CHAPTER 1

SYSTEM DESCRIPTION

This Chapter Implements QSTAG 269 and STANAG 2934, Chapter 11.

The multiple launch rocket system is a highly mobile, rapid-fire, surface-to-surface, free-flight rocket and guided missle system. It is designed to complement cannon artillery; to attack the enemy deep; and to strike at counterfire, air defense, and high-payoff targets. It can supplement other fire support systems by engaging a dense array of mechanized targets during surge periods. The MLRS battalion is a corps asset and can be attached to a field artillery (FA) brigade or to division(s) within the corps. The MLRS battery is organic to armored and mechanized infantry divisions. Light infantry divisions may receive MLRS support from corps assets.

Section I
INTRODUCTION

MLRS Employment Concept

The capabilities of MLRS make it one of the most versatile FA weapon systems available for both joint and combined arms operations. Its range, mobility, and lethality allow it to execute the full spectrum of fire support -- providing close support to maneuver units, protecting the force with counterfire, and attacking operational targets for the division, corps, Marine air-ground task force (MAGTF), or joint task force commander and in support of theater missile defense (TMD).

Regardless of the tactical mission, MLRS units are positioned and fight well forward and use their shoot-and-scoot capability to improve survivability. Forward positioning is critical to accomplishing these deep missions. When providing close support in the offense, MLRS units move with the maneuver forces they support, stop to fire as required, and then move rapidly to rejoin the formation. In the defense, these systems support maneuver units by moving laterally along the forward line of own troops (FLOT). This allows MLRS units to take maximum advantage of their range to protect maneuver units from the destructive effects of the enemy's indirect fire systems. The mobility and massive firepower of the MLRS make it well-suited to augment other artillery fires supporting cavalry units engaged in operations such as screening, covering force, and movement to contact.

The 32 kilometer (km) range of the MLRS rocket and the 165 km range of the Army tactical missile system (Army TACMS) provide the division, corps, MAGTF, and joint commanders with a deep strike option. To support deep operations, MLRS units are positioned close to the FLOT and in some cases beyond the FLOT to engage the enemy at maximum ranges and to continue to attack him throughout the depth of the battlefield. The MLRS units assigned the mission of firing Army TACMS in support of a joint force commander's deep operation will often operate in a maneuver brigade area of operations. Intermixed with maneuver and cannon units, these MLRS units will find themselves continually coordinating for positions within the maneuver brigade sector.

The MLRS plays a critical role in contingency operations because it provides a massive infusion of combat power in small, rapidly-deployable force packages. The extreme lethality of the MLRS family of munitions (MFOM), coupled with the air deployability of the system on a variety of aircraft, makes MLRS units the logical choice to deep fires for initial entry forces.

System Components

The multiple launch rocket system consists of the components described below.

M270 Launcher

Each launcher has the onboard capability to receive a fire mission, determine its location, compute firing data, orient on the target, and fire. Each bay of the launcher must be loaded with the same type munition. Once laid and armed, the launcher can fire:

- Twelve rockets in less than 60 seconds at up to six aimpoints.
- Two missiles in less than 20 seconds at one or two aimpoints.

Launch Pod/Containers and Guided Missile Launch Assemblies

Each launch pod container (LPC) holds six rockets, and each guided/missile launch assembly (GMLA) holds one missile. The pods are stenciled with the DOD identification code (DODIC). This is the same code that is displayed on the fire control panel (FCP) when ammunition status is displayed to the M270 crew members.

Ammunition Resupply Vehicles and Trailers

The ammunition resupply capability for MLRS is provided by the heavy expanded mobility tactical truck (HEMTT) M985 and the heavy expanded mobility ammunition trailer (HEMAT) M989/M989Al. Each one can carry four rocket/missile pods for a total of 48 rockets or eight missiles in a HEMTT and HEMAT load (the HEMAT M989 is limited to two launch pods during peacetime operations, but the HEMAT M989A1 does not have this limitation).

Command, Control, and Communications System

The MLRS has an automated command, control, and communications (C3) system to provide command and control of subordinate launchers and to facilitate communication on the battlefield. Major components of the C3 system are the fire control system (FCS), located in the launcher, and the fire direction system (FDS), located at the platoon. Only selected batteries and battalions have the fire direction data manager (FDDM).

Section II

LAUNCHER AND SUBSYSTEMS

M270 Launcher

The M270 launcher is a highly mobile, lightly armored, tracked carrier vehicle with a launcher-loader module (LLM) mounted on the vehicle bed (see Figure 1-1). The launcher consists of a three-man crew (section chief, gunner, and driver). Personal equipment is stored in the crew's equipment storage containers located in the carrier under the LLM cage. References are listed at the back of this publication.

The M270 launcher has two major configurations. The US has a system that can fire rockets and missiles; the memorandum of understanding (MOU) nations have M270 launchers which can only fire rockets. The difference between them is the payload interface module (PIM), a new stabilization reference package/position determining system (SRP/PDS) and software special applications packages (SPAPS).

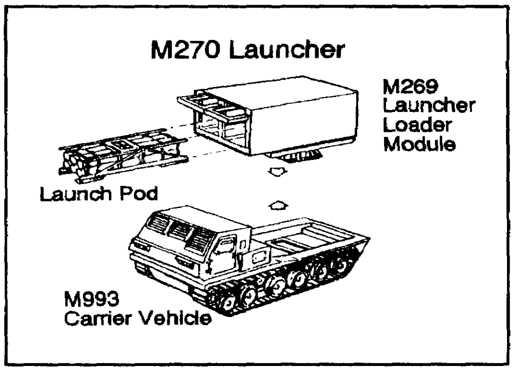

Figure 1-1. M270 launcher.

M993 Carrier Vehicle

The carrier vehicle is a longer version of the Bradley fighting vehicle with nearly 80 percent common components. It is 6.3 meters (m) (22 feet [ft] 11 inches [in]) long, 2.6 m (8 ft 6 in) high, and 2.97 m (6 ft 9 in) wide. When heaviest (loaded with M26 rocket LPCs), the launcher weighs approximately 24,036 kilograms (kg) (52,990 pounds). It can climb 60 percent slopes, traverse a 40 percent side slope, ford 1.1 m (40 in) of water, and climb 1 m vertical walls. The launcher has a cruising range of 483 km (300 miles) and can be transported by C-14lB and larger cargo aircraft (see Appendix A).

The vehicle cab is constructed of aluminum armor plate, providing ballistic protection to the crew. It is fitted with an M13A1 gas particulate filter unit that protects the crew from chemical and biological agents and radioactive particles. It also has a vehicle cab overpressure system to protect the crew from toxic rocket and missile exhaust.

M269 LLM

The LLM consists of two sections--a mechanical section and an electrical section. These sections work together in order to perform all firing and non-firing functions.

LLM Mechanical Section

The mechanical section consists of base, turret, and cage assemblies. The base assembly provides for the physical mounting of the LLM to the carrier. Both the turret and base assemblies house the electronics and hydraulics of the launcher drive system (LDS) that actually perform the rotation and elevation functions the LLM. The cage assembly performs two important functions. First, the structure of the cage assembly aligns, holds, and protects the launch pods. Second, two boom and hoist assemblies mounted in the cage assembly give the launcher crew a built-in ammunition loading and unloading capability.

LLM Electrical Section

The electrical section consists of three subsystems: the primary power supply, the communications system, and the FCS.

Primary Power Supply. The primary power supply is the source of power for all launcher equipment. It uses standard military lead acid batteries to provide 24 volts of power to the launcher components. It also controls the distribution of power through the use of switching relays.

Communications System. The launcher communications system includes a secure -12 series frequency modulated (FM) radio and one communications mode selector control (CMSC) device or the newer single-channel ground and airborne radio system (SINCGARS) AN/VRC-92A radio system with embedded communications security (COMSEC) capability. The CMSC detects an incoming signal, determines whether it is digital or voice traffic, and automatically routes it to the secure FM radio in the proper mode for decryption. The CMSC is not required if using SINCGARS with embedded COMSEC. Each crew member has a combat vehicle crewman (CVC) helmet that is connected to an AN/VIC-1 intercom system.

Fire Control System. The FCS functions with the other launcher components to provide overall control of the LLM. It monitors, coordinates, and controls all electronic devices used during a launch cycle. The FCS consists of the fire control panel (FCP), electronics unit (EU), fire control unit (FCU), boom controller (BC), short/no-voltage tester (SNVT), SRP/PDS, PIM, program load unit (PLU), and communications processor (CMP).

- **Fire Control Panel.** The FCP, located in the center of the carrier cab in front of the gunner's seat, has a data entry keyboard for manual entry operations and for message menu selection. The panel also gives alphanumeric displays in simple language. Next to the data keys are built-in test (BIT) indicator lamps for line replaceable units (LRU). These allow rapid detection and isolation of faults in the FCS.
- **Electronics Unit.** The EU contains the computer program and data processing electronics to receive, compute, and distribute fire mission parameters. The EU holds all current weapon files and operational data for the launch and ballistic computation programs in its "bubble" memory (permanent, nonvolatile). However, only those munition programs which have been moved into the EU random access memory (RAM) can be used by the launcher FCS to compute launch and other fire mission data. The EU automatically identifies munition type and copies necessary weapons files born bubble to RAM. If the proper software is not loaded, the crew can then use the PLU to load required munition data into the EU.
- **Fire Control Unit.** The FCU contains the electronic circuits that change the EU outputs into control signals for other launcher components. It also takes inputs from the other components and changes them into signals the EU can use.
- **Boom Controller.** The boom controller permits remote control of the loading and off-loading functions and positioning of the LLM for maintenance.
- **Short/No-Voltage Tester.** The SNVT is a built-in test device used during loading operations. It is used to test the FCS W19 umbilical cables for stray voltage or static electricity. The test ensures that the cables are safe to connect to the loaded launch pods.
- **Stabilization Reference Package/Position Determining System.** The SRP/PDS is composed of two integrated subsystems that are housed in separate compartments; the SRP and the PDS. The SRP uses an electrically driven north-seeking gyrocompass. The SRP provides heading, elevation, and launcher slope. The PDS uses two encoders on the vehicle final drives and orientation data from the SRP to determine position location.
- **Payload Interface Module.** The PIM provides communications power and interface between the loaded launch pods and the EU. Initial input of the EU munitions programs require use of the PLU and the PIM.
- **Communications Processor.** The CMP controls the flow of the digital coded audio tone

messages sent and received by the launcher communications-FCS interface. It is designed to ensure the FCS does not acknowledge, nor allow itself to be disrupted by, digital messages not addressed to that launcher. It also rejects any weak or garbled signals.

Program Load Unit. The PLU is an electronic device used to program the EU memory (see Figure 1-2). The PLU mounts a cassette containing operational program data. The PLU is connected to the EU through the PIM interface connector W31P2 using PLU cable assembly. When the FCS is turned on, the PLU downloads the data on the cassette into the EU memory. Each cassette has 4 megabytes (MB) of memory. The PLU is used to access specific munition programs on the cassettes. The hand-carried PLU issued to the firing platoons is used to program or change the current programming of the launcher EU. The PLU requires at least 22-25 minutes to transfer an entire cassette of data.

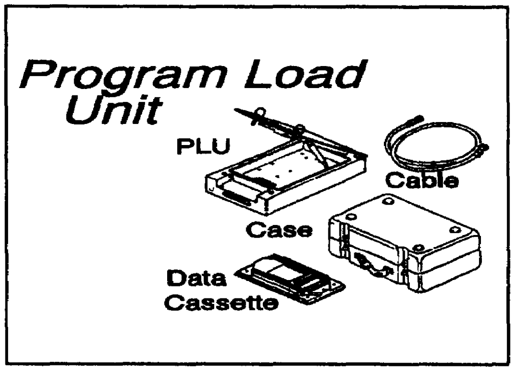

Figure 1-2. Program load unit.

FCS Functions

The launcher FCS provides the link between the crew, external digital message sources, and the launcher components. It performs the following significant functions:

- Monitors and integrates all onboard sensor data.
- In conjunction with the launcher communications system, provides a digital interface between the launcher crew and the command and control elements.
- Monitors the status of built-in tests.
- Enables the crew to control launcher components.
- Computes firing data for all fire missions.
- Lays the LLM and sets fuzes or programs warheads as required.
- Controls LLM operations.

The FCS receives data input in the following ways:

- Current mission data are input automatically through digital coded audio tone radio messages or manually through the FCP keyboard.
- The EU munitions programs are input from a cassette through a PLU.

Data communication is the most common and preferred method of input to the FCS. Through radios, the FCS can communicate digitally with the platoon FDS or the battery/battalion FDS/FDDM. The FCS can receive MLRS and MET category formats as well as the SYS;PTM message. Secure data digital communication between TACFIRE, the initial fire support automation system (IFSAS), the light TACFIRE (LTACFIRE), or the Marine Corps Fire Support System (MCFSS), and a launcher FCS must be routed through an FDS/FDDM, because message formats are not compatible. The FCS allows the crew to send and receive fixed-format messages and to receive free-text messages.

The primary means of communication is FM secure data, however, FM voice secure communication is available as a backup. In case of data communication failure or when operating voice, the crew can manually enter all data elements through the FCP keyboard.

The EU automatically monitors, integrates, and computes data from other FCS launcher electronic components. It continuously monitors the SRP/PDS data and computes launcher heading (travel direction), location, and altitude. The FCS determines the firing data when the target information is received. When the crew enters the appropriate mission command, the FCS commands the LLM to lay on the required launch azimuth and elevation, and sets the rocket fuze times or programs the warheads. The FCS fires the rockets or missiles when commanded by the gunner through the FCP.

The FCS continuously checks its internal components and those of the LLM. These checks are made throughout the mission cycle. If a malfunction is detected, the crew members are notified by an error warning message or LRU/BIT displayed on the FCP.

The FCS can currently operate in five different language formats: US-English, UK-English, German, French, and Italian.

Note: The launcher is unable to fire the mission if a malfunction ocurs in a launcher FCS; that is, in the FCP, EU, FCU, or SRP/PDS. Since no backup means exist to fire the launcher manually, the fire mission must be redirected to an operational launcher for completion.

Section III
MLRS FAMILY OF MUNITIONS (MFOM)

Launch Pod

Description.

Each M270 holds either two LPCs or two GMLAs (not a mix of the two) in the LLM (see Figure 1-3). Each launch pod contains either six rocket tubes or one missile housing in a containerized shipping, storage, and launch frame. Rockets and missiles are factory assembled and tested. Rockets are stored in fiberglass containers; missiles are stored in an aluminum enclosure with fiberglass camouflage panels on the exterior. Both rockets and missiles are then mounted on the frame. Both the rocket tubes and the missile housing are connected by cable to common electrical connectors. Not only are handling, transport, and loading fixtures similar, the LPC and GMLA are also visually similar.

The launch pod is 4.04m (13 ft 2 in) long (without skids) and 1.05 m (3 ft 5 in) wide. The height of the pod is 0.84 m (2 ft 9 in) with skids and 0.72 m (2 ft 4 in) without skids. When loaded with rockets (tactical or practice), each LPC weighs 2,270 kg (5,005 pounds). A loaded GMLA weighs 2,095 kg (4,609 pounds), and an inert training GMLA weighs 1,360 kg (2,998 pounds).

Four aluminum bulkheads provide rigidity to the frame and support for the rocket tube or missile housing. Tie-down and lifting D-rings are located on the top of the frame at the four corners. A lifting rod is installed for lifting the container by the launcher boom and hoist assemblies.

Stacking pins at the top four corners of the frame permit stacking of the launch pods. They can be stacked two high during transport and four high during storage. They can

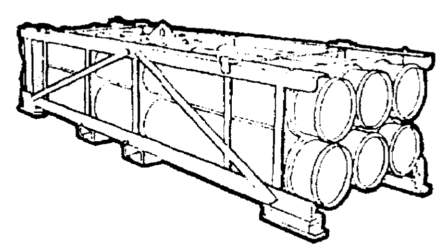

Figure 1-3. Launch pod.

be handled by forklift, since they have two inner bulkheads that serve as support members. Each launch pod is marked for the center of gravity and proper lift areas.

The detachable skids mounted to the bottom four corners of the frame must be removed from the pod before it is loaded into the LLM. A quick-release pull pin allows easy removal of the skids. The GMLA also has a lifting rod cover which must be removed before being loaded into the LLM.

The changing of rocket and missile pods requires a repositioning of the loading hoist assembly system.

Rockets

The MLRS rockets are tube-launched, spin-stabilized, free-flight projectiles. The rockets are assembled, checked, and packaged in a dual-purpose launch-storage tube at the factory. This design provides for tactical loading and firing of the rocket without troop assembly or detailed inspection. Major components of the rocket assembly include four stabilizer fins, a propulsion section, and a warhead section. (See Figure 1-4, page 1-6.)

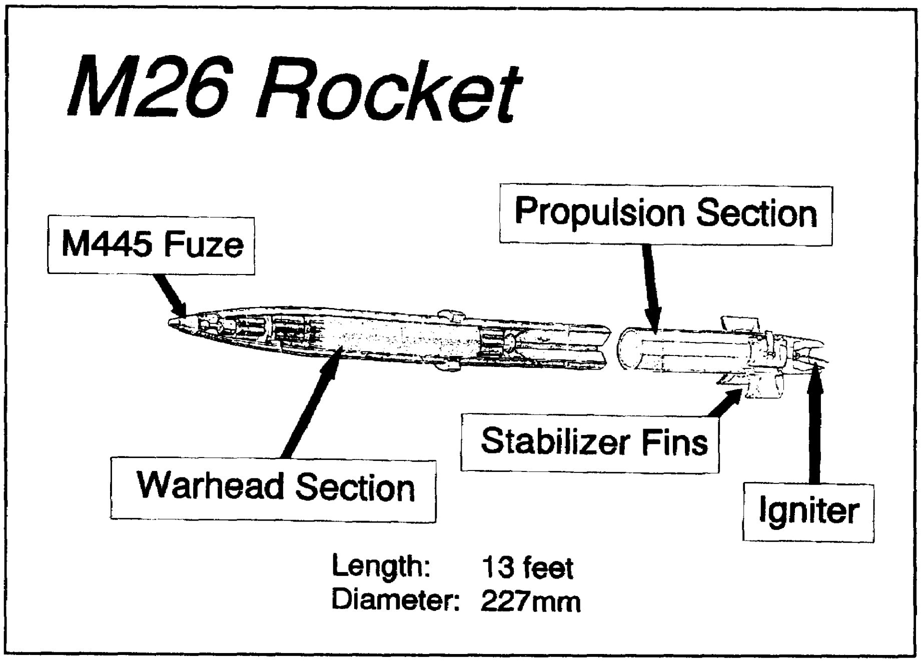

Figure 1-4. M26 rocket.

Propulsion for the rocket is provided by a solid propellant rocket motor. An umbilical cable, passing through the aft end of the launch tube, links the FCS to an igniter in the rocket nozzle. The motor is ignited by an electrical command from the FCS.

Each rocket is packaged with the four fins folded and secured by wire rope retaining straps. As the rocket moves forward upon firing, lanyard devices trigger a delayed strap-cutting charge. After the rocket leaves the launch tube, the charge cuts the straps. This allows the fins to unfold and lock. The M28 and M28A1 rockets' LPCs have an additional fin release device to ensure deployment.

The MLRS rocket follows a ballistic, free-flight (unguided) trajectory to the target. The propulsion provided by the solid propellant rocket motor is the same for each rocket, so rocket range is a function of LLM elevation. The four stabilizer fins at the aft end of the rocket provide in-flight stability by maintaining a constant counterclockwise spin. The initial spin is imparted to the rocket through spin rails mounted on the inner wall of the launch tube.

M26 Rocket

This is the basic rocket for MLRS. It is used against personnel, soft and lightly armored targets normally with a target location error (TLE) of 150 m or less. Larger TLEs may reduce effectiveness. Each rocket dispenses 644 M77 dual-purpose improved conventional munitions (DPICM) submunitions over the target area.

M26 Warhead Function

Warhead event is initiated by an electronic time fuze (M445) that is set remotely by the FCS immediately before ignition of the rocket motor. The fuze triggers a center burster charge. This causes the warhead to rupture, the polyurethane filler to shatter, and the submunitions to be spread over the target area.

M77 Submunition Description

The armed M77 submunitions detonate on impact (see Figure 1-5). The antimateriel capability is provided through a shaped charge with a built-in standoff. The M77 can penetrate up to four inches of armor. Its steel case fragments and produces antipersonnel effects with a radius of 4 m.

This rocket can attack targets at ranges between 10-32 km. Although system software allows firing at ranges as short as 5 km, the submunition dud rate increases significantly at ranges less than 10 km.

M28 Rocket (Training)

The M28 rockets are available for live firing at Army training installations. This practice rocket has the same flight characteristics as the M26 rocket. It has a spotting charge of three smoke canisters and steel ballast rods rather than submunitions.

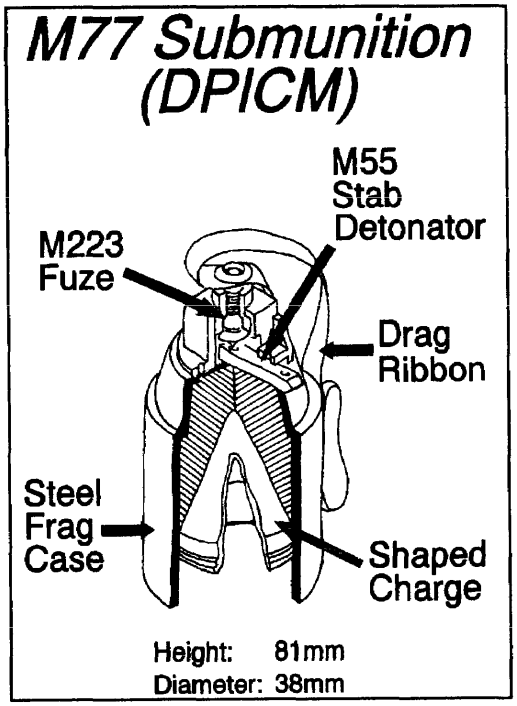

Figure 1-5. M77 submunition.

M28A1 Rocket (Training)

The M28A1 rocket (reduced range) is also available for live firing at Army training installations. This practice rocket has a monolithic (relatively uniform and predictable) trajectory and a reduced range (8-15 km). This results in a much smaller surface danger area (SDA) than the M28/M26, thus allowing it to be fired on many tube artillery firing ranges. It has a blunt nosed, high-drag warhead section which contains an impact activated smoke charge. It has the same motor assembly as the M26/M28.

Missiles

The Army TACMS missiles are ballistically launched, inertially guided missiles. They are designed to carry a variety of submunitions, to include "smart" munitions and lethal mechanisms to provide a wide range of future capabilities. Currently, the Army has only the M39 missile.

Missile Assembly

The missile has four sections: the guidance and control section, propulsion section, control section, and the warhead assembly (see Figure 1-6).

Guidance and Control Section (GCS). The GCS provides all navigation, guidance, autopilot, and internal communications functions for the Army TACMS missile

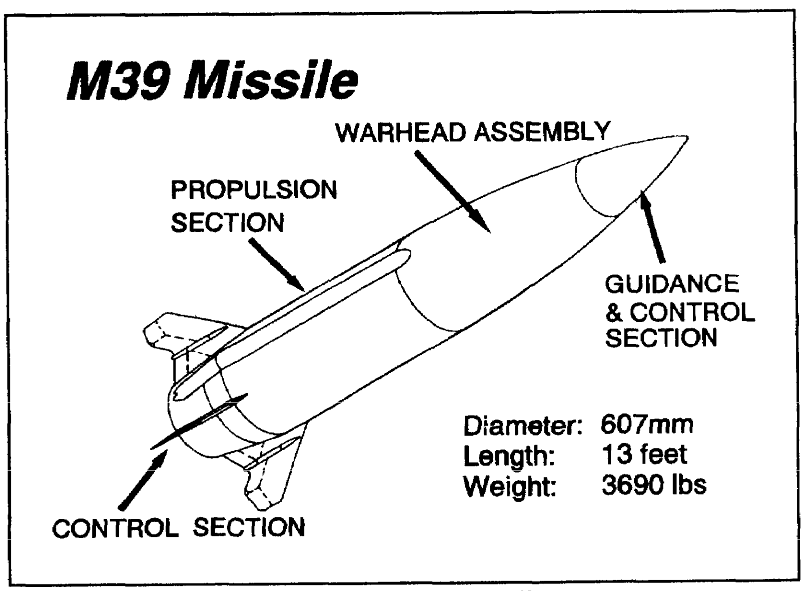

Figure 1-6. M39 missile.

while in flight and for all ground operations. Continuous determination of position, attitude, and motion are provided by the inertial sensors, associated electronics, and software processing. Guidance and autopilot functions are provided by software processing within the GCS computer. All communications, both internal and external to the missile (missile to launcher and/or ground support equipment), are provided by the GCS electronics and software. This includes communications with the M270 FCS electronics for launch control, the ground support equipment for maintenance, and the control system electronics unit (CSEU) for missile fin actuator control.

Propulsion Section. The solid rocket motor furnishes the energy necessary to launch the missile and sustain missile flight for a sufficient time to meet Army TACMS altitude and range requirements. The solid rocket motor consists of a motor case, propellant, insulation/liner, nozzle, and igniter arm/fire assembly.

Control Section. The primary functions of the control section assembly are to position the missile fins, provide the missile electrical power while in flight, and support selected pyrotechnic functions.

Warhead Assembly. The primary function of the warhead assembly is to carry, protect, and dispense the missile payload. The warhead assembly consists of a rolled aluminum shell with aluminum support structures and front and rear bulkheads. A center tube connects the bulkheads and provides a central wire route. In addition to the payload, the warhead assembly contains a skin severance system which controls the release of the payload at the required time.

M39 Missile Warhead

This warhead is used against personnel and soft targets normally with a TLE of 150 m or less. Larger TLEs may reduce effectiveness. Each missile dispenses a cargo of approximately 950 antipersonnel and antimateriel (APAM) M74 grenades over the target area. The M39 missile (Army TACMS Block I) has a minimum range of 25 km and a maximum range of 165 km.

M39 Warhead Function. Warhead event is initiated by an electronic time fuze (M219A2) that is set in the same manner as the M445 electronic time fuze of the M26 rocket. The fuze detonates shaped charges mounted to the skin and bulkheads. This in turn severs the skin. By means of centrifugal force and airstream currents, the M74 grenades are distributed over the target area. Arming of the M74 grenades is accomplished by the spin action which is induced on the individual grenade.

M74 Submunition Description. The M74 grenade is filled with composition B explosive filler and is covered by a steel shell (see Figure 1-7). Upon impact and detonation each grenade breaks up into a large number of high-velocity steel fragments that are effective against targets such as truck tires, missile rounds, thin-skinned vehicles, and radar antennas. This submunition is not effective against armored vehicles. The M74 grenade also contains incendiary material and has an antipersonnel radius of 15 m.

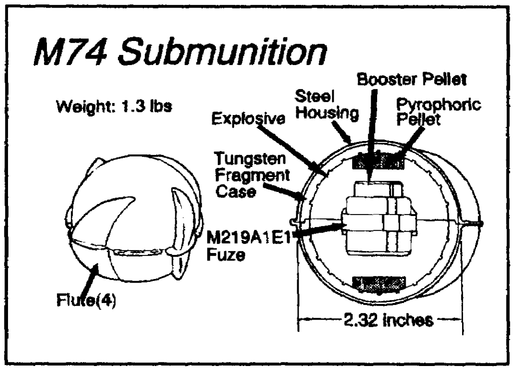

Figure 1-7. M74 submunition.

Future Developmental Munitions

Rockets

Extended Range Rocket. The extended range (ER) rocket is an evolution of the basic M26 rocket that extends the range to 45-plus km. This greater range capability is achieved through a 20 percent reduction in the number of submunitions and a modified rocket motor. It has at least the same accuracy as the basic M26 rocket. ER-rocket accuracy is enhanced by an improved rocket detent located in the launch tube. Additionally, the wind measuring device (WMD), a component of the future Improved FCS, updates the firing solution prior to launch at the firing point with corrected low level wind readings. The effectiveness of the M26 rocket is maintained in the ER-rocket even though the submunition payload has been decreased. This is due to the improved center core burster and a reduction in the dud rate, made possible by an improved drag ribbon design and the incorporation of a self-destruct fuze.

MLRS Smart Tactical Rocket (MSTAR). MSTAR will be a robust smart munition warhead primarily employed against counterfire targets, but with capabilities to attack other moving or stationary, hot or cold targets. The munitions will be delivered by the ER MLRS rocket. MSTAR will provide the division commander with a highly responsive, fire-and-forget engagement capability against a wide variety of targets of tactical depth. MSTAR will offer greater lethality with reduced logistical burdens, minimize effects of huge target location errors, and reduce collateral damage.

Extended Range Rocket (Guided). Low cost guidance for MLRS rockets seeks to integrate a guidance and control system into the ER MLRS to provide much improved delivery accuracy (2-3 mil circular error probable [CEP]). The demonstrated system will be designed to allow for the inclusion of a global positioning satellite (GPS) receiver and antenna in order to be postured for any future requirement in which very accurate (5 meter CEP) delivery errors maybe required. Guidance for MLRS will significantly improve the effectiveness of both DPICM and precision guided submunition payloads while reducing logistics burdens, mission times and collateral damage.

Missiles

Army TACMS Block IA. The Block IA missile carries approximately 300 M74 bomblets. A GPS receiver will be integrated into the missile which allows it to receive positioning data updates for increased accuracy. The Block IA missile ranges targets from 100 to 300 km.

Army TACMS Block II. Block II employs the brilliant antiarmor technology submunition (BAT) (see Figure 1-8). The Block II missile ranges targets from 35 km to 140 km. The Block II payload consists of thirteen BAT submunitions which are equipped with both acoustic and infrared sensors that give each submunition the capability of acquiring and attacking moving armor targets. After the dispense from the main warhead, each BAT submunition autonomously seeks an individual target within a moving armor column with its acoustic sensor. Once each submunition is close enough to its selected target vehicle, the inbred seeker is activatated and provides guidance during the terminal trajectory. The BAT submunition has a tandem shaped charge warhead designed to defeat all known reactive armor.

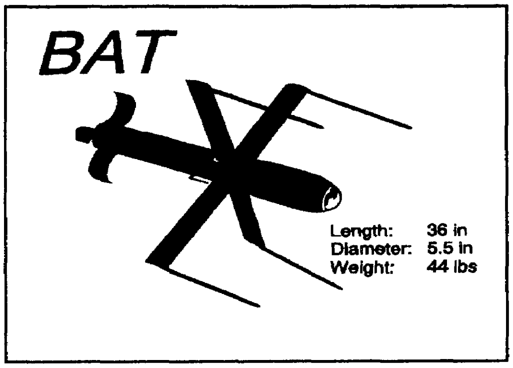

Figure 1-8. BAT submunition.

Army TACMS Block IIA. Block IIA employs an improved BAT submunition that is effective against both hard and soft, moving and stationary targets. The Block IIA payload consists of six improved BAT submunitions which are equipped with sensors that give each submunition the capability of acquiring the target regardless of whether an inbred signature exists. The improved BAT submunition has a multipurpose design to kill both hard and soft targets at ranges that exceed the Block II missile.

This section implements QSTAG 269 and STANAG 2934, Chapter 11.

Section IV
ASSOCIATED EQUIPMENT

Ammunition Resupply Vehicle and Trailer (HEMTT/HEMAT)

The M985 HEMTT is a 10-ton, 8-wheel or 8-wheel-drive truck with a 5,400-pound lift capacity materiel-handling crane (see Figure 1-9, page 1-10). A secure FM radio provides voice command and control capability. The rear-mounted crane can traverse 360° to the left or right. Both the HEMTT and the HEMAT can be loaded and unloaded with the crane. The HEMAT does not have to be unhooked from the HEMTT. The truck carries four launch pods with a gross vehicle weight of 59,000 pounds.

Its operating range is 300 miles, and it can climb a 30 percent slope. The HEMTT has a 445-horsepower diesel engine with an automatic transmission. It can be transported by C- 130 and C-141B aircraft in an unloaded configuration and by C-5A/C-5B aircraft in a loaded tactical conflguration. (See Appendix A.)

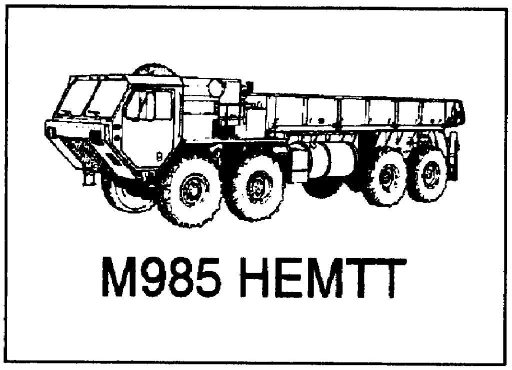

Figure 1-9. M985 HEMTT

The M989A1 HEMAT can carry four launch pods and has a fully loaded gross weight of 31,000 pounds (see Figure 1-10). The trailer can be towed by a launcher in an emergency.

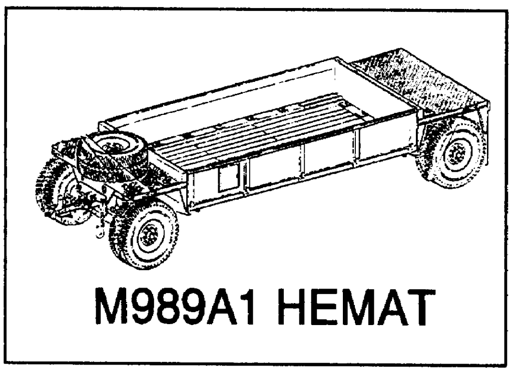

Figure 1-10. M989A1 HEMAT.

Command, Control and Communications System

Tactical command and control and technical fire direction of MLRS units is provided through a C3 system. The C3 system includes the radio system, FED, FCS, FDS, and in some units, the FDDM. This system is designed to be integrated with several Army and Air Force command, control, communications, and intelligence (C3I) systems to optimize fire support system employment and effectiveness. The MLRS C3 system also can be used to conduct and execute command and control without external C3 input during independent operations. This independent C3 capability exists at battalion, battery, and platoon levels. The hub of the MLRS C3 system is the MLRS FDS and FDDM. The FDS/FDDM can communicate digitally with the following systems:

- M270 FCS.
- The Tactical Fire Direction System (TACFIRE, LTACFIRE, and MCFSS).
- The Advanced Field Artillery Tactical Data System (AFATDS).
- Firefinder Radar (AN/TPQ-36 and AN/TPQ-37).
- Meteorological Data System (MDS).
- Meteorological Measuring Set (MMS).
- Initial Fire Support Automated System (IFSAS).
- The Forward Entry Device (FED).

Fire Direction System

The MLRS Fire Direction FDS provides tactical fire direction and data communications for command and control at the MLRS platoon, battery, and battalion. Initialization procedures define the FDS capabilities for the specific echelon. The FDS (AN/GYK-37) consists of the lightweight computer unit (LCU), tactical communications interface module (TCIM), the AC/DC converter/charger, the TCIM wireline adapter, and the printer (see Figure 1-11).

Components

Lightweight Computer Unit. The LCU is the computer for the FDS. It receives, stores, processes, displays, and transmits tactical and firing data.

Tactical Communications Interface Device. The TCIM provides the interface between the LCU and the communications devices.

AC/DC Converter/Charger. This device converts the vehicle DC power to proper levels for the FDS computer.

TCIM Wireline Adapter. This device interfaces wire from a tactical communications transmitter to either the internal TCIM or the external TCIM.

Printer. The printer prints incoming, outgoing, and/or displayed messages as selected by the operator.

TACFIRE Interface Device (TID). This device allows the TCIM to use the multiple subscriber equipment.

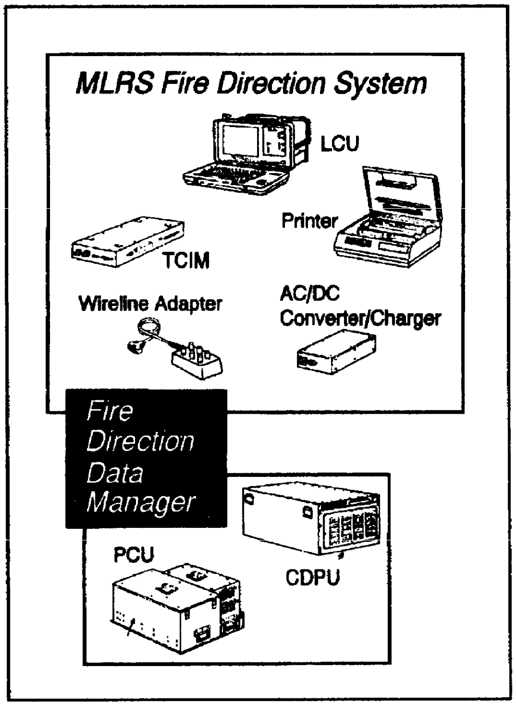

Figure 1-11. MLRS fire direction system.

Characteristics

The FDS has the following capabilities:

- Receives, transmits, and stores data.
- Accepts data input from the keyboard.
- Communicates in either encrypted or clear modes.
- Relays digital messages between two other subscribers.
- Processes a fire mission in less than two minutes.
- Monitors messages.

Fire Direction Data Manager

The FDDM is used to enhance the tactical and technical fire direction at both the corps fire support element (FSE) and FA brigade FCE as well as the MLRS battalion and battery. It supplements the basic FDS with a more robust communications data processing capability.

Components

The FDDM consists of the basic FDS, a power conditioner unit (PCU), a communications and data processing unit (CDPU), and the PLU described earlier in this chapter.

Power Conditioner Unit. The PCU consists of rechargeable batteries and electronic assemblies that interface vehicle or auxiliary power to the FDDM. The PCU provides backup power to the FDDM in the event of loss of input power. It also provides a power status signal to the FDDM. The PCU consists of a vented battery box and a sealed electronics box.

Communications and Data Processing Unit. The CDPU consists of two microcomputers and an internal power supply mounted in a common chassis. One microcomputer performs communications modem type functions and distributes all message traffic. The other microcomputer performs database management and tactical fire solutions for fire mission processing, scheduling, capabilities analysis, fire planning and munition selection and technical fire control for special applications (SPAP) munitions processing. The FDDM system can function in a degraded mode with only one microcomputer working. The chassis also contains switches, indicators, and connectors necessary for operation of the CDPU.

Forward Entry Device

The FED is a small man-packed data communications terminal with limited processing capability. The FED will be employed to compose, edit, transmit, receive, store, and display messages used in the planning and execution of fire support operations. Operational facilities in the MLRS battalion using the FED will be liaison officers, survey sections, battery commanders, and firing platoon leaders.

Survey Equipment

Position Azimuth Determining System (PADS)

The survey section of the MLRS battery is equipped with one position and azimuth determining system (PADS). PADS is a self-contained surveying system that rapidly determines accurate location, azimuth, and altitude. It is operated by two people. This equipment gives the MLRS battery a highly mobile survey capability, MLRS survey operations are outlined in Chapter 4.

Global Positioning System (GPS)

The precision lightweight GPS receiver (PLGR) is a highly accurate satellite signal navigation set (AN/PSN-11). The set operates as a part of NAVSTAR GPS. Up to five satellites are continuously tracked simultaneously. The AN/PSN-11 has an antenna, keyboard, backlit display, receiver processor unit, and a battery.

It is designed for battlefield use anywhere in the world. It is sealed watertight for all-weather day or night operations.

The PLGR is held in the left hand and operated with the left-hand thumb. Capability is included for installation in ground facilities, and air, sea, and land vehicles. The AN/PSN-11 is operated standalone using prime battery power and an integral antenna. It can be used with an external power source and external antenna (see Figure 1-12).

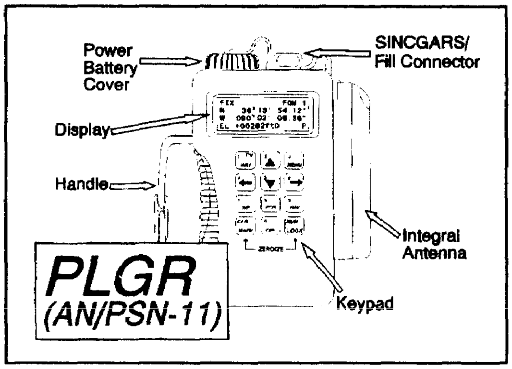

Figure 1-12. PLGR AN/PSN-11.

GPS receivers rely on electronic line of sight with the satellites. Dense foliage, buildings, mountains, and canyons will mask the signal. All GPS receivers automatically try to track visible satellites as low as 50 above the level horizon. Each receiver has a function which displays the direction and vertical angle to the satellite. This display indicates if masking is a problem. When a satellite signal is masked, move to another location if another satellite is not visible.

Multipath (reflected signals) may occur if the GPS antenna is tilted away from a satellite. This may cause a reflected signal from the satellite to be received that has more signal strength than the direct signal, causing several hundred meters of position error.

The PLGR is only useful for position control for MLRS when it provides a figure of merit (FOM) of 1. The FOM is a number from 1 to 9 located in the upper right portion of the display which shows the total estimated position error (EPE) as shown in Table 1-1 below.

Table 1-1. Estimated Position Error

FOM Value	Estimated Position Error
1	≤ 25 m
2	≤ 50 m
3	≤ 75 m
4	≤ 100 m
5	≤ 200 m
6	≤ 500 m
7	≤ 1000 m
8	≤ 5000 m
9	> 5000 m