'clock at an altitude below 1,000 feet.
WARNING: TARGET, TWO O'CLOCK	SL	Early warning information. Target reported approaching from the 2 o'clock direction but not visually detected by the squad.

★Section VII. EMPLOYMENT PROCEDURES

6–19. General

The Chaparral and Vulcan weapon systems were designed for separate and specific applications in defense against the low-altitude air threat. Chaparral units are best employed in an area defense providing air defense to the maximum number of divisional elements and other elements in vulnerable areas to the rear.

a. Chaparral units may be employed in all four air defense artillery tactical missions (direct support, general support, reinforcing, and general support-reinforcing) or, if the situation dictates, Chaparral units may be attached to the supported force. The normal mission for Chaparral is direct support. As the range capability of Chaparral precludes a complete defense of a division area, Chaparral fire units are used to defend key divisions units or installations based upon priorities established by the division commander.

b. Chaparral supports both offensive and defensive operations and can provide air defense of march columns. Details of this support are discussed in the following paragraphs as well as in

FM 44–1, FM 44–3, and basic doctrinal manuals of the combat arms.

c. Chaparral fire units are employed primarily to provide air defense for ground combat and combat support units and installations. The weapons are deployed forward and along likely low-altitude avenues of approach when such avenues are clearly defined. If there are no definite low-altitude avenues of approach, Chaparral fire units may be distributed throughout the defended area, particularly toward the front and to cover the folds of the earth where Hawk units cannot detect and engage aircraft because of radar masking.

d. Chaparral fire units may also be employed in conjunction with Vulcan fire units in a composite defense of large vital area (VA), such as supply depots, airfields, and staging areas in the field army service area and communications zone. This is the normal employment of the nondivisional battalions.

e. Chaparral fire units may be used to provide low-altitude air defense for march columns. However, Chaparral does not have the capability to engage ground targets nor can it fire while moving. Chaparral can best be employed in defense of march columns by prepositioning fire units along the route of march or moving them in echelon to preselected positions along the route.

6–20. Chaparral Employment During Defensive Operations

a. General. Employment of the ADA Chaparral/Vulcan battalion during defensive operations is, in general, more controlled at the ADA battalion level than during the support of offensive operations. The two fundamental forms of defense used by the division are the mobile defense and area defense. In mobile defense, ground security of Chaparral fire units is more of a problem than when the division is conducting an area defense.

b. Mobile Defense.

(1) In the mobile defense the force commander uses relatively light forces in the forward defense area and retains a strong reserve force. He anticipates that a strong enemy attack will penetrate the forward defense area and selects the time and place for counterattacking, using his reserve. The counterattack force (reserve) is heavy in combat power and often called the killing force. Success of the mobile defense depends upon successful use of this force. Figure 6–7 shows a typical mobile defense supported by the division Chaparral/Vulcan battalion.

(2) In a mobile defense the Chaparral batteries are normally used for area (air) defense coverage, weighing Chaparral units well forward in the low-altitude avenues of approach. Chaparral fire units operating in the forward defense area must establish and maintain communications with the nearest maneuver element to keep abreast of changes in the tactical situation. Communications is especially important in a mobile defense situation in which the FEBA is lightly defended. In a mobile defense, Chaparral fire units in the forward defense area are extremely vulnerable to ground attack, since optimum firing positions very likely will be outside the perimeter of the defending forces, and may be occupied only during periods of good visibility. Alternate positions will be selected and prepared to enhance weapons security. Arrangements must be made with the defending force near the firing position for Chaparral fire units to occupy positions inside its perimeter during darkness or other periods of limited visibility.

c. Area Defense. In an area defense, emphasis by the force commander is placed upon defending ground avenues of approach through the forward edge of the battle area (FEBA) and defending in depth to hold the terrain. This concept of ground defense by the force lends itself most readily to the area concept of air defense. Chaparral will normally be deployed in a division area (air) defense with emphasis on the low-altitude approaches into the division area. Chaparral fire units must be prepared to defend against possible airborne or airmobile attack. Due to the smoke signature of Chaparral, frequent moves to alternate positions will be made. Communications between the alternate positions and the supported unit must be maintained for the alternate position to be effective. Since Chaparral unit responsibilities include flank protection, coordination of air defense activities accross force boundries should be maintained. Chaparral platoon leaders can accomplish this by contacting adjacent Chaparral/Vulcan units and Redeye section leaders.

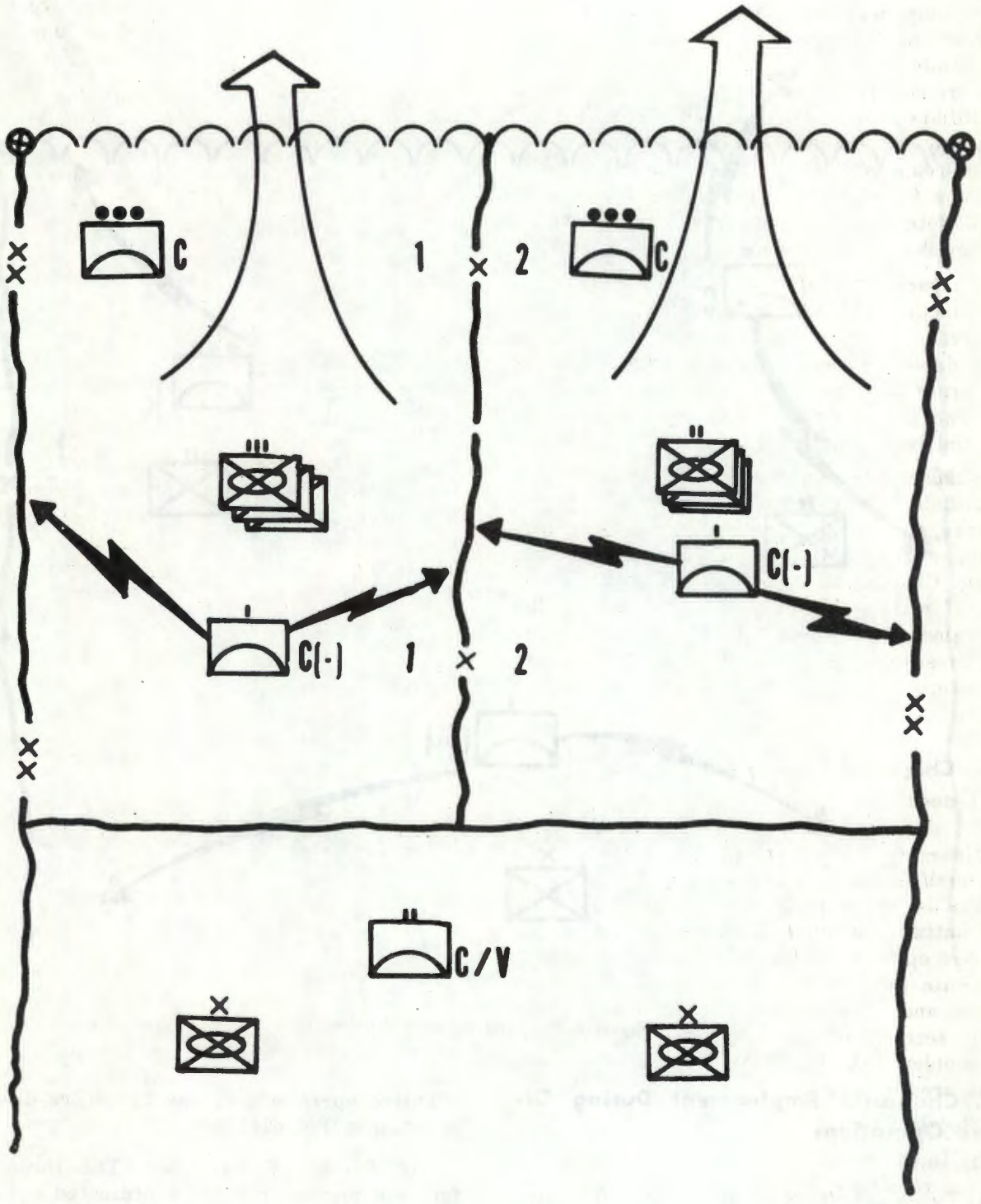


Figure 6-7. Mobile defense supported by Chaparral/Vulcan battalion.

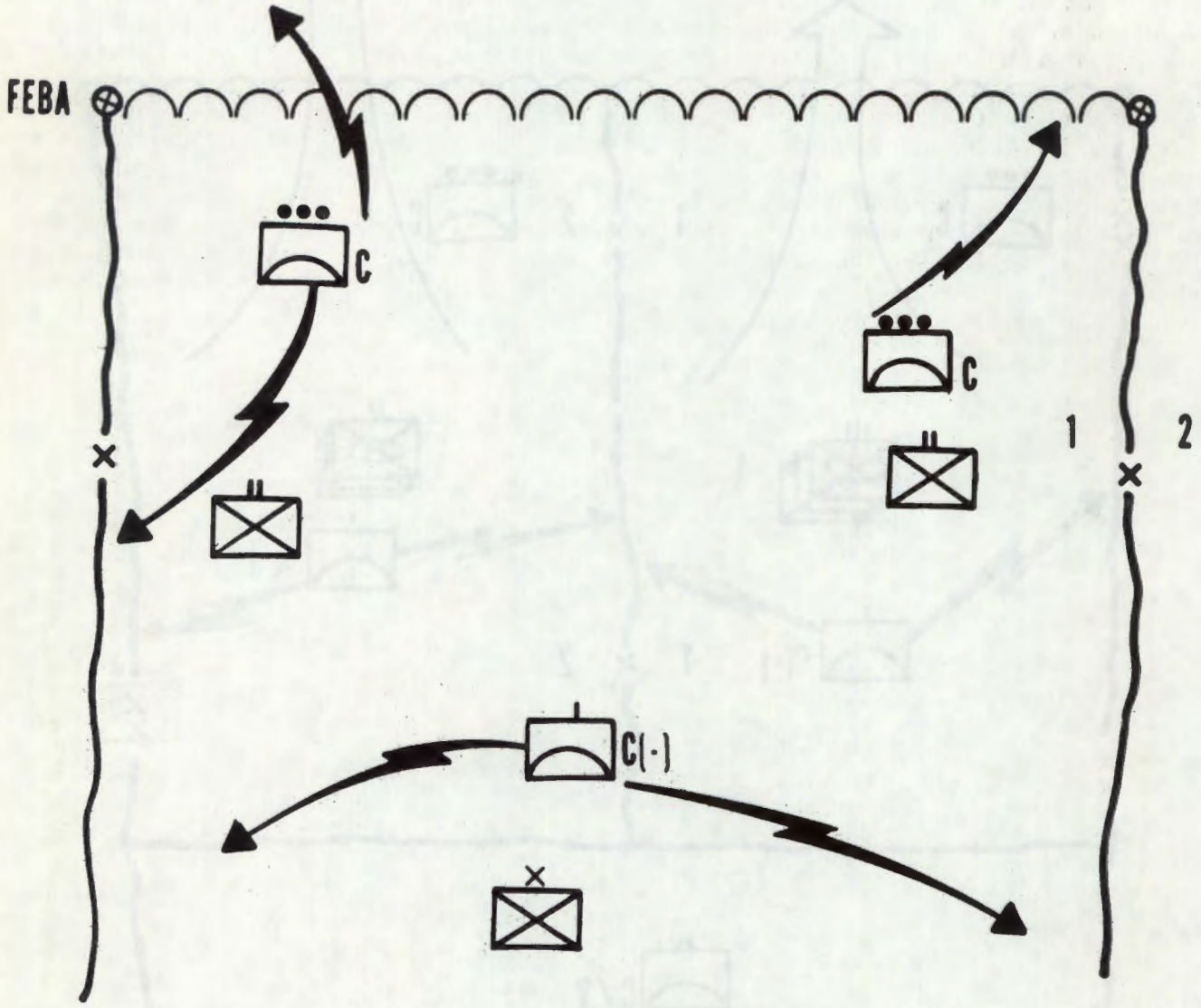


Figure 6–8. Chaparral area defense.

6–21. Chaparral Employment During Offensive Operations

a. General.

(1) *Types of offensive operations.* The five types of offensive operations are movement to contact, reconnaissance in force, coordinated attack, exploitation, and pursuit. The types of offensive operations may look different at each echelon of command; however, each operation will normally use one or more of the types of offensive operations. These types are discussed in detail in FM 61–100.

(2) *Forms of maneuver.* The three basic forms of maneuver in the coordinated attack are the penetration, the frontal attack, and the envelopment. The turning movement and a double envelopment are variations of the envelopment. The attacking force normally uses a combination of the forms of maneuver. FM 61–100 discusses the forms of maneuver in detail.

(3) *Chaparral in offensive operations.* Chaparral fire units normally participate in all forms of offensive operations with the exception of reconnaissance in force. Vulcan is best suited for this mission because of its ground support capability. Chaparral units may be assigned a general support mission in support of force installations and the reserve during offensive operations in addition to maneuvering with ground forces.

b. Movement to Contact. Where the supported force has little or no information of how or where the enemy is disposed, the tactical situation may require a movement to contact. A typical formation for a division movement to contact is shown in figure 6-9. Chaparral units are placed with the covering force and flank and rear guard elements so as to be in the best locations for defending the main body. Chaparral commanders will select positions for Chaparral squads that will provide the best coverage of low-altitude avenues of approach. As the force advances, the Chaparral fire units will leapfrog to new advance positions. This procedure will allow continual air defense of the advancing supported force. Chaparral batteries will maintain radio communications with the battalion AADCP to receive air defense warnings and information and to provide long-range early warning to the fire units. Liaison will be maintained, when possible, with adjacent air defense artillery units and maneuver battalion Redeye sections. As with any other flexible situation, the supporting Chaparral units must maintain close liaison with maneuver battalions to keep abreast of the tactical situation.

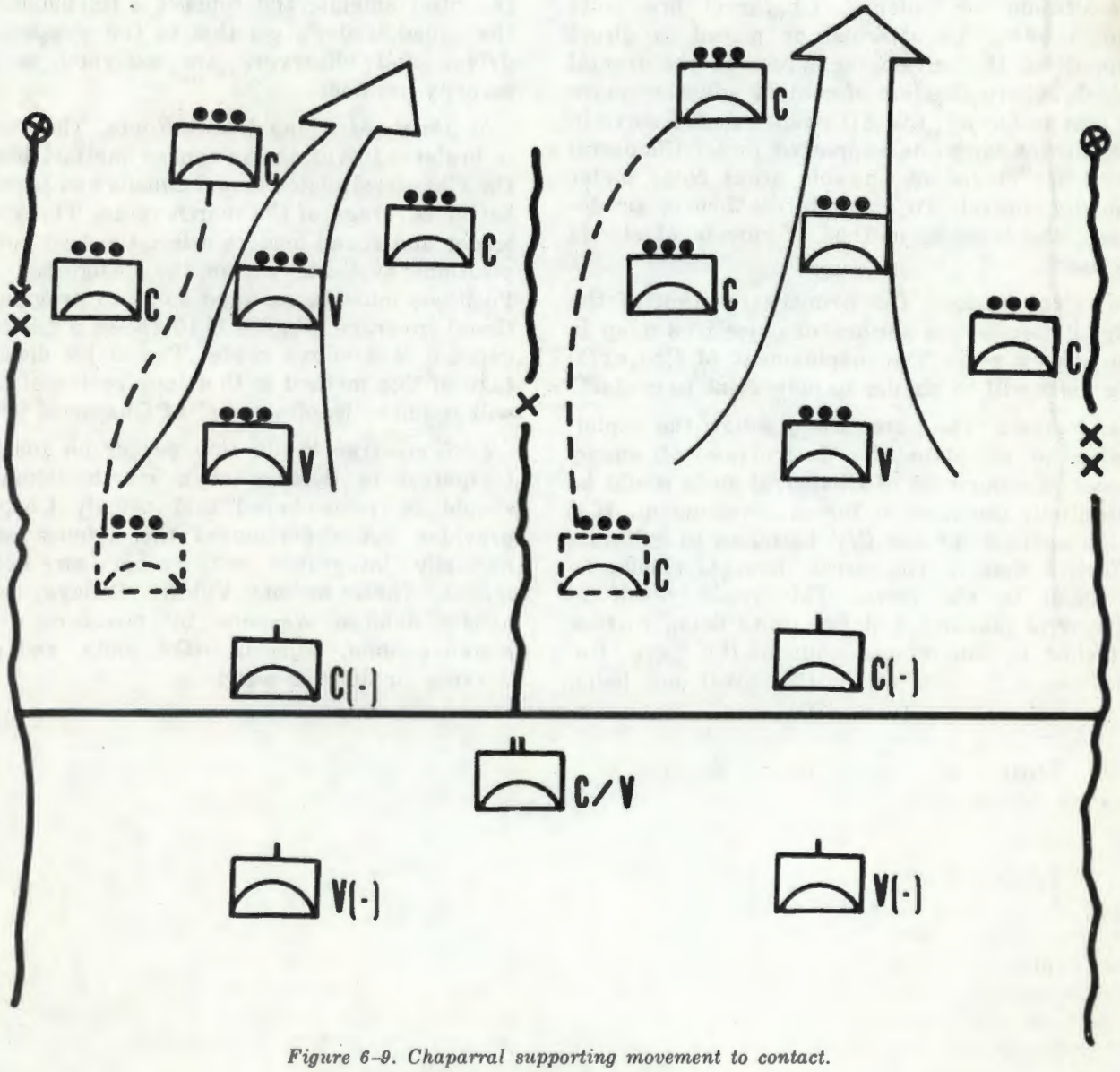


Figure 6-9. Chaparral supporting movement to contact.

c. Coordinated Attack. The coordinated attack is as well-planned as time and the situation allow. Employment of Chaparral fire units during a coordinated attack will vary with the choice of offensive maneuver. In the penetration, Chaparral may be used to provide an area air defense of the force fire support elements by covering the low-altitude air avenues of approach into the division area. This will also provide some protection for the reserve and key installations. Once the reserve has been committed, consideration must be given to assigning ADA units, including Chaparral, to a direct support mission of air defense of the reserve. Actions of Chaparral commanders would be essentially the same as described in *b* above. In the envelopment the main or enveloping attack passes around or over the enemy's principal defense positions. To give the enveloping force a good low-altitude air defense, Chaparral fire units should either be attached or placed in direct support of the enveloping force. In the frontal attack, where the line of contact advances more or less uniformly, the ADA units should move in conjunction with the supported force. Chaparral units are moved as suitable areas come under friendly control. To maintain continuous air defense, the leapfrog method of movement should be used.

d. Exploitation. The primary function of the exploitation is the seizure of objectives deep in the enemy rear. The employment of Chaparral fire units will be similar to movement to contact.

e. Pursuit. The pursuit may follow the exploitation to complete the destruction of enemy forces. Employment of Chaparral units would be essentially the same as for an envelopment. If it is impractical for the C/V battalion to maintain effective control, Chaparral elements should be attached to the force. This could result in Chaparral platoons and fire units being further attached to subordinate units of the force. Regardless of the size of the Chaparral unit being attached (from battery to platoon), the senior air defense artillery commander will serve as an air defense advisor to the supported force commander. Although attachment implies that the attached unit is under the command and control of the supported force commander, the ADA chain of communications will be maintained to insure early warning and air defense information.

6–22. Defense of March Columns

a. In Convoy. Chaparral squads should be placed at equal distances throughout the convoy. The Chaparral units cannot fire while moving in the column, but must disperse at least 200 feet from the closest vehicle or troop concentration. The platoon leader and squad leader will move the Chaparral units out of the column, position the blast shields, and connect a telephone from the squad leader's position to the weapon. The driver and observers are assigned to local security positions.

b. Stationed Along March Route. This method is preferred over the in-convoy method because the Chaparral platoons and squads can provide a better coverage of the march route. The platoon leader and squad leaders select the best possible positions available within the designated area. Positions must be selected so as to provide continual coverage. Figure 6–10 shows a Chaparral defense of a march route. The major disadvantage of this method is that long routes of march will require "leapfrogging" of Chaparral units.

c. Summary. While this paragraph discusses Chaparral in defense of a march column, it should be remembered that usually Chaparral provides but a portion of the defense and is normally integrated with other air defense means. These include Vulcan, Redeye, use of nonair defense weapons by members of the march column, adjacent ADA units, and other Service air defense weapons.

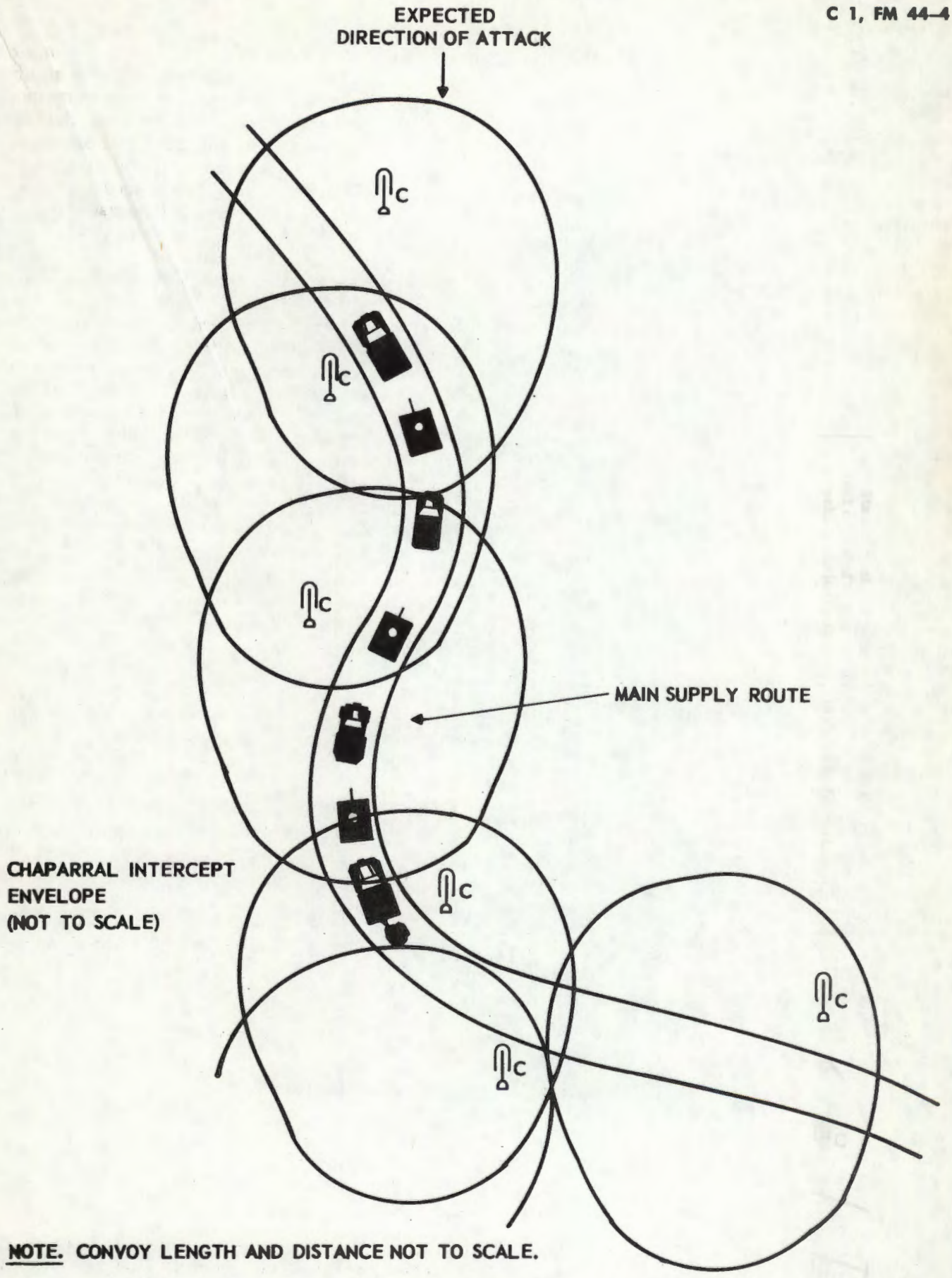


Figure 6–10. Chaparral defense of a march route.

CHAPTER 7

SQUAD DRILL

7-1. General

Tactical employment of Chaparral requires the cooperative and timely efforts of all squad members. This chapter describes the duties and responsibilities of each squad member and prescribes a formal drill procedure to be used in training squad members in the performance of their duties.

7-2. Duties and Responsibilities of Squad Personnel

a. Squad Leader. The Chaparral squad leader is in direct command of the squad and is responsible to the platoon sergeant for:

(1) Training and efficiency of squad personnel.

(2) Duty performance of squad members.

(3) Operation of Chaparral equipment by squad members to include:

(*a*) Chaparral launching station.

(*b*) Chaparral carrier.

(*c*) Communications equipment.

(4) Site selection, preparation, and improvement.

(5) Travel, emplacement, and march order of the Chaparral equipment.

(6) Maintenance of all squad equipment.

(7) Enforcement of safety rules.

(8) Selection, designation, and identification of targets.

(9) Performance of other duties as prescribed by the platoon sergeant.

b. Gunner. The gunner is second in command of the squad and is responsible to the squad leader for:

(1) Performance of operator maintenance of the Chaparral launching station, missiles, and communications equipment.

(2) Operation of the Chaparral launching station.

(3) Effective delivery of fire on targets designated by the squad leader.

(4) Performance of other duties assigned by the squad leader.

c. Driver. The driver is responsible to the squad leader for:

(1) Operating the Chaparral carrier.

(2) Performing operator maintenance on the carrier and associated equipment.

(3) Detecting all aircraft in his assigned area of search.

(4) Performance of other duties assigned by the squad leader.

d. Observers. Chaparral observers are responsible to the squad leader for:

(1) Detecting all aircraft in their assigned sectors of search.

(2) Assisting the gunner and driver in operating and maintaining squad equipment.

(3) Performing other duties assigned by the squad leader.

7-3. Purpose of Squad Drill

The objective of squad drill is to attain a high degree of proficiency, precision, speed, and teamwork in operating the Chaparral system. To be effective, squad drill should be:

a. Conducted in silence except for commands and reports.

b. Repeated until squad reactions are automatic, rapid, and efficient.

c. Supervised so that mistakes are discovered and corrected immediately.

d. Conducted so that each member of the squad can perform all duties within the squad.

7-4. Squad Member Designations

For the purpose of describing and conducting squad drill, members are designated as follows:

a. Squad Leader	SL
b. Gunner	No. 1
c. Driver	No. 2
d. Observer	No. 3
e. Observer	No. 4

7-5. Squad Training Commands and Formations

Training of Chaparral crewmen requires that each crewman be able to perform all duties within the squad. The squad leader will rotate each squad member through each duty position; e.g., No. 1, No. 2, No. 3, and No. 4, during drill.

The commands and formations are explained in *a* through *c* below.

Note. In the crew drills explained in *a* through *c* below, the time phasing of crew actions is indicated by the vertical position of the action statements. Where, as in *a* below, the actions by individual crew members are sequential, the first action is at the top of the list (SL) and the next action (No. 1) is listed lower on the page to indicate that SL must complete his action before No. 1 starts his. Where actions are simultaneous, they are listed on the same horizontal line as in *c* below.

a. FALL IN. Used to assemble the squad for drill.

SL	No. 1	No. 2	No. 3	No. 4
Stations himself 6 meters in front of vehicle and commands, FALL IN.	Falls in 2 meters in front of the vehicle's right track, facing SL.	Falls in at close interval to left of No. 1.	Falls in at close interval to left of No. 2.	Falls in at close interval to left of No. 3.

b. COUNT OFF and CALL OFF. These commands are given after the squad is assembled for drill.

SL	No. 1	No. 2	No. 3	No. 4
Commands, COUNT OFF, CALL OFF.	Replies, ONE, GUNNER.	(1) Executes eyes right (2) Replies, TWO, DRIVER, and faces to the front.	(1) Executes eyes right. (2) Replies, THREE, OBSERVER, and faces to the front.	(1) Executes eyes right. (2) Replies, FOUR, OBSERVER, and faces to the front.

c. CHANGE POSTS. This command is used to rotate the squad and is given after the squad is formed.

SL	No. 1	No. 2	No. 3	No. 4
Commands, CHANGE POSTS.	Falls out and assumes the position of No. 4.	Assumes No. 1 position.	Assumes No. 2 position.	Assumes No. 3 position.

7–6. Examine Equipment

a. To insure that all equipment is functioning properly prior to subsequent drills or operation, the squad leader forms the squad and conducts the drill as outlined below.

b. Examine equipment.

SL	No. 1	No. 2	No. 3	No. 4
(1) Commands, EXAMINE EQUIPMENT. (2) Supervises and coordinates the actions of the squad during drill.	(1) Falls out and double times to the right rear of the vehicle and, assisted by No. 3, lowers vehicle tailgate. (2) Performs preenergizing checks (less the receiver (R–442/VRC) in	(1) Falls out and performs checks on the vehicle. (2) Inspects all fire extinguisher controls for broken seals. (3) Checks that vehicle cab doors operate correctly and will lock.	(1) Falls out and double times to the left rear of the vehicle. (2) Assists No. 1 in lowering vehicle tailgate. (3) Opens left missile storage compartment and verifies that four missile	(1) Falls out and checks the basic issue items for correct storage.

SL	No. 1	No. 2	No. 3	No. 4
	accordance with tables 4–3 and 4–4. (3) Energizes the launching station as follows: sets MASTER POWER and COMM switches at ON; sets and holds LAMP TEST switch at ON; observes that all lamps are lit; releases switch. (4) Verifies that the ERECT-RETRACT, LEFT STORED, RIGHT STORED, and LAUNCH RAIL heater circuit breakers are on. (5) Climbs on launching station deck, opens the canopy, and enters the mount. Closes canopy and insures proper seal by observing for light leakage. (6) Verifies that PWR SUPPLY and MOUNT DRIVE circuit breakers are set at ON. (7) Sets MOUNT POWER switch at ON; verifies that MOUNT POWER lamp is lit. (8) Sets and holds ERECT/OFF/RETRACT switch at ERECT until mount movement stops. (9) Rotates sight into operating position and puts on headset. (10) Sets BRIGHT/DIM switch at BRIGHT, sets and holds the LAMP TEST switch at ON and verifies that all lamps light; releases switch and sets BRIGHT/DIM switch at DIM.	(4) Checks that blast covers are secured. (5) Checks vehicle fuel tank caps for tightness. (6) Checks radiator for coolant level and the cap for tightness. (7) Checks vehicle battery electrolyte level. (8) Checks fan and generator belts for proper tension and excessive wear. (9) Checks the oil level on the engine, transmission, differential and final drives. (10) Checks tracks, road wheels, idler wheels, and drive sprockets for excess wear, damage, and correct oil levels. (11) Checks condition of winch controls, cables, chain and hooks. (12) Checks swim kit. (13) Checks the operation of the bilge pumps and verifies that pump vents are clear. (14) Starts engine and checks gages and instruments for proper operation; listens for unusual noises and vibrations.	cases are present and secure, closes door. (4) Opens wing and fin compartment, verifies that the correct number and type of wings are present and secure. (5) Verifies that 32 control fins are present and secure and that the correct tools are secured to the compartment door. Closes and latches door. (6) Opens the right missile storage compartment door and verifies that four missile cases are present and secure. Closes and latches door. (7) When mount is erected, climbs on launching station deck. (8) Opens the MPU compartment, checks the external condition of the MPU, closes and latches the compartment doors. (9) Checks the fuel cell caps for a snug fit. (10) Examines launch rails and missiles for defects, and safety pins and streamers, missile dome protectors; and control	(2) When mount is erected, climbs on the launching station deck, opens the crew equipment compartment, and checks for presence of field wire reels, telephones, remote control units, and TADDS. (3) Removes the remote control unit from storage and checks that batteries are installed. (4) Checks the TADDS for a correct battery charge.

(11) Sets MOUNT CONDITIONING BREAKER at ON and MOUNT CONDITIONING switch at HEAT/COOL (LOW-MED-HIGH) and verifies that heater and air conditioner operates; sets BLOWER switch at LOW-MED-HIGH and verifies that blower speed varies accordingly. Verifies that TRIGGER lock switch is turned to OFF.		fins and wings for correct installation.	
(12) Sets COMMUNICATIONS switch at INTERCOM AND RADIO RCVR.		(11) Climbs down from the launching station deck, turns the PRIME POWER switch to MAN, waits until the timer runs down, presses the MAN START switch, and starts the MPU.	
(13) Verifies that the RT–524/VRC can be heard in the headset.		(12) Notifies No. 1 that the launching station deck is clear.	
(14) Assisted by No. 4, makes a communication check of all launching station external communication connections.			(5) When requested by No. 1, connect a telephone to the right/left and MCP INTERCOM connections and conducts a communications check.
(15) Presses action switches, moves gunner's hand control left/right/up/down, observes that DRIVE SYSTEM warning lamp goes out, and that the mount and launch rails respond to the left/right and up/down commands.		(13) Obtains the IR flashlight and prepares to check missiles.	(6) Connects the telephone to the AUX terminals and verifies that the R–442/VRC can be heard.
(16) Positions the mount at 6 o'clock and the launch rails at −9°.			(7) Connects the remote control unit to the RADIO terminals and verifies that the unit will key the transmitter and the receiver can be heard.
(17) Directs No. 3 to remove the dome protector from the upper right missile.			
(18) Turns the MODE switch to TEST, presses the SEQUENCE ADVANCE switch until the desired missile is selected. Allows the	(15) Assisted by No. 4, checks the vehicle headlights and	(14) Removes the dome protector from the selected missile.	(8) Returns the telephones and remote control unit to storage, closes the crew-equipment compartment.
			(9) When requested by No. 2, verifies that vehicle

SL	No. 1	No. 2	No. 3	No. 4
	missile to cool for 1 minute. (19) Directs No. 3 to hold the IR flashlight in front of and slightly off center of the selected missile. (20) Verifies that a missile tone is heard in the headset. Sets MISSILE—CAGE/UNCAGE switch at UNCAGE and verifies that tone stops; releases switch. (21) Directs No. 3 to replace protective covers. Selects a new missile and repeats check procedure. (22) Sets and holds LOAD/OFF/STOW switch at STOW until mount is positioned at 6 0'clock and the launchers are positioned at 0°. Releases switch. (23) Sets and holds the ERECT/OFF/RETRACT switch at RETRACT until the mount is fully retracted. Releases switch. (24) Deenergizes the mount in the reverse order of energizing. (25) Opens canopy, leaves the mount and sets the switches on the MCP in	taillights (if the tactical situation permits). (16) Checks the steering, braking, shifting, and accelerator controls for proper operation. Shuts off engine.	(15) Holds the IR flashlight about 1 foot in front and slightly off center of the missile to be tested. (16) Replaces protective covers; repeats check procedures on remaining missiles. (17) When missile checkout is complete, checks that all mount doors are closed and latched. (18) Verifies that the launching station deck is clear of personnel and equipment. (19) Climbs down and announces, ALL CLEAR, to No. 1. (20) Returns the IR flashlight to storage. Verifies that all base structure doors are closed and latched.	headlights and taillights are lit.

	accordance with tables 4–4. (26) Assisted by No. 3, closes and latches tailgate.		(21) Assists No. 1 in closing and latching tailgate.	
(3) When squad has completed its examination of equipment, commands, REPORT.	(27) Returns to formation and reports, MOUNT AND MISSILES IN ORDER, or any discrepancies found.	(17) Returns to formation and reports, VEHICLE IN ORDER, or any discrepancies found.	(22) Returns to formation and reports, LAUNCHING STATION IN ORDER, or any discrepancies found.	(10) Returns to formation and reports, EQUIPMENT AND COMMUNICATIONS IN ORDER, or any discrepancies found.

7–7. Preparation for Action

a. When the Chaparral system arrives at the selected position, the system is emplaced and prepared for action in the following sequence.

SL	No. 1	No. 2	No. 3	No. 4
(1) Selects a spot near the proposed emplacement. (2) Designates the spot to No. 2 and commands, HALT VEHICLE, at (exact spot).		(1) Halts vehicle on spot designated by SL. (2) Sets vehicle brakes and keeps the engine running. (3) Takes headset from No. 4, and assumes duty of maintaining communications.		(1) Gives headset to No. 2.
(3) Commands, DISMOUNT, and dismounts through right door. (4) Directs No. 1 to act as as guide in emplacing the system. (5) Orders No. 2 to move system into position. (6) Orders No. 4 to reconnoiter the area forward of the emplacement site and select an observation post. (7) Orders No. 3 to reconnoiter the area to the rear of the emplacement and select a command post. (8) Directs all operations and provides security from ground attacks.	(1) Dismounts from the vehicle. (2) Moves to the selected emplacement site and acts as a guide in moving the system into position.	(4) Releases brakes, moves vehicle into position guided by No. 1. Shuts off engine. (5) Maintains communications with platoon headquarters.	(1) Dismounts from the vehicle. (2) Reconnoiters the area to the rear of the position and selects a command post.	(2) Dismounts through right vehicle door. (3) Reconnoiters the area forward of the position and selects an observation post to SL. (4) Returns to the vehicle and reports the location of the observation post to SL.

SL	No. 1	No. 2	No. 3	No. 4
(9) When the Chaparral is emplaced and the personnel posts are selected, commands, FALL IN.			(3) Returns to the position and reports location of the command post to SL.	
(10) Designates posts; primary target line, reference point, sectors of search, and primary field of fire; explains tactical situation; gives instructions regarding local security.	(3) Falls in on spot designated by SL.	(6) Remains in vehicle, continues to monitor communications.	(4) Falls in and dresses on No. 1.	(5) Falls in and dresses on No. 3.
(11) Commands, PREPARE FOR ACTION.		(7) Assumes the duty of local security.		
(a) Monitors the vehicle communications.	(4) Falls out, double times to the rear of the vehicle and, assisted by No. 3, lowers vehicle tailgate.	(8) Transfers communications and security responsibility to the SL.	(5) Falls out, double times to the rear of the vehicle, and assists No. 1 in lowering vehicle tailgate.	(6) Falls out, double times to front of vehicle.
(b) Assumes the duty of local security.		(9) Dismounts from vehicle and, assisted by No. 4, unfolds blast shields into firing position.		(7) Assists No. 2 in unfolding blast shields into firing positions.
c) Supervises the squad.	(5) Turns PRIME POWER switch to MAN, presses MAN START switch, and starts MPU.	(10) Closes and latches vehicle cab doors.	(6) Climbs on launching station deck and checks that missile wings and fins are securely attached.	
	(6) Sets MASTER POWER switch at ON. *Note.* Sets BATTERY HEATER switch at ON, if required.			
	(7) Verifies that ERECT-RETRACT, LEFT STORED, RIGHT STORED, and LAUNCH RAILS circuit breakers are set at ON.			
	(8) Climbs on launching station deck, opens canopy, enters gunner's compartment, closes and latches canopy, and puts on headset.			
	(9) Rotates gunner's sight into position, adjusts reticle illumination, and adjusts gunner's seat.			
	(10) On control panels, verifies PWR SUPPLY circuit breaker, MOUNT POWER switch, MOUNT DRIVE circuit breaker, MOUNT CONDITIONING			(8) Obtains three telephone sets, four reel units with field wire, one

circuit breaker are set at ON, and MOUNT CONDITIONING and BLOWER switches as desired.

(11) Holds mount ERECT/OFF/RETRACT switch at ERECT until mount is fully erected. Releases switch.

(12) Observes that MOUNT and STRUCTURE interlock lamps are out.

(13) Turns COMMUNICATIONS switch to INTERCOM AND RADIO RCVR.

(14) Directs No. 3 to remove rolleron protecting covers, safety pins, and streamers from each missile (if this is an actual battlefield condition).

(15) Directs No. 3 to remove missile dome protective covers.

(16) Performs missile preoperational tests as as follows:

(*a*) Turns MODE switch to TEST. Observes that one missile selection indicator lamp lights.

(*b*) Sets SEQUENCE ADVANCE switch momentarily on three times. Observes that remaining missile selection indicator lamps light.

(*c*) Directs No. 3 to hold IR flashlight about 1 foot in front of, and off and off center of,

(7) Removes rolleron protective covers from all missiles.

(8) Removes safety pins and streamers (when directed to do so).

(9) Removes missile dome protective covers and places them in crew equipment compartment.

(10) Holds IR flashlight in front of each missile as directed by No. 1.

remote control unit, TADDS, and two pairs of binoculars from storage.

(9) Places one telephone set, one reel unit with field wire, and one pair of binoculars on the left side of launching station deck.

(10) Connects wires to INTERCOM terminal pair 1 or 2 on left intercom panel and RADIO terminals.

(11) Places two telephone sets, three reel units with field wire, TADDS, remote control unit, and one pair of binoculars on the launching station deck, right side.

(12) Connects wire to INTERCOM terminal pair 1 or 2, AUX terminal, and RADIO terminals on right intercom panel.

SL	No. 1	No. 2	No. 3	No. 4
	each missile in turn. (*d*) Monitors for missile tone in headset. (*e*) Sets MISSILE—CAGE/UNCAGE switch at UNCAGE and checks that tone stops for each missile tested.			
	(17) Checks that launching station deck is clear, momentarily presses action switch and rotates hand controls, observing that DRIVE SYSTEM WARNING lamp goes out and mount traverses and launch rails elevate/depress. Verifies that TRIGGER lock switch is turned to OFF.		(11) Leaves launching station deck and, assisted by No. 4, closes and latches tailgate.	(13) Assists No. 3 in raising and latching tailgate.
	(18) Opens canopy and reports to SL, LAUNCHING STATION READY.	(11) Reports, VEHICLE READY.	(12) Reports, MISSILES READY.	(14) Reports, COMMUNICATIONS EQUIPMENT READY.
(12) After receiving reports from all members, commands, ACTION POSTS.				
(13) Obtains remote control unit, TADDS, reel unit with field wire connected to RADIO terminals, and binoculars, from the launching station deck. (14) Lays field wire to the squad command post and connects it to terminals on remote control unit. (15) Conducts a communications check with platoon headquarters. (16) Emplaces and orients the TADDS and plots the fire unit position on it.	(19) Closes and latches canopy. (20) Slews mount to the designated reference point and notes the azimuth reading.	(12) Obtains a telephone set and binoculars from the launching station deck and goes to the forward observation post. When No. 4 arrives, connect telephone to the field wire.	(13) Obtains two reel units with field wire and two telephones from launching station deck. (14) Lays two lines of wire to the SL command post and connects one pair of wires to each telephone. (15) Confirms that the auxiliary receiver can be heard over the AUX telephone line.	(15) Obtains one reel unit with field wire from the launching station deck. (16) Lays wire to the forward observation post.
(17) Verifies that No. 1 and the forward observation post	(21) Conducts a communications check with the	(13) Conducts communications check with the No.	(16) Conducts a communications check with No. 1	

have established communication with his command post. (18) Notifies No. 1 of the mode to use. (19) Commands squad to begin search and scan procedures. (20) When squad is ready for operation, reports, by radio to platoon leader, SQAD (number) READY FOR ACTION.	forward observation post and SL and reports the azimuth indicator reading of the reference point. (22) Turns MODE switch to the mode indicated by the SL. (23) Reports over intercom, SYSTEM READY FOR ACTION.	1 and command post position. (14) Notes and records azimuth of reference point as reported by No. 1. (15) When No. 4 is ready, reports FORWARD OBSERVATION POST READY FOR ACTION. (16) Begins search and scan of assigned sector, alternating with No. 4.	and the forward observation post. (17) Records the azimuth to the reference point as reported by No. 1. (18) Starts search and scan of assigned sector on command from SL.	(17) Reports to No. 2 that he is ready for action. (18) Starts search and scan of assigned sector, alternating with No. 2.

b. Emergency emplacement and preparation for action from a march column. This sequence is required for rapid replacement from a march column when RSOP and full emplacement is not feasible.

SL	No. 1	No. 2	No. 3	No. 4
(1) Commands, EMERGENCY EMPLACEMENT, directs No. 2 to move the vehicle to a designated spot. (2) Maintains radio communications from the right side of cab. (3) Commands Nos. 2 and 4 to proceed to a vantage point and furnish ground security for the squad. (4) Connects end of field wire to external intercom binding posts and lays wire to the command post. Connects telephone and establishes communications with No. 1.	(1) Assisted by No. 3, unlocks tailgate, sets MASTER POWER switch and ERECT—RETRACT BREAKER to ON; turns PRIME POWER switch to AUTO; closes and latches tailgate. (2) Climbs on the launching station deck, enters the mount, energizes the control panels; erects the mount and adjusts the sight; assumes radio communications. (3) Notifies SL that he is ready for action.	(1) Drives to position designated by SL. (2) Assisted by No. 4, unfolds blast shields (*do not latch*); closes left cab door. (3) Accompanied by No. 4, goes to point designated by SL and prepares to defend the Chaparral position.	(1) Assists No. 1. (2) Removes the dome covers from the missiles, removes safety pins and streamers; when mount is erected, opens crew equipment, removes a field telephone and reel of wire; closes and latches compartment door; climbs down from deck; closes right cab door; goes to SL command post. (3) Searches for targets.	(1) Assists No. 2. (2) Accompanies No. 2 and prepares to defend the Chaparral position from ground attack.

c. Emergency emplacement and preparation for action from emergency march order.

SL	No. 1	No. 2	No. 3	No. 4
(1) Commands, EMERGENCY EMPLACEMENT, directs No. 2 to move to designated spot. (2) Obtains a telephone and reel of wire from the launching station deck, and connects the wire to the intercom binding posts. Lays wire to a position at least 200 feet from the vehicle. Connects the telephone and establishes contact with No. 1. (3) Tells No. 1 to report the squad ready for action.	(1) Assumes radio communications; verifies that the controls on the LCP, CCP, and RCP are set correctly. (2) When communications is established with the SL, announces, READY FOR ACTION. (3) Scans an assigned search sector; notifies the unit that squad is ready for action.	(1) Drives to position designated by SL. (2) Assisted by No. 4, unfolds blast shields. (3) Closes left cab door. (4) Accompanied by No. 4, proceeds to a position designated by SL.	(1) Removes all equipment from the launching station deck except one telephone and one reel of wire. Places the equipment on the seat of the cab. (2) Goes to SL command post and assists him in searching for targets.	(1) Assists No. 2. (2) Closes right cab door. (3) Accompanies No. 2.

d. The drill procedures outlined above should be practiced by the squad in a training situation until each squad member is thoroughly familiar with his duties and his relations with other squad members. Posts should be rotated as often as possible to insure complete cross training of all squad members. The system should be emplaced and squad positions manned within 15 minutes after arriving at the position. During emergency emplacement, system should be emplaced within 3 minutes.

7–8. Target Engagement

a. General. This drill prescribes the procedures used by the squad to search for and engage targets. The drill procedures are based on the weapon being emplaced and prepared for action, weapons control status in effect, and communications nets operational.

b. Surveillance Procedures (Not Alerted).

SL	No. 1	No. 2	No. 3	No. 4
(1) Maintains communications with platoon headquarters, No. 1, and the forward observation post. (2) Directs all squad activities. (3) Conducts search and scan procedures, alternating with No. 3. (4) Monitors TADDS for early warning of approaching aircraft.	(1) Turns MODE switch to READY. (2) Maintains communications with SL and forward observation post. (3) Maintains surveillance along primary target line. (4) Monitors control panels for system malfunction.	(1) Maintains communications with SL and No. 1. (2) Maintains surveillance of assigned sector, alternating with No. 4.	(1) Monitors auxiliary receiver and reports intelligence to SL. (2) Maintains surveillance of assigned sector, alternating with SL.	Maintains surveillance of assigned sector, alternating with No. 2.

c. Surveillance Procedures (When Alerted).

SL	No. 1	No. 2	No. 3	No. 4
(1) Alerts the squad to the approach of a potential target by relaying target azimuth to No. 1 and the forward observation post. (2) Directs squad to commence search along the expected route of target approach. (3) Directs No. 1 to turn MODE switch to OPR and set ARM switch at ARM. (4) Searches the sky along the approach azimuth.	(1) Searches the sky along the expected azimuth of approach. (2) Turns MODE switch to OPR and sets ARM switch at ARM. (3) Turns TRIGGER lock switch to ON.	(1) Searches the sky along the expected azimuth of approach. (2) When the target is sighted, the observer sighting the target reports to SL; e.g., TARGET 10 O'CLOCK (HIGH, LOW). Other observers continue surveillance of their assigned sectors. (3) The observer reporting the target will continue to call out the target position until SL notifies him that he has the target sighted. He then returns to sector surveillance.		

d. Target Engagement. The following steps are based on an air defense warning RED and weapons control status of weapons tight.

SL	No. 1	No. 2	No. 3	No. 4
(1) Searches the azimuth reported by the observer. (2) When he sights the target, announces, CONTACT, to the observers. (3) Identifies target and, if single and hostile, commands, HOSTILE, CAT (I, II, or III), (azimuth), (HIGH, LOW), SHOOT-LOOK-SHOOT, ENGAGE.	(1) Slews the mount to the direction of approach and searches for the target. (2) When target is sighted, announces, CONTACT, to SL.	Nos. 2, 3, and 4 resume search of their assigned sectors.		
	(3) Centers the target in sight reticle; determines by sight picture if target can be engaged (table 6–1). (4) Tracks the target for the best IR tone. When tone is received, announces, TONE, over intercom. (5) Checks HOLD FIRE lamp. (6) When he has a good missile tone, sight picture, and no HOLD FIRE lamp lit, launches the missile.			
(4) Observes the missile flight, when missile explodes, determines target damage. If target is not destroyed, commands, No. 1, FIRE TWO. (5) When target is destroyed, commands, ABANDON.	(7) Reacquires target as rapidly as possible and prepares to fire a second missile, if required. (8) Returns to assigned sector or primary target line.	Nos. 2, 3, and 4 continue search of their assigned sectors.		

★*e. Target Engagement, Multiple Targets.* The following steps are based on an air defense warning RED and weapons control status of weapons tight.

SL	No. 1	No. 2	No. 3	No. 4
(1) Searches the azimuth reported by the observer. (2) When he sights targets, announces, CONTACT, to observers. (3) Identifies target and, if hostile, commands, HOSTILE, CAT (I, II, or III), (azimuth), (HIGH, LOW), (FRONT-TO-REAR, REAR-TO-FRONT) SHOOT-NEW TARGET-SHOOT, ENGAGE.	(1) Slews the mount to the direction of approach and searches for the target. (2) When he sights targets, announces, CONTACT, to observers.	Nos. 2, 3, and 4 resume search of their assigned sectors.		
	(3) Centers the target(s) in sight reticle; determines if target is within engagement range (table 6–1). (4) Tracks target for best IR tone; when tone is received, announces, TONE, over intercom. (5) Checks for no HOLD FIRE lamp lit. (6) When good missile tone is heard and HOLD FIRE lamp is out, launches missile. (7) Acquires a new target and repeats steps (3) through (6) above.			
(4) Assesses target damage; orders CEASE FIRE when targets are destroyed or out of range.				
	(8) Returns to assigned search sector or to primary target line.			

7–9. Post-Action Drill

a. General. After completing an engagement, it may be necessary to displace Chaparral to an alternate position to avoid being targeted by enemy ground fire or attacked by hostile aircraft. If a move of considerable distance is required and time and the tactical situation permits, the displacement should be conducted as described in *b* below. If the tactical situation is urgent and displacement must take place immediately, the procedure described in *c* below should be followed.

b. Normal Displacement. This drill procedure is based on the squad members being located at their tactical positions. The squad leader will order the displacement upon receipt of orders from platoon headquarters. Normal displacement drill is outlined as follows:

SL	No. 1	No. 2	No. 3	No. 4
(1) Using the intercom, commands, MARCH ORDER. (2) Closes and secures TADDS. (3) Disconnects field wire from remote control unit. (4) Carries binoculars, TADDS, and remote control unit to the weapon.	(1) Sets and holds LOAD/OFF/STOW switch at STOW until mount is positioned at 6 o'clock and the launch rails at 0°. (2) Removes and stows the gunner's headset. (3) Stows the sight; turns TRIGGER lock switch to OFF.	(1) Disconnects field wire from telephone. (2) Returns to the vehicle, reeling the field wire. (3) Disconnects the field wire from the external communications panel and places the reel on the launching station deck. (4) Performs before-operation checks on the vehicle.	(1) Disconnects field wire from telephones. (2) Returns to the vehicle and places telephones on the launching station deck. ★(3) Reels up the three reels of field wire, disconnects them from the external communications panel, and places them on launching station deck.	(1) Carries the telephone and binoculars to the vehicle. (2) Climbs on to launching station deck, opens crew equipment compartment. (3) Removes the missile dome protectors and lays them on the deck.
(5) Reestablishes radio communications with platoon headquarters, using the vehicle cab communications. (6) Acts as local security while the squad is preparing for march order.		★(5) Assisted by No. 3, stows blast shields. (6) Reports, VEHICLE READY.	(4) Assists No. 2 in stowing blast shields. (5) Assists No. 4 in stowing equipment.	(4) As the SL, No. 2, and No. 3 return equipment, stows it in the crew equipment compartment. (5) Closes and latches the compartment doors and notifies No. 1 that the launching station deck is clear. (6) Reports, EQUIPMENT READY.
(7) Receives reports from squad as their tasks are completed.	(4) Sets and holds the ERECT/OFF/RETRACT			

	switch at RETRACT until the mount is fully retracted. (5) Sets all mount controls as shown in table 4–4. (6) Opens canopy, dismounts, closes and latches canopy. (7) Replaces missile dome protectors. (8) Sets MCP controls as shown in table 4–4. (9) Assisted by No. 3, raises and locks vehicle tailgate. (10) Reports, MOUNT READY.		(6) Assists No. 1 in raising and locking tailgate.	
(8) When the squad has reported ready, commands, MOUNT. (9) When No. 2 has mounted, transfers communications to No. 2. (10) Inspects Chaparral to insure that all equipment is secured. (11) Mounts cab through right door, takes over communications, and commands, START ENGINE. (12) When engine is started, commands, MOVE OUT. (13) Directs No. 2 in operating the vehicle.	(11) Mounts cab through right door after No. 3.	(7) Mounts cab through left door and puts on headset. (8) Returns communications to SL, takes off headset. (9) Starts engine, reports, READY. (10) Drives Chaparral over the directed route.	(7) Mounts cab through right door after No. 4.	(7) Mounts cab through right door. (8) Puts on headset and monitors the R–442/VRC.

c. Emergency Displacement. If the firing of missiles during an engagement discloses the location of the position and draws enemy fire, the squad may have to displace immediately. In this case the emergency displacement should be conducted as follows:

SL	No. 1	No. 2	No. 3	No. 4
(1) Using the intercom, commands, EMERGENCY MARCH ORDER. (2) Orders communications lines cut if necessary. (3) Returns to the vehicle at double time, carrying TADDS, remote control unit, and binoculars. (4) Orders stowage of the required blast shields.	(1) Turns MODE switch to STANDBY. (2) Remains in mount during displacement. (3) Scans area for indications of a probable ground attack.	(1) Returns to vehicle at double time, carrying binoculars and telephone. Places equipment in vehicle cab. (2) Stows the required blast shields assisted by Nos. 3 and 4. Takes driver's	(1) Returns to vehicle at double time, carrying field telephones. (2) Recovers as much wire as time permits, cuts wire and returns reel units to the vehicle cab. (3) Assists No. 2 in stowing required blast shields.	(1) Recovers as much wire as time permits, cuts wire and returns to vehicle and places reel unit in vehicle cab. (2) Assists No. 2 in stowing blast shields.

SL	No. 1	No. 2	No. 3	No. 4
		position in the cab. (3) Starts engine.	(4) Climbs on launching station deck to secure equipment during travel. (5) Scans the area for indications of a probable ground attack.	(3) Climbs on launching station deck to secure equipment during travel. (4) Scans the area for indications of a probable ground attack.
(5) Establishes communications with platoon headquarters when squad is loaded. Directs No. 2 to alternate position.		(4) When directed, moves vehicle and drives to new location.		

7-10. Missile Reloading

a. As soon as possible following an engagement, the empty rails should be reloaded. Missile reloading drill is as follows:

Note. The missile weighs 190 pounds and requires four men to handle and support when the missile case clears the storage bin.

SL	No. 1	No. 2	No. 3	No. 4
(1) Commands, MISSILE RELOAD, FALL IN.	(1) Falls in 1 meter behind the left vehicle track.	(1) Falls in, dressing on No. 1.	(1) Falls in, dressing on No. 2.	(1) Falls in, dressing on No. 3.
(2) Commands, RELOAD.	(2) Falls out and, assisted by No. 2, lowers vehicle tailgate.	(2) Falls out and assists No. 1 in lowering tailgate.	(2) Falls out, opens fin storage compartment, and removes the safety pins and streamers and hands them to No. 2.	(2) Falls out, opens the storage bin containing first missile to be loaded.
(3) Designates the missile to be loaded, based on gyro running time. (4) Supervises and directs the reloading procedures, assisting as required.	(3) Energizes prime-power subsystem and conditions the mount for loading. (4) Sets MASTER POWER switch at OFF and observes that the MASTER POWER lamp goes out.	(3) Climbs on launching station deck, opens umbilical latch access door on launch rail to be loaded, removes sheared umbilical cable. (4) Inspects launch rails, cleans them if needed.	(3) Removes rail cleaning equipment and places it on the launching station deck. (4) Removes required wings and fins from storage and places them on launching station deck.	(3) Disconnects heater cable between the missile case and storage compartment.
	(5) Takes position in front of storage bin containing first missile to be loaded.	(5) Installs safety pins and streamers on all launch rails. (6) Verifies that detent pins on empty rails are in the retracted position.	(5) Removes the required tools and places them on launching station deck.	
(5) Positions himself to assist in lifting and guiding the missile onto launch rail. (6) Cautions squad to be prepared to take weight of the missile as it clears the storage bin.	(6) Assists No. 4 in pulling missile case out until warning stripe appears.	(7) Climbs down and takes a position behind No. 1.	(6) Climbs on launching station deck and assists No. 2 as required. (7) Climbs down and takes position behind No. 2.	(4) Assisted by No. 1, grasps the extractor handle and pulls the missile case out of storage bin until the warning stripe is exposed.
	(7) Assists Nos. 2, 3, and 4 in removing the missile	(8) Assists Nos. 1, 3, and 4 in removing the missile	(8) Assists Nos. 1, 2, and 4 in removing the missile	(5) When Nos. 1, 2, and 3 are in position, remove

	case from the storage bin.	case from the storage bin. (9) Releases case clasps and helps remove the case lid. (10) Assists in removing the missile from case.	case from the storage bin. (9) Releases case clasps and helps remove the case lid. (10) Places case lid on launching station deck. (11) Assists in removing missile from case.	missile case from storage bin.
(7) Assists in removing missile from its case and supporting its weight. (8) Disconnects the heater cable from the umbilical cable and stores it in missile case.	(8) Assists SL, Nos. 2 and 3 to support the missile weight and rest one end on the tailgate. (9) Climbs to the launching station deck. (10) Verifies that the umbilical assembly access door is open.			(6) Supports end of missile case clear of ground by holding extractor handle.
	(11) Guides the missile and engages the hanger lugs. (12) Pushes the missile against the butt plate to engage the rear snubber and detent pin.	(11) Assists in supporting the missile while it is being engaged to launch rail. (12) When missile is supported by the rail, climbs on the launching station deck.	(12) Assists in supporting the missile while it is being engaged to launch rail. (13) When missile is supported by the rail, climbs on the launching station deck.	(7) Assists in supporting the missile while it is being engaged to launch rail. (8) When missile is supported by the rail, climbs on the launching station deck.
	(13) Checks for proper detent pin engagement. (14) Engages umbilical retractor assembly and connects the umbilical cable to the launch rail umbilical connector.	(13) As No. 3 attaches wings, uses the torque wrench to secure retaining screws. (14) Returns the torque wrench to the wing and control fin compartment door.	(14) Attaches the wings (the rolleron wings are attached opposite each other).	(9) Attaches control fins to the missile.
(9) Checks that missiles are properly loaded and empty missile cases are returned to the storage bins.	(15) Checks that wings and control fins are properly installed, rolleron protectors are off, and missile dome protectors are on. (16) Sets LOADING SAFETY switch at PWR ON and MASTER POWER switch at ON. (17) Enters the gunners compartment; energizes the mount. (18) Performs missile checkout, as described for No. 1 in para 7–7*a*(16), assisted by No. 3.	(15) Assists No. 4 in closing the missile case and returning them to the storage bins.	(15) Obtains IR flashlight from wing and fin storage compartment. (16) Assists No. 1 in checking new missile. (17) Secures IR flashlight and closes the wing and fin storage compartment.	(10) Closes the empty missile cases and returns them to the storage bins, assisted by No. 2.

b. The procedure outlined in *a* above will be repeated for each missile. The reloading drill should be practiced until the crew can reload four missiles in 8 minutes or less. This time does not include missile checkout.

7–11. Missile Unloading

a. To control gyro running time on the missiles carried by the Chaparral system, the missiles are rotated periodically from storage to the launch rails. This requires that missiles be unloaded from the rails and returned to storage.

b. Missile unloading is accomplished as follows (it is assumed the system has a full basic load of missiles and all launch rails and storage bins contain missiles):

SL	No. 1	No. 2	No. 3	No. 4
(1) Commands, MISSILE UNLOAD, FALL IN. (2) Selects missile to be unloaded and the storage bin in which it will be placed. (3) Designates launch rail to be unloaded. (4) Designates the temporary disposition of the missile in the storage bin.	(1) Falls in 1 meter behind left vehicle track.	(1) Falls in, and dresses on No. 1.	(1) Falls in, and dresses on No. 2.	(1) Falls in, and dresses on No. 3.
(5) Commands, UNLOAD. (6) Supervises the unloading procedures, assisting as required.	(2) Falls out and, assisted by No. 2, lowers vehicle tailgate. (3) Energizes the launching station and conditions the mount for loading.	(2) Falls out and assists No. 1 in lowering vehicle tailgate.	(2) Falls out, opens fin storage compartment door, removes the torque wrench and Allen wrench and lays them on the deck.	(2) Falls out and opens the door to the missile storage compartment designated by the squad leader. (3) Grasps the extractor handle and pulls the missile case out of the compartment until warning stripe is exposed.
	(4) Moves to the designated storage bin to assist in unloading missile. (5) Assists Nos. 2, 3, and 4 in removing the missile from the storage compartment.	(3) Moves to the designated storage bin. (4) Assists Nos. 1, 3, and 4 in removing the missile case from storage.	(3) Moves to the designated storage bin. (4) Assists Nos. 1, 2, and 4 in removing the missile case from storage.	
(7) Disconnect the missile heater cable.		(5) Unlocks the case clasps and removes the case lid.	(5) Assists No. 2 in removing the case lid and places the lid on the launching station deck.	(4) Supports one end of the missile case while the other end rests on the tailgate.
	(6) Assists the SL and Nos. 2 and 3 in removing the missile from the case.	(6) Assists the SL and Nos. 1 and 3 in removing the missile from the case.	(6) Assists the SL and Nos. 1 and 2 in removing the missile from the case.	(5) Sets the end of the missile case on the ground and climbs on the launching station deck.

The SL and Nos. 1, 2, and 3, move the missile to the designated spot and place it on the missile chocks.

	(7) Climbs on the launching station deck. (8) Opens the umbilical assembly door and disconnects the umbilical cable. (9) Obtains the detent latch lever and rotates the detent pin to the retracted position. (10) Assisted by Nos. 2, 3, and 4, slides the missile forward until it clears the rail.	(7) Obtains the torque wrench and, assisted by No. 3, removes the missile wings and lays them on the launching station deck. (8) Assists Nos. 1, 3, and 4 slide the missile forward off the rail.	(7) Assists No. 2 in removing the missile wings. (8) Assists Nos. 1, 2, and 4 slide the missile forward off the rail.	(6) Obtains the Allen wrench from the deck and removes the missile control fins. (7) Assists Nos. 1, 2 and 3 slide the missile forward off the rail.
(8) Attaches the heater cable to the missile; assists Nos. 1, 2, and 3 to place the missile in the empty case.	(11) Assisted by the SL and Nos. 2, and 3, places the missile in the empty case.	(9) Assists SL and Nos. 1 and 3 place the missile in the empty case.	(9) Assists SL, and Nos. 1 and 2 place the missile in the empty case.	(8) Releases hold on the missile and picks up the end of the empty missile case.

The case is closed, returned to the missile storage compartment, and locked into place. The new missile is now loaded in accordance with paragraph 7–10.

7–12. Swim Kit Installation and Removal

These procedures train the soldier to correctly install and remove the swim kit.

a. Installation of Swim Kit.

SL	No. 1	No. 2	No. 3	No. 4
(1) Commands, INSTALL SWIM KIT. (2) Supervises the squad during checks and installation of the swim kit. Assists when necessary.	(1) Assisted by No. 3, lowers tailgate and inspects the seal between the hull and tailgate. (2) Assisted by No. 3, removes the left storage tray, removes the flotation curtain and stanchions, and places them on the deck. (3) Assisted by No. 3, installs stanchions and end beam.	(1) Assisted by No. 4, inspects access plates in hull for a snug fit and that seals are in place; checks bilge pumps for proper operation; and checks the track shrouds for proper installation. (2) Assisted by No. 4, remove the end, side, and tailgate strips from the hull.	(1) Assists No. 1. (2) Assists No. 1, slides out the right storage tray, and removes the end beam and brackets; lays them on the deck. (3) Assists No. 1.	(1) Assists No. 2. (2) Assists No. 2.
(3) Assists No. 1.	(4) Assisted by SL, Nos. 1, 2, and 3, unfolds flotation curtain and inspects for cracks or holes. Checks the rope looped through the holes at top of curtain.	(3) Assists No. 1.	(4) Assists No. 1.	(3) Climbs onto launching station deck and prepares to hang flotation curtain.
(4) Assists No. 1.	(5) Assisted by SL, Nos. 1, 2, and 3, positions the	(4) Assists No. 1.	(5) Assists No. 1.	(4) As the rest of the squad, positions the curtain,

	flotation curtain around the hull, starting at the right front corner of the launching station. (6) Starting at the right front corner of the launching station deck (rear of the engine) alines the holes in the curtain, end piece, and hull, and inserts the mounting screws. (7) Assisted by No. 3, attaches the side strips, tailgate strips, and the final end strip (left front), and tightens the screws. (8) Obtains the exhaust extension from the cab and, assisted by No. 3, removes the regular extension and attaches the swim kit exhaust extension.	(5) Assists No. 1 in alining holes in the flotation curtain, hull, and end strip. (6) Assists No. 4 in drawing the curtain taut (vertically) as No. 1 and No. 3 attach mounting strips.	(6) Tightens the mounting screws. (7) Assists No. 1. (8) Climbs onto the engine grille and assists No. 1 in mounting the exhaust extension.	hangs a loop of rope over each stanchion and the end beam to support the curtain. (5) Assisted by No. 2, draws the curtain taut (vertically), loops and tightens the rope over each stanchions and tightens the loops on the end rail. The slack rope is taken up at the right rear, left rear, and left front corners of the curtain.)
(5) Inspects the Chaparral swim kit.	(9) Takes mounted position in cab.	(7) Secures the tools. (8) Takes mounted position in cab.	(9) Takes mounted position in cab.	(6) Takes mounted position in cab.

b. Removal and Storage of Swim Kit After Water Crossing.

SL	No. 1	No. 2	No. 3	No. 4
(1) Commands, REMOVE AND STORE SWIM KIT. (2) Supervises the duties of the squad, assisting when necessary.	(1) Assisted by No. 3, removes the end, side, and tailgate mounting strips. (2) Assisted by No. 3, shakes the water from the flotation curtain.	(1) Assisted by No. 4, inspects vehicle for damage and checks the operation of bilge pumps.	(1) Obtains the necessary tools and assists No. 1. (2) Assists No. 1.	(1) Assists No. 2.
(3) Assists in removal and folding of the flotation curtain.	(3) Assisted by SL, Nos. 2 and 3, folds the flotation curtain keeping the adhesive strip clear of the ground. Places the folded curtain on the launching station deck. (4) Removes the stanchions from their emplaced positions; lays them on the deck.	(2) Assists No. 1. (3) Replaces side and end strips using the existing hardware.	(3) Assists No. 1. (4) Dismantles the end beam and mounting brackets; lays them on the deck.	(2) Climbs on the launching station deck and unhooks the rope as SL and Nos. 1, 2, and 3 fold the curtain. (3) Replaces side and end strips using the existing hardware.

	(5) Assisted by No. 3, lowers tailgate, pulls out the storage trays, places the folded curtain and stanchions in the left storage tray; replaces storage tray, and closes tailgate. (6) Removes swim kit exhaust extension.	(4) Replaces tailgate strips, assisted by No. 4. (5) Stores the tool kit.	(5) Assists No. 1 to lower the tailgate, pulls out the storage trays, places the end beam brackets in the right storage tray, returns the storage tray, and closes tailgate. (6) Replaces the normal exhaust extension.	(4) Assists No. 2 in replacing tailgate strips.
(4) Inspects the Chaparral for correct storage of equipment.				

CHAPTER 8

SYSTEM MAINTENANCE AND SUPPORT

8-1. General

Organizational maintenance is that maintenance which is the responsibility of, and performed by, a using organization on its assigned equipment. Squad members are personally responsible for the maintenance of the Chaparral weapon system and additional items of equipment issued with it. Battery maintenance personnel have the duty and responsibility of assisting squad personnel in the performance of equipment maintenance and of supplying inspection, advisory, and repair services to the squad.

8-2. Purpose

The purpose of preventive maintenance services is to detect the first signs of electrical and mechanical failure and to insure that appropriate corrective action is taken before expensive and time-consuming repairs or replacements are required. Effective preventive maintenance results from frequent inspection and service of equipment by operators and by battery, battalion, and support maintenance personnel under the active supervision of commanders at all levels.

8-3. Operator Maintenance

Two types of recorded preventive maintenance are prescribed for all equipment periodically. The first type is a daily or weekly service performed by the squad. The second type is monthly or quarterly, as required, performed by the squad and supervised by the organizational maintenance personnel.

a. Daily Preventive Maintenance Service. Each major item of equipment will be inspected and, if necessary, serviced each day it is operated. Daily maintenance is divided into three parts:

(1) *Before-operation service.* This is a brief service to ascertain that the equipment is ready for operation. It is mainly a check to see if conditions affecting the equipment's readiness have changed since the last after-operation service.

(2) *During-operation service.* This service consists of detecting unsatisfactory performance. While operating the equipment, the operator should be alert for any indication of malfunction of any part of the equipment.

(3) *After-operation service.* This service consists of correcting any deficiency noted during operation. If applicable, it also includes cleaning and properly stowing the equipment.

b. General Procedures. The following general procedures apply to operator and crew preventive maintenance services and to all inspections of equipment.

(1) Inspection to see if items are in good condition, correctly assembled or stored, secure, not excessively worn, not leaking, and adequately lubricated is a maintenance requirement for most items of equipment and should be performed automatically by the user as a general procedure.

(*a*) Inspection for good condition is usually a visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. Good condition means that a component or part is not bent, twisted, chafed, burred, broken, cracked, bared, frayed, dented, collapsed, torn, cut, or deteriorated.

(*b*) Inspection of an item to see that it is correctly assembled or stowed is usually a visual inspection to see if the item is in its normal position and if all of its parts are present and in their correct relative positions.

(*c*) Inspection of an item to determine if it is secure is usually a visual examination or a check by hand, wrench, or prybar for looseness. Such an inspection must include any brackets, lockwashers, locknuts, locking wires, cotter pins, straps, buckles, and protective covers, as well as any connecting tubes, hoses, or wire.

(*d*) Excessively worn means worn beyond serviceable limits or to a point likely to result in failure if the item is not replaced. Excessively worn includes illegibility as applied to markings, data on caution plates, and printed matter.

(2) Any special cleaning instructions required for specific equipment are contained in the publications pertinent to the equipment. General cleaning instructions are as follows:

(*a*) Use dry cleaning solvent or mineral

spirits paint thinner to clean or wash grease or oil from all metal parts, except those exposed to powder fouling during firing.

(*b*) Use solvent cleaning compound (CR) to clean parts exposed to powder fouling.

(*c*) A solution of one part grease-cleaning compound to four parts of dry-cleaning solvent or mineral spirits paint thinner may be used for dissolving grease and oil from engines and engine compartments. After cleaning, use cold water to rinse off any solution remaining on the item being cleaned.

(*d*) After parts are cleaned, rinse and dry them thoroughly. Apply a light grade of oil to all unprotected metal surfaces (other than optical instruments) to prevent rusting.

(3) General precautions in cleaning are as follows:

(*a*) Dry-cleaning solvent and mineral spirits paint thinner are flammable and should not be used near an open flame. Fire extinguishers should be provided nearby when these materials are used.

(*b*) These cleaners evaporate quickly and have a drying effect on the skin. If used frequently, cracks in the skin and, in some individuals, a mild irritation or inflammation of the skin may result.

(*c*) Avoid getting petroleum products, such as dry-cleaning solvent, mineral spirits paint thinner, engine fuels, or lubricants, on rubber parts because they tend to cause rubber to deteriorate.

(*d*) The use of diesel fuel oil, gasoline, or benzene (benzol) for cleaning is prohibited.

(*e*) The use of water, steam, or air under high pressure for cleaning the interior of the carrier hull or launching station is prohibited.

c. Specific Maintenance Procedures. Specific operator maintenance procedures for major items of equipment common to the Chaparral system are presented in detail in Department of the Army technical manuals as listed in appendix A.

8–4. Maintenance Support

Maintenance support of the Chaparral squad in the field and in garrison is provided by the battery headquarters maintenance sections and by direct support units organic to or attached to the division maintenance battalion.

a. The battery maintenance sections provide organizational level maintenance assistance to the squads to include preventive maintenance; adjustments; alinements; and replacement of certain components, assemblies, subassemblies, and piece parts on a direct exchange basis as prescribed in the appropriate technical and supply manuals. Certain organizational level maintenance assistance functions (such as preventive maintenance services) are performed on a scheduled periodic basis and require that arrangements be made as to the time and place they are to be performed. In combat situations arrangements for the accomplishment of scheduled preventive maintenance are usually made by the platoon leader and include consideration of the tactical situation; time the fire unit will be inoperative; location of the tools, test equipment and other required facilities; and distance and routes. Normally, in combat situations, these maintenance services will be performed at night. The principles that organizational maintenance will be performed as close to the point of failure as possible and that mission accomplishment has first priority will be governing factors in arranging for maintenance services. In garrison situations the time and place for the performance of organizational level maintenance may be established by SOP. Usually, the fire unit squad will accompany the system to assist organizational maintenance in the performance of maintenance services.

b. Direct support maintenance services for Chaparral fire units are obtained by request through the platoon leader to the battery maintenance section. If the battery maintenance section determines that the required services are beyond the scope of organizational maintenance, it will request assistance from the appropriate direct support unit. If possible this support will be provided by a contact team at the point of failure. If the contact team cannot repair the failure, it will determine if the system can remain in service or if it must be evacuated to a direct or general support facility for repair. The guiding principle for all maintenance support operations is minimum interruption of the ADA mission.

8–5. Equipment Serviceability Criteria (ESC)

The ESC furnishes the squad, platoon, or battery with a procedure for evaluating the readiness condition of the equipment to perform satisfactorily for 90 days with normal maintenance support. Application of the procedure does not eliminate or reduce the requirement for prescribed maintenance service on the equipment and does

not authorize replacement of components. A detailed explanation and grading criteria is found in TM 9–1425–585–ESC.

8–6. Supply

The Chaparral squad and platoon have no organic supply capabilities. The battery has a limited supply capability and must rely on the battalion S4 for its support.

a. Supply categories are organized in 10 classes as follows:

(1) I. Subsistence.

(2) II. Clothing, individual equipment, organizational tool sets and kits, and household supplies.

(3) III. Petroleum, oil, and lubrication.

(4) IV. Construction.

(5) V. Ammunition.

(6) VI. Personal demand items.

(7) VII. Major end items.

(8) Medical material including medical repair parts.

(9) Repair parts (less medical).

(10) Material to support nonmilitary programs.

b. Since the battery is the lowest unit that can stock material, the battery supply will requisition and receive supplies from the battalion S4. The amounts of any class of supply stocked will depend on the authorized usage, available space and, in the case of some foodstuffs, the time the item can be stored before it spoils.

c. During periods of garrison duty, supply of a Chaparral squad does not present a problem. However, in either field or combat situations, supply procedures must be coordinated as to how, when, and where the squad will be resupplied. Normal resupply for combat duty will be done at night and at a place previously designated by the platoon leader through coordination with the battery commander.

CHAPTER 9

OPERATION UNDER ADVERSE CLIMATIC CONDITIONS

9–1. General

The Chaparral system can operate effectively under adverse climatic conditions provided the equipment is properly prepared for the condition expected and the crew is trained in the special techniques and procedures required. The scope of this manual precludes the presentation of detailed instructions for operation under adverse environmental conditions but makes reference to appropriate field manuals and technical manuals that should be consulted for this information.

9–2. Extreme Cold

a. Extremes of cold affect both men and materiel. In extreme cold a man can become numb and indifferent, neglecting essential tasks. Under some conditions exposure, even for a few minutes, can cause death. If Chaparral is to be deployed to areas where extreme cold is to be expected, personnel serving the weapon must be trained in cold weather operations and survival. (Detailed information on military operations in cold weather are contained in FM 31–70 and FM 31–71.)

b. Extreme cold may cause lubricants to thicken or congeal, batteries to freeze or to furnish insufficient current for equipment operation, insulation to crack, electrical circuits to short, and reduced vaporization of fuel. Also, extreme cold will cause various materials to become hard and brittle so that they are easily damaged and broken. Chaparral is designed to operate at temperatures down to −50° F., provided it is properly winterized and maintained, and special cold weather operation instructions contained in the appropriate technical manuals are observed. Cold weather operation and maintenance instructions for the Chaparral launching station are contained in TM 9–1440–585–12. TM 9–207 contains general information on the winterization of equipment. Cold weather operation and maintenance instructions for the Chaparral vehicle M730 are contained in TM 9–1450–585–10. Special driving instructions for operating tracked vehicles under unusual conditions are contained in TM 21–306.

c. A tactical consideration in cold weather operations is that extreme cold may increase IR acquisition range because of low atmospheric moisture content and low background noise generation.

9–3. Extreme Heat

a. Extreme heat may be encountered either in desert areas or in tropic or subtropic jungles. Chaparral is designed to operate at temperatures up to +120° F. In desert areas heat is usually accompanied by a very low humidity in association with dust and sand. In the tropics heat is usually accompanied by oppressive humidity and lush vegetation. In both areas special operating techniques and procedures are required to insure personnel efficiency and equipment effectiveness.

b. Military operations in desert and jungle areas and the techniques of personnel survival are covered in FM 31–25 and FM 31–35, respectively.

c. The main effect of extreme heat on materiel and equipment is overheating during operation. This can be avoided by insuring that good ventilation is always provided, cooling systems are operating properly, filters are clean, and ventilation louvers and passages are open and clean. Also, continuous operation at high speeds should be avoided and equipment should be shielded as much as possible from the sun. If operation is in a hot, humid environment, equipment is subject to rapid rusting and accumulation of fungus. Make frequent inspections and clean and lubricate to prevent excessive deterioration. A humid environment will also require frequent renewal of the desiccant used in the air purification system. Sand and dust encountered in a hot desert environment can damage or jam moving parts. In this case equipment should be covered to prevent entry of sand into engine compartments and excess lubricants should be wiped off exposed surfaces to prevent adhesion of sand or

dust particles. Special maintenance instructions for equipment operated in a tropical environment are contained in FM 31–35, and for desert conditions in FM 31–25. The basic system technical manuals, TM 9–1440–585–12 and TM 9–1450–585–10, provide additional information on operation and maintenance under conditions of extreme heat.

d. A tactical consideration for operating in a hot, humid environment is that atmospheric absorption of IR radiations will increase, resulting in reduced IR acquisition ranges.

CHAPTER 10

WATER-CROSSING OPERATIONS

10–1. General

During some operations it may become necessary for the Chaparral squad to cross rivers and streams, a capability which the system has under certain conditions. This chapter outlines certain techniques and procedures that the Chaparral squad leader should use during water-crossing operations.

10–2. Considerations Before Crossing

Upon reaching a river or other water obstacle, the Chaparral platoon sergeant, section leader, or squad leader should follow a definite sequence or checklist to insure a successful crossing without delay or mishap. This sequence is as follows:

a. Determine the stream characteristics and velocity.

b. Determine bank conditions at the entrance to the stream.

c. Select landing points on the far shore and determine the bank condition at those points.

d. Determine the point at which the vehicle must enter the stream so that it will arrive at the selected landing point. Vehicle speed, stream velocity, and stream width are factors in determining the distance that the vehicle will drift downstream as it crosses.

e. Insure that the Chaparral vehicles are checked properly before they enter the water and after leaving the water. (For detailed procedures on preparing the vehicle for water operations, refer to paragraph 10–7 and to TM 9–1450–585–10).

10–3. Stream Characteristics

Stream characteristics that must be considered are changes in velocity, channels, and debris that may be present.

a. Changes in Velocity. A sluggish stream or river may become a torrent in a few hours or minutes as a result of a heavy rainfall. This is quite likely in tropical regions or mountainous areas. Stream velocities must be checked at frequent intervals to provide warning of such drastic changes that may endanger the crossing.

b. Channels. Velocities of the stream may vary in different parts of the stream. The rate of flow is usually slowest near the shore and fastest in the main channel.

c. Debris. Fast-moving streams often carry large quantities of logs, brush, and other debris. In cold climates, chunks of ice may be floating in the stream. Debris can be a serious hazard to the Chaparral vehicle in river crossings, as a single piece can foul a track and put the vehicle out of control.

10–4. Determining Stream Velocity

The maximum velocity of a stream in which the Chaparral vehicle can be operated safely depends on such factors as the choppiness of the water, amount of debris or ice in the water, and maximum downstream drift distance that the unit can accept. When the rate of flow is greater than 4 miles per hour, the leader must pay particular attention to drift distance, balance of loads on the vehicles, entry into the water, and ability of the drivers. A simple way to determine stream velocity is to observe the time required for a floating device, such as wood, cork, or empty ammunition can, to move a measured distance. Measure a distance of at least 100 feet along the near river bank. Designate the upstream end as point A, and the downstream end as point B. At point A, throw any object that will float into the fastest part of the stream. Using a stopwatch or the second hand of a watch, determine the time it takes for the floating object to travel from point A to point B (fig 10–1). Divide the number of feet the object travels by the number of elapsed seconds. For example, if it takes 20 seconds for the object to travel the 100 feet, the rate of flow of the stream is 100 feet/20 seconds = 5 feet per second. This figure in feet per second must then be converted into miles per hour or knots, using the conversion chart shown in figure 10–2. To convert feet per second to miles per hour without using the table, mul-

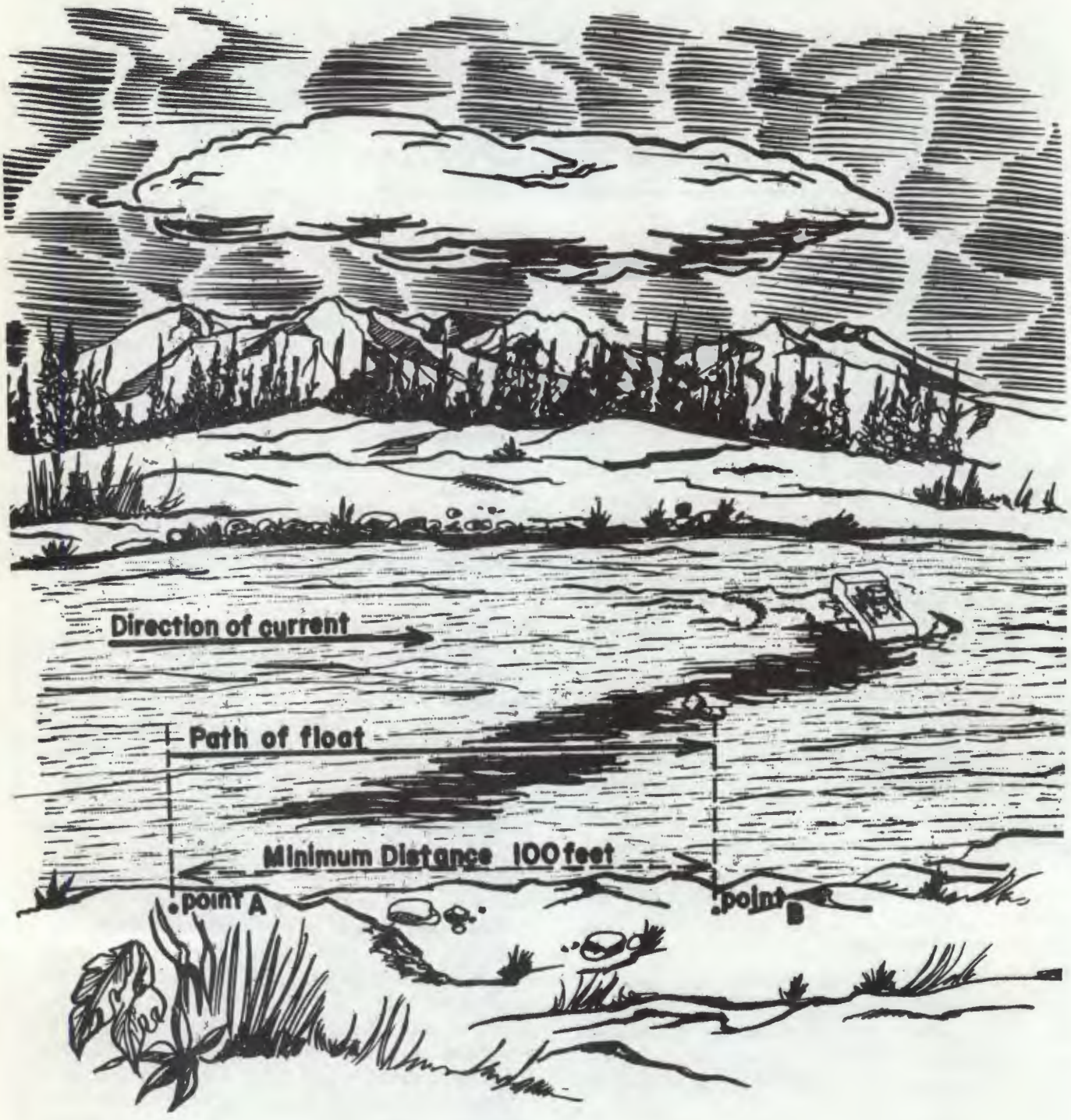


Figure 10–1. Determining stream velocity.

tiply feet per second by 0.68; to convert to knots, multiply feet per second by 0.6. At least two tests should be made with floating objects and the average rate of flow in feet per second used.

10–5. Bank Conditions and Slope at Entrances and Exits

The squad leader must determine the condition of the banks at both entrance and exit points and the degree of slope that the vehicle must descend and ascend.

a. Bank Conditions. Banks can often be improved by using pioneer tools issued as part of the Chaparral vehicle equipment, or by using earth-moving equipment if engineer support is

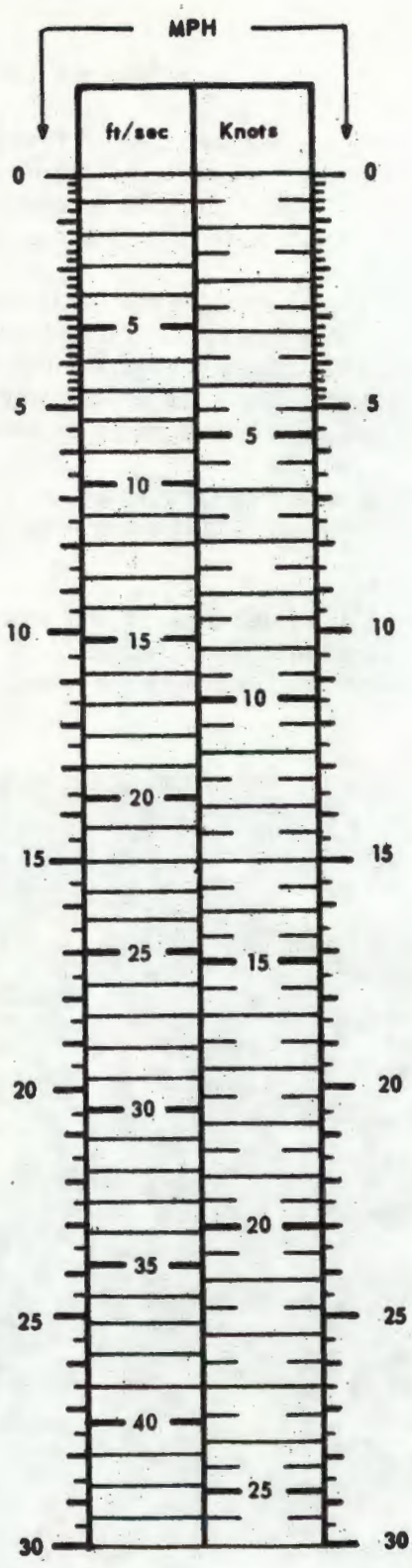


Figure 10–2. Velocity conversion chart.

available. Entrances into the water may be improved by laying logs (corduroying).

b. Slope of Entrances and Exits. Gently sloping entrances and exits are desirable. However, even on the most gradual slopes, the Chaparral vehicle must enter the water slowly (approximately 2 mph) to avoid a large bow wave. When descending banks, the vehicle tends to dive unless the approach is slow enough to allow the bow to float. The most common way to express slope is in percent (fig 10–3). For example, a 1 percent slope rises or descends 1 unit in 100 units of horizontal distance; a 10 percent slope rises or descends 10 feet in 100 feet, or 10 yards in 100 yards. The formula to determine percent slope is as follows:

$$\frac{\text{Vertical distance}}{\text{Horizontal distance}} \times 100 = \text{Slope in percent}$$

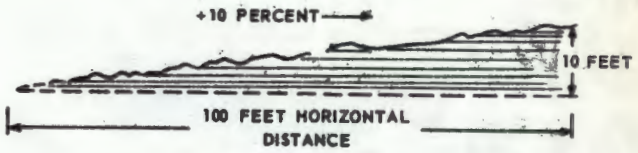


Figure 10–3. Percent of slope.

10–6. Determination of Landing Point

Because of drift caused by stream current, the squad leader must determine at what point his vehicle will arrive on the far bank.

a. The bow of the Chaparral vehicle should be pointed directly across the stream, perpendicular to the river current, except when the speed of the stream is greater than the speed of the vehicle. Then the bow of the vehicle may be pointed upstream (into the current) at an angle of not more than 30°. When the speed of the vehicle and the speed of the current are the same, and the vehicle is pointed directly across, the vehicle drifts 1 foot downstream for each foot it moves forward. When the speed of the current is twice that of the vehicle, the vehicle will drift downstream 2 feet for each foot it moves forward.

b. A simple formula for determining the point of landing on the far bank is as follows:

$$\frac{\text{Stream velocity (mph)}}{\text{Speed of vehicle (mph)}} \times \text{Distance across stream in feet} = \text{Distance of downstream drift of vehicle in feet.}$$

For example, a Chaparral vehicle traveling at 4 miles per hour in a stream that has a velocity of 4 miles per hour and is 100 feet wide will land 100 feet downstream from the point of entry into the water.

c. The maximum speed of the Chaparral vehi-

cle in water is approximately 4 miles per hour. When traveling at approximately 4 miles per hour in water, the speedometer should indicate approximately 12 miles per hour. This difference of 3 to 1 is caused by the difference in traction of the tracks on land and in water.

10-7. Preparing Chaparral for Water Crossing

The Chaparral can ford streams that do not exceed a depth of 40 inches or, if a swim kit is installed, can swim providing the height of the waves do not exceed 1 foot.

a. Fording. Prior to fording a stream the following is accomplished:

(1) Tailgate and cab doors are closed.

(2) Hull drain plugs and service access doors are checked for tightness.

(3) Bilge pumps are turned on and checked to insure that air is blowing from the pump exhaust.

(4) When entering water, select firm ground free of rocks, stumps, or debris. Avoid soft ground or steep grades where the vehicle may become mired or skid. Enter water slowly and at a right angle to the bank.

(5) All fording in water near 40 inches deep should be done at a slow speed of 3 to 4 miles per hour to avoid forming a bow wave. Control vehicle speed and transmission range so that waves and splashes do not cause water depth to exceed 40 inches.

(6) When emerging from water, try to select a gentle slope to avoid taking water over the tailgate.

b. Swimming. Preparation of the vehicle for swimming is accomplished as follows:

(1) Tailgate and cab doors are closed.

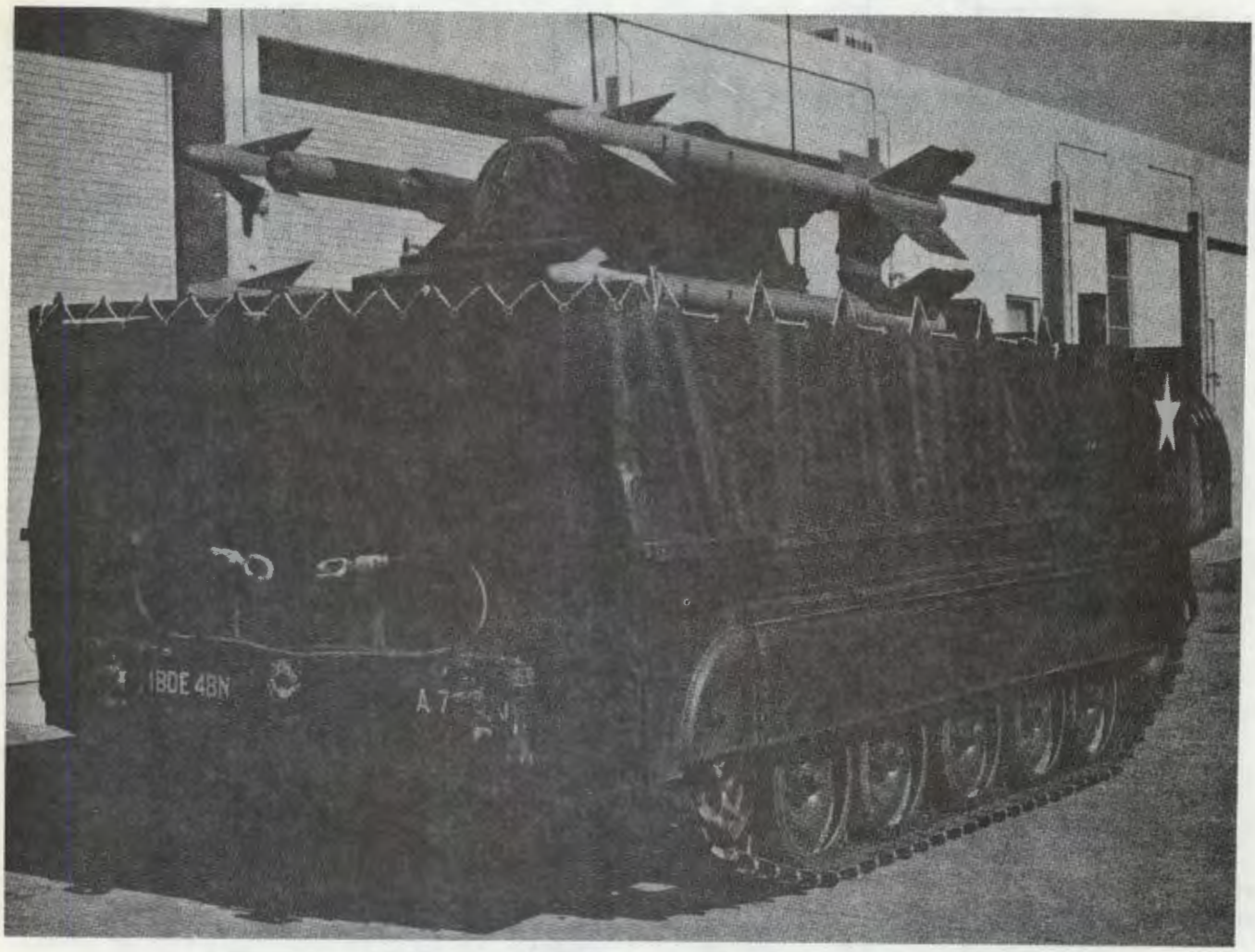


Figure 10-4. Chaparral with swim kit installed.

(2) Hull drain plugs and service access doors are checked for tightness.

(3) Swim kit is removed from storage trays.

(4) Stanchions are installed in receptacles in the hull.

(5) Flotation curtain is bolted to the hull with the hardware provided in the kit.

(6) Rope attached to the top of the flotation curtain is looped over the top of each stanchion and end beam and tightened until the curtain is smooth.

(7) Engine exhaust extension is attached.

(8) The operation of the bilge pumps is checked. If no water is in the bilges, air should blow from the pump exhaust.

10-8. Entering Water

Caution: **Do not enter water with high, choppy waves. They may wash over the sides of the vehicle and flood the launching station. Operation in waves exceeding 1 foot in height should be avoided if possible.**

a. When possible, select firm ground free of rocks, stumps, or debris, on which to enter the water. Avoid soft ground or steep grades where the vehicle may lose traction and may become mired or skid. Inspect entry point for underwater obstacles.

b. When entering from a firm, gradual slope into water deep enough to float the vehicle, use range 1 and a speed of not more than 2 miles per hour.

c. When entering water from a steep slope, or a slope with obstacles, enter at a speed of not more than 2 miles per hour to avoid forming a bow wave. Maintain a close watch to see that water does not enter the intake and exhaust grills. If water appears to be swamping the vehicle and it is not committed to the water, back off; if the vehicle is committed, accelerate to raise front of vehicle and become waterborne as soon as possible.

10-9. Driving in Water

The two general methods of crossing a stream are in echelon when multiple units must cross in one move, and in column when multiple units cross one at a time.

a. Echelon. If the mission requires that multiple vehicles cross in one move, the best method is echelon. Echelon left is used when the stream flows left to right and echelon right is used when the stream flows right to left. The Chaparral vehicle farthest downstream moves out first, followed by the next farthest downstream, and so on; the vehicle farthest upstream moves out first, followed by the next farthest downstream, and so on; the vehicle farthest upstream moves out last. Vehicles should be separated by at least 25 feet laterally and from front to rear. This formation insures that upstream vehicles do not drift into downstream vehicles.

b. In Column. If there are insufficient entrances and exists to allow echelon crossing, the column method should be used. In a column crossing, vehicles use the same entrance and exist and maintain at least a 25-foot interval.

c. Driving the Vehicle During Water Crossing. Control and movement of the Chaparral during water crossing will be accomplished by the following:

(1) When one vehicle overtakes another (this is not normal, but may happen when one vehicle is having trouble) it may pass the slower vehicle on either side, provided there is ample space. However, the vehicle being overtaken has the right of way. The passing vehicle should leave the wake of the overtaken vehicle at an angle of at least 45° and should be sure to provide ample passing space.

(2) Keep shift lever in 1–2 range for all water operation except stopping.

(3) Steer vehicle in water as on land. To avoid overshooting turns, release steering levers before turn is complete and allow momentum of vehicle to complete turn.

(4) To cross a slow stream (2 mph or less), head vehicle in any desired crossing direction. The fastest way to cross is to head straight across and allow the stream to carry the vehicle downstream until the far bank is reached. If exit must be made directly across from entry point, head vehicle diagonally upstream and cross.

(5) Crossing a swift stream in a straight line should be avoided. If the vehicle hits an underwater obstacle, the vehicle may roll and take water in through the air intake and exhaust grills. The preferred method for crossing a swift stream is to head the vehicle diagonally upstream.

(6) If the vehicle strikes an underwater obstruction, apply brakes and reduce speed, then shift to R, back off, and go around.

Warning: **Do not try to cross over or go through obstacles; the vehicle may roll or hang up.**

10-10. Stopping in Water

a. To stop the vehicle in water, release the accelerator pedal and pull back on both differential steering levers to brake tracks.

b. When tracks have stopped, release the steering levers, shift to R, and depress the accelerator pedal until forward motion has ceased.

10-11. Leaving Water

a. Avoid mushy, muddy, or steep slopes. Avoid exits where there are large rocks or a considerable amount of debris.

b. Approach shore as squarely as possible and attempt to maneuver the vehicle so that both tracks strike land at the same time.

c. Ease up on accelerator pedal to reduce track speed before striking land and shift to the 1 range when the tracks ground.

Caution: **The critical time during an exit is when the tracks first ground. Once either track strikes, steering becomes difficult until both tracks have enough traction for normal steering.**

d. Climb bank in range 1 and avoid skidding sideways or spinning tracks.

e. When bilge is empty of water, stop bilge pumps.

CHAPTER 11

DESTRUCTION AND DECONTAMINATION

Section I. DESTRUCTION OF EQUIPMENT

11-1. General

a. Destruction of the Chaparral weapon system, when subject to capture or abandonment in the combat zone, will be undertaken only when, in the judgment of the commander concerned, such action is necessary in accordance with orders of, or policy established by, the army commander.

b. The information which follows is for guidance only. Certain procedures outlined herein require the use of explosives and incendiary grenades, which normally may not be authorized item for the system. The issue of these items and related materials and the conditions under which destruction will be affected are command decisions and are governed by the tactical situation. Of the several means of destruction, those most generally applicable are as follows:

(1) *Mechanical.* Requires ax, pick-mattock, sledge, crowbar, or similar heavy implements.

(2) *Burning.* Requires fuel, oil, incendiary grenades, or other flammables.

(3) *Demolition.* Requires suitable explosives or ammunition.

(4) *Gunfire.* Includes artillery, machineguns, rifles using rifle grenades, and launchers using antitank rockets. Under some circumstances hand grenades may be used.

c. In general destruction of essential parts, followed by burning, will usually be sufficient to render the material useless. However, selection of the particular method of destruction requires imagination and resourcefulness in the use of the facilities at hand under the existing circumstances. Time may be a critical consideration.

d. If destruction to prevent enemy use is resorted to, the materiel must be so badly damaged that it cannot be restored to a usable condition in the combat zone either by repair or cannibalization. Adequate destruction requires that all parts essential to the operation of materiel, including essential repair parts, be destroyed or damaged beyond repair. However, when lack of time and personnel prevent destruction of all parts, priority is given to the destruction of those parts most difficult to replace. Equally important, the same essential parts must be destroyed on all like materiel so that the enemy cannot construct one complete unit from several damaged ones.

e. If destruction is directed, due consideration should be given to:

(1) Selection of a point of destruction that will cause greatest obstruction to enemy movement and will prevent hazard to friendly troops from fragments or ricocheting projectiles which may occur incidental to the destruction.

(2) Observation of appropriate safety precautions.

11-2. Destruction of Chaparral System

a. General. Destruction of the Chaparral system should be undertaken only when capture by the enemy appears unavoidable. However, if the equipment is to be destroyed, destruction should be as complete as possible within the available time. For destruction to be effective, it must be planned, systematic, checked, and supervised. Destruction should begin with the destruction of components that will render the equipment inoperative and continue progressively toward total demolition. The factor governing the extent of destruction should be the available time. In every case, missiles on the launch rails and in the stowage compartments must be rendered useless.

b. Procedures. Destruction or rendering the weapon useless will include firing the missiles, smashing components, or burning. The sequence, time permitting, should be:

(1) Point the launchers in the direction of the enemy and fire the missiles on the launch rails.

(2) Smash the mount control panels, tear wiring loose, smash the gunner's sight, and break or bend the gunner's hand control handles.

(3) In the engine generator compartment,

smash the engine block, cylinder head, and generator of the MPU; smash the cylinder head of the missile air compressor.

(4) In the forward compartment, bleed off the air, smash the missile air purification system, master power distribution box, erect/retract motor, and batteries.

(5) In the mount, smash the hydraulic power supply, missile control electronic assembly, mount drive electronic assembly, mount distribution box, and hydraulic pumping unit.

(6) Smash the receiver R-442/VRC.

(7) Lower tailgate and smash the master control panel, tear wiring loose, and smash the receiver-transmitter RT-524/VRC.

(8) Pull missiles out of the left and right missile storage compartments and smash the gyro/optics units, and missile electronic units.

(9) Remove wings and control fins from storage racks and smash rolleron wing gyros. Smash flat-plate wings and fins.

(10) Empty fire extinguisher, cut the fuel line at the MPU, and allow fuel to drain into the base structure.

(11) Remove all circuit diagrams, wiring diagrams, technical manuals, SOP's, SOI's, and other written material and destroy completely by burning.

(12) Check that all vital elements, such as lamps, switches, instruments, valves, and control levers and handles, have been rendered useless.

(13) Prepare the vehicle for destruction by burning as outlined in TM 9-1450-585-10.

(14) Open all doors and hatches to admit air for combustion and pour fuel and oil over the entire system. Ignite by means of an incendiary grenade fired from a safe distance, a burst from a flame thrower, a combustible train of suitable length, or other appropriate means.

(15) Take cover immediately. Rocket motors may explode when ignited, and explosive ammunition, if present, constitutes a hazard. The danger zone extends approximately 500 yards.

(16) Demolition of explosives will be accomplished in accordance with FM 5-25 and TM 9-1375-200.

Section II. DECONTAMINATION OF EQUIPMENT

11-3. General

a. Contamination. Equipment that has been contaminated by chemical, biological, or radiological agents constitutes a danger to personnel. Contamination means the application of an agent in any form and by any means.

b. Decontamination. Decontamination is the process of removing or destroying the contaminating agents, or changing them into a harmless form. Generally, only equipment contaminated by persistent agents need be decontaminated.

11-4. Decontamination for Chemical Agents

Chemical agents, such as G-agents or V-agents, can be removed by an application of warm water and soap, gasoline, or denatured alcohol. Mild cases of contamination can be removed by aeration. Engines need not be washed since the heat of the engine will destroy the agents. Individuals may decontaminate their vehicle for mild cases; however, should the attack be heavy or cover a large number of vehicles, the decontaminating should be done by the CBR team.

a. Slurry is an effective decontaminant but will corrode unpainted metal surfaces if allowed to remain longer than 1 hour or if metals are not thoroughly cleaned and oiled.

b. DANC solution is an effective decontaminant for V-agents, but does not neutralize G-agents.

c. DS2 solutions are effective against G-agents and are noncorrosive for most metals.

d. Detailed information on vehicular decontamination may be found in TM 3-220.

CHAPTER 12

SAFETY

12–1. General

Personnel operating and maintaining the Chaparral missile system must be constantly aware of the hazards associated with the equipment and observe safe practices and procedures. This chapter outlines the hazards peculiar to the Chaparral system and, where applicable, gives handling precautions and procedures.

12–2. Safety Measures for Handling High-Pressure Air Systems

a. The air compression and purification system of Chaparral contains air compressed to a pressure of 3,000 pounds per square inch gage (psig). An explosive and fragmentation hazard exists, and contact with a high-pressure leak can result in tissue puncture and freezing of the tissue.

b. Personnel who handle high-pressure airhoses and components should be thoroughly trained in the use and maintenance of the equipment and in the application of safety measures to protect against existing hazards.

c. The following precautionary measures should always be taken:

(1) Inspect all systems using high-pressure air before, during, and after use for leaks, defective airhoses or lines, improperly adjusted valves, malfunctioning regulators and relief valves, and presence of foreign materials in the system.

(2) Clear all airhoses, air lines, and valves at regular intervals. Release pressure through bleeder valves before disconnecting any lines or hoses or making any repairs.

(3) When pressurizing a system, personnel operating the valves should stand clear of hose connections and should turn the valves slowly to prevent shock loading or pressure surges which may damage hoses or components. Close valves manually to prevent overtightening; never tighten with a wrench or tool.

(4) Observe the following precautions pertaining to high-pressure airhoses:

(*a*) The minimum bending radius for flexible airhoses is 4 inches for 1/4-inch inner diameter (ID) hose, 6 inches for 3/8-inch ID hose, 7 inches for 1/2-inch ID hose, and 9 1/4 inches for 3/4-inch ID hose.

(*b*) Never coat or paint an airhose. Paint will impair the normal breathing tendency of the hose.

(*c*) When not in use, depressurize and protect airhoses from the sun.

(*d*) Do not kink, twist, strike, walk on, run over, jerk, or otherwise abuse airhoses.

12–3. Explosive Hazards

a. Chaparral MIM–72A missiles contain explosives. All safety regulations applicable to missiles and explosives will be strictly enforced. Explosive components containing electrical wiring must be protected at all times from stray voltages or induced electrical currents. Handling, storage, and firing precautions are contained in AR 385–62 and TM 9–1300–206.

Warning: **No electrical checks will be made on the S&A device at any category of maintenance. Only visual inspection, as described in TM 9–1410–585–14, will be performed.**

b. Explosive hydrogen gas is generated during charging of the batteries. Insure that the battery box lid is closed and latched.

c. Exercise care in filling the MPU fuel cells. Do not spill fuel into the base compartment. Check MPU fuel lines and connections periodically for leaks. Fuel vapors forming in the base compartment can explode by a spark from the electrical system.

12–4. Toxic Hazard

Exhaust gases of the missile motors are a health hazard to persons in an inclosed environment, such as the mount, if the environmental pressurization system is malfunctioning or inoperative.

12–5. Mechanical Hazard

Before performing maintenance in the vicinity of the mount or inside the mount well while the mount is in the elevated position, insure that the mount up-lock pins are engaged and the four wooden safety blocks are installed.

12-6. Noise Hazard

A dangerous noise level exists in the vicinity of the Chaparral system when missiles are launched. Permanent ear damage may result to personnel during missile launching if they are at distances less than 200 feet. The gunner must wear the communication-type headset provided for adequate protection within the mount.

12-7. Missile Handling Precautions

a. General. When handling the missile and missile components, limit the number of personnel exposed and the quantity of hazardous material handled to the minimum practical level. The precautions contained in TM 9-1300-206 must be observed.

b. Rocket-Motor Handling Precautions.

(1) The S&A device, warhead, and motor are dangerous and must be handled accordingly.

(2) No electrical checks will be made on the S&A device during any category of maintenance.

(3) Do not remove the red plastic cap from the electrical connector on the target detecting device (TDD) until ready to assemble.

(4) Never attempt to cool, cover, or move an assembled missile that has been subjected to intense heat.

(5) If a motor not assembled with a missile should ignite, the forward head will blow out at 350-psi chamber pressure, propelling the head with a force of approximately 7,000 pounds. The head will blow straight forward but no fragmentation will occur. Following ejection of the head, the propellant may burn for 1 minute. The burning is orderly, with no sparks, propellant, or solids being ejected from the motor.

(6) Do not stack bare motors. Stack or store them in their containers in a horizontal position. Never place a motor over a sharp edge. This may dent the motor case and cause separation of the propellant from the case or propellant cracking. The weight of the motor should be distributed equally along its axis.

Warning: **Do not tamper with the rocket motor. Any attempt to adjust, replace, or repair any item except by the specific instructions contained in TM 9-1410-585-14 can result in an immediate hazard to both operating personnel and equipment.**

(7) In normal handling, the motor can be ignited by an electrical current through the squib bridge wires or by external heat sufficient to raise the igniter temperature to 525° F. The risk of handling the motor mated with the missile warhead is greatly increased since, upon ignition, the unit becomes highly propulsive and will explode or fragment upon striking a solid object.

(8) The major hazards in handling and storage of the rocket motor are as follows:

(*a*) Accidental activation of the igniter due to electromagnetic radiation, induction, or direct application of power to the igniter circuit.

(*b*) Auto-ignition of the motor or igniter due to fire or other external heat source, including local heating by power tools.

(*c*) Ignition of the motor propellant due to impact or grinding action encountered in dropping, adjustment, repair, replacement, or otherwise tampering with motor components.

12-8. Handling of Misfires

The Chaparral missile or the associated firing circuitry may malfunction, and the missile will not leave the rail. Should a missile malfunction, the following procedure should be followed:

a. Keep the canopy closed.

b. Set the ARM switch at OFF, turn the MODE switch to STANDBY, and set the TRIGGER lock switch to OFF.

c. Keep the missile pointing downrange.

d. If the tactical situation permits, wait 15 minutes before removing the missile.

e. Unload the missile from the launcher and move it to a designated safe area.

Caution: **Do not attempt to dismantle the missile body.**

f. Notify the supporting explosive ordnance detachment (EOD).

★CHAPTER 13

CHAPARRAL UNIT-CONDUCTED TRAINING

Section I. GENERAL

13-1. Purpose

This chapter provides information intended to aid the Chaparral unit commander in determining the need for, planning, and conducting a training program within his unit. The information is directed toward the training of Chaparral crews and squads only; however, the general approach to training suggested herein can be applied to other battery elements if desired.

13-2. Army Training Policy

a. AR 350-1 establishes Army policies, objectives, responsibilities, and guidance for the conduct of military training. The stated objective of training is to attain and maintain a state of operational readiness to conduct combat or other operations in accordance with assigned missions.

b. Authority and responsibility for planning, directing, conducting, and supervising training is delegated to the lowest command element having the ability to conduct effective training. For the purpose of this chapter, the lowest command element meeting this requirement is assumed to be the Chaparral battery.

c. Commanders train their units to the highest degree of operational readiness allowed by the availability of personnel, equipment, time, funds, facilities, and restrictions imposed by operational and installations support requirements.

d. Commanders at all levels should base their evaluation of unit and individual training proficiency on personal observation, sampling techniques, the periodic administration of performance tests and field exercises, and not on the number of hours of instruction to which a unit or individual has been exposed.

e. Commanders at all levels are responsible for the programing, supervision, and conduct of training within their units and for the maintenance of high standards of training excellence.

13-3. Training Objectives

The objectives of unit-conducted training are to—

a. Qualify Chaparral crewmen to expertly perform all the duties of their assigned duty position, qualify each crewmen to effectively perform the duties of all other squad positions, and to prepare the crewman for advancement in his MOS.

b. Develop squads and platoons into coordinated combat teams capable of rapid and correct response to the mission requirements of the battery.

13-4. Training References

a. A complete list of training references is provided in appendix A of this manual. The field manuals listed provide the doctrine, tactics, techniques, procedures, and drills required for training while the technical manuals listed provide the information necessary for operating and maintaining the equipment.

b. ATP 44-325 provides a training program that may be used as a reference in planning and conducting a unit training program. The program lists supporting Army subject schedules (ASubjScd) that provide detailed lesson outlines for each subject along with lists of applicable references, training devices, and visual training aids. The documents can be modified to suit the unit's training needs.

c. The proficiency testing program for Chaparral missileman badge awards contained in FM 44-19 can be used as a guide and incentive for advanced proficiency training.

d. ATT 44-325 is a source of information on testing the combat readiness of platoons and squads.

Section II. CONDUCT OF TRAINING

13-5. Planning

a. Since training time is a scarce commodity, its allocation must be carefully planned. Time should not be wasted on subject areas in which the unit is proficient; instead areas of weakness should be detected and training priorities established so that available training time can be used effectively to correct these weaknesses.

b. In developing a training plan the commander can assume a number of training requirements:

(1) The usual crewman attrition rate for a Chaparral battery is approximately 30 percent annually. Replacements are usually recent graduates of advanced individual training and require additional training before becoming fully qualified as Chaparral crewmen. On-the-job or augmentation training for replacements should be planned as a continuing program.

(2) Weaknesses develop in subject areas not exercised by the unit's operational mission. For example, a unit assigned a static defense mission for a long time may forget RSOP procedures or aircraft recognition proficiency may slip below the 90 percent level if a continuing recognition training program is not maintained. These potential problems should be recognized and provided for in the training plan.

(3) Chaparral crews may (and usually do) consist of three or four men rather than the five men authorized. This means that the men available must pick up and perform the duties of the missing crewmen. This fact of life should be recognized and cross-training within the squad should be provided for.

c. Instructor resources should be considered in developing a training plan. Squad leaders can be used for training crewmen on system operation and servicing. The battery Chaparral mechanic can instruct in maintenance procedures and requirements. Platoon leaders can be used in training squad members in tactics, RSOP, and command and control. Most instructional support will come from the internal resources of the battery.

d. Equipment for training will usually be obtained from internal resources. Army training aids centers are located at most major installations and can provide training films, graphic training aids, and other devices on a loan basis. The ground observer aircraft recognition (GOAR) kit provides excellent support for aircraft recognition training and the Chaparral simulator/evaluator, T3, is available to support target tracking practice.

e. The training method to be used for each period of instruction should be determined and entered in the plan. Whenever possible, hands-on-equipment training should be used. On-the-job training can be used to qualify replacements but it should be progressive and closely supervised. Battery- and platoon-level field training exercises can be used to develop tactical skills and teamwork.

f. The plan should include a means of evaluating the training and measuring progress. Performance tests should be used wherever possible to measure and control training progress.

13-6. Execution

Four phases in the execution of a training program are preparation, presentation, application, and evaluation. An additional element, supervision, can also be added to the list.

a. Preparation. Regardless of the type of training to be conducted, preparation is essential. The instructor must assure himself that he knows his subject; that he has a definite plan of progression; and that the necessary facilities, equipment, and aids are at the proper place at the proper time. Dry runs (rehearsals) of the instruction should be conducted before a critical audience whenever possible.

b. Presentation. The presentation of the subject matter to the trainee should progress logically from the simple to the difficult. Trainee participation must be demanded. Each step or item of the subject should be explained and demonstrated by the instructor and his assistants and then performed by the trainee.

c. Application. Application of the subject being taught is essential to retention and the development of skill. Application should accompany, or immediately follow, presentation to be most effective. Repetitive application (practice) should be included in the program whenever possible.

d. Evaluation. Evaluation is necessary to training progress. The mere fact that training is presented is meaningless unless its effectiveness toward reaching pre-established goals can be determined. Task performance is the best means of

evaluating training and the standards should be high. The trainee should demonstrate proficiency in each task taught or be retrained to the point where he does attain such proficiency.

APPENDIX A

REFERENCES

Department of the Army pamphlets of the 310-series should be consulted for the latest changes or revisions of references given in this appendix and for new publications relating to materials covered in this manual.

A-1. Army Regulations (AR)

11-21	Environmental Pollution Abatement.
385-62	Firing Guided Missiles and Heavy Rockets for Training, Target Practice, and Combat.

A-2. Field Manuals (FM)

5-15	Field Fortifications.
5-20	Camouflage.
5-25	Explosives and Demolitions.
31-25	Desert Operations.
31-35	Jungle Operations.
31-70	Basic Cold Weather Manual.
31-71	Northern Operations.
(S) 44-1A	US Army Air Defense Artillery Employment (U).
44-1-1	US Army Air Defense Artillery Operations.
44-3	Air Defense Artillery Employment, Chaparral/Vulcan.
*44-6	Procedures and Drills for Forward Area Alerting Radar.
44-30	Visual Aircraft Recognition.

A-3. Technical Manuals (TM)

3-220	Chemical, Biological, and Radiological (CBR) Decontamination.
5-2805-258-14	Operator, Organizational, Direct Support, and General Support Maintenance Manual: Engine, Gasoline, 10 HP Military Standard Models.
9-207	Operation and Maintenance of Army Materiel in Extreme Cold Weather, 0° to −65°.
9-1300-206	Care, Handling, Preservation, and Destruction of Ammunition.
9-1375-200	Demolition Materials.
(C) 9-1410-585-14	Operator, Organizational, DS and GS Maintenance Manual: Chaparral Intercept-Aerial Guided Missile XMIM-72A, Chaparral Training Missile XM30, and Supporting Equipment (Chaparral Air Defense Guided Missile System) (U).
9-1425-585-ESC	Equipment Serviceability Criteria for Chaparral Intercept-Aerial Guided Missile System XM48.
9-1440-585-12	Operator and Organizational Maintenance Manual: Intercept-Aerial Guided Missile System XM54 (Launching Station) (Chaparral Air Defense Guided Missile System).
9-1450-585-10	Operator's Manual: Carrier, Guided Missile Equipment, Self-Propelled, XM730.
11-5805-201-12	Operator and Organizational Maintenance Manual, Including Repair Parts and Special Tool Lists, Telephone Set TA-312/PT.

*To be published.

11-5820-401-10	Operator's Manual: Radio Sets AN/VRC-12 and AN/VRC-43, -44, -45, -46, -47, -48, and -49.
11-5820-477-12	Organizational Maintenance Manual: Radio Set Control Groups AN/GRA-39 and AN/GRA-39A.
21-306	Manual for the Tracked Combat Vehicle Driver.
38-750	The Army Maintenance Management Systems (TAMMS).

APPENDIX B

ABBREVIATIONS

Following are abbreviations and their meanings as used in this manual.

ADA	Air defense artillery
CBR	Chemical, biological, and radiological
CCP	Center control panel
CEOI	Communications-electronics operation instructions
dc	Direct current
EOD	Explosive ordnance detachment
ESC	Equipment serviceability criteria
F.	Fahrenheit temperature scale
FAAR	Forward Area Alerting Radar
FM	Frequency modulation
gal	Gallon
hr	Hour
ID	Inside diameter
IR	Infrared
km	Kilometer
kmph	Kilometer per hour
LCP	Left control panel
LSGM	Launching station guided missile
MCP	Master control panel
mpg	Miles per gallon
mph	Miles per hour
MPU	Main power unit
OVE	On-vehicle equipment
psi	Pounds per square inch
psig	Pounds per square inch gage
RCP	Right control panel
RCVR	Receiver
RF	Radiofrequency
RFDL	Radiofrequency data link
rpm	Revolutions per minute
RSOP	Reconnaissance, selection, and occupation of position
S&A	Safety and arming
SL	Squad leader
SOP	Standing operating procedures
SSB	Single side band
TADDS	Target alert data display set
TDD	Target detecting device
XMTR	Transmitter

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By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:
VERNE L. BOWERS
Major General, United States Army,
The Adjutant General.

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