Coordinating Draft

MCRP 3-13.1A

Tactics, Techniques, and Procedures for the Expeditionary Fighting Vehicle

US Marine Corps

Coordinating Draft

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FOREWORD

Marine Corps Reference Publication (MCRP) 3-13.1A, *Tactics, Techniques and Procedures for the Expeditionary Fighting Vehicle*, provides the first doctrinal basis for the use of expeditionary fighting vehicles (EFVs) in support of Marine air-ground task force (MAGTF) operations. The EFV is a cornerstone to the effective/rapid/thorough implementation of the Marine Corps' expeditionary maneuver warfare and ship-to-objective maneuver operating concepts that are also undergoing development and evaluation. Therefore, EFV doctrine will evolve as our doctrinal concepts mature and this MCRP will serve as a baseline document from which to develop further tactics, techniques and procedures (TTPs) for operational testing and follow-on doctrinal publications.

This publication's target audience is officers and staff noncommissioned officers that serve as members of MAGTF staffs and assault amphibian battalions equipped with the EFV. However, it also provides TTPs for the EFV crews and any attached units and focuses on technical capabilities and employment considerations to be used during developmental testing and fielding of the EFV.

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

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MCRP 3-13.1A
Tactics, Techniques, and Procedures for the Expeditionary Fighting Vehicle

Table of Contents

Chapter 1. Overview
1001. Vehicle Characteristics
    a. EFV(P) Vehicle
    b. EFV(C) Vehicle
1002 Assault Amphibian Units
    a. Headquarters & Service Company
    b. Assault Amphibian Company
        (1) Headquarters Platoon
        (2) Maintenance Platoon
        (3) Assault Amphibian Platoon
1003 Marine Air-Ground Task Forces (MAGTF) and EFV Combat Support
    a. Marine Expeditionary Force (MEF)
    b. Marine Expeditionary Brigade (MEB)
    c. Marine Expeditionary Unit (Special Operations Capable)
    d. Special Purpose MAGTF (SPMAGTF)
    e. Marine Prepositioning Force (MPF) MAGTF
1004 Crew Components and Duties
    a. EFV(P)
    b. EFV(C)

Chapter 2. Land Operations
Section I. Organization for Combat
2101. Fundamentals of EFV Task Organization
2201. Types of Mechanized Units
    a. Tank Heavy Company Team
    b. Mech Infantry Heavy Company Team
    c. Balanced Company Team
    d. Mech Infantry or Tank Pure Company
2103. EFV Allocations
    a. EFV Battalion
    b. EFV Company
    c. EFV Platoon
2104. Recommended Load Plans
Section II. Offensive Operations
2201. Offensive Tactics
2202. Combined-Arms Team
2203. Types of Offensive Operations
2204. Movement to Contact
    a. Meeting Engagement
    b. Bypass
2205 Hasty Attack

- a. Actions on Contact
- b. Conduct of the Attack
- c. Actions of the Commander

2206. Deliberate Attack
- a. Occupation of the Assembly Area
  - (1) Quartering Party
  - (2) Main Body
- b. Actions in the Assembly Area
  - (1) Scheme of Maneuver
  - (2) Control Measures
  - (3) Preparations
  - (4) EFV Employment Considerations
- c. Actions in the Attack Position
- d. Crossing the Line of Departure
- e. Supporting the Attack
- f. Attacks During Limited Visibility
  - (1) The Illuminated Attack
  - (2) The Nonilluminated Attack
  - (3) EFVs in Limited Visibility Attacks
  - (4) Movement Formation in Limited Visibility
  - (5) Movement Techniques in Limited Visibility
- g. Attacking a Strong Point
  - (1) Isolate the Site of Penetration
  - (2) Breach or Penetrate
  - (3) Exploit the Penetration
  - (4) Task Organization
- h. Consolidation and Reoganization
- i. Exploitation and Pursuit
  - (1) Exploitation
  - (2) Pursuit

2207. Forms of Maneuver
- a. Frontal Attack
- b. Flanking Attack
- c. Envelopment
- d. Turning Movement

2208. Combat Formations
- a. Column
- b. Line
- c. Wedge
- d. Vee
- e. Echelon
- f. Distance and Interval

2209. Security
- a. Security During a Halt
  - (1) The Coil
  - (2) The Herringbone

b. Security During a Movement
2210. Movement Techniques
a. Guidelines for EFV Movement
(1) Avoid Possible Kill Zones
(2) Take Active Countermeasures
(3) Use Suitable Movement Techniques
(4) Cover and Concealment
(5) Watch Your Wingman
b. Mounted and Dismounted Infantry
c. Movement Options
(1) Traveling
(2) Traveling Overwatch
(3) Bounding Overwatch
2210. Use of Terrain
a. Terrain Driving
b. Terrain Trafficability Characteristics
c. Cross Country Terrain Considerations
(1) Driving Along a Hillside
(2) Driving in Mud, Snow, or Sand
(3) Driving Through Woods and Brush
(4) Bridge Crossing
2211. Enemy Contact
a. Meeting Engagement
b. Immediate Action and Battle Drills
c. Actions on Contact
d. Near Ambush
e. Far Ambush
f. Antitank Guided Missile
g. Indirect Fire
h. Harassing Fire
i. Enemy Air Attack
j. Follow-on Actions
2212. Platoon Standing Operating Procedures
2213. Dismounting the EFV
a. Ramp and Personnel Door
b. Dismount Procedures
2214. Types of Halts
2215. Employment of Smoke
a. Vehicle Capabilities
b. Crew Procedures
c. Safety Considerations
2216. Immediate Action
2217. Obstacles
2218. Weather and Visibility
2219. Role of the Reserve

Section III. Defensive Operations
2301. Characteristics of Defensive Operations
a. Defense in Depth
(1) Ambush
(2) Counterattack
(3) Invisible Positions
(4) Parallel Defensive Positions
b. Preparation
c. Disruption
d. Concentration
e. Flexibility
f. Defensive Missions
2302. Organization of the Battlespace
a. Deep Operations
b. Close Operations
(1) Security Area Operations
(2) Main Battle Area Operations
(3) Reserve Operations
c. Rear Operations
d. Nonlinear Defense
2303. Planning
a. Static and Positional Element
b. Planning Analysis
c. Defend and Counterattacks
(1) Defend
(2) Delay Operations
(3) Counterattack
(4) Spoiling Attacks
(5) Other Missions
2304. Preparation of the Battlespace for the Defense
2305. Mobile Defense: Defend in Sector
a. Intelligence
b. Maneuver
(1) Direct Fire
(2) Positioning
(3) Conduct of Fire
c. Preparation, Execution, and Counterattack Planning
(1) Preparation
(2) Execution
(3) Counterattack Planning
d. Fire Support
e. Mobility, Countermobility, and Survivability
(1) Turning Obstacles
(2) Blocking Obstacles
(3) Fixing Obstacles
(4) Disrupting Obstacles

f. Aviation
g. Combat Service Support
h. Command and Control
2306. Position Defense: Defend a Battle Position
a. Intelligence
b. Maneuver
(1) Concentrating Fires
(2) Levels of Preparation
(3) Tasks
(4) Considerations for Employment
c. EFV in a BP
(1) Infantry Mounted
(2) Infantry and EFVs on the Same BP
(3) Infantry and EFVs on Separate BPs
d. EFVs in the Mobile Reserve
e. Counterattack Planning
f. Mobility, Countermobility, and Survivability
g. Aviation
h. Combat Service Support
i. Command and Control
2307. Position Defense: Defend a Strongpoint
a. Intelligence
b. Maneuver
(1) Reserve
(2) Concept of the Defense
(3) Preparation
(4) Execution
(5) Counterattack
c. Fire Support
d. Mobility, Countermobility, and Survivability
e. Aviation
f. Combat Service Support
g. Command and Control
2308. Retrograde Operations
a. Delay
(1) Intelligence
(2) Maneuver
(3) Fire Support
(4) Mobility, Countermobility, and Survivability
(5) Aviation
(6) Combat Service Support
(7) Command and Control
b. Withdrawal
(1) Intelligence
(2) Maneuver
(3) Fire support

(4) Mobility, Countermobility, and Survivability
(5) Aviation
(6) Combat Service Support
(7) Command and Control
c. Retirement
(1) Intelligence
(2) Maneuver
(3) Fire Support
(4) Mobility, Countermobility, and Survivability
(5) Aviation
(6) Combat Service Support
(7) Command and Control

Chapter 3. Water Operations
Section I. Fundamentals of EFV Water Operations
3001. Types of Amphibious Operations
a. Conventional Movement
b. Over-the-Horizon Movement
3002. OTH Ship-to-Shore Movement
a. Planning
b.Maneuver Units
c. Command & Control of the OTH Ship-to-Shore Movement
d. Methods of Control
(1) Independent Control
(2) Waypoint Control
(3) Advisory Control
(4) Positive Control
(a) Aircraft Relay
(b) Trail Ship Control
e. OTH Ship-to-Shore Movement Control Measures and Movement Execution
(1) Execution of the OTH Ship-to-Shore Movement
(a) Launch Phase
(b) Transit Phase
(c) Approach Phase
(d) Attack Penetration Phase
(2) EFVs Operating in Proximity of LCACs
(a) Off-Set LCAC/EFV Operations
(b) Sequenced LCAC/EFV Operations
Section II. EFV High Speed Operations
3201. EFV High Speed Waterborne Movement Considerations
a. EFV Wave Organization and Relationships
b. Leader—Wingman Relationship
c. EFV Wave High Water Speed Formations
(1) Echelon
(2) Wedge
(3) Staggered Column

(4) Line Abreast
3202. EFV High Speed Waterborne Movement Execution
a. Coming Up on Plane
b. Stationkeeping and Heading Changes
c. Transit and Approach Routes
d. Coming Off Plane
(1) En Masse
(2) Sequenced
e. Movement from Transition Line Through Attack Penetration Areas

Chapter 4. Gunnery
4001. Placing the EFV MK46 Weapons Station in Operation
4002. Ammunition and Target Destruction
a. Classification
(1) Armor-defeating Ammunition
(2) Chemical Energy Ammunition
(3) Target Practice Ammunition
(4) Dummy Ammunition
b. Identification
c. Components of a Main Gun Round
d. Armor-Defeating Ammunition
(1) Armor Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) or Long Rod
(2) MK 258 MOD 0
(3) MK 268 MOD 0
e. High Explosive (HE) Ammunition
(1) MK 266 Mod 1 HEI-T
(2) MK 264 Mod 0 MPLD-T
(3) MK 240 Mod 0 SAPHE-T
f. Target-Practice Ammunition
g. Machine Gun Ammunition
h. Smoke Grenade Ammunition
(1) L8A1 and L8A3 Smoke Grenades
(2) M76 Smoke Grenades
(3) M82 Smoke Grenades
4003. Boresight and Zero
4004. Target Acquisition
a. Target Acquisition Process
b. Crew Search
c. Dismounted Observer
d. Ground-Search Techniques
(1) Rapid-Scan Technique
(2) Slow-Scan Technique
(3) Detailed-Search Technique
e. Off-Center Vision
f. Air-Search Techniques

- (1) Horizontal Search and Scan
    - (2) Vertical Search and Scan
    - (3) Estimation of Upper Search Limits
- g. Target Detection
    - (1) Target Signatures
    - (2) Dismounted Infantry Signatures
    - (3) Track-Vehicle Signatures
    - (4) Antitank Signatures
    - (5) Artillery Signatures
    - (6) Aircraft Signatures
    - (7) Obstacles and Mines
    - (8) Detection Challenges
- h. Target Location
    - (1) VC Override Method
    - (2) Traverse Method
    - (3) Reference Point Method
    - (4) Clock Method
    - (5) Sector Method
    - (6) Sketch Card Method
    - (7) Grid Method
- i. Target Identification
- j. Target Acquisition Reports
    - (1) Target Classification
        - (a) Most Dangerous
        - (b) Dangerous
        - (c) Least Dangerous
    - (2) Target Confirmation

4005. Range Determination
- a. Recognition Method
- b. Deliberate Range Determination Methods
    - (1) MIL Relationship Method
    - (2) Adjacent EFV Method
    - (3) Map Method
    - (4) Range Method
    - (5) Flash-Bank Method

4006. Direct Fire
- a. Battlecarry
- b. Fire Commands
    - (1) Fire Command Elements
        - (a) Alert
        - (b) Ammunition or Weapon
        - (c) Number and Mode of Fire
        - (d) Description
        - (e) Direction
        - (f) Range
        - (g) Execution

(2) Termination of Engagement
(3) Repeating Commands
(4) Correcting Errors
(5) Crew Duties in Response to a Fire Command
c. Target Engagements
(1) Multiple Main Gun or Coax Machine Gun Engagements
(2) Direct-Fire Adjustment Techniques
(3) Subsequent Fire Commands
(3) Re-engage Method
d. Gunnery Techniques
(1) Precision Gunnery
(2) Degraded-Mode Gunnery
(3) Battlesight Gunnery
(4) Firing Through Smoke
e. Error Sources
(1) Fixed Bases
(a) System Parallax
(b) Ballistic Drift
(2) Variables Biases
(a) Boresight/Boresight Retention
(b) Crosswind
(c) Fire Control
(d) Ballistic Solution
(e) Muzzle Velocity Variation
(f) Range Estimation
(g) Optical Path Bending
(h) Variable Jump
(3) Random Errors
(a) Round-to-round Dispersion
(b) Gunner Lay Error
4007 M240 Coax Machine Gun
a. Engagement Techniques for Far Targets
b. Engagement Technique for Point Targets
c. Special Use of the COAX Machine Gun
(1) Suppressive Fire Engagements
(2) Reconnaissance by Fire
(3) Ranging
(4) Designating Targets
(5) Incendiary Effects
(6) Ricochet Fire
4008 Employing the EFV Weapon Station
a. Fighting Position
(1) Types of Fighting Positions
(2) Fighting Position Construction
(3) Fighting Position Proofing
b. Weapons Planning Ranges and Considerations

c. Creating a Sketch Card
d. Mode of Fire (Single Shot or Burst)
e. Field of View
f. Thermal Settings (White Hot vs. Black Hot)
4009. Loss of a Crewman (Casualty)

Chapter 5. EFV Command, Control, Communications, Computers. and Intelligence (C4I)
5001. Communications Equipment
a. EFV(P)
b. EFV(C)
c. SINCGARS Radio
d. Shadowfire Multi Band/Mission Radio
e. EPLRS Radio
f. HF Radio
g. Intercoms
(1) EFV(P)
(2) EFV(C)
h. Navigation Unit
i. Fax/Copier/Printer
j. DACT and IOW
5002. C4I Architecture
a. EFV(P) Crew Situational Awareness Capabilities
b. EFV(C) C4I Suite
(1) EFV(C) Voice Communications
(2) EFV(C) RF Communications
(a) EFV(C) HF RF Communications
(b) EFV(C) VHF RF Communications
(c) EFV(C) UHF RF Communications
(3) EFV(C) Computer Network
(a) Data Network
(b) Servers
(c) Staff Workstations
(d) Peripherals
(e) Digital Storage
(4) EFV(C) Signal Entry Panel (SEP)
5003 Security
5004 C4I and the Tactical Battlefield
a. EFV(P) Systems Architecture
b. EFV(C) System Architecture
5005. Tactical Operations
a. Tactical Data Nets for the EFVs
b. Tactical Communications for the EFVs
(1) Infantry Squad Leader and EFV(P) Vehicle Commander
(2) Infantry Platoon Commander and EFV(P) Section Leader
(3) Infantry Company Commander/FST and EFV(P) Platoon Commander

(4) BLT Tactical Echelon CP and EFV(C) Vehicle Commander
(5) RLT Tactical Echelon CP and EFV(C) Vehicle Commander
c. Tactical Setup for EFVs
(1) EFV(C) Staffing
(2) Tactical Communications for EFVs
(a) EFV(C) CommO's and 3rd Crewman Responsibilities
(b) Example of Tactical Radio Selections
(c) Internet Addressing
(d) EFV(C) C4I Assignment Worksheet
(e) EFV(C) Stationary Operations

Chapter 6. Maintenance Operations
6001. Interactive Electronic Technical Manual
a. Embedded Logistics and Administrative System
b. Current Capabilities
c. IETM Access
d. IETM Familiarization & Training
(1) User Login
(2) User Options Menu—General Option
(3) Select User Options
(4) Initiate Data Transfer Menu
(5) Select Begin Data Transfer
(6) Tether PMD for Data Transfer
(7) Select OK System Downloads Data
(8) Download Complete
(9) Access Troubleshooting Options Screen
(10) Access W/C List
(11) Selecting a W/C
(12) Access IETM Information Through W/C
(13) End W/C Troubleshooting
(14) Browse for IETM Information
(15) Close IETM
6002. Maintenance Support and Test Equipment
a. On-Board Tools
b. Portable Maintenance Device
c. Third Echelon Test System
d. Slings
e. Tow Bar
f. Nitrogen Charging System
g. Intermediate Passenger Helicopter Aircrew Breathing Device (IPHABD) (SDD Only)
6003 Maintenance Concept
a. Levels of Maintenance
(1) Organizational
(2) Intermediate
(3) Depot

6004 Crew Tasks and Responsibilities
6005 Maintainer Tasks and Responsibilities
6006 Troubleshooting
    a. On-Board Diagnostics
    b. Manual Troubleshooting Procedure
6007 Field Service Representative Responsibilities
    a. FSR Technical Engineering Support
    b. FSR Supply Support
6008. Supply Support
    a. Ordering
    b. Checking Supply Status
6009 Packaging-TBD
6010 Safety and Environmental
    a Safety
        (1) Waterborne Safety
        (2) Land Mode Safety
        (3) Operation and Maintenance Restrictions and Limitations
        (4) Safety Advisor Process
        (5) Maintenance of Use Notices
        (6) Personal Protective Equipment (PPE) Required
        (7) Medical Support
        (8) Emergency MEDEVAC Evacuation Procedures
        (9) MISHAP Reporting
    b. Environmental Compliance

Appendices

A Pre-Operations Checklist
B Embarked Troops—Water Operations Safety Brief
C Embarked Troops—Land Operations Safety Brief
D Embarked Troops—5th Station AFT Land Operations Duties
E Embarked Troops—5th Station AFT Water Operations Duties
F Weapon Conditions
G Recommended EFV (P) Rifle Company & Infantry Battalion Load Configurations
H Disabled Vehicle Evacuation Procedures—Land Operations
I Disabled Vehicle Evacuation Procedures—Water Operations
J Equipment Stowage for the EFV(C)
K EFV Gunnery Tables
L Fire Support Concepts
M EFV At Sea Recovery
N EFV (P) Technical Data
O EFV (C) Technical Data
P Glossary

Chapter 1 Overview

The Expeditionary Fighting Vehicle (EFV) is the United States Marine Corps (USMC) primary means of tactical mobility for the Marine rifle squad during the conduct of amphibious operations and subsequent ground combat operations ashore. The EFV is a self-deploying, high water speed, armored amphibious vehicle capable of seamlessly transporting Marines from ships located beyond the horizon to inland objectives. While providing the speed and maneuvering capabilities to operate with the main battle tank on land, the EFV can negotiate current obstacles to the landing force (oceans, lakes and rivers) as high speed avenues of approach and maneuver. The EFV is an armored, fully tracked infantry combat vehicle that is operated and maintained by a crew of three Marines, and has a troop capacity of 17 Marines with their individual combat equipment. The EFV is a replacement for the current Assault Amphibious Vehicle (AAV7A1). The total EFV requirement is for 1,013 vehicles. The EFV is keystone to the Marine Corps Expeditionary Maneuver Warfare and Ship-to-Objective Maneuver (STOM) operating concepts. The EFV family of vehicles consists of a personnel variant, EFV(P), and a command and control variant, EFV(C). The current acquisition objective of 1,013 EFVs, includes 935 EFV(P)s and 78 EFV(C)s.

1001 Vehicle Characteristics

a. EFV(P) Vehicle

The EFV(P)'s Command, Control, Communications, Computers, and Intelligence (C4I) system extends beyond the line of sight in order to expand the battlespace of the MAGTF while minimizing their vulnerability. The EFVs land mobility characteristics are comparable to the Marine Corps' main battle tank, the M1A1 Abrams tank. This requires a top speed of approximately 45 miles per hour, the capability to traverse the same terrain at the same speed as the tank during cross-country operations, and the capability to cross the same obstacles and terrain features (i.e. trenches, hills, walls, and soft soils) as the tank. The EFV contributes to the survivability of the amphibious task force and permits a significantly faster build up rate of combat power ashore. The EFV achieves a water speed of 20 to 25 knots in a 3-foot significant wave height and can cross a surf zone characterized by up to eight-foot plunging surf. See appendix N for EFV(P) technical data.

Figure 1-1. EFV(P) Vehicle

b. EFV(C) Vehicle

The EFV(C) will provide the commander and his selected staff the freedom of movement and information access to conduct close operations and maintain situational awareness. It provides mobility commensurate with the situation to permit the commander and his selected staff to move rapidly to observe events during the battle. In addition, it provides the functional interface via systems applications to support the intelligence, maneuver, and fire support requirements of the commander and his selected staff, and provides secure voice and data capability between the crew, and the embarked commander and staff. The EFV(C) provides the full range of C4I functionality required to operate as a Regiment or Battalion, Alpha or Bravo command post or a Temporary Fire Support Coordination Center (FSCC). The EFV(C) will provide workstation positions, communications systems and MAGTF C2 tactical software systems applications for an embarked infantry battalion or regimental commander and six (6) staff stations. Each staff station can support the voice and data processing requirement for the Commander, Operations Officer, Intelligence Officer, Fire Support Officer, Air Officer, Artillery Liaison Officer, Naval Gun Fire Officer and Communications Officer. See appendix O for EFV(C) technical data.

Figure 1-2, EFV(C)

1002 Assault Amphibian Units

Assault amphibian (AA) units are organized and equipped to land the surface assault elements of the landing force in a single, seamless lift from assault shipping to inland objectives. When required, the AA unit organization can be tailored to support specific MAGTF lift requirements.

The assault amphibian battalion, the largest AA unit within the Marine Division, is organized to support this capability at each MAGTF level. Using a building block approach, regardless of the MAGTF organization, typically an AA section will support a rifle platoon. An AA platoon will typically support a rifle company. An AA company will support an infantry battalion. The AA battalion can support an infantry regiment and other elements within the Marine Division. This doesn't preclude, however, an AA company, utilizing each of it's 3 AA platoons and headquarters platoon, from supporting separate rifle companies from one or more infantry battalions. Nor does it preclude the AA battalion from providing support, utilizing each of it's four AA companies and headquarters & service company, from providing support to one or more infantry regiments. Each situation will be somewhat different, depending upon units that may already be deployed as part of the MEU(SOC) rotation cycle or participating in the Unit

Deployment Program (UDP). As always, the MAGTF commander will structure his force based upon the mission, equipment and troops available, and time available.

The AA battalion is assigned to the Marine division. The AA battalion is sized and organized to provide combat support to a regimental landing team (RLT). The battalion and/or its subordinate units are attached to or placed in support of a GCE commander to provide tactical mobility, direct fire support, and communications support, across the littorals to elements of the landing force. The AA battalion can augment subordinate AA units with additional vehicles, personnel, and logistics capabilities. Figure 1-3 depicts the organization of the AA battalion.

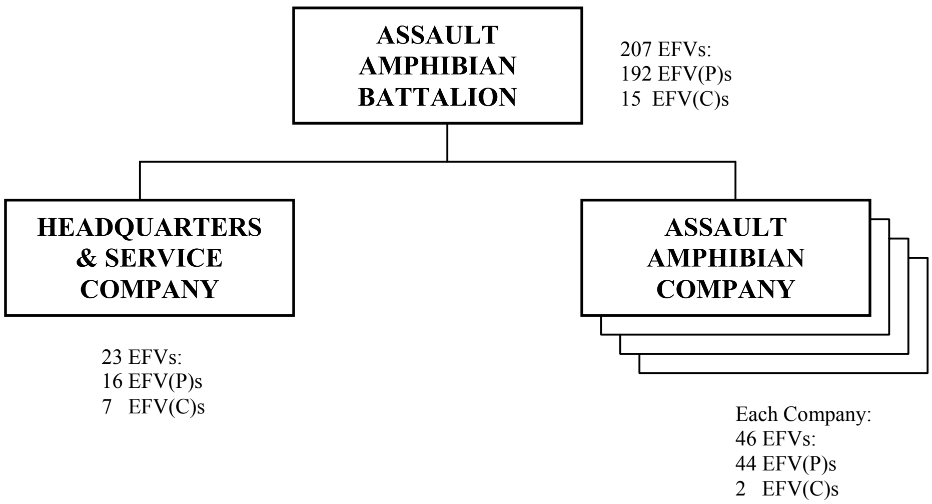


Figure 1-3. Assault Amphibian Battalion.

a. Headquarters & Service Company

The (H&S) Company of the AA battalion provides the battalion commander the means to effect command and control of the battalion. Through its subordinate platoons and sections, the H&S company provides administrative, medical supply, communications, maintenance, and other service support functions to the AA battalion. Within H&S company, the general support platoon, comprised of 23 EFVs, provides the AA battalion the ability to provide tactical mobility and armored protection to designated tactical echelon command posts and attachments. Figure 1-4 depicts the organization of H&S company.

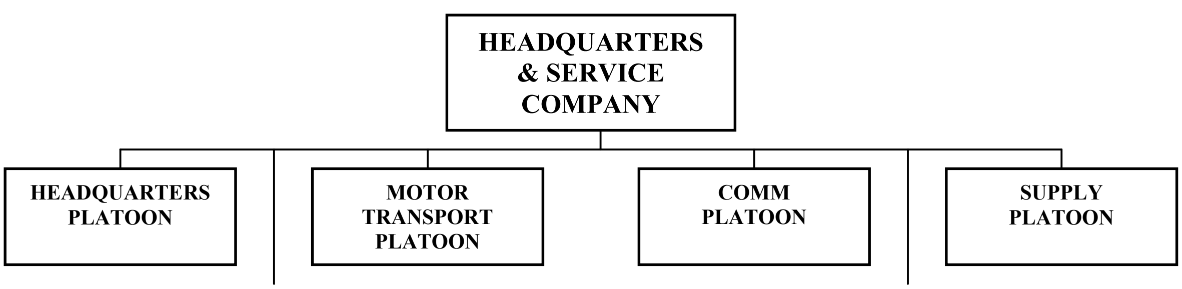


Figure 1-4. Headquarters and Service Company.

b. Assault Amphibian Company.
The AA company is normally employed to lift the surface assault elements of a reinforced infantry regiment. The AA company consists of 3 line platoons, a maintenance platoon, and a headquarters platoon. The AA company is sized and organized to provide tactical mobility and combat support to a battalion landing team (BLT). Figure 1-5 depicts the organization of the AA company.

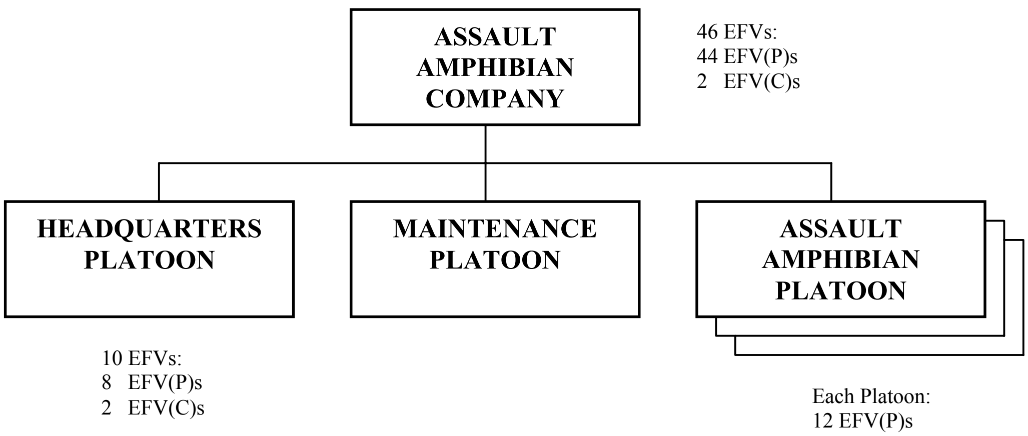


Figure 1-5. Assault Amphibian Company.

(1) Headquarters Platoon. In addition to providing administrative, logistic, ordnance, and medical support to the company, the headquarters platoon of the AA company two AA sections: the command tractor and general support sections. The command tractor section consists of 2 EFV(C)s and 2 EFV(P)s, which provide supported units (typically, an Infantry battalion) with the ability to mechanize the unit's tactical echelon command post. The EFV(P)s of this section act as "chase" vehicles for each EFV(C), providing security and additional lift for the command element. The general support section consists of 6 EFV(P)s, which can be assigned duties as required by the AA company commander. Normally, when in support of an infantry battalion, these tractors will lift elements of the 81mm mortar platoon, designated elements of the anti-armor platoon, or combat engineer personnel attached to the infantry battalion. This section may also be reinforced by the general support platoon of H&S company.

(2) Maintenance Platoon. The maintenance platoon of the AA company provides organizational maintenance support to the company. Assault amphibian repairmen and communications technicians make up the majority of the platoon. These personnel are typically organized into contact teams that are employed at the direction of the AA company commander, and are also assigned to the AA platoons to provide direct support. The AA company commander will organize and deploy the maintenance platoon to best fit the tactical situation and overall task organization of the supported unit(s).

(3) Assault Amphibian Platoon. Each AA line platoon consists of 12 EFV(P)s, and is sized and organized to provide tactical mobility and combat support to a reinforced infantry rifle company. Typically, AA platoons are attached to or in general/direct support of the rifle company. Assault amphibian platoons consist of a headquarters section, and 3 AA sections. The 3 EFV(P)s of the headquarters section are employed to lift the command element of the rifle company, attached indirect fire and close air support personnel, and elements of the 60mm mortar section. Each of the 3 AA sections is employed to lift a reinforced rifle platoon, with attachments from the weapons platoon, such as machine gun teams and/or assault teams. An AA platoon may be reinforced with EFV(P)s from the General Support Section of the AA Company. Figure 1-6 depicts the organization of the AA Platoon.

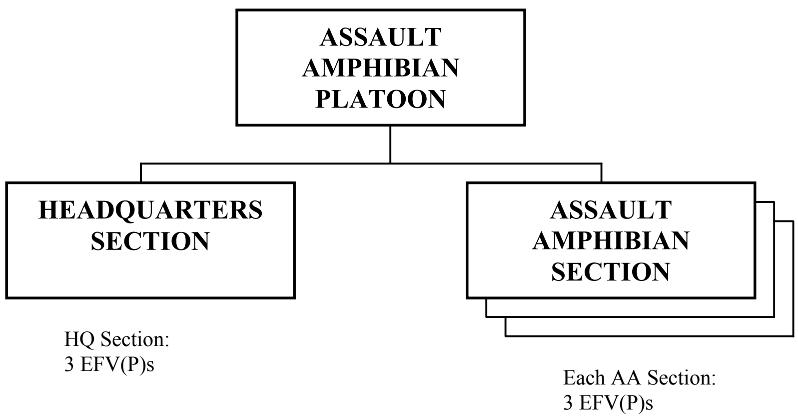


Figure 1-6. Assault Amphibian Platoon.

Each AA section contains 2-4 EFV(P)s. Typically, AA sections are sized and organized to support a reinforced rifle platoon. Each EFV(P) can lift 17 combat equipped Marines or a reinforced rifle squad. For command and control, logistical, and tactical employment purposes, the AA section is normally the smallest unit for employment of assault amphibians.

1003. Marine Air-Ground Task Forces (MAGTFs) and EFV Combat Support.

One of the strengths that any Marine Air Ground Task Force (MAGTF) brings to the battlefield is the ability to task organize to meet the situation. Being able to tailor the major components of the MAGTF (command element (CE), ground combat element (GCE), aviation combat element (ACE), and the combat service support element (CSSE) allows the Marine Corps to bring the "right gear" to the fight. This flexibility in task organization also flows down to the subcomponents of the MAGTF, as well. Cross attaching between infantry and armor units, reinforcing with combat support units (such as assault amphibian units, combat engineers, and aviation defense units) allows commanders within the GCE to build their units to meet the needs of the mission at hand. EFV combat support can be organized and scaled to meet the particular mission of a MAGTF.

a. Marine Expeditionary Force (MEF).
The Marine Expeditionary Force (MEF) is supported by the AA battalion organic to the Marine Division. The AA battalion provides capabilities to provide tactical lift to a RLT (Rein) and additional lift to mount additional command elements. The AA battalion possesses 207 EFVs (192 EFV(P)s, and 15 EFV(C)s) organized into 4 AA companies (44 EFV(P)s, and 2 EFV(C)s) and the H&S company (16 EFV(P)s, and 7 EFV(C)s). Each AA company provides the tactical lift for an infantry battalion (Rein). The assault amphibian assets of the H&S company provide a reinforcing capability to any of the 4 line companies, and allow the mounting of command elements, such as the AA battalion, tank battalion, combat engineer battalion, or the regimental and division tactical echelon command posts.

b. Marine Expeditionary Brigade (MEB).
The Marine Expeditionary Brigade (MEB) is supported by elements of the AA battalion, dependent upon the brigade's mission and task organization. Typically, a MEB will be supported by an AA battalion (Minus) comprised of elements of the battalion headquarters, H&S company, and two AA companies. This breaks down to 2 AA companies of 44 EFV(P)s and 2 EFV(C)s each, and a H&S company element of 11 EFV(P)s and 3 EFV(C)s. This provides for the mechanizing of 2 infantry battalions (Rein) employing the 2 AA companies. Utilizing the H&S company assets, the capability exists to mount additional attachments to those infantry battalions and the mounting of additional command elements, such as the AA battalion (Minus), tank battalion, or the tactical echelon command element of the MEB.

c. Marine Expeditionary Unit (Special Operations Capable) (MEU(SOC)).
The Marine Expeditionary Unit (Special Operations Capable) is typically supported by a reinforced AA platoon. This platoon consists of the standard AA platoon of 12 EFV(P)s, and a command section comprised of one EFV(C) and one EFV(P). The MEU(SOC) AA platoon supports the lift requirements of a reinforced rifle company from the Battalion Landing Team (BLT) of the MEU(SOC). The command section provides the MEU(SOC) Commander the ability to mount portions of the MEU(SOC) or BLT command element, dependent upon the situation.

d. Special Purpose MAGTF
The Special Purpose MAGTF is sized and organized to accomplish a specific mission. When required, assault amphibian support will be structured to meet the needs of the SPMAGTF. Normally, the size of the SPMAGTF is similar to a MEU(SOC), which is supported by an AA platoon (reinforced). This provides the tactical lift capability for a reinforced rifle company and the tactical echelon command post of the SPMAGTF.

e. Maritime Prepositioning Force (MPF) MAGTF.
A MAGTF constituted from MPF assets is supported by assault amphibians based entirely upon the situation. Each of the three standing Maritime Prepositioned Squadrons (MPS) contains 106 EFVs (99 EFV(P)s, and 7 EFV(C)s), the same number of assets associated with a

MEB. This breaks down to 2 AA Companies of 44 EFV(P)s and 2 EFV(C)s each, and a H&S Company element of 11 EFV(P)s and 3 EFV(C)s. This provides for the mechanizing of 2 infantry battalions (Rein) employing the 2 AA Companies. Utilizing the H&S company assets, the capability exists to mount additional attachments to those infantry battalions and the mounting of additional command elements, such as the AA battalion, tank battalion, or the tactical echelon command element of the associated MAGTF. In accordance with standard MPF procedures, the EFV unit must be represented as part of the offload preparation party.

1004 Crew Composition and Duties

a. EFV(P)

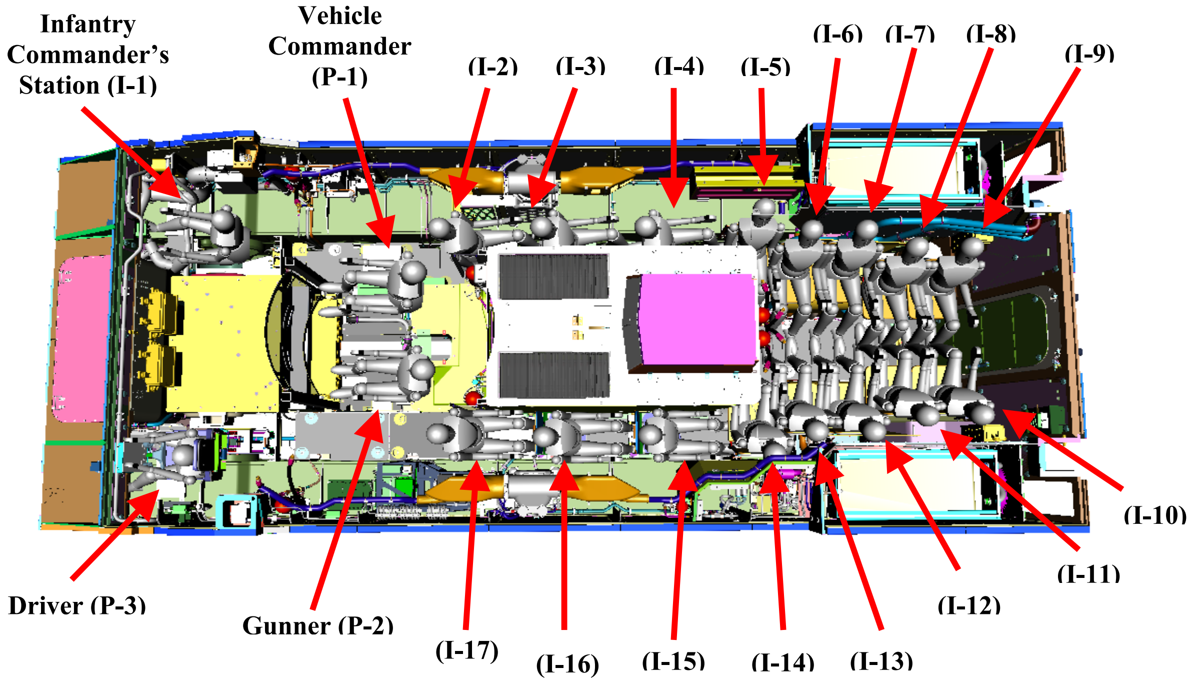
The crew is comprised of a vehicle commander, a gunner and a driver. The vehicle commander and gunner are located in the turret of the vehicle, while the driver's station is located on the port side near the bow. The vehicle commander and his gunner form the "core" of the EFV crew and every attempt should be made to keep these two individuals together and assigned to the same vehicle during operations

The vehicle commander has overall responsibility for the safe operation and sound tactical employment of the vehicle. Although he will receive tactical direction from the infantry troop commander, when embarked, he nevertheless retains ultimate responsibility for the readiness and tactical employment of his vehicle, and for the safety of all personnel on board. When infantry are embarked, he determines and approves the proper load configuration and weight distribution (especially important during high speed water operation) and oversees the actual loading and placement of personnel and equipment. He is also responsible for training his crew to assume his duties when/if needed.

The gunner has primary responsibility for the safe handling and effective employment of the 30mm cannon. He also assists the vehicle commander with load planning and execution. The gunner will also normally provide a vehicle orientation brief, to include assignment of communications equipment, to embarked personnel.

The driver is responsible for the safe operation of the vehicle. He is also responsible for the tactically sound movement techniques described in chapter two. The entire crew is responsible for conducting "at halt" checks as directed by the vehicle commander and outlined within this handbook.

The embarked troop commander is located opposite of the driver on the starboard side of the vehicle. The embarked troops are located along the port and starboard sponsons and the troop area at the stern of the vehicle. Figure 1-7 below provides a view of the EFV(P)'s internal seating layout.



3 Crew Stations (P1 – P3), 17 Infantry (I-1 – I-17)

Figure 1-7. EFV(P) Internal Seating Layout.

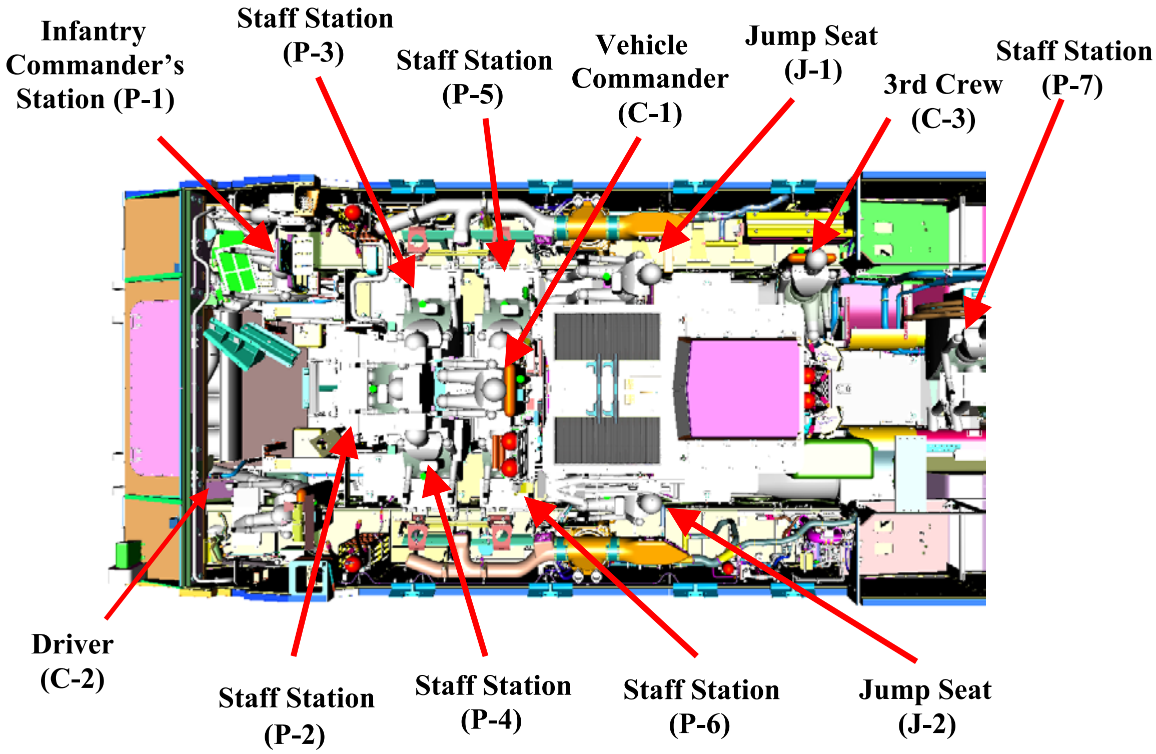
b. EFV(C)
The crew is comprised of a vehicle commander, a driver, and a third crewman. The EFV(C) vehicle commander provides operational guidance and recommendations to the embarked infantry commander on the employment/positioning of the EFV(C) to best support command and control of the maneuvering EFV(P) embarked infantry units. The EFV(C) third crewman provides direct communication/network support to the embarked infantry communications staff representative in the preparation, use and maintenance of the C4I Suite communications/network equipment to support the embarked infantry commander and staff's requirements for command and control.

The commander of the embarked troops is responsible for everything his unit does or fails to do. Embarked staff responsibilities are as follows:

- The operations officer is responsible for planning, coordinating all tactical operations including integrating fires and maneuver and allocating personnel, weapons, equipment and ammunition.
- The intelligence officer is responsible for intelligence planning and supervision, which includes the assignment of resources, management of intelligence means, production, and dissemination of intelligence products and counter intelligence.
- The fire support officer is responsible for supervising the fire support coordination center and developing fire support plans as well as other duties.

- The air officer is responsible for providing subject matter expertise on all aviation issues, liaison with the tactical air control party (TACP), and coordination of all aviation support.
- The communications officer is responsible for the overall communications and information systems operations.
- The naval gunfire officer is responsible for providing subject matter expertise on all naval gunfire issues, liaison with the naval gunfire spot teams, and coordination of all Naval Gun Fire support.
- The artillery liaison officer is responsible for liaison with the artillery forward observers and coordination of all artillery fire support.

In addition, the EFV(C) provides two Jump Seats to accommodate additional regiment, battalion or FSCC support personnel. The tactical software systems applications provided in the EFV(C) vehicle are Command and Control Personal Computer, Intelligence Operations System (IOS V1), Intelligence Operations System (IOS V2), and Advance Field Artillery Tactical Data Systems (AFATDS). Figure 1-8 provides a view of the EFV(C)'s internal layout.



Staff Stations (P1 – P7), 3 Crew Stations, 2 Jump Seats (J1, J2)

Figure 1–8. EFV(C) Internal Layout.

Chapter 2. Land Operations

This chapter provides the techniques and procedures employed by the EFV unit during land operations. The chapter is broken down into three main sections: organization for combat, offensive operations and defensive operations. The tactics, techniques, and procedures specified in Marine Corps Warfighting Publications (MCWP) 3-13, *Employment of Assault Amphibian Vehicles*, remain in effect unless specifically addressed in this chapter.

Section I. Organization for Combat

EFVs normally operate in support of Marine infantry, and often as part of a mechanized task force. Additional information related to this subject is found in MCWP 3-13.1, MCRP 3-12.3B and FMFMs 9-1 and 9-2.

2101. Fundamentals of EFV Task Organization

Regardless of the size or organization of operating EFV units they must all possess four basic fundamentals. Those basic fundamentals are:

- Flexibility:
  - Based on the situation.
  - Must fit rapidly changing situation.
  - Elements within task-organized unit must have similar degree of mobility.
- Unity of command:
  - Mechanized units operate at distances and tempos that often preclude centralized control.
  - EFV units are attached to a supported unit in which there is a nucleus command cell.
  - Commanders should avoid making frequent changes to task organization.
  - Commanders will usually establish standing relationships in order to develop SOP's and familiarity.
- Self-sufficiency:
  - Build-in CSS assets to allow mobility across the battlefield.
  - Attached CS assets provide integrated and centralized synchronization to allow for maximum fire support when needed.
- Tactical integrity:
  - Tactical integrity facilitates command and control.
  - Commanders should not break units down below their "base" unit. (i.e., section or fire team)

2102. Types of Mechanized Units

a. Tank Heavy Company Team

- Comprised of more tank than mech infantry units. See figure 2-1.
- Preferred when shock action and firepower are desired.

- Terrain is open with few obstacles.
- Enemy fire is suppressed.
- As an example, a rifle platoon embarked aboard an EFV section is cross-attached to a Tank Company to provide dismounted support as required.

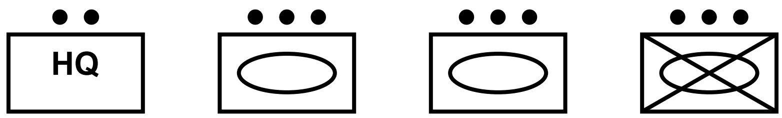


Figure 2-1. Example of a tank heavy mechanized company team.

b. Mech Infantry Heavy Company Team:

- Comprised of more mech infantry than tank units. See figure 2-2.
- Employed in the conduct of security operations (guard, cover, screen).
- Employed when specific terrain must be seized and held.
- In built up areas.
- During limited visibility.
- In restricted terrain.
- Against battle positions or strong points.
- When heavy anti-tank fires or obstacles are expected.
- As an example, a tank platoon is cross-attached to a mechanized infantry company to provide armor support as required.

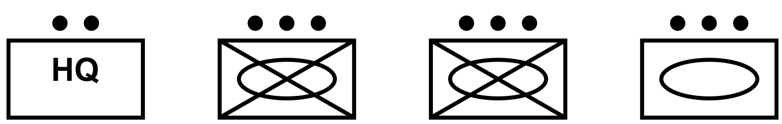


Figure 2-2. Example of a mech infantry heavy company team

c. Balanced Company Team

- Comprised of equal tank and mech infantry units. See figure 2-3.
- Employed to achieve maximum flexibility.
- Enemy situation is unclear.

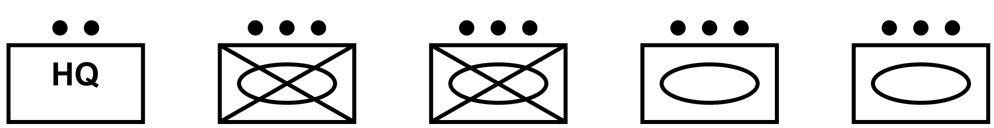


Figure 2-3. Example of a balanced company team

d. Mech Infantry or Tank Pure Company

- Has either tank or mech infantry units but not both. See Figure 2-4.
- May be established when specific requirements of the mission dictate (river crossings, riverine operations).

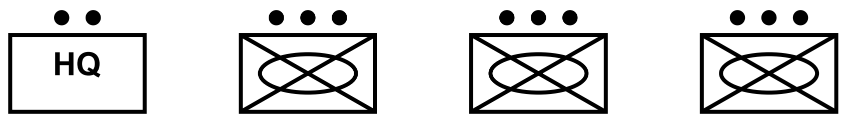


Figure 2-4. Example of a mech infantry pure company

2103. EFV Allocations

Capabilities of EFV units to embark infantry vary with their size. The EFV battalion is assigned to a marine Division.

a. EFV Battalion.
This is the largest of the EFV units.

- EFV BN usually supports an infantry regiment.
- Provides EFVs that make infantry units mechanized.
- Provides tactical mobility, enhanced firepower, and armor protection.
- Provides cross-country mobility roughly equal to tanks.
- Is not designed as an infantry-fighting vehicle.
- Is best suited for offensive operations involving deep penetrations and envelopments.
- Is excellent in the defense to conduct a counterattack or mobile defense.
- Provides mobility in security operations.

b. EFV Company
Typically four EFV companies are assigned to the EFV battalion.

- Normally supports an infantry battalion with 44 EFV(P)s and 2 EFV(C)s.
- Recommended load plans are provided at Appendix G.
- Minimum requirements include:
    - 12 EFV(P)s per rifle company x 3 companies.
    - 1 EFV(C) and chase EFV(P) for the tactical CP.
    - 1 EFV(C) and 1 chase EFV(P) for Bravo Command or “Jump CP.”
    - the command group chase vehicle.
    - 6 EFV(P)s for 81mm mortar platoon. (or as otherwise allocated.)
    - EFVs may be required for additional attachments (combat engineers, etc), normally drawn from the EFV Bn H&S company.

c. EFV Platoon
This is the most common unit to support a standard marine rifle company during operations and is the base EFV maneuver element.

- Normally supports a rifle company.
- 12 EFV(P)s per rifle company.
- 3 EFV(P)s per rifle platoon x 3 platoons (1 rifle squad [rein] per EFV[P]).
- 3 EFV(P)s for the command group, fire support coordination personnel, and weapons platoon (minus) per rifle squad.

An EFV Platoon is normally comprised of twelve EFV(P)s, organized into three sections of three vehicles each, and a Headquarters Section of three vehicles to be employed at the discretion of the EFV Platoon Commander. The EFV Platoon Commander is responsible for the safe and effective employment of the platoon as a whole, while the EFV Section Leader is responsible for the safe and effective employment of his section within the platoon formation. The EFV Vehicle Commander is responsible for the safe and effective employment of his individual vehicle within the section formation.

The Rifle Company Commander, as the embarked (or supported unit) tactical commander, will normally be aboard the same EFV(P) as the EFV Platoon Commander. The Rifle Platoon Commanders will normally be aboard an EFV Section Leader's vehicle. When mounted, the Rifle Company Commander exercises maneuver control of his company through the EFV Platoon Commander, the Rifle Platoon Commanders through the EFV Section Leaders. While mounted or dismounted, the Rifle Company Commander coordinates EFV(P) direct fires through the EFV Platoon Commander, the Rifle Platoon Commanders through the EFV Section Leaders. The Rifle Company Commander, particularly during waterborne operations, will utilize the training and expertise of the EFV Platoon Commander and his Section Leaders for advice on tactical employment considerations, to include formations, movement techniques, and battle drill for actions on contact.

The "leader – wingman" concept is employed down to the EFV Section level. For example, in a section of three EFVs, there are two wingmen who guide off the movements of the leader. This concept facilitates overall unit movement, maintenance of security, and transitioning from one formation to another. It can be particularly effective during periods of radio listening silence and enhance unit survivability in built-up areas.

2104. Recommended Load Plans

Recommended load plans are provided at appendix G. Unit and individual vehicle load outs will vary dependent upon mission and task organization.

Section II. Offensive Operations

The purpose of offensive operations is the destruction of the enemy and his will to fight. Although a well planned and executed defensive posture can give the defender several advantages over the attacker, the attacker has a major advantage that is decisive if properly exploited. He can apply combat power at points of his choosing. Since the defender cannot be strong everywhere, the attacker can usually concentrate enough combat power at a decisive time and place to overwhelm the defender. The EFV provides the infantry with the capability to rapidly maneuver to a decisive point and to deliver a killing blow.

A mechanized force is primarily offensive in nature. Only in the offense can the commander fully exploit the mobility, firepower, and shock action of mechanized forces. The EFV unit provides the requisite armor protected mobility and firepower to enable the infantry commander to conduct offensive mechanized operations.

2201. Offensive Tactics

Offensive operations are composed of the following phases: preparatory, conduct, and exploitation. Mechanization provides the commander the mobility to rapidly maneuver throughout the battlefield. Additionally, this physical speed assists the commander's ability to establish the tempo of operations. A higher tempo in turn generates greater combat power through surprise and violent maneuver against the enemy's critical vulnerabilities and center of gravity. Minimal preparation time, speed of execution, and rapid and relentless exploitation characterize the offense in mechanized operations.

Many of the fundamentals of offensive tactics are related and provide logical and time-proven application of the principles of war to the offense. These fundamentals are listed below and are discussed in detail in FMFM-6.

- Maintain situational awareness.
- Exploit known enemy gaps.
- Control key terrain.
- Dictate the tempo of operations.
- Neutralize the enemy's ability to react.
- Maintain momentum.
    - ➢ Act quickly.
    - ➢ Exploit success.
    - ➢ Be flexible.
    - ➢ Be audacious.
    - ➢ Provide for security of the force.

2202. Combined-Arms Team

Combined arms are the key to success in Marine Corps offensive tactics.
The mechanized or tank company is the basic ground combined-arms fighting unit, designed to maneuver against the enemy and defeat or bypass him. Units are formed by attaching tank platoons to mechanized infantry companies and mechanized infantry platoons to tank companies. EFV units in support of rifle companies and platoons provide the mechanization and additional firepower required for the conduct of offensive operations.

A typical maneuver company consists of a command and control unit and assault unit. Assault units are created by assigning EFV and tank units with infantry platoons, as well as attached weapons and engineers. Tactical integrity of task-organized units should be maintained when embarked in EFVs. Therefore, one EFV(P) will normally support a reinforced rifle squad. Crew-served weapons, support, and command personnel may be transported in these same vehicles.

To best use the tank-mechanized team's firepower, each unit should be assigned the mission it performs best. Armor (tank and EFV) units attached to infantry units assist by:

- Providing mobile protected firepower.
- Neutralizing or destroying hostile weapons by fire and movement.
- Clearing paths for dismounted infantry.
- Neutralizing and destroying fortified positions with direct fire.
- Supporting dismounted infantry by direct fire.
- Providing protection against long range antitank fire.
- Leading the attack when appropriate.

Infantry units assist armor units by:

- Breaching or removing antitank obstacles.
- Assisting in the neutralization or destruction of enemy antitank weapons.
- Designating targets for tanks and EFVs.
- Protecting armor units from infantry and hand held antitank weapons.
- Leading the attack dismounted when necessary.
- Assisting in the consolidation of the objective.
- Clearing bridges and fording areas.

EFVs provide overwatch for the movement of tank units and provide suppressive fire to cover their flanks and rear -- EFVs also support by fire the attack of their dismounted infantry.

The mechanized team commander organizes his force to maximize the capabilities of both mechanized infantry and tanks. If the team is to exploit its offensive capabilities, tanks, EFVs and infantry must work together. Certain conditions determine which of these elements leads and whether infantry dismounts.

Tanks normally lead and infantry remains mounted when:

- Enemy anti-armor fires can be effectively suppressed by fire and/or smoke.
- Terrain and weather afford armor units good trafficability.

The infantry can follow tanks dismounted or mounted on the EFVs. The infantry usually remains mounted when enemy resistance is extremely light or has been significantly reduced by supporting fire. Infantry may also remain mounted when the enemy is in hasty positions with no

AT weapons and sufficient tanks exist to handle the situation. When dismounted, infantry follow tanks as they move over an enemy position, covering the flanks and rear of the tanks and using small arms and grenades on enemy positions. TOWs, EFVs and other available supporting weapons will support by fire. Although the EFV is far more survivable than the AAV7A1 it is replacing, it is still vulnerable to antitank weapons, and is not designed to be employed as a tank.

Infantry leads dismounted when:

- Obstacles prevent mounted movement and cannot be bypassed.
- Effective anti-armor fire can't be suppressed any other way.
- Terrain canalizes mounted movement into likely enemy ambush sites and minefields (e.g. urban areas and defiles).
- Visibility is limited.

When tanks lead, they and infantry maneuver together, supported by fire from other tanks, EFVs and from the team's other supporting weapons. Throughout the maneuver, each gives the other mutual support. EFVs follow the tanks close enough to provide covering fire to the tanks or to exposed flanks to protect them from enemy infantry and AT weapons.

EFVs may lead tanks under certain conditions. For example, an unfordable body of water or a marshy area may require EFVs to lead while tanks support by fire. Or, there may not be enough tanks to accompany every maneuver element. In this case they will be used where the need is greatest.

When necessary, both tanks and EFVs can move close to or even under supporting artillery (air burst) fire. However, this maneuver should be the exception rather than the rule, since vehicles and equipment can be damaged.

Once the supported commander decides to dismount his infantry, he chooses when and where to dismount. Timing is critical--dismounting too early will slow the team's momentum and can unnecessarily expose the infantry. The dismount point must provide cover and concealment, yet be as near the objective as possible. EFV unit leaders must ensure that their vehicles do not halt in the open and that all vehicles are properly dispersed.

When dismounted infantry follow tanks, EFVs may follow closely behind the infantry, providing suppressive fire to the flanks. When visibility is poor and fields of fire are short, tanks, EFVs and infantry will move together.

When leading the attack, the dismounted infantry rapidly close with the enemy by fire and movement.

Dismounted infantry may designate targets for over-watching vehicles and use small-arms fire and grenades to destroy any enemy remaining in position.

2203. Types of Offensive Operations

EFV units normally participate in the offense as part of a larger force, which will be conducting one of four types of offensive operations:

- Movement to contact.
- Attack.
- Exploitation.
- Pursuit.

A movement to contact is an offensive operation design to gain or re-establish contact with the enemy.

The purpose of the attack is to defeat, destroy, or neutralize the enemy. An attack emphasizes maximum application of combat power, coupled with bold maneuver, shock effect in the assault, and prompt exploitation of success. There are a number of different types of attacks. The differences between the types of attacks lie in the degree of preparation, planning, coordination, and the effect desired on the enemy.

- A deliberate attack is an offensive action characterized by pre-planned, coordinated employment of fire and maneuver to close with and destroy or capture the enemy.
- A hasty attack is an attack in which preparation time is traded for speed to exploit an opportunity.
- The reconnaissance in force is always a deliberate attack to obtain information and to locate and test enemy dispositions, strengths, and reactions. While the primary purpose of a reconnaissance in force is to gain information, the commander must be prepared to exploit any opportunity.
- A feint is a supporting effort designed to distract the enemy's attention away from the main effort.
- Demonstrations are related operations, also designed to divert enemy attention to allow decisive action elsewhere. A demonstration is a show of force that threatens an attack at another location but does not make contact with the enemy.
- A raid is an offensive operation, usually small in scale, involving a penetration of hostile territory for a specific purpose other than seizing and holding terrain. It ends with a planned withdrawal upon completion of the assigned mission.
- A spoiling attack is normally launched from a defensive posture to disrupt an expected enemy attack. A spoiling attack attempts to strike the enemy while he is most vulnerable; during his preparations for attack in assembly areas and attack positions or while he is on the move prior to crossing the line of departure.
- A counterattack is similar to the spoiling attack in that it is also conducted from a defensive posture. The counterattack is conducted with the reserve or otherwise uncommitted or lightly engaged forces. Its mission is to attack the enemy when a tactical error by the enemy has exposed him to counteraction. The commander should be prepared to use this attack as a means to move to the offensive.

An exploitation is an offensive operation that usually follows a successful attack and is designed to disorganize the enemy in depth. During the exploitation the enemy may still be capable of fielding cohesive units after being attacked.

A pursuit is an offensive operation designed to catch or cut off a hostile force attempting to escape, with the aim of destroying it. The main difference between exploitation and pursuit is the condition of the enemy.

In practice, these types of operations are closely related. Furthermore, at the small unit level--particularly at the individual EFV level--the crew actions are essentially the same for all four types of operations. It is not the type of operation which distinguishes crew actions, but the movement techniques and forms of maneuver which are the distinguishing characteristics. The EFV unit must be trained and organized to transition from one type of operation to another without delay. The transition may occur in sequence in a successful battle, beginning with movement to contact to locate the enemy and concluding with the destruction of the enemy through pursuit.

2204. Movement to Contact

Movement to contact is a type of offensive operation. The main objective of a movement to contact is to gain or regain contact with the enemy. Movement to contact is conducted when the enemy situation is vague. Therefore, the unit uses formations and movement techniques allowing the greatest amount of flexibility and security. The unit conducting the movement to contact should lead with a minimum of its combat power forward. This will allow the bulk of its combat power to maneuver.

A unit conducting a movement to contact is organized into two elements: the security force (also referred to as the advance guard) and the main body. This organization permits the depth of formation necessary to provide early warning and reaction time for the commander. Companies in the main body move, using techniques that maximize control, speed, and flexibility. The main body reacts to the situation based on the actions of the security force. The security force protects the unit from surprise by observing and reporting enemy activity. The missions of the security force are to:

- Report enemy contact to the unit commander.
- Collect and report all information about the enemy.
- Select tentative fighting positions for on-coming units.
- Attempt to penetrate enemy security elements and reach and identify the enemy main force.
- Perform chemical and engineer reconnaissance.
- Bypass or breach (in stride) hasty obstacles.

The security force performs forward reconnaissance or security in addition to, or in place of, light armored reconnaissance units. In relatively open terrain, a tank-heavy team combined with EFV, infantry, and combat engineers permits the greatest amount of flexibility and has enough combat power to develop the situation after contact with the enemy has been made, breach minor obstacles, secure terrain and clear small villages and wooded areas. When contact with the enemy is made it is called a meeting engagement. When decisive contact is not desired with an enemy unit/position the decision may be made to bypass.

a. Meeting Engagement
A combat action that occurs when a moving force, incompletely deployed for combat, engages the enemy at an unexpected time and place. A meeting engagement often occurs during a movement to contact. The basic principle of a meeting engagement is seizing or retaining the initiative. The infantry unit commander controls the movement of his unit through the EFV unit leader.

Success or failure in most meeting engagements is determined in the opening moments and depends on the ability of the commander to quickly bring to bear all the combat power at his disposal. Reacting immediately, the element first making contact engages the enemy by fire, deploys, reports, and develops the situation. The side that brings effective fire to bear on the enemy first has a significant advantage. Overwatch elements and supporting arms suppress the enemy. When possible, the leading element fights to eliminate the enemy and continue the advance. When this is not possible, the commander may:

- Order the lead element to fix the enemy in place and bypass with the rest of the force.
- Conduct a hasty attack.
- Adopt a hasty defense or delay while the next higher commander reacts to the situation; or disengage.

b. Bypass
One of the options available to a commander when contact is made with the enemy is to bypass. This would typically be appropriate if the enemy does not present a meaningful threat and bypass routes are available. If you did stop to engage the enemy, it could mean that accomplishing your main mission would be jeopardized. Light enemy resistance should not be allowed to slow your momentum. It is likely that the operations order will specify whether or not light enemy resistance is to be bypassed. However, the enemy isn't ignored--there are actions taken by the mechanized force, which should be part of the unit's SOP. The EFVs may likely be directed to suppress by fire. The infantry would remain mounted and the mechanized unit commander would call for indirect fire and smoke to screen his unit's movement past the enemy position. Whenever enemy is bypassed the unit commander must report to higher headquarters so follow-on forces are not surprised.

2205. Hasty Attack

A hasty attack is an attack in which preparation time is traded for speed in order to exploit an opportunity. Opportunities for hasty attacks result from movements to contact, meeting engagements, successful defense, penetrations, or any unplanned success. Use simple, easily coordinated schemes of maneuver and plans for supporting fires that can be executed without hesitation. In order to maintain initiative and momentum, minimum time is devoted to preparation. A hasty attack seeks to take advantage of the enemy's lack of readiness and involves boldness, surprise, and speed--characteristics well suited to mechanized forces.

a. Actions on Contact

Actions on contact by the sections and platoons (and individual EFV crews) will be similar to those of a deliberate attack. However, the specific actions will depend on the enemy's response to the contact. It is likely some type of immediate action will be necessary pending receipt of an order to attack. This could include delivering suppressive fires with the 30mm gun and/or maneuvering to cover and concealment. You can expect to have minimal time for any last minute preparations before the order to attack is given. The order will usually be an oral frag order with only as much detail as time and the situation permit, but little or no time will be available for the preparatory actions associated with deliberate attacks.

b. Conduct of the Attack

A mechanized attack may be conducted mounted or dismounted. Once the attack has begun and the tactical situation changes, it may be necessary to alter the plan. Therefore, infantry platoons and EFV sections must be prepared to react to changes rapidly. During the attack the control of EFV fires will be the primary responsibility of EFV unit leaders in order to maximize combat power and insure the safe employment of the weapons system.

c. Actions of the Commander

The commander must place himself in the most advantageous position from which he can command and control his unit. He must go wherever he feels his presence is most needed. He must keep in mind that his primary weapon is the mechanized unit that he controls.

The commander should attempt to make maximum use of all fire support assets available in order to support his movement. Fire neutralizes, suppresses, demoralizes, and destroys enemy forces. Movement brings this firepower into positions from which it extends and completes destruction. Maneuver consists of fire and movement. Fire, direct and indirect, placed on the enemy reduces his capability to interfere with the mechanized unit’s movement.

The EFV provides the infantry with all the essential elements of maneuver. The speed and mobility of the vehicle allows the commander to place his vehicles and infantry in the most advantageous position rapidly, and the MK 46 weapons station can provide accurate fires on the target.

2206. Deliberate Attack

A deliberate attack is a type of offensive action characterized by preplanned coordinated employment of firepower and maneuver to close with and destroy or capture the enemy. EFV sections and platoons will generally be part of a larger mechanized force when a deliberate attack is ordered. A deliberate attack is required to destroy or penetrate a well-prepared enemy defense. The longer preparation time allows for more detailed fire planning, to include scheduled fires, and more specialized task organization. The purpose of a deliberate attack is to break through the enemy's main defensive zone into his rear area to destroy artillery positions, command posts, logistics support areas, air defense artillery positions, and lines of communication. The attacking force concentrates overwhelming combat power into a rapid, violent attack on a narrow front through the enemy defensive system. In such an attack, the team may be instructed to assault and secure a critical piece of terrain, or drive rapidly through the enemy position, sliding off and around the flanks of enemy strong points in order to quickly enter the enemy rear area. A deliberate attack offers the best opportunity to use offensive air support without delaying the attack.

Prior to any offensive operation using EFVs, careful consideration should be given in planning. This includes occupying an assembly area, actions in the assembly area, actions in the attack positions, actions after crossing the line of departure, how EFVs support the attack, considerations for visibility and conducting the attack.

a. Occupation of the Assembly Area

An assembly area is used to prepare for future operations. While not a battle position, it should be located on easily defensible terrain, and should be planned like a defensive position. Assembly areas will be designated which offer cover and concealment from the enemy while preparations are made for the attack.

(1) Quartering Party. The mechanized force commander may decide to organize a quartering party to reconnoiter an area for an assembly area. He would likely include the EFV platoon sergeant or one of the section leaders in the quartering party in order to seek advise from him on the suitability of an area for EFV occupation, and to aid in planning for any future offensive operations. Additional EFV personnel may be included in the advance party to aid in organizing the assembly area for the arrival of the main party. Ideally the quartering party will move over the same routes to be used by the main body in order to get a time distance check. If the quartering party is to perform a route reconnaissance over a route on which no current information exists or is subject to enemy interdiction, engineer personnel may accompany the quartering party to perform evaluation of roads and bridges. Other duties of the quartering party would be to scout for individual vehicle locations within the assembly area and then act as guides to the sites for the main body, reconnoiter the area for enemy forces, organize the area based on the commander's guidance, designate unit areas, command post, and an area for the combat trains, improve and mark entrances and exits, and mark and remove obstacles. The quartering party is very vulnerable and therefore must be security conscious during the entire period that they are operating as a separate entity.

(2) Main Body. The main body will move into the assembly area either at a prearranged time or when the quartering party signals that the assembly area is prepared for occupation. Movement to the assembly area will be swift, usually using a column formation. Guides will direct the EFVs to their specific area within the assembly area upon arrival. Once in the assembly area, the EFV crews will concentrate on readying their vehicle for combat and maintaining security measures while waiting to be briefed on the mission.

b. Actions in the Assembly Area

(1) Scheme of Maneuver. When preparing for a deliberate attack the mechanized company commander and EFV platoon commander must first reconnoiter the area as much as time permits. In particular, they try to locate obstacles between the LD and objective area, covered routes into or around enemy positions, and positions from which direct fire weapons can support an assault. The unit commander then develops a scheme of maneuver and a fire support plan based on his knowledge of the mission, enemy, troops available, terrain, and weather in the operations area. His scheme of maneuver must be simple and:

- allow rapid closing with the enemy, using terrain to avoid enemy fire;
- use terrain features and other measures to keep control of maneuver and fires;
- keep infantry mounted as long as possible to use the mobility, firepower, and protection of the EFV; and
- strike the enemy flank, rear, or other known weak points.

The commander's fire support plan must use all available fires. EFVs will usually be tasked to fire at AT weapons, crew-served weapons positions and enemy soldiers.

(2) Control Measures. Only those control measures required to ensure adequate control of the attack are specified. The control measures that apply to a specific EFV unit will depend on the mission that each is assigned. Given the standard mission of transporting the infantry to a dismount point and then supporting by fire, control measures must include as a minimum: Time of departure from the assembly area, route of advance, location of dismount point, location of any checkpoints and phase lines if applicable, sector of fire for supporting the attack, specific instructions for shifting fires during the assault, and actions after the objective is seized.

(3) Preparations. Use all available time for preparing the EFVs and crews for the attack. Combat trains should be available for any logistic needs such as fuel and ammunition. The operational conditions of all vehicle systems are checked. After all crews have been briefed, it is imperative that the unit leaders ensure that everyone understands their role. The optimum preparatory measure would be to conduct a rehearsal if the time available and tactical situation permits.

(4) EFV Employment Considerations. The vulnerability of the EFVs to antitank fire makes employment considerations a critical factor. It is imperative that troops dismount EFVs and deploy against the enemy when the situation dictates. Therefore, small unit leaders require the authority to be flexible in the execution of the deliberate attack, particularly as it applies to dismounting infantry units. However, with the greatly increased fire support capability of the EFV (30mm gun), and other supporting arms, particularly tanks, the need to dismount early will be minimized.

c. Actions in the Attack Position

The purpose of an attack position is to have a covered and concealed location short of the LD where last minute instructions are issued and final coordination is made. An attack position is normally planned, but may be bypassed if the attacking unit is engaged with the enemy earlier than anticipated, or if no final coordination is required prior to crossing the LD. This is the area where the infantry normally dismounts to conduct the attack.

d. Crossing the Line of Departure
A line of departure is designated to coordinate the departure of attack or scouting elements. It is one of the standard control measures used in a deliberate attack. A time is attached to the LD, which specifies when it is to be crossed. This makes coordination easier with adjacent and supporting units.

e. Supporting the Attack
There are many variations on how EFVs can support the attack. One procedure is for EFVs to support the attack by fire after infantry units have dismounted. This entails maneuvering to a hull-down position to fire on the objective, or to at least fire to the front and flanks of the advancing dismounted units. This fire support role would usually be in coordination with other supporting arms fires. An example of a variation of this support role is using EFVs to deceive the enemy. After dismounting the infantry, EFVs maneuver away from the main point of the attack to deceive the enemy as to the actual location of the attack.

f. Attacks During Limited Visibility
Limited visibility includes smoke, haze, snow, rain, fog, and darkness. The mechanized unit commander must be prepared to take advantage of all forms of limited visibility to continue all functions of combat. The nature of night movement will be greatly affected by the amount and types of night vision equipment available to the mechanized force. Generally, a mechanized force is well equipped. EFVs are equipped with night vision devices for drivers. Vehicle commanders and other vehicles that are not equipped with organic night viewing devices should be assigned night vision goggles. While night vision devices greatly enhance the ability to move at night, they do not eliminate the need for the control techniques mentioned above.

Not only do attacks during limited visibility require more detailed preparation than attacks during good visibility, objectives are normally smaller and distances to them shorter. Plans must be kept simple but complete and must be understood by all. If time and the enemy situation permit, leaders should reconnoiter routes and observe the objective area during good visibility. Indirect fire should be planned for suppression, and for illumination during darkness. Whether the attack is mounted or dismounted, every Marine should participate in a rehearsal on his portion of the plan to insure complete understanding throughout the unit

(1) The Illuminated Attack. If the attack is to be done during darkness, the commander may illuminate the battlefield using indirect fire. If he wishes to take advantage of the limited visibility conditions or cannot adequately illuminate the battlefield, he may attack mounted, dismounting short of the objective as appropriate. He may also decide to attack dismounted and use stealth to gain surprise. An illuminated night attack is conducted similar to a daylight attack. Illumination makes control easier and allows rapid movement. It also improves the enemy's ability to detect advancing units. Illumination fires are planned and called as needed--normally for the final assault.

Smoke can be cut down the effectiveness of enemy battlefield illumination and some of his night vision devices. Indirect High Explosive (HE) fire may be used to hide the sound of the EFVs as well as to suppress enemy gunners.

The commander may decide to attack mounted to maintain momentum against an enemy occupying hastily prepared positions. This allows the infantry to close rapidly on the objective, and it conserves their strength. As during good visibility, the mechanized unit moves mounted to the last covered and concealed position short of the objective. Infantry units may then dismount and assault the objective while the EFVs provide covering fire. During the assault, the EFV unit leader must closely control the fires to avoid endangering the dismounted Marines. A signal such as a pyrotechnic device should be prearranged to designate when the EFVs should lift or shift fires from the objective. As soon as the objective is seized, the EFVs should quickly move to the objective area just as in a daylight attack. The infantry should have a prearranged coded signal such as a blinking, filtered flashlight to help EFVs locate and join with the dismounted troops. The rifle unit leader should select positions on the objective for the EFVs and require each rifle squad to provide a ground guide to simplify the EFVs movement into positions.

(2) The Nonilluminated Attack. Even though a non-illuminated attack is planned, the mechanized unit leader should plan illumination from the LD to the objective so it is available if needed. The mechanized unit leader also should plan for the use of smoke during the attack. If the enemy fires illumination, the mechanized unit leader can call for indirect fire smoke or use smoke grenades to screen movement. Smoke also will reduce the effectiveness of some of the enemy's night vision devices.

The main advantage gained by attacking without illumination is surprise. Non-illuminated attacks can be conducted during any condition of reduced visibility. The concept of a dismounted attack without using illumination is to get as close as possible to the enemy's position without a fight--then, before he can react, surprise and overwhelm him. The objective will be relatively close to the LD, usually within range of supporting fires from the EFVs.

(3) EFVs in Limited Visibility Attacks. The mission of the EFVs during limited visibility is usually to support the infantry units by fire or by fire and movement. In the mechanized unit's operation order (OPORD), the EFVs, tanks, and TOWs are normally assigned a firing position, a sector of fire, and a route to the objective. The firing position may be along the LD or to the rear of the LD. The OPORD should specify how the EFV unit leader plans to control the EFV fire and the route that the dismounted infantry will move, and the portions of the objective to be occupied by the direct fire units (EFVs, tanks, and TOWs).

If the noise of the vehicles will alert the enemy, they move as close as they can to the overwatch position and halt until ordered to occupy it. From there a dismounted observer can be sent forward to observe the sector of fire and assist the direct fire units when they move into the position. The EFVs can then support the dismounted infantry by fire, or by fire and movement, as directed by the mechanized unit commander.

Once the objective is seized, the direct fire units should move as quickly as possible to the objective with dismounted infantry providing guides and occupy hull-down positions just as in a daylight attack. When the mechanized force commander plans a non- illuminated attack by stealth, he normally will use the following control measures and techniques:

<u>Control Measures:</u>

- Attack Position. It should be short of the LD, provide cover and concealment, and permit easy entry and exit. The attack position may be occupied only long enough for the unit to receive final instructions and insure coordination. This is normally the area where the infantry dismounts prior to the conduct of the attack.
- Line of Departure (LD). An LD is designated to coordinate the commitment of attacking units or scouting elements at a specified time of attack.
- Point of Departure (PD). Because it is critical that all movements be closely coordinated, the rifle sections are assigned a specific point to cross over the LD.
- Release Point (RP). Each company commander releases control of his platoons to the platoon commanders at the platoon RP. RPs are far enough back to let units deploy before they reach the squad RPs and the probable line of deployment. Platoon/squad RPs are used during dismounted attacks.
- Route. The company commander normally picks the route from the company RP to the platoon RP. Platoon leaders pick routes from the platoon RP to the squad RP.
- Probable Line of Deployment (PLD). The company commander plans to complete deployment along the PLD before moving forward. If the attack is not yet discovered at the PLD, the unit advances quietly until discovered or ordered to assault. The PLD is generally along an easily identifiable terrain feature perpendicular to the direction of attack.
- Objectives. The company commander assigns each platoon an objective, which is part of the company objective. These should be easy-to-identify terrain features.
- Limit of Advance. To keep friendly supporting fires from falling on friendly dismounted troops, the company commander may designate a limit of advance. It should be a terrain feature that is easy to recognize even during limited visibility. The assaulting elements must not advance beyond this feature. This limit of advance allows use of supporting fires beyond the objective without endangering friendly troops.
- Dismount Point. Should be a planned point that is either outside the range of effective enemy anti tank weapons or within range but covered in order to allow for safe dismount of the infantry.
- Support by Fire Position. The position must be located within the maximum effective range of the MK46 weapon station.

<u>Control Techniques</u>

- The speed of march should he maintained at approximately 15 mph, since greater speeds normally result in broken intervals between vehicles.
- Map distances should be converted to tenths of miles and the odometer used to determine distances.
- Units should make extensive use of GPS.
- When possible, routes should be marked with luminous devices or chemical lights.
- Check points located on terrain which is identifiable at night should be used as control

measures.

- Night observation devices (NOD) and dround surveillance radars may be positioned by surveillance, target acquisition (STA) platoon along the route to aid in control.
- Guides are provided along the route to assist the moving force.
- Drivers of vehicles that become disabled should immediately notify the vehicle to the rear allowing it to by-pass and continue movement. The driver must then assist with traffic control, directing other following vehicles to bypass his vehicle. He then awaits a recovery vehicle. (A recovery plan should always be included in a night movement order).

(4) Movement Formation in Limited Visibility. The column and wedge mounted formations are the easiest to control. The unit leader should place his EFV as the base vehicle in either formation. In a column, the unit leader's EFV should lead. In a wedge, the unit leader's vehicle should be in the left front of the formation. Both formations make rapid movement easier by allowing the drivers to guide on the base vehicle with minimal supervision by the vehicle commanders. This frees the vehicle commanders to concentrate on detecting and identifying targets. The line formation is the most difficult to control because of the limited flank vision of the driver when using his night vision device. Therefore, the line formation should be limited to moving short distances, as when rapidly crossing a danger area or assaulting a position.

Many of the same considerations for mounted formations apply to dismounted formations. Infantry units move closer together for better control. Marines should be close enough to see each other. Leaders should place themselves near the front of the formation for movement control.

(5) Movement Techniques in Limited Visibility. When visibility is limited by darkness only, the mechanized unit should be able to move using any of the movement techniques, making only minor adjustments to formations as previously discussed. When smoke, fog, or falling snow limits visibility, the unit’s ability to provide overwatch may be reduced. In all conditions of limited visibility, the loss of security to the flanks and rear is a major consideration in movement planning. When using bounding over watch, the platoon should consider bounding a section instead of one vehicle to increase the security of the bounding element. This would allow one vehicle to observe to the left front and another to the right front, making up for the driver's limited field of view. An EFV platoon or section moving by traveling over watch keys its movement on the lead EFV. The distance between the lead EFV and the platoon or section is based on the ability of the driver and vehicle commander of the overwatch vehicles to keep the lead vehicle in sight. When the traveling technique is used, the lack of flank security becomes an even more important consideration. The unit, traveling in a staggered column, is vulnerable. This technique would be used only when the chance of enemy contact is slight and speed of movement is necessary.

g. Attacking a Strong Point

A strong point is a key point in an enemy defensive position, usually strongly fortified and heavily armed with automatic weapons, around which other positions are grouped for its protection. A strong point defense (i.e., fortified area) is a defensive system that contains numerous strong points disposed in depth and width in such a manner as to be mutually supporting. The principle sequence that guides a commander in his planning is: isolate-breach-exploit. Once a reconnaissance has provided the commander with sufficient detail of the enemy position, the commander will eventually arrive at a general concept of operations and task organize his force.

(1) Isolate the Site of Penetration. The site of penetration is the point of the initial breach of the enemy position. It should be the weakest point. This location is isolated by intense direct and indirect fires, Close Air Support (CAS), and smoke to destroy enemy positions and to prevent lateral movement to reinforce the position. Indirect fires and smoke are planned to ensure continuous fires isolate the enemy

(2) Breach or Penetrate. The main effort is directed toward the breach or penetration of the strongpoint. Objectives are assigned in the area of the point of penetration forward of the enemy's platoon and company defensive positions. Normally. the infantry and engineers dismounts beyond the range of enemy direct fire weapons and move by cover and concealment. The penetration is made on a narrow front. The breach force breaches the enemy's protective obstacles, gains a foothold in the trench line, and creates a gap in the strongpoint large enough to pass through the assault force. The gap is then widened and deepened to allow for exploitation. The tanks and EFVs support by fire during the initial breach. If sufficient obstacle lanes have been cleared, tanks follow and support the dismounted infantry by fire. Tanks move quickly to exploit the initial breach. EFVs should be brought forward only when the anti armor defenses are destroyed. The EFVs then assist in holding the shoulders of the penetration. Mutual support between attacking elements is maintained so that they are not isolated and defeated. The attacking elements will be subject to counterattacks that attempt to cut off the penetration.

(3) Exploit the Penetration. The main effort is shifted from the breach force to the assault force following a successful breach. The assault force passes rapidly through the breach, supported by the fires of the support force and the breach force. The task force objective is normally an isolated platoon position. At every level, the envelopment is the preferred form of maneuver. If the task force assault force can get to the rear of the strongpoint, the remainder of the task force can neutralize the remaining platoon strong points by attacking from positions on the flank or rear.

As subsequent platoon positions are encountered, the task force assault force (company team) may repeat the breaching process. As in the initial breach, EFVs support by fire while the tanks and dismounted infantry complete the reduction of the strongpoint and associated trench lines. The task force commander may commit the reserve to complete the destruction of the strongpoint and prepare for a counterattack or continue to attack.

(4) Task Organization. The task organization for an attack of a strongpoint defense is a deliberate grouping of forces to accomplish a mission. Companies and platoons are normally assigned the role of breach force, support force, or assault force. Each role implies certain tasks, techniques, and procedures that must be developed and rehearsed regardless of the specific objectives tasked by the completed operations order. The task organization is done as soon as possible, usually before the completion of the operations order. This allows units the time to develop SOPs and to rehearse those general techniques and procedures implied by the role assignment.

Normally the main effort, the breach force makes the initial breach and the assault force passes through it. The battalion task force normally assigns a mechanized company to this role. The company assigns a mechanized infantry platoon. Engineers are normally assigned to the battalion breach force, and if available, to the company breach force.

The support force is to provide supporting fires to the breach force initially, and then to the assault force. The support force usually consists of tank companies or tank-heavy company teams and TOW assets. At the company level, the support force consists of tanks and EFVs providing a base of fire for the maneuver elements.

The assault force attacks through the breach and destroys the enemy position. The assault force is usually a mechanized-infantry company. The assault force may be required to breach enemy close-in obstacles and should include infantry and engineers. At the company level, the assault force is one or more mechanized-infantry platoons. The assault force may provide security for the breaching force. After the obstacle is breached, the assault force moves through the breach and assaults the enemy position. Each squad may be given an objective to assault.

h. Consolidation and Reorganization
The mechanized unit should consolidate and reorganize as soon as it takes an objective. This is done so that they are prepared to repel an enemy counterattack and continue with the attack.

An objective is held until the commander orders other action. At times the attack may be continued with little or no hesitation to exploit success. In this case, only required reorganization is done and consolidation is unnecessary.

Consolidation consists of actions taken to secure an objective and prepare to repel an enemy counterattack. In his order, the commander normally designates rifle platoon and AA unit positions and actions to be taken. The EFV platoon consolidates an objective by:

- Occupying the position designated in the attack order (EFVs are moved into hull-down positions, if available, and assigned specific sectors of fire).
- Establishing local security and mutual support between EFVs and adjacent infantry units.
- Eliminating any remaining pockets of enemy resistance and securing enemy prisoners of war (EPW).
- Preparing hasty fighting positions as quickly as possible.

Reorganization includes all actions taken to prepare to continue fighting. Reorganization should be as specified in unit SOPs. In general, the EFV section leader:

- Replaces key personnel (as needed) such as vehicle commanders and drivers;
- Assesses damage to EFVs and reports to the EFV platoon commander if assistance is needed.
- Conducts vehicle maintenance/and redistribution of ammunition as required.

The EFV platoon commander:

- Replaces key personnel (as needed) such as the platoon sergeant or squad leaders who were lost;
- Informs the EFV company and/or infantry company commander of the platoon's status.
- Oversees evacuation of casualties.
- Requests needed re-supply; and refueling.
- Sends POWs under guard to the POW collection point.

i. Exploitation and Pursuit

Exploitation and pursuit follow a breakthrough of the enemy's defensive position during an attack. During exploitation and pursuit, the attacker drives deep into the enemy's rear area, destroying artillery and air defense positions, command posts, logistics complexes, and communication centers. The EFV unit participates in these operations as part of a larger force. It moves similar to a movement to contact, and looks for and destroys vulnerable targets--the enemy's combat support and combat service support. Pursuit normally follows a successful exploitation; at section and platoon level, there is almost no difference between the two operations.

(1) Exploitation. An exploitation is an offensive operation that usually follows a successful attack and is designed to further disorganize the enemy in depth. A mechanized force is ideally suited for exploitation operations because of its inherent speed, mobility and shock action. Mechanized forces may be held in reserve, when working with non-mechanized forces, and committed to an exploitation operation after a deliberate attack. The purpose of the exploitation is to take advantage of the enemy’s loss of a defensive position, by continuing the attack, increasing the tempo of operations, not allowing him time to react, and in doing so destroying his cohesion. An exploitation operation ends when:

- the enemy loses his ability and will to fight and a pursuit operation is initiated enemy resistance increases requiring a deliberate attack; and
- the force conducting the exploitation can no longer be supported or sustained.

The exploitation is conducted similar to a movement to contact with numerous hasty attacks. The exploitation is normally assigned to no less than a battalion size unit. Direction is provided by a frag order that emphasizes decentralized execution of orders. Deep objectives are selected. Company size mechanized units normally attack on a narrow front, with task forces and regiments employing multiple axes. Enemy resistance of insufficient strength to jeopardize the mission is normally suppressed, bypassed, and cleared by follow-on units. The operation is fast paced continuing day and night creating extended supply lines. High consumption rates of class III and V is normal during exploitation.

Initial planning for an exploitation begins prior to the deliberate attack and anticipates a successful attack. It develops a reconnaissance plan, analyzes terrain suitable for mechanized operations beyond the objective, and identifies potential deep objectives. Fire support and combat service support planning must also be conducted prior to the deliberate attack. The final plan is completed at the deliberate attack is successfully completed. The planning must be accomplished rapidly to reduce enemy reaction time. It is METT-T analysis that confirms the locations of all units, identifies enemy location and intentions, and confirms anticipated objectives and axes of advance.

(2) Pursuit. A pursuit is an offensive operation designed to catch or cut off a hostile force attempting to escape, with the aim of destroying it. A pursuit often develops from a successful exploitation operation in which the enemy defense begins to disintegrate. A pursuit may also be initiated when the enemy has lost his ability to fight effectively and attempts to withdraw. EFVs are ideal for the pursuit since they can exert continuing pressure on the enemy. Additionally, they provide the force with the ability to move rapidly to encircle enemy forces attempting to flee or strike the enemy on his flanks. The pursuit must be unrelenting and push to the utmost limits of endurance of the troops, equipment, and supplies and continue both day and night.

2207. Forms of Maneuver

a. Frontal Attack

The frontal attack is the simplest form of attack and can be executed the quickest. A frontal attack may be used to quickly overcome a weak or unprepared enemy. The speed and armor protection of combat vehicles reduce the force's exposure to enemy fire. The goal of the frontal attack is to achieve a penetration. Against a hasty defense, tank and EFV-heavy forces alone may be able to force a rupture of enemy lines; against a deliberate defense, infantry-heavy forces will be required. After a penetration is created, infantry heavy forces are best used to hold and widen the gap, while tank-heavy forces exploit quickly by attacking suitable objectives within the enemy position.

b. Flanking Attack

The flanking attack shares most of the characteristics of the envelopment, but to a lesser degree. A flanking attack generally is less risky and takes less time to develop but is less likely to achieve decisive success. Again, the overwhelming preponderance of mobile combat power will be put in the main attack.

c. Envelopment

Generally, the envelopment is the preferred form of maneuver. It capitalizes on the mobility inherent in EFV units. The most mobile forces are typically distributed in the main attack and those forces with less mobility are in the supporting attack. Further, the overwhelming preponderance of combat power, usually including most of the tanks, will be placed in the main attack. Speed of execution is emphasized to achieve surprise. By nature, of all the forms of maneuver, the envelopment takes the longest time to execute. Deep envelopments may require the displacement of artillery to provide continuous support.

d. Turning Movement
A turning movement is a form of maneuver in which the main effort seizes objectives so deep that the enemy is forced to abandon his position or divert major forces to meet the threat. The intent is to force the enemy out of his position without assaulting him. EFVs may participate in turning movements as part of a larger force.

2208. Combat Formations

All EFV units use formations to facilitate command and control and to avoid confusion. Formations also enhance speed, firepower and security and improve the ability to react to anticipated situations. Like movement techniques, the formation that is selected is determined by a METT-T analysis. Again, the commander must continuously analyze the situation and be flexible enough to change formations as the situation changes. Formations at the company-team/EFV platoon level are detailed and indicate the relative position of individual sections and vehicles. FORMATIONS ARE FLUID. EFV section leaders down to individual vehicle commanders must have the freedom to adjust to the terrain and/or the enemy situation. EFV platoon and section formations are identical in general characteristics and employment considerations. The use of formations and the rapid movement from one to another increase a unit's responsiveness to a constantly changing situation.

The EFV unit uses five basic combat formations while on the move. These formations modified as necessary, permit the unit to react appropriately in most situations and under most conditions. Unless directed, using the same formation is not necessary for all elements of the unit. For instance, the EFV platoon as part of a company mechanized team could be advancing in column while one of its sections is in a wedge formation as part of the advance guard, or one section could be in echelon formation to protect an exposed flank. Unit leaders will select the formations they think most appropriate for the current situation, unless directed otherwise. The five basic armored combat formations are column, line, wedge, vee, and echelon.

a. Column
The column is relatively easy to control and provides good protection to the flanks. Protection to the front and rear is limited. It is used primarily during limited visibility, in restricted terrain, or during road marches. The staggered column is a variation of the standard column. It is used when enemy contact is possible and the terrain allows for dispersion. Both the column and staggered column are illustrated in figure 2-5. This formation:

- Increases security against air and artillery attacks by its greater dispersion compared to a normal column.
- Provides good security and permits maximum fire to the flanks, but restricts fire to the front.
- Is easy to control, and it facilitates rapid deployment into other combat formations.
- Provides the depth and time needed to deploy the elements once enemy contact

has been made.
- Facilitates rapid movement when speed is required.

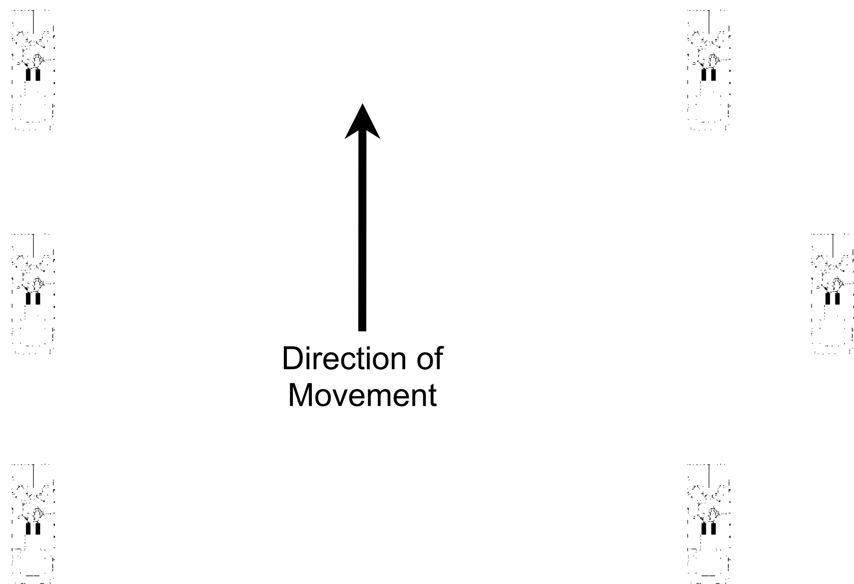


Figure 2-5. Column & Staggered Column.

b. Line
The line formation provides maximum firepower forward, is the most difficult to control, and provides poor protection to the flanks. It is the primary formation used during the assault; may also be used by forces in supporting positions; or used by forces emerging from smoke, crossing crests, and departing wooded areas. There are variations of the line in which tanks and EFVs are on the same line, or tanks leading with EFVs following. Figure 2-6 illustrates the line formation.

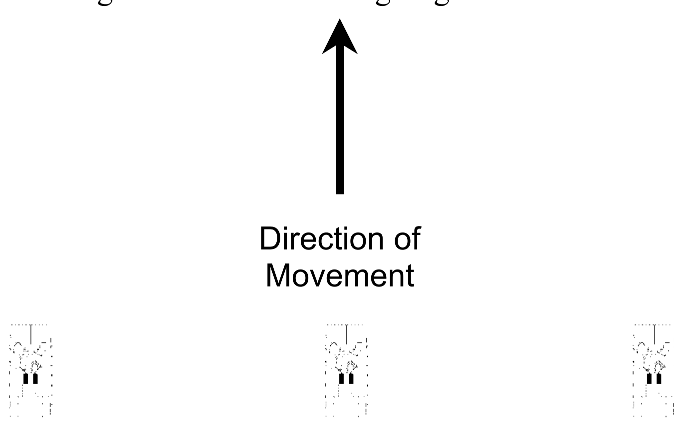


Figure 2-6. Line.

c. Wedge
The wedge formation provides the greatest freedom of maneuver because it provides all around

protection and can change quickly to another formation reducing reaction time. However, it requires sufficient space to disperse subordinate units laterally and in depth. It is used during movement to contact when enemy contact is possible or likely. Figure 2-7 illustrates the wedge formation.

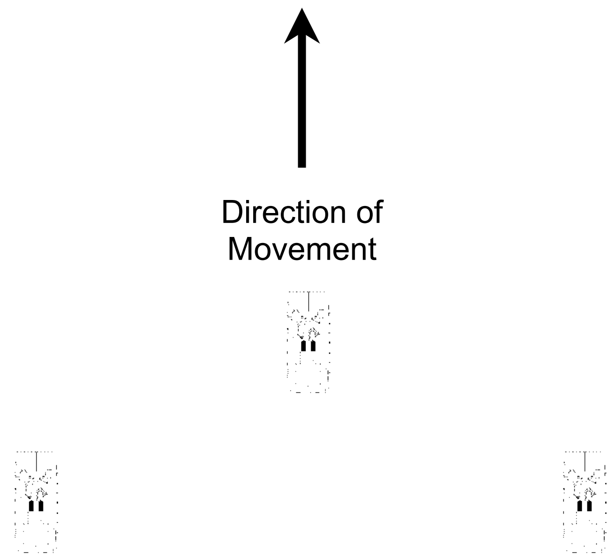


Figure 2-7. Wedge.

d. Vee

The Vee formation provides greater firepower forward and allows rapid transition to other formations. It is more difficult to control than the wedge formation and requires sufficient space for dispersal both laterally and in depth. It is often used during a movement to contact when enemy contact is possible or likely. It facilitates rapid transition to the assault and rapid deployment into any other formation. Figure 2-8 illustrates the Vee formation.

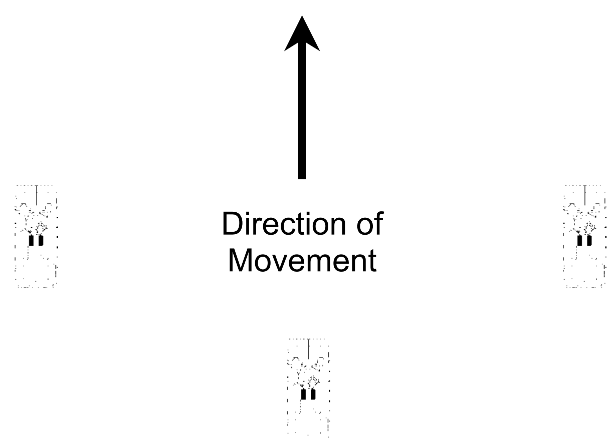


Figure 2-8. Vee.

e. Echelon

The echelon formation provides excellent firepower to the front and to either flank. It is used when a unit wants to cover and exposed flank from an enemy threat. the echelon formation is illustrated in figure 2-9. The echelon formation:

- Eases deployment perpendicular to the direction of march
- Provides the best security to the echelon flank for the higher formation
- Is similar to the column formation but with vehicles staggered to the left or right.

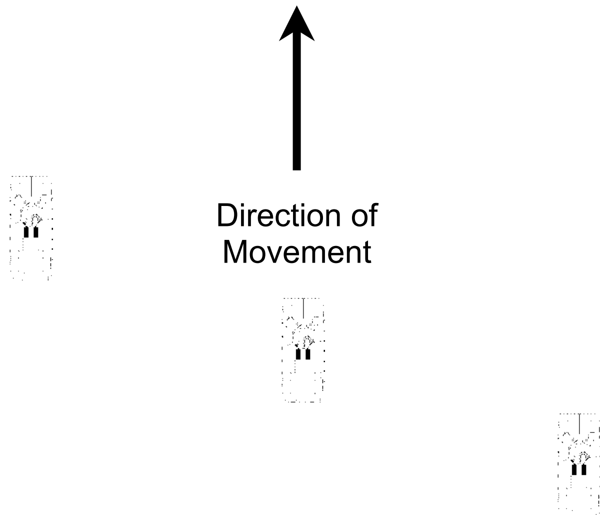


Figure 2-9. Echelon (Right).

f. Distance and Interval

Movement into and out of the various formations must become second nature to each armored crewman. The formations are intended to reduce confusion by providing a position for each vehicle within the formation. The formations are intended to be flexible and modified to fit the situation and terrain as opposed to having exact geometric dimensions and designs. Distances between vehicles and the different units of the mech team will vary based on terrain, visibility and the enemy situation. As the terrain becomes more rugged, or as vegetation becomes dense, or if visibility is reduced, the distances between vehicles are shortened, however, individual vehicles should always maintain an interval of at least 50 meters between them. In terrain where there is little or no cover and concealment available, the distance between vehicles is increased.

2209. Security

Security, whether on the move or stationary, in garrison or on the battlefield is constant. Security of a unit is an inherent responsibility and cannot be passed on to another unit.

a. Security During a Halt

While halted, armored units use two basic types of formations for security. They are the armored coil and the herringbone.

(1) The Coil. The coil is a stationary formation providing all around security and observation. It is useful for tactical refueling, re-supply, and issuing unit orders. Because it presents an easy target, it is not designed to be used for long periods of time, especially during daylight. Security is posted, the turret is manned and radios are monitored. The infantry should disembark and provide security outside of the coil, forward of the EFVs. There are two methods to form an armored coil. One method is to have the unit leader form the coil by leading his unit in a circle. When the circle is complete, all vehicles stop, and turn 90 degrees outboard, and post security. The other method is done by the unit leader giving the command for a coil formation. The vehicles move directly to their assigned positions, as stated in their unit SOP, seek cover and concealment, and post security. Each section is responsible for a designated sector of the coil. For example using the clock method; "First section, you have from 12 to 3 o'clock, Second section, you have from three to six o'clock, Third section you have from nine to 12 o'clock and Headquarters has from 6 to 9 o'clock." (The direction of movement is always considered twelve o'clock). Figure 2-10 illustrates a mechanized coil.

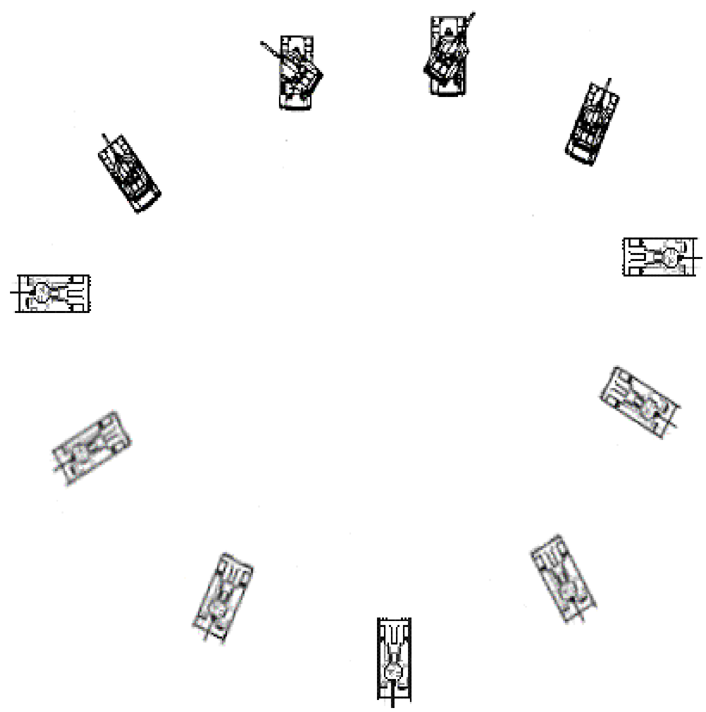


Figure 2-10. The Mechanized Coil.

(2) The Herringbone. The herringbone formation is a battle drill formation used to disperse the mechanized unit when traveling in a column formation. It is used during air attacks or when the unit must stop unexpectedly during movement. It lets the unit move to covered and concealed positions off a road or from an open area and establishes all around security without detailed instructions being issued. The vehicles are repositioned as necessary and, as time permits, they take advantage of the best cover, concealment, and fields of fire. The infantry should disembark at least a fire team to establish local security. The turret will be manned and the radios are monitored. The crew and the disembarked infantry should be prepared to move out quickly, since the herringbone is just used for temporary halts. Figure 2-11 illustrates a herringbone.

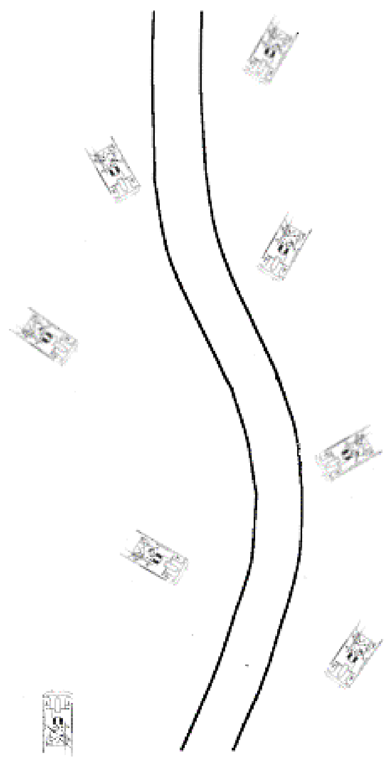


Figure 2-11. Herringbone.

b. Security During a Movement
Vigilance is the key to early detection. Survival will depend on a crew's ability to search for, detect, locate, identify, classify, and engage the right targets effectively. EFV gunners must have the advantage of firing first. Effective security requires the combined effort of all crewmembers. During the march, the platoon maintains security through observation, weapon orientation, dispersion and camouflage. Crew search is the act of carefully viewing or watching the area of operations, using search and scan techniques and sectors of observation, to acquire targets. Figure 2-12 illustrates possible enemy locations that EFV crews and units must scan for. When moving, EFV units must ensure the following for good security:

- Platoon commanders or section leaders will assign sectors of observation to each vehicle. When operating as a unit, each EFVs' 360-degree coverage will create overlapping fields of observation.
- Vehicle commanders assign sectors of observation to their crew and embarked personnel so that there is 360 degrees observation around the vehicle. Standard sectors of observation for the EFV depend on weapon station orientation for the TC and vehicle

commander.

- Weapon stations are oriented on assigned sectors throughout the formation.
- While driving each EFV driver will constantly search for routes and firing positions which provide maximum protection from enemy fire. He is also searching to his direct front for obstacles, mines and booby traps. The driver must always be asking himself; what action would I take if the enemy engaged us right now?
- If traveling with open hatches, everyone manning a hatch will also be assigned areas of observation, and will provide close-in security against a dismounted enemy threat.
- To provide early detection of enemy aircraft, each vehicle may have an air watch, or certain vehicles within the platoon or section may be designated as air guard vehicles. Their crews perform air rather than ground observation.
- When the EFV is in position defilade, dismounted observers and security are posted. These personnel should move far enough away from the EFV so that they can hear battlefield noises above vehicle engine sounds. One person from the vehicle team, preferably the infantry troop commander, must be designated to observe the dismounted element to relay signals of enemy activity, to provide fire support if needed, and to signal when it is time to move out.

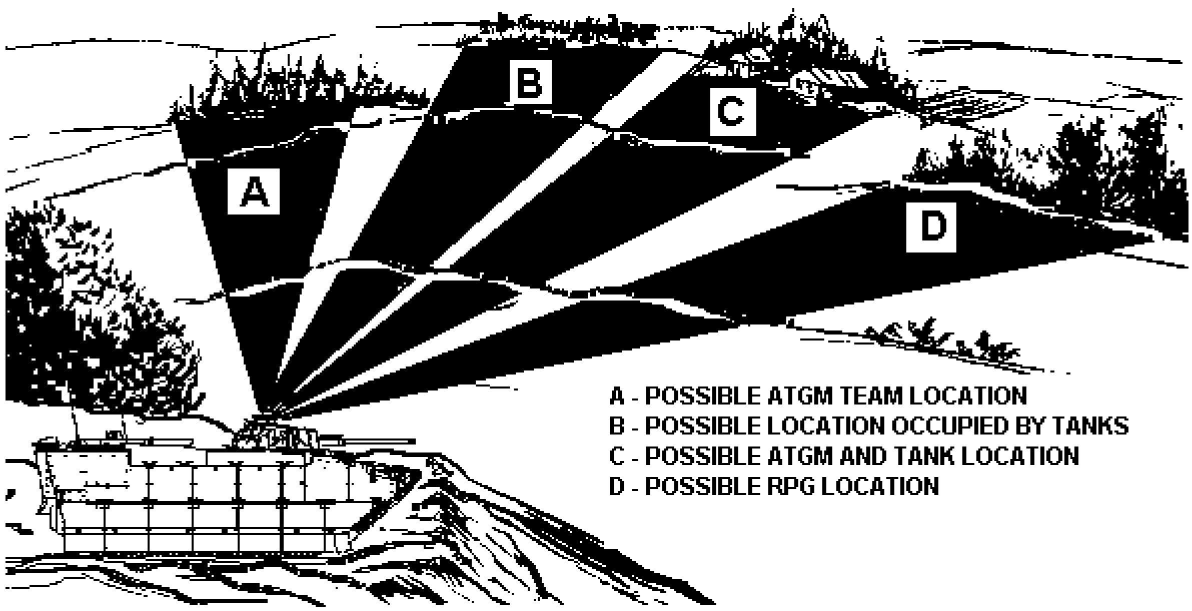


Figure 2-12. Scanning for possible enemy locations

2210. Movement Techniques

On the modern battlefield, the Commander must decide which movement techniques are to be used based on the enemy situation. Battlefield movement techniques limit the unit's exposure to enemy fire and put it in a good formation to react to enemy contact. During movement to contact, the movement technique used is based on the chance of enemy contact. Tactical movement techniques are used in conjunction with formations and require sound individual vehicle movement techniques. They allow the unit leader to establish the relative degree of security appropriate for the team's movement.

Often, a unit moving on the battlefield, when not in contact, encounters the enemy at a time and place of the enemy's choosing. To offset the enemy's advantage, movement techniques must be used that will cause initial contact to be made with the least number of men and vehicles. This means that the smallest force will be leading. The rest of the unit should be in position to provide suppression fires or fire and movement in support of the element that makes contact.

Each vehicle commander controls the movement of his EFV in consonance with the unit leader's guidance. He insures that his EFV has the correct turret orientation and is properly dispersed in accordance with the formation being used and the terrain being traversed.

a. Guidelines for EFV movement
Regardless of the movement technique chosen, EFV crews when moving should take the following steps:

(1) Avoid Possible Kill Zones. Avoid obvious avenues of approach; it's easier to cross difficult terrain than fight the enemy on unfavorable terms. Also, avoid large open areas, especially when they're dominated by high ground or by terrain that can cover and conceal the enemy.

(2) Take Active Countermeasures. Use smoke, direct and indirect fires to suppress suspected enemy positions.

(3) Use Suitable Movement Techniques. Battlefield movement techniques limit the unit's exposure to enemy fire and put it in a good formation to react to enemy contact.

(4) Use cover and concealment. Knowing how to make good use of cover and concealment is just as important to the EFV crewman as it is to the infantryman. Therefore, you must select routes and positions that provide cover, concealment, and good fields of fire for EFV weapons. Very seldom will you run across terrain where you are not able to find cover or concealment; every EFV crewman must learn to see and use each fold in the ground and every bit of possible cover within an area or zone of action.

(5) Watch Your Wingman.- The individual EFV usually operates as part of a section. The wingman concept helps in the command and control of an EFV section. During operations the wingmen orient their vehicles on the section leader's vehicle, and in the absence of orders, they move, stop, and shoot when their section leader does, as dictated in their unit SOP. Vehicles within the section can expect to receive direction from their section leader in the form of:

- Formation to be used and order of march.
- Technique of movement.
- Target and engagement area responsibilities.

- Communication methods and signals.
- Target identification.
- Fire commands.
- Round affect and impact observation.
- Actions on battle positions.
- General instructions to vehicle crews.

b. Mounted and Dismounted Infantry
Mechanized infantry in the Marine Corps normally move mounted, but fight dismounted. This is because mechanized vehicles can move rapidly and conserve the infantrymen's strength while reducing their exposure to chemical and radiological contamination, as well as small arms fire and artillery shrapnel. The mechanized team will usually move mounted until it is necessary to disembark for tactical reasons. The company team conducts a tactical movement during both a movement to contact and the approach phase of an attack. The following considerations govern the conduct of a tactical movement:

- Reconnaissance
- Dispersion
- All Around Security
- Cover and Concealment
- Speed
- Observation and Fields of Fire
- Maneuver Space
- Command and Control

c. Movement Options
Likelihood of contact is divided into three categories. The unit should select its movement option and adjust its movement technique to fit the likelihood of contact. If enemy contact is—

- Not likely, then movement is by traveling.
- Possible, then movement is by traveling overwatch.
- Expected, then movement is by bounding overwatch.

(1) Traveling. The traveling technique of movement is used when speed is important and enemy contact is not likely. This technique of movement is the least secure. The column formation is common while using this method of movement technique.

(2) Traveling Overwatch. Traveling overwatch is used when enemy contact is possible but not expected. This technique provides more time and distance in which to react if the lead element makes contact with the enemy. An armored unit using this movement technique could be using a wedge, vee, echelon or column formation. With traveling overwatch the main body is continuously moving and cover and concealment is used. Visual contact between the overwatching element and the main body must be maintained and the overwatching element must always be ready to support the main body if they are fired upon by an enemy force. Although caution is called for because of the enemy situation, speed is important to accomplish the mission. Figure 2-13 illustrates EFVs moving in traveling overwatch.

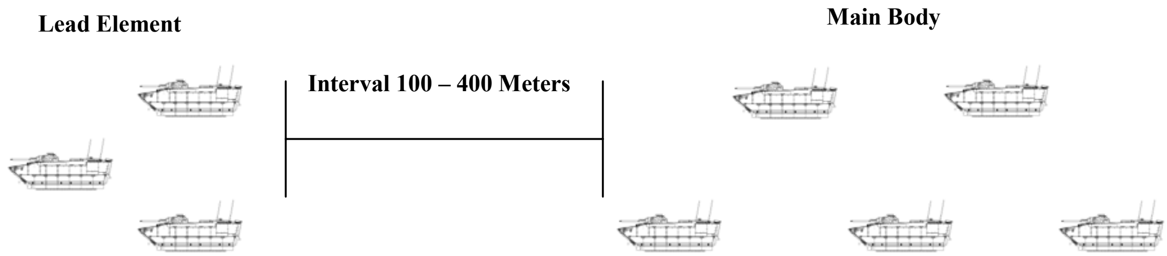


Figure 2-13, Example of traveling overwatch movement

If the EFV platoon is not part of a larger mechanized force and the traveling overwatch technique is being employed, a column formation is normally used. In this case the lead vehicle or section, is pushed forward of the rest of the platoon (100 to 400 meters, depending on the situation). The trailing or overwatching vehicles key their movement to the lead vehicle or section. The rest of the platoon will vary its rate of movement as required to maintain the desired interval. The lead vehicle or section may have to reduce its speed if the overwatching vehicles cannot keep up.

If the EFV platoon is part of a larger mechanized force other units may be employed as the overwatching element, such as tank or anti-tank units. In this case, the platoon moves continuously and uses all available cover and concealment, and there is not a fixed formation. The EFV with its stabilized weapons platform is also an effective overwatch element while on the move.

(3) Bounding Overwatch. Bounding overwatch is used when contact is expected. This is the most deliberate and cautious form of movement technique. It is also the slowest but most secure movement technique. There are two ways to execute bounding overwatch: alternate and successive. In both ways, the overwatch element covers the movement of the bounding force from a covered and concealed position, which offers good observation, and fields of fire against likely enemy positions. If the bounding element makes contact, the overwatch element must be able to render immediate support by providing suppression or fire and movement. The bounding force moves forward to a pre-selected position while covered by the overwatch element. When it reaches the new position, it secures the location so that the overwatch force can move forward.

The length of each bound is tied closely to the range of weapons, observation, and fields of fire of the overwatch element. The "two thirds rule" is a good rule to follow for the range of the overwatching weapons. Using this rule the overwatching element must be able to reach out in front of the bounding element with two thirds of its maximum effective range. (For example: The maximum effective range of the EFV(P)'s MK 44 30mm gun is 2000 meters, therefore, the farthest that the bounding element should advance in front of an overwatching EFV section is approximately 600-700 meters. This way the overwatching EFV section can effectively engage an enemy target 1,300 meters beyond the bounding element).

When an EFV platoon is employing bounding overwatch, normally one section will bound, overwatched by one or more of the other sections. When the new position is reached, the bounding element should dismount enough infantry for local security. If the new position is relatively open, the infantry may not need to dismount. As soon as the position is secured, the roles reverse, and the bounding element becomes the overwatching element. This process is repeated for subsequent moves.

The two ways to execute bounding overwatch are alternate bounds and successive bounds.

Alternate bounds are a "leap frog" movement. One section overwatches while the maneuver element bounds to the next terrain feature, always keeping each other in sight. The bounding element passes the overwatch element to the next terrain feature that has the characteristics of a good overwatch position. Figure 2-14 is an example of this technique.

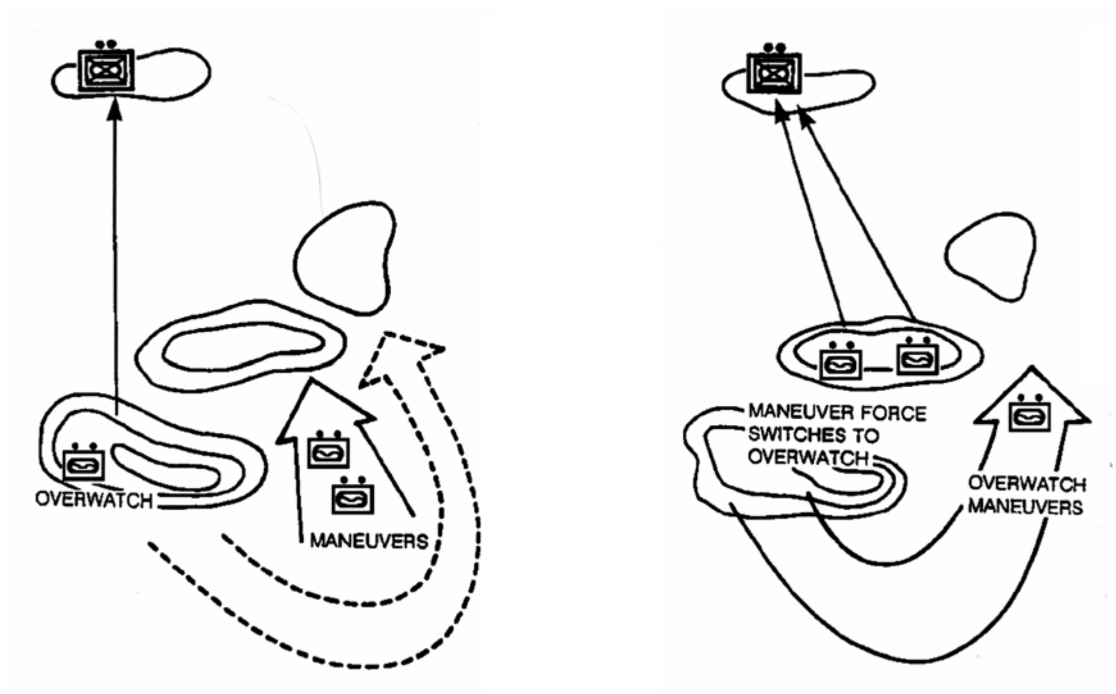


Figure 2-14, EFV sections moving in alternate bounds

The other type of bounding overwatch is successive bounding. In successive bounding the overwatch and bounding element use the same terrain feature or another terrain feature that is on line with the first. It can be a little slower than alternate bounding. Figure 2-15 illustrates this.

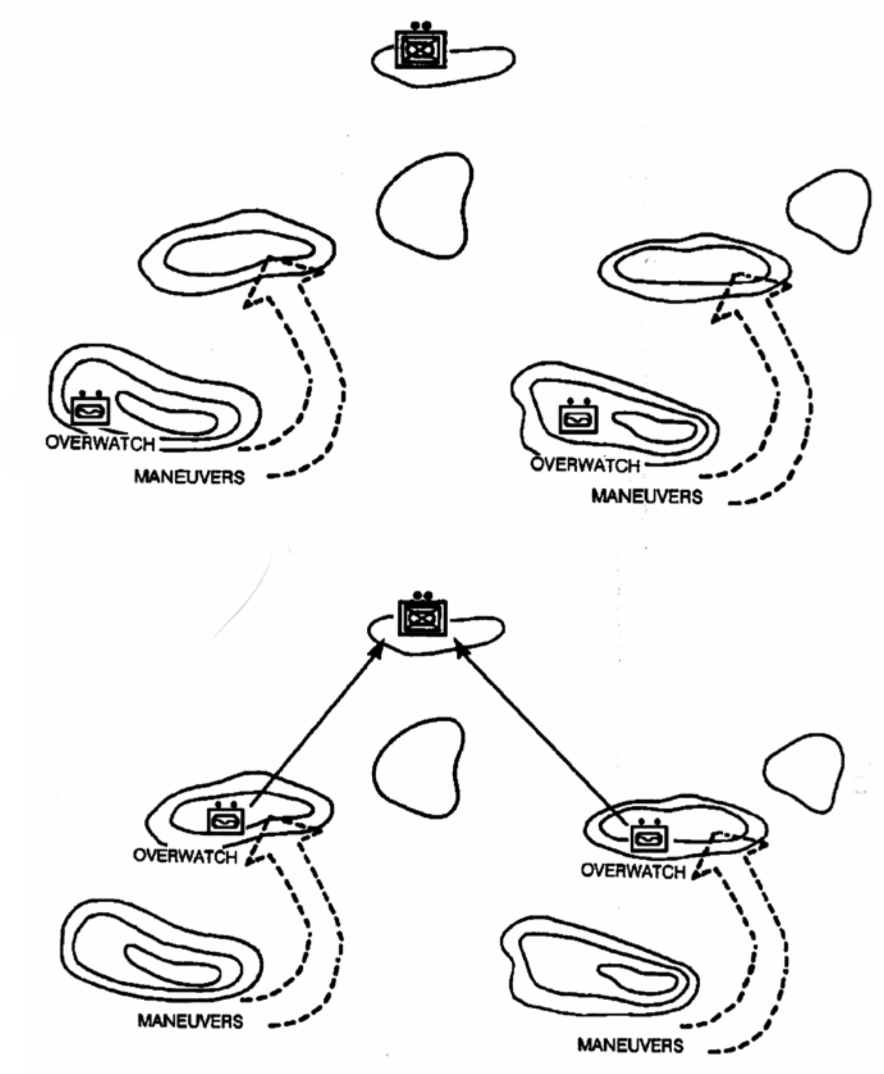


Figure 2-15, EFV sections moving in successive bounds

The determination to use alternate or successive bounds will probably depend on the terrain and availability of covered and concealed positions. Normally a combination of alternate and successive bounds will be made during movement, neither type is used exclusively.

The EFV platoon as part of a mechanized force may be employing the traveling or traveling overwatch technique, while the lead element (typically tanks) is using bounding overwatch.

2210. Use of Terrain

a. Terrain Driving

Terrain driving uses all available natural cover and concealment to avoid enemy fire. Terrain driving should be a habit; it must be used when enemy contact is expected, or even possible. If the enemy cannot see you, he cannot mass fires to destroy you. Despite its obvious advantage, moving along covered and concealed routes does have drawbacks. It reduces speed, increases control problems, and makes the unit more vulnerable to hand-held anti-armor and other types of short-range weapons. Vehicle commanders must select routes and positions that provide cover, concealment, and good fields of fire for their vehicles. There are five basic rules for terrain driving:

- **Use all available cover and concealment** - Manmade and natural cover and concealment is already constructed and provides excellent protection.
- **Don't skyline** - Do not present a large target by making a silhouette of yourself.
- **Always back out of a defilade position** - The enemy may orient their weapons on the smoke signature of your weapons or exhaust. When a vehicle pulls forward out of a defilade position it becomes skylined and makes a good aiming point for an enemy gunner.
- **Control dust** - The enemy can see a dust trail from a greater distance than the vehicle itself and a dust trail is a clear indication of a unit on the move.
- **Move across open areas quickly** - The more time spent in the open, the greater the chance of being seen and acquired by enemy weapons. Use rapid rushes from one covered position to another covered position. If you are exposed for less than **11 seconds,** it will be extremely difficult for an enemy ATGM gunner to acquire, fire, track, and hit you at long range. Time for EFVs to travel one kilometer at different speeds is shown in table 2-1 below.

Vehicle Speed	How Long It Will Take
20 kmph (12 mph)	3 minutes
25 kmph (15 mph)	2 minutes and 30 seconds
40 kmph (24 mph)	1 minutes and 30 seconds
60 kmph (36 mph)	1 minute

Table 2-1, EFV speed vs. distance to cover one kilometer

Additional driving rules rules include:

- Avoid unnecessary shortcuts that leave telltale tracks.
- If possible, select several intermediate defiladed positions into which you can move quickly if heavy antitank fire is drawn before you reach the objective. Never move directly forward from a defiled position.
- When fired upon by the enemy while in the open, do not stop. Use speed to get under cover.
- Take a zigzag course and vary your speed to make it hard for the enemy to track your EFV. Remember to cross open areas quickly.
- When fighting against enemy infantry armed with antitank weapons, keep alert. Swing the EFV in the direction of the nearest antitank gunner. This makes the EFV a smaller target.
- If it is necessary to cross a crest, an EFV unit advances supported by EFVs in

firing position.
- Select a firing position that is provided with cover, concealment, and good fields of fire.

b. Terrain Trafficability Characteristics.
Varying terrain characteristics will impact the EFV unit's ability to efficiently maneuver:
- Dark patches of ground usually mean poorly drained terrain where tracks may mire. Dark gray or bluish soil is usually muck, which cannot be crossed by EFVs. Crops are usually a fair indication of the traction the terrain will afford. Cotton, beans, peanuts, and sweet potatoes need fairly well drained soil. These types of fields can be crossed easily, except in extremely wet weather.
- If the banks of the river are planted with such crops as wheat, cotton, or corn, there will usually be good traction. The best ground for driving is normally next to the river or on the first terrace; the middle area is usually soft and mucky. When driving across or near streams, stay on coarse sand or gravel.
- Avoid any spot that looks like finer-grained soil or that is cracked on the surface. Such spots are usually fine silt that can mire an EFV. If it is necessary to cross such an area, choose the light-colored area. During dry weather, the area is easily passable by EFVs.
- Gravel is usually suitable ground for EFVs. However, there may be small spots which are poorly drained and which might cause an EFV to bog down. Look for and avoid darker ground, bowl-shaped depressions, and finely grained soil.
- In dry weather, eroded clay soil gives good traction; in wet weather, it is slippery. The best route for EFVs is along the wider high places. An EFV may belly on the narrow ridges or slip off into one of the deep gullies in wet weather.
- Gently sloping terrain with scattered patches of vegetation provide good traction for EFVs.
- Scattered clumps of small trees indicate good terrain for EFVs. Scrub pines are an indication of good ground. Avoid patches of grass that are deeper in color and coarser in texture than the surrounding grass.
- Sparse vegetation, scattered trees, and sloping land indicates good ground for EFVs.
- Rice paddies have a firm bottom with about 10 inches of mud on top. Watch out for pits; when crossing a paddy that has been planted, stay away from any spot where the rice does not show above the water.
- Sugar cane fields, where the cane is not over 10 feet high, can usually be crossed with EFVs. Care must be used to avoid hidden obstacles.
- Mangrove trees and Nipa palms usually grow in swampy, poorly drained areas that are difficult to cross with EFVs.

c. **Cross Country Terrain Considerations**. When moving cross-country, EFVs will be required to negotiate vertical banks, obstacles, mud, and sand. Crews will be required to practice formation driving over all types of terrain and operate buttoned-up under all conditions in daylight and at night. Sound judgment must he used in choosing the right driving ranges and speeds, in using brakes and accelerator, and deciding whether to cross an obstacle or select another route. There are several conditions that EFV drivers should use special care to avoid damage to the EFV. These conditions are:

(1) Driving Along a Hillside. Whenever possible avoid driving along the side of a hill. Drive straight up or down using low gear. Additional considerations:

- If you must drive along the side of a hill, avoid making sharp turns to prevent throwing a track.
- Avoid boulders, stumps, ruts, and uneven ground.
- If the EFV starts to slide sideways, it should be turned downhill.
- If it is necessary to park the EFV on a hill side, park at an angle, not completely crossways.

(2) Driving in Mud, Snow, or Sand.

- Keep the tracks moving, and try to avoid bellying the vehicle. Do not follow in the tracks of an EFV in front of you.
- If possible, drive around patches of mud, snow, or sand. If unavoidable, however, go through short stretches of mud, snow, and sand in low gear. If the EFV begins to dig itself in, STOP.

(3) Driving Through Woods and Brush.

- Whenever possible avoid hitting trees. EFVs should never backtrack through woods in which trees have been pushed down. The trunks and limbs will point toward the vehicles like spears and may damage vehicle components or injure personnel.

(4) Bridge Crossing. Signs are displayed on or near bridges picturing a number or two numbers and a drawing of a tank. These numbers represent the weight capacity of the bridge in tons. Follow the below guidelines during bridge crossings:

- Do not exceed five miles per hour on bridges (or the posted speed limit)
- Use minimum or no steering
- Maintain a 50 meter interval between EFVs at all times

2211. Enemy Contact

a. Meeting Engagement

A movement to contact often results in a meeting engagement. Such engagements occur when contact with the enemy is made suddenly, with little or no prior information concerning its size, location, and disposition. The enemy force may be stationary or moving.

b. Immediate Action and Battle Drills

When a platoon makes contact, it must react quickly and aggressively. Action upon enemy contact is commonly referred to as an immediate action (IA) drill or battle drill. Success or failures in most meeting engagements are determined in the opening moments and depends on the ability of the commander to quickly bring to bear all the combat power at his disposal. The side that brings effective fire to bear on the enemy first has a significant advantage. Each individual crewmember must know how to react in a given situation. A number of actions must take place immediately and are made almost simultaneously, they are:

- SUPPRESS BY FIRE: SHOOT
- DEPLOY: MOVE
- REPORT: COMMUNICATE

c. Actions on Contact

The first action on contact is to deliver a high volume of fire with all available weapons into the enemy position. EFVs that are exposed to enemy fire move rapidly to hull-down firing positions. Smoke from the vehicles smoke grenade launchers may be used to help conceal the EFV from enemy gunners. An initial contact report should be made as soon as possible so that the unit leader can have the information that he needs to develop the situation. This initial report should be brief and accurate and contain at least WHO, WHAT, WHERE, and WHEN. Examples of contact reports are as follows:

- "Alpha Two Zero One, this is Alpha Two Zero Three." "Receiving machine gun fire from my three o'clock. Looks like dismounted infantry in the tree line. I am engaging. Out."
- "Charlie Three Zero Four, this is Charlie Three Zero Two." "Observing four T-72 tanks moving from left to right. Twenty-five hundred meters to my direct front. Out." (Example of a visual contact, but no engagement.)

Fire neutralizes, suppresses, demoralizes, and destroys enemy forces. Movement brings firepower where it can extend and complete destruction. Maneuver consists of fire and movement. Fire, direct and indirect, placed on the enemy to reduce his capability to interfere with friendly (moving) elements is a base of fire. The base of fire permits the forward movement of friendly forces and suppresses enemy direct-fire weapons.

d. Near Ambush

Immediate action in a near ambush (300 meters or less): the killing zone is under heavy, highly concentrated fire. There is little time to seek cover and the longer you remain in the killing zone the more certain your destruction. Therefore, if attacked by a near ambush, react as follows:

- Vehicles in the killing zone, without order or signal, immediately assault directly into the ambush position, occupy it, and continue the attack or break contact, as directed. This action moves friendly forces out of the killing zone, prevents other elements of the ambush from firing on friendlies without firing on their own positions, and provides positions from which other actions may be taken.
- Vehicles not in the killing zone but able to support by fire, engage the enemy. Other vehicles stand by to maneuver against the attack force and other elements of the ambush, as directed.

e. Far Ambush
Immediate action in a far ambush (over 300 meters): like a near ambush the killing zone is also under heavy, highly concentrated fires, but from a greater range. This greater range provides vehicles in the killing zone some space for maneuver and an opportunity to seek cover. Therefore, if attacked by a far ambush, react as follows:

- Vehicles in the killing zone, without order or signal, immediately return fire if the enemy is within range, seek cover and concealment, and continue firing as long as the enemy is within range or until directed otherwise. (Employment of on-board smoke could be used to help conceal your EFV.)
- Vehicles not in the killing zone stand by to maneuver against the ambush force, as directed. Engage the enemy if they are within range.
- The attack is continued to eliminate the ambush or to break contact, as directed.

f. Antitank Guided Missile
Immediate action for an antitank guided missile (ATGM):

- EFVs that are exposed to the ATGM fire move rapidly to hull down firing positions. All gunners that are able to engage the ATGM, whether exposed to the ATGM fire or not, continue to fire at the spot at the base of the smoke trail, or at the flash of the weapon's position.
- The first crewmember that observes the weapons signature will give the initiating battle drill brevity code word over the net; "Missile, Missile, Missile."
- If cover and concealment is not available or there is some ground to cover before you can reach a defilade position, the driver should drive the EFV in an erratic, zigzag path at varying angles to the ATGM position, this will make it more difficult for the enemy gunner to track. Another evasive action is to turn quickly to the right or left in the last seconds of the missile's flight. It is the driver's job to make every attempt to get some type of obstruction, such as the earth, trees, telephone poles, or bushes, between the enemy firing position and the EFV.
- To try and conceal the EFV from the enemy gunner's view, the EFV vehicle commander may also fire smoke grenades. Another technique that the driver can use is to turn or back up the vehicle into the vehicle's own dust cloud to obscure the enemy gunner's view.
- Table 2-2 provides ATGM maximum effective ranges and flight times for many of the common ATGMs used on the battlefield.

Missile Type	Maximum Range	Flight Time at Given Range

TOW 1	3,750 meters	15 secs at 3,000 meters
TOW 2	3,750 meters	----------------------------
AT-3 Sagger	3,000 meters	25 secs at 3,000 meters
AT-4 Spigot	2,000 meters	11 secs at 2,000 meters
AT-5 Spandre 1	4,000 meters	16 secs at 4,000 meters
AT-6 Spiral	5,000 meters	11 secs at 5,000 meters
HOT 2	4,000 meters	13 secs at 3,000 meters
M47 Dragon	1,000 meters	11 secs at 1,000 meters

Table 2-2, ATGM maximum ranges and time of flights

g. Indirect Fire

Immediate action to indirect fire while on the move consists of closing all vehicle hatches and moving quickly out of the impact area.

- It is important to button-up vehicle hatches to protect the crew and embarked Marines from shrapnel. Crews must realize that visibility will be somewhat reduced with all hatches closed, so they must ensure that optics and vision blocks are always clean and unobstructed.
- Masking may be necessary (based on the enemy's capabilities and the MOPP level), because the enemy may employ a mix of HE and chemical ammunition.
- It is important to continue to move through the impact area quickly. It is much easier for a forward observer to achieve hits on a stationary target than to adjust fire onto a moving target. A technique that the unit leader can use to try and avoid the indirect fire is to change the direction of movement for the unit. Once out of the impact area the unit will correct its course again. (If your unit is in a static or defensive position, you may move from your primary fighting position to your alternate position, but any other movement out of your battle position must be on order.)

h. Harassing Fire

Immediate action when receiving harassing or indiscriminate small arms fire is to return fire and continue to move (depending on previous orders given for the operation).

i. Enemy Air Attack

If attacked by enemy air immediate action is to move from the axis of attack and find cover and concealment. If none is available, keep moving and drive an erratic course. The unit should also engage the aircraft with all available weapons. To reduce the chances of being engaged by aircraft do the following:

- If the aircraft does not see you - stop! It is hard for aircraft traveling at fast speed and high altitude to see you. Any movement (dust trail, reflection from optics or vision blocks) may draw their attention to you.
- If the aircraft is not engaging your unit or an adjacent unit, do not engage it. Again, this will draw attention to you.

j. Follow-on Actions
The situations above are examples of scenarios where immediate action or battle drills can be used. In each situation, the success of the immediate action or battle drill employed is dependent on proper training in recognizing the enemy situation or nature of the ambush, and well-rehearsed reaction. After the initial reaction it is up to the unit leader to develop the situation.

2212. Platoon Standing Operating Procedures

Immediate action and battle drills will be incorporated into unit (including platoon) SOPs. The purpose of a platoon SOP is to provide standard methods for operations within an EFV platoon**.** When specific orders are too time-consuming or not possible, a well-rehearsed platoon SOP ensures fast, predictable actions by all EFV crews.

A unit SOP must be drilled repetitively so that every EFV crew within the platoon will react automatically to any tactical situation. Instructions to initiate SOPs and fire commands must be brief and precise. (Brevity code words are often used to keep commands brief). SOP's could include guidance on:

- Command and control.
- Operations security.
- Organizing for combat.
- Down vehicle (bump plan).
- Tactical operations.
- Personnel.
- Vehicle positions (for example, "C-32 will always be on my right and C-33 on my left". <u>Or</u> "In a platoon armored coil the lead section will have from 10 to 2 o'clock, the second section will have from 2 to 5 o'clock, the last section will have from 7 to 10 o'clock, and headquarters section will protect our rear from 5 to 7 o'clock". The direction of march is always 12 o'clock).
- Aircraft engagement techniques

2213. Dismounting the EFV

a. Ramp and Personnel Door
When the infantry dismounts, they must do so rapidly. Embarked infantry must have well-practiced procedures for quickly dismounting the EFV and organizing on the ground for combat operations. There are two exits to dismount the vehicle: the ramp and the ramp personnel door. The ramp is the easiest and fastest. If the ramp cannot be used or the squad leader wants to dismount only a few personnel, the ramp door may be used.

b. Dismount Procedures
The troop commander (TC) must keep his squad informed and alert as to possible dismount situations. As soon as he knows where and how he wants to dismount, he will alert his squad members in the troop compartment while the vehicle commander (VC) locates a suitable dismount point. Once the VC gives the signal to the infantry to dismount the following

procedures should be used:

- The squad leader's dismount alert should trigger an automatic response from the Marines in the troop compartment:
- Each Marine secures his weapon, ammunition and any other equipment that he needs.
- Each Marine ensures his weapon is on safe with the muzzle on the deck and locks and loads.
- During darkness, only blue/green interior lights or red filtered flashlights are used in the troop compartment, and only if necessary. This will help maintain their "night vision" before dismounting.
- The TC keeps his CVC helmet on until the order to dismount is given. This insures the he can monitor any last-minute radio traffic.
- The Marine occupying the 5th station aft will inform the VC over the ICS when the last Marine exits the EFV and that the ramp area is clear. The VC will then direct the driver to raise the ramp.
- If the VC does not receive verification that the ramp area is clear, he or the gunner must visually confirm that it is safe to raise the ramp.

The driver should always be on the alert for covered and concealed positions. When the order is given to dismount the infantry, he should make every effort to stop the vehicle in a covered and concealed position. This will add to the security of the infantry as they disembark and reduces the chance that they will be engaged by direct fire. It may also be possible for them to deploy without the enemy detecting the dismount. Whenever possible the driver should also stop the vehicle with it pointed at the enemy. This will help the infantry to orient on the enemy.
The VC directs the driver to a proper dismount point and helps the driver to orient on the enemy. The VC then directs the driver to lower the ramp. Suppressive fire is used, if needed. The TC removes his CVC helmet and dismounts. Once the driver is ready to move out he scans the area and assists the Gunner in acquiring targets. During darkness all lights must be off to prevent a violation of light discipline when the ramp is lowered.

Normal SOP for an infantry squad when they dismount, is to quickly move forward along both sides of the vehicle to a position 20 to 30 meters in front hitting the deck either on line or forming a hasty 180 degree arc. If the dismount is due to enemy contact, the TC may deviate and order; "Action left/right/rear" if the driver was unable to orient the front of the vehicle towards the enemy. In any event, disembarked infantry must be cautioned to stay clear of the vehicle to prevent possible injury when the vehicle resumes movement.

The EFV crew must know the location of dismounted infantry. The vehicle commander should keep the driver oriented so that he does not endanger dismounted infantry as the EFV is moved. This is especially critical at night. Many times when moving, there will be temporary halts. This might be during overwatch, while leaders meet, vehicle breakdowns, or because of an obstacle. In such cases, at least a fire team should dismount to provide local security. When this is the case the ramp door could be used to disembark instead of the ramp, so that the vehicle is ready to move out quickly. All dismount events should be coordinated between the VC and the 5th station aft to insure safety.

2214. Types of Halts

During an armored movement units conduct three types of halts: scheduled halts, unscheduled halts, and disabled vehicle halts. Scheduled halts are planned along the route of march for maintenance, rest, refueling or to follow higher-level movement orders. Unscheduled halts are caused by unforeseen developments such as obstacles, unannounced changes to movement plans, or enemy activity forward of the unit which prevents further movement. Disabled vehicle halts are the result of a vehicle becoming disabled and unable to continue movement. The driver moves the vehicle out of the way so as not to block the rest of the armored formation. The VC reports the vehicle breakdown and status immediately. If the malfunction is not known right away an update can be given later. If the vehicle is creating an obstruction it is towed or pushed out of the way. A guide is posted to direct traffic around the disabled vehicle. The embarked infantry may be required to provide the guide and provide local security. Once the vehicle is clear of traffic the crew can begin to troubleshoot and correct the problem. The rest of the unit will normally continue to move. If the crew can quickly repair the vehicle, they rejoin the formation and take their position when they can. If the armored formation has passed, or the crew could not repair the vehicle it waits for maintenance action/repair. If a unit leader's vehicle is disabled he moves to another vehicle.

During halts, security is always maintained. Weapon stations are manned, sectors of observation are scanned, communications are monitored and local security is posted. During a halt the unit assumes a defensive posture and will probably form either an armored coil or herringbone. During halts it becomes easy for an armored column to become "bunched up". It is important to keep a good interval (at least 50 meters) between vehicles and units.

2215. Employment of Smoke

Smoke obscures vision and degrades most sighting devices. Both friendly and enemy forces use smoke to reduce their opponent's ability to see, move and fight. Thermal- imagery sights and viewers provide the means to see and shoot through most smoke. (If the enemy has thermal sights, the value of smoke cover is decreased, but the smoke still degrades the enemy's target acquisition abilities.) Both forces may use smoke to screen their own movement, or to deceive the enemy.

EFV crewmembers must understand the considerations that effect the use of smoke and use them to their advantage on the battlefield. The tactical situation (enemy location, wind direction, wind speed, humidity, rain, width and depth of desired coverage and desired time of obstruction) dictates how effective smoke employment will be. The on-board smoke capabilities of the EFV can be an effective combat multiplier. On the initial use of smoke by the vehicle it can be easily detected by the enemy. So once on-board smoke has been employed, the vehicle commander must immediately issue driving commands.

a. Vehicle Capabilities

The EFV is equipped with two turret-mounted M6 smoke grenade launchers consisting of four individual 60mm launcher tubes each. Each set of launchers provides 60 degrees of coverage oriented in the slew direction of the turret. These smoke systems help cover movement, reduce the enemy's ability to acquire and engage the EFV. These smoke systems can be used with other smoke sources (artillery, mortars, naval gunfire, close-air support and smoke pots).

The M6 smoke grenade launcher system provides the EFV a self-screen smoke capability. Once fired, it provides an immediate smoke screen. If the VC chooses to fire just one launcher, he will create an initial smoke screen that will cover an arc of approximately 60 degrees. If the VC chooses to fire both launchers he will create an initial smoke screen that will cover an arc of approximately 120 degrees. Figure 2-16 illustrates the smoke dispersion pattern when all launchers are discharged.

Extreme caution should be used when firing the smoke grenades. Smoke grenades contain red phosphorus, a highly flammable fire-producing chemical. The grenades are propelled into the air and detonate approximately 30 feet above ground and 20-50 feet from the EFV. Awareness of wind direction is critical as it will affect the burst coverage and distance, persistence and direction of travel of the screening agent, and influence any adverse effects of the agent on the vehicle or externally stowed equipment. In a no-wind or light-wind environment, the screen can persist for several minutes. As such, EFV hatches should be closed prior to employing these grenades. Additionally, consideration should be given to the potential effects on the surrounding area, to include dismounted personnel and equipment.

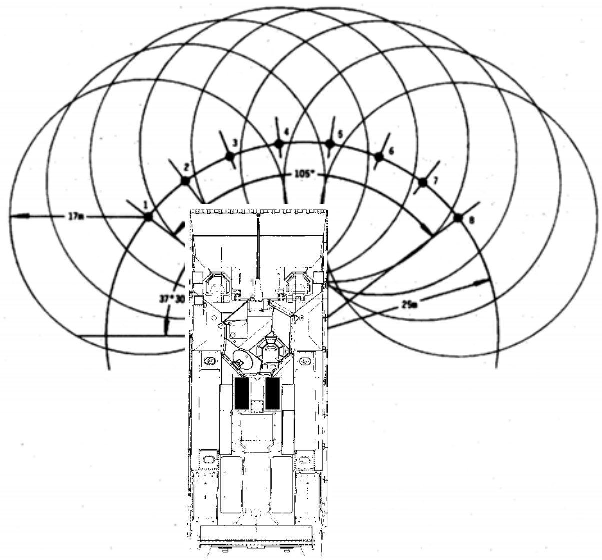


Figure 2-16, EFV smoke dispersion pattern

b. Crew Procedures

The following procedure coordinates crew actions when firing the smoke grenade launcher:

- To alert the crew and embarked personnel, the VC gives a warning, "Grenade Launcher" while traversing the turret toward the area where the smoke screen is desired. Upon hearing, “Grenade Launcher” all hatches are closed. The VC arms the grenades, checks to ensure that it is clear to fire, then fires one or both launcher tubes. When the tactical situation permits, the VC checks the grenade dischargers to make sure all grenades have been launched, and then reloads.

- After loading the smoke grenades into the discharger tubes, cover the loaded tubes with the rubber discharger caps. The rubber caps are designed to blow off when the grenades are fired. If the grenades are not protected from the elements, you increase the possibility of a misfire.

c. Safety Considerations

While smoke may not produce immediate physical effects, extended exposure to large concentrations may produce secondary effects such as shortness of breath, inflammation of the respiratory system, dizziness, vertigo, or vomiting. Effected personnel should be removed from the smoke and attended to by a corpsman.

2216. Immediate Action

Immediate action drill training should be part of all field training. Immediate action allows a unit to maneuver, in combat, instinctively. It starts with the basics and expands to more complex actions. The EFV unit leader will "chalk talk" and diagram intended immediate action maneuvers. These diagrams start with simple maneuvers executed in relatively flat, open terrain and progress to complex maneuvers in forested, hilly terrain. The progression from "chalk talk" (which would include the use of terrain models and any other visual aid desired) goes through actual maneuvering of vehicles, but starting with step-by-step movement, at slow speed before progressing to uninterrupted maneuvers at full speed with embarked infantry and against an opposing force. Immediate action drill training is a continuous process.

The following drills are examples and not all-inclusive. These examples will typically be included in unit SOPs. Some of these examples are applicable to action that would be taken prior to, or in anticipation of, a meeting engagement. Keep in mind the importance of integrating the infantry in immediate action drill training, particularly for those drills that require the simultaneous movement of EFVs and disembarked infantry. Additionally, task organization will be different depending on the type and size of the unit. The following drills are drawn from a mechanized company perspective, and each commander should adjust the formation depending on METT-T:

- DRILL TITLE: Bulldog. A bulldog is an on-line movement to close with the enemy. This movement can be conducted from any of the basic formations. The bulldog can be to the left, right or to the front. This drill would normally be conducted when a unit encounters an ambush or is conducting a mounted assault on a lightly defended enemy position.
- DRILL TITLE: Panther. The panther is an assault by part of the mechanized unit (i.e., one EFV Section of the EFV Platoon) that seeks to flank an enemy force with the maneuvering element. Once engaged, the remainder of the mechanized unit fixes the

enemy or conducts other actions such as screening an exposed flank or acting as the reserve.
This movement can be conducted from any of the basic formations and can be to the left, right, or to the front. This battle drill would normally be conducted during a movement to contact and after the situation has developed to the point were the unit commander can make an educated assumption as to the size, activity, and location of the enemy.

- DRILL TITLE: Hammerhead. The hammerhead is an assault by all of the force (i.e., two EFV Sections of the EFV Platoon) except the fixing force. The maneuvering units normally attempt to flank the enemy force. Hammerheads are difficult to control due to the coordination required between the two flanking elements. The distance traveled and the terrain involved in the movement will have an effect on the timing of the assault. Hammerheads can be executed from any formation. The point unit won't always make contact first. Another unit may make contact and become the logical choice to assume the fixing force mission.
- DRILL TITLE: Snowstorm. Snowstorm may be used when a unit is receiving indirect fire. Once a unit begins receiving indirect fire the code word "snowstorm" is passed. Immediately upon receiving the warning all vehicle hatches should be closed. If the unit is moving it should keep moving as quickly as possible out of the impact area. If a unit is stationary it should immediately begin moving.
- DRILL TITLE: Bandits. Bandits are used when a fixed-wing or helicopter attack occurs. This can happen with little or no warning. If this is the case your actions will be dependent upon whether you are moving or stationary.
    - If stationary:
        - Sound the warning, "BANDITS- BANDITS- BANDITS" and the cardinal direction of the attack.
        - Remain stationary to avoid stirring up dust clouds.
        - Train all available weapons on the aircraft and fire.
    - If moving:
        - Sound the warning.
        - Execute a herringbone and attempt to get out of the line of the aircraft's path.
        - At the first opportunity stop and train all available weapons on the aircraft and fire.

2217. Obstacles

An obstacle is any object that stops, impedes, or diverts movement on the battlefield. Obstacles may be natural or manmade. A series of obstacles is referred to as a barrier. The commander exploits natural obstacles to the greatest degree possible and reinforces them with man-made obstacles. Obstacles perpendicular to an axis of advance favor the defender by slowing or canalizing the attacker. Obstacles parallel to an axis of advance may assist in protecting the flank of an attacking force. Natural water obstacles such as oceans, rivers, lakes and swamps are considered maneuver areas or avenues of approach for EFVs. Whenever possible, friendly obstacles should be covered by observed fire.

2218. Weather and Visibility

The EFV can operate effectively in all types of weather and visibility conditions. Weather affects observation, traffic ability, control, performance of personnel, functioning of equipment, air support, and the range and effects of weapons. The commander must anticipate changes in the weather and be prepared to capitalize on the advantages the different types of weather can present. The EFV has an excellent night and obscured vision capability at both the driver's and gunner's stations. For more information on night or limited visibility gunnery see chapter 4.

2219. Role of the Reserve

The primary purpose of the reserve is to enter the action offensively at the proper time and place to ensure victory or exploit success. The decision to commit the reserve rests with the commander but he should notify the next higher commander that the reserve has been committed. After committing the reserve the commander should begin reconstituting a new reserve immediately.

EFV units are ideally suited for the role of the reserve force. The mobility of the EFV allows the reserve to react to troubled spots quickly or to exploit an unexpected gap in the enemy's position. The EFVs speed allows it to exploit this gap from greater distances and from over more rugged terrain than other types of vehicles might be able to negotiate. Additionally, bodies of water that are normally viewed as obstacles are in fact avenues of approach for EFV units. The commander can plan the use of his reserve along the avenues that the enemy would not normally expect a unit to maneuver through.

Section IIII. Defensive Operations

The defense is the employment of all means and methods available to prevent, resist, or destroy an enemy attack. Compared to the offense, the defense is generally the less decisive form of war. It can deny success to the enemy but rarely can it assure victory.

Defensive operations are conducted to:

- Destroy enemy forces.
- Defeat an enemy attack.
- Gain time.
- Concentrate forces elsewhere.
- Control key or decisive terrain.
- Wear down enemy forces prior to offensive operations.
- Retain strategic, operational, or tactical objectives.

The basic concepts for defensive doctrine consist of:

- The use of security forces forward, to the flanks, and in depth to delay and disorganize the enemy's advance operations in the main battle area.

- Operations in the main battle area oriented on defeating the enemy not holding the initial forward edge of the battle area (FEBA) trace.
- Reserve operations in support of the main area.
- Spoiling attacks to destroy or delay enemy momentum.
- Rear operations to retain freedom of action in the rear area.
- The use of counterattacks to destroy or repulse enemy penetrations of the defense area.

2301. Characteristics of Defensive Operations

a. Defense in Depth
The most important characteristic of modern defensive operations is defense in depth. It does not seek to hold a line but rather control an area. Penetration of a line is expected and may be allowed but the area is used to destroy the attacker. Key concepts in defense in depth are ambush, counterattack, invisible positions, and parallel defensive positions. The EFV-equipped force can conduct defense in depth through aggressive use of the EFVs mobility, firepower, and flexibility as a personnel carrier.

(1) Ambush. Although mainly a technique associated with patrolling, an ambush is a way to shock and surprise the enemy through counterattack, hidden defensive positions, maneuver, etc. within the area one wishes to defend.

(2) Counterattack. The counterattack is the central part of a modern defense. Offensive action violently and aggressively executed within the defense in depth in order to cut him off and destroy him must be planned and conducted by the defender. Its purpose should be to destroy the attacker, not just regain ground.

(3) Invisible Positions. If your position can be seen, it will be destroyed by a determined enemy. Therefore, your positions should be invisible to the enemy as much as possible. It could be in the reverse slope or hide positions and much like an ambush, it is unseen until the ambush is sprung.

(4) Parallel Defensive Positions. If the area is large enough, parallel defensive positions should be attempted. Rather than placing positions perpendicular to the enemy attack, place them alongside his avenues of approach.

b. Preparation

The defender has significant advantages over the attacker. Generally, he knows the ground and has time to prepare with covered, concealed, and reinforced positions. The attacker has the initiative in choosing the time and place of attack. In order to minimize this advantage, the defender must slow or change the enemy's pace in order to give him time to isolate, fight, and destroy the enemy piecemeal.

Operational security is the defender's first priority of work. EFV units must maintain operational security through good tactical sense, avoidance of patterns, and deception. The defender must defeat enemy reconnaissance and surveillance efforts.

c. Disruption
An attacker's strength comes from momentum, mass, and mutual support of maneuver and combat support elements. The defender must slow or fix the attack, disrupt the enemy's mass, and break up the mutual support between his elements.

d. Concentration
Through the use of reconnaissance and security forces, the defender can shape the battlefield and force the enemy to an area where he can concentrate his forces to defeat him. Disperse, concentrate, and disperse again in a constant effort to imbalance the enemy is the goal of the defender. The EFVs inherent mobility gives the defender the ability to disperse and then rapidly concentrate in terrain that may be unavailable to the enemy.

e. Flexibility
Defending forces must designate reserves and combat service support assets in depth to react to enemy actions. Contingency planning coupled with rehearsals are one way to ensure that an enemy penetration does not destroy the entire force. The ability to see the entire battlefield through the use of organic and non organic means as well as analyze the enemy's actions are key in ensuring the force's ability to maintain security and not be surprised. The EFV, with its mobility, increased firepower, and enhanced ability to maintain situational awareness, contributes to any commander's flexibility.

f. Defensive Missions
Units of a mechanized task force (MTF) composed of EFV-mounted infantry, tanks, anti-tank missile carriers, and light armored vehicles (LAVs) may be tasked with the following missions:

- Defend in sector.
- Defend a battle position.
- Defend a strongpoint.
- Reserve.
- Counterattack.
- Security force actions (guard, cover, screen).
- Withdraw.

2302. Organization of the Battlespace

The MTF may defend a portion of a larger unit's battlespace or defend by itself. In either event, the battlespace will normally be organized into the following areas:

- Deep operations area where military actions are conducted against enemy capabilities which pose a potential threat to friendly forces. It is forward of the forward line of own troops (FLOT) where force reconnaissance (FORECON) and navy special warfare teams normally operate.
- Security area is forward and to the flanks of the defending force where division recon,

LAV, tank, and EFV units may operate.

- Main battle area where the preponderance of the defending force (including EFV units) operates.
- Rear area where the reserve (often with EFVs) and combat service support units operate.

a. Deep Operations

Deep operations are actions against enemy forces that have capabilities to pose a potential threat to friendly forces. Deep operations give the commander opportunity to shape the battlefield by separating enemy echelons, disrupting his command and control and combat service support assets, and decreasing his tempo. Joint air, deep strike artillery, long range naval surface fire support assets and other assets controlled by force reconnaissance, Navy SEALs, and other special operations units are normally used in this area.

While the GCE does not normally conduct deep operations, it must be prepared to contribute to execute deep operations as directed by the MAGTF CE. EFVs with their inherent mobility, armor protection, and firepower make them ideal assets to support deep operation units.

b. Close Operations

(1) Security Area Operations. The forward security force normally established by a MEF is called a covering force. It conducts independent operations against enemy lead echelons in the Covering Force Area (CFA) where it attempts to deceive the enemy of the size, strength, and location of the defense. Normally, LAV units are tasked with this mission within a MAGTF. However, mechanized units with EFVs may be assigned this mission if reinforced with anti-tank, artillery, engineer, and air defense capabilities. Forces assigned to this mission may revert to the reserve when they disengage from the enemy.

(2) Main Battle Area Operations. Based on his estimate of the situation, the MTF commander will assign sectors or battle positions to his mechanized units. Sectors normally coincide with a major avenue of approach, while battle positions are usually placed on the flanks of avenues of approach. The main effort is allocated the preponderance of maneuver and fire support assets. Additionally, units may be assigned to be the guard force. The guard force allows the commander to extend the defense in time and space to prevent enemy organization of the main battle area. Mechanized units with EFVs are ideal for this mission due to their mobility and firepower. METT-T determines the organization of the guard force. It is normally oriented to the flanks and its mission lasts as long as the commander deems it necessary to complete preparations in the main battle area. After its guard mission is completed, the unit may receive a cover or screen mission. Mechanized units with tanks, EFVs, and anti-tank weapons may also receive a screening mission. A screening force may be established to gain and maintain contact with the enemy, to observe enemy activity, and to report information. It normally fights only in self-defense, but it may be tasked to:

- Repel enemy reconnaissance units as part of the counter-reconnaissance plan.
- Prevent enemy artillery from acquiring terrain that enables them to engage frontline units.
- Provide early warning.

- Attack enemy units with supporting arms.

Units in the MBA are deployed in depth in mutually supporting positions. The use of the reverse slope, where available, should be considered when selecting positions. Mounted reserves are designated in order to provide additional depth and flexibility to the commander.

Enemy penetration points should be anticipated. Mounted forces then attempt to counterattack on enemy flanks.

(3) Reserve Operations. Reserve forces are committed at the decisive moment and are key to the success of the defense. As the reserve, a EFV equipped mechanized unit could expect to conduct the following operations: counterattack; spoiling attack; block, fix or contain; and reinforce. They may also conduct rear area operations as a tactical combat force (TCF).

c. Rear Operations
Normally, a MTF does not have a rear area mission within a MAGTF. However, it may be assigned offensive missions against enemy Level II (platoon to company sized units) or Level III (company sized units and above) penetrations.

d. Nonlinear Defense
Due to the changing nature of warfare and technology, nonlinear warfare is now a reality. This type of warfare does not break down the battlefield into neat, orderly areas where units conduct specific defensive operations. Nonlinear defense is similar to a sector defense wherein units of the MAGTF fight the penetrating enemy using successive attacks to its flank, never giving the enemy a surface to attack, but rather, always presenting him with an elusive target. Reinforced mechanized units, like covering forces, can conduct this type of defense using indirect and direct fire weapons as well as air and naval surface fire support (NSFS) to wear the enemy down to such a point that a counterattack can be mounted to destroy him.

2303. Planning

a. Static and Positional Element
Every defense contains two primary elements and should be weighed carefully: a static or positional element. A positional element, which is anchored in key terrain and a mobile element, which generates combat power through maneuver and concentration of forces. Positional defense is characterized by the use of battle positions, strongpoints, fortifications, and barriers to halt the enemy advance. A mobile defense is characterized by offensive action, supplementary positions, shifting of forces, and commitment of the reserves. Commanders may have to use both types of defense planning depending on the situation. Mechanized units employing tanks and EFVs are ideally suited for the mobile defense while other units defend battle positions and strongpoints.

b. Planning Analysis
The MTF commander (and his subordinate commanders) must analyze the orders of the MAGTF and higher commander in order to determine specified and implied tasks from the commander's

intent at least two levels above. The following questions may assist the planner in his analysis:

- Is the engagement to be decisive or will there be freedom of movement?
- How will higher headquarters create a weakness in the enemy?
- How are counterattacks to be conducted, coordinated, supported?
- How is the MTF tied in to other units?
- Is there decisive or key terrain to be retained?
- What are possible follow-on missions? Contingency plans?

c. Defend and Counterattacks
Generally, a MTF based around an infantry battalion is given missions of: defend, delay, counterattack, or spoiling attack. An MTF can also be assigned less frequent missions in the defense.

(1) Defend. Defend missions can apply to a sector, battle position, or strongpoint. Defend in sector requires the MTF to destroy the enemy before he reaches the rear boundary. The units fight within the entire sector consistent with the commander's intent and requirements to tie in with other units.

Defense from a battle position (BP) requires the MTF to occupy a general location from which it can block an avenue of approach, fire into an assigned area, retain key terrain, and perform any other tasks. The BP can be for units from battalion task force to platoon size. Units assigned a BP can maneuver in and outside the position as necessary to adjust fires or to seize opportunities for offensive action in accordance with commander's intent.

Defend a strongpoint implies the defense of a heavily fortified position that holds or controls key terrain or blocks an avenue of approach. A strongpoint is a key point in a defensive position, usually strongly fortified and heavily armed.

(2) Delay Operations. Delay missions allow the forfeiture of terrain in order to gain time. It gives the commander the ability to shape the battlefield by depleting the enemy and giving time for other units to prepare.

Withdrawal allows the unit or part of the unit to free itself for a new mission. A withdrawal is conducted to break contact with the enemy when the MTF commander finds it necessary to reposition all or part of his forces. It could be assisted or unassisted, with or without enemy pressure.

(3) Counterattack. Counterattacks can be conducted by fire and maneuver, or by fire only. Counterattack by fire requires movement to a position in order to bring maximum fire against the enemy. The enemy force is the primary objective and any terrain seized is only important as long as the enemy can be engaged from this position. Counterattack by fire and maneuver implies that the intent is to close with and destroy the enemy or to capture key terrain.

(4) Spoiling Attacks. Spoiling attacks are attacks made on the enemy to seriously impair his ability to attack while the enemy is in the process of assembling for an attack.

(5) Other Missions

Other missions that may be assigned to a MTF include: assisting in the passage of the covering or security force, preparing obstacles, and providing surveillance or intelligence.

2304. Preparation of the Battlespace for the Defense

In preparing the battlefield for defense EFV unit leaders consider the enemy's capabilities, weather, terrain, and time-space considerations in order to determine enemy air and ground avenues of approach within the battlespace. Consideration should be given to the following:

- Primary and secondary avenues of approach and mobility corridors.
- Key terrain to determine where the enemy can be slowed down or exposed to counterattack.
- Determining from the enemy's perspective:
  - Maneuver space: Consider choke points, obstacles; and what kind of unit can use the avenue of approach.
  - Trafficability: How does soil trafficability, ruggedness of terrain, weather, and visibility affect vehicle movement rates?
  - Cover and Concealment: What terrain allows for safe movement as close to the defender as possible before deploying into assault formations?
  - Observation and Fields of fire: What terrain is suitable for direct fire of tanks, ATGMs, attack helicopters, directed energy weapons, or self-propelled artillery?
  - Key Terrain: What terrain gives the defender a decisive edge over the attacker? What choke points, natural obstacles, and restricted terrain can be used? Can a reverse slope be used?
  - Limited visibility effects: What avenue of approach is best during periods of smoke, fog, dust, and/or darkness?
  - Enemy air avenues of approach: From which direction will enemy aircraft likely come?
- Determining the most likely and most dangerous enemy courses of action.

2305. Mobile Defense: Defend in Sector

Defend in sector is the most common defense mission assigned to a battalion-sized MTF. A sector is an area designated by boundaries within which a unit operates. In the nonlinear battlefield, MTFs must be proficient in conducting a sector defense.

a. Intelligence

A reconnaissance and surveillance (R&S) plan will likely be developed and must be coordinated with higher headquarters to avoid duplication of efforts and friendly fire. The R&S plan must cover both mounted and dismounted avenues of approach and seek to destroy the enemy's reconnaissance forces. EFVs may be used to move assets in the R&S plan if other mobility assets are not available.

b. Maneuver
A maneuver plan is formulated from the battle handover line (BHL) to the rear of the boundary. Once the S-2 has identified the enemy avenues of approach, his capabilities, and vulnerabilities, the commander determines how many weapons systems are required to destroy the enemy and designates areas of vulnerabilities as engagement areas (EAs). The following are considerations when establishing an EA.

(1) Direct Fire. Plan for the direct fire of each EFV (primary and secondary weapon) and determine the number and type of weapons available to defeat the enemy at a designated EA. Items that need to be considered include:

- Range to the EA's kill zone.
- Rate of fire of each weapon type.
- Hit/Kill probability.

The EFV unit leader must ensure that the supported infantry commander is aware of the capabilities and limitations of his vehicle and weapons as he makes decisions concerning an EA.

(2) Positioning. Using the following as a guide, an MTF commander positions his units with the following considerations:

- Line of sight from their position to the EA.
- Fields of fire with minimum exposure time.
- Cover and concealment, hull defilade and turret defilade positions for EFVs and other vehicles.
- Flank shots available.
- Dispersion laterally and in depth.
- Mutual support.
- Minimizing the effects of limited visibility.
- Avoiding obvious terrain that may be an enemy target for preplanned fires.
- Alternate and supplementary positions (to include the use of hide positions before moving to a firing position).
- Maneuver room to secondary and alternate positions.
- Coordination of cross-boundary fires.

(3) Conduct of Fire. The MTF commander positions his units to provide the most effective fire without having to adjust their location. This does three things:

- Ensures that the engagement begins at the right time.
- Disperses fires adequately.
- Fires at the most critical targets first.

The construction of an effective EA is crucial to the success of the defense. The first task is to determine how best to engage the enemy. Two techniques are:

- Opening fire at each weapons system's maximum range, although this does not maximize all the unit's assets and gives the enemy time to possibly maneuver away from the EA.
- Opening fire of all weapons systems at the same time. This technique achieves surprise and inflicts heavy losses on the enemy.

The following are recommended direct fire control measures that should be included in all EA plans:

- Break lines: Break lines are designated by the commander in order to prevent decisive engagement. Units are told how much damage is to be inflicted in a given EA; " I want a company destroyed at EA DELTA and another company destroyed at EA FOXTROT." If the enemy continues, units can move to subsequent positions with little or no communications based on break lines and event-oriented criteria designated by the commander. "Move to secondary positions once three enemy vehicles breach the minefield."
- Trigger lines: Trigger lines are selected along identifiable terrain that crosses the EA. There may be one or more, depending on how the commander wants to engage the enemy. If the commander wants to engage the enemy at the maximum range of each weapons system, the MTF may have several trigger lines. If the enemy is to be drawn into an EA where all weapons systems can fire into him, then there is only one trigger line.
- Sectors of fire: Sectors of fire are designated to allow interlocking fires in the EA. The more units that contribute from different angles of fire, the better the effect. The commander designates a sector of fire to each unit, delineating their orientations with TRPs. The TRPs must in turn be placed on easily identifiable terrain that allows the concentration of fire where the enemy is most vulnerable. Alternate orientations and supplementary orientations must also be planned for. Alternate orientations are required to cover the same terrain effectively if original positions are compromised. Supplementary orientations are required if the enemy comes from another avenue of approach. Specific sectors of fire are always situation and terrain dependent; however, a sector of fire for an individual EFV is normally 60 degrees (or 180 degrees for a 3 vehicle section).
- Engagement criteria: designates when the unit can commence fire after the enemy has crossed the trigger line; i.e. "commence fire after 10 tanks cross the trigger line."
- Disengagement criteria: designates when the unit should fall back into rearward positions, i.e. "disengage after the enemy crosses Break Line "Gator"
- Target priority: specifies what targets to engage first; i.e. C2 vehicles
- Destruction criteria: designates which weapons systems will engage what targets; tanks will engage tanks, EFVs will engage BTRs, etc.
- Battle damage assessment (BDA): assesses the number of enemy weapons systems destroyed
- Primary firing position: provides the vehicle and crew the best means (terrain, cover,

concealment, etc.) to accomplish the assigned mission.

- Alternative firing position: allows the vehicle and crew to cover the same sector of fire as the primary position. Alternate positions are occupied when the primary position becomes untenable or unsuitable for carrying out the mission. Vehicles may occupy alternate positions before an attack to rest or carry out maintenance actions or to add the element of surprise to the defense.
- Supplementary firing position: provides the best means to accomplish a task that cannot be accomplished from the primary or alternate positions. These positions are normally located to cover additional enemy avenues of approach and to protect the flanks and rear of the unit's position.
- Figure 2-17 below illustrates how an EFV section would defend a prominent battle position using primary, alternate, and supplementary fighting positions.

If the commander properly employs the above fire control measures, units will know when to engage, where to fire, and what to shoot at and in what precedence.

Example: "Team EFV will orient from TRP 002 to TRP 009 and engage once a platoon size element has crossed the stream. Target priority is C2 and BTRs."

c. Preparation, Execution, and Counterattack Planning

(1) Preparation. The defense maneuver plan must be rehearsed to ensure that subordinate units understand their roles and the commander's intent. It is also during rehearsals that command and control is verified. Each unit must know its role in the defense; when to fire, who to fire at, where to fire, and how to destroy the target. The commander must "walk the ground" if time is available to see his position from the enemy point of view to verify cover and concealment, fire control measures, and the obstacle plan. He should also verify the known distance to TRPs, the position of his obstacles using GPS, and ensure that the EA is established according to his guidance.

(2) Execution. During the execution of the plan, changes must be kept to a minimum to lessen the chances of confusion. The commander weighs the need to pull back units to secondary positions against the need to maintain fire on the enemy at the EA. He also determines where and when to commit the reserve. When he commits the reserve, scouts should lead the reserve along its designated route, clear the area when the reserve engages the enemy, and quickly re-establish a screen in anticipation of the enemy's next echelon.

(3) Counterattack Planning. There are two types of counterattack that can be used in case of enemy penetration; counterattack by fire and counterattack by fire and maneuver. The EFV can be used in both types. The commander must decide what type to use depending on terrain and enemy actions.

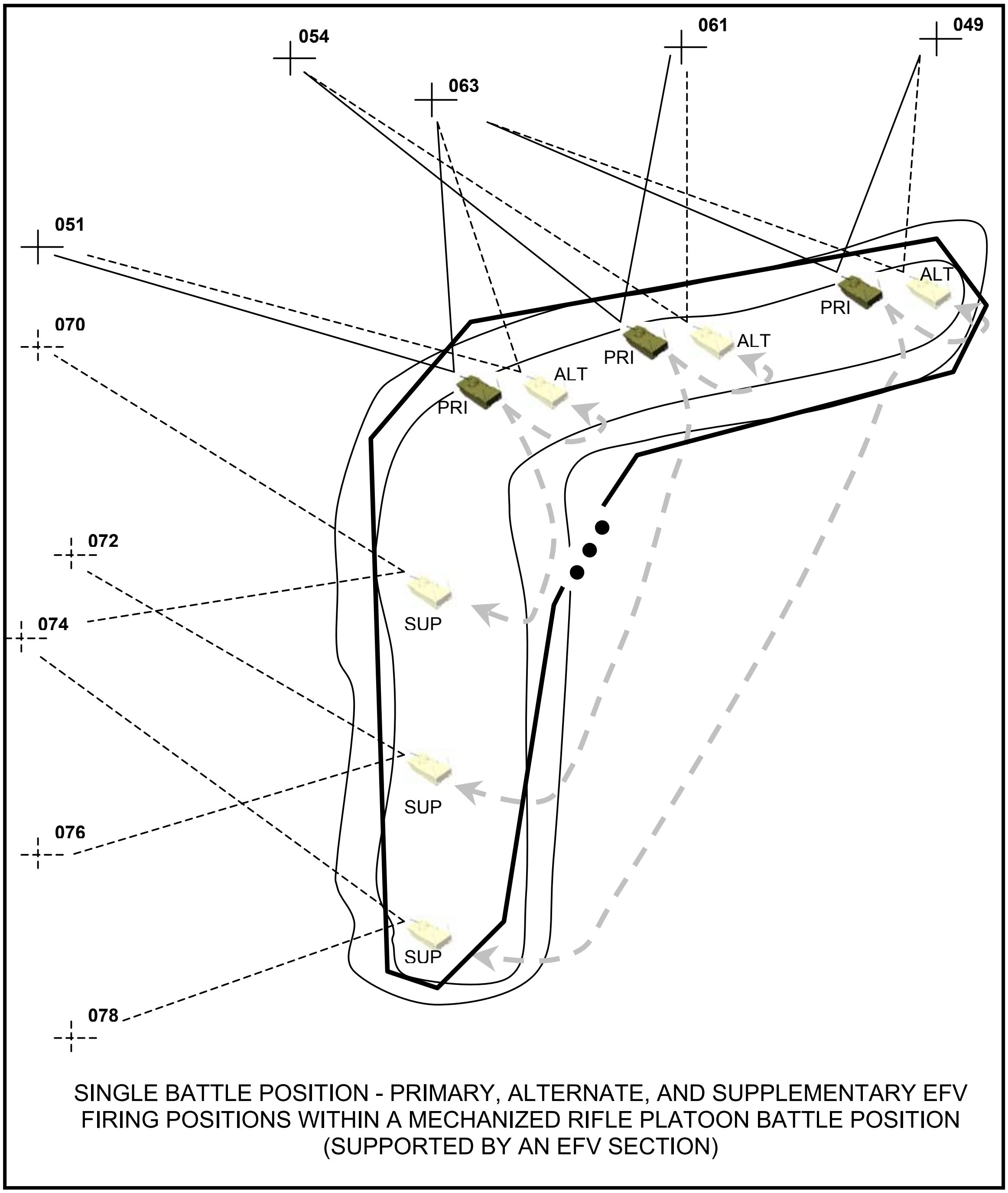


Figure 2-17. Example of a battle position for an EFV section.

- Counterattack by fire. This type of counterattack augments the existing direct fire of the unit in the EA. The direct fires of the counterattack force must be integrated in the direct fire plan. The reserve must undergo the same planning and rehearsals with prepared routes to the counterattack by fire positions.

- Counterattack by fire and maneuver. This counterattack can either seize terrain that the enemy has occupied or destroy the enemy. When seizing terrain taken by the enemy, the counterattack force must have an obstacle-free avenue of approach, a limit of advance to prevent them from overrunning their support, and restrictive fire measures to prevent fratricide. When destroying the enemy, the same fire support measures must be taken but the force is not keyed on any terrain; only on the systematic destruction of enemy units that have penetrated the sector.

d. Fire Support

The fire support plan must be coordinated with the obstacle and maneuver plans. It enables the reconnaissance elements of the defense to wear the enemy down with long-range fires and canalizes the enemy into avenues of approach we want him to use. Within the EA, fires should be planned to cover obstacles and deadspace, while providing direct fire weapons better shots against the enemy. Fires should be coordinated with fixed and rotary wing aviation as well as possible rocket support in mind.

The fire support plan must also support the counterattack plan. Indirect fires, aviation, and NSFS should be utilized to screen the counterattack force as it moves to position, suppresses the enemy, and assists in disengagement of friendly forces. The FSC should develop two fire support plans; one for the defense and the other for a counterattack.

During the battle, fires should initially destroy enemy reconnaissance assets. Fires should be adjusted in support of the obstacle plan. When a unit has to disengage and move to another position, fires should be used to delay enemy reaction and screen friendly movement.

e. Mobility, Countermobility, and Survivability

The MTF commander prepares an obstacle plan based on the MAGTF commander's desires. He designs it to achieve the function required by the MAGTF (turn, block, fix, and disrupt). Engineer assets must be used wisely to ensure that priority obstacles or survivability positions are constructed. EFVs may be used to assist combat engineers in performing these missions because of their mobility; however, cargo space for hauling engineer materials is limited. The EFV unit leader must be aware of the types of obstacles (turning, blocking, fixing, disrupting) not only to assist combat engineers but also to determine their effects on EFVs during the conduct of the defense.

Obstacle types are combined to manipulate the enemy's formation, disrupt his C2, cause attrition, and lead him to the EA where he can be destroyed. Engineer officers within the MAGTF and MTF should be assigned in the planning and preparation of these obstacles. EFV unit leaders must ensure that the capabilities and limitations of the EFV are taken into considerations when obstacles are planned to ensure that they maintain their mobility on the battlefield. The amount and type of obstacle (mines, ditches, hedgehogs, etc.) and amount of time required to emplace them will vary and will need to be considered during the planning of the defense. When the obstacle plan is complete, engineer elements continue their work in depth. They can dig secondary or tertiary positions, make an obstacle more dense, or provide elements to clear lanes for friendly forces. The EFV unit leader must ensure that his vehicles can get in and out of dug-in positions quickly if the situation dictates.

(1) Turning Obstacles. Turning obstacles are used in conjunction with a BP within a sector to deflect a threat formation in order to give defending forces a chance for a flank or rear shot. When positioning a turning obstacle, it cannot be so obvious that the enemy readily identifies it and moves away from it. Turning the enemy in small increments can give him a false impression and give defenders the flank or rear shot desired.

(2) Blocking Obstacles. Blocking obstacles are designed to be very expensive to breach. They are constructed to limit a penetration, to stall an attack, to set up a counterattack, or to protect key terrain that must be retained. They are constructed in depth with a variety of obstacles and enough density to make the enemy conduct a breaching operation. They should be tied in with restrictive terrain.

(3) Fixing Obstacles. Fixing obstacles are prepared to slow the enemy down to give direct fire weapons a good shot at maximum range. They are constructed with enough obstacles to make the enemy conduct breaching operations but no so dense as to make the enemy redirect his movement to a less defended avenue of approach.

(4) Disrupting Obstacles. Disrupting obstacles are used to frustrate the enemy and delay the enemy so he will abandon routes. This is important in compartments in the same direction as the attack. These obstacles should be quick to emplace and must be in sufficient depth to make the enemy work at getting through this avenue. An example is a series of craters on a hard surface road to slow enemy follow-on CS or CSS assets.

f. Aviation

The MTF will normally work with the ACE of the MAGTF in order to ensure that mechanized forces have adequate fixed wing, rotary wing, unmanned aviation and air defense support. Fixed wing and rotary wing offensive air support is integrated into the fire support plan while unmanned aviation assets are integrated into the R&S plan. Assault support assets in the form of rotary wing or unmanned aerial vehicles can be used to conduct re-supply of maneuver units. The use of aviation-transported bladders to reposition fuel for EFVs and other vehicles is just one of the many uses for assault support aircraft. When planning a defense in sector, Stinger and Avenger teams from the light anti-aircraft air defense (LAAD) battalions must be considered to ensure proper coverage. Stinger teams may be placed in EFVs to give them more mobility. The EFVs 30mm MK44 gun may be used to cover deadspace where enemy helicopters using terrain masking can hide in ambush.

g. Combat Service Support

CSS elements must be positioned away from obvious locations that will be targeted by the enemy. However, they should be close enough to ensure rapid re-supply of the MAGTF's assets. If they are available, EFVs may be used to supplement the vehicles of the combat trains due to their mobility; however, internal; cargo space for such a mission is extremely limited. EFVs can be used to transport certain, small amounts of pre-packed supplies to re-supply other units. If possible, all units should be re-supplied, maintained, and refueled before reconnaissance assets detect the enemy. EFVs, due to the amount of POL they use, should be priority customers for the combat trains. Alternate locations must be reconnoitered and routes checked for combat trains. Combat trains and contact teams must have multiple routes to BPs and rehearse their movement in order to minimize confusion during the actual battle. The objective of CSS units is to ensure the MTF's volume of fire and combat power is maintained to sustain the fight. CSS units must be prepared to conduct local defense in case of enemy penetrations. If EFVs are part of the combat trains, their primary and secondary weapons systems will play a key part in the defense of CSS units.

h. Command and Control
The MTF commander must ensure that he has redundant and secure communications to control his forces in the sector. Contingencies must be planned for and rehearsed. Ideally, the commander should be with the main effort. If needed, either the XO or the S-3 can be with the remaining forces. Command and control in this type of defense will be enhanced through the proper use of the EFV(C) by the MTF commander and his staff.

2306. Position Defense: Defend a Battle Position

A BP is a defensive position from which a unit will fight. A BP can be for units from platoon to battalion task force size. Units assigned to a BP fight from within the general area of the position. Units can maneuver within the position to adjust fires or seize the opportunity for offensive action within the commander's intent. It can be hasty or it can be improved. When sited so as to deny the enemy access to a given area or to prevent his advance in a given direction, it is called a blocking position.

a. Intelligence
The selection of a BP is the culmination of the joint efforts of the intelligence and operations sections. Significant enemy avenues of approach and key terrain is identified and units are positioned in order to defeat this threat. Both mounted and dismounted avenues of approach down to the infantry platoon level must be examined in order to account for all possible gaps in the area. The EFV unit leader must be prepared to give the infantry commander recommendations based on his experience and knowledge of mechanized combat.

The S-2 must recommend a strong counter-reconnaissance effort because the static nature of defending a BP lends itself to enemy targeting. The R&S and deception plans take on added importance in this type of defense. The R&S plan is conducted like that in a sector defense but should add that any reconnaissance elements outside the BP should be coordinated with the MAGTF headquarters and that electronic surveillance equipment should be positioned away from the BP in case the enemy vectors in on their signals. Mechanized units are ideal for conducting counter-reconnaissance work due to their mobility and firepower.

The deception plan should include the use of dummy positions within each BP, the use of fake headquarters elements to reinforce fake positions, dummy minefields and obstacles covered by maneuver elements, and poor noise and light discipline. EFVs can be used to highlight a deception BP by having them occupy a terrain feature, set up dummy positions, and then leave at night.

b. Maneuver

The commander may maneuver forces within his assigned BP. If he chooses to maneuver outside the BP, he must notify the MAGTF or higher headquarters and coordinate with other units. BPs are identified by a number. One technique is to assign numbers sequentially for ease of control. When companies are assigned BPs, the battalion BP number is indicated first followed by the company BP number. Platoon BPs are designated alphabetically.

(1) Concentrating Fires. A BP is less restrictive than a strongpoint and requires less preparation. As a method of defense, a BP my be terrain-oriented or threat-oriented and it is an excellent way to concentrate fires in order to:

- Block threat avenues of approach.
- Place fires as the threat approaches.
- Hold terrain deemed critical by the commander.
- Place fires on threat airborne/airmobile LZs.
- Place fires on routes on the defender's flank.
- Support a reverse or counterslope defense.
- Mass fires from different positions.

(2) Levels of Preparation. Because BPs are used to control maneuver, each company is usually assigned more than one BP to allow for greater flexibility. Each position is given a task or level of preparation related to the mission to be accomplished. Levels of preparation include:

- Occupy. This is complete preparation and occupation of the BP. EFV unit leaders need to coordinate with engineer units if it is necessary to dig-in EFVs, due to the length of time involved in the preparation of primary, supplementary and alternate positions.
- Prepare. This is complete preparation of the position with occupation of a small security force. The main force will occupy the position after departing their initial position.
- Reconnaissance. This position is reconnoitered for occupation with each element given a designated position and direct fire instructions; however, the position is not physically prepared for occupation. The unit quartering parties are ideal for this task. EFV units must be represented in the quartering parties in order to assist the infantry in finding appropriate positions.

Example. "Team Mech, occupy BP31, prepare BP33, and recon BP35".

(3) Tasks. To properly prepare BPs for defense the following tasks should be accomplished:

- Post security (may call for turret/silent watch for EFVs).
- Plan and develop fire control measures (sectors, TRP orientations, and EAs). EFV unit leaders ensure that range cards are made and then integrated with the unit fire plan.

- Designate alternate positions (ensure ability to engage the primary avenue of approach).
- Designate supplementary positions (ensure the ability to engage a secondary avenue of approach).
- Designate hide positions (may be dug-in if needed; making sure that resources and time are available).
- Dig primary fighting positions for anticipated fighting condition (day, night, limited visibility; again, due to limited engineer assets, the EFV unit leader must ensure the necessity of having EFVs dug-in before assets are allocated).
- Achieve mutual support/concentration of fires.
- Emplace obstacles.
- Clear fields of fire.
- Establish coordination or contact points.
- Emplace wire for communications (gun loop for EFVs to be used if the position will be occupied for more than 30 minutes).
- Pre-stock or dig-in ammunition and other supplies (ensure that batteries are recharged, fuel is topped off, and ammunition is replenished).
- Designates OP/LPs and patrol routes (if EFVs are used for patrols, the unit commander must ensure that he is aware of the obstacle plan).
- Mark and prepare routes (if possible, alternate routes should be planned again in coordination with the engineers).
- Rehearse movement back to and into the position (EFVs must practice getting to their firing positions during all visibility conditions with or without ground guides).
- Use backbriefs to ensure mission intent is understood.
- Install chemical agent detectors; prepare for the appropriate mission oriented protective posture (MOPP) level.
- Install intrusion-sensing devices (make sure they are not activated by EFVs or other friendly vehicles).
- Install camouflage and take appropriate concealment actions (continuous).

(4) Considerations for Employment. The MTF is not restricted to the boundary of the BP but will coordinate with higher headquarters to place elements of the force outside the position. Some considerations for employment are:

- Security force and scouts to screen forward of the position (the use of EFVs as security for this force must be weighed against the mobility of the remainder of the force)
- Scouts or infantry to occupy contact or coordination points
- Combat train placement
- Mortar placement
- Infantry patrol routes
- OP/LP placement
- Night and limited visibility fighting positions when required
- Anti-armor ambushes (must be tied in with the obstacle plan)
- Maneuver to enhance combat power at the decisive point
- Re-supply routes (alternate routes are a must)

- Space for all elements of the task force
- Space for hide, supplementary, and alternate positions (when considering these positions, the ability of the EFVs MK 46 Weapons Station to engage the enemy must be foremost in the mind of the EFV unit leader)
- Fire control measures to define areas that need to be covered

c. EFVs in a BP. The following are methods of employing EFVs with infantry in defending BPs. These are guidelines that can be used as a foundation from which to build your own mechanized team or force's SOPs. There are three ways infantry defending with EFVs can be deployed:

- Infantry mounted
- Infantry and EFVs on the same battle position
- Infantry and EFVs on separate battle positions

(1) Infantry Mounted. This method may be used when the BP is only temporarily occupied and the unit may have to relocate quickly. This technique simplifies the control and coordination between the infantry commander and his supporting EFVs and improves the unit's ability to react and move quickly. It is normally employed when:

- adequate firepower can be employed from the EFVs
- increased local security or observation is not needed
- the unit may have to move on such short notice that having dismounted men would not allow the unit to move quickly enough

The major disadvantage of this method is that the unit has less firepower than it would if infantry was dismounted.

(2) Infantry and EFVs on the Same BP. When the infantry and EFV unit deploys on the same battle position, there are two ways to control EFVs:

- Decentralized Control. In this method, some or all of the infantry dismount under control of their platoon commanders, who also retain control of their respective EFV sections. The platoon commander gives orders to the EFV section leaders, who instruct their respective EFV crews. Use this method when the infantry cannot stay mounted but must temporarily occupy a battle position and be ready to quickly relocate.
- Centralized Control. This method is used when the mechanized company must occupy a battle position and be prepared to repel an attack. The infantry dismounts and is positioned a distance from the EFV platoon. The infantry company commander controls his EFVs through the EFV platoon commander. This deployment is effective when the company battle position has multiple avenues of approach with both long and short range fields of fire. It enables each EFV and infantry element to be positioned on terrain suited to its own capabilities. This usually allows a more determined defense of the ground than the first method.

The infantry is usually positioned in close terrain that limits vehicle movement and firing positions. EFV sections take up positions on terrain which offers good movement and firing positions with long fields of fire (1500-2000 meters). EFVs may be positioned forward, flanking, or behind the infantry.

The positions of the units must allow the infantry to quickly remount. To do this, the EFV platoon commander will plan assembly areas where the EFV sections will rejoin the infantry platoons. He will designate routes that allow covered, but rapid, movement to assembly areas.

EFV units will normally support infantry with fires from their 30mm MK44 gun and M240 machineguns. The EFVs can be a considerable distance away from the infantry, as long as they can support by fire and rapidly rejoin the infantry by covered and concealed routes. EFVs are positioned as required to provide the most accurate fire on the enemy. For example, they may first be forward of the infantry and engage the approaching enemy from that point. Then, as the enemy closes, they move to alternate positions to better support.

Based on the infantry company commander's orders, the EFV platoon commander assigns the EFV sections positions and sectors of fire. Time permitting, he also chooses supplementary positions. When available covered positions are inadequate or when multiple avenues of approach exist, the EFV platoon leader may keep his EFVs centralized in platoon or section hide positions, which speeds movement to firing positions. This simplifies control and allows quick massing of fires on whichever avenue of approach the enemy uses. There can be a separate hide position for each EFV or one large position (still with good dispersion between vehicles) for the entire unit. To use a hide position, an observer remains forward to watch the enemy avenue of approach. EFVs are positioned to the rear, in a covered and concealed position. When the observer sees a target in range, he calls the EFVs forward to engage the enemy from prepared firing positions.

(3) Infantry and EFVs on Separate BPs. This deployment is used when the supported infantry commander needs dismounted infantry in one location and their EFVs in another. In this case the EFV platoon commander will control fires and maneuver as required by the company commander. EFV and infantry units may be separated if the infantry is ordered to occupy positions in heavily wooded or rugged terrain where EFVs cannot go. At this time the EFV unit is located in a concealed assembly area near the infantry or is assigned a battle position on more suitable terrain.

d. EFVs in the Mobile Reserve. While most units assigned to defend from BPs have similar mobility, in some cases, task organized units may not all be mounted in EFVs. Some may have been trucked while others lifted by helicopters or MV-22s. In this case, the commander should utilize EFVs in the mobile reserve role in order to maximize their inherent mobility and firepower.

e. Counterattack Planning. Counterattack planning for defense of a BP is similar to that of defending a sector. Both counterattack by fire and counterattack by fire and maneuver need to be considered and rehearsed. Control measures for maneuver and fire control are important in ensuring that the counterattack force does not overrun its fire support and that it does not become the victim of friendly fires. Mechanized forces should be used for counterattacks due to their inherent mobility.

Ideally, the counterattack force is not committed until the commander is certain that the enemy's second-echelon forces have been slowed or stopped by deep fires and/or obstacles. This will ensure that the force does not get trapped between two enemy forces. Also, obstacles should be used to reduce the enemy’s ability to maneuver against the counterattack force.

The counterattack force should have several BPs selected and prepared in case it has to fall back in light of extremely heavy enemy attacks. This will ensure that the force does not get attrited before it can be committed to a counterattack. If the counterattack force is pinned down in its BP, the MTF commander may have to assign this mission to another force not otherwise engaged.

The fire support plan must ensure that the enemy does not discover the actual BP until it is in the EA. It must support the deception and obstacle plan. Fixed wing and rotary wing CAS, along with EFVs and LAV mounted mortars, are ideal for supporting MTF scouts forward of the BP. Once they withdraw, artillery or NSFS can be used to confuse the enemy about actual defensive positions. Ideally, the enemy will attack dummy positions while presenting a flank or rear target to the defenders. Mortar priority targets should be established along dismounted avenues of approach. The EFVs primary and secondary weapons systems can be used to supplement mortar fire. Final Protective Fires (FPFs) must also be planned for key company team BPs.

Fire support during movement to alternate BPs and during a counterattack must be rehearsed in order to minimize friendly fire and synchronize other parts of the plan. MAGTFs should use their aviation support to ensure that the enemy does not maintain contact with a displacing company team or hit a counterattack force in an unprotected flank.

f. Mobility, Countermobility, and Survivability

The considerations for engineer support are similar to those considered in the defend in sector mission previously discussed. Emphasis should be placed on emplacing disrupting obstacles in such a manner as to direct the enemy force into an established EA. Mobility along counterattack routes must be improved and reaction forces must be planned for. Survivability positions for individual vehicles within the BPs must be prioritized. Once the primary positions have been prepared, secondary and tertiary positions can also be prepared. Because the BP may be occupied for a long period of time, considerable engineer assets may be needed to dig-in and fortify MTF assets including EFVs. The EFV unit leader must weigh factors such as cover and concealment, mobility, ability to get infantry in and out of vehicles, ability to engage targets, and ability to maintain his vehicles if they are to be dug-in.

g. Aviation

Aviation assets will usually support the defense of a BP. Both manned and unmanned systems can be used in identifying and verifying enemy actions. They can also be used to destroy threat reconnaissance assets and slow down follow-on echelons. When the enemy is trapped in an EA, the commander must ensure that rotary wing and fixed wing assets are part of the FS and direct fire plan to engage the enemy.

Air defense concerns are much like those of defense of a sector but are further complicated by the unit's relatively fixed positions. The MAGTF's air defense system must be fully understood by the MTF in order to minimize confusion, prevent friendly fire, and destroy enemy aviation before it can attack the defenders. Avengers and man portable Stingers must be protected from enemy ground forces while MTF direct fire weapons must be integrated into the air defense plan. The use of EFVs to transport Stinger teams as well as mass firing of EFV weapons systems against low flying enemy aircraft must be considered and weighed against the possibility of detection and attack by the enemy.

h. Combat Service Support

Pre-stocked ammunition and other classes of supply and use these before calling for emergency resupply in order to minimize movement and possible detection within the BP. Combat trains must be positioned away from easily targeted locations if possible and must have "push" packages or contact teams to conduct emergency re-supply or repair as far forward as possible. Casualties must be treated as quickly as possible. Aviation assets are a key element of the medical evacuation system. If EFVs are assigned to support CSS units, they may be used to carry selected personnel and small pre-packaged ammunition and other supplies.

While in a BP, EFV units should make use of all available time to refuel, recharge batteries, and conduct crew maintenance on their vehicles. Coordination with CSS units is essential to ensure proper support.

i. Command and Control

The MTF commander must ensure that all his units know his intent and how he plans to destroy the enemy. An enemy limit of advance must be designated. Since flexibility is the key to dynamic defense, this limit of advance should be the only control measure that restricts the subordinate commanders' initiative. The proper selection of a tactical command post for the operation is essential in order for the commander to observe the action without drawing undue attention to himself. The plan must be adjusted accordingly and the commander must be able to control and distribute the direct and indirect fires of his force. The EFV(C) has superb communications systems, which lend themselves for use as a mobile tactical command post for the commander. The EFV unit leader must ensure that he knows this vehicle's full capabilities and limitations in order to better advise the infantry commander.

For the EFV unit leader, command and control of his personnel and vehicles will depend on the tactical situation and on his relationship with the supported infantry commander. He should make recommendations on the employment of his vehicles in a BP and ensure that communications security measures such as radio silence, "short counts", and the use of wire are used to the extent possible.

2307. Position Defense: Defend a Strongpoint

MAGTFs may be given a mission to defend a strongpoint when terrain retention is required to stop or redirect enemy formations. Strongpoints are positioned adjacent to restrictive terrain or other defensive positions.

a. Intelligence
Since the defense of a strongpoint is key to winning the battle, the S-2 must analyze the terrain and conduct his IPB in the most detailed manner. It has to be defensible in 360 degrees and the terrain analysis must take into account the full spectrum of enemy offensive capabilities from infiltration to a major attack. Some considerations in the initial intelligence planning include:

- Ability of reconnaissance assets to provide early warning.
- Ability of reconnaissance assets to sustain themselves if the strongpoint is surrounded.
- Ability of reconnaissance assets to get in and out of the strongpoint without being detected.
- Ability of reconnaissance assets to conduct a "stay behind" mission in support of the defensive plan.
- Use of UAVs, GSRs, and other intrusion detection devices in the R&S Plan.
- Ability to execute the R&S Plan if OP/LPs outside the strongpoint are compromised.

Throughout the preparation and conduct phase of the defense, the S-2 must ensure that the commander is thoroughly briefed of the enemy's possible actions as well as the unit's own vulnerabilities. As discussed in previous sections, EFVs may be used to give mobility to forces involved in the R&S plan.

b. Maneuver
Defending a strongpoint is the most labor-intensive operation a MTF may execute. While it is static, there has to be built-in flexibility through the use of direct and indirect fire plans and properly constructed positions.

Site selection for all the MTF's elements is the first priority so that weapons systems can engage the enemy at the most likely avenues of approach. Construction of the EA and fire control measures are similar to other defense missions but without the depth of fires one finds in the other missions. Positioning of EFVs and infantry follow the same precepts previously discussed. If infantry is positioned in front of EFVs, the EFV unit leader must ensure that they have a safe route back to the EFVs, while ensuring that they do not enter his weapons system's field of fire.

Once suitable locations are defined, company/team BPs are selected. Some considerations when selecting company BPs within a strongpoint are:

- How much firepower is needed to cover a particular avenue of approach?
- How responsive is the position to threats from another direction?
- What is the best task organization for the company teams?
- Where will EFVs be best utilized within the strongpoint?
- What type of weapon is needed to cover an avenue of approach?

In a strongpoint defense, a reserve must be designated in order to conduct the following missions:

- Block a threat penetration against the perimeter.
- Reinforce success or a section of the defense.
- Counterattack to restore a portion of the defense.

(1) Reserve. The reserve could be either mounted, dismounted, or both. It could be formed from CS and CSS units if all infantry and armor units are employed. Ideally, it should be near the CP in order to provide protection and minimize delays in its employment by the commander. EFVs and other combat vehicles should be used in this role to give the commander flexibility, mobility, and firepower.

(2) Concept of the Defense. A MTF must be able to transition from being part of a defense in sector as part of a MAGTF defense plan to being isolated and defending a strongpoint. If the position is important enough to warrant adequate preparations, then it is probably important to the enemy as well. Massive artillery preparation followed by a ground attack must be anticipated. The commander must ensure that alternate and supplementary positions are established along with primary positions within the strongpoint. This will enable the force to give way to a relentless enemy assault, regroup, and counterattack. Every member of the force must have a fighting position that supports the commander's intent and all CS and CSS personnel are expected to contribute to the defense. Within the strongpoint, there will be positions that will be more fortified than others; these should become the springboards for offensive operations within the strongpoint. Occupation, evacuation, and counterattacks from these positions should be planned and rehearsed if possible. Terrain should be used to ensure optimum shots for direct fire weapons systems, including the EFVs 30mm; dead space and infiltration routes must be minimized or made inaccessible.

When conditions permit, mobile assets like EFV mounted infantry may remain outside the perimeter to provide early warning, delay or confuse the enemy. Once these units are inside the strongpoint, their mission becomes holding it against the enemy. Interlocking direct fires must be planned over the entire position along with counterattack by fire positions and external direct-fire control measures.

(3) Preparation. The MTF commander will prepare for the battle by rehearsing the direct fire plan. He will then get the enemy's perspective on his positions from both mounted and dismounted avenues of approach to ensure that his positions have the proper cover and concealment. The actions of the reserve, CS, and CSS units must also be rehearsed.

(4) Execution. This section discusses actions if the enemy engages the strongpoint. As mentioned before, the enemy will probably not want the position unless it is key terrain. If it is, he will throw overwhelming forces against the strongpoint. Preceding a ground attack may be a massive artillery preparation that will destroy or damage anything that is not protected. This will be accompanied by enemy units maneuvering toward the position. It is at this point that stay behind reconnaissance units can call for fires to disrupt the enemy's formations. Aviation assets, NSFS, and artillery should be used to prevent the enemy from reaching the position.

As the enemy nears the position, direct fires will engage him in accordance with the FS and obstacle plan. If the enemy is not stopped at the main EA, the commander must be able to direct fires against an enemy penetration. If the enemy manages to make a penetration, forces will have to seal off and isolate this penetration. If this can be done by repositioning of forces to supplementary positions near the penetration, it will save the unit's reserve for other tasks.

If the enemy manages to weaken significant portions of the perimeter, those positions may have to be evacuated and forces repositioned to secondary positions. It may be at this point that the reserve is called upon to conduct a counterattack as the enemy has overextended his forces and has not been able to consolidate his gains. At this point EFVs may be used with or without infantry in the counterattack role. CS and CSS units could also be used as provisional rifle platoons or squads embarked aboard the EFVs.

The last option for the MTF if the enemy continues to make progress is to call fire on his own defensive positions in an effort to stem the enemy's advance. If this is not successful, the MAGTF Commander will have to attempt a rescue of the strongpoint or have the MTF attempt a breakout.

(5) Counterattack. The reserve is usually tasked with conducting the counterattack in a strongpoint defense. It must be able to move out of its own mini-strongpoint where it has been protected from direct and indirect fires to covered and/or concealed routes to the point of enemy penetration. Ideally, the force should hit the enemy at a flank, isolate the penetration force, and seal the gap in the position. This action should be rehearsed and synchronized with the FS and obstacle plan over the main enemy avenue of approach in order to account for the most probable penetration points.

c. Fire Support

The fire support plan must be oriented on terrain features that may be occupied by the enemy. Key terrain, mounted and dismounted avenues of approach, and infiltration routes should be targeted. The MTF's deep fires must be aimed at limiting the number of enemy at the strongpoint while close fires aim to destroy the enemy before he can make a penetration. The fire support plan is closely tied to the obstacle plan and like other portions of the commander's overall plan, it should be rehearsed if possible. The EFVs primary weapon system provides the commander with a highly accurate and lethal means to employ (day or night) in this situation.

Should the enemy make a penetration, the plan must take into account evacuation, counterattack by fire, or having fires on their own positions. Fire on your own position, especially if delivered by aviation, must only be considered if the fortifications are prepared to the appropriate level of protection.

Once the attack begins, fires will either stop the enemy before he reaches the position, blunt an enemy penetration, or assist in the evacuation to secondary positions. As a last resort, it should be fired on friendly positions to clear the enemy and/or make way for a counterattack.

Throughout this evolution, fires must be maintained in depth in order to disrupt or stop second echelon enemy forces from reaching the position.

d. Mobility, Countermobility, and Survivability
Strongpoints should be picked so they are far enough from the enemy to allow the MTF time to develop the position and avoid detection. The engineer commander should accompany the MTF commander in the reconnaissance of the area and prepare the position with the following considerations:

- Make the position physically impassable to armor.
- Use fires and obstacles to slow, disrupt, or turn the enemy.
- Maximize anti-armor weapons capability using obstacles.

Based on the commander's guidance, the engineer commander determines the priority of work and allocates his assets to best support his concept. Strongpoints are built from the inside out. The following are essential tasks in building positions in a strongpoint:

- Prepare obstacles to prevent being overrun by tanks.
- Prepare hull-down positions for armor assets.
- Emplace obstacles at optimum weapons range.
- Construct protected routes between positions.
- Plan and coordinate for scatterable mines.
- Assist in building infantry fighting positions and CPs.
- Prepare and booby trap dummy positions.
- Prepare disabled vehicles for destruction.

While heavy engineer assets concentrate on performing the above, infantry as well as CS and CSS assets prepare fighting positions, shelters, and close-in obstacles. One way to enhance the protection of EFVs is to use sandbags around, on top, and on the sides of the EFV position.

The obstacle and fortification system that is built within the position needs to be integrated with the direct and indirect fire plans of the force. Obstacles that could stop mounted and dismounted forces covered by enfilade fire are most effective.

Should a rescue attempt be made of the remnants of the MTF in the strongpoint or a breakout attempted, the remaining engineers would be a key asset to ensure that mobility routes in or out of the position exist.

e. Aviation
Aviation support for defending a strongpoint will be similar to the other types of defense. Deep fires will be conducted by fixed wing aviation while the close battle will be supported by both fixed and rotary wing CAS. Assault support may be a key element in preparing the position as it can be used to haul engineer supplies from distant areas to the strongpoint. Reconnaissance by UAVs and manned aircraft will be important assets for the commander as he attempts to gauge the enemy's intentions and disposition.

Air defense assets will have to work closely with the engineers in order to construct positions for Stingers and Avengers that could survive an intense artillery preparation and give them the best shots against enemy aviation. Like other elements of the force, the air defense commander needs to rehearse his actions and be prepared to fight against enemy penetration. EFVs should be a key part of the air defense plan due to their ability to place a high volume of accurate fire on a given target.

f. Combat Service Support

The CSS Plan for the strongpoint defense must be integrated with the overall plan to ensure that engineer actions, fire support plans, and maneuver within the position is supportable. This may involve pre-positioning stockpiles of all classes of supplies within company/team positions and developing a plan that would support the unit in case of the loss of one or more of these caches of supply. A CSS traffic control plan will have to be developed to ensure that supplies and personnel get to the perimeter and casualties make their way to the aid station. EFVs in the logistics role may be key assets in providing CSS in a large strongpoint because of their ability to travel rough terrain.

A refueling plan must be developed for the MTF's vehicles and equipment. Because of the nature of the position, it may be necessary to carry out refueling using 5gallon cans or fuel bladders.

The most important aspect of the CSS operation is to ensure that combat trains stay abreast of the needs of the units. Use of pre-positioned stocks, movement within the perimeter, re-supply via air, and use of captured enemy stocks are all facets of the CSS plan to effectively sustain the force.

g. Command and Control

The strongpoint defense has the smallest margin for error and the greatest price to pay. The commander must fight surrounded and have the confidence in his plan and his forces to hold until relieved by other forces. He must ensure that communications are redundant, secure, and survivable. He must have a tactical command echelon where he or his next in command can fight the battle if the main command echelon is destroyed. Finally, he must have the mobility to move about the battlefield to immediately influence the battle. The use of the EFV(C) will be a key asset to accomplishing this.

EFV unit leaders will exercise command and control over their personnel and equipment in the same manner as they did in defending from a BP. Again, the communications security measures such as use of wire, radio silence, and “short counts” should be used to decrease the enemy’s ability to detect friendly forces and intentions.

2308. Retrograde Operations

A retrograde operation is a movement to the rear or away from the enemy. A retrograde may be planned or it may be forced by enemy action. Retrogrades may be classified as delay, withdrawal, or retirement.

a. Delay

A delay operation trades space for time while avoiding decisive engagement. It incorporates all the dynamics of defense but emphasizes force preservation and mobility over the enemy. It is conducted:

- When the force's strength is insufficient to defend or attack.
- To reduce the enemy's offensive capability.
- To gain time by forcing the enemy to deploy.
- To determine the enemy's main effort.
- When the enemy's intent is not clear or the commander wants intelligence.
- To protect the force and provide early warning.
- To allow time to reestablish the defense.

(1) Intelligence. The S-2 prepares for the delay like other defensive operations but with more emphasis on the relationship between terrain and enemy avenues of approach. The delaying force will likely fight a numerically superior enemy on a wide front.

The IPB will assist the commander in determining the best locations to force the enemy to deploy from his movement formations, where the commander should focus his R&S efforts, and an idea of the enemy's possible courses of actions. The R&S effort should emphasize getting early warning to the force in order to validate the IPB templates. As the enemy approaches the sector, R&S forces should execute their portion of the FS and Counter-reconnaissance Plan by calling indirect fire on the enemy and destroying his reconnaissance assets. Laser guidance of munitions for artillery, NSFS, and aviation are just one way the R&S assets can be used to delay the enemy. Once the enemy's first echelon approaches the sector, these assets should be withdrawn and displaced to a flank where they can continue to screen the force.

(2) Maneuver. There are two kinds of delay missions: delay from successive positions and delay from alternate positions. Delay from successive positions is used when delaying in less threatened areas and the defender has greater mobility than the enemy. Units delay continuously on and between BPs throughout their sector, fighting rearward from one position to the next, holding each position for as long as possible or for a specified amount of time. Delay from alternate positions is a technique in which a unit delays in sector with subordinate units deployed in depth. As the forward unit delays, another unit occupies the next position and prepares to assume the fight. The forward unit disengages and passes through the rearward position and prepares a subsequent position in depth after handing over the battle. It is used when the sector has a narrow front, when the terrain restricts the enemy or when the delaying force has less mobility than the attacker.

After the screen has been withdrawn and the enemy reaches the unit's sector, direct and indirect fires should be directed against the enemy in accordance with the plan. EFV unit leaders and individual vehicle commanders must be aware how long they are expected to stay in their BP since the enemy will likely react with artillery preparation. Fires should be massed to cover the withdrawal of a unit to a subsequent position.

Because delays are designed to get the most firepower up front against the enemy, the MTF reserve may be smaller than normally assigned. If the MTF is a battalion task force, two platoons vice a company team may be used as the reserve.

If the unit is in danger of becoming decisively engaged, a counterattack may be conducted to destroy enemy units that have maintained contact. This should be directed to the enemy's flank or rear. After inflicting severe damage, the force can then disengage and move to their subsequent position.

The delay should be planned to end in another operation such as a counterattack. The MTF will establish final defensive positions at the rear of the sector and this should ideally be a blocking position for a counterattack on the enemy's flank.

(3) Fire Support. Developed concurrently with the maneuver and obstacle plan, the fire support plan is similar to other defend mission fire support plans. The main difference is that fires are primarily used to buy time for the delaying force vice destroying the enemy at an EA. Smoke and scatterable mines are useful tools for the commander as he deploys to his next position.

Mortar teams may be mounted in EFVs to enhance their mobility. This may require split section operations.

During rehearsal, the fire support plan should be exercised. Actions on the EA and upon disengagement by direct and indirect fire assets, as well as aviation units should be checked to ensure synchronization. Fires on BPs should be planned to discourage aggressive pursuit by the enemy.

Upon the enemy's engagement by R&S assets, artillery will be used to destroy reconnaissance assets. Then it will be used to destroy enemy cohesion and slow his advance as he encounters the obstacle belt. If the enemy reaches withdrawal lines, artillery will be fired to give the withdrawing units time to break contact from the enemy. An FPF will be fired if the enemy manages to maintain contact.

(4) Mobility, Countermobility and Survivability. Obstacles placed in a sector where the force has been assigned a delay position have several uses; one is force the enemy to deploy repeatedly as it maneuvers through the sector, another is to close routes of egress, and still another is to prevent the enemy from closing in on the force. Siting as well as the ability to be engaged by indirect and direct fires are the components of an effective obstacle. Additionally, demolitions should be prepared for use upon withdrawal of a force from a BP. It can be used to deny the use of a particular avenue of approach or force him to expend effort in improving it.

To ensure mobility of the force, routes to subsequent positions must be obstacle free and able to handle the traffic the MTF will push through that route. The engineers assigned to the force must also have the ability to deal with enemy emplaced minefields and obstacles on those egress routes.

Survivability must be incorporated into each BP. The ability of the force to maintain its strength is tied directly to its mobility and how well positions are fortified. The commander will designate the level of preparation for each BP but each one will be prepared to the same standard as primary BPs as time allows.

(5) Aviation. Since the delay force will probably not be the main effort, what aviation assets that the force gets must be completely integrated into the maneuver, obstacle, FS, and logistics plan. Fixed wing CAS sorties are ideal complements to obstacles, which slow the enemy or aid the force in disengagement. Rotary wing CAS could be used for the same purpose or held back to strike at the enemy flank as he tries to negotiate an obstacle. Manned and unmanned reconnaissance assets will assist the commander in determining the enemy's likely avenues of approach.

(6) Combat Service Support. CSS will be accomplished in the same manner as defend in sector missions. Since the commander will know when he expects his forces to move to their subsequent positions, planning for re-supply is simplified. However, because things seldom go as planned, the logisticians must have inherent flexibility in their plan. As noted above, the use of aviation assets for emergency re-supply should be planned.

Pre-stocked supplies located in subsequent BPs may be used to assist in the CSS effort. The CSS units must also have the same mobility as the other units in the force in order for them to keep up. Use of alternating positions for aid stations and other CSS facilities should be planned and utilized during the delay. If EFVs are in support of CSS units, they should be utilized to maximize the mobility of these units and enhance their overall ability to support the force.

(7) Command and Control. Since the commander must trade time for space while preserving his force, his selection of times by which the force must delay forward of specified lines is crucial. Additionally, he must ensure coordination between adjacent units in order to minimize confusion and friendly fires. The graphic control measures he picks as well as accurate reporting take on additional meaning in this decentralized battlefield. During the rehearsals, the commander must exercise not only his subordinate maneuver units but his reserve as well.

In the conduct of the delay, the MTF commander must be where he can best observe and assist his subordinate unit commanders. Since the unit may have a wide frontage, the use of the XO or S-3 in the main command echelon to watch another sector may be necessary. The commander must ensure the freedom of his unit to maneuver in order to prevent decisive engagement with the enemy. The EFV(C) is ideal for use by the commander in a delay.

b. Withdrawal

A withdrawal is a planned operation in which a force in contact disengages from the enemy. The commander wants to put distance between his force and the enemy as quickly as possible and without the enemy's knowledge. A withdrawal is undertaken:

- If the objective of the operation cannot be achieved and the force is in danger of being destroyed.
- To avoid battle under unfavorable conditions.
- To draw the enemy into an engagement area.
- To allow for use of the force or parts of it elsewhere.

There are two types of withdrawal; a withdrawal under pressure and a withdrawal not under pressure.

(1) Intelligence. The intelligence officer will plan the withdrawal similarly to a delay. He needs to determine whether or not the enemy has the ability to maintain contact and put pressure on the force. He should have a detailed IPB with the situation and event templates as well as the most likely enemy course of action. The R&S plan should concentrate on verifying enemy courses of action and ensuring the MTF receives the earliest indication of enemy activity. As the main body moves to the rear, the detachment left in contact (DLIC) or rear guard will remain in place, maintain contact with the enemy, and be prepared to delay the enemy using all available assets. They then disengage and rejoin the remainder of the task force.

(2) Maneuver. The MTF will normally conduct an unassisted withdrawal when it is not under enemy pressure. If the enemy maintains contact and the MTF has to conduct a withdrawal under pressure, the MAGTF could send a covering force to assist in this operation. Reinforced LAV units are typically used in this role. If the MAGTF commander cannot spare a covering force, the task force may have to designate one of its units as the DLIC. Generally a company team reinforced with mortars, scouts, and supported by fixed and rotary wing CAS would comprise the DLIC. Another method is to use a reinforced platoon from each company team to form the DLIC. Whenever possible, withdrawal under enemy pressure should be conducted under limited visibility conditions. The DLIC remains in position deceiving the enemy while the remainder of the force withdraws. If necessary, the DLIC must be prepared to conduct delay operations in order to provide security to the rest of the force.

The withdrawal should be rehearsed in order to work out coordination, command, and control problems. It should include the actions of the DLIC and since most withdrawals include a rearward passage of lines, a representative from the stationary force should be there to work out recognition signals and actions at different phase lines.

Once the withdrawal begins, the main body will displace along designated routes while the DLIC remains in place to provide security. As the company teams approach each contact point, guides from the stationary force should meet them and guide them through passage lanes to the rear of the stationary force.

The OIC of the DLIC will continually assess the effectiveness of the MTF deception and determine if a delay is required. If the enemy does not detect the withdrawal, a gradual withdrawal of the DLIC should be done using stealth if possible and using fire support assets if necessary. If the enemy detects the withdrawal, the DLIC must delay and conduct battle hand-over and rearward passage of lines.

(3) Fire Support. The fire support plan must take advantage of natural and man made obstacles within the sector in order to give the force a mobility advantage over the enemy who may want to pursue. Choke points, EAs, and identified enemy vulnerabilities (C2, supply dumps, etc.) should be targeted. FPF and smoke screens must be planned to keep the force obscured and separate from the enemy. Mortar teams mounted in EFVs are one way that the MTF commander can use organic assets to support the fire support plan.

During the rehearsal of the withdrawal, the fire support plan must be exercised in order to ensure that all agencies involved are aware of their mission. If possible and if it does not give away the withdrawal, fires against choke points and EAs should be rehearsed. During the conduct of the withdrawal, fire support could be used in the deception role, masking the movement of the force while suppressing the enemy. If the enemy chooses to attack, then the fire support plan is executed in support of the delay by the DLIC. Fires should be used to minimize the DLIC's vulnerability, force the enemy to deploy, and delay his pursuit of the main body.

(4) Mobility, Countermobility, and Survivability. Unless the enemy is not in contact, there will be little opportunity to construct obstacles forward of the main defensive line. Planning for obstacles will then be directed to slowing the enemy while ensuring the main body has a mobility advantage over the enemy. Since the bulk of the unit's support assets are moved to the rear in preparation for a withdrawal, the availability of engineer supplies may be limited. As in any other obstacle plan, it must be tied in to the fire support and maneuver plan.

The mobility plan should be carefully reviewed during the rehearsal. Mobility assets (bulldozers and retrievers) should be placed near choke points to prevent congestion and to make alternate routes if needed. Engineer detachments should be readily available to clear enemy or friendly minefields. Countermobility operations should be rehearsed so demolitions are not conducted while part of the force is still on the far side of an obstacle. Engineers will ensure that the force can travel on their assigned routes even if they are damaged by enemy action. If the primary routes are blocked alternates will be used. The obstacle plan will be used in conjunction with the fire support plan and direct fires. Reserve demolitions and FASCAM will be used to further slow the enemy.

(5) Aviation. Air support for withdrawals must ensure the following: protection of the main body as it withdraws, support for the DLIC, and protection of the force as it moves. Aviation assets must be thoroughly integrated into the FS plan, the obstacle plan, the CSS plan, and the maneuver plan in order to take advantage of its capabilities. Air defense units will provide security throughout the depth of the sector and be prepared to move to alternate positions if primary withdrawal routes are damaged or destroyed.

(6) Combat Service Support. CSS of the withdrawal is concerned with four areas: support of the main body, support of the DLIC, support of the road movement to the assembly area, and support of the force upon reaching the assembly area. Because most of the CSS assets should be moved to the rear prior to withdrawal, the S-4 must apportion his units to best support the different elements. The most significant concern is support for the DLIC. Because of its possible delay mission, it must have ammunition, medical support, fuel, and maintenance support on hand or nearby at all times. Pre-stocking may work in some cases but moving dumps are preferred in order to save the supplies vice destroying them. The main body will require mobility support as well as emergency services such as refueling, towing, and maintenance. If EFVs are used in support of CSS units, they will play a critical role in supporting the DLIC.

During the withdrawal, CSS units must ensure that the DLIC has all the support it needs to delay the enemy. Casualties be evaluated, stabilized, and evacuated to the rear expeditiously. Here, helicopters and EFVs in MEDEVAC and emergency resupply roles can greatly enhance CSS support. Damaged vehicles which cannot be repaired are evacuated and then destroyed so as not to clog the withdrawal routes. EFV unit leaders must ensure that all communications material security (CMS) items are removed from EFVs prior to destruction. If this is not feasible, they should use all means to destroy CMS materials to prevent capture by the enemy. When the main body is at the assembly area, the CSS element turns its attention to getting the force ready for its next mission. EFV units must use this time to conduct crew maintenance, identify vehicles that need additional maintenance or repair, and perform re-supply functions in preparation for the next mission.

(7) Command and Control. In a withdrawal, the commander moves with the main body. The XO or the S-3 will take charge of the DLIC with a portion of the MTF staff to assist him. Because the force needs to be ready for the next mission, the commander must orient himself to the main body. During rehearsals, the commander ensures that all subordinate commanders know their missions, refines the FS plan, and makes liaison with the stationary force commander in preparation for a rearward passage of lines. He then finds the position where he can best control the main body and then coordinates with the OIC of the DLIC to minimize confusion during the withdrawal. When the withdrawal begins, the commander must ensure that he can monitor the progress of both the main body and the DLIC. If the DLIC encounters difficulty accomplishing its mission, he must have the ability to reinforce it.

c. Retirement

A retirement is an operation in which a force not in contact moves away from the enemy. A retiring unit is normally protected by another unit between it and the enemy. However, the retiring unit must establish security. Often a retirement immediately follows a withdrawal.

(1) Intelligence. The S-2 needs to concentrate on the route the retiring force will use to move. The EFV unit leader can assist him through his knowledge and experience by ensuring that factors that affect the movement of EFVs and other vehicles are considered when the route is chosen.

(2) Maneuver. The MTF will use the appropriate movement technique based on METT-T when it conducts a retirement.

(3) Fire Support. The FS plan should be developed much like that of a movement to contact FS plan. There are no other considerations for retirement that have not been discussed in previous sections.

(4) Mobility, Countermobility, and Survivability. The engineers in the MTF should ensure that minefields in the route are cleared as soon as possible.

(5) Aviation. Aviation assets could be used to conduct route reconnaissance to provide the latest information to the MTF. They could also be used to conduct emergency re-supply if needed.

(6) Combat Service Support. The CSS plan for a retirement is similar to that of a withdrawal with the deletion of CSS for the DLIC. The focus of the CSS plan is to make sure the force gets to its rear assembly area and has the ability to re-supply, refit, and rearm immediately. EFV unit leaders must again coordinate with the CSS personnel to ensure that the proper POL, ammunition, and other classes of supply needed by EFVs are available at the rear assembly area.

(7) Command and Control. Depending on METT-T, command and control for a retirement is similar to a withdrawal and a road march. Special considerations revolve around weather and terrain and the EFV unit leader must advise the MTF commander of the capabilities and limitations of the EFV as in other types of operations.

Chapter 3 Water Operations

This chapter provides the techniques and procedures employed by the EFV unit during amphibious operations that commence from the amphibious task force (ATF) and terminate at a designated location ashore. The tactics, techniques, and procedures specified in Marine Corps Warfighting Publications (MCWP) 3-13, *Employment of Assault Amphibian Vehicles,* and MCWP 3-31.5, *Ship-to-Shore Movement*, unless specifically addressed in this chapter, remain in effect.

Section I. Fundamentals of EFV Water Operations

3101. Types of Amphibious Operations

The EFV allows the Marine Corps to conduct several types of amphibious operations well into the 21st century. As the Marine Corps employs the concept of Expeditionary Maneuver Warfare (EMW), the surface assault elements of the Amphibious Task Force must be capable to conduct operations resembling the historical "conventional" ship-to-shore movement, and the more dynamic, fluid movement associated with the Ship-to-Objective Maneuver (STOM) concept. The tactics, techniques and procedures employed in execution of the ship-to-shore movement will depend upon a variety of factors to include the mission, available equipment, threat, littoral terrain, and weather.

a. Conventional Movement
MCWP 3-13, *Employment of Assault Amphibian Vehicles* and MCWP 3-31.5, *Ship-To-Shore Movement,* provide the amphibious task force (ATF) with the framework and techniques used during conventional, "under-the-horizon" (UTH) amphibious operations employing assault amphibian vehicles and other surface landing craft. Typically, an UTH amphibious operation is characterized by the launching of the surface assault element within visual sight (for the assault amphibian crew) of the coast line and the applicable landing beaches.

During the conventional amphibious operation, the EFV operating in displacement, or "transition," mode will employ techniques and procedures similar to the AAV. The EFVs transition mode includes the capability to employ the vehicle's land drive suspension, and allows the vehicle to operate at speeds of up to 10 knots while waterborne. Consequently, the techniques and procedures described in both MCWP 3-13 and MCWP 3-31.5 are applicable. However, the EFV can be called upon to use its high water speed capability, particularly when initially closing the penetration site or moving parallel to the coastline

b. Over-the-Horizon Movement
Tactical memorandum COMSURFWARDEVGRU 3-02.1-99, *Over-the-Horizon Surface Amphibious Operations*, and MCWP 3-31.5 provide the ATF with the framework and techniques used during over-the-horizon (OTH) amphibious operations employing assault amphibian vehicles and other surface landing craft. When the tactical situation requires, the ATF can execute an OTH, ship-to-shore (STS) movement of the Landing Force. An OTH STS movement

can be employed as part of a STOM operation to achieve tactical surprise, exploit gaps in the threat defenses, afford maximum flexibility in selection and use of penetration sites, or to provide standoff protection to the ATF.

The OTH STS movement is designed to execute a specific, primary landing plan, which can also have branch or sequel plans incorporated. These branch and sequel plans can be initiated for a variety of reasons, but must be included in the overall planning and briefings to insure success. To that end, the assault wave diagram and landing area diagram *(MCWP 3-31.5/NWP 3-02.1, Chapter 3, Figures 3-11 & 3-12, pages 3-17 & 3-18)* must be developed with flexibility in mind. EFV unit leaders must be intimately familiar with both diagrams, which will be used in mission planning, development of primary and alternate routes, and navigation system loading.

As the OTH STS movement involves various types of landing craft moving at both low and high water speed across the littorals, over significant distances, it must be meticulously planned and well briefed down to the assault amphibian/landing craft crew level.

3102. OTH Ship-to-Shore Movement

a. Planning
To the maximum extent possible, prior to executing a high speed, ship-to-shore movement of surface forces, detailed planning will be conducted to accommodate the myriad of factors involved. In the past, tactical level commanders have often been provided with only a minimum of information pertaining to a 1,000 to 5,000 yard boat lane with the landing site generally visible during the entire transit. However, given the desire to use the littorals as maneuver space, special consideration must be given to providing timely, accurate and detailed information to the lowest level commanders who will control and execute this movement. The sea is a continuously changing environment for which subtle variances in weather can have a dramatic effect within the space of a few miles.

To allow safe and effective planning to be accomplished, the EFV unit leader have access to planning factors and information of the littoral area, to include weather zones and sea states, underwater hydrography, off-shore and in-shore currents, natural and man-made obstacles, expected illumination, tidal and surf zone conditions, beach gradients and composition, and beach exit characteristics.

Of specific importance, the EFV unit leader must be provided with the location of the 3 fathom curve. It is at this location that the EFV must configure from water mode to transition mode to complete the remainder of the STS movement. The EFV requires approximately 12 feet of mean water depth to allow for appendage movement during reconfiguration from water mode to transition mode, and vice versa. Given effects of tides and wave action, the 3 fathom curve (18 feet) is that point where reconfiguration will normally be executed, or no later than the surf zone.

b. Maneuver Units

EFV formations use the platoon as its base maneuver unit during OTH STS movements. An EFV platoon maneuvering from ship-to-shore will normally be designated as a single wave. An infantry battalion, embarked aboard an EFV company, could be comprised of several waves. The senior EFV officer or SNCO within each wave is normally designated as the wave guide officer (WGO).

An EFV platoon is normally comprised of twelve EFV(P)s, organized into three sections of three vehicles each, and a Headquarters Section of three vehicles to be employed at the discretion of the EFV Platoon Commander. The EFV platoon commander is responsible for the safe and efficient employment of the platoon as a whole, while the EFV section leader is responsible for the safe and efficient employment of the section within the platoon formation. The EFV vehicle commander is responsible for the safe and efficient employment of the vehicle within the section formation.

The rifle company commander, as the embarked tactical commander, will normally be aboard the same EFV(P) as the EFV platoon commander. The rifle platoon commanders will normally be aboard an EFV section leader's vehicle. The rifle company commander exercises maneuver control of his company through the EFV platoon commander. Particularly during waterborne operations, the rifle company commander will utilize the training and expertise of the EFV platoon commander and EFV section leaders to execute the ship-to-shore movement. The EFV platoon commander is responsible for the efficient and safe execution of the ship-to-shore movement, to include the coordination and implementation of deviations from the original plan among the subordinate EFV sections. The EFV platoon commander will insure that the wave as a whole conforms to the method of control established by the Navy Control Group (NCG), the control measures depicted on the landing area and assault wave diagrams, and the approach schedule.

To facilitate command and control of the wave, the "leader - wingman" concept is employed down to the EFV section level. Dependent upon task organization, within a section of four EFVs, there are two sets of "leader - wingman" groups, with the section leader's "group" being the "leader" of the subordinate group. In a section of three EFVs, there are two "wingmen" guiding off the movements of the leader. This relationship assists in the transition of EFVs from one formation to another, and in the control of the waterborne maneuver as a whole.

For a description of recommended EFV (P) and EFV(C) load configurations for the rifle company and infantry battalion, refer to appendix G.

c. Command & Control of the OTH Ship-to-Shore Movement

Command & control of EFV units during the STS maneuver involves the organization of the littoral area and employment of control techniques. During the OTH STS movement, intelligence information flows to the command element from available sources and influences where control agencies direct the landing force relative to potential littoral penetration sites (LPS). Alternatively, in the case of independent or waypoint control, intelligence information may pass either by voice or digital means directly to landing platforms during movement from advance forces or sensors ashore to alter selection of potential LPSs.

Normally, a primary control officer (PCO), aboard the primary control ship (PCS), and acting under the auspices of the NCG, will exercise control of EFV units within a single LPZ. This relationship is analogous to the conventional amphibious assault, where the PCO typically controls the flow of surface traffic across a colored beach.

Employing the appropriate C2 network, the PCO provides guidance to the surface element waves, based upon the chosen method of control, to enable the execution of the landing plan, or the desired branch or sequel plan.

During the execution of a high speed, OTH STS movement, it is vital that EFV vehicle commanders maintain visual contact within the leader-wingman relationship within assigned waves. This is particularly important during limited visibility operations or operations during periods of EMCON. The employment of the EFVs Navigation Beacon can aid in the requirement to maintain visual contact. The situational awareness of the EFV vehicle commanders can also be aided by the onboard digital display, which may depict the location of other elements of the surface assault. Within the EFV section, each vehicle commander is responsible for the navigation of the vehicle and maintaining the appropriate position relative to the section leader's vehicle. Section leaders are responsible for navigating the section over the appropriate route, and maintaining the section formation and position relative to the EFV platoon. Finally, the EFV platoon commander is responsible for navigating the EFV platoon over the selected route(s), determining the appropriate EFV platoon formation, and insuring that all elements of the EFV platoon adhere to the control measures established by the assault wave diagram throughout the movement to shore. Embarked troop commanders can assist individual vehicle commanders by observing and alerting the VC to obstacles or other hazards en route while in the water.

d. Methods of Control

The EFV OTH STS is characterized by high-speed maneuver commencing beyond visual and radar range of the shoreline, the potential use of one or more penetration points, and varying methods of control during the movement. The method of control employed is dependent upon several factors, including the mission and tactical situation, weather and visibility, volume of surface traffic (both military and civilian) and other hazards to navigation, and the communications capabilities of the controlling platform. Normally, this control function is provided by the PCO, located aboard the PCS. However, the operator performing the control function may be aboard an amphibious ship, another landing craft, or airborne platform.

When required, the EFVs navigation beacon is used throughout the movement and regardless of the method of control. The penetration point may be identified by a beach marker or other initial terminal guidance (ITG) provided by advance forces to ensure maximum accuracy when landing. During assaults involving the breach of minefields and obstacles, the preferred method is to identify the cleared route using a lane marking system.

During the conduct of the OTH STS, the method of control may change dependent upon a variety of factors, to include changes in weather & visibility, the developing tactical situation, and the amount and type of surface traffic. There are four types of control. These are independent control, waypoint control, advisory control, and positive control.

(1) Independent Control The EFV formations, also referred to as waves, shall exercise independent control when amphibious operations are conducted under EMCON conditions. Each EFV crew shall be pre-briefed on the route(s) to be used and, once launched, exercise control of the vehicle and formations of vehicles independently. Employing the EFVs navigation system, the wave can independently move from OTH to an alternate preplanned way point or craft control point (CCP) and alter its routing to the appropriate littoral penetration point (LPP). The WGO (typically the EFV platoon commander or section leader) will insure the unit remains within the prescribed operating area. For OTH assaults using independent control, EFV formations must pass over the designated craft departure point (CDP) as accurately as possible and at the time specified in the approach schedule.

(2) Waypoint Control Under waypoint control, each EFV crew will be pre-briefed on the route(s) to be used and, once launched, conduct an independent ship-to-shore or shore-to-shore maneuver. Employing the EFVs navigation system, the WGO (typically the EFV Platoon Commander or Section Leader) will insure the unit maintains movement along the designated route consisting of a series of preplanned waypoints. At designated waypoints, or CCPs, the embarked tactical commander can instruct the WGO to redirect the formation along another designated route depending on the tactical situation.

(3) Advisory Control Under advisory control, each EFV crew is provided the launch position and a vector to the first CCP. The PCS tracks the wave formation and periodically provides the WGO a current position, required vector to appropriate course, and time, early or late, based on the approach schedule. The WGO modifies course and speed of the wave to regain the planned approach schedule.

(4) Positive control

The amphibious assault direction system (AADS, AN/KSQ-1) or the advanced amphibious assault direction system (AAADS) provides the PCS the means to electronically track and direct waves during the OTH STS. (Depending upon the distance of the OTH STS, a helicopter relay may be employed when using the AADS.) A combination of PLRS, GPS, along with digital and voice communications allows for coordination of the movement between the PCS and the WGO.

Note:

> Detailed information on the AN/KSQ-1 can be found in COMSURFWARDEVGRU TACMEMO PZ0021-1-96, *Tactical Procedures for Using the AN/KSQ-1 Amphibious Assault Direction System.*

(4) Positive Control

Under positive control, wave position and navigation information shall be continuously updated via an external control source that may be electronic, voice communication, or digital data link. Radar, often coupled with the amphibious assault direction system, is the primary sensor for determining wave position relative to the designated route by the PCS. Voice or other communication means may be used to provide position and vector information to the WGO. Since radar contact can't be continuously maintained by the PCS for many OTH assaults, the following methods may be employed:

(a) Aircraft Relay Aircraft may be stationed to allow ship-based control of wave teams. The relay is electronic using tactical data systems. The aircraft can also act as a voice network relay.

The PCO exercises active direction and control of Waves using a combination of either/or UHF and VHF networks. Controller calls concerning waypoint/CCP passage, course, and speed changes, if desired, can be conducted by coded broadcast (pre-established during mission planning) with acknowledgement required or not required, dependent upon the situation. If communications fail, the assault can continue by reverting to the method of control best suited for the situation.

Course and speed changes to Waves can be provided to the WGO by using base course, plus or minus a number of degrees/right or left a number of degrees per voice radio or a prearranged signal. Acknowledgement by the WGO can be made by radio, or by signal should radio transmissions be undesirable.

(b) Trail Ship Control A ship or other surface craft may be positioned to maintain the UHF/VHF C2 network and/or radar contact of the Wave as it transits to the landing area. Depending upon the distance involved, relative to the radar horizon at surface level, it may be necessary to use multiple trail control units to provide a continuous control from the ATF to the penetration point. In the case of multiple trail control units, the WGO must be fully aware of when the Wave passes from one control station to the next along the route of advance.

e. OTH Ship-to-Shore Movement Control Measures and Movement Execution

Control measures form the "framework" for the execution of the OTH STS movement. These control measures aid both the controllers and the executors of the movement, providing leaders at all levels have a common frame of reference. This will aid not only in the execution of the primary plan, but also facilitate the execution of branch or sequel plans. Appendix P, glossary of terms, provides descriptions of the various control measures.

During the movement, the EFV formation will proceed from one craft control point (CCP) to successive CCPs along preplanned routes. Given the necessary dispersion of the formation, only selected vehicles will proceed along the precisely specified route (given the inherent precision of navigation aids), while other vehicles will guide off the movements of these vehicles based upon the formation desired. Typically, these selected vehicles will be those of the EFV platoon commander or section leaders. Special care in planning must consider hydrographic information along a preplanned route is analyzed to ensure vehicles guiding off the leader can operate in safe conditions.

Figure 3-1 provides a notional landing area diagram for an OTH STS movement employing both EFVs and LCACs. The diagram represents a landing within an unrestrictive littoral penetration zone (LPZ), comprised of two littoral penetration sites (LPS). The landing area diagram provides control measures to insure sufficient dispersion between the LCAC and EFV, while also providing flexibility in the execution of the landing plan.

The number and dispersion of LPSs and the associated routes within an LPZ will be situational dependent. However, regardless of the number of LPSs, detailed planning should provide for sufficient dispersion and control measures to insure the safe and efficient maneuver of all landing craft, to include EFVs, AAVs, LCACs, LCUs, and other craft.

Figures 3-2 through 3-5 provide the notional assault wave diagram descriptions for an OTH STS movement. The assault wave diagram is a subset of the landing area diagram, and provides more detail relative to control measures, routes, and potential LPSs. Collectively, these figures represent an OTH STS movement within an unrestrictive LPZ, comprised of two LPSs.

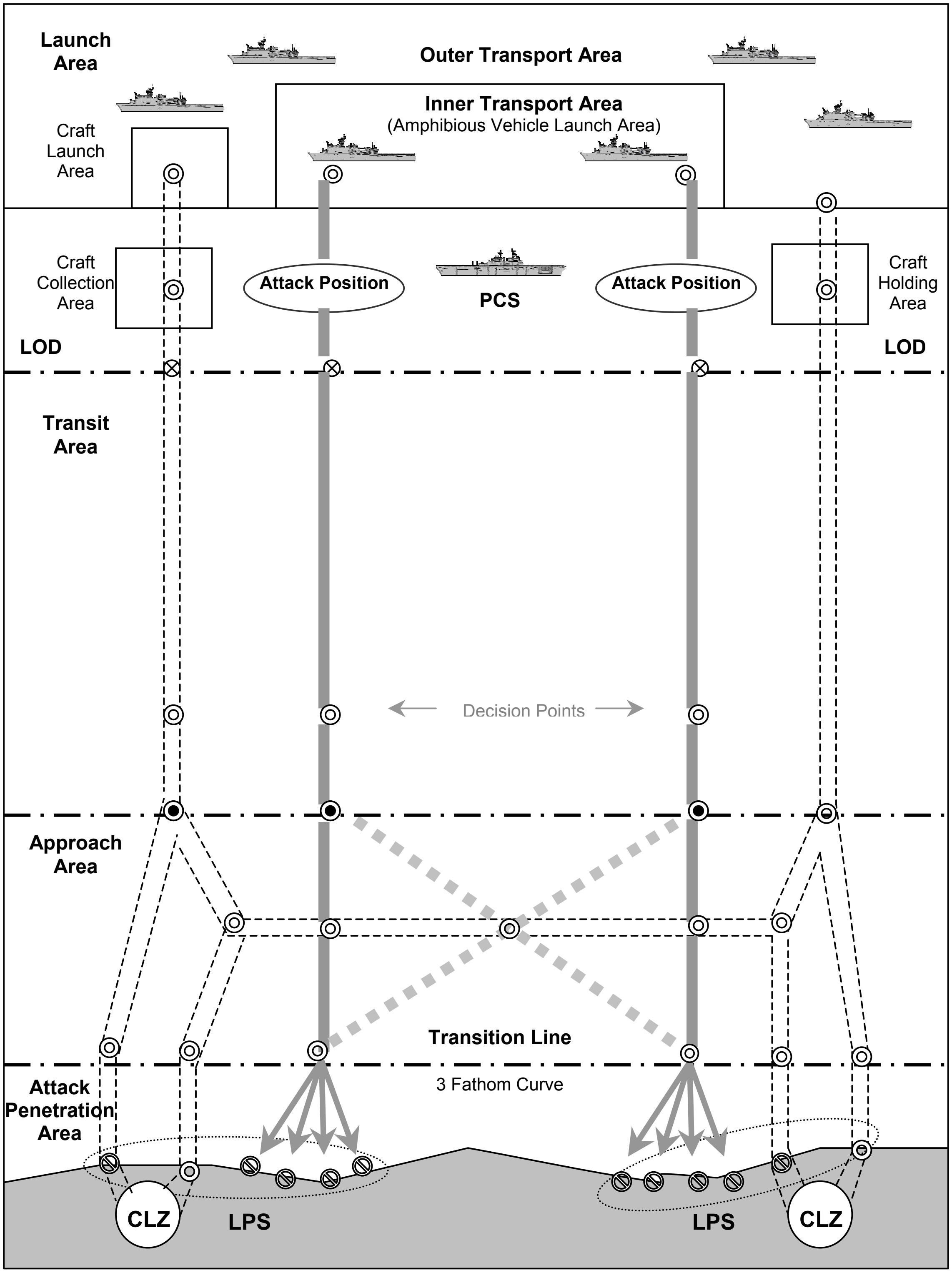


Figure 3-1. Landing Area Diagram.

Craft Departure Point
Craft Control Point / Decision Point
Craft Initial Point
Craft Penetration Point/Littoral Penetration Point
EFV Primary Route
EFV Alternate Route

(1) Execution of the OTH Ship-to-Shore Movement The execution of the OTH STS movement is broken down into four phases: launch phase, transit phase, approach phase, and the attack penetration phase.

(a) Launch Phase

EFVs are launched in transition mode within the amphibious vehicle launch area in the vicinity of designated launch points (LP). Once EFV units form into the appropriate waves (formations),

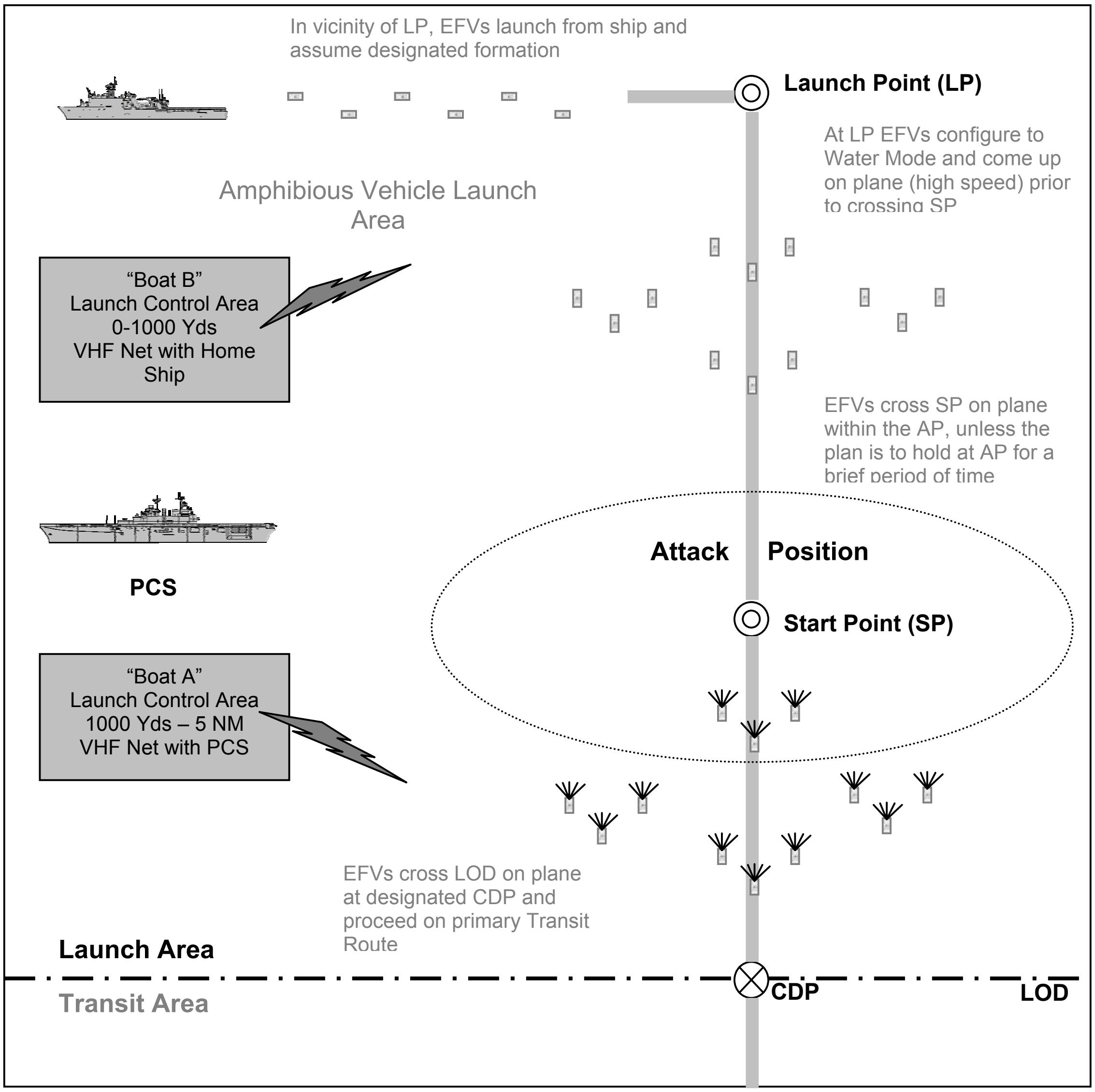


Figure 3-2. Launch Phase

they begin movement at low speed (5-10 knots) toward the start point (SP), located within the attack position (AP).

While within the Amphibious Vehicle Launch Area, the EFV wave is under the control of the PCS. This is to insure deconfliction between other ships and wave teams within the launch area. Upon launch of all EFVs in the wave, the WGO will report to the PCS and receive clearance to proceed in accordance with the landing plan.

As the wave enters the AP and approaches the SP, the EFVs will configure to water mode and either hold within the AP for a short period of time, or proceed immediately with the OTH STS movement. At the direction of the WGO, the EFVs increase power to come up on plane prior to crossing the SP. The WGO reports the wave's coming up on plane to PCS to insure safety and deconfliction within the launch area.

Passing through the AP, the wave adjusts formation as required and assumes the appropriate high water speed (20-25 knots) for the OTH movement. The wave then departs the AP and crosses the LOD at high speed at the designated CDP.

(b) Transit Phase

As the EFV waves cross the LOD, they enter the transit phase of the OTH STS movement into the transit area. Figure 3-3, shows a graphic representation of what occurs while EFVs move through the transit area. This phase of the movement embodies the rapid, long distance maneuver shoreward of the surface elements of the landing force. The method of control employed during the transit phase will depend upon a variety of factors, to include the capabilities of the PCS, visibility, weather, volume of surface traffic, and the tactical situation.

When employing advisory or positive control procedures, the PCS provides deconfliction for each wave, and other surface craft, within the LPZ. When employing independent or waypoint control procedures, the WGO provides deconfliction with other surface traffic. During this phase of movement PCS will advise the WGO of the location, heading, and speed of other surface contacts that could pose a hazard to the wave's safe movement. Dependent upon the situation, PCS may revert to advisory or positive control methods to reduce the risk of collision.

The wave will proceed at high speed along the designated transit route. Designated EFVs, normally the EFV platoon commander and selected EFV section leaders, will insure their vehicles remain on the specified course, while each EFV will maintain the required position in the formation. Wave formation will be maintained using the leader-wingman technique. Formations chosen should facilitate command and control, as well as provide security during the transit. A "base" EFV section will be designated to control speed and heading. To assist in station keeping and identification, the EFVs navigation beacon is employed.

When multiple littoral penetration sites are available to the wave, decision points (DP) will be located along the transit route. These decision points allow sufficient time for the WGO to notify the wave whether the primary route is to be followed, or if the wave will be maneuvering to a preplanned alternate route.

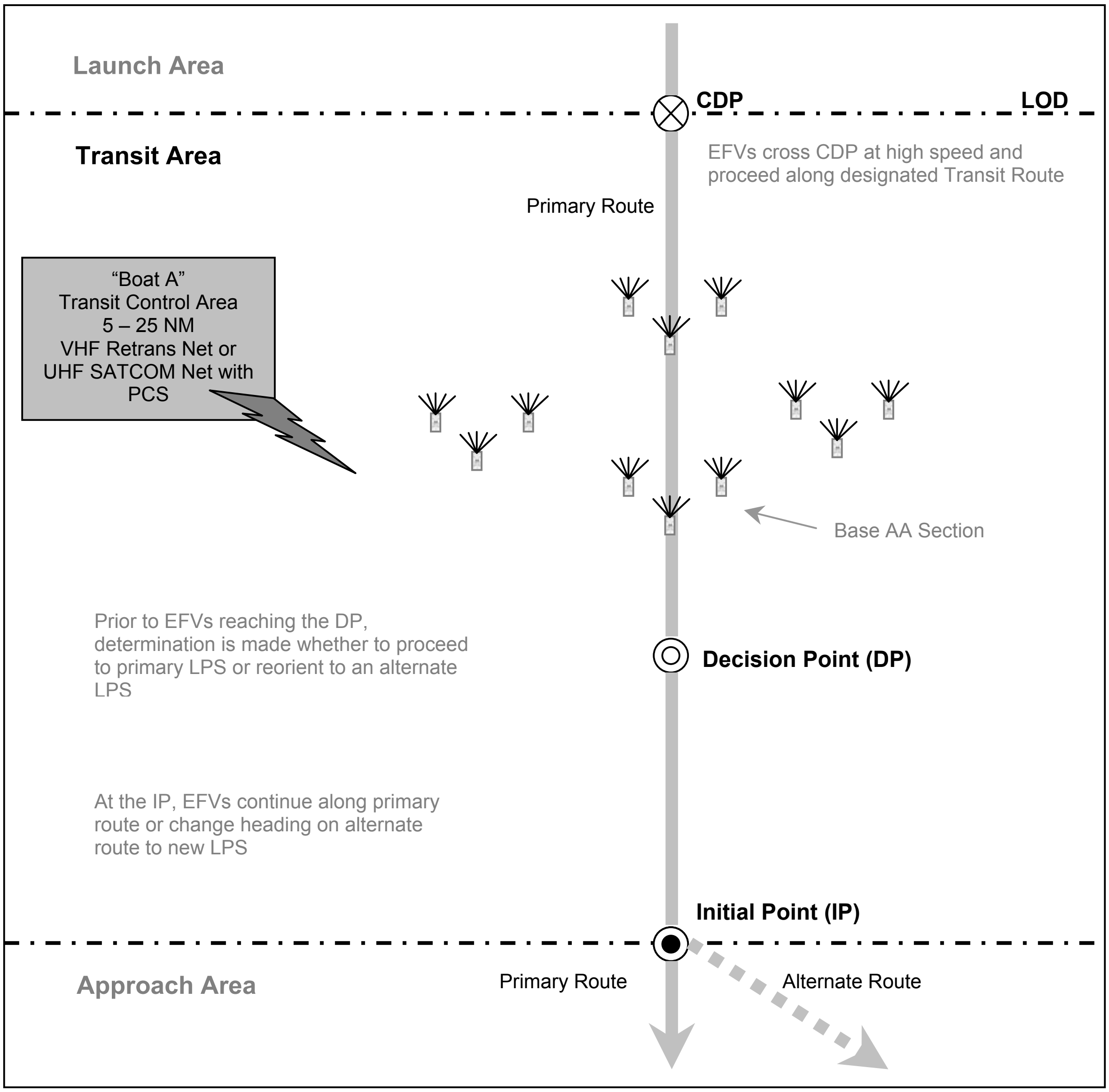


Figure 3-3. Transit Phase.

Subsequent to passing the decision point (DP), the wave will approach the approach area initial point (IP). It is at the IP that the wave will either continue along the primary route to the primary LPS, or execute a heading change to an alternate route to follow to an alternate LPS.
If at all possible, heading changes for EFV waves should be no greater than 45°. This will assist EFVs on the inboard side of the formation to remain on plane, and prohibit excessive catch-up times for EFVs on the outboard side of the formation. If a heading change of greater than 45° must be executed, it is advised that the heading change be made incrementally. Additionally, significant sea state and wave heights will adversely influence efficient heading changes.

(c) Approach Phase

During the approach phase EFVs will be moving through the approach area and converging on the selected LPS(s). Specific attention must be given in the approach area to deconflict surface elements, particularly during periods of limited visibility. This may include civilian maritime traffic. Craft control points (CCPs) along primary and alternate routes will be used to control waves to avoid collisions and "bunching up" while in the approach area. These CCPs are also used to control the movement of waves across intersecting routes, such as those routes used by LCACs or other landing craft. As required, waves and other surface elements will be directed to "hold" at an IP or CCP to allow for the passing of higher priority traffic, or to avoid civilian craft.

While in the approach phase, unless directed to hold position at the IP or a designated CCP, the wave team remains on plane at high speed along the desired route. The EFV platoon commander will notify the EFV section leaders to prepare to come off plane as the wave approaches the release point (RP). Figure 3-4 illustrates what is occurring during the approach phase.

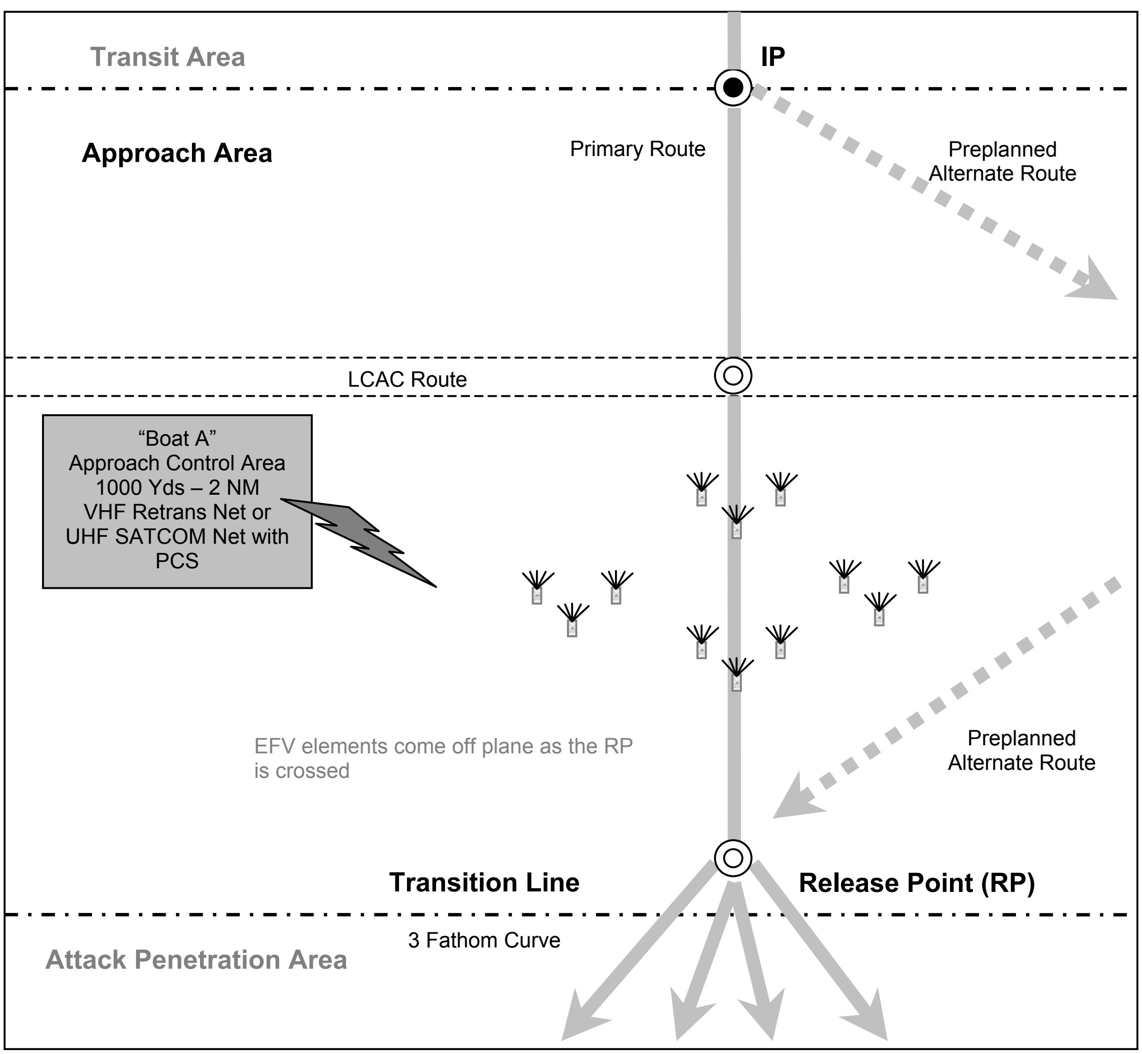


Figure 3-4. Approach Phase.

(d) Attack Penetration Phase

As the wave crosses the RP, located along the transition line, the OTH STS movement now enters the Attack Penetration Phase. The transition line typically marks the 3 fathom curve (18 feet of mean water depth), which will permit the EFVs to configure to transition mode and proceed through the attack penetration area. Figure 3-5 illustrates what occurs as EFVs move through the attack penetration area to their respective LPPs. When directed by the EFV section leader, as EFV elements cross the RP, they will reduce power, come off plane, and configure to transition mode.

Note:

While lying to in calm water, the EFV requires 12 feet of water depth from the surface to accomplish this reconfiguration.)

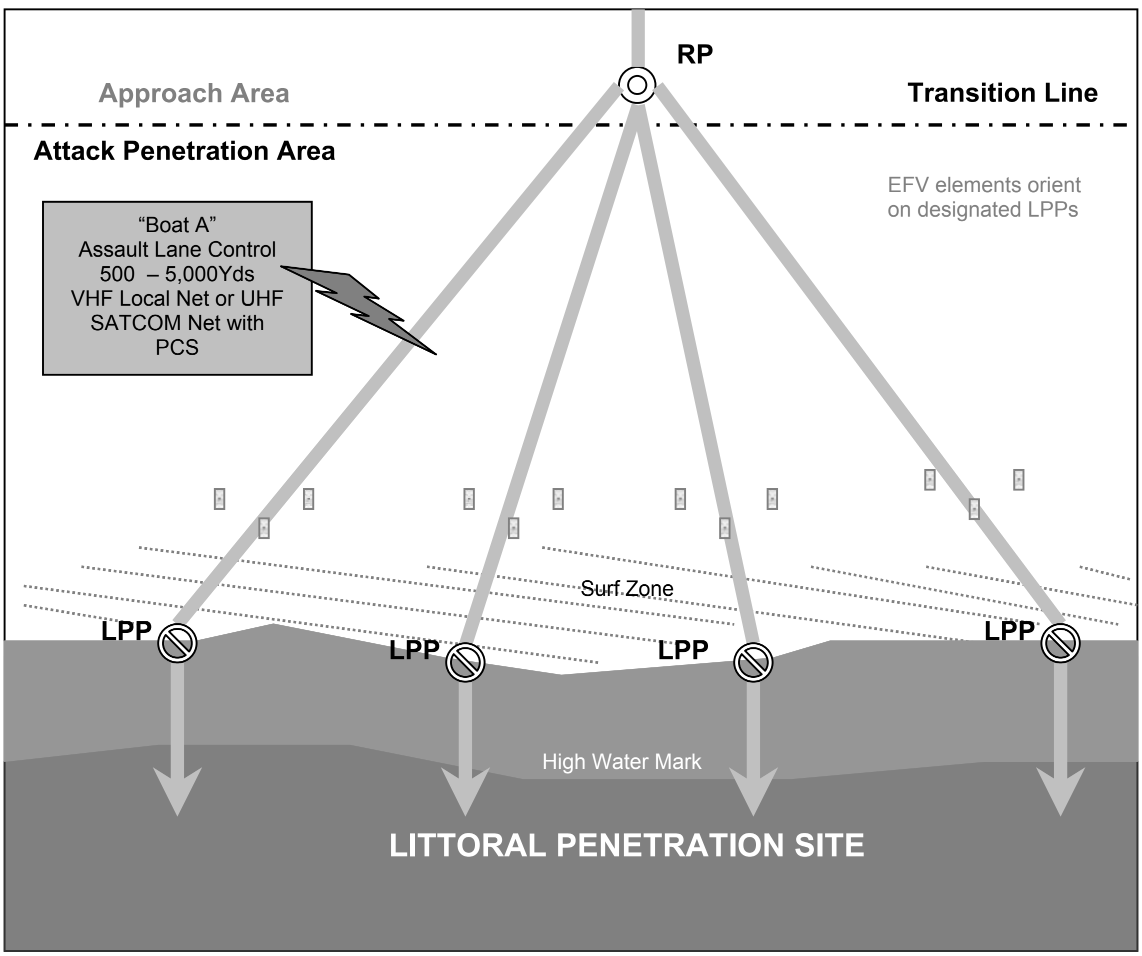


Figure 3-5. Attack Penetration Phase

Dependent upon the formation employed, specific attention must be given by "trail" elements that power is reduced in sufficient time to avoid "running up" on lead elements. Conversely, attention must be given so that power is not reduced too soon, creating undesired gaps between EFV sections within the wave.

For all intents and purposes, when the wave crosses the transition line, it has entered the LPS. As the wave comes off plane at the RP, EFV sections will proceed to their designated position in the formation used to assault the shore line. Formations will be dependent upon the size of the LPS and the likelihood of enemy contact.

Dependent upon the size and trafficability of the LPS, one or several LPPs may be employed. In the event a single LPP is used, the EFV Sections will maintain the appropriate formation while guiding off the base section, which will be "centered up" on the LPP. If multiple LPPs are used, EFV Sections will proceed from the RP to their designated LPP.

The method of control employed during the attack penetration phase will depend upon a variety of factors, to include the capabilities of the PCS, visibility, weather, volume of surface traffic, and the tactical situation. However, the WGO may be required to assume control of the wave at any time given the potential for enemy contact or developing dangerous situations.

Penetration of the surf zone is analogous to the crossing of any danger area. To preclude broaching, EFV crews will normally maintain a heading perpendicular to the wave train. During movement down the assault lanes, the EFVs stabilized MK46 weapon station will be able to provide accurate direct fire shoreward. Dependent upon the likelihood of enemy contact, consideration should be given to providing overwatching elements seaward of the surf zone. It should be noted that the EFVs transition flap does preclude close in fires over the bow. Consequently, MK46 employment is more effective over the flanks and forward quarters of the vehicle.

If required by the method of control, as the EFVs exit the surf zone, the WGO reports the "touch down" of the team at the LPP to PCS. Once the EFVs have touched down at the LPP, the transition flap is stowed and the vehicle is configured to land mode. The wave then moves inland rapidly toward beach exits to continue the assigned mission. This may include securing the inland perimeter of the LPS to safeguard the landing of LCACs and LCUs. As soon as the first intermediate objective is secured, and the off-load of equipment belonging to the surface assault element from landing craft is accomplished, the attack penetration phase, and the OTH STS movement, is completed.

(2) EFVs Operating in Proximity of LCACs . Given the nature of the OTH STS operation, the landing force will employ LCACs to provide the initial lift of ground combat equipment and material. Typically, waves comprised of EFVs will make the initial landing to secure the LPS in advance of the LCACs.

Dependent upon the terrain associated with the LPS, EFVs and LCACs can be expected to operate in relative close proximity. Planning of the OTH STS movement should include off-set routes and landing sites that separate these dissimilar craft by a prudent distance, but no less than 500 yards. Where beach separation of 500 yards is not feasible, LCAC and EFVs may land across the same beach. However, sufficient time must exist between scheduled waves to preclude LCAC overtaking slower EFVs in transition mode. Particular consideration should be given to maintaining safe dispersion between dissimilar craft. Where the routes of these craft must intersect, for whatever reason, special attention must be given regarding deconfliction and the use of control measures to preclude an unsafe condition. If the EFVs and LCACs must use the same route due to cannelization (due to obstacles or terrain), the craft must be sequenced by time. During periods of limited visibility, the Positive method of control will be employed to insure the safety of the crews and crafts.

The wave is most vulnerable when passing through the LPP. It is critical for the wave as a whole to pass through the LPP quickly, while still maintaining the ability to react to the tactical situation. The EFVs will be accomplishing their maneuver through the surf zone, which, dependent upon hydrographical characteristics, can be a tedious task. Once inside the surf zone, the EFV is limited in its maneuverability while still waterborne. The LCACs will also be transiting the surf zone and proceeding to specified cushioned landing sites (CLS) within the CLZ. Craft landing zone support teams (CST) will be directing the ingress and egress of the LCACs within the CLZ, and conducting the off load of LCACs cargo. The chances of congestion within the LPP are significant, particularly during periods of limited visibility, and should be avoided at all costs.

(a) Off-Set LCAC/EFV Operations The preferred method of landing EFV waves in close proximity of LCACs is to use LPSs of sufficient size to allow suitable off-set between the EFV penetration points and LCAC penetration points. Where beach separation of 500 yards is not feasible, LCAC and EFVs may land across the same beach. However, sufficient time must exist between scheduled waves to preclude LCAC overtaking slower EFVs in transition mode. Particular consideration should be given to maintaining safe dispersion between dissimilar craft. As a guide, EFV and LCAC penetration points should be no closer then 500 yards.

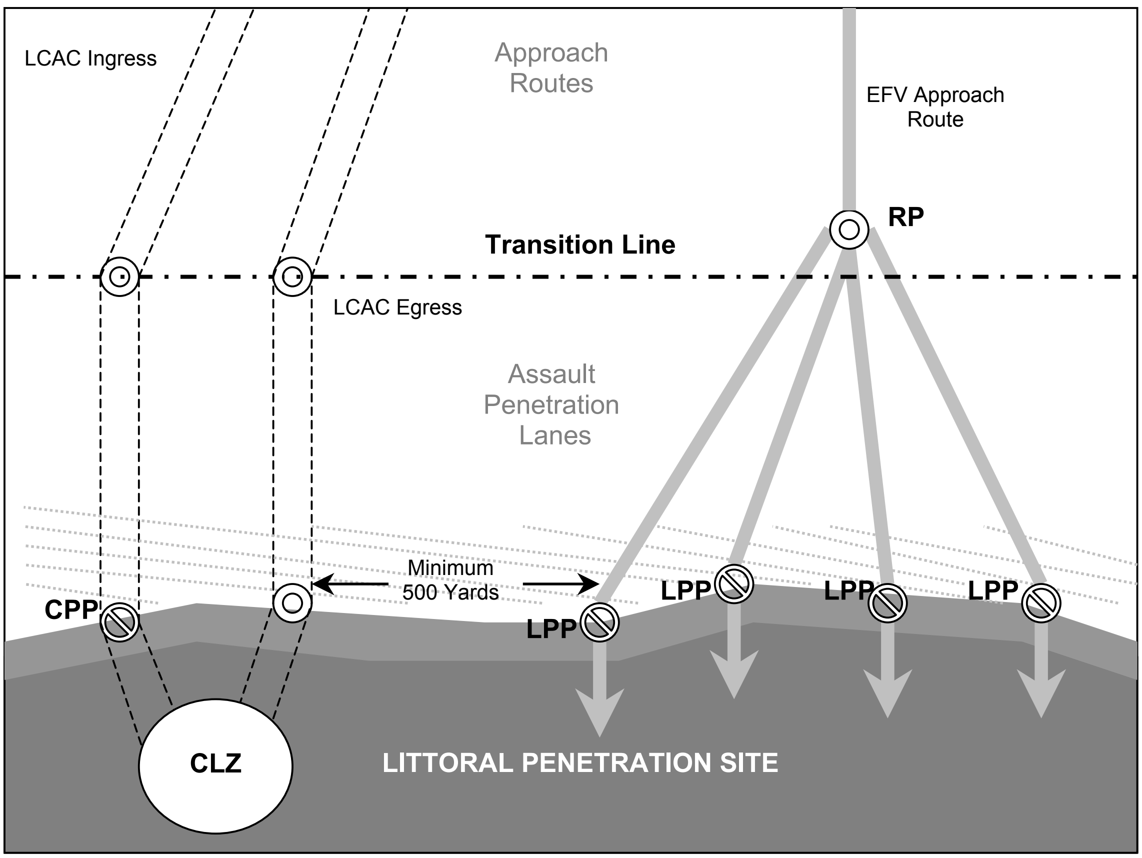


Figure 3-6. Off-Set EFV / LCAC Operations

The LPS should possess multiple inland access routes to allow the EFVs to rapidly depart the LPS without interfering with LCAC debarkation activities and movement within the CLZ. If access routes are limited, given that the EFV is self deploying and can continue maneuver ashore quickly, the EFVs penetration point should facilitate its rapid departure away from the LCAC CLZ and the debarkation activities occurring in that area. Consideration must also be given to the LCAC egress route as they return seaward via assigned retirement routes depicted. Figure 3-6 above depicts a notional organization of a LPS of sufficient size for simultaneous EFV and LCAC operations.

(b) Sequenced LCAC/EFV Operations If the LPS is of insufficient size to allow for suitable dispersion of EFV and LCAC penetration points, then time sequencing of landing platforms through the LPP/CPP must be accomplished. The sequencing will be prioritized dependent upon the tactical situation ashore. The actual time sequence, or separation, between the EFVs use of the LPP/CPP and that of the LCAC will vary depending on sea states, visibility, and the threat level in the vicinity of the LPS.

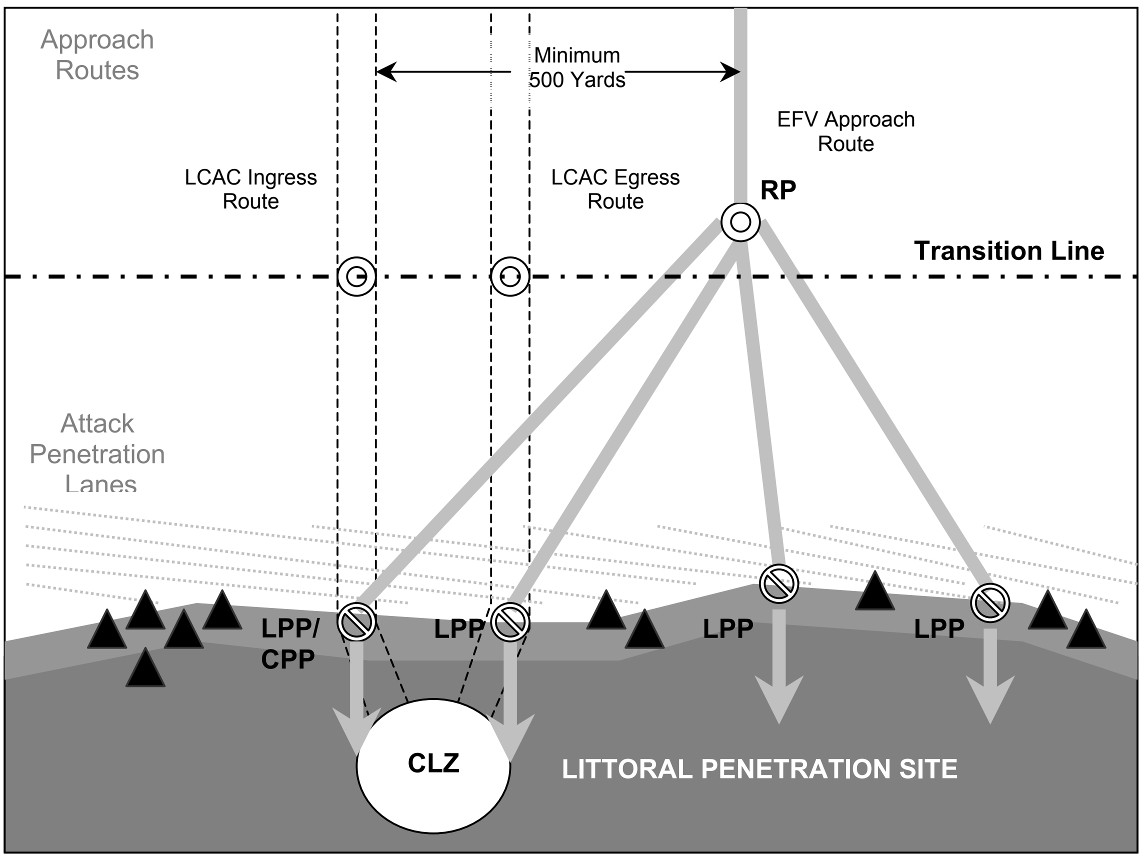


Figure 3-7. Sequenced AAAV / LCAC Operations.

The operation may require breaching assets be put ashore prior to landing other ground mobility assets, hence, LCACs carrying such equipment would land ahead of the EFVs. In this case, the planned positioning or arrival time of the EFVs at and within the LPS area must take into consideration the LCAC egress route out of the LPS should the LCACs be departing prior to the EFV penetration. Only in cases where a suitable rehearsal has been accomplished is it recommended that EFVs land immediately behind the LCACs and assume stationary defensive positions while the LCACs disembark their loads. It must be remembered that once the LCACs off load their cargo, they must have sufficient maneuver space to quickly and safely exit the CLZ. Not only does this present a lucrative target to the enemy, it also creates a significant movement hazard to both platforms.

The EFV wave will normally pass through the LPS rapidly, exiting the beach area and proceed deeper inland to avoid congestion in the area, allowing subsequent waves to move ashore unobstructed. If the situation warrants and the terrain supports it, the lead EFV element may proceed to an inland position from which it may perform overwatch duties while trail EFV elements pass through the LPS. Figure 3-7 above depicts a notional organization of a LPS for sequenced EFV and LCAC operations.

Section II. EFV High Speed Operations

3201. EFV High Speed Waterborne Movement Considerations

a. EFV Wave Organization and Relationships

The EFV wave is typically comprised of a rifle company embarked aboard an EFV platoon. The wave commander, normally the senior embarked landing force representative, in this case the rifle company commander, tasks the EFV platoon commander, as the wave guide officer (WGO), with the safe and efficient movement of the wave throughout the ship-to-shore movement.

The EFV platoon is organized into sections to facilitate safe and efficient movement of the wave. The EFV platoon commander executes control of the platoon through the section leaders. The EFV section leader controls the EFVs within the section, insuring their safe and efficient employment. Typically this control is accomplished employing VHF voice communications. The EFV platoon commander insures that the wave moves in accordance with the Landing area diagram, employing the designated method of control (independent control, waypoint control, advisory control, or positive control). The EFV platoon commander also ensures the wave maintains proper formation and dispersion during the ship-to-shore movement.

b. Leader – Wingman Relationship

Within the EFV section, the section leader's movement guides the movement of the other EFVs within the section. Dependent upon task organization, an EFV section can be comprised of three to four EFVs. Employing the "leader-wingman" technique, for a section of three EFVs, there are two trail wingmen following the guidance and movements of the EFV section leader. Within a section comprised of four vehicles, there are two pairs of "leader-wingman" groups, with the Section Leader's pair being the "leader" of the subordinate pair.

This relationship will be maintained throughout the duration of high water speed movements. It is critical that vehicle commanders maintain visual contact with designated vehicles. During periods of limited visibility, the navigation beacon is used to assist in providing situational awareness. If visual contact is lost, the vehicle commander will notify the EFV section leader, who will then attempt to identify and re-orient the vehicle that has lost contact. Until contact is re-established, no heading changes will be made unless to avoid collision.

c. EFV Wave High Water Speed Formations

EFV platoon and section formations will be dependent upon the situation. While in transition mode, the EFV will employ the same formations and movement techniques as those employed by the AAV. While in water mode, traveling at planing speeds of 20 knots or greater, factors such as weather, seastate, visibility, and the tactical situation will each influence the formation to be employed. The formation chosen should facilitate command and control of the wave as it executes high water speed maneuver. During periods of limited visibility, the EFV navigation beacon is employed to assist EFV crews in maintaining situational awareness relative to the formation. As required, the EFV vehicle commander will also employ the night vision devices available (Thermal Sight, Night Vision Goggles) to enhance this awareness. Constant communication must be maintained between the vehicle commander and the driver to insure safe and effective maneuver.

Typically, a lateral dispersion of no less than 100 meters will be maintained between EFVs. A longitudinal dispersion (following distance) of 150 meters is desired at high speed. Following distance will depend heavily on visibility and sea conditions.

(1) **Echelon** The echelon (left or right) formation provides greater firepower forward and to the flanks. It is relatively easy to control. The echelon right formation allows the drivers of trail vehicles to maintain visual contact with the leading vehicles. The echelon can also be employed during the acceleration to high water speed, minimizing the risk of running up on a lead vehicle. Figure 3-8 shows an EFV section executing a high water speed echelon formation.

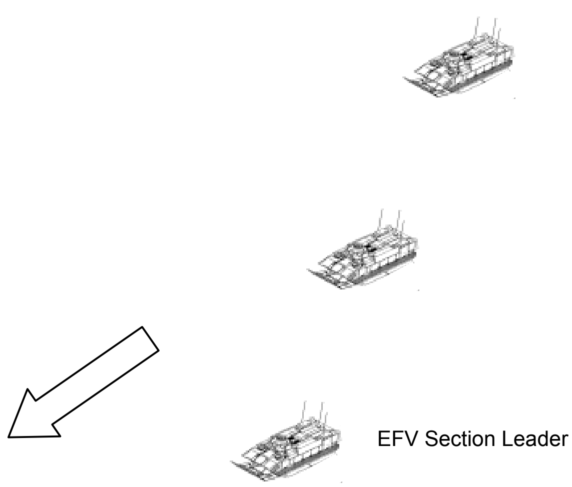


Figure 3-8. Echelon Right.

(2) **Wedge** The wedge formation provides the greatest freedom of maneuver because it provides all around protection and can change quickly to another formation. The wedge is the most often employed formation in addition to the staggered column. However, it requires sufficient space to disperse subordinate units laterally and in depth. The wedge also affords sections leaders the ability to maintain visual contact with other leader vehicles and with subordinate EFVs. Like the echelon, the wedge can also be employed during the acceleration to high water speed, minimizing the risk of running up on a lead vehicle. Figure 3-9 illustrates an EFV section using a wedge formation.

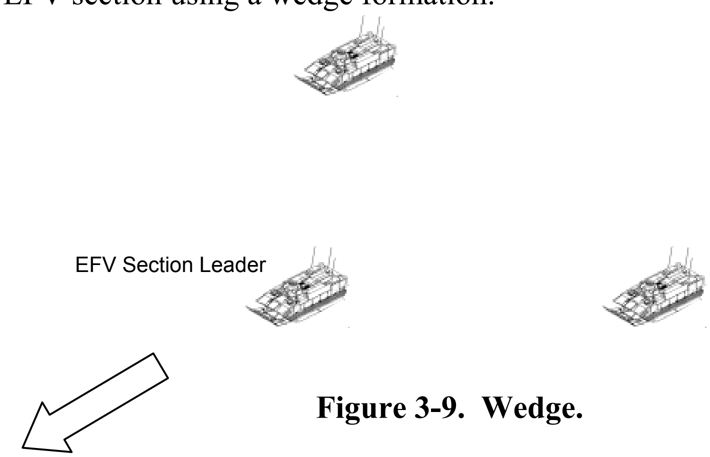


Figure 3-9. Wedge.

(3) **Staggered Column** The staggered column is the easiest formation to control and provides good protection to the flanks. Protection to the front and rear is limited. It is primarily employed while negotiating channelized areas, administrative movements, or during extended water marches. Linear dispersion between vehicles is to be considered, to insure sufficient reaction time is given to avoid collision. The staggered column is not recommended for employment during the acceleration to high water speed, given the possibility of a EFV overtaking a preceding EFV in getting up on plane. Emphasis must be given to maintaining visual contact with the EFV ahead and astern. Figure 3-10 illustrates an EFV section in high water speed staggered column formation.

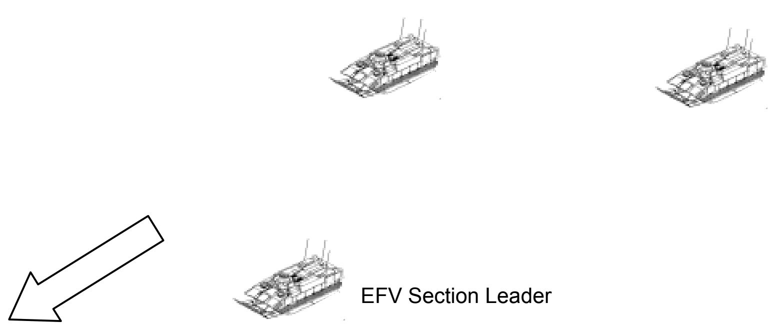


Figure 3-10. Staggered Column.

(4) Line Abreast The line abreast formation provides maximum firepower forward, but provides poor protection to the flanks. The line is considered only a temporary formation. It provides the ability to land all vehicles in the formation quickly and at the same time. The line can also be employed during the acceleration to high water speed, allowing each EFV to get up on plane while not running the risk of overtaking a preceding EFV. However, the line is difficult to control as each vehicle must maintain the same relative speed and heading. Adequate lateral dispersion must be maintained during the run up to high speed. It is also difficult to maintain visual contact between leader vehicles. Figure 3-11 shows an EFV section in line abreast formation.

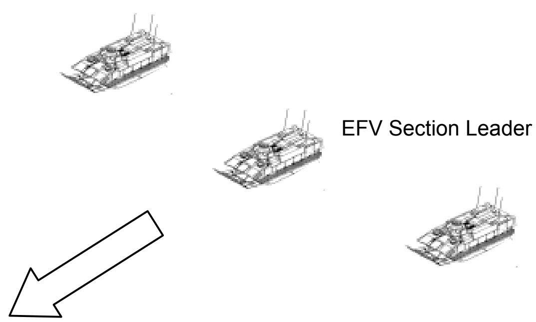


Figure 3-11. Line Abreast.

3202. EFV High Speed Waterborne Movement Execution

a. Coming Up on Plane

Preparatory to execution of a high water speed movement, the EFV platoon commander will insure that all vehicles in the wave have accomplished the reconfiguration from transition mode to water mode subsequent to launching from a ship or the shoreline. This reconfiguration may require a short pause in wave movement, and is accomplished as soon as possible after all vehicles have launched.

After reconfiguration to water mode is completed, the EFV platoon will assume the designated formation and continue movement from the launch point (LP) toward the start point (SP) located within the attack position (AP). On order from the EFV platoon commander, the wave increases power to increase speed and come up “on plane.” The intent is for the wave to achieve planing speed prior to crossing the SP and subsequent crossing of the line of departure (LOD). Once on plane, the wave will cross the LOD at the designated craft departure point (CDP).

During the planning phase of the OTH movement, consideration must be given to the distances between the LP, SP, and CDP, to insure sufficient run up distance to allow the EFVs to come up on plane relative to the EFV in the heaviest operating weight condition. This planning will assist in the efficient execution of the landing plan, particularly relative to the time schedule as surface elements cross the LOD. For planning purposes, a distance of no less than 1,000 meters between each control measure (LP-SP-CDP) is recommended.

When required by the landing plan, the wave may be directed to hold position in the AP to allow for other elements of the landing force to be properly positioned. This can be accomplished with the wave lying to, or executing a ready circle to lessen the impacts of off shore currents and sea conditions.

The designated transit speed of the wave will initially be set at the slowest speed allowable for planing. This allows for EFVs, which have taken a longer than expected time to come up on plane, the ability to increase speed temporarily to catch up and assume appropriate position in the formation. This increased speed, known as “catch up speed”, will be designated prior to launching. The EFV section leader will notify the EFV platoon commander when all vehicles within the section have come up on plane and assumed the appropriate formation.

b. Stationkeeping and Heading Changes
The EFV platoon commander, acting as the wave guide officer, insures that each EFV section maintains appropriate position and dispersion within the formation and that the wave maintains heading along the designated route. During high water speed movements, one or more of the EFV platoon’s section leaders, dependent upon the platoon formation, will follow the designated route for the wave. Prior to wave heading changes, normally executed at designated control points, the EFV platoon commander will alert EFV section leaders of the upcoming heading change. At the appropriate time, the EFV platoon commander will then order the execution of the heading change. The EFV section leaders will insure the sections then accomplish the heading change, maintaining appropriate formation and dispersion.

While at high water speeds, a lateral dispersion (side-to-side) of no less than 50 meters will be maintained by all EFVs. This dispersion should be maintained while in the wedge, echelon, and line abreast formations. When in a column type formation, a linear dispersion (stern-to-bow) of no less than 150 meters will be maintained. During periods of limited visibility, vehicle commanders should avoid following directly in trace of lead vehicles to lessen the likelihood of collision should the lead vehicle suffer a mechanical casualty and come off plane. Should this occur, the vehicle suffering the casualty will immediately switch it’s navigation beacon to the 360º emergency mode and report the casualty to the EFV section leader. Figure 3-12 depicts a notional wave formation.

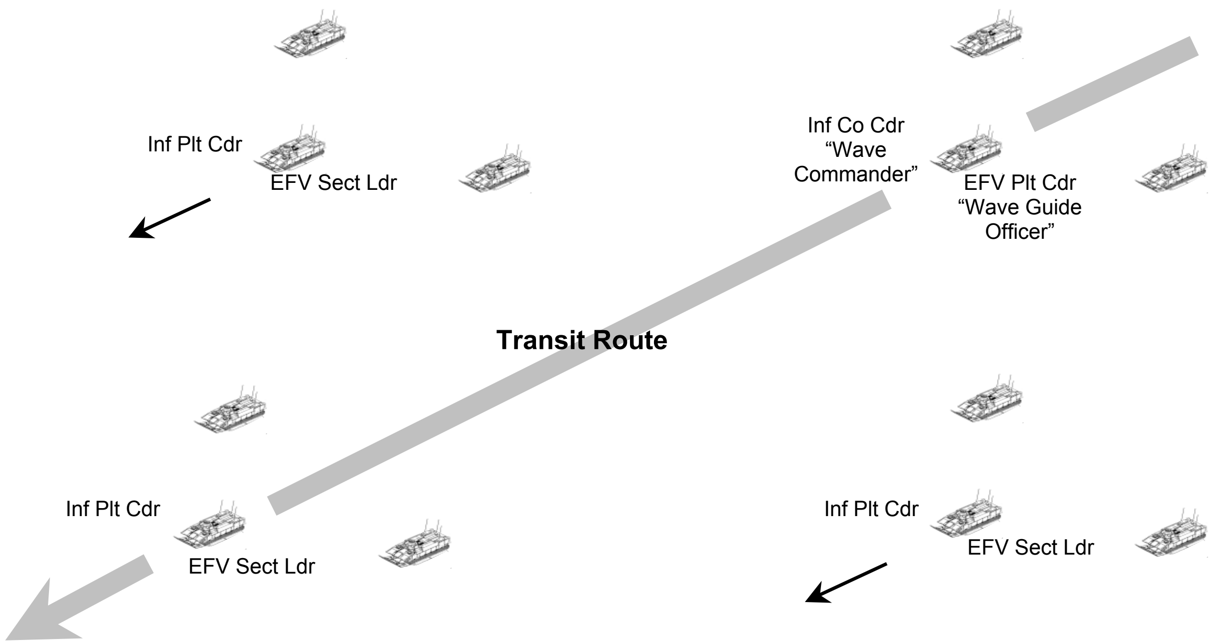


Figure 3-12. Notional EFV Wave Formation.

When traveling at high speeds, wave heading changes will not be made arbitrarily. Should the wave commander or the wave guide officer determine that a heading change is required, the wave will be alerted preparatory to the execution of the change. This will allow EFV section leaders to insure that all vehicles are alerted and properly positioned. Typically, heading changes will only be made to avoid hazards to navigation (disabled craft, etc) or re-orient to an alternate route.

When executing heading changes at high speeds, consideration must be given to both EFV platoon and section formations. Dependent upon the severity of the change, out-board vehicles in the formation may require a short period of time to catch up and maintain reassume the proper formation. Also, consideration must be given to the in-board vehicles slowing so that they may be subjected to coming off plane. Accordingly, severe heading changes, when at all possible, should be made incrementally. For example, a 90º wave heading change should be made in three separate 30º increments. During the planning and execution phases, consideration must be given to the wave’s formation and relatively wide turning sweep with regard to other surface traffic.

If a radical heading change is required (i.e., 180º), if sufficient maneuver space isn’t available for the EFV unit, the wave team should come off plane (see coming off plane techniques at paragraph d. on next page), execute the appropriate heading change, and then come back up on plane.

c. Transit and Approach Routes

During the transit phase of the high water speed movement, the wave will follow a designated primary transit route, which is comprised of a series of craft control points (CCPs). This means that only selected "leader" EFVs will navigate precisely along this base route, while the remaining vehicles will be off set, using the leader-wingman technique. Normally, dependent upon the formation employed, one or two EFV section leaders and/or the EFV platoon commanders vehicles will be on this base route.

The primary transit route leads to a specified initial point (IP). Crossing the IP, the wave enters the approach area. Dependent upon the number of potential landing sites, alternate approach routes may branch off at the IP. Just like the primary transit route, each approach route is made up of a series of CCPs. The wave either continues high speed movement along the current route, now called the primary approach route, or changes heading to a preplanned, alternate approach route. The decision to use an alternate landing site, and the alternate approach route to get there, should be made well enough in advance to crossing the IP to allow the Wave to prepare for the heading change.

When water space and time for planning permits, a primary transit route may be assigned to each EFV section within the wave. In essence, this means that each EFV section becomes a separate Wave for control purposes. Accordingly, the EFV section leader functions as the wave guide officer for the section. This technique is normally employed only when alternate routes and landing sites will not be employed, and it is known prior to launching that each EFV Section will land at specific penetration points. During the planning phase, it must be considered that the separated EFV Sections may lose visual contact with one another. It is strongly advised that should the separated sections be required to regroup, this be accomplished at slower water speeds in Transition Mode.

c. Coming Off Plane
As the Wave moves along the approach route and approaches the transition line at high water speed, the EFV platoon commander will insure the platoon is alerted to prepare to come off plane. The transition line is located along the 3 fathom curve (18 feet of water depth), which will allow for the safe reconfiguration of the EFV from Water Mode to Transition Mode.

Note:

While lying to in calm water, the EFV requires 12 feet of water depth from the surface to accomplish this reconfiguration.)

During the planning phase, consideration should be given to tidal data when establishing the transition line. Additionally, determining the location of the 3 fathom curve and annotating it's location on the EFV navigation overlay is critical. The wave will be prepared to come off plane as it passes across the release point (RP) and approaches the transition line. There are two basic techniques for the wave to come off plane, en masse and sequenced.

(1) **En Masse** This technique is typically employed when the EFV Platoon will utilize a

single littoral penetration point (LPP) and it is desired for the entire wave to come off plane simultaneously. This reduces the likelihood of vehicle or section run up, depending on the formation. However, it also increases the likelihood that the wave, once off plane, can be left dispersed over a greater distance then desired. Prior to ordering the wave off plane, the EFV platoon commander should insure that the EFV sections have assumed the desired dispersion, while section leaders insure individual vehicles have closed up the formation suitably. Once the dispersion is verified, the EFV platoon commander will order the wave to reduce power and come off plane en masse as lead elements pass through the RP. It should be noted that, should the situation allow, the wave can assume a formation that allows the EFV sections to come abreast of one another, facilitating a linear formation as the wave comes off plane.

(2) **Sequenced** This technique is typically employed when EFV sections will utilize separate LPPs that are dispersed in excess of 500 meters. This allows each section to quickly orient on its assigned LPP to make the penetration of the surf zone prior to coming off plane. When utilizing the sequenced method, the decision of when to come off plane can be delegated to the EFV section leader. The EFV section, prior to the section coming off plane, will insure that the section formation prohibits the danger of run up. Using this technique, the RP should be located at least 500 meters seaward of the transition line. This will allow the EFV section to pass through the RP and orient on the appropriate LPP prior to coming off plane at the transition line. During the execution of the sequenced method of coming off plane, EFV section leaders and vehicle commanders must remain vigilant on the potential of running up on lead sections.

e. Movement from Transition Line through Attack Penetration Area.
After coming off plane, the wave will configure to transition mode as soon as possible, leaving the transition flap deployed. Movement will continue as the EFVs orient on their assigned LPP and the EFV platoon assumes the appropriate tactical formation. Platoon and section formations will be dependent upon the tactical situation ashore (likelihood of enemy contact) and speed desired to penetrate the surface zone and exit the beach area. Figure 3-13 illustrates an EFV wave transiting the attack penetration area and coming ashore to continue the attack inland.

If the landing is considered to be opposed (enemy can bring to bear direct and/or indirect fires), it is at this time the enemy may put forth a maximum effort to stall or halt the attack. As such, the attack penetration area can be considered a danger area and should be transited as rapidly as possible, while potentially employing an overwatch technique to cover the movement of wave elements.

Employing the stabilized MK46 weapon station, a designated EFV section(s) can provide direct fire ashore to cover the movement of the Wave as the surf zone is negotiated. With the transition flap deployed, targets can best be engaged by firing over the flanks or quarters of the EFV. Coordinated indirect fires and close air support can also be employed to support the attack penetration movement.

As the EFV wave moves ashore, it may be directed to provide security for follow on LCAC operations within the LPS, or to continue the mission to move inland to secure initial objectives.

As the tactical situation allows, as soon as practical after coming ashore, the EFV platoon should conduct an at-halt check, stow personal floatation devices and other equipment associated with water operations, and, as necessary, redistribute stowed equipment and supplies to facilitate land operations. (Certain equipment, supplies, and Class V allowances stowed internally during the STS movement may now be best stowed externally for safety, access, and embarked troop comfort.)

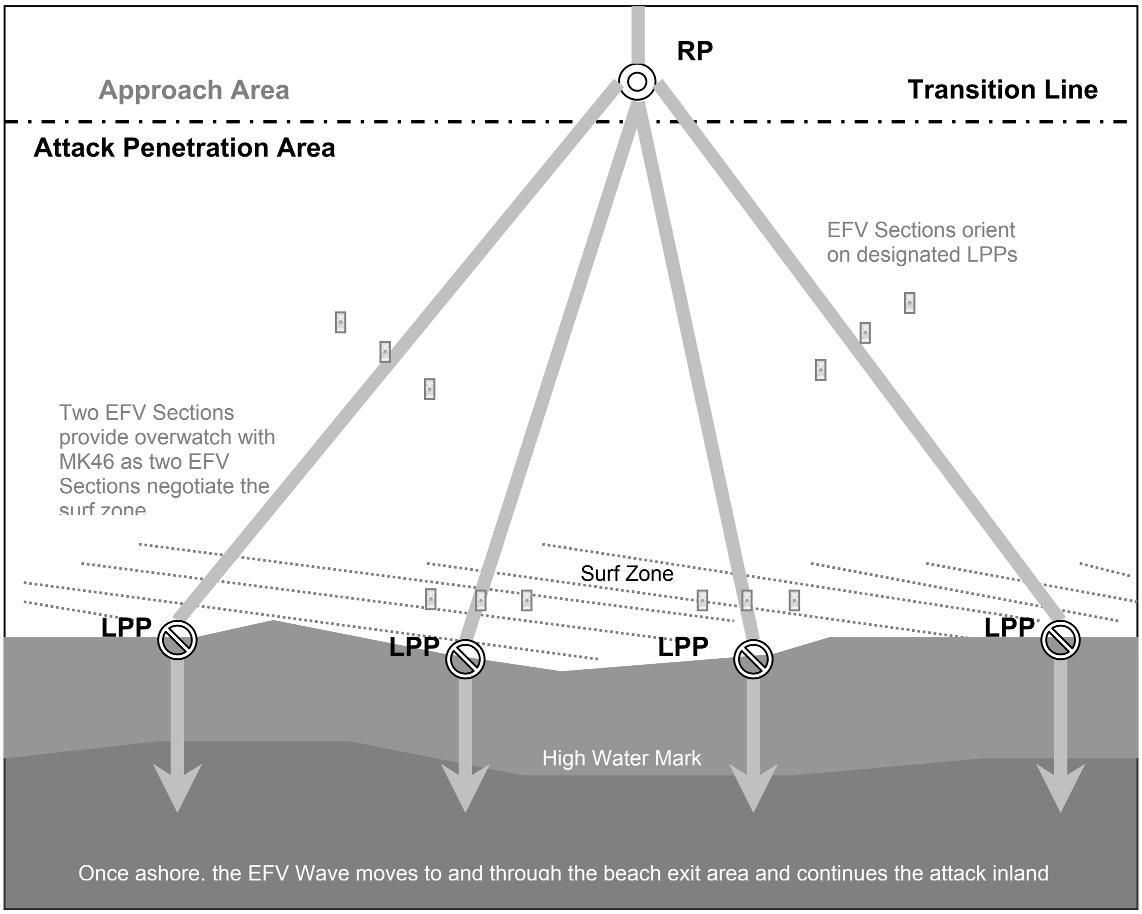


Figure 3-13. Attack Penetration Area Movement.

Chapter 4 Gunnery

To defeat the enemy force and survive, EFV crews must have a thorough knowledge of their vehicles' functional capabilities, the techniques of acquiring targets, and the effective use of all crew-served weapons across a spectrum of threat targets. In addition, crews must develop and sustain tactical crew skills that will allow them to maneuver effectively and survive on the battlefield. This combination of crew gunnery and tactical skills is essential for total weapon system proficiency.

This chapter provides basic guidance on EFV weapon station employment and crew-level tactics. The draft gunnery tables (appendix K) are designed to develop and test the proficiency of individual, crew, and section/platoon gunnery techniques. The series of engagements on each table is intended to duplicate (within the safety and resource constraints of live-fire ranges) typical battlefield tasks under realistic firing conditions against likely target arrays.

The following outlines EFV system gunnery procedures designed to attain and sustain crew and unit level tactical gunnery proficiency:

- Detect, acquire, identify, and classify targets.
- Use direct-fire engagement techniques.
- Determine range.
- Employ machine guns.
- Employ the EFV weapon station.

This chapter also describes the characteristics, capabilities, and employment of ammunition used on the EFV and the gunnery tables and tactical tables used to determine individual, crew, and platoon gunnery proficiency.

4001. Placing the EFV MK46 Weapons Station in Operation

For procedure on placing the EFV MK46 weapon station in operation, functional checks, loading and unloading of ammunition, and important safety information, refer to the EFV Interactive Electronic Technical Manual (IETM).

4002. Ammunition and Target Destruction

The success of EFV mounted forces depends on the effective use of the appropriate ammunition against battlefield targets.

a. Classification
Conventional 30mm main gun ammunition is classified according to type and use.

(1) Armor-defeating Ammunition Kinetic energy ammunition (Long Rod) is the primary round used against heavily armored Infantry Fighting Vehicles (IFVs) and similar targets. In a secondary role, it is used against hardened structures and heavily fortified fighting emplacements. Additionally, it may be used against targets where the shortest time of flight to the target is desired, e.g. highly maneuverable watercraft, such as jet skis, or against other highly maneuverable targets.

(2) Chemical Energy Ammunition Chemical energy ammunition is the primary round used against lightly armored targets, field fortifications, materiel targets and personnel. In a secondary role, it is used to suppress area targets. Chemical energy ammunition includes, but is not limited to, the following:

- Semi Armor Piercing High Explosive Incendiary-Tracer [SAPHE-T].
- Multi Purpose Low Drag-Tracer [MPLD-T].
- High Explosive-Tracer [HEI-T]).

(3) Target Practice Ammunition Target practice (TP and TP-T) ammunition is used for gunnery training. These rounds have ballistic characteristics similar to service ammunition.

(4) Dummy Ammunition Dummy ammunition is used for practicing gunnery-related tasks; it has no propellant or explosive charge and is mocked up to provide an appearance that represents service or training ammunition.

b. Identification
Ammunition for the 30mm main gun can be identified by shape, the projectile color code, and markings on the projectile. A standard NATO color code is used for main gun ammunition (see figure 4-1). The projectile, cartridge case and packing materials have markings that provide additional information about the ammunition and the firing weapon:

- Tracer.
- Caliber and type of weapon.
- Type of filler.
- Type of projectile (round).
- Model of projectile (round).
- Ammunition lot number.
- Quick reference for round type.

The color of the ammunition projectile indicates the purpose of the round. The basic projectile color indicates**:**

- Black ....Armor-defeating.

- Yellow..................……..Antipersonnel/antimateriel.
- Light Blue ....Target practice.

The color of the lettering on the ammunition indicates the type of filler or charge:

- White Letters .... Inert (no filler or charge).
- Yellow Letters.............High-explosive filler.
- Red Letters ....Incendiary.
- Black band ....Secondary armor defeating.

c. Components of a Main Gun Round
A complete round of main gun ammunition is usually composed of the following basic parts; however, not all types of rounds will have every part listed:

- Cartridge case. The aluminum or steel casing that contains the propellant and primer. When the round is fired, the cartridge case expands to seal the interface between the bolt face and rear of the breech.
- Propellant. The composition that burns, producing gas pressure that forces the projectile from the cartridge case, down the gun barrel and toward the target.
- Primer. The cap in the base of the cartridge case that, when struck by the firing pin, ignites the propellant charge.
- Fuze. The part of the projectile that causes it to function upon impact or at a specific time (not currently used in kinetic-energy rounds).
- Projectile. The part of the round that travels through the gun tube.
- Subprojectile. The part of the projectile that travels to the target.
- Ogive. The forward portion of the projectile. The ogive is designed to reduce air resistance and provide aerodynamic stability.
- Bourrelet. A raised metal or plastic ring around the outer forward surface of the projectile. Its purpose is to center the forward part of the projectile as it travels through the bore.
- Body. The part of the projectile between the bourrelet and the rotating bands. It contains either a subprojectile or an explosive chemical filler and fuze, or all three.
- Rotating band or obturator. The hard plastic or metallic ring(s) around the base of the projectile. It seals the propellant gas behind the base of the projectile and imparts spin to a spin-stabilized round, or absorbs spin on fin-stabilized rounds.
- Tracer. An element inserted in the base of projectiles that, when ignited, burns and allows the projectile's trajectory and impact to be observed during flight.

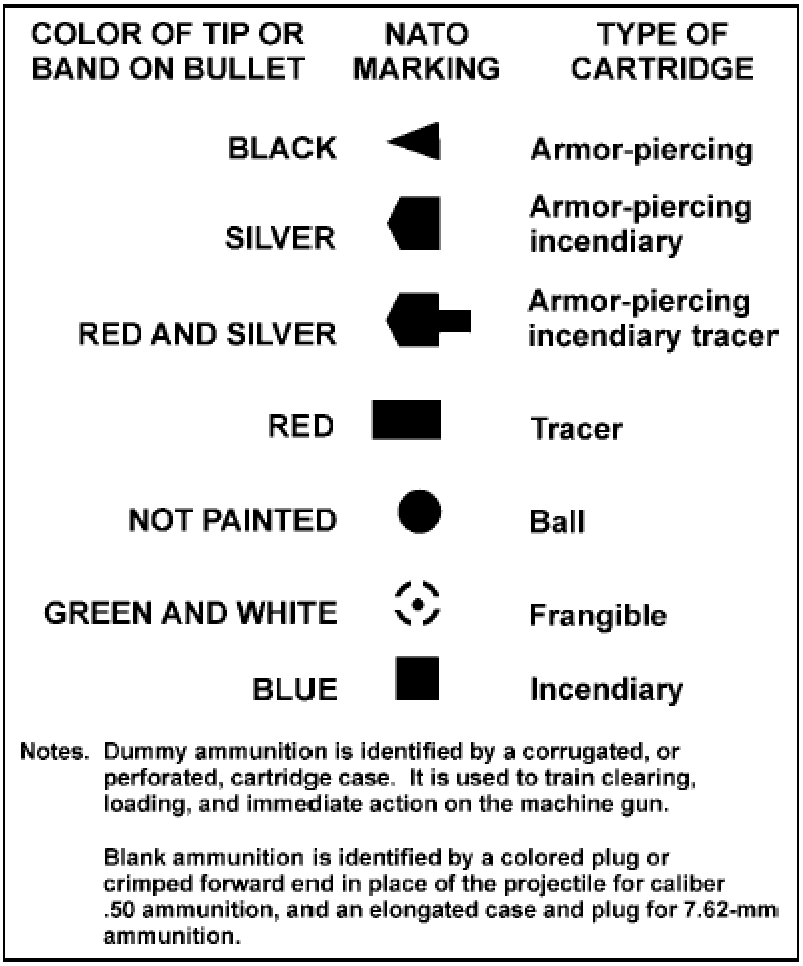


Figure 4-1. Standard NATO Color Codes For Ammunition

d. Armor-defeating Ammunition
Armor-defeating projectiles use either kinetic energy or chemical energy to penetrate and destroy armored targets.

Note:

30mm AP main gun rounds will not be fired over friendly troops, unless troops are protected by adequate cover. Troops may be struck by the discarded components, or a round malfunction may cause an air burst. The danger area extends to 1,000 meters (1,095 yards) from the gun and 70 meters (77 yards) on either side of the gun-target line.

(1) Armor Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) or Long Rod Long rod ammunition includes two basic types of ammunition:

- APFSDS-T, MK258, Armor Piercing Fin Stabilized Discarding Sabot-Tracer
- APFSDS-T, MK268, Armor Piercing Fin Stabilized Discarding Sabot-Tracer

Currently, a final selection of long rod ammunition has not been made. Long rod rounds are the primary armor-defeating round for main guns and the most accurate of all EFV ammunition. Long rod rounds use kinetic energy (the combined mass [weight] and velocity [speed] of the projectile) (no explosives are needed) to penetrate the target. The effectiveness of long rod rounds depends on the density of the target surface; therefore, consider target armor thickness when selecting the appropriate armor-defeating round for a specific target: use long rod ammunition when faced with penetrating heavily armored vehicles (IFVs) or heavily fortified emplacements. Also, when possible, maneuver or situate your element to engage armored targets from the flank or rear where the armor is less dense.

(2) MK 258 MOD 0 The MK 258 MOD 0 APFSDS-T cartridge is a scaled up version of the 25mm M919. It is a fixed round which features a high density, inert tungsten alloy, long rod penetrator sub-projectile held in a three petal aluminum sabot and plastic obturator projectile assembly. A three-piece plastic nose cap protects the penetrator ogive during ammunition handling. The projectile assembly is crimped into a steel cartridge case by a single 360 degree crimping ring. The cartridge case contains the single base, multi-perforated, extruded and impregnated propellant, flash tube assembly and Dynamit Nobel AG (DNAG 8235) percussion primer. The round is initiated by firing pin contact with the percussion primer. Upon exiting the muzzle at reduced spin, the sabot, obturator, and nose cap fall away radially and the penetrator continues to the target. Figure 4-2 shows an illustration of this round.

Performance Specification: WS 33595
DOD Hazard Classification: 1.2.2 C (Interim)
Salient Features:
Cartridge Dimensions: 30-mm X 173-mm (overall max length – 279.5 mm)
Cartridge Overall Weight: 735 gms
Nominal Projectile Weight: 229 gms
Nominal Penetrator Weight: 153 gms
Muzzle Velocity (Ave) @ 21°C (MK44 Automatic Cannon): 1430 m/s
NEW: 185.8 gms (NEW=Net Explosive Weight)
Tracer:
Designation: RS305
Quantity of Energetics: 1.15 gms
Designation: RS205
Quantity of Energetics: 0.15 gms
Propellant:
Designation: Wimmis PC 5214
Quantity: 184 grams
Primer:
Designation: Dynamit Nobel AG (DNAG 8235) percussion primer
Quantity of Energetics: 0.15 gms
Booster:
Designation: Dynamit Nobel AG (DNAG B01)
Quantity of Energetics: 0.35 gms
Manufacturer's Data:
Nordic Ammunition Company
Nammo Raufoss AS
Box 162, N-2831

Raufoss, Norway
Cage Code: N0017
Top Assembly Drawing No. 890789-000

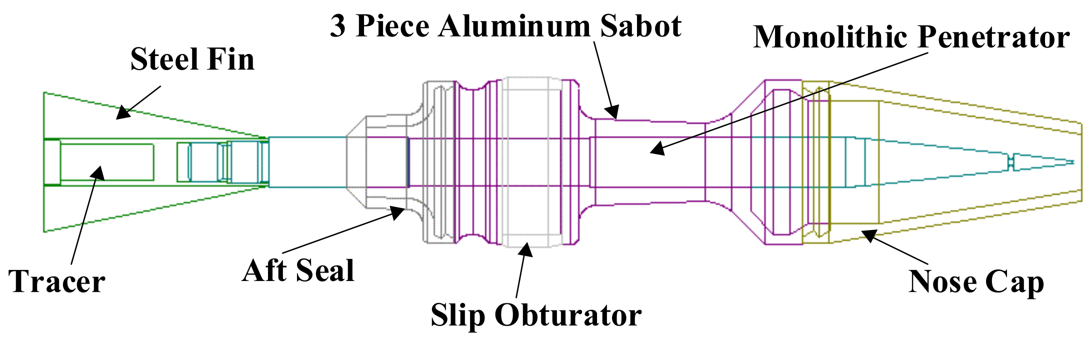


Figure 4-2. MK 258 MOD 0 APFSDS-T 30x173mm

(3) MK 268 MOD 0 The MK 268 Mod 0 APFSDS–T cartridge is a scaled-up version of the 25-mm APFSDS–T (PBM090) used by the Canadian Army. It is a fixed round a high-density, inert tungsten alloy, long-rod penetrator sub-projectile held in a plastic molded three-petal sabot and aluminum collar projectile body assembly. A single 360-degree crimping ring holds the projectile assembly in a steel cartridge case. The cartridge case a double base, multi-perforated, extruded and impregnated propellant propellant; a flashtube igniter assembly; and DNAG 8235 percussion primer. Upon exiting the muzzle at full spin, the sabot and collar release radially, and penetrator continues to the target. Figure 4-3 shows an illustration of this round.

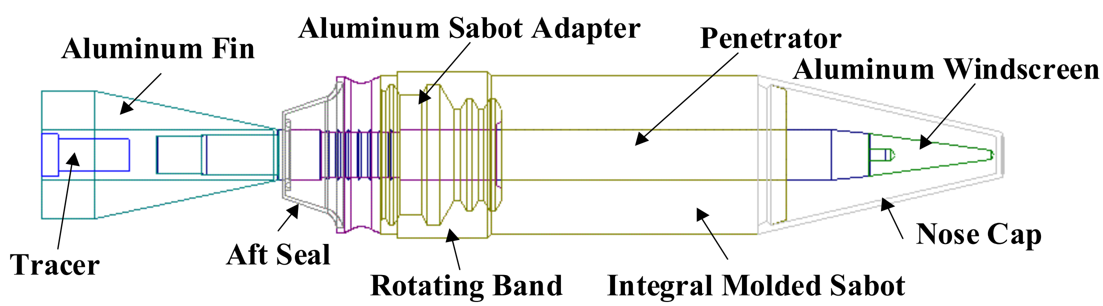


Figure 4-3. MK 268 MOD 0 APFSDS-T 30x173mm

e. High Explosive (HE) Ammunition
HE ammunition includes three basic types of ammunition:

- HEI-T, MK266 Mod 1B, High Explosive Incendiary-Tracer.
- MPLD-T, MK264, Multi Purpose Low Drag-Tracer.
- SAPHE-T, MK240, Semi Armor Piercing High Explosive-Tracer.

Currently, a final selection of HE ammunition had not been made.

HE ammunition is used primarily against dismounted infantry, lightly armored targets, unarmored vehicles (trucks, etc.), and materiel and lightly fortified infantry emplacements. HE ammunition can be used against troops when blast concussion and fragmentation are desired. It can also be used against buildings and crew-served weapon emplacements at extended ranges. It is relatively easy to observe this round due to its high trajectory and relatively slow muzzle velocity. It has greater blast, concussion, and fragmentation effect than long rods. HE ammunition has an armor-defeating capability against lightly armored targets.

(1) MK 266 Mod 1 HEI-T HEI-T ammunition is used when blast and fragmentation are the primary desired terminal effects. HEI-T ammunition also has a limited ability to start and sustain fires in flammable structures and materials. Due to the ammunition design and super-quick nose fuse, HEI-T ammunition will not penetrate well against armored targets or fortified positions. HEI-T will strike the target and the fuse initiates the explosive filler super-quick causing blast and fragmentation. HEI-T ammunition is effective against dismounted infantry and unarmored targets. HEI-T ammunition will have some suppressive effect against armored targets and fortified positions by flattening tires and damaging optics of wheeled armored personnel carriers (APCs) and causing the occupants of fortified positions to duck in order to avoid fragmentation that may enter bunker embrasures, etc.

The MK 266 MOD 1 30-mm x 173-mm High Explosive Incendiary - Tracer (HEI-T) Cartridge is a fixed round which features a steel projectile body assembly crimped into an aluminum cartridge case by a single 360° crimping ring. The projectile contains PBXN-5 as the main charge explosive, a zirconium pellet for incendiary effect, tracer and incorporates a single, wide, plastic rotating band. The nose-mounted fuze is the FMU-151/B Point Detonating. The cartridge case contains the single base (approx. 90 % Nitrocellulose) propellant, flash tube assembly and percussion primer.

Performance Specification: TBD
DOD Hazard Classification: 1.2.2 E (Interim)
Salient Features:
- Cartridge Dimensions: 30-mm X 173-mm (overall max length – 289.9 mm)
- Cartridge Overall Weight: 703 gms
- Nominal Projectile Weight: 400 gms
- Muzzle Velocity (Ave) @ 21°C (MK44 Automatic Cannon): 1040 m/s

NEW: 203.69 gms
Fuze:
- Designation: FMU-151/B Point Detonating
- Detonator Assembly Composition:
  - Priming Mixture: 0.005 gms
  - Lead Azide: 0.021 gms
  - RDX: 0.03 gms
- Lead Assy:
  - PBXN-5 (Type 1 Class 3): 0.6 gms

Explosive: PBXN-5

Quantity: 48 gms

Incendiary:

Quantity: 5.4 gms

Composition:	Zirconium	98 %
	Other	2 %

Tracer:

Designation: Igniter

Quantity of Energetics: 0.5 gms

Designation: Sustainer

Quantity of Energetics: 1.6 gms

Propellant:

Designation: RP-1315-FS

Quantity: 147 grams

Primer:

Designation: MK36A2 Percussion Primer

Quantity of energetics: 0.162 gms

Flash Tube:

Designation:

Quantity: 0.375 gms

Composition:

Black Powder

Manufacturer's Data:

Alliant Ammunition Systems Co LLC, a subsidiary of Alliant Techsystems Inc
Twin Cities Army Ammunition Plant Building 104
New Brighton, MN 55112
Cage Code: OMVU4
Top Assembly Drawing No. 28068727

(2) MK 264 Mod 0 MPLD-T MPLD-T ammunition is pyrotechnically initiated and functions in a delay type manner. There is no fuse, per se, in MPLD-T ammunition. The pyrotechnic initiation of MPLD-T occurs as the round strikes the target and loses velocity over time. This pyrotechnic initiation effectively provides a delay of approximately 6 m/s. When the round initiates, the explosive filler conflagrates and causes the projectile case to fracture and form a cone of relatively large fragments to be formed in an approximate 30 degree cone, forward along the line of flight. This functioning characteristic gives MPLD-T good capabilities against lightly armored targets and fortified emplacements. The round initially uses kinetic energy to begin to penetrate the surface of the target. As velocity is lost, the pyrotechnic chain initiates the filler and the fragment cone continues to penetrate using mechanical shear. In the case of a lightly armored target, such as a BTR, MPLD-T penetrates the vehicle armor and bursts as it enters the interior compartment, introducing blast energy and fragments into the interior of the vehicle. Additionally, MPLD-T has very good capability to start and sustain fires in flammable structures and materials, particularly diesel fuels. MPLD-T has only limited effectiveness against troops due to its tendency to ricochet upon contact with the ground and pass through the target area without the pyrotechnic chain initiating the filler.

The MK 264 MOD 0 Multi-purpose Low Drag - Tracer (MPLD-T) Cartridge is produced by NAMMO Raufoss of Norway. It is a fixed round with a pyrotechnic ignition providing semi-armor penetration capability, fragmentation and incendiary effects. The projectile shell body assembly contains the main charge explosive, an incendiary charge in both the aluminum nose cap and shell body, and self-destruct explosive. The self-destruct feature initiates on tracer burn through. The tracer is designed to burn for more than 3000 meters. The driving band is a single, wide band of Ultem 2100-1000. The projectile assembly is crimped into a steel cartridge case by a single 360-degree crimping ring. The steel cartridge case contains the double base (approx 7.5 % Nitroglycerine & 90% Nitrocellulose) propellant, flash tube assembly and percussion primer.

Performance Specification: WS 33603
DOD Hazard Classification: 1.2.2 G (Interim)
Salient Features:
    Cartridge Dimensions: 30-mm x 173-mm (overall max length – 290 mm)
    Cartridge Overall Weight: 840 gms
    Nominal Projectile Weight: 363 gms
    Muzzle Velocity (Ave) @ 21°C (MK44 Automatic Cannon): 1070 m/s
NEW: 189 gms (NEW=Net Explosive Weight)
Explosive:
    Designation: PBXN-5
    Quantity: 16 gms (approx)
Incendiary:
    Nose: Quantity of Energetics: 6 gms (approx)
    Shell Body: Quantity of Energetics: 2 gms (approx)
Self Destruct:
    Designation: A4
    Quantity: 2 gms (approx)
Tracer:
    Designation: RS302
    Quantity of Energetics: 8 gms
    Designation: RS202
    Quantity of Energetics: 1.5 gms
    Designation: RS251
    Quantity of Energetics: 1 gm
Propellant:
    Designation: NC 1316 (Bofors)
    Quantity: 152 grams
Primer:
    Designation: Dynamit Nobel AG (DNAG 8235) Percussion Primer
    Quantity of Energetics: 0.15 gms
Booster:
    Designation: Dynamit Nobel AG (DNAG B01)
    Quantity of Energetics: 0.35 gms
Manufacturer's Data:

Nordic Ammunition Company
Nammo Raufoss AS
Box 162, N-2831
Raufoss, Norway
Cage Code: N0017
Top Assembly Drawing No. 679033-000

(3) MK 240 Mod 0 SAPHE-T SAPHE-T ammunition has a dual function capability not available from either HEI-T or MPLD-T ammunition. SAPHE-T ammunition has a delay functioning base fuse and will penetrate lightly armored targets and fortified positions before the fuse initiates the explosive filler (approximately 6 m/s delay), where it provides effects much like the MPLD-T, except that the fragmentation pattern is a much broader cone. Additionally, SAPHE-T provides function similar to the blast and fragmentation of effects HEI-T when fired against dismounted infantry. When available, SAPHE-T is the preferred HE ammunition type for employment due to its broader application and effectiveness against the EFV target set.

The MK 240 MOD 0 Semi-Armor-Piercing High Explosive - Tracer (SAPHE-T) Cartridge is produced by Diehl of Germany. It is a fixed round with a Point Initiating Base Detonating Fuze providing semi-armor penetration capability, fragmentation, and incendiary effects. The steel projectile shell body assembly contains the main charge explosive, and an incendiary charge. The rotating band is a single, wide band. The projectile assembly is crimped into a steel cartridge case by a single 360-degree crimping ring. The cartridge case contains the single base propellant, flash tube assembly and percussion primer. At the time this handbook was written, the configuration of this round had not been finalized.

f. Target-Practice Ammunition
Target-practice ammunition is used during gunnery training in place of service ammunition. On the EFV, these rounds are nearly ballistically matched to service rounds out to approximately 1500 meters. Beyond this range, as the ballistic similarities decrease, their accuracy decreases. The fire control system on the EFV has the ballistics for each training round. In the fire command, target-practice rounds are announced as the round they represent. Their color code is light blue with white letters.

g. Machine Gun Ammunition
The EFV machine gun ammunition is belted in disintegrating metallic link belts. The 7.62-mm coax machine gun and the EFVC vehicle commander's machine gun use the M13 clip-type open link.

Machine gun ammunition is identified by type, caliber, model, and lot number. A color code on the bullet tip or band identifies the type. Markings are also located on packing containers.

h. Smoke Grenade Ammunition
The L8A1 and L8A3 red phosphorus and M76 infrared smoke grenades are fired from the grenade launcher mounted on the EFV to provide screening protection for the vehicle and crew. The M82 smoke grenade is designed to simulate the L8A3 and M76 smoke grenade. The grenade launcher consists of two dischargers (one on either side of the turret), mounting hardware, arming and firing switches on the VC's and gunner's panel, and wiring. Four smoke grenades are loaded in each discharger.

Currently, it is expected that the only smoke grenade that will be in the USMC inventory when the EFV is initially fielded is the M76.

Smoke grenades contain fire-producing chemicals and are dangerous to exposed personnel outside the vehicle.

(1) L8A1 and L8A3 Smoke Grenades United Kingdom (UK) L8A1 and L8A3 red phosphorus screening smoke grenades are identified by the markings at the base of the casing. Figure 4-4 shows these rounds. The grenade is propelled from the discharger by pressure build-up in the metal base when electrical current at the electrical firing clip ignites the squib-type electric fuse and propellant charge. The propellant charge simultaneously ignites the delay composition within the delay holder. During flight, the delay composition burns through and ignites the black powder bursting charge. The bursting charge ignites the red phosphorus and butyl rubber composition and bursts the rubber body, dispensing the burning red phosphorus and butyl rubber pellets to produce a smoke cloud.

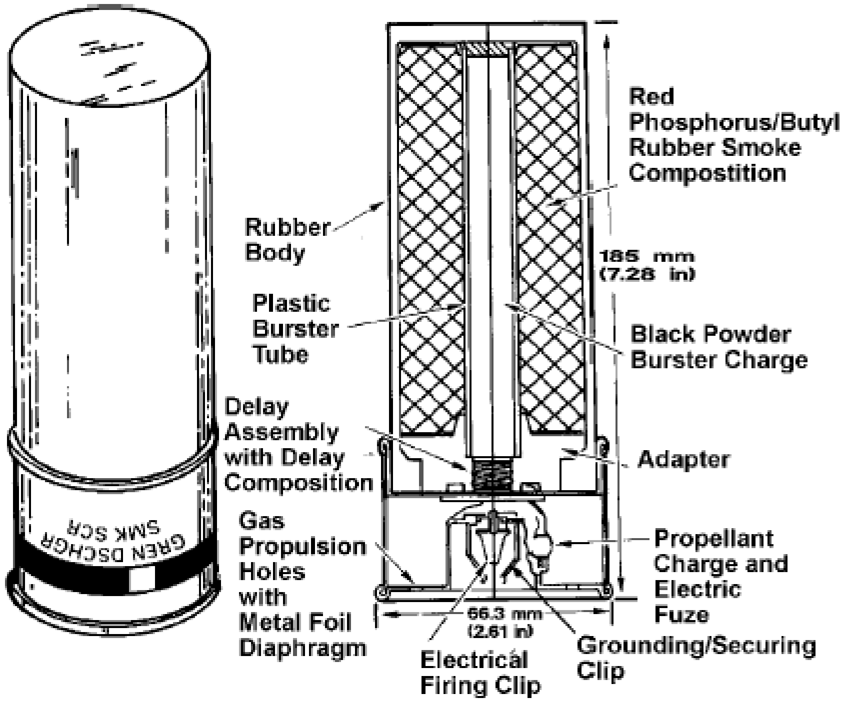


Figure 4-4. L8A1 and L8A3 Smoke Grenade.

(2) M76 Smoke Grenade The M76 infrared screening smoke grenade is identified by the markings at the base of the casing. Figure 4-5 shows this round. The grenade is propelled from the discharger when an electrical current at the firing contact activates the electrical match. The electrical match ignites the propellant, which both launches the grenade and ignites the pyrotechnic time delay detonator. Launch acceleration causes the setback lock to displace aft, out of engagement with the safe and arm slider/bore rider. When the slider/bore rider clears the launch tube, it moves into the armed position, which aligns the transfer lead with the time delay detonator and the booster lead. When the time delay detonator ignites the transfer lead, booster lead, and central burster, the grenade bursts, creating an infrared obscuring cloud.

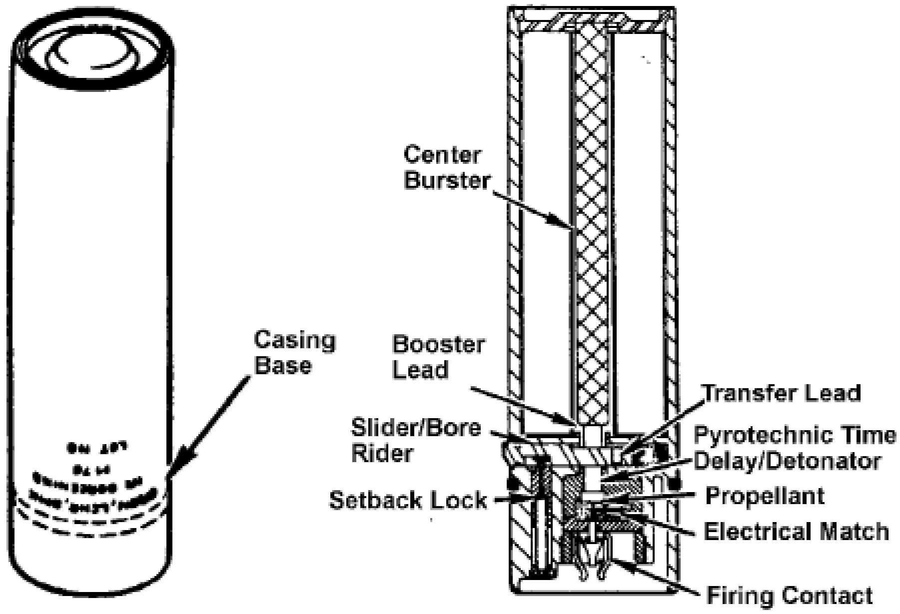


Figure 4-5. M76 Smoke Grenade.

(3) M82 Smoke Grenade The M82 smoke grenade is identified by the markings at the base of the casing. Figure 4-6 illustrates this round. The M82 is an electronically initiated, propellant-launched grenade that functions to disseminate a screening cloud 30 meters forward of the firing vehicle. The environmentally acceptable smoke composition consists of 1.8 pounds of titanium dioxide. The grenade's plastic body houses the launch system, the safe and arming mechanism, the explosive booster and burster, and the smoke composition. The M82 is designed to simulate the L8A3 and M76 smoke grenade and can be used during gunnery or force-on-force training. This grenade is a visual spectrum grenade. It does not provide screening within the IR or radar spectrums.

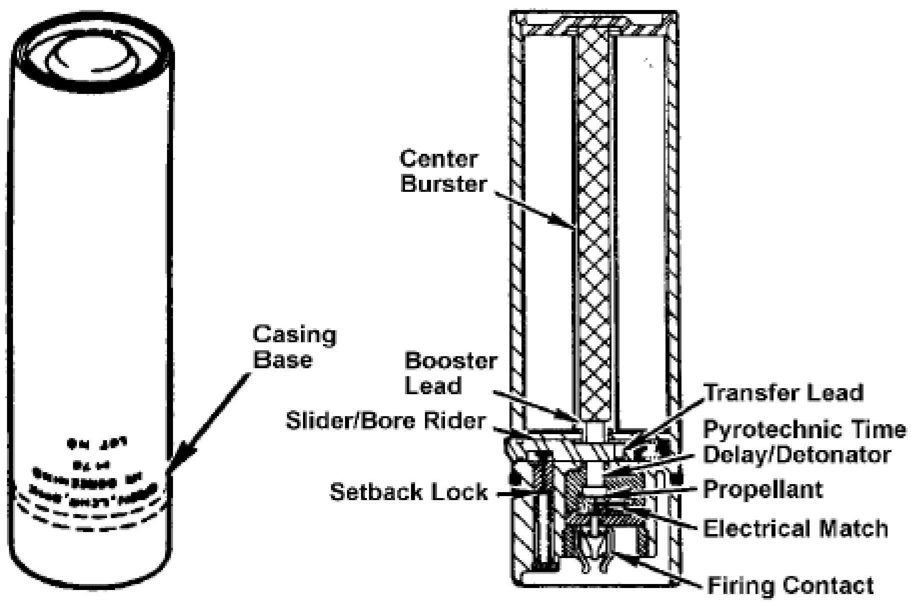


Figure 4-6. M82 Smoke Grenade.

4003. Boresight and Zero

For boresight and zero procedures for the main gun and COAX consult the IETM.

4004. Target Acquisition

Speed and accuracy of engagement depend on crew proficiency in target acquisition; yet target acquisition is one of the hardest gunnery tasks to train effectively. Target acquisition is the timely detection, location, and identification of targets in sufficient detail to permit accurate attack by either direct or supporting fire. Effective target acquisition requires the combined effort of all three EFV crewmen and embarked infantry as appropriate. EFV crews must be proficient in the techniques and procedures of both target acquisition and conduct-of-fire to engage the enemy successfully in combat. This paragraph describes the target acquisition process, discusses methods for acquiring and classifying targets, and relates target acquisition confirmation to the conduct-of-fire process.

a. Target Acquisition Process

The target acquisition process is a series of progressive and interdependent steps or actions by which an EFV crew acquires enemy targets for destruction. It is a continuing requirement for all EFV crewmembers, whether in the offense or defense, moving or stationary. There are six steps in the target acquisition process:

- C*rew search* is the crew's collective efforts, using both the unaided eye and vehicle optics within assigned sectors of observation, to survey for enemy presence.

- D*etection* is the discovery of any phenomena (personnel, equipment, and objects) that is potentially a target.
- *Location* is the determination (by direction, reference point, or grid) of where a potential military target is on the battlefield (ground or air).
- *Identification* is the friendly, hostile, or neutral character of a detected potential target, determined by its physical traits (such as size, shape, and functional characteristics).
- *Classification* is the categorizing of a potential target by the relative level of danger it represents.
- *Confirmation* is the rapid verification of a target in terms of the initial identification and classification.

During conduct of fire the VC and gunner must confirm that the target is properly identified as enemy and classified before engaging. At section and platoon level, leaders must make sure the target acquisition process is outlined for their specific mission.

In the offense, sectors of observation vary due to terrain and weather conditions. As the unit moves, the unit leader must make sure all areas within the unit's sector are covered. The unit leader adjusts sectors using TRPs, prominent terrain features, or other graphic control measures. Unit leaders must also decide which vehicles will scan using daylight sights and which vehicles will use thermal sights. Air guard and ATGM observers must also be designated. The unit may be required to make these adjustments from a short halt (overwatch) to ensure maximum target acquisition and fire distribution.

In the defense, the same rules apply. When constructing the unit fire plan, the unit leader must make sure that dead space, secondary avenues of approach, and obstacles not covered by direct fire are observed continuously. Overlapping observation and fires, both within and between units, must also be planned in the defense.

b. Crew Search

Crew search, or observation, is the act of carefully viewing or watching the area of operations, using search and scan techniques and sectors of observation, to acquire targets.

EFV crews and units each have sectors of responsibilities when conducting a search for targets. Terrain, visibility conditions, vehicle positioning, and fire distribution planning dictate the distance (depth and width) an EFV crew, section, or platoon must cover. Each vehicle's sector of fire and observation must overlap with the sectors of adjacent vehicles. Based on these factors, the VC and gunner must coordinate how they will cover the vehicle's assigned sector, for both the offense and defense. Sectors of responsibility are areas assigned to each crewmember, and embarked infantry as appropriate, for search and target acquisition. Standard sectors of observation depend on turret orientation for all crewmembers except the driver and embarked infantry. Crewmembers must know their assigned sectors of observation to ensure 360-degree coverage of the battlefield. When operating with the section or platoon, each vehicle's 360-degree coverage will create overlapping fields of observation.
Sectors are normally assigned as follows:

- The VC's sector of responsibility is 360-degrees. However, when embarked infantry observes from the rear cargo hatches, the VC’s primary focus is in the forward 180-degree arc.
- The gunner's sector is along the axis of the main gun, within the limits of the CMS in three times magnification.
- -The driver's sector is to the port and forward, to the limits of his vision blocks.
- The embarked troop commander’s (TC’s) sector overlaps that of the driver forward and extends to the limit of his vision blocks to the starboard.

During buttoned-up operations, the EFV crew's ability to acquire targets is reduced by at least 50 percent. The crew must make sure all vision blocks and sights are clear and free of obstruction. During buttoned-up operations, it is critical that vehicles within the section and platoon work together to cover areas of potential dead space. This is best accomplished by employing appropriate combat formations or techniques of movement to ensure that the most seamless all around observation is maintained. Within the vehicle crew, heightened vigilance is critical. The sectors of responsibility for the crew must be altered as follows:

- VC must observe 360-degrees using his vision blocks covering the area that may be covered by embarked infantry observing from the rear hatches when not buttoned up.
- Gunner remains the same.
- Driver remains the same.
- TC remains the same

Notes. When preparing for operations, each crew must make sure that the seats, foot stands, safety guards, and hatches are checked and adjusted to support the crew in target acquisition. This is especially true for the VC when in the open-protected or buttoned-up mode. Regardless of the technique used, the crew tries to reduce its assigned sector to a manageable level to ensure that neither crew member is required to manipulate the gun and turret excessively and that the crew can rapidly acquire, identify, and engage targets.

c. Dismounted Observer
When the EFV is in a hide position, a dismounted observer forward of the position, either an EFV crewman or the dismounted infantry, equipped with binoculars and landline communications, can provide effective observation. The observer(s) must be able to provide information such as friendly and enemy vehicle movement, location, and number. They must also know if civilian or neutral vehicles are in the area. The observer is the eyes and ears of the VC.

d. Ground-Search Techniques
Crewmembers will scan their areas of observation at all times to detect targets or possible target signatures. Three ground-search techniques (rapid scan, slow scan, and detailed search) enable crewmembers to locate targets quickly. All crewmembers may use all three techniques simultaneously, using the unaided eye, binoculars, or vehicle optics.

(1) **Rapid-Scan Technique** The rapid-scan technique is used to quickly detect obvious signs of enemy activity (see figure 4-7). It is usually the first method used, whether the EFV is stationary or moving. The VC will use binoculars or the unaided eye and the gunner will use the CMS (daylight channel or thermal). To use a rapid-scan technique do the following:

- Start in the center of the sector and rapidly scan from the nearest to the farthest visible point.
- Then, orient left or right and conduct a rapid scan, near to far. This sweep must overlap the center area previously scanned.
- Once one side of center is scanned completely, scan the other side the same way.

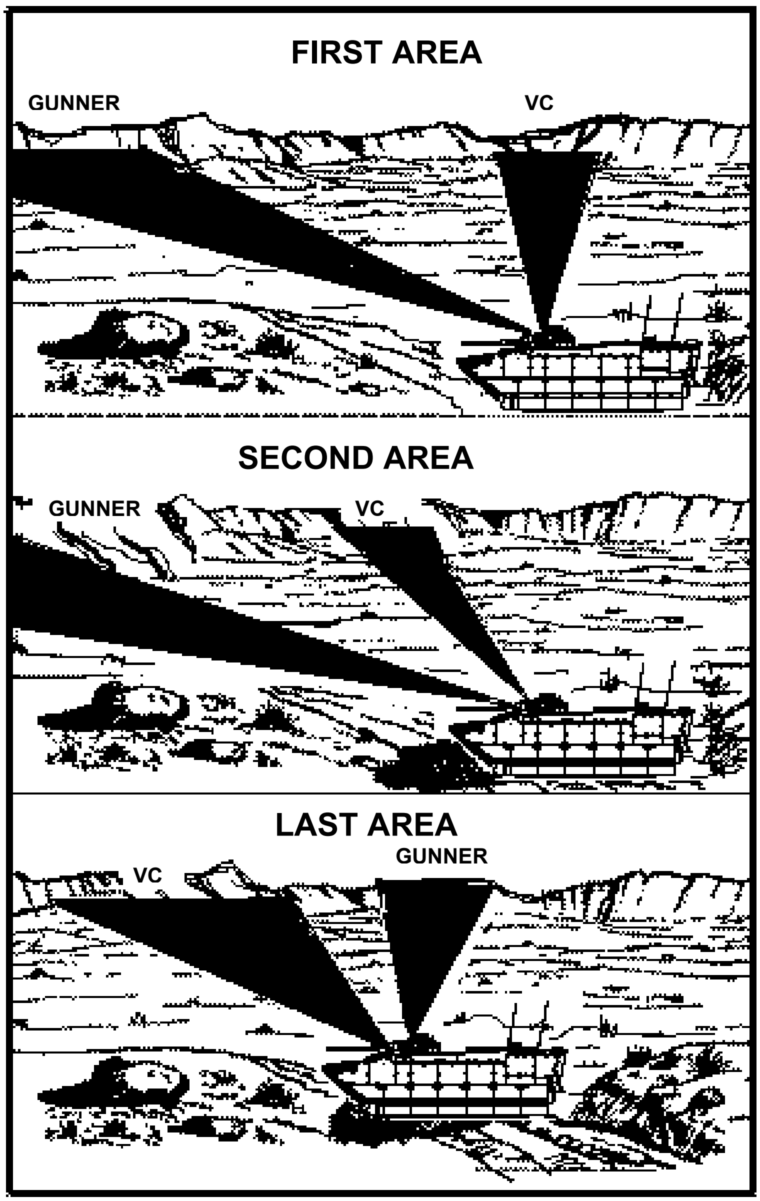


Figure 4-7. Rapid Scan Technique

(2) Slow-Scan Technique If no obvious targets are identified during the rapid scan, crewmembers will scan the terrain more deliberately, using the EFV's optics or binoculars and the slow-scan technique (see figure 4-8). The slow-scan technique is best employed by the VC or gunner in a defensive position or from a short halt. To perform a slow-scan you must:

- Pause at short intervals to give the eyes time to focus, search a strip of the target area using the height of the CMS reticle in 10X as a reference, from right to left.
- Then, search a strip farther out, from left to right, overlapping the first strip.
- Continue until the entire target area is searched.
- When a suspicious area or possible target signature is detected, stop and search the immediate area thoroughly, using the detailed-search technique.

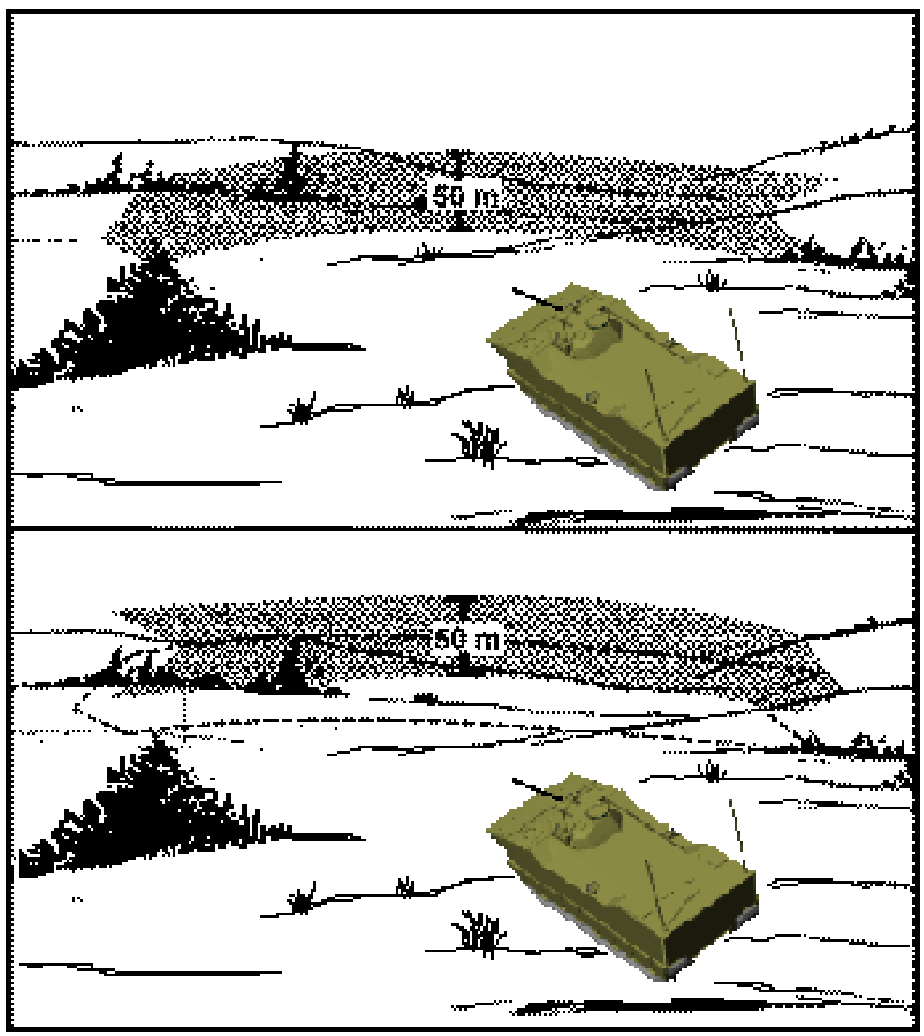


Figure 4-8. Slow-Scan Technique.

(3) Detailed-Search Technique If no targets are found using the rapid-scan or slow-scan techniques and time permits, crews should use their optics (day and night) to make a careful, deliberate search of specific areas in their sector (see figure 4-8). This method is also used to search, in detail, small areas or locations with likely or suspected enemy activity. To conduct a good detailed search:

- Concentrate on one specific area or location, and study it intensely.
- Look for direct or indirect target signatures by sweeping left and right of the focal point (terrain feature) of the area.

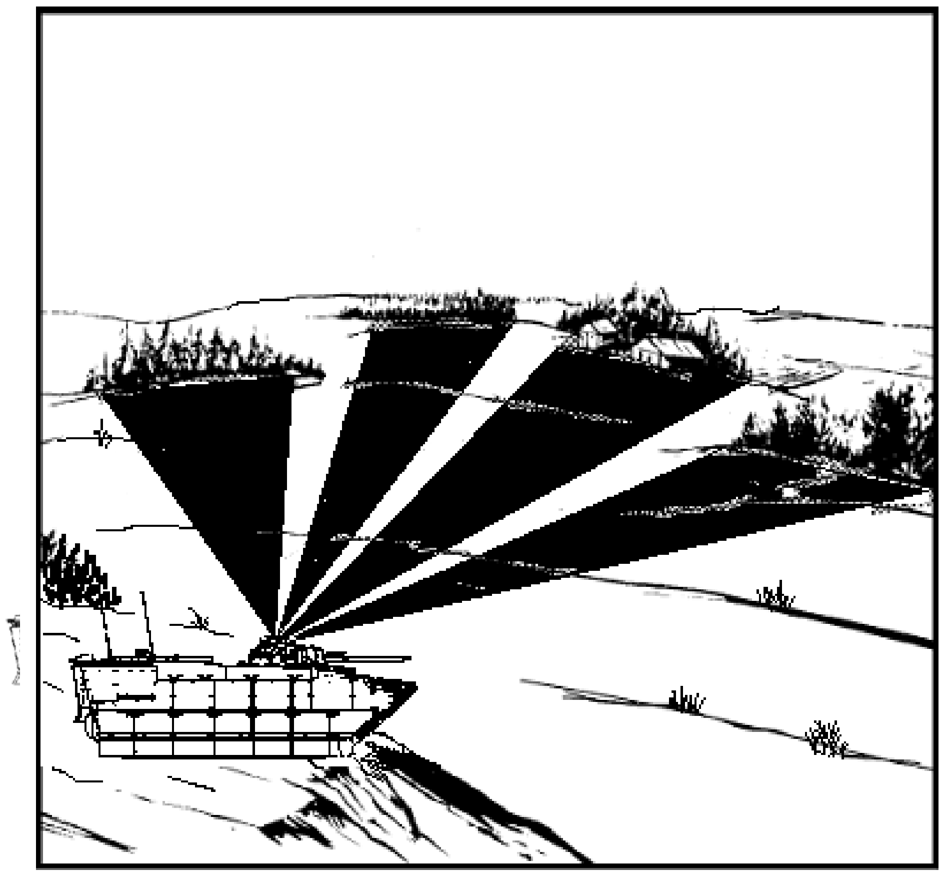


Figure 4-8. Detailed-Search Technique.

e. Off-Center Vision

Day and night scanning techniques (rapid scan, slow scan, and detailed search) are similar, with one exception. Do not look directly at an object at night, using daylight optics or the unaided eye; look a few degrees off to the side (off-center vision). When scanning with off-center vision, move the eyes in short, abrupt, irregular movements. Pause a few seconds at each likely target area to detect any movement. If a possible target is detected, use off-center vision to observe it.

Frequent eye movement is necessary to prevent object fade-out while observing the object. Cupping the hands around the eyes will also increase night vision.

f. Air-Search Techniques
While scanning their assigned sector for ground targets, crewmembers must also be aware of air targets. To aid in the detection of air targets, crews should use the horizontal search-and-scan technique or vertical search and-scan technique. Crewmembers should periodically check the air space above their assigned sector using the rapid-scan technique. As each crew member completes a rapid scan across the sector and his field of view meets the horizon, he should switch to a detailed search and make a careful, deliberate search of tree lines, valleys, and possible air corridors silhouetted by distant background terrain.

Attack helicopters try to engage at extremely long ranges; therefore, target identification is difficult. Crews must make every effort to correctly identify the target. To prevent fratricide, leaders must keep crews informed of friendly aircraft operating in their unit's sector.

Based on METT-T, the unit commander may establish one or more air guards. An air guard is a designated vehicle (or vehicles). The air guard is primarily responsible for detecting and engaging aerial targets. An air guard crew searches for aerial targets in the same manner as other crews. Gunners search their assigned sector using the search and scan techniques. However, sector limits established for the gunner must cover likely helicopter locations/avenues of approach and gunners must make sure ground reference points are always within their field of view.

(1) Horizontal Search and Scan Search up to 20 degrees above the horizon by moving the eyes in short movements across the sky, working your way up and across. Continue the scan pattern below the horizon to detect aircraft flying nap-of-the-earth. See figure 4-10.

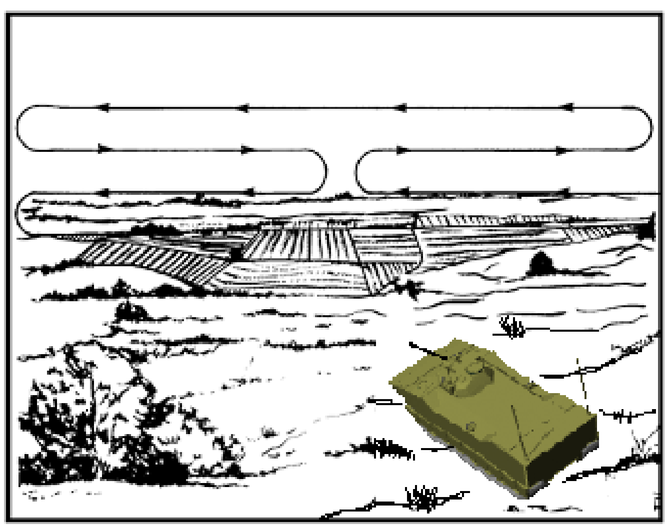


Figure 4-10. Horizontal Search and Scan.

(2) **Vertical Search and Scan** Search the sky using the horizon as a starting point and prominent terrain features as points of reference. Move the eyes in short movements into the sky, then back down, continuing this movement across the terrain. Scan in the same pattern below the horizon to detect aircraft flying nap-of-the-earth. See figure 4-11.

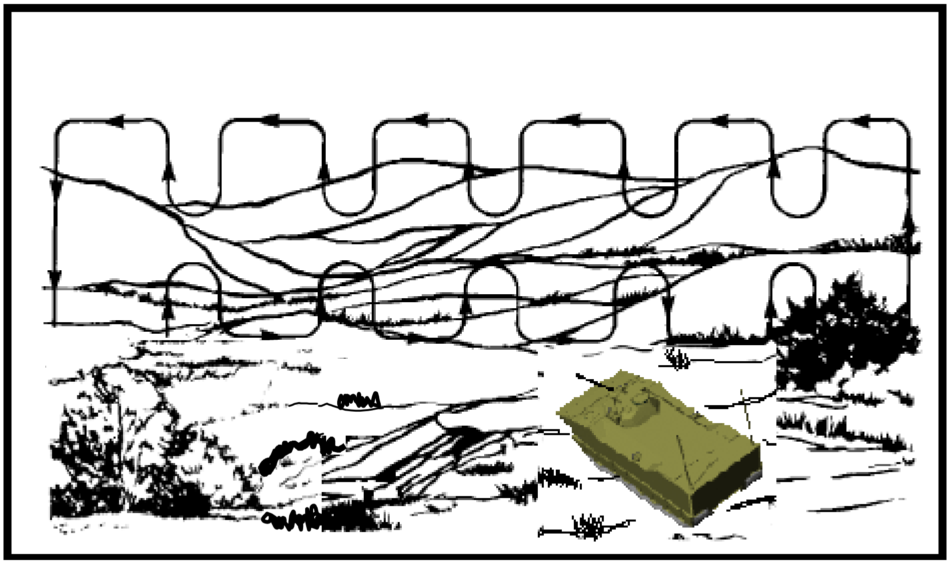


Figure 4-11. Vertical Search and Scan.

(3) **Estimation of Upper Search Limits** When scanning the sky for aircraft, crewmembers may miss high-flying aircraft if they limit their search too near the horizon; yet, they are likely to miss low-flying aircraft if they expand the upper limits of their search too high above the horizon. The correct upper limit of search is 20 degrees. Estimate 20 degrees using the technique illustrated. With the fingers fully spread, the tip of the thumb is the upper search limit. See figure 4-12.

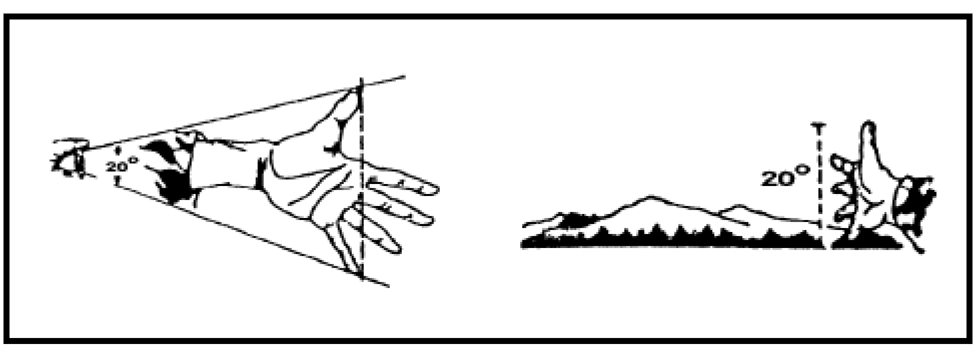


Figure 4-12. Estimating 20 Degrees.

g. Target Detection
Target detection is the discovery of objects on the battlefield (personnel, vehicles, or equipment) of potential military significance.

(1) Target Signatures Target signatures are telltale indicators (clues) that help an observer detect potential targets on the battlefield. Most weapons and vehicles have identifiable signatures. These distinguishing characteristics may be the result of equipment design or the environment in which the equipment is used:

- Firing a weapon produces blast, flash, dust, smoke, and noise.
- A tank, IFV or APC moving through a built-up area makes much more noise than one moving through an open field.
- Fixed-wing and rotary-wing aircraft produce noise such as a fast-moving jet aircraft breaking the sound barrier, and light reflected off aircraft windows, canopies, or rotating blades.
- Helicopters produce dust or excessive movement of treetops and bushes caused by rotor wash.

Look for targets where they are most likely to be employed. Look for track vehicle signatures in open areas and rolling terrain. Enemy antitank positions will cover primary avenues of approach where tanks and APCs are likely to be used. Look for helicopters on the backside of woodlines, ridgelines, and significant folds in the terrain. These are only a few examples of signatures with which crews must be familiar. Sight, sound, and smell can all assist in detecting signatures that may lead to target location and identification.

(2) Dismounted Infantry Signatures Some examples of dismounted infantry signatures are:

- Fighting positions.
- Broken vegetation.
- Footprints.
- New and old fires.
- Thermal signatures viewed through thermal optics.
  - Exposed skin areas are more visible than clothes.
  - Hot weapons are more visible than cold weapons.
  - Hair and glasses are less visible than exposed skin.

(3) Track-Vehicle Signatures Some examples of track-vehicle signatures are:

- Vehicle tracks on ground.
- Engine noise.
- Exhaust smoke.
- Dust clouds from movement.
- Weapon firing reports, and smoke.

- A bright white flash at night.
- Thermal signatures viewed through thermal optics:
  - Suspension and exhaust systems are more visible than the rest of the vehicle and the surrounding area.
  - A gun tube that has just fired is more visible than one that has not.
  - Normally, vehicles are more visible than the surrounding area and are readily visible through the thermal sight, when weather conditions permit.

(4) Antitank Signatures Some examples of antitank signatures are:

- The *swish* noise of a missile launch.
- Long, thin wires from previously fired ATGM.
- The sharp *crack* noise of an ATGM being fired.
- A soldier dismounted with an ATGM, may be within 100 meters of a PC.
- Thermal signatures viewed through thermal optics.
  - The suspension system and engine exhaust is more visible on track vehicles.
  - The engine exhaust, wheels, and windshield are more visible on wheel vehicles.
  - A fired ATGM leaves a distinct hot spot, more visible than the surrounding area.
  - A dismounted soldier has the same characteristics as listed under soldier signatures.

(5) Artillery Signatures Some examples of artillery signatures are:

- A loud, dull explosive noise.
- A grayish white cloud of smoke.
- A bright orange flash with black smoke from airbursts.
- A rushing noise heard several seconds before the impact of a round.
- Thermal signatures viewed through thermal optics.
  - Self-propelled artillery has the same thermal signature as a track vehicle.
  - Towed artillery signatures vary according to the towing vehicle.

(6) Aircraft Signatures Some examples of aircraft signatures are:

- Aircraft noise.
- Glare of sun from canopies, wings, and fuselages of fixed-wing aircraft, as well as windows and rotor blades of helicopters.
- Vapor trails from engine exhaust and fired missiles.
- Dust and movement of foliage from hovering helicopters.
- Thermal signatures viewed through thermal optics.
  - Fixed-wing aircraft are more visible than the surrounding sky.
  - Helicopters, once they unmask, are more visible than the surrounding area.

(7) Obstacles and Mines Some examples of obstacle and mine signatures are:

- Loose or disturbed dirt in regular patterns.
- A previously destroyed or disabled vehicle that appears to have struck a mine.
- Troop positions and vehicles covering obstacles and mines.
- Thermal signatures viewed through thermal optics. (Loose dirt is more visible than packed dirt.)

(8) Detection Challenges Some targets are more difficult to detect than others are. Increased crew sustainment training and greater concentration are needed to detect and locate these targets. The tactical tables were designed to meet many of these challenges in training. Some examples of these more difficult targets and detection challenges are:

- Targets on the extreme edge of the field of view (peripheral targets).
- Targets that are camouflaged or in shadows.
- Targets that can be heard but not seen.
- Targets under less than ideal indirect-fire illumination. (If the illumination is in front of the target, the resulting shadow will be darker than the target. If the illumination is behind the target and not in position to *wash out* the crew's optics, the target should stand out distinctly from the background. Always keep one eye closed during illumination search, and never look directly into the illumination source.)
- Small, single targets such as a lone, dismounted ATGM or RPG position.
- Natural obstacles (such as weather and terrain).
- Man-made obstacles (such as smoke and battlefield clutter).
- Behavioral or physical deficiencies (such as fatigue and eye reaction to gun flashes).

The following tips will help detect targets:

- Scan with the unaided eye first, then with magnifying optics. All EFV optical devices can be used to acquire targets at ranges beyond the extent that the unaided eye can see; however, the thermal sight is the preferred optics for searching and detecting targets, day or night.
- VC and gunner should not scan and search the same sector in the same manner; they should alternate sectors. (For example, when the gunner is searching the left sector with the thermal, the VC should be searching the right sector with binoculars.)
- While scanning, crewmembers should shield their eyes from the blinding effects of the sun. Looking directly into the sun will cause them to miss targets coming from the sun's direction. Squinting changes the eyes' focal length, which helps bring distant targets into focus.
- Turn down the dome light, panel lights, and illuminated reticles in the optics to increase the ability to acquire targets during day or night observation. This will also decrease the possibility of being acquired by enemy gunners using passive sights.

- Do not overlook targets at the edge of the peripheral field of view, where they are harder to detect and locate. Protective masks narrow the field of view. When masked, crewmembers must compensate by moving their heads more. Concentrate search in areas where targets are more likely to appear, such as identified avenues of approach, woodlines, and reverse-slope firing positions.
- While on the move, continue to search for targets. The VC must continuously reassign sectors for scanning and searching based on visibility and changes in the terrain.
- When searching for aerial targets, especially above the horizon, frequently focus their eyes on a distant object, land feature, or even a cloud to prevent distant objects from becoming blurred. Once an aircraft is spotted, crewmembers should keep their eyes on it. If it is necessary to look away, remember exactly where the target was and its heading direction from a specific point, such as a cloud or terrain feature. This will help sight the target again in less time.

h. Target Location

Target location is the determination of where a potential target is on the battlefield. Locating a target occurs as a result of observation and detection during crew search. The target location methods used by EFV crewmen to fix or locate a target for another crewmember depend on the individual's specific crew position, the unit SOP, and available time.

(1) VC Override Method This method may be the fastest, most accurate method of target location. After acquiring the target, the VC lays the gun for deflection with his power control handle. The gun on the EFV is laid for deflection when the target appears slightly to the left of the end of the gun tube, as viewed from the VC's position.

(2) Traverse Method The traverse method is a relatively quick method. It is used primarily by the VC to get the gunner on target when the VC cannot use his power control handle to guide the gunner. (Example: "TRAVERSE LEFT (RIGHT) STEADY ON."

(3) Reference Point Method The reference point method is used with the vehicle optics. The VC uses his binoculars to determine the mil value from a terrain feature or known position. He then announces the mil value to the gunner. The gunner uses the mil reticle relationship to traverse onto the target. The key to this location method is VC and gunner familiarity with the mil sight relationship. (Example: "ATGM- TRP ONE THREE THREE-RIGHT FIVE MILS.") The reference point method is used by all crew members to hand over targets in the vicinity of a TRP. (Example: "TWO IFVS- TRP ONE THREE FOUR.")

(4) Clock Method The clock method is one of the fastest methods used to get the VC or gunner on target. The crew bases 12 o'clock on the direction of vehicle movement while traveling and on hull orientation when stationary. Drivers and TC's usually use the clock or sector method to locate targets for the VC or gunner. (Example: "IFV-NINE O'CLOCK.")

(5) Sector Method Similar in concept to the clock method, the sector method is quick. It is best used to indicate a direction from the vehicle's direction of movement (moving) or hull orientation (stationary). Center sector is always to the direct front. (Example: “THREE PC’s – LEFT REAR.”)

(6) Sketch Card Method This method is used in defensive positions. When preparing the sketch card, the VC will have the gunner identify specific terrain features, TRPs, and section or platoon targets within both his sector of fire and adjacent sectors. When the VC needs to shift fires, the gunner will know exactly where to look for targets. Sketch cards must be carefully integrated with the fire plans of dismounted infantry.

(7) Grid Method The grid method is the least desired technique, due to the length of time it takes to bring the gunner on target. The VC receives the location of a target by map grid (usually from a listening post or observation post). The VC then uses his map to orient the main gun into the target area.

i. Target Identification
Target identification is the determination that a potential military target is a particular object (such as a specific vehicle, by type). As a minimum, this identification must determine the potential target as friendly or enemy. EFV crews must know what to engage and what not to engage.

The EFV crew's only method of positive vehicle identification is visual. As engagement ranges increase, camouflage techniques improve, and battlefield obscuration increases, the effectiveness of visual identification greatly diminishes. Being able to identify first gives an EFV crew the advantage of engaging first and destroying the enemy. The crew should identify targets as friend, foe, or neutral at the maximum range, depending on visibility. Repeated crew sustainment training and evaluation on target identification is the key to proficiency.

Target identification training is an essential part of any weapon system proficiency training program. VCs must continually train their crews in target identification using both thermal and day sights, with binoculars, and through vision blocks.

EFV crew vehicle and aircraft (target) identification training programs should incorporate some or all of the following references:

- STP 21-1-SMCT, Soldiers Manual of Common Tasks.
- GTA 17-2-13, Armored Vehicle Recognition (Study Cards 1-52).
- GTA 44-2-17, 18 and 19, Combat Aircraft (recognition cards).
- Recognition of Combat Vehicles (ROC-V).

Unit S2s have more information on identifying vehicles, aircraft, and equipment likely to appear on the battlefield. Keep in mind that in many parts of the world, potential enemies may possess a mix of allied and enemy-made vehicles making it difficult to distinguish a vehicle as a friendly or enemy target.

j. Target Acquisition Reports

Targets acquired by a crewmember are immediately reported to the VC with an acquisition report. This target hand-over procedure may take place during any of the three target acquisition phases (detection, location, or identification) and must take place before the classification step of the target acquisition process.

An acquisition report consists of three elements: alert (optional), description, and location (optional for gunner only). (Example: "DRIVER REPORT, MOVING PC, LEFT FLANK.")

The acquisition report is given internally between crewmembers who can readily identify each other (crew position) by voice.

Therefore, the description element of the report usually serves as the alert element also. (Example: "MOVING IFV˜ ONE O'CLOCK" [VC and gunner recognize the driver by voice as initiator of the report].)

Note

An acquisition report by the gunner, driver or TC cannot be used as the alert or target description element of a fire command.

(1) Target Classification Target classification is the grouping of potential targets by the relative level of danger they represent. It is the fifth step in the target acquisition process and is determined by the VC after target acquisition has been completed. To defeat the many enemy targets that may appear on the battlefield, the VC must rapidly decide which targets present the greatest danger. Targets are classified as *most dangerous*, *dangerous*, or *least dangerous*.

Estimating the enemy array, target by target, leads to a priority of engagements. The VC further analyzes the targets in terms of *hard* (armored vehicle, concrete bunker) versus *soft* (truck, troops) and *point* (PC, truck) versus *area* (troops) to determine the proper ammunition and weapon system to use in an engagement. The VC must continuously revise the classification of targets as they are destroyed.

(a) Most Dangerous When the crew observes an enemy target with armor-defeating capabilities that appears to be preparing to engage them, the target is classified *most dangerous*. This type of target is the greatest threat and must be engaged immediately. If there is more than one, engage the closest one first. The crew should use alternate firing positions when engaging three or more *most dangerous* targets from a stationary (hull-down) position.

Smoke (indirect fire or on-board smoke grenades) may also be used to split targets or keep the enemy from observing your vehicle. Minimizing the number of rounds fired from any one position will help confuse the enemy about your vehicle's exact location.

(b) Dangerous When the crew sees a target with armor-defeating capabilities, but that target is not preparing to engage them, the target is classified *dangerous*. This type of target should be engaged after all *most dangerous* targets have been destroyed, unless otherwise

specified by the priority of engagements. Multiple *dangerous* targets are engaged the same as *most dangerous* targets, the closest one first.

(c) Least Dangerous A target that does not have an armor defeating weapon system, but can report you to one that does, is classified *least dangerous*. Engage this type of target after all *most dangerous* and *dangerous* targets have been destroyed, unless certain *least dangerous* targets have a high priority of engagement, as in the case of command and control vehicles.

(2) Target Confirmation Target confirmation is the rapid verification of the initial identification and classification of the target. It is the final step in the target acquisition process and is completed *during* conduct-of-fire. Confirmation takes place after the VC has issued all elements of the fire command, *except* the execution element, and as the gunner is completing his precise lay. Gunners also go through a confirmation step. For the gunner, the verification is simply that, as he makes his final precise lay, he assures himself that the target is hostile, not friendly or neutral.

The VC (examining the target through the Compact Modular Sight extension, if necessary) completes his evaluation of the target based on the target's appearance and his knowledge of the tactical situation. If the VC determines the target is hostile, he continues the engagement. If he determines the target is friendly or neutral, he announces "CEASE FIRE." If he cannot confirm the nature of the target, he continues to observe until he can.

If the gunner confirms that the potential target is hostile, he completes his final lay and engages the target on order. If the gunner determines the target is friendly or neutral, he announces "CONFIRMATION FRIENDLY" or "CONFIRMATION NEUTRAL" to the VC. If he cannot determine the nature of the target, he announces "CONFIRMATION DOUBTFUL." The VC will then determine whether to continue or terminate the engagement.

It is vital that VCs be kept informed of the current tactical situation to assist in target confirmation, especially in movement of friendly elements within or between battle positions, forward passage of lines, withdrawal of any covering force, or the movement of civilian vehicle traffic in the area of operations.

4005. Range Determination

Although the LRF is the principal means of determining range in the EFV, LRF malfunctions, environmental conditions, or target size may force the crew to use an alternate method. Alternate methods vary from the simple and quick recognition method to the more complex, time-consuming, but accurate mil relation formula. Additional methods include reticle relationship, ranging with the coax machine gun, flash-bang, adjacent EFVs, known range, and map. Each method is based on varying situations, conditions, and degrees of accuracy. Each of these methods should be practiced at every opportunity and individual performance checked using the LRF. There are two ways to conduct range determination. The first is immediate range determination and the other, deliberate range determination.

a. Recognition Method

With practice, range determination by recognition is quick and accurate; however, this method will not work with passive or thermal sights. The principle of the recognition method is simple. When the VC sees a target, he can determine the range according to what he recognizes. For example, if a target can be recognized as a IFV with the unaided eye, it is within 1,500 meters; if a target can be recognized as a IFV through magnifying optics (CMS, binoculars, and so forth), it is within 5,000 meters. Table 4-1 gives range estimations for targets as seen with the unaided eye and through magnifying optics (binoculars).

RANGE DETERMINATION	RECOGNITION METHOD	
Target	**Unaided Eye (meters)**	**Magnification 7 or 8 Power (meters)**
Tank crew, troops, machine gun, mortar, Antitank gun, antitank missile launchers	500	2,000
Tank, personnel carrier, truck, (by model)	1,000	4,000
Tank, howitzer, personnel carrier, truck	1,500	5,000
Armor vehicle, wheel vehicle	2,000	6,000

Table 4-1. Range Estimations for Targets

When using the recognition method, the size and clarity of the target in relation to its background must be considered. Some light and terrain conditions make a target seem closer; other conditions make it seem farther away. The target conditions may cause an error in estimating range by the recognition method.

- The target seems closer if:
  - -It is a bright, clear day.
  - -The sun in front of target.
  - -Targets are at higher elevations.
  - -It is a large target.
  - -Bright colors (white, red, yellow) are used.
  - -There is contrast.
  - -Looking across ravines, hollows, rivers, depressions.
  - -In the desert.
  - -At sea.
- The target seems farther if:
  - -Fog, rain, haze, or twilight exists.
  - -The sun is behind the target.
  - -Targets are at lower elevations.
  - -It is a small target.
  - -Dark colors are used.
  - -The targets are camouflaged.

b. Deliberate Range Determination Methods

(1) MIL Relationship Method The mil relation may be used in deliberate range determination. One mil equals a width (or height) of 1 meter at a range of 1,000 meters. The relationship of the angle, the length of the sides of the angle (range), and the width (height) between the sides remains constant. Figure 4-13 shows the constant relationship as the angle increases from 1 to 2 mils and the range increases from 1,000 to 2,000 meters. **Note**. Fire control systems use mils (m) to apply deflection and elevation corrections and measure angular velocity. One mil is equal to 1/6400 of a circle; there are approximately 17.8 mils in one degree.

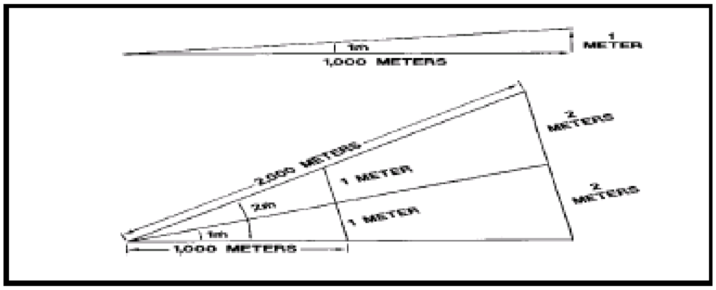


Figure 4-13. Constant Mil-Angle Relationship.

To determine range using the mil relation, the width, length, or height of the target must be known. (Accuracy depends on knowledge of target dimensions and the ability of the individual to make precise measurements with the binoculars.) Measure the width, length, or height with the binocular mil scale or a nonballistic reticle, substitute the mil relation, and compute the range. The relationship of the angle in mils (m), the length of the sides (or range) in thousands of meters (R), and the width between the ends of the sides in meters (W) is expressed as the mil relation. As a memory aid, the word WORM may be used, meaning width over range X mil or.

$$\frac{W}{R \text{ X } m}$$

The mil relation may be converted into a formula by removing the factor that is to be determined.
Thus: W = R X m | 1,000
or R = W | m X 1,000
or m = W | R X 1,000

The mil relation holds true whether the W factor is in a horizontal or vertical plane, if the mil angle is measured in the same plane. Because the mil relation is constant, other units of measurement such as yards, feet, or inches may be substituted for meters in expressing width or range; however, the relation holds true only if both W and R are expressed in the same unit. For example, if the sides of a 1-mil angle are extended to 1,000 yards, the width between the ends of the sides is 1 yard.

The following formula should be used when looking at the tank from the side view. **Example:** A T-72 is approximately 6.7 meters long (W). Using binoculars, the VC determines that the tank he sees is 5 mils (m) in length (W). Remove the R factor from the mil relation: W | m x 1,000. Substitute the two known values for W and m and solve for R: R = 6.7 | 5 = 1.34. Since R is in thousands of meters, multiply the answer 1.34 x 1,000 = 1,340 meters. This will be the range to the enemy tank.

The following should be used when looking at the tank from a frontal view. **Example:** A T-72 is approximately 3.3 meters wide (W). Using binoculars, the VC determines that the tank he sees is 2.5 mils (m) wide (W). Remove the R factor from the mil relationship: W | m x 1,000. Substitute the two known values for W and (m) and solve for R: R = 3.3 | 2.5 = 1.32. Since R is in thousands of meters, multiply the answer 1.32 x 1,000 = 1,320 meters. This will be the range to the enemy tank.

(2) Adjacent EFV Method Range information can be obtained from an adjacent EFV that has an operable LRF. If the EFV providing the range data is relatively close (lateral distance) to the receiving EFV, then it will be at the same range from the target.

(3) Map Method A map can also be used to determine range to a target. The VC finds his EFV's position and the target's position on a map, then he measures the distance between the two points on the map scale.

(4) Range Method When time permits the EFV crew to prepare a position for combat, one of the first things that should be done is to range to areas where targets are likely to appear. These known ranges are recorded on a sketch card. If the LRF is inoperative or cannot be used, recorded range data will significantly reduce engagement time and improve accuracy. The crew performs as in a normal engagement except that the gunner or VC manually indexes the announced range. The range to a previous target engagement is also classified as a known range.

(5) Flash-Bang Method Sound travels through the air at a fairly constant speed, about 330 meters (approximately 1,100 feet) per second. This makes it easy to estimate range, if the crew can see and hear the action. For example, when the crew sees the flash or smoke of a weapon, or the dust it raises, immediately start counting at a rate of one count per second. When the crew hears the report of the weapon, they stop; then multiply the number they were counting when they heard the report by the constant 330. This will be the range to the weapon in meters. If the crew stops on the number 3, the range is about 990 meters. The crew should practice timing the speed of the count. The best way to do this is to practice with pyrotechnics fired at known distances. If this is not possible, have someone time the count. When the count reaches a number higher than 10, start over again. Counting numbers such as 12 and 13 will throw timing off. With practice, crews can estimate range more accurately with this method than by eye alone.

4006. Direct Fire

EFV crews must be able to engage and destroy targets quickly and with a minimum expenditure of ammunition. To accomplish this, each member of the crew must know his particular job well enough that, in combat, his responses are automatic. Each crewmember must be familiar with the duties of the other EFV crewmen so that loss of one member will not destroy the fighting effectiveness of the EFV. This section discusses the fire commands, gunnery techniques, and crew duties required to effectively employ all EFV-mounted weapons.

a. Battlecarry

Battlecarry is a posture in which a EFV is prepared for an engagement at all times (the main gun feeder is loaded with ammunition, the AMMUNITION SELECT switch has selected HE or AP, and the gun select switch is in the TRIGGER SAFE position). The crew will place their EFV in a battlecarry posture before moving into a tactical situation or upon command from an approving authority. All engagements begin from this posture. This allows the crew to keep the fire control system prepared for an engagement at all times.

b. Fire Commands

All direct-fire engagements begin with a fire command. The fire command coordinates the crew’s effort, reduces confusion, and helps the crew engage targets faster. This section discusses the fire command elements, reduced fire commands, crew duties in response to fire commands, target engagements, and direct-fire adjustment techniques.

(1) Fire Command Elements The VC issues a fire command to his crew for each target engagement. Standard terminology and logical sequence are used to achieve effectiveness and speed of engagement. Only those elements necessary to select, aim, and fire the EFV's weapons are given. There may be as few as two or as many as six elements, depending on the situation. Table 4-2 provides examples of terminology used with each fire command used with each fire command.

Element	Example
Alert	"GUNNER"
Ammunition or Weapon	"SABOT"
Number and Mode of fire	“1 Burst”
Description	"PC"
Direction (optional)	"TRAVERSE RIGHT—STEADY—ON"
Range (optional)	"ONE TWO HUNDRED"
Execution	"FIRE"

Table 4-2. Fire Command Terminology

(a) Alert The first element of the fire command alerts the crew to an impending engagement. The alert element for engagements in which the gunner fires the main gun or coax is "GUNNER." For engagements when the VC fires the main gun or coax, the VC announces the weapon element only (for example, "MAIN GUN” OR "COAX," as appropriate, alerts the crew that the VC will engage a target from his position).

(b) Ammunition or Weapon The second element of the fire command tells the crew what type of ammunition or which weapon will be used. The ammunition element of the fire command is the gunner's cue to select the appropriate weapon or ammunition.

(c) Number and Mode of Fire The third element of the fire command tells the crew the number of rounds to be fired and mode of fire to engage with (single shot or burst). The mode of fire is dependent on METT, target description, range and desired effect. Example: If the target is "Troops" the command may be "Gunner, HE, 2 Burst, Troops".

(d) Description The third element of the fire command identifies the target to the crew. If there are several similar targets, it tells the gunner which target to engage first. Most targets can be designated by one of the terms in table 4-3:

Target	**Announced As**
Tank or tank-like target	"TANK"
Unarmored vehicle	"TRUCK"
Personnel carrier	"PC"
Infantry Fighting Vehicle	"IFV"
Helicopter	"CHOPPER"
Fixed-wing aircraft	"PLANE"
Personnel	"TROOPS"
Machine gun	"MACHINE GUN"
Antitank gun, antitank missile, or towed artillery	"ANTITANK"
Other targets	Use the briefest term possible to clearly describe the target.

Table 4-3. Target Descriptions

Combining terms ("ANTITANK TRUCK") can identify combination targets, such as truck-mounted antitank guided missile systems. The gunner announces "IDENTIFIED" as soon as he identifies the target. If the gunner cannot identify the target, he announces "CANNOT IDENTIFY;" the VC may have to give an elevation or deflection direction, designate or lay the main gun in the target area, or engage the target himself.

If there are multiple targets, the VC identifies the targets he acquires (for example, "GUNNER–SABOT–TWO IFV's"). The VC then designates which target to engage first ["RIGHT (LEFT, NEAR, FAR, STATIONARY, MOVING) IFV"]

Note

An acquisition report from the gunner or driver cannot substitute for the description element of the fire command. However, the gunner does not have to announce "IDENTIFIED" if he gave the acquisition report.

(e) Direction The VC omits the direction element if he can lay the main gun for direction and elevation. If the VC cannot lay the main gun for direction he uses either the known range method or estimated-range method to determine direction and elevation.

In the traverse method the VC tells the gunner "TRAVERSE LEFT (RIGHT)." The gunner rapidly traverses in the direction announced. As the gun tube nears the target, the VC announces "STEADY," and the gunner slows his traverse. When the VC thinks the target is in the gunner's field of view, the TC announces "ON." When the gunner sees the target(s), he announces "IDENTIFIED."

The reference point must be one that the gunner can see and recognize easily. For example, the VC's command might be "REFERENCE POINT.BRIDGE.TRAVERSE RIGHT." The gunner identifies the reference point and traverses right, looking for the target. The VC may have to further define the target description and location.

(f) Range The VC announces an estimated range to the target to assist the gunner in acquiring the target. With an operational LRF, the gunner will lase to every target. If the LRF is not operational, or environmental conditions prevent its use, determine range using either the known-range method or the estimated-range method depicted below or other methods, as deemed necessary.

By knowing the range to probable target areas, the crew can reduce engagement time and improve accuracy by indexing the known EFV-to-target range into the GCP. The known range from a previous target engagement may also be used.

To engage targets when the LRF cannot be used and the range is unknown, the VC or gunner must estimate the range to the target. Range data is announced in the fire command in even hundreds or thousands, otherwise digit by digit.
Examples: If the VC announces.

"INDEX ONE EIGHT HUNDRED," the gunner uses the GDP and manually enters the range.

(g) Execution Once the crew responds to the first elements of the fire command, the VC will announce the execution. Before announcing the execution command, the VC will mentally run through the confirmation procedures described in *Target Acquisition*As a minimum, he will *reconfirm the target as hostile before firing;* if there are multiple targets within the VC's sector, he designates to the *most dangerous* target first. Three execution commands may be given followed by an announcement of “on the way”:

- "FIRE." The command "FIRE" tells the gunner to fire the gun. If the VC designates the gunner to a single target and is able to assist the gunner, he issues the command, "FIRE." If the VC wants to delay firing, he will announce "AT MY COMMAND," then announce "FIRE" when he is ready to engage.
- “FIRE AND ADJUST." If the VC cannot assist the gunner in adjustment, he announces "FIRE AND ADJUST." This tells the gunner that he will not receive a

subsequent fire command and must conduct the engagement on his own. If the VC continues to designate the gunner to each target, then continues to scan his sector, he issues the command "FIRE AND ADJUST."

- "FROM MY POSITION." Normally, the gunner will engage all main gun targets; however, if he is unable to identify the desired target, the VC will engage the target from his position. If the gunner can identify the target while the VC is engaging from his position, the gunner announces "IDENTIFIED." The VC can return control to the gunner or complete the engagement from his position. To maintain overall control and ensure continuous target acquisition, the VC should return control to the gunner immediately after the gunner identifies the target. To return control to the gunner, the VC announces "FIRE."
- "ON THE WAY" is the last verbal response announced by whoever is firing. Whoever is firing will squeeze the trigger on the "Y" of "WAY." Additionally, when the gunner is firing the coax and releases the trigger, even momentarily, he must announce “ON THE WAY” prior to resuming firing.
- If the VC wants to change the type of ammunition being fired, he announces, "FIRE, FIRE HE (SABOT)." The gunner must respond "HE (SABOT) INDEXED," to inform the VC that the proper ammunition is loaded and indexed.

(2) Termination of Engagement Although this is not an element of a fire command, every engagement must be terminated. The VC announces "CEASE FIRE" to end a main gun or coax engagement. Once the command of “CEASE FIRE” is given, the gunner moves the main gun SAFE/ARM lever to the SAFE position. When the gunner completes his part of a multiple weapon systems engagement, he announces "GUNNER COMPLETE." The gunner then moves the GUN SELECT switch to TRIGGER SAFE, the MAGNIFICATION switch to 3X, and continues to scan his sector. The VC has overall responsibility of the turret and is still responsible for terminating the engagement.

(3) Repeating Commands When a crewmember fails to understand an element of a fire command, he announces the element in question and the VC repeats that element only. For example, if the gunner announces "AMMO," the VC repeats "SABOT."

(4) Correcting Errors To correct an error in a fire command, the VC announces "CORRECTION" and corrects the fire command, starting with the incorrect element and repeating all elements that follow. If the description element was wrong, the VC announces "CORRECTION," gives the correct target description, and continues with the fire command (for example, "GUNNER–SABOT–PC–CORRECTION – IFV –FIRE"). If an error has been made in the fire command, and the execution command has been given, the VC must cease-fire and issue a complete, new fire command. To correct an error in a subsequent fire command, the VC announces "CORRECTION" and repeats the entire subsequent fire command.

(5) Crew Duties in Response to a Fire Command Each crewmember has specific duties to perform in response to each element of a fire command. The TV and gunner will apply the *rules of lay* for every round fired. The rules of lay are:

- End lay in elevation.
- Always aim at the center of visible mass.
- Remember the sight picture at trigger squeeze.

A crew's ability to accomplish any mission depends on the ability of its crewmembers to perform individual tasks and, at the same time, operate effectively as a crew. Consequently, unit trainers must emphasize both individual and collective training. These crew duties are designed to provide tank crews an outline to be used when conducting training. The following pages show examples of various duties performed by individual crewmembers while performing the collective tasks associated with main gun engagements. Each crew should periodically practice these procedures to enhance effectiveness and crew performance.

With the enhancements of digital capabilities for information gathering and reporting, and the CMS for increased observation, the EFV can cover a larger sector of fire than previous assault amphibian vehicles. This larger sector could have multiple avenues of approach. The gunner could be required to engage multiple targets on his own, while the TC continues to scan with binoculars, which places increased responsibilities on the gunner to make his own decisions when given the command, "FIRE AND ADJUST." See figure 4-14. Also, this requires the VC and gunner to maintain a constant communication flow.

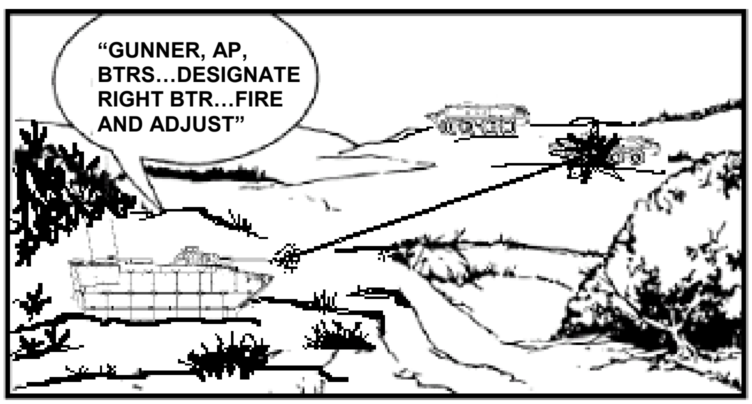


Figure 4-14. Multiple Target Engagement

c. Target Engagements
In combat, EFV crews may engage targets using multiple engagement techniques. These engagements require speed and accuracy to suppress or destroy all targets.

(1) Multiple Main Gun or Coax Machine Gun Engagements A multiple main gun or coax machine gun engagement is more than one target engaged with the same weapon. These engagements, especially multiple IFV engagements, require rapid and accurate fire, target destruction, and quick shifts to new targets. The VC determines which target presents the greatest threat (*most dangerous*) and issues a fire command to engage that target first. The VC determines the next *most dangerous* target, directs fires to the second target and continues this process until all targets are destroyed. When moving from one target to another, the gunner must make sure he releases the palm switches momentarily (dumps lead solution), then squeezes the palm switches again. This eliminates the floating reticle and makes laying on the next target much faster. The gunner must now re-lase to the new target to establish an accurate ballistic solution.

The VC must decide whether or not a target has been destroyed. Indications that a target has been sufficiently damaged include secondary explosions or crewmembers abandoning the vehicle.

Multiple engagements require the VC to shift fires quickly from one target to the next as the classification of *most dangerous* changes from moment to moment. Multiple coax machine gun engagements are performed in the same manner. The *most dangerous* target is engaged first; fires are then shifted to the next *most dangerous* or *dangerous* target.

(2) Direct-Fire Adjustment Techniques Closely following the before-operation checks, prep-to-fire checks, and the direct-fire techniques already discussed will increase the chances of achieving a first round, target destructive hit. However, in some situations, direct-fire adjustment will be necessary. When a gunner or VC fires a round and misses the target, the crew must take actions to obtain a rapid target hit with a subsequent round.

Many factors can cause a target miss. These factors depend on the direct-fire technique used and the ammunition fired. The following factors could contribute to target misses:

- Incorrect boresight.
- Battle damage.
- Failure of the crew to perform correct before-operation checks or armament accuracy checks of the fire control system.
- Error in crew drill during the engagement, such as an incorrect lay of the sight reticle on the target aiming point (poor sight picture).
- Loss of boresight.
- Round-to-round dispersion.
- Incorrect range.
- Excessive cant (trunnion tilt).
- Refraction (optical path bending).

A sensing is a mental notation by the gunner or VC of where the round strikes or passes the target in relation to the target aiming point. A sensing will be given for every main gun round fired. If the first round fails to destroy the target, sensings may enable the gunner or VC to adjust subsequent rounds. The ability to sense a fired round will depend on obscuration and flight time. Obscuration is the flash, muzzle blast, heat shimmer, debris, and movement of the firing EFV (platform rock) may prevent the crew from sensing their fire. When firing main gun ammunition, especially sabot, flight time is so short that the projectile may reach the target before obscuration has cleared.

Because of obscuration and time of flight, it is almost impossible to sense sabot rounds at ranges less than 1,000 meters. Even at extreme ranges (3,000 to 4,000 meters), determining an accurate sensing is extremely difficult, due to the size of the tracer and tracer burnout, unless the target is hit.

When possible, all crewmembers should attempt to sense every round fired. When firing HE ammunition, a bright flash or explosion will be visible if the target is hit. When firing sabot ammunition, a splash of sparks produced when the round impacts on a target. If the point at which the tracer strikes short, passes, or hits the target cannot be sensed, the gunner announces "LOST." When the gunner senses the strike of the round in relation to the target, he announces one of the following sensings:

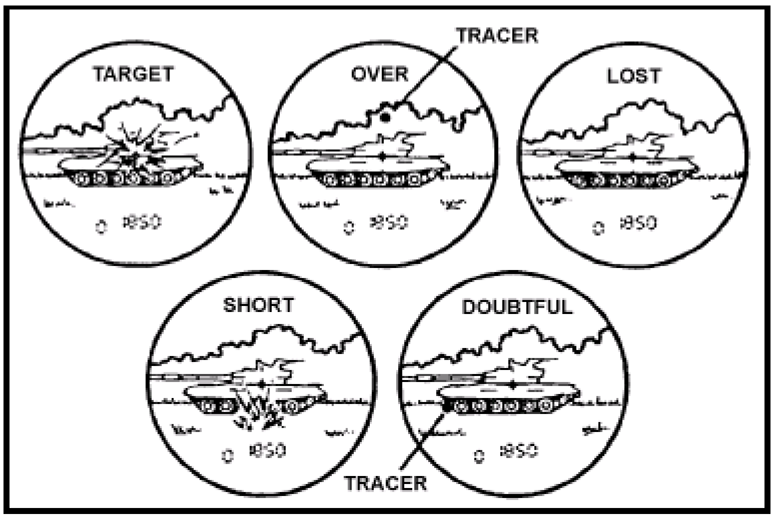


Figure 4-15. Sensings.

- "TARGET" −Any part of the target is hit by direct fire.
- "OVER" -The round, tracer, or its effects are sensed over the target.
- "SHORT" −The round, tracer, or its effects fall between the firing EFV and the target.
- "DOUBTFUL" -The round, or its effects, are seen as passing to the left or right of the target, but appear correct for range. With this sensing, it is *doubtful* that range correction is required, but a deflection shift is necessary.
- "LOST"—Neither the round nor its effects are sensed, in relation to the target.

(3) Subsequent Fire Commands A subsequent fire command may contain up to four elements: alert, deflection correction, range correction, and execution.

- Alert. The sensing for the round fired alerts the gunner that a subsequent fire command is being issued.
- Deflection Correction (only if necessary). A deflection correction is based on the VC's or gunner's sensing of where the round strikes in relation to the target. Because of the accuracy of the fire control system, deflection errors should not exceed one target form. A deflection error in excess of one target form indicates a fire control

malfunction, optical path bending, or an error in the gunner's lay. Deflection corrections will not be less than half target form or more than one target form. For deflection errors in excess of one form, reengage.

- Range Correction (only if necessary). A range correction is based on the VC's or gunner's sensing of where the round strikes in relation to the target. Range corrections will not be less than half target form or more than one form. For range corrections in excess of one target form, re-engage.
- Execution. The VC completes the subsequent fire command by announcing "FIRE."

Note:

When adjusting by target form using the CMS reticle, do not release palm switches or re-lase to target. This will cause the ballistic solution to change.

The alert and execution elements are always given. A deflection or range correction should be given when a full-up fire control system is not available. Otherwise, the reengage method should be used. A sensing of "LOST," "OVER," "SHORT," or "DOUBTFUL" will cue the crew that a subsequent fire command will be given.

(4) Re-engage Method If the fire control system is fully operational, the reengage method is the preferred method for subsequent rounds after a first round miss. Reengage is a rapid technique in which a new ballistic solution is entered in the fire control system. The reengage method can only be used with a full-up fire control system.

Example:

Driver: "OVER."
VC: "OVER−REENGAGE."
Gunner: Dumps the lead solution in the fire control system by quickly releasing and regrasping the palm grips, then re-lays, re-lases to the target, and announces "IDENTIFIED."
VC: "FIRE."
Gunner: "ON THE WAY."

d. Gunnery Techniques

There are three types of gunnery techniques, precision, degraded, and battlesight.

(1) Precision Gunnery Precision gunnery is defined as: using the full capability of the fire control system to engage targets. Precision gunnery is the most accurate technique of direct-fire engagement and is used when the EFV has a fully operational fire control system. *The preferred method is to use the thermal sight as the primary sight (day or night)*. The TIS is very effective for target acquisition, sensing, firing through obscurants, and minimizing the effects of directed-energy weapons such as laser washout. In some instances (such as desert environment), the GPS daylight channel may work better. Normally, when using precision gunnery techniques, only four (alert, ammunition or weapon, description, and execution) of the six elements will be needed in the fire command ("GUNNER−SABOT−IFV−FIRE"). The direction is normally omitted if the VC lays the gun for direction. The range is determined by the LRF and evaluated by the gunner and VC prior to firing.

If moving over rough terrain, keeping the target within the field of view may be more of a challenge. If the target is lost, go to a lower magnification to reacquire.

(2) Degraded-Mode Gunnery Degraded-mode gunnery techniques are used when the crew cannot use the full capability of the fire control system. Sometimes it may be necessary to fight with less than a fully operational system (use degraded-mode gunnery procedures).

The VC may decide to fire degraded mode before the engagement starts (battlesight or fire control malfunction) or when a malfunction of the fire control system or an environmental condition during a precision engagement requires a change in the engagement. When a precision engagement has started, but due to fire control malfunction, cannot be completed, the VC may have to issue further instructions to the gunner; this depends on the urgency of the engagement and the time available.

The degraded-mode technique used will depend on which fire control component is inoperative. The following situations may occur during an engagement. The corrective actions, including the appropriate fire command, are indicated. These actions allow the EFV crew to engage targets effectively until repairs return the EFV to a fully operational status, or until environmental conditions change.

Effective use of the LRF may be lost due to any of the following:

- Internal LRF or vehicle malfunction.
- Environmental conditions (fog, falling snow, or heavy rain).
- Man-made or battlefield smoke and obscurants.
- Multiple returns from a target smaller than the LRF beam width, with interference both in front of, and behind, the target.

Battlesight gunnery is the quickest method that can be used when the LRF is ineffective. It is the preferred method when targets are within battlesight range.

When the gunner cannot determine range effectively using the LRF, the VC or gunner can enter the estimated range into the system manually. This allows the gunner to use the CMS and a full ballistic solution for the estimated range.

(3) Battlesight Gunnery Battlesight gunnery is used when an accurate EFV-to-target range cannot be determined, when the computer is inoperative, or in most surprise situations. This method takes advantage of the relatively flat trajectories of armor-defeating ammunition to ensure a high probability of first-round hits. It is normally used when the fire control system is not fully operational, or when weather conditions (fog, rain) or enemy actions (use of smoke) prevent the gunner or VC from using the LRF. Battlesight gunnery is quick, but not as accurate as precision gunnery. Point of aim will continue to be center of visible mass, as the gunner applies the rules of lay.

Example fire command: "GUNNER—BATTLESIGHT—IFV—FIRE."

The battlesight fire command format is standard. The system is already indexed with ammunition and range; as determined by the commander using METT-T, the ammunition or weapon element is changed to BATTLESIGHT in the fire command (for example, "GUNNER–BATTLESIGHT–IFV–FIRE"). This informs the gunner that there will be no attempt to determine range; therefore, the range element will be omitted from the fire command. If the target is beyond battlesight range, the range will need to be estimated, changing the fire command where the appropriate ammunition is announced as well as the range element of the fire command.

The gunner will fire using the CMS and the predetermined battlesight range for the ammunition selected. If all fire control systems except the LRF are operational, a full ballistic solution except for *lead* is provided for the CMS for the previously indexed range.

The unit commander may choose (based on METT-T) from a variety of range and ammunition combinations for his unit's battlesight.

If the primary threat (most likely target to be engaged) is IFVs, sabot is the most appropriate ammunition; if the primary threat is lightly armored vehicles or infantry use HE.

The typical range setting (1,200 meters for sabot, and 850 meters for HE) is used, unless the commander gives guidance otherwise. (Selecting a range in excess of 1,200 meters for sabot or 850 meters for HE can, at certain ranges, cause the trajectory of the round to exceed the height of the target.) Factors for selecting another battlesight setting include weather, smoke, range, or other conditions that reduce visibility. The battlesight range should be based on the commander's analysis of METT-T.

(4) Firing Through Smoke During battlesight engagements, the CMS allows firing of the main gun and the coax machine gun through most types of smoke and other battlefield obscurants. When obscurants are present and acquisition is limited to the TIS, the gunner must make wide sweeps of the sector of fire with the sight set to three times magnification to prevent targets from going unnoticed.

e. Error Sources

The greater the range, the lower the probability of hit. This means that, as the range to the target increases, expectations of first-round hits decrease. Many other factors affect firing accuracy. The system and environmental and human factors involved in any target engagement comprise what is called the gun error budget-fixed biases, variable biases, and random errors. Each error source has varying effects on firing accuracy. The effect of these errors may be significant when a number of error sources act on the fire control system at the same time. Also, the effect of these error sources is magnified when engaging targets at long ranges. Error sources are either fixed, variable, or random.

(1) Fixed Biases Fixed biases are error sources induced by ammunition, weapon, and fire control system design and manufacture. Because they are fixed, or built-in, these error sources can be compensated for.

(a) System Parallax System parallax is the vertical and horizontal distance between the centerline of the main gun and the optical axis of the sights. When the gun and sights are boresighted, all lines of sight converge at the boresight range. At ranges less than or greater than the boresight range, the lines of sight differ. Normally, the ballistic computer compensates for system parallax and a correction is determined and incorporated into the solution sent to the CMS.

(b) Ballistic Drift Drift, the lateral departure of spin-stabilized ammunition from the gun-target line, is the product of air resistance and projectile spin. Projectiles will drift in the same direction as the spin caused by the rifling of the main gun. The MK44 gun rifling has a uniform right-hand twist; therefore, all spin-stabilized ammunition fired from it will drift to the right. The computer offsets drift in the ballistic solution. The computer takes this into account when the correct ammunition subdesignation is entered into the computer.

(2) Variables Biases Variable biases are error sources that remain fairly constant when firing one type of ammunition at a particular target and a given range, but can change considerably from one engagement to the next.

(a) Boresight/Boresight Retention Initial boresight errors can occur due to tolerances in the muzzle boresight device, round-off errors in splitting means, or if the MBD operator and gunner are not sighting on exactly the same target aiming point. Once an initial boresight is established, errors can occur when the spatial relationship between the end of the tube and the GPS changes. Two primary causes are gun tube droop or turret deformation (due to the sun or wind, the turret heats up unevenly and changes the initial alignment).

Although initial boresight/boresight retention errors are some of the largest error sources, they are more easily controlled or corrected by the crew.

(b) Crosswind Air turbulence (wind) moving laterally to the gun-target line will cause the projectile to deviate from the gun-target line. The effect of crosswind on any round other than APFSDS-T is significant, regardless of engagement range. Crosswind, either estimated or provided from meteorological data, is manually entered in the GDP. The computer calculates a correction based on the assumption that this crosswind is constant all the way to the target.

(c) Fire Control Errors can be induced by certain stresses placed on the fire control system. The fire control system cannot compensate for most of these stresses, such as design tolerances, metal fatigue, and vehicle vibrations. However, it can compensate for the following factors:

- Muzzle displacement, or *thermal bending* is caused by uneven heat distribution along the gun tube. *Gun tube droop* is caused by gravity acting on the gun, and can disturb the gun-sight relationship established through boresighting. The thermal shroud reduces muzzle displacement caused by uneven heat distribution, but does nothing about the gravitational effect. Frequent boresighting will reduce the effect of muzzle displacement by reestablishing the gun-sight relationship.
- Air density and temperature affect the ballistics of the projectile. Air density varies with temperature and altitude. Since the computer accepts data on barometric pressure and temperature, it compensates for air density.

(d) Ballistic Solution An incorrect ballistic solution may be computed for various reasons: incorrect ammunition selected, incorrect range determined, an unknown failure in the computer, or an unknown failure in one of the input devices.

*(e) Muzzle Velocity Variation***.** Changes in the muzzle velocity of the projectile are due to the ammunition or weapon. The following factors will cause a vertical deviation in the strike of a round:

- Damaged rifling
- Tube wear
- Temperature of the propellant
- Change of propellant loading density
- Tube length

Note

Gun tube wear results in lowered muzzle velocity and increased dispersion.

(f) Range Estimation Errors associated with range determination are primarily a training problem (see paragraph 4005. Range Determination).

(g) Optical Path Bending The apparent illusion of target displacement is commonly called refraction. Under certain light and environmental conditions, the path of light (line of sight) may not travel in a straight line. Refraction may cause problems for EFV crews attempting engagements at ranges beyond 1,500 meters. Refraction may occur under the following conditions:

- Day, clear sky, flat terrain, winds less than 10 miles per hour.
- Night, clear sky, flat terrain, winds less than 4 miles per hour.

Any time heat shimmer is present, refraction may also be present.

Refraction makes the target appear lower during the day; the sight picture, though it appears center of visible mass to the gunner, is actually below the target. The result of this may be a short round. At night, the effects are opposite and may result in an over round. See figure 4-16 and 4-17.

Be aware that the laser beam will refract with other light rays and still hit the desired target.

The most effective measure available to the crew to minimize refraction is an elevated firing position. A position at least ten meters above intervening terrain will generally negate any effects. When a crew operating under conditions favorable to refraction misses short during daylight and over during night with their first round (an elevated position is not available), they should apply the following adjustment:

- Day, adjust the sight picture up one-half target form (top of target).
- Night, adjust the sight picture down one-half target form (bottom of target).

Under normal conditions, crews do not need to make a correction for refraction at ranges less than 1,500 meters.

Boresight does not correct refraction, but crews must make sure that all before-operation checks and boresighting procedures are done correctly. When a crew is missing targets under these conditions, the cause may be refraction and not crew error or loss of boresight due to improper procedures.

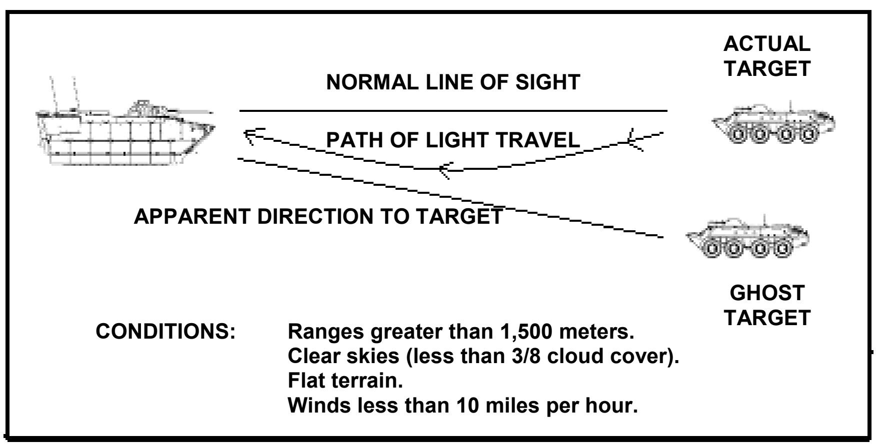


Figure 4-16. Day Refraction (Exaggerated View).

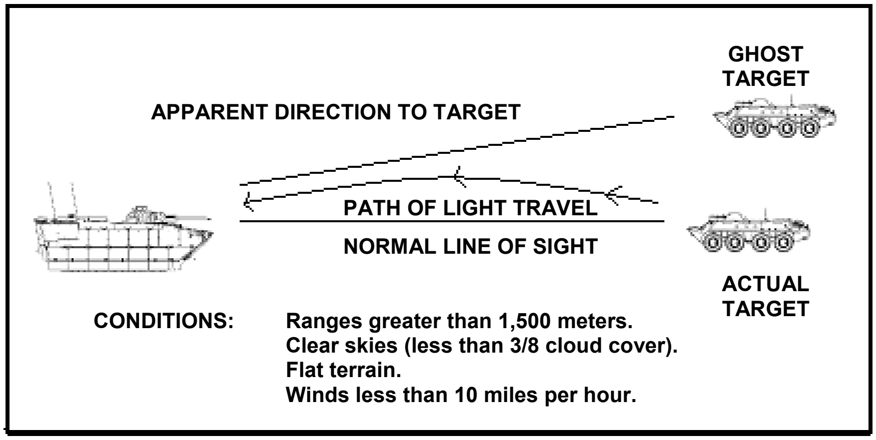


Figure 4-17. Night Refraction (Exaggerated View).

(h) Variable Jump Variable jump is the average difference between actual impacts for a particular occasion and the intended strike of those rounds, given all inputs to the ballistic computer are correct or within tolerance. Variable jump may be corrected using standard sight adjustments after subsequent round misses.

(3) Random Errors Random error sources are those that vary for each round fired. They cannot be predicted from one round to the next, nor can the crew compensate for them. The VC and gunner must be aware of random errors and not be unduly influenced by them when they occur.

(a) Round-to-Round Dispersion With a perfect gun and ammunition firing under ideal conditions, all rounds would hit the same spot. In reality, there is a spread of shots around a central point. The area into which these shots fall is called the dispersion zone. There is no way the crew can compensate for dispersion, but they should be aware of its effects. As the range to the target increases, so does the size of the dispersion zone. If the round misses by only a slight amount, a re-lay and reengage technique may achieve a target hit.

(b) Gunner Lay Error Gunner lay error is caused when the gunner fails to make a correct lay to the target aiming point while either boresighting or engaging targets. It is a significant error source and primarily a training problem. To reduce this error, each gunner must be trained to make his final lay to the correct aiming point, ending his lay in elevation. This will minimize the effects of gunner lay error.

4007. M240 Coax Machine Gun

EFV crews must be able to effectively engage dismounted infantry, crew-served weapons, ATGM teams, RPG teams, trucks, thin-skinned armored vehicles, lightly constructed covered positions.

The coax machine gun can effectively engage area or point targets out to 900 meters, its maximum effective range (tracer burnout). When using the coax, the TC or gunner should set the

LRF RANGE switch based on the operational environment. Figure 4-18 depicts the correct LRF sight picture when employing the coax machine gun.

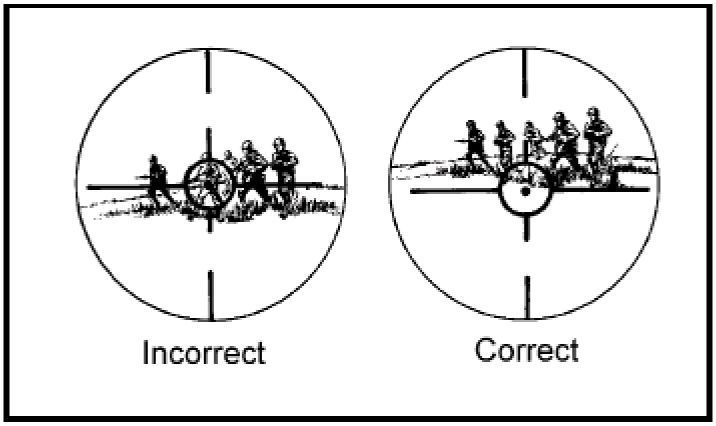


Figure 4-18. Sight Picture for Lasing on Troops Using Last Return Logic.

a. Engagement Techniques for Far Targets
Immediately after lasing, the gunner should *dump* lead by quickly releasing then re-engaging the palm switches. This rationale is based on the slow ballistic characteristics of the 7.62-mm round that cause the ballistic computer to induce a large lead angle. With the sweeping firing pattern (back and forth) used in these engagements, lead makes it difficult to place effective fire on the target. After having lased and dumped lead, the gunner brings the reticle up to the center of the target area and fires an initial burst. An initial burst is a continuous burst fired through the target area, designed to kill as many troops as possible before they hit the ground or find cover.

After an initial burst has been fired, if pockets of resistance remain visible, use the machine gun area engagement technique, but shift to a 20- to 30-round burst using the Z-pattern technique. See figure 4-19.

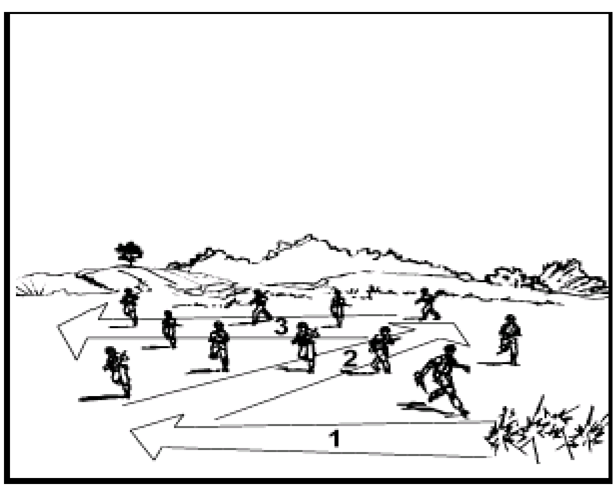


Figure 4-19. Z-Pattern Technique for Area Targets.

In the offense, continue to move when engaging targets in the normal mode. Movement of the turret and vehicle carries the burst through the target when a narrow frontal area target is presented (see figure 4-20 [EFVs will similarly employ the technique depicted by the M1A1s in the figure]) Round dispersion will cover target width.

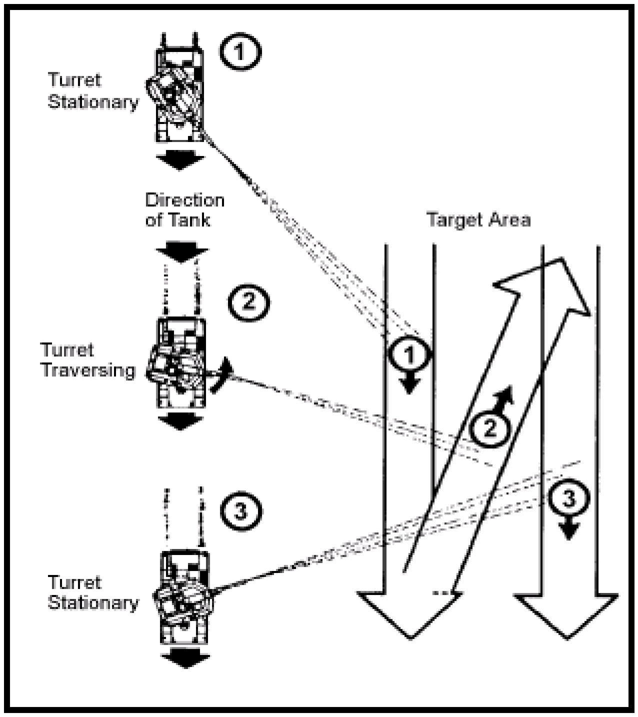


Figure 4-20. Z-Pattern from Moving EFV.

Due to the rapid decrease in range to the target during offensive coax engagements, it may be necessary to re-lase to the target during the engagement. Also, the gunner must not forget to dump lead after re-lasing.

b. Engagement Technique for Point Targets

When engaging point targets with the coax machine gun, follow the same manipulative procedures as with main gun engagements. In normal mode, point targets can be engaged with the coax while the EFV is on the move. Stabilization allows the gunner to use the CMS to acquire, identify, and fire on targets effectively without stopping the EFV. If the LRF is inoperative, use the CMS with the coax, battlesight range previously indexed. (Recommended coax battlesight range is 500 meters, unless specified otherwise by unit SOP.)

c. Special Use of the COAX Machine Gun

The COAX machine gun is and effective weapon, but it also serves the EFV crew in different ways. The crew is limited only by their ingenuity in using the COAX machine gun. The following are special uses of the COAX.

(1) Suppressive Fire Engagements EFV suppressive fire is direct fire placed on known or likely enemy locations to degrade one or more of the enemy's basic combat functions: moving, shooting, observing, or communicating. Whenever possible, use the COAX machine gun for suppressive-fire engagements to conserve main gun ammunition. Suppressive fire with the M240 is most effective when fired at a sustained rate of 20- to 30-round bursts (4 to 6 tracers) every 10 seconds. No specific pattern or engagement technique is prescribed; however, each burst should strike within 10 meters of the suspected target area. In dense terrain or areas of high enemy troop activity, overwatching EFVs can cover maneuvering EFVs with suppressive machine gun fire.

To conserve main gun ammunition, use the M240 COAX on targets within 900 meters. Due to the relatively small amount of 30mm ammunition available, suppressive fire engagements with this weapon should be limited.

(2) Reconnaissance by Fire To conserve main gun ammunition, use the M240 COAX mounted machine gun in reconnaissance by fire to cause a hidden enemy to react. Fire a single burst of 20 to 30 rounds while constantly observing for enemy movement, return fire, or the flash of rounds striking metal.

Reconnaissance by fire is used when other means of enemy detection have been unsuccessful or are not available. It is best employed with another EFV within the same section. One EFV can fire on a suspected enemy position or suspicious area to cause the enemy to react and compromise his position at the time of our choosing, not his. The second EFV can then engage and destroy the enemy from a different location.

(3) Ranging When the LRF is inoperative, the M240 may be used as a ranging gun out to 900 meters. Limited use of this technique is recommended, because it reveals your position.

(4) Designating Targets Section and platoon leaders can use machine gun fire effectively to designate targets for other EFVs, artillery forward observers, or aerial fire support. Limited use of this technique is recommended, because it reveals your position.

(5) Incendiary Effects Machine gun tracers or incendiary ammunition can be used to set fire to any readily combustible material such as dry grass, grain, dried brush, or wood. Fire will deny a particular area to enemy use, and smoke from a burning field can be used to screen movement.

(6) Ricochet Fire Use ricochet fire when fighting in built-up areas. Machine gun fire can be directed around corners by bouncing rounds off buildings, walls, or streets. Ricochet fire can also suppress sniper fire. Machine gun fire can be directed low and in front of lightly armored vehicles which 7.62 mm could not defeat frontally in order to ricochet up into the more lightly armored belly.

No proven technique has been defined for ricochet fire. It should be used on structures that are solid and provide a ricochet effect. Caution should be exercised when using ricochet fire to prevent rounds from ricocheting back into friendly forces.

Although not particularly accurate, ricochet fire can also produce a desired psychological effect.

4008. Employing the EFV Weapon Station

This paragraph is designed to provide a source of information on a variety of topics concerned with employing the EFV's weapon station. This is not designed as a complete guide to employing the EFV, rather, it is a compilation of items not covered in other sections of this handbook or in the IETMs and that may be of use to the armor crewman in the field.

a. Fighting Position
A fighting position is a place from which an EFV crew can engage enemy targets using the EFV's weapon systems and sights. The position must provide fields of fire for the crew, frontal and flank protection, and access to maneuver without exposing the EFV to the enemy.

Note

The following information on EFV fighting positions is designed for combat. Fighting positions constructed on multi-use ranges are designed to facilitate the firing of many different vehicle platforms and cannot be designed in the same manner as EFV combat positions.

(1) Types of Fighting Positions There are three types of fighting positions: hasty, two-tiered, and three-tiered. A hasty fighting position provides minimal protection for the EFV and crew (see figure 4-21). It is the least desirable fighting position. Kinetic-energy rounds can penetrate the forward spoil and possibly the EFV. The two-tiered fighting position, preferred over the hasty, is used most commonly (see figure 4-22). It provides increased protection to the crew allowing them to identify and prepare to engage targets before pulling forward. For the EFV, this is a turret-defilade position. The turret must be exposed in order for the gunner to observe using the CMS. The three-tiered fighting position is the most desirable to build, but also the most time-consuming (see figure 4-23). This position allows the VC to observe the battlefield while remaining completely hidden from enemy ground observation.

In the lowest level of the three-tier positions, the VC should be able to view the engagement area from the turret with binoculars. If he cannot view the area, he may place an LP/OP.

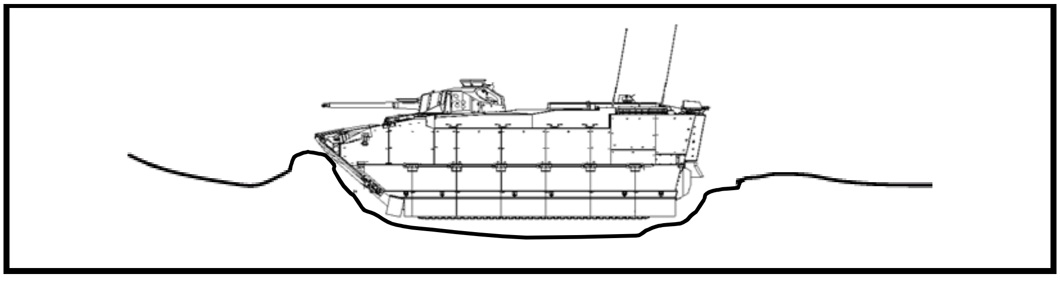


Figure 4-21. Hasty Fighting Position (Hull Down).

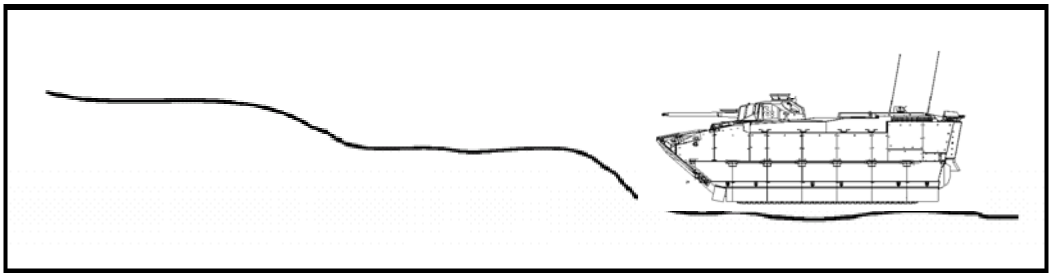


Figure 4-22. Two-Tiered Fighting Position (Turret Down).

Figure 4-23. Three-Tiered Fighting Position (Hide).

(2) Fighting Position Construction Fighting position construction is one of the most critical aspects of the defense, but is often not accomplished to standard. To be successful, a prepared defensive position should meet the following criteria:

- Vehicle will not be skylined while firing.
- Completely hidden from enemy view, to include all of the spoil.
- Allows full 360-degree turret movement in the hull-down position (terrain dependent).
- Allows full 360-degree ability to engage using the CMS (terrain dependent).
- Provides routes of escape to the rear of the position.
- Allows crew to scan using binoculars in the turret-down position.
- Provides covered and concealed routes to alternate and subsequent fighting positions.

Although not all-inclusive, the above is a guide for things to consider when developing a fighting position. When the VC is first assigned an area, he should lie on his stomach on the ground and sight through his binoculars to make sure that, once the hole is dug, the gunner will be able to use the CMS to cover his assigned sector. The VC should then supervise the engineer's movement to the spot and subsequent digging.

(3) Fighting Position Proofing Once the hole is nearly complete, the VC should pull his EFV into the position, check his fields of fire, and direct modifications until the position is complete. Once the vehicle is in the position, the gunner should begin to make a sketch card of the assigned sector. The driver should tie down all antennas, cover all reflective material, and gather material to break up the outline of the top of the EFV to avoid detection by enemy aircraft. Once the gunner and driver are complete, the VC and driver should rehearse pulling into the position.

b. Weapons Planning Ranges and Considerations
The weapons planning range for an EFV is the range at which the unit commander intends to begin engaging enemy targets. Although the commander determines the weapons planning range, it is important that the VC understand the capabilities of the rounds on his vehicle. When developing the section and platoon fire plan, the VC must use the various types of ammunition appropriately to destroy targets without overkill. In the offense, where section or platoon fire commands may not be practical, the VC must be able to decide which type of round to fire without hesitation.

With limited rounds on board, the VC must weigh the alternatives and try to make every round count. The weapons planning range for a EFV cannot be separated from the number of rounds the VC is prepared to expend. While it is possible to hit a moving enemy IFV at 3,000 meters, the probability of doing so on the first round is low. While 7.62mm effective range is 900 meters based on tracer burn-out, it is still possible to accurately engage and suppress enemy infantry at ranges out to 1,500 meters with COAX in order to preserve 30mm HE. Or with enemy infantry at ranges closer than 900 meters the VC may chose to engage with HE because of the increased lethality of 30mm HE.

To counter these factors, engage from closer ranges, especially if engaging frontally. Several factors combine to make frontal engagements of enemy IFV's beyond 2,500 meters with longrod and enemy LAV's beyond 1,500 meters with HE only marginally effective. Enemy armor is difficult to penetrate from the front. The sides, top, and rear have relatively thin armor; therefore, flank and rear engagements give greater P_K at extended ranges. LAVs can be engaged with longrod when the range is past the effective range of HE with high P_H (better dispersion, faster time of flight) but will result in a lower P_K due to reduced behind armor debris effects.

Obviously, there is a balance. Although engaging at a close range frontally will increase P_H and P_K, it will also reduce the number of targets that can be destroyed before that attacker is too close. Further, the attacker may close with more systems and combat power. If mission considerations take priority (as in a delay mission), the engagement ranges may be extended at the cost of the number of kills possible before resupply is required.

Several additional planning factors must be considered when engaging targets at longer ranges. By engaging at longer ranges, the VC compromises his position and loses the element of surprise. While long-range engagements have a lower P_H and P_K, they can disrupt enemy command and control (by causing enemy vehicles to button up) and achieve mobility kills and cause enemy infantry to go to ground. Long-range engagements require sensing EFV's using observed fire techniques and should be attempted from an elevated firing position. Only the best firing crews and most accurate EFVs should be chosen as the long-range gunnery crews.

If the tactical situation permits, the optimum planning range against IFVs in the frontal 60-degree arc is 1,500 meters. This can be extended with recognition of degraded P_H, and reduced kills per on-EFV load of ammunition. The weapons planning range can also be reduced based on terrain, weather, and obscuration.

c. Creating a Sketch Card

The crew will make a sketch card showing their sector for their deliberate or hasty defensive fighting position. A sketch card is a rough topographical sketch of the EFVs assigned sector. The sketch card will aid the crew in target acquisition, and enable EFV unit leaders to develop their fire plans in conjunction with the supported infantry unit. See figure 4-24 for an example of a correct sketch card.

The unit leader will designate the primary, alternate, and supplementary positions for his EFVs. After the positions have been designated and reconnoitered (time permitting), the unit leader will designate the sector limits of fire for the EFV and the TRPs within the sector. The unit leader must give the VC the number designators for the TRPs. As the positions are prepared, the VC and gunner will prepare the sketch cards for each position. When the cards are completed, one copy will be sent to the unit leader and the other copy will be kept with the EFV (normally within 20 minutes).

When the EFV is moved into position, and before engineer assets are released from the position, the crew will make sure the target areas and obstacles within the sector can be fired upon, and determine if assigned TRPs can be engaged. A TRP that could be engaged before the position was prepared may be masked when the EFV is dug in. The unit leader must be informed of any inability to engage assigned TRPs and may direct a change in position.

If time permits, the VC will make physical contact with his wing or flanking elements to determine overlapping fire within the sectors and the position of friendly OPs. As a minimum, the sketch card will depict the following:

- *All key terrain* features.
- *TRPs*. TRPs should be marked with a cross and their assigned number in the upper right quadrant of the cross. Mark all TRPs that are visible, whether they are in your sector or not.
- *High speed avenues of approach*.
- *Symbol indicating North.*
- *Preplanned fires (direct and indirect).* These may be added after the unit leader receives this information from the fire support team with the supported infantry unit and constructs an integrated fire plan. These should be marked with a cross, with the letter designation in the top left block and numeric designation in the top right.

- *Range bands*. These will help when the LRF fails. The number of bands will be determined by the terrain or mission. (If terrain permits, range bands of 1,200, 1,800, and 2,400 meters will be used.) A minimum of three range bands should be used.
- *Right and left limits of assigned sector*. These limits are marked by double lines beginning at the EFV's position and extending through the terrain feature that designates the boundary limit.
- *A reference point* near the center of the sector and, ideally, at or beyond your maximum engagement range. The reference point should be a prominent, immovable, and readily identifiable feature; it should not be a target and should not be easily destroyed. The reference point should be depicted using a military map symbol, sketch of feature, or brief word description, and marked with the letters *Ref Pt* inside a circle.
- *Obstacles and dead space*. Obstacles should be marked on the sketch card using approved military symbols. Dead space should be marked using diagonal lines with the words "DEAD SPACE."
- *The position of elements left and right, and friendly OPs/LPs*. These positions should be marked with standard symbols. (This information will be omitted if the tactical situation does not allow enough time to make contact with wing and flank elements, or otherwise determine their exact location).
- *Identification data*, which consists of the *vehicle tactical number* placed directly below the EFV symbol, and the *firing position* (primary, alternate, or supplementary) marked with a capital P, A, or S, placed below the vehicle tactical number.
- *Marginal information* placed in the bottom left third of the sketch card, to indicate the following:
    - List of TRPs.
    - Range to TRPs.
    - Reference points.
    - Description of TRPs.
    - Description of obstacles and other likely target areas visible to your position.
    - Range to obstacles and other likely targets.
- *Legend*, placed in the bottom right third of the sketch card, to indicate the following:
    - Explanation of symbols used on the card.

- Other control measures and pertinent information, as required.

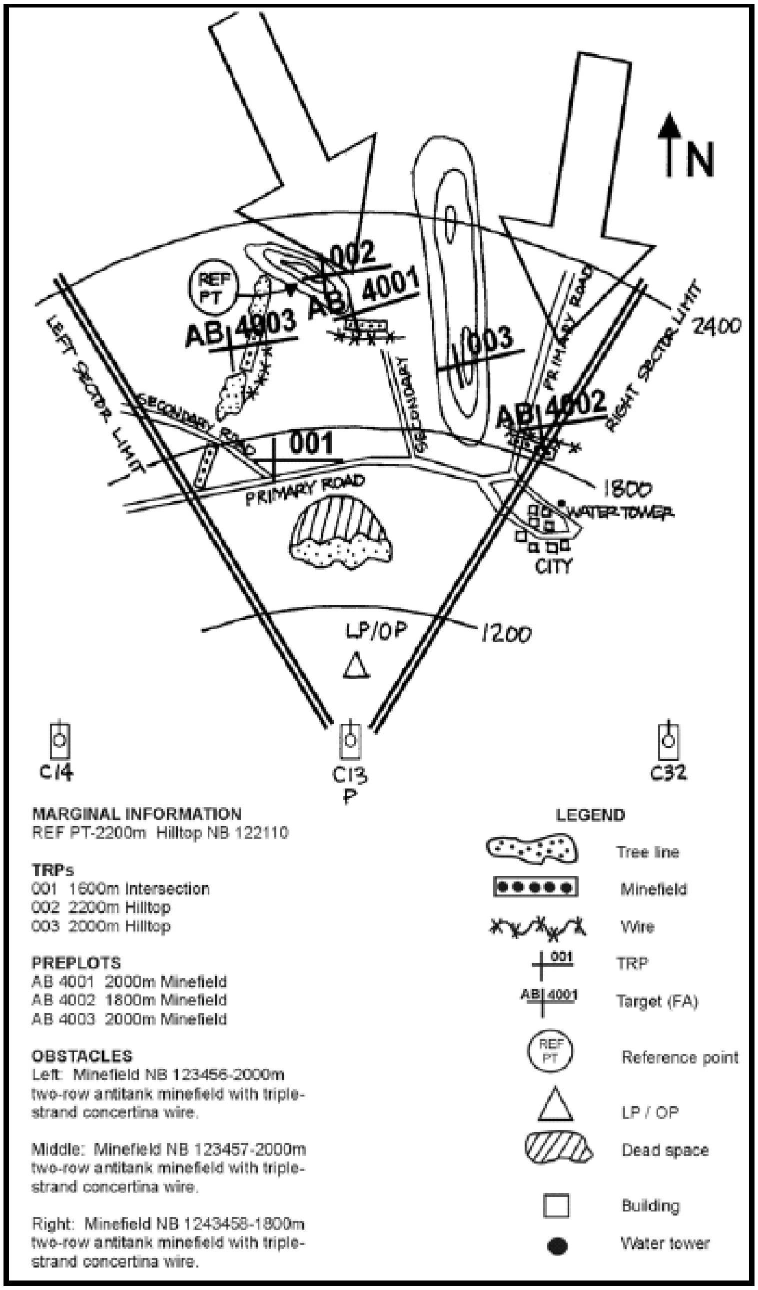


Figure 4-24. Example of a Sketch Card

d. Mode of Fire (Single Shot or Burst)

The unit leader or VC will determine the mode of fire to engage a target with. METT-T, target description, range and desired effects all play a role in determining the mode of fire. The EFVs fire control system and ammunition offer a high probability of hit in either SS or burst.

e. Fields of View The FLIR has three magnifications, 3.5, 10 and 20 power, and two fields of view (FOV), narrow and wide. While on the move or scanning for targets select the magnification and FOV that will allow you the best view of the battle field, i.e. 10 power and WFOV. Once a target has been identified choose the magnification and FOV that will give the highest target resolution. Example: If your target is a BTR at 2000 meters you may set your FLIR to 20 power and Narrow FOV.

f. Thermal Settings (White Hot vs. Black Hot)
Gunner should switch from White Hot to Black Hot and determine which offers the highest resolution of the battlefield. The use of Black Hot or White is at the discretion of the gunner.

4009. Loss of a Crewman (Casualty)

In the event the EFV suffers the loss of one crewman the vehicle may continue to operate although in a degraded capacity. To maintain situational awareness and the ability to operate the MK44, the remaining crewman will take the VC position while in the offense or on the move. Since the VC and Gunners Stations have redundant fire control capabilities, this allows for safe vehicle movement and effective control of fires. When the EFV is in a static or defensive position the gunner's position will be manned. This will allow full use of the EFVs firepower capabilities.

Chapter 5 EFV Command, Control, Communications, Computers, and Intelligence (C4I)

The EFV(P) C4 and EFV(C) C4I systems have been selected and designed to enable the vehicle crew and the embarked Marine infantry or staff to successfully exercise command and control while executing the future Marine Corps warfighting concepts of expeditionary maneuver warfare (EMW) and ship-to-objective maneuver (STOM).

The EFV(P) C4 capabilities are state-of-the-art marine and land navigation and communications systems able to determine the vehicle position and provide appropriate position location information (PLI) reports through the installed command, control, communications, and computer (C4) systems. These C4 systems enable the EFV(P) vehicle commander (VC) and troop commander (TC) to command and control EFV movements, formations, safety, and fires and interface with navy movement control during water operations. Current intelligence and reconnaissance information is provided via higher, adjacent, and subordinate units within the command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) architecture.

The EFV(C), as a variant of the EFV(P) design, provides the same C4 capabilities to the crewmen and embarked infantry. In addition, the EFV(C) provides the supported infantry commander (regiment and battalion levels) a mechanized tactical echelon command post. The primary purpose of the EFV(C) tactical echelon command post is to support the immediate close operation, normally controlling only those forces engaged in the close battle, and providing the commander with freedom of movement and information critical to his situational awareness. The EFV(C) provides the commander with mobility commensurate with the situation allowing him to move rapidly to observe critical events during the battle. The EFV(C) tactical echelon command post is designed to provide intelligence, maneuver, and fire support functions for the commander. The command group typically consists of the commander (CO), intelligence officer (S-2), operations officer (S-3), fire support coordinator (FSC), air officer (AO), and sufficient communications personnel. Other staff members may be added or deleted as made necessary by the situation or personality of the commander.

The EFV(C) mounted tactical echelon command post allows the infantry commander to position himself where he can best direct and control the operation. With the EFV(C), the tactical echelon command post is highly maneuverable yet provides the commander and selected staff with the capability to communicate, both voice and data with higher, adjacent, and subordinate units; combat support units; combat service support units; and joint forces. To assist him in the continuous collection, processing, and dissemination of combat information and orders, he establishes appropriate headquarters echelons. Depending on the situation, the infantry unit may maintain as many as three headquarters echelons: the tactical echelon, the main echelon, and the rear echelon. The headquarters echelons exist to support the commander wherever he may be on the battlefield. They consist of an appropriate allocation of personnel and facilities used by the commander and staff to plan, direct, control, and coordinate operations of the regiment. The tactical echelon and rear echelons are extensions of the main echelon, and are manned appropriately based on the commander’s estimate of the situation. Communications connectivity between the established echelons is required to ensure situational awareness is maintained by all decision makers, anticipatory planning is enhanced, and passage of control from one echelon to another is transparent to subordinate forces of the regiment.

During an operation, the tactical echelon supports the close operation by continuously coordinating and integrating the immediate tactical requirements of committed elements. The tactical echelon receives displays, analyzes, and distributes combat information and tactical intelligence from higher, lower, and adjacent units to support the close operation. It integrates and expedites fires of all fire support assets supporting the close operation. The tactical echelon is designed and manned to be small, mobile, and survivable. Its survivability is directly related to its small size and capability to rapidly displace. It contains only essential personnel and equipment. It is deployed forward near lead battalions or even farther forward when the situation dictates.

The EFV(C) provides the infantry commander with the following:

- The freedom of movement and information access to conduct close operations and maintain situational awareness;
- The functional interface via systems applications to support the intelligence, maneuver, and fire support requirements of the commander and his selected staff;
- Secure voice and data capability between the crew and the embarked commander and staff; and,
- The full range of C4I functionality required to operate as a tactical echelon command post or a temporary fire support coordination center (FSCC).

5001. Communications Equipment

a. EFV(P)

The EFV(P) functions within the Marine Corps' command and control architecture and will interface and inter-operate, as required, within the planned Joint command and control architecture. Figure 5-1 depicts the EFV(P)'s communications and navigation equipment.

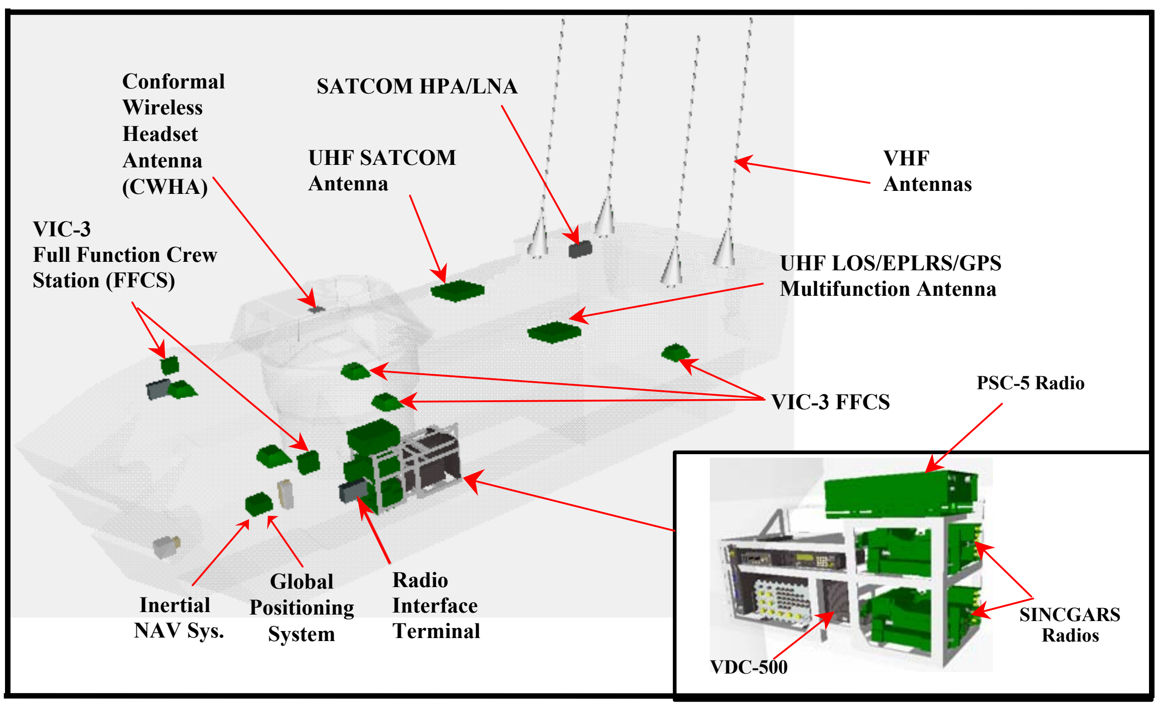


Figure 5-1. EFV(P) Communications & Navigation Equipment

The EFV(P), as the Marine Corps' primary ground mobility asset, has a radio suite that will provide line of sight (LOS) and beyond line of sight communications (BLOS) capabilities to enable connectivity with higher, adjacent, subordinate, and supporting elements. The EFV(P) possesses an intercom system for communication between crew stations, the embarked troop commander (TC), and the 5th position aft. The communications equipment aboard the EFV(P) are listed below in table 5-1.

Equipment	Quantity	Comments
A AN/VRC-89 SINCGARS & A AN/VRC-90 SINCGARS	3	Very high frequency (VHF)
AN/PSC-5D SHADOWFIRE MULTI BAND/MISSION	1	Ultra-high frequency (UHF) SATCOM, UHF HAVEQUICK II & VHF SINCGARS
AN/VSQ-2 EPLRS	1	UHF data information exchange. The plan is to field one per EFV section
VIC-3 INTERCOM	1	5 stations (Driver, VC, Gunner, TC, and 5th position aft)
ETHERNET INTERFACES	2	TC & 5th position aft station, used, for example, as DACT or IOW interface to vehicle LAN/radios

Table 5-1. EFV(P) Communications Equipment

The EFV(P) has the capability to digitally link into the Enhanced Position Location Reporting System (EPLRS) data network (which provides data connectivity to higher headquarters) and to the Single Channel Ground and Airborne Radio System (SINCGARS) data network (acting as the company data (and voice) network).

b. EFV(C)

The EFV(C) communications (over and above the EFV(P)) are depicted in figure 5-2.

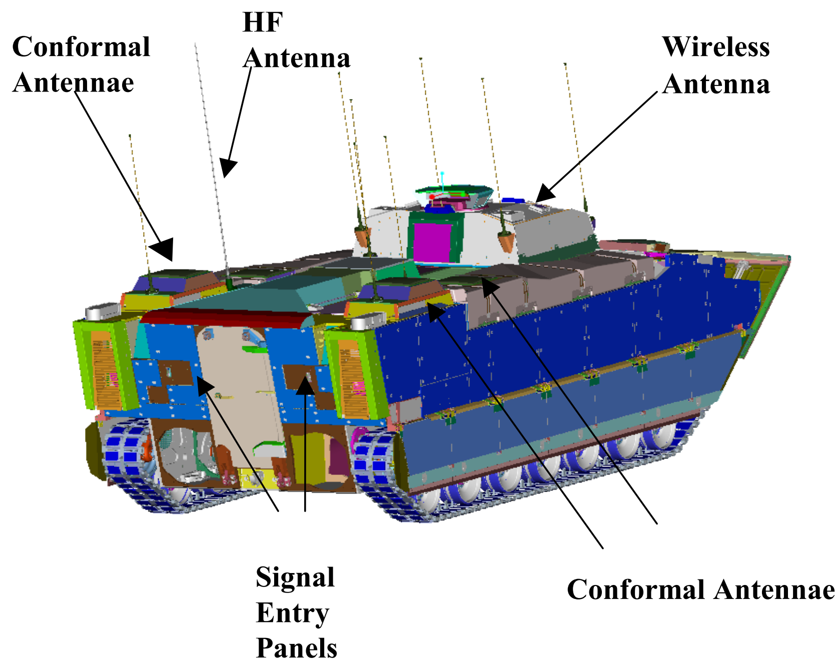


Figure 5-2. EFV(C) Exterior View

The intercommunications system for the EFV(C) provides the capability to integrate voice communications internal to the vehicle between crew/staff members (individually with one another, any combination of individuals, and conference with all) and provides remote access to all onboard radios from all staff/crew positions in order to connect to other external voice units. In the future, the EFV(C) will provide the commander, embarked staff, jump seat personnel, and crew access to the intercom system via a wireless headset connection during dismounted operations.

The EFV(C) communications suite is listed below in table 5-2:

Equipment	Quantity	**Comments**
AN/VRC-89 SINCGARS	6	VHF
AN/PSC-5D SHADOWFIRE MULTI BAND/MISSION	2	UHF DAMA SATCOM, UHF HAVEQUICK II & VHF SINCGARS
AN/VSQ-2 EPLRS	2	UHF data information exchange
MESHNET INTERCOM	1	12 stations, 2 rings (embarked staff on one ring and crew and jump seats on the other ring). Capability to extend the intercom externally via two connections on the SEP panels
AN/PRC-138 Automatic Link Establishment (ALE)	1	High frequency (HF) automatic link establishment radio
ETHERNET INTERFACES	11	To include 1 each at the staff jump seats, used, for example, as DACT or IOW interface to vehicle LAN/radios
TS-21 FAX	1	Also provides copier and printing capabilities

Table 5-2. EFV(C) Communications Equipment

Signal entry panels (SEPs) located aft on the port and starboard sides of the EFV(C) provide both voice and data connections to the staff for the extension of the C4I system. The SEPs allow the EFV(C), while in stationary operations mode, to either extend its own internal data network to include external members or to tie into other networks. Extension of the data network encompasses linking additional EFV(C)s, unit operations centers (UOCs), tactical switching centers, Shipboard Wide Area Networks (SWANs), shipboard Local Area Network (LAN) on ships so equipped, and remote staff operating outside the EFV in a tactical shelter. The EFV network supports up to 24 connected workstations including the workstations internal to the vehicle. Attachment points on the SEP include Ethernet (RJ-45 and N type), LAN, and TBD fiber optic connections. Note: The SDD EFV(C) will not have functional fiber optic connections at the SEP.

c. SINCGARS Radio

The AN/VRC-89 and AN/VRC-90 SINCGARS radios (30 – 87.975 Mhz) provide high security against threat, electronic warfare (EW), by using frequency hoping with integrated COMSEC. It is capable of voice and data transmission (up to 16 kbps under optimum conditions and over limited distances).

SINCGARS is the MAGTF VHF radio that serves as the primary means of communications for command and control and fire support on the battlefield at the infantry battalion and company level. The AN/VRC-90 SINCGARS radio is depicted in figure 5-3.

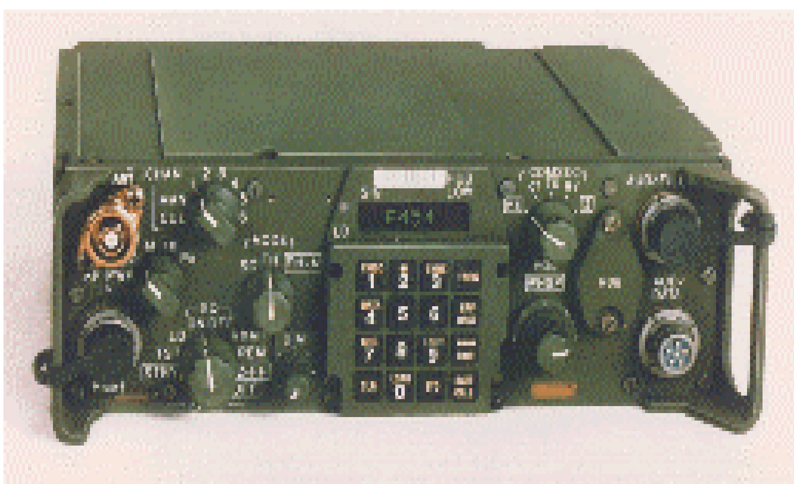


Figure 5-3 AN/VRC-90 SINCGARS

d. Shadowfire Multi Band/Mission Radio

The AN/PSC-5 Shadowfire Multi Band/Mission radio (30 – 400 Mhz) provides embedded narrow/wide band secure voice and data, embedded 5/25Khz DAMA, Non-DAMA backward compatibility, supporting 2.4 and 16 kbps data transfer rates, and the multi band/mission features (SATCOM UHF, LOS UHF, and VHF SINCGARS).

Shadowfire SATCOM capabilities are employed for long-range communications over-the-horizon (OTH). Multiple-access schemes can operate either with fixed channel assignments to the various users or with channels being assigned in varying fashion according to demand. The latter is called demand assigned multiple access (DAMA). With demand assignment the user makes a channel request, and, after a brief time lag, a channel is allocated.

Shadowfire LOS UHF capabilities are employed for MAGTF ground and airborne UHF communications incorporating single channel or HAVEQUICK II (frequency hopping) modes.

The Shadowfire also provides SINCGARS capabilities as discussed in paragraph 5001c. The AN/PSC-5 Shadowfire Multi Band/Mission radio is depicted in figure 5-4.

Figure 5-4 AN/PSC-5 Shadowfire Multi Band/Mission Radio

e. EPLRS Radio

The AN/VSQ-2 EPLRS radio (420 – 450 Mhz with spread spectrum frequency hoping) provides a dedicated data communications capability between regiment and battalion tactical data networks (TDNs) within the ground combat element. A Net Control Station Enhanced (Downsized) (NCS-E[D]) is currently required to establish an EPLRS communications network, providing centralized network management, automatic processing of PLI, digital data message exchange, KYK-13 Crypto Keying, over the air re-key (OTAR), position location: to 15 M CEP, automated routing and relay, and the comm link will not disestablish if NCS-E(D) goes off-line.

During water operations, EPLRS can provide EFV position location to the Amphibious Assault Direction System (AADS) AN/KSQ-1 command and control data system. The AADS provides real time information to the amphibious command ship (ACS), primary control ship (PCS), and the secondary control ship on the position and movement of surface landing craft in the amphibious task force (ATF). An AN/VSQ-2 EPLRS with NCS-E(D) is depicted in figure 5-5.

Figure 5-5. AN/VSQ-2 EPLRS with NCS-E(D)

f. HF Radio

The AN/PRC-138 ALE HF radio is capable of both long- and short-range secure voice and data communications typically limited to rates of 2.4 kbps. The primary advantage of using a HF radio is its capability to provide long-range, OTH communications. An AN/PRC-138 ALE HF is depicted in figure 5-6.

Figure 5-6. AN/ PRC-138 ALE HF

g. Intercoms

(1) EFV(P) The VIC-3 intercom system is an all digital design used in multiple vehicle configurations. The VIC-3 intercom system is depicted in figure 5-7.

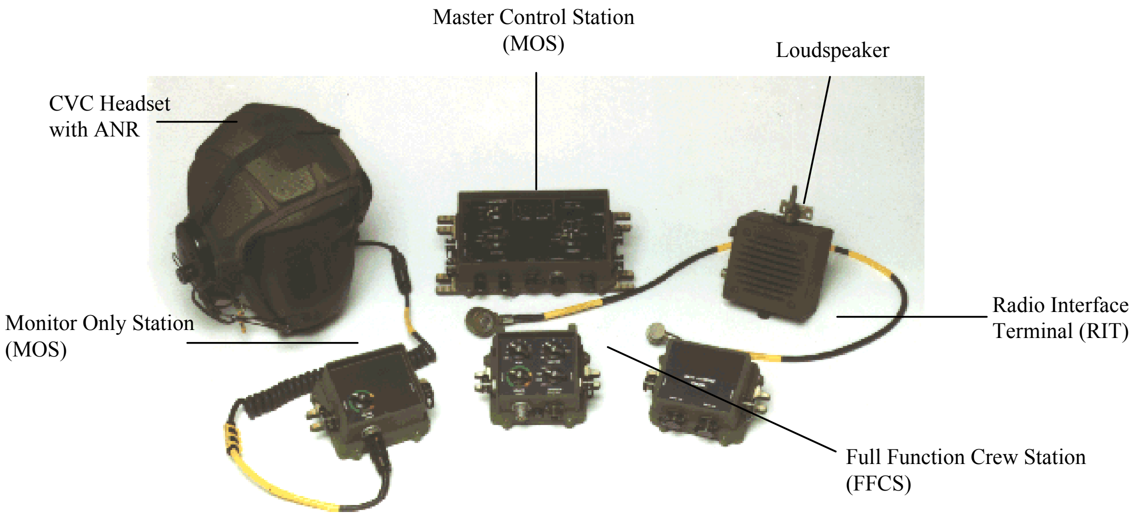


Figure 5-7. The VIC-3 Intercom System

(2) EFV(C) MESHnet is the generic name for a family of communications distribution systems used in command and control environments. Variations of the system depend on the mission and its communication assets. The variation used in the EFV(C) is the AN/TSQ-207 (DASC). By networking communication resources the EFV(C)'s communication distribution system (CDS) provides a common pathway or meshing of intercom, telephone, radio, and data equipment and services. The CDS LAN is comprised of a Network Access Unit (NAU) and up to ten User Control Units (UCDs) in a standard ring topology. The EFV(C)'s LAN acts as a pathway allowing access to communication resources connected to the NAU. The LAN pathway may be extended into a tented area or another vehicle. The extended cable and its UCD(s) are still part of the EFV(C)'s LAN. The MESHnet NAU is depicted in figure 5-8. The NAU is the heart of the CDS. A two-channel intercom (IC) service is provided by the NAU. IC1 and IC2 are mutually exclusive and LAN specific.

Figure 5-8. MESHnet Network Access Unit

The NAU provides for two telephone services, a local internal to EFV(C) service and a built-in interface to access external telephone switches. The telephone services allow the users to call UCD to UCD with a 4-digit number. Additional telephone services include conference calling, call waiting, call forwarding, call transfer, call hold, speed dialing, and line groups. The UCD is depicted in figure 5-9.

Figure 5-9. MESHnet UCD

h. Navigation Unit
The navigation unit consists of an inertial navigation unit (INU) with an embedded global positioning system (GPS). The INU with embedded GPS is depicted in figure 5-10.

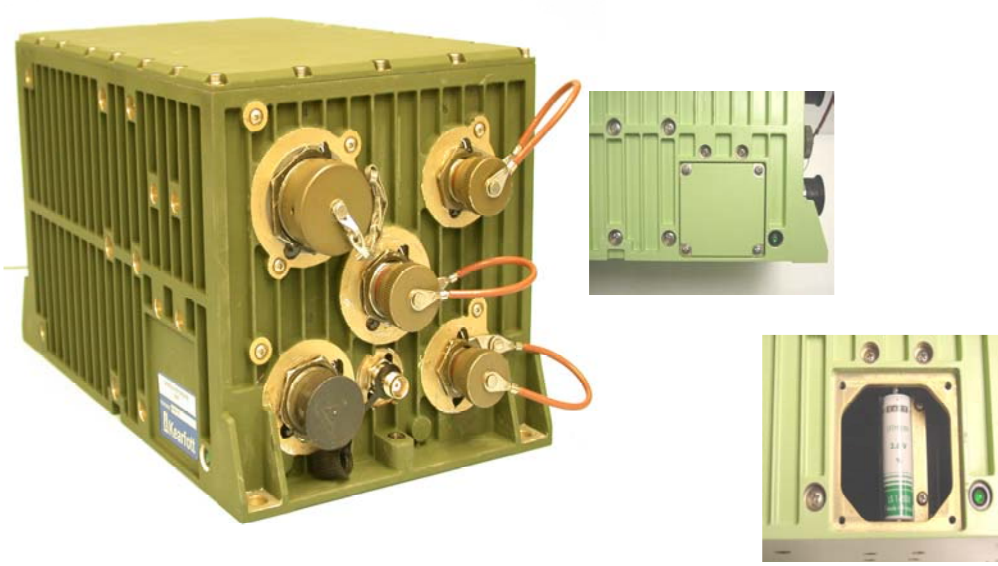


Figure 5-10. INU with Embedded GPS Receiver

i. Fax/Copier/Printer

The TS-21 Blackjack is a ruggedized unit that provides the user with Fax, copier, and printing capabilities. The TS-21 is depicted in figure 5-11.

Figure 5-11. TS-21 Blackjack

j. DACT and IOW

The data automated communications terminal (DACT) is a small, tactical computer and communications terminal that gives users the capability to receive, process, and transmit various messages, to include text and symbology, used by tactical data systems. It runs Command & Control Personal Computer (C2PC) application software providing the user with the Common Tactical Picture (CTP) and message processing. These capabilities allow the DACT to share a common picture of the battlespace, automate data exchange, and provide for MAGTF C4I network connectivity. In addition, the DACT contains a GPS receiver. It is fielded to infantry leaders, used by dismounted infantry, and will be brought aboard the EFVs by the infantry. The DACT interface to the EFVs provides the user an ability to utilize the EFVs communications radios and interface with the EFV's LAN. A DACT is depicted in figure 5-12.

Figure 5-12. DACT

The Intelligence Operations Workstation (IOW) is comprised of a Panasonic CF-28 Toughbook, a Canon BJC-55 Color Bubble Jet combination printer/scanner and the magneto-optical (MO) drive. The IOW is packaged in a hard shell, water tight embarkable case weighting approximately 54 lbs. It operates C2PC application software and other word processing applications. IOWs are fielded to infantry leaders, primarily at the staff level (S-1,2,3,&4s). They are used in main command posts (CPs) and in garrison by infantry. The EFV(C) provides interfaces for the IOW. The IOW Toughbook is depicted in figure 5-13.

Figure 5-13. IOW Toughbook

5002. C4I Architecture

a. EFV(P) Crew Situational Awareness Capabilities

The EFV(P) is capable of providing the VC, driver, and TC stations with situational awareness (SA) to include displaying a CTP of the enemy and friendly situation with location and status information. The EFV utilizes its navigation system, which incorporates a GPS integrated with an Inertial Navigation System (INS), in conjunction with the C2PC tactical software as the resources for situational awareness in the vehicle. The C2PC software uses the same products identified for the Intelligence Operations Server (IOS) V1, to include the Vector Product Format (VPF) Littoral Warfare Data (LWD), and in addition, Digital Terrain Elevation Data (DTED) for SA and the CTP. C2PC is a client agent that provides the capability to import CTP data from databases (processed intelligence data, i.e., enemy locations, intelligence reports, and Joint Photographic Experts Group [JPEG] format and National Imagery Transfer File [NITF] format files) from (external to EFV[P]) databases to include IOS V2. C2PC processed information includes operations orders and overlays and other CTP data. C2PC also provides a moving map capability that displays not only the vehicle's location but also preplanned routes and tactical overlays. Information such as "steer-to" current heading & position, and speed can be continuously displayed, as well. For mapping, C2PC uses Raster Product Format (RPF) and VPF map standards and DTED. The situational awareness capabilities integrated into the EFV enable the vehicle to conduct tactical navigation over extended distances. In addition, C2PC allows the VC and TC to generate, transmit, receive, and display messages (both preformatted and free text) in the required formats of the timeframe, to include US Message Text Format (USMTF) and Variable Message Format (VMF) for operational, intelligence, logistics, and fire support messaging. The messages provided are listed below:

- Operational/intelligence/logistics messages:
  - Spot/salute report.
  - Op plan/frag/warning orders.
  - Op/intel overlay.
  - Situation report.
  - Position report.
  - Free text message.
  - MEDEVAC request.
  - Rapid request/logistics support.
  - NBC-1 report.
- Fire support messages:
  - Artillery/mortar messages.
    - -- Call for fire.
    - -- Adjustment.
    - -- Check fire.
    - -- End of mission and surveillance.
    - -- 81mm and 60mm call for fire.
- Close air support messages:
  - Tactical air request.
  - 9-line brief.
  - Assault support request.

Figure 5-14 shows a common display processor (CDP), the primary Marine-Machine Interface (MMI) between the crew and the EFV, used for navigation. The CDP is used to display the situation map, unit and enemy positions, fire support data, free text and pre-formatted messages, disseminate frag orders, and display overlays. The CDP allows, via an ethernet port, for the download of information from a DACT to the CDP to utilize while on EFV and the upload from CDP to DACT to utilize after departing the EFV. The CDP software consists of **Windows NT** and C2PC. In addition, the CDP is used to monitor and report all of the vehicle health information. Figure 5-15 shows C2PC on the CDP. The CDP, using C2PC application software, is interoperable with VHF SINCGARS, UHF SATCOM, UHF HAVEQUICK, and EPLRS.

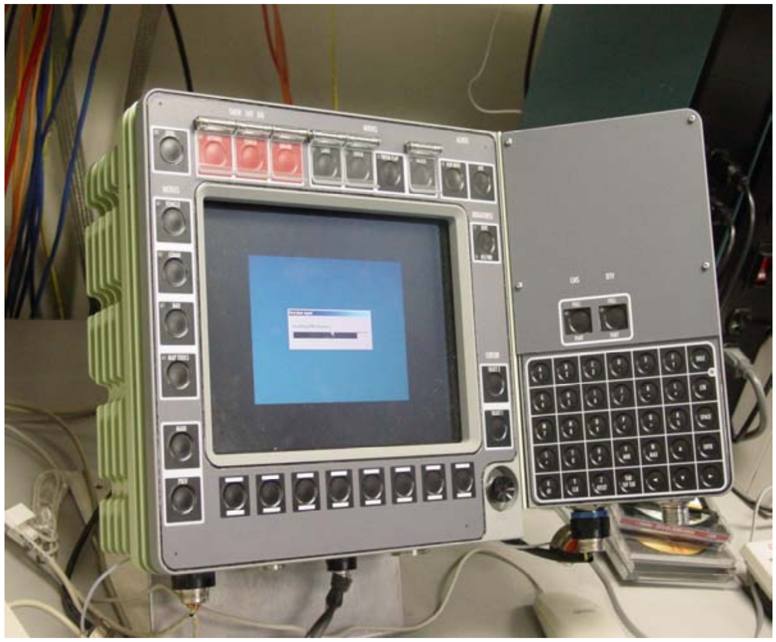


Figure 5-14. EFV Common Display Processor (CDP)

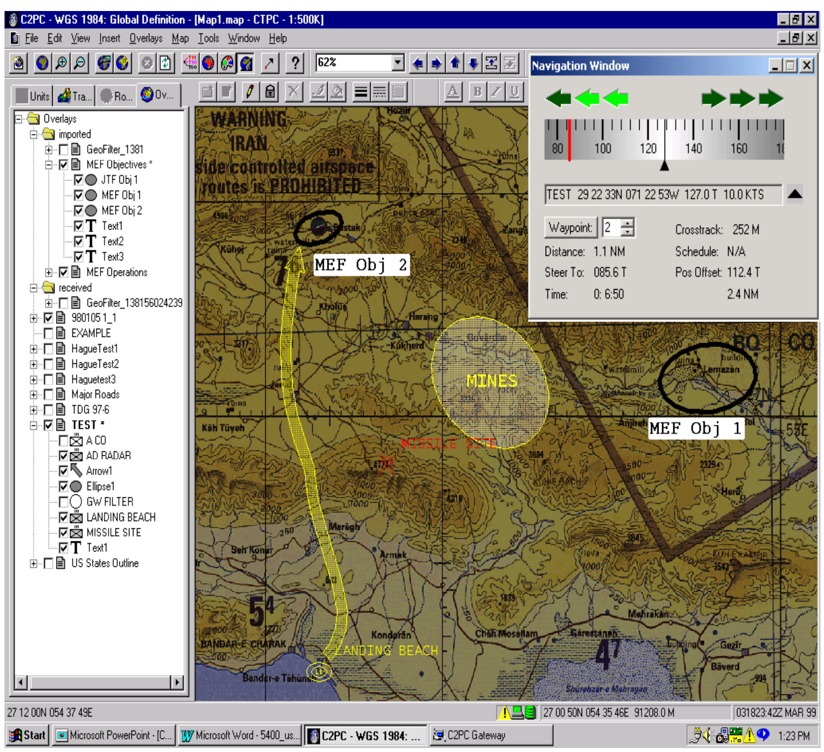


Figure 5-15. C2PC on the CDP

b. EFV(C) C4I Suite

In addition to the situational awareness and CTP capabilities provided to the EFV(P) described in 5002a, the EFV(C) incorporates an integrated C4I Suite that provides the infantry commander and his command group with communications to support operations/maneuver, intelligence, and fire support needs. This C4I suite allows the embarked Marines to effectively function as either an infantry battalion or infantry regimental tactical echelon headquarters. The suite is composed of LOS and BLOS radio equipment, computer hardware, and tactical software applications. This C4I suite provides the embarked commander and his command group the capability to communicate and interoperate with Marine Corps senior, adjacent, and subordinate maneuver units; combat support units; combat service support units and joint forces.

The EFV(C) provides seven computer workstation positions, communications systems, and tactical warfighting applications for an embarked infantry battalion or regimental commander and six staff members. Notionally, the staff will include an intelligence officer (S-2), operations officer (S-3), fire support coordinator (FSC), air officer (AO), artillery liaison officer (ALO), and a communications and information systems representative (S-6). In addition, two jump seats are provided with work surface, intercommunications access, and a network interface (e.g., DACT/IOW plug-in to EFV[C] network providing the ability to exchange data and messaging with the rest of staff and use of onboard radio assets).

The EFV(C) C4I suite hosts the same tactical command and control (C2) software applications fielded to all other Marine Corps amphibious assault (AA) and infantry units. The tactical software systems applications provided at the staff workstations are as follows:

- IOS V1 is the software upgrade of the Tactical Combat Operations (TCO) (Global Command and Control System-Maritime (GCCS-M)). Its primary function is to be an operational planning tool for MAGTF commanders. Major functional capabilities include:
  -Maintenance and dissemination of a Common Tactical Picture (CTP)
  -Track management
  -Development and dissemination of operations orders and overlays

Note:

The IOS V1 software application is a subset of IOS V2 software application; thus, IOS V2 is the software application actually loaded on the EFV(C)

- IOS V2 is the software upgrade of the Intelligence Analysis System (IAS) Suite. The primary function continues to be the automation of MAGTF intelligence activities, to include collection, processing and dissemination of multi-source, critical tactical intelligence. Major functional capabilities include:
  -All Source Intelligence Fusion at all command levels
  -Development of enemy ground situation
  -Access to joint, theater, and national intelligence
  -Rapid tactical intelligence production and dissemination
- Tactical data network (TDN) functionality provides server functionality for the on-board and externally connected data systems. The TDN capability includes, but is not limited to, Internet Protocol (IP) routing, name services, file services, dynamic host configuration, and electronic mail services.
- C2PC is a client agent that provides the capability to access data from the IOS V1

database (CTP data), the IOS V2 database (processed intelligence data), and the Advanced Field Artillery Tactical Data System (AFATDS) database (fire control messaging) and display at the crew (VC and Driver) and EFV(C) embarked staff workstations.

- AFATDS aboard the EFV(C) provides the infantry commander with the capability to rapidly integrate ground, air and naval fire support into the scheme of maneuver. As a battlefield management and decision support system, it assists the infantry commander and the fire support coordinator (FSC) in the planning, delivery and coordination of supporting arms. AFATDS supports the fire support C2 requirements for the Marine Corps.

A functional diagram of the EFV(C) C4I suite is pictured in figure 5-16.

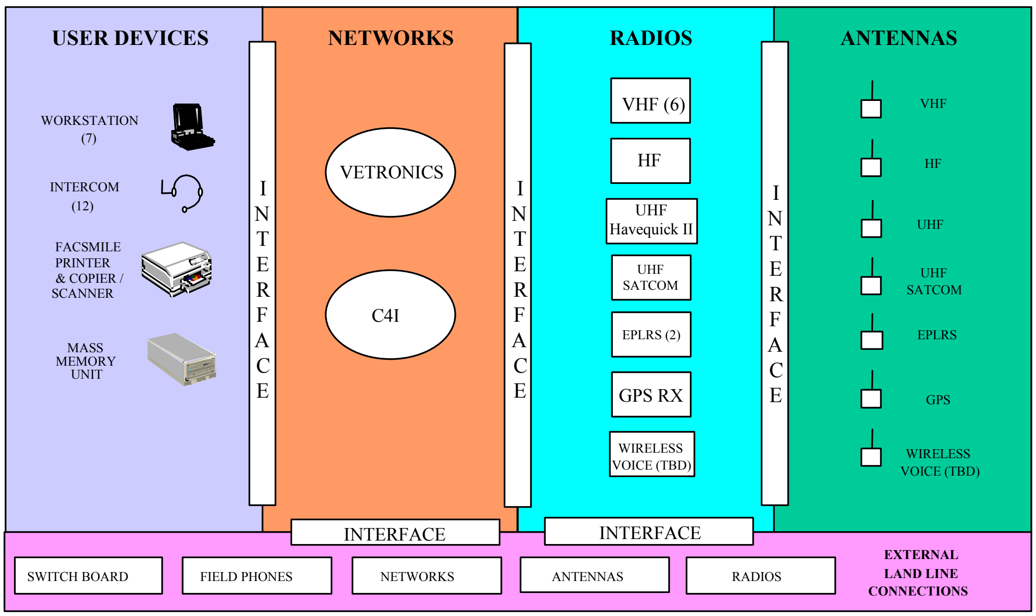


Figure 5-16. EFV(C) C4I Suite

The EFV(C) C4I suite consists of the following subsystems as depicted in figure 5-17:

- Voice communications subsystem.
- Radio frequency (RF) communications subsystem.
- Computer networks subsystem.
- Signal entry panel.

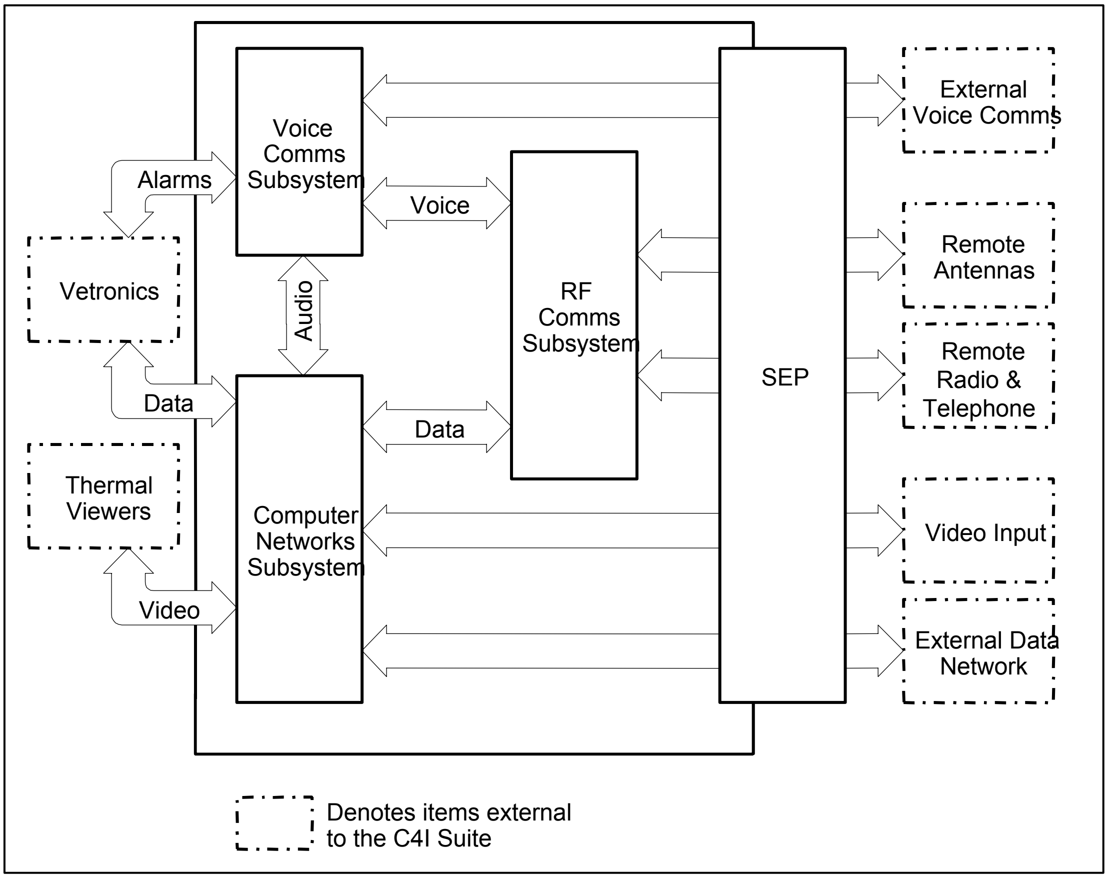


Figure 5-17. EFV(C) C4I Subsystem

(1) EFV(C) Voice Communications The C4I Suite provides an integrated Voice Communications Subsystem (VCS). The VCS is the means by which all voice signals are distributed within (and external to) the EFV(C). The VCS is depicted in figure 5-18. The Voice Communications Subsystem is operable during all modes of EFV operation and during transitions between modes. VCS User Stations provide an interface to the VCS allowing an operator audio access and control of the communications equipment and circuits connected to the VCS.

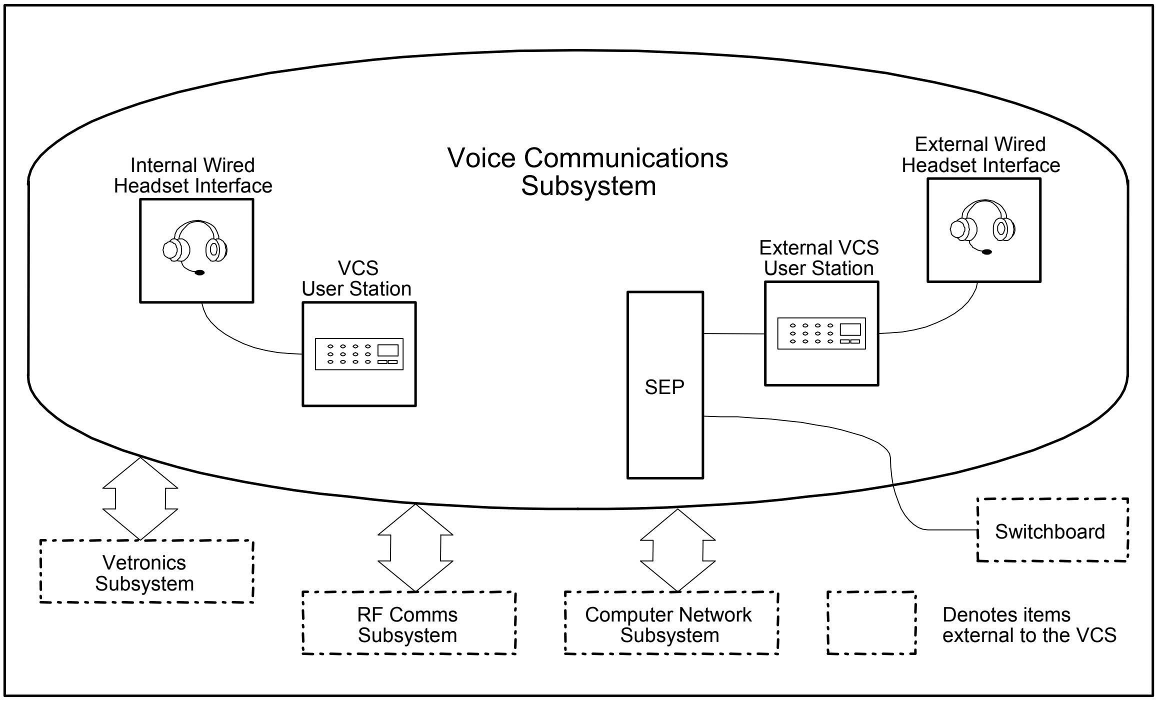


Figure 5-18. Voice Communications Subsystem

(2) EFV(C) RF Communications The EFV(C) RF Communications Subsystem (RCS) operates in three frequency bands: HF; VHF; and UHF. The RCS is depicted in Figure 5-19. The RF Communications Subsystems is operable during all modes of operation and during transition between modes.

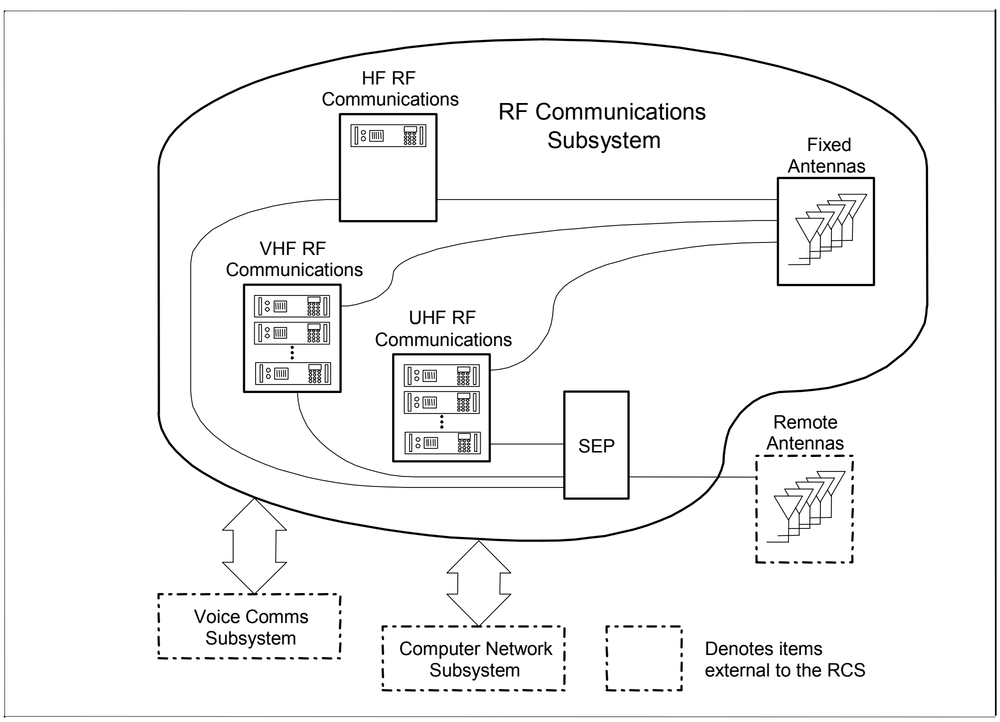


Figure 5-19. RF Communications Subsystem.

(a) EFV(C) HF RF Communications The HF RF communications subsystem, shown in figure 5-20, comprises an RF capability in the frequency range of 1.6 MHz to 30 MHz. The HF subsystem consists of an HF voice/data radio, capable of ALE, using both groundwave and skywave propagation. The HF subsystem is capable of operating while the EFV(C) is stationary and on the move. While the EFV(C) is stationary, the HF subsystem permits the connection to a unit provided HF dipole antenna.

The HF radio communications system is capable of sending and receiving secure voice and data communications. The HF radio (PRC-138) communications subsystem is a Type-I NSA-approved encryption device with zeroize capability.

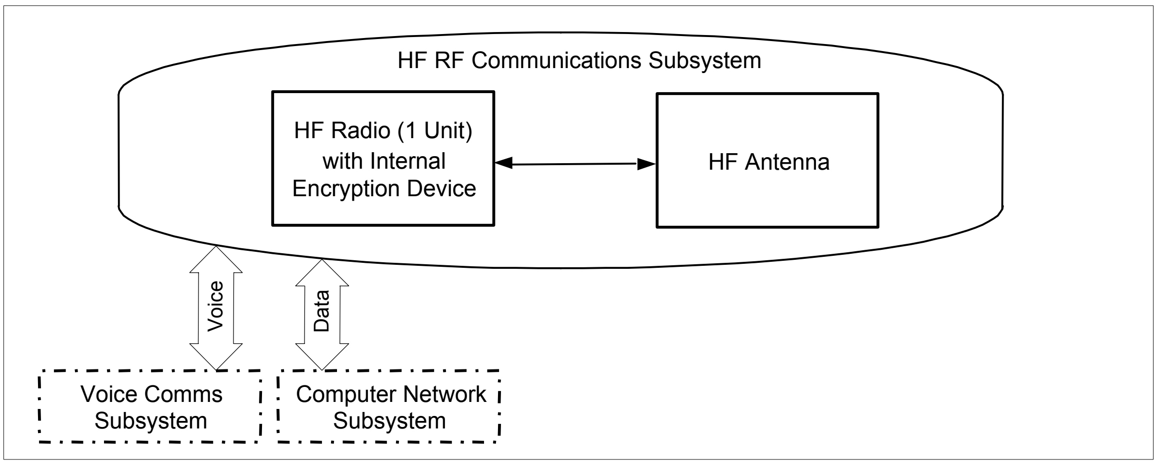


Figure 5-20. HF RF Communications Subsystem

(b) EFV(C) VHF RF Communications The VHF RF communications subsystem, shown in figure 5-21, comprises all the RF capabilities within the frequency range of 30 MHz to 88 MHz. The C4I Suite provides eight VHF voice/data circuits (SINCGARS waveform, operating single channel or frequency hopping). The VHF subsystem is comprised of three SINCGARS AN/VRC-89 radio systems (containing two SINCGARS radios each), and two AN/PSC-5D radios. Each AN/VRC-89 contains a single radio frequency power amplifier (RFPA). Hence, only one radio contained within the duel mount may be operated at 50Watts (W), while the second may only operate up to 4W. The AN/PSC-5Ds are limited to operation up to 18W. VHF radio communications operate while in stationary and on the move modes of operation.

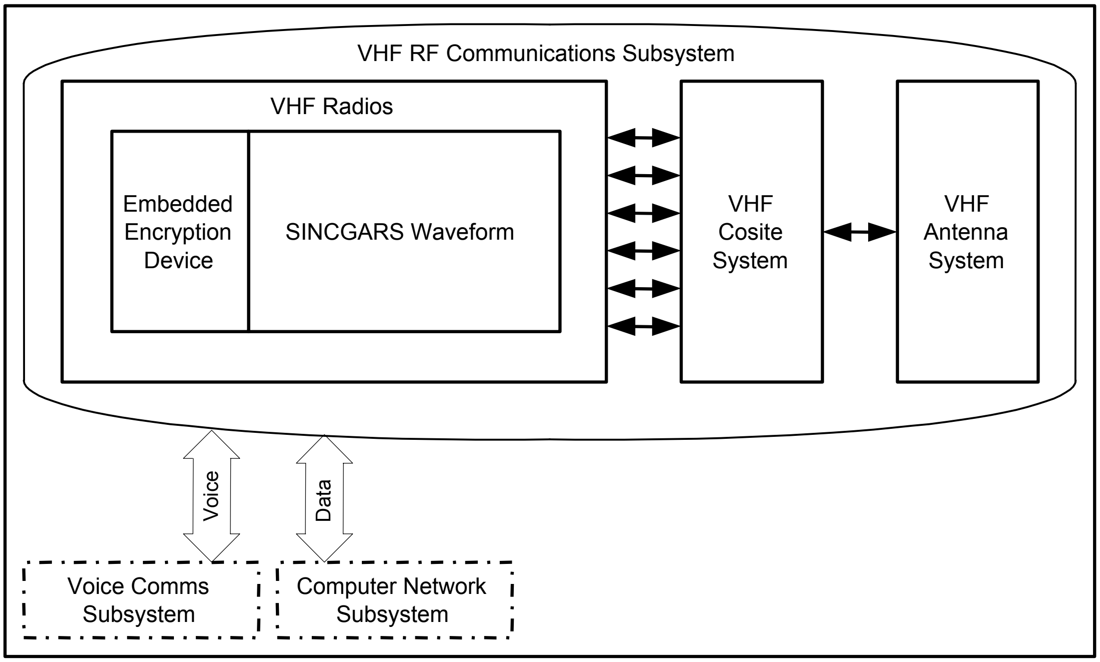


Figure 5-21. VHF RF Communications Subsystem

VHF cosite mitigation is required when two or more transmitters are co-located with a receiver. A receiver is typically configured for high sensitivity while the transmitters are configured for high power. It is the difference between these two extremes of radio operation that necessitate the need for cosite mitigation. The EFV(C) cosite mitigation improves the isolation between transmitters and receivers. This isolation is accomplished through the use of the following techniques:

- Antenna frequency, spatial and polarization diversity.
- Active/passive cosite mitigation (RF filtering, interference cancellers, etc.) on the transmitters and receivers.
- Transmitter and receiver arbitration.
- Spectrum management to control technical system parameters, such as, power, frequencies, etc.
- Traffic management.
- Operational procedures.

The VHF RF radio communications subsystem is able to send and receive secure voice and data communications. The VHF RF radio communications subsystem is compatible with a Type I NSA-approved encryption device with zeroize capability.

(c) EFV(C) UHF RF Communications The UHF RF communications subsystem, as shown in figure 5-22, is comprised of the RF capabilities in the frequency range of 225 MHz to 3 GHz. The C4I Suite provides two HF data radios (EPLRS waveform) and two multiband/multimode radios providing either two, or a combination of the two, UHF LOS voice/data channels (non-HAVEQUICK) or HAVEQUICK II waveform) or two UHF-SATCOM voice/data channels (DAMA and non-DAMA capable). The C4I Suite provides the RF channel for one GPS circuit.

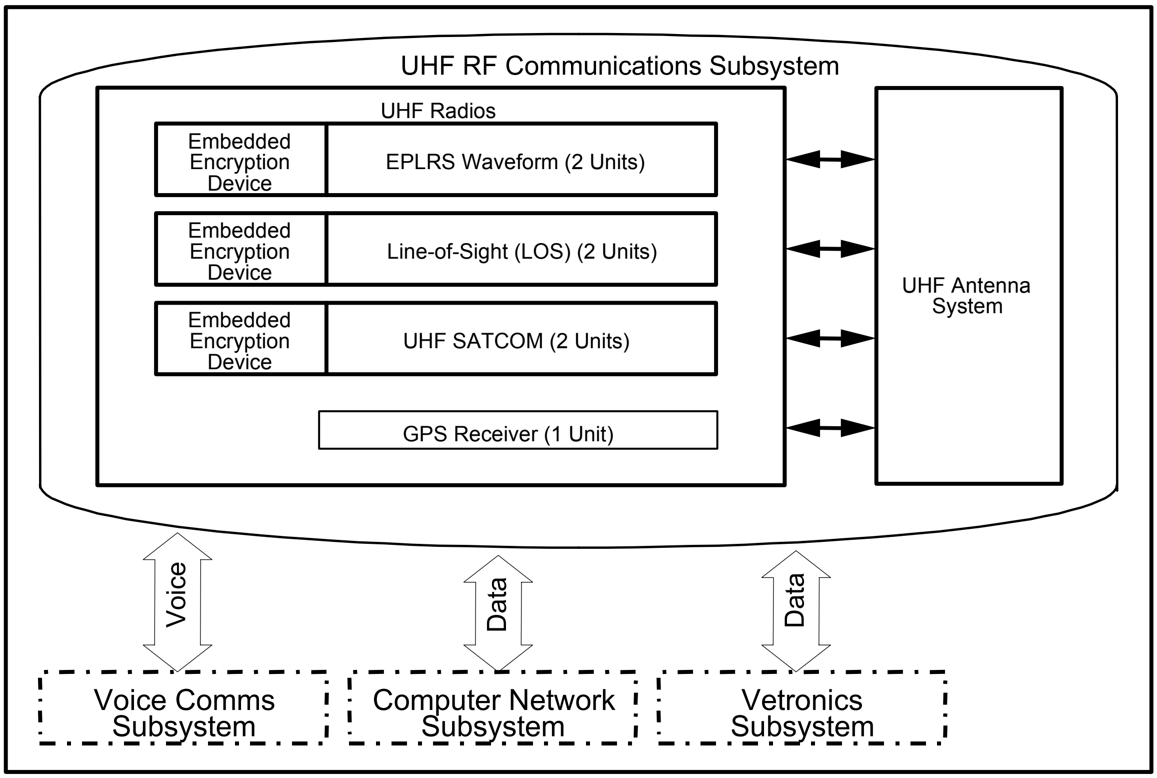


Figure 5-22. UHF RF Communications Subsystem

The EPLRS, in its installed configuration:

- Can achieve a maximum link range limited to RF line of sight.
- Is capable of operating while stationary and on the move.
- Is capable of sending and receiving data communications.
- Is compatible with a Type I NSA-approved encryption device with zeroize capability.
- Transceivers are capable of operating simultaneously with each other, and with all other transceivers on the vehicle.

The EFV UHF LOS capability consists of AN/PSC-5D SHADOWFIRE radio(s) with MXF-114 power supply unit(s). The UHF LOS capability primarily provides EFV to fixed wing communications. The UHF LOS operates in the 225.000 to 399.975MHz frequency bands in 25kHz channel increments. UHF LOS capabilities are capable of operating when the vehicle is stationary and when on the move. The UHF LOS system is able to send and receive secure voice and data communications. The AN/PSC-5D has an embedded Type I NSA-approved encryption device with cryptographic and zeroize capability. The EFV(C) carries two AN/PSC-5D radios; but, only one AN/PSC-5D is wired for UHF LOS operations. UHF LOS transceivers are capable of operating simultaneously with all other transceivers on the vehicle.

The UHF Satellite Communication (SATCOM) system consists of two AN/PSC-5D radios. The UHF SATCOM operates with DAMA and non-DAMA (single channel) SATCOM Channels. The UHF SATCOM capability is operable when the vehicle is stationary and when on the move. Each SATCOM system supports one voice or one 16kbps data circuit. The data rate is controlled by the UHF SATCOM subsystem to be the maximum allowable on the link given the error rate performance of the channel and the configuration of the radio itself. Each SATCOM system supports one voice or one 2.4kbps data circuit. Each UHF SATCOM system is designed such that it can support a 3 kbps burst rate data circuit using a 5 kHz bandwidth DAMA channel at a maximum sustained rate of 2.4 kb/s when the operating conditions permit. The data rate is controlled by the UHF SATCOM subsystem to be the maximum allowable on the link given the error rate performance of the channel and the configuration of the radio itself. The UHF SATCOM radio communications system is able to send and receive secure voice and data communications. The AN/PSC-5D has an embedded Type I NSA-approved encryption device with cryptographic and zeroize capability. One of the two UHF SATCOM transceivers is capable of operating simultaneously with all other transceivers on the vehicle.

The C4I suite includes an antenna, low noise amplifier and cross-band filter for the EFV Vetronics Navigation Subsystem GPS.

(3) EFV(C) Computer Network The Computer Network Subsystem comprises servers, workstations (with display), data network, tactical and non-tactical applications, peripherals, non-volatile digital storage backup and retrieval, and LAN connection points for user provided computers (e.g., DACT/IOW). The Computer Network Subsystem is illustrated in figure 5-23. The Computer Network Subsystem is operable during all modes of operation, and during transition between modes. The Computer Network Subsystem provides TDN functionality for the on-board and externally connected data systems.

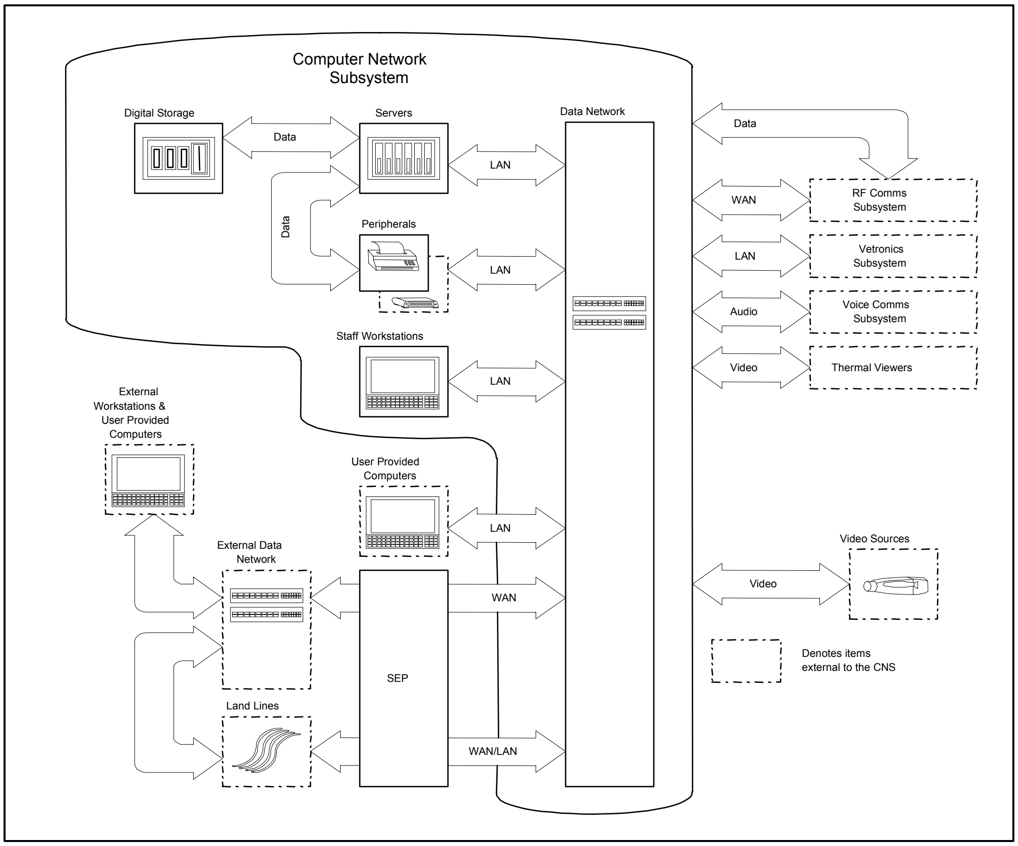


Figure 5-23. Computer Network Subsystem

(a) Data Network The C4I data network provides the data communications backbone to the EFV(C) staff workstations facilitating accurate data and information exchange. The functionality of the EFV(C) C4I data network is comprised mostly of data switching and routing. Data switching is used primarily for LAN support. Data routing is the means by which hosts on the LAN access the Marine Corps' Wide Area Network (WAN). The EFV(C) data network is ethernet based and utilizes standard commercial open data communications protocols.

Staff workstations, servers, user-provided equipment (e.g., IOWs, DACTs), and other network devices – are connected to the EFV(C) C4I LAN via a fast ethernet switch. The C4I suite provides eleven Ethernet IEEE 802.3 compliant network connections internal to the vehicle, in addition to those required by organic assets (e.g., FAX/Printer/Copy Machine), that attach user provided computers (e.g., DACTs or IOW). In addition to these internal ethernet connections, the C4I Suite has the capacity to support a total of no less than 24 network workstations located internally and externally to the vehicle (7 internal organic workstations and 14 additional external workstations during stationary operations).

All C4I suite data network LAN ethernet connections support 10Base-T and 100Base-T mediums. All C4I Suite data network LAN ethernet connections auto-negotiate between 10Base-T and 100Base-T media. The C4I Suite data network provides connectivity between 10Base-T and 100Base-T media. The C4I Suite data network LAN supports full-duplex transmissions.

The C4I data network LAN supports IEEE 802.1Q virtual LANs, IEEE 802.1D Spanning Trees, ethernet IEEE 802.3, and the future integration of a IEEE 802.11 wireless LAN.

C4I WAN connections are supported by network router(s) utilizing commercial open standard routing protocols.

The C4I data network supports a minimum of four WAN serial connections. The serial connections are Electronic Industries Association (EIA) RS-232, RS-422, and RS-530 compatible. The serial connections support synchronous serial communications and asynchronous serial communications. Point-to-point protocol (PPP) is supported over the serial connections. X.25 and X.121 protocols are supported over the serial connections. The C4I data network supports WAN connections over the switched telephone network Tri-Services Tactical Communications (TRI-TAC) Unit Level Circuit Switch (ULCS). The C4I data network supports WAN connections over Ethernet IEEE 802.3 connection. The C4I data network supports a minimum of two 10/100Base-T auto-negotiated WAN connections. The C4I data network supports a minimum of two external 100BaseF connections.

The C4I data network equipment is capable of uploading configuration files to a server or staff workstation via file transfer protocol (FTP). The C4I data network equipment is capable of downloading configuration files from a server or staff workstation via FTP. The C4I data network equipment supports remote login, including Telnet. The C4I data network is Simple Network Management Protocol (SNMP) manageable. The C4I data network equipment maintains MIB-II compliant management information bases.

(b) Servers Servers provide centralized computing for network applications to run in support of client applications running on the staff workstations.

A design decision was made such that the C4I Suite provides servers for two IOS V2 applications to support staff workstation clients. The IOS V1 applications and databases are a subset of the IOS V2 applications and databases; therefore, the functionality for both IOS V1 and

IOS V2 is provided to the EFV(C) staff for their use. This design decision was made to support the development of procedures to synchronize the two IOS V2 databases. Currently these two databases act independently and are not synchronized and one can not provide a seamless backup for the other.

The C4I Suite provides two (2) servers for the AFATDS application to support staff workstation client(s). These two (2) servers provide the ability for at least 2 AFATDS clients to operate with AFATDS simultaneously, one to work the current battle and the second to plan for future battles, in a UNIX environment, without conflicting with one another. The two AFATDS servers talk via ethernet IP addresses so that each is up to date on the current tactical picture and should the AFATDS working the current battle go down the other AFATDS can seamlessly take over the current battle. The C4I Suite provides the ability for the AFATDS server application to interface directly with tactical radios and external networks to send and receive digital fire control messages. Each AFATDS server is provided with two (2) 100BaseT ethernet interfaces.

The C4I Suite provides a network server, providing TDN functionality, that performs Internet Protocol (IP) routing, name services, file services, dynamic host configuration, and electronic mail services. The network server provides the capability for analog Red, Green, Blue (RGB) video output supporting common video interfaces Video Graphics Array (VGA) (640x480 pixels resolution), Super Video Graphics Array (SVGA) (800x600 pixels resolution), eXtended Graphics Array (XGA) (1024x768 pixels resolution). The Network Server hardware is compatible with Windows NT4.0 and Windows 2000 operating systems by Microsoft. The network server incorporates email server capability using Microsoft Exchange Server 5.5 software by Microsoft, a Wins Dynamic Host Configuration Protocol (DHCP) server capability using Microsoft NT Server software, a Domain Name System (DNS) server capability using Microsoft NT Server software, an FTP Transmission Control Protocol/Internat protocol (TCP/IP)-based utility resident in Window 2000 and NT4.0, an HyperText Transfer Protocol (HTTP) TCP/IP-based utility resident in Window 2000 and NT4.0, a Trivial File Transfer Protocol (TFTP) server capability using TFTP server software by Wallusoft, a Telnet TCP/IP-based utility resident in Window 2000 and NT4.0, Portable Document Format (PDF) file reading capability using Acrobat Reader 4.0 software by Adobe, Web Browsing capability using Internet Explorer 4.0 by Microsoft and Netscape Communicator 4.7 by Netscape, E-Mail client capability using Outlook 2000 by Microsoft and Netscape Mail 4.7 by Netscape, X-Terminal emulation capability using Exceed 6.2 emulation software by Hummingbird, Virus Scanning capability using Norton Antivirus 5.0 by Symantec, hard disk scanning and repair utilities using Norton Utilities 2.0 by Symantec, network monitoring capability using HP Openview 6.1 software by Hewlet Packard, ASCII Terminal emulation capability using Tera Term Pro 2.3 terminal emulation software by Tera, Software Installation capability using Norton Ghost 6.0 by Symantec and Install Shield Professional Edition by Installshield, and System Backup capability using Veritas Backup Exec – Server 8 by Veritas.

The file server provides the capability for analog RGB video output supporting common video interfaces VGA (640x480 pixels resolution), SVGA (800x600 pixels resolution), XGA (1024x768 pixels resolution). The file server has a Universal Serial Bus (USB) 1.0 interface for interface to carry-on peripherals such as memory devices, scanners and digital cameras. The file server provides storage for the C4I Suite.

The C4I Suite hosts C2PC Gateway version 5.9.0.3 or later versions. Server hardware hosting C2PC Gateway is compatible with Windows NT4.0 and Windows 2000 operating systems. The C2PC Gateway interfaces to C2PC clients over the C4I data network LAN. The C2PC Gateway interfaces to the IOS V1 Tactical Data Base Manager (TDBM) over the C4I data network LAN. The C2PC Gateway interfaces to C2PC clients over three VHF tactical radios and one HF tactical radio as a minimum.

(c) Staff Workstations The staff workstations in the EFV(C) provide each member of the command group with a computer for executing client applications. A staff workstation is defined as the processor, display, keyboard, and pointing device used by each of the seven embarked staff members. The C4I Suite provides seven staff workstations for the embarked Battalion or Regiment staff command group to perform their assigned duties. The staff workstations:

- Provide the capability for analog RGB video input using common video interfaces XGA (1024x768 pixels resolution) and SXGA (1280 x 1024 pixels resolution)
- Provide the capability for digital video output in accordance with the Digital Video Interface (DVI) standard using common video resolutions XGA (1024x768 pixels) and SXGA (1280 x 1024 pixels)
- Hardware is compatible with Windows NT4.0 and Windows 2000 Professional operating systems by Microsoft
- Incorporate Windows 2000 Professional by Microsoft as the disk based operating system
- Incorporate email client capability using Outlook 2000 by Microsoft

- Incorporate X-Terminal emulation capability using Exceed 6.2 emulation software by Hummingbird
- Incorporate PDF file reading capability using Acrobat Reader 4.0 software by Adobe
- Incorporate Virus Scanning capability using Norton Antivirus 5.0 by Symantec
- Incorporate hard disk scanning and repair utilities using Norton Utilities 2.0 by Symantec
- Incorporate word processing, spreadsheet, presentation, and database capability using Office 2000 office productivity software by Microsoft, and
- Incorporate Command and Control client capability using government furnished C2PC 5.9.0.3 software

The EFV(C) data network and servers allow each staff workstation to access any of the tactical or non-tactical applications; thus, allowing the staff to sit anywhere in the vehicle and pull up the application that applies to their duties. The staff workstations also provide a capability for split screen allowing the staff to toggle between applications.

The staff workstation display, the display processor unit (DPU), supports a common video interface, resolution and size, provides the video interface standards needed for operation of the C4I Suite and the system application programs, and is capable of directly receiving and displaying an analog RS-170 video signal. The DPU has common interfaces, technical display characteristics and physical footprint with a minimum refresh rate high of 60Hz to eliminate human-perceivable flicker under normal vehicle conditions.

The C4I suite provides human-machine interfaces at each staff workstation for computer input from and output to the operator conforming to MIL-STD-1280 keyboard with pointing device.

The C4I suite allows the input of RS-170 video signals from the driver thermal viewer (DTV) and vehicle commander thermal viewer for display at any one of the staff workstations. The C4I Suite allows the input of RS-170 video signals from external sources for display at any of the staff workstations.

Figure 5-24 depicts a DPU, the staff workstation. Figure 5-25 depicts C2PC on the PDU.

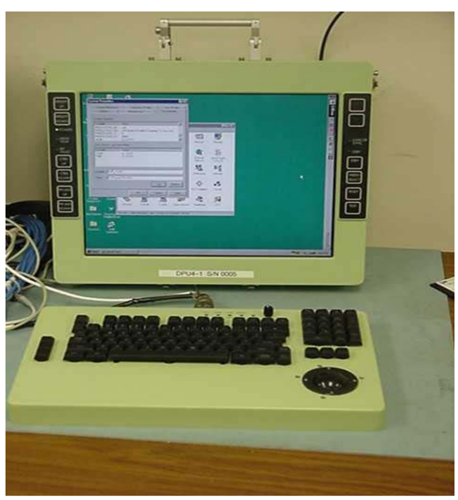


Figure 5-24. Display Processor Unit (DPU) and Keyboard

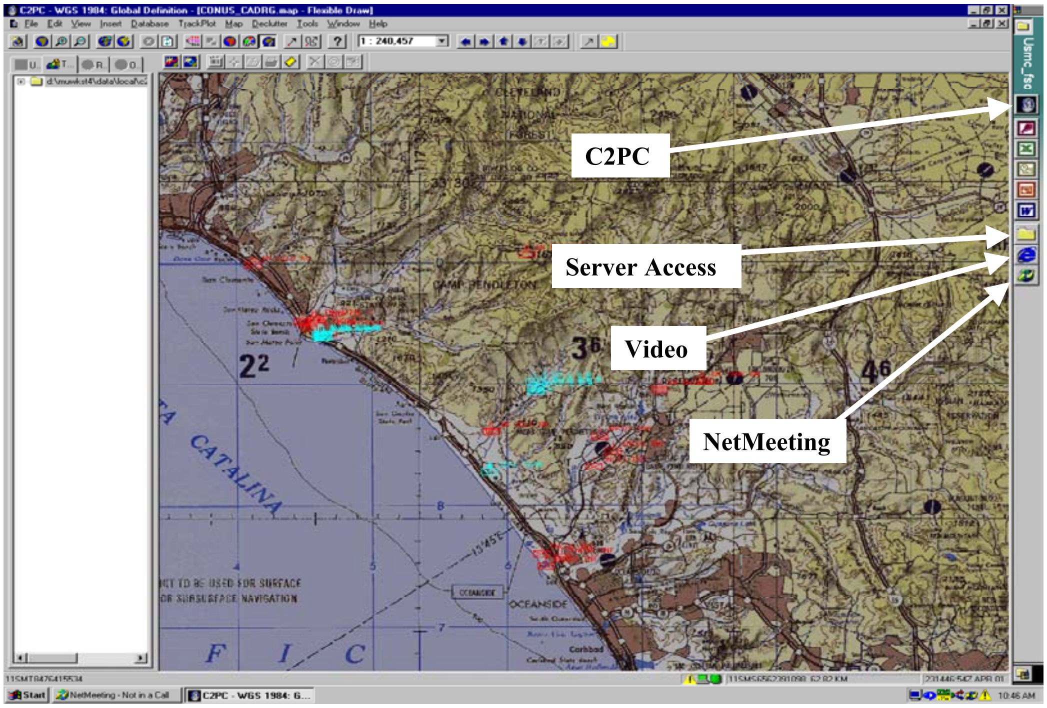


Figure 5-25. C2PC on the DPU

(d) Peripherals The C4I Suite, via the TS-21, provides the facility to send and receive facsimile transmissions and print, copy, and scan capabilities.

Each C4I staff workstation has the capability to remotely access the on board TS-21 facsimile capabilities. The C4I Suite supports transmission and reception of facsimile over HF tactical radio, over VHF tactical radio, over SATCOM, and over the TRI-TAC network via digital non-secure telephone (DSVT).

The C4I suite provides each C4I suite staff workstation with the capability to remotely access the on-board TS-21 printer and any externally connected printers.

The TS-21 facsimile, printer, copier, and scanner capabilities have the minimum capability to print on 8.5-inch by 11-inch paper. The high-resolution selection provides 204 horizontal x 196 vertical pixels/inch (8.0 x 7.7 pixels/mm).

(e) Digital Storage The C4I Suite provides dedicated non-volatile digital storage for each server. The Non-volatile digital storage devices support Multi-mode Single-Ended/Low Voltage Differential (MSE/LVD) Small Computer Serial Interface (SCSI). Utilizing these storage devices the C4I Suite provides the capability to back-up all application software and user data (this includes all software necessary to host and operate all C4I applications) and to retrieve application software and user data from these digital storage devices. The devices used for back-up storage media are CD-R/W (Compact Disc – Read/Write) and DVD-R/W (Digital Video Disc – Read/Write). The devices used as back-up retrieval media are CD-ROM (Compact Disc – Read Only Memory), CD-R/W, DVD-ROM, DVD-R/W compact discs. The C4I Suite provides the capability to attach additional MSE/LVD SCSI devices as the back-up and retrieval media as needed.

The C4I suite provides facilities to download user application programs and data/databases into the vehicle. The C4I suite provides downloads to be done from 4 mm digital audio tape (DAT), DVD, CD-ROM, or other non-organic MSE/LVD SCSI devices. Prior to the start of a mission, the C4I suite is capable of downloading mission-specific information via an external network connection.

The C4I suite provides mass memory units (MMUs) allowing for removal of the non-volatile digital storage and digital storage back-up/retrieval media for rapid declassification of the vehicle.

The C4I suite computer network system provides for hosting on-vehicle IETMs to assist with fault isolation, trouble-shooting, and on-vehicle maintenance.

(4) EFV(C) Signal Entry Panel (SEP) The EFV(C)'s SEP panels are used to connect the staff workstations to assets located external to the vehicle without degrading the armor, NBC, and electromagnetic interference (EMI) integrity of the vehicle shell. The two SEPs located at the rear of the EFV(C) are identical in functionality. Figure 5-26 depicts a signal routing diagram for a SEP.

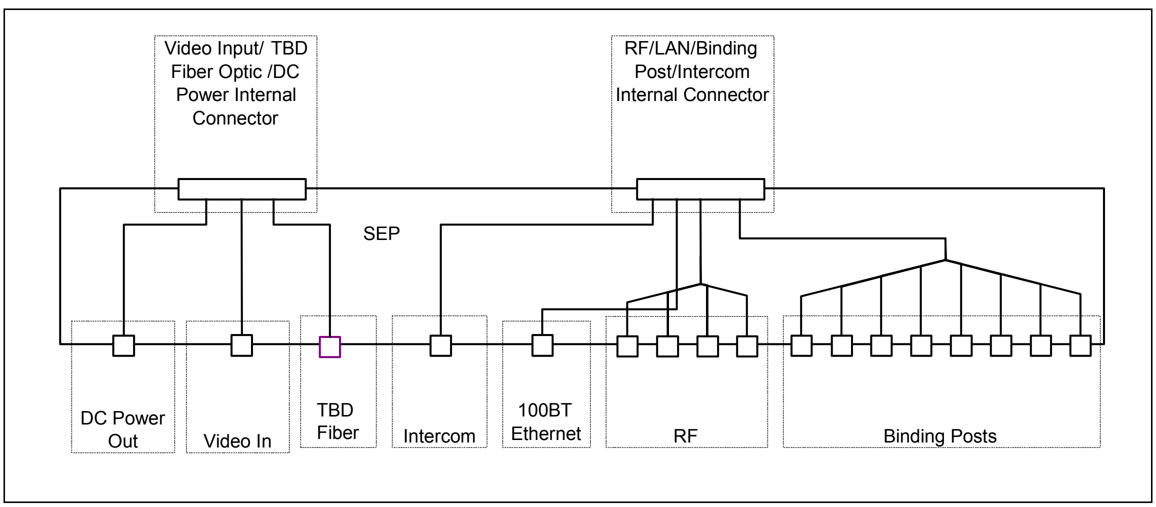


Figure 5-26. SEP Signal Routing Diagram

The SEPs are entry and exit points for signals into and out of the EFV(C) vehicle. The purpose of the SEP is to allow the EFV(C) to employ remote antennas, support external workstations linked into the vehicle LAN, and connect to various two and four wire communications schemes using binding posts.

5003. Security

Standard security procedures are employed on the EFV to safeguard classified material and/or information. All personnel and automated data systems comply with applicable DoD information security (INFOSEC) procedures. Both the EFV(C) and the EFV(P) employ specific technical information assurance safeguards. The EFV is required to provide the necessary provisions for information security, and will receive security accreditation up to and including SECRET-HIGH. These technical safeguards include the use of government furnished communications encryption equipment and other specific physical controls to ensure the security of data being received, processed, used or transmitted from or to the EFV. The encryption capability will be either embedded within the communications equipment, or will be provided as a separate encryption device. Additional physical security capabilities are provided through the use of an audit log, directed access control, such as password controls and specification of privileges for data/documentation, and use of classification markings of printed documentation, hardware and data storage mediums. Mass memory assets, containing classified or sensitive data are designed for operator quick removal. In addition, physical destruction of data and medium is a viable option. The EFV is designed in compliance with application software entity security standards and human-computer interface security standards. These standards require the EFV to provide for unauthorized user intrusion detection and detection and eradication of malicious code (virus detection and removal). Further, the EFV will have the ability to purge magnetic and semi-conductor memory, and the capability to execute zeroization/permanent erasure of all sensitive/classified data, both digitally stored vehicle data (to disable operations) and stored tactical C2 systems data.

5004. C4I and the Tactical Battlefield

The EFV variants employ the full communications and command and control systems capability necessary to provide the embarked Marine units the essential C4I capability to meet the tactical situation. The digital messaging capability available on the variants fulfills the operational commander's requirements in the areas of fire support, maneuver, and intelligence. The EFV(P) as a maneuver asset is capable of observing, directing, and reporting information required at higher and adjacent command facilities. The messages available via the C2PC provide the digital form to allow this activity to occur. The EFV(C), as a command and control facility, is capable via the C4I Suite and the crew's C2PC of receipt, processing and distribution/transmission of tactical C2 information to higher, adjacent, subordinate, supporting arms, combat service support, and as required, joint services/allied/coalition command nodes.

The EFV(P) employment will remain consistent: i.e., amphibious armored personnel carrier. The EFV(C) will be employed in one of two mission configurations: one tactical echelon CP or two temporary FSCC. These mission configurations will further be employed within either a battalion landing team (BLT) or regimental landing team (RLT) command organization. As previously identified the EFV(C) is equipped with MAGTF C4I software applications and these are the commander and staff's primary decision-aids. The EFV(P) and EFV(C) crews will use C2PC as the primary situational awareness and digital messaging processor. Communications systems identified in the systems architecture for the EFV(P) and EFV(C) provide the necessary links to support voice and/or digital data operational traffic prior to and during the tactical employment.

The EFV(C), in its role as the tactical echelon CP, is capable of receiving geospatial data, intelligence, and imagery information via voice and/or digital message links from the MAGTF command element (CE) afloat/ashore. The MAGTF CE Afloat is jointly staffed, Navy/Marine Corps intelligence center aboard the ship, which obtains, through the use of shipboard communications assets, needed updates and new raw intelligence data from Unified Combatant Commands/National agencies. The CE intelligence personnel analyze and evaluate raw imagery and intelligence data received from external agencies and organic/external sensors. With the movement of the MAGTF CE ashore, the MAGTF CE intelligence staff acts as the "reach back port" through organic/attached communication assets to request and receive necessary updates and information. At no time is the EFV(C) a receiver of unprocessed intelligence/imagery data.

The MAGTF commander will provide the scaled and filtered operational products to the infantry commander in the prosecution of the maneuver battle.

Geospatial data will be provided to the MAGTF CE and is loaded into the EFV(P) and EFV(C) C2 tactical software application systems by S-2/topographic personnel prior to deployment of vehicles. The medium for providing this data to the infantry commander/EFV(C) and EFV(P) will be through a CD or a LAN connection. The geospatial data received will be scaled to the operational mission requirements.

MAGTF CE processed intelligence data will be provided to the EFV when aboard ship via the ship's LAN connection for download of overlay/CTP/intelligence/fire support data to the tactical C2 systems. During EFV seaborne maneuver and subsequent land operations, intelligence data will be provided via OPORD Annex K-specific tactical communications links.

During the tactical employment, the EFV(P) and the EFV(C) BLT and RLT tactical echelon CPs, require the timely distribution of CTP data throughout the operation. The initial area of data must be updated to reflect changing operational information, e.g., changes to approach lanes and current enemy movement, in order to allow for rapid modification to the initial landing plan or the mission. In addition, changes in fire support plans, calls for fire, and identification of targets of opportunity by assets organic to the assault echelon require processing and timely delivery. The identified areas are important and the value of the data is commensurate with the phase of the operational mission.

The combat employment of EFVs in the tactical environment will also utilize the expeditious and effective employment of naval surface fire support and air support as a force multiplier. The ability to receive, process, and forward to identified agencies/firing units the specific orders to fire/engagement directions is essential to the success of the battle.

Marine Corps employment of the EFV variants in a tactical operation require sufficient connectivity for access of intelligence updates and information that will be used by the onboard MAGTF C4I software applications, primarily IOS V2 in the EFV(C). The detail required is determined by the needs of the operational commander. MAFTF CE intelligence personnel acquire imagery from external agencies or employed sensors. The MAGTF CE intelligence staff will process and interpret the imagery-based data. This processed data will be used for immediate and planned targeting and current enemy and friendly position location information. Imagery is provided to the EFV(C) while aboard ship through the LAN connection. This imagery will be provided in National Imagery Transmission Format (NITF) format or JPEG file format over the LAN or the Annex K of an OPORD-specified intelligence communications link. Access and review of this processed data/imagery by the infantry commander's intelligence officer aboard the EFV(C) is via the onboard IOS V2 application or the C2PC application. The C2PC intelligence client segment allows the operator to access the IOS V2 database via the C2PC. Processed intelligence/imagery data provided to the EFV(C) will be stored as dictated by the commander. Intelligence data, to include imagery, will support the following required intelligence functions:

- Determine threat forces center of gravity, critical vulnerabilities, capabilities, and intentions.
- Identification of suitable entry points, route trafficability, detailed terrain, weather and other environmental factors covering the maneuver space.

- Assist commanders in the identification of critical information requirements.

As a result, the commander will be able to maintain enemy situational awareness, plan future activities effectively, and facilitate timely decision making.

The EFV(P), in its role as a primary ground mobility asset, provides for voice and/or digital message links to mobile, sea-based, or stationary CPs in order to access intelligence/situational awareness data from near-real time sensor assets: e.g., other ground vehicles and sensors and observers, or from operations database information (IOS V1). The communications systems aboard the EFV(P) supports the timely access and distribution of data to both crew and embarked troop commander.

a. EFV(P) Systems Architecture

The EFV(P) system architecture is shown in figure 5-27. The C4 systems architecture is based on the mission of the vehicle, the echelon of vehicle on the battlefield, and what units need to exchange data with it.

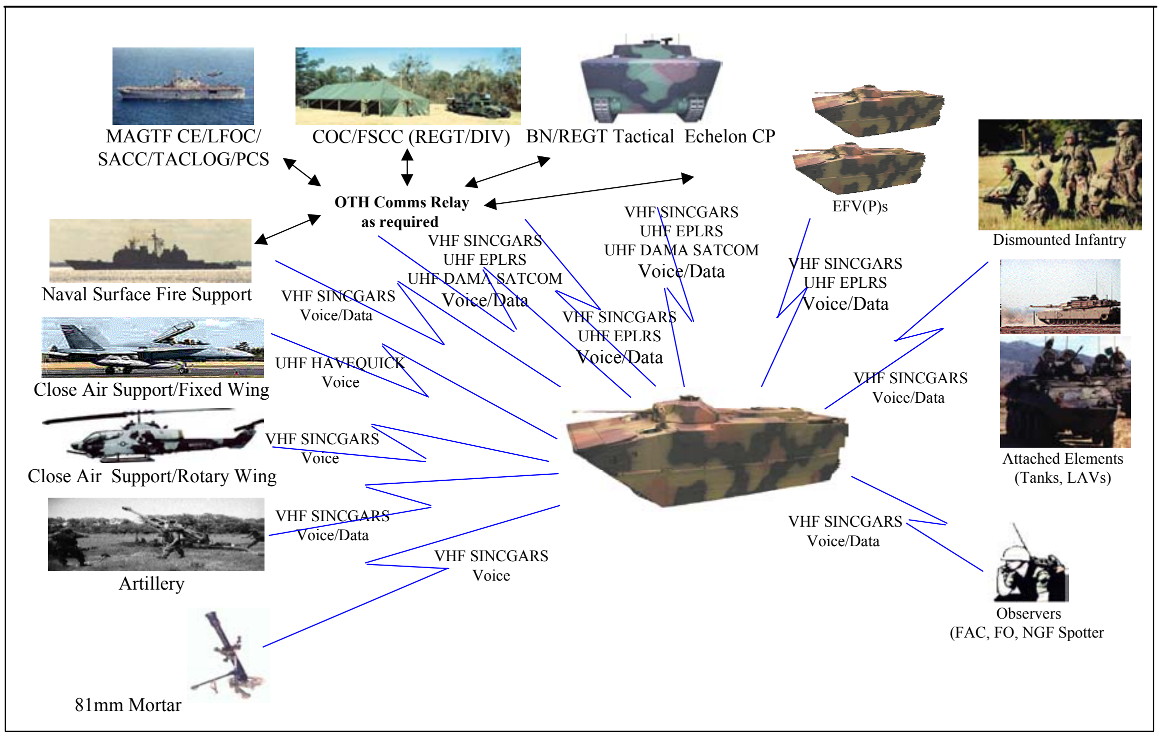


Figure 5-27. EFV(P) Systems Architecture

The EFV(P) crew is capable of establishing direct connectivity for digital traffic with the EFV(C), Marine Corps organizations, and other units and agencies, to include Joint forces via its onboard C2PC application software. C2PC provides the crew operational digital message capability with higher and adjacent units/agencies to the level that these other units comply with the digital message standards available to C2PC (e.g., VMF). Standard voice communications connectivity is provided via the onboard communications suite. This suite provides the communications links to the units outlined in the Marine Corps operational architecture and the unit's organization communications plan.

b. EFV(C) Systems Architecture.

The EFV(C) system architecture is shown in figure 5-28. This system architecture identifies specific communications assets and MATGF C2 tactical software applications that are used aboard the EFV(C). The C4I systems within the EFV(C) conform to the interoperability identified with the Marine Corps operational and system architecture, with the primary directed functional capability of providing essential interoperability with other Marine Corps units. As with the EFV(P), the tactical systems architecture will be based on the mission of the vehicle, the echelon of the vehicle on the battlefield, and units that need to exchange data with it.

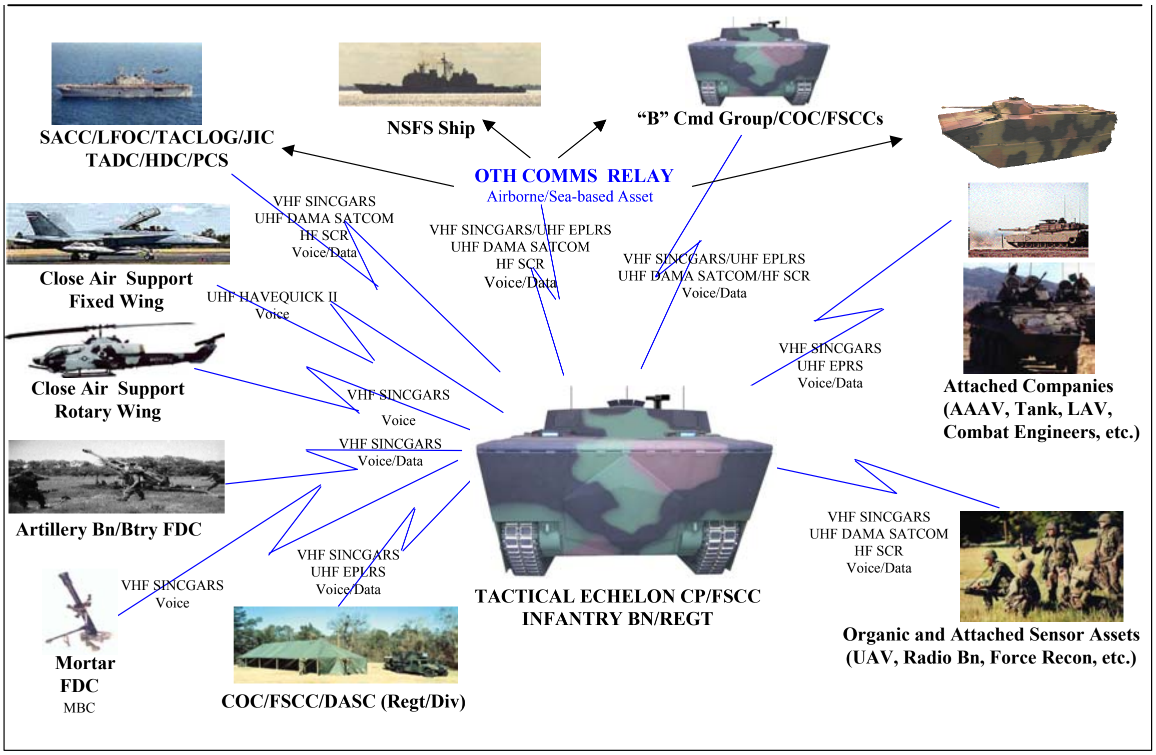


Figure 5-28. EFV(C) Tactical Echelon CP/FSCC Systems Architecture

Key MAGTF C4I systems employed at the BLT and RLT tactical echelon CP will be the C2PC client, IOS V1, IOS V2 and AFATDS. These C2 systems applications address functional mission tasks in operations, intelligence and fire support. The connectivity and CTP update loading will require the C2PC client, IOS V1, and IOS V2 to reach back to the landing force operations center (LFOC) aboard ship, COC ashore, or IOS servers on the EFV(C) to access the databases required. The AFATDS links back to the supporting arms coordination center (SACC), the force fires coordination center (FFCC) and other C2 agencies dependent upon the phase of the operation. Connectivity and receipt/transmission of digital message traffic with adjacent units, to include joint agencies/units, fire support assets, to include aircraft, and other mechanized assets, i.e., EFV(P), artillery fire direction center (FDC), etc., will be received and processed through the C2PC, IOS V1, IOS V2 and AFATDS systems/workstations. Interoperability with joint forces is provided via voice/physical liaison or via the MAGTF level C2 systems and communications network/physical liaison. In addition, EFV(C) crew is capable of establishing direct connectivity for digital traffic with the EFV(P) via the onboard C2PC for crew related operational message traffic. Standard voice communications connectivity is provided via the onboard communications suite to link identified agencies, elements, units, or weapons assets as specified within the organization's communications plan.

5005. Tactical Operations

a. Tactical Data Nets for the EFVs

For the infantry commander to successfully control the tactical battlespace requires the use of three tactical networks, maneuver, intelligence, and fire support.

Maneuver systems support operations planning and execution by providing commanders and their staff with shared SA through an integrated representation of the battlespace. Maneuver systems pull and fuse information from all functional areas. These systems provide the means for mission receipt and rapid development and dissemination of the commander's intent and OPLANs and OPORDs. The EFV(C) utilizes IOS V1 to provide an automated capability to process battlefield information. IOS V1 processes and fuses tactical information to form a CTP of the battlespace. IOS V1 supports development of COAs and the preparation and dissemination of OPLANs and OPORDs, including overlays that are geographically referenced to an electronic map.

Intelligence systems support the timely planning, collection, processing, production, and dissemination of all-source intelligence while supporting the effective employment of reconnaissance, surveillance, and target acquisition resources. The EFV(C) utilizes IOS V2 to provide the intelligence personnel with intelligence operations planning and direction, all-source processing and fusion, and dissemination capabilities.

Fire support systems support the planning, coordination, and control of artillery, air, and naval gunfire. The EFV(C) provides AFATDS as the fire support automated system for use by the fire support coordination (FSC) officer to assist the infantry commander in the planning, delivery, and coordination of supporting arms. AFATDS provides the infantry commander with the capability to rapidly integrate ground, air, and naval surface fire support with the scheme of maneuver.

IOS V1, IOS V2, and AFATDS consist of workstations operating at the secret level (or higher) on multiple LANs interconnected on the SIPERNET through MAGTF communications networks. The EFV(C) tactical echelon CP IOS V1, IOS V2, and AFATDS represents three of these interconnected LANs.

Note:

> Communications and information systems personnel are responsible for connecting IOS V1, IOS V2, and AFATDS to the SIPRNET, providing them with IP addresses, and assisting operations personnel in installing and maintaining these C2 applications and their networks. They are not responsible for the maintenance of the applications themselves.

The SIPRNET RF capabilities, used to meet the data requirements of the three (3) networks described above, maneuver (IOS V1), intelligence (IOS V2), and fire support (AFATDS), is pictured in figure 5-29. EPLRS is used at the regiment and below level and provides for a data net known as the MAGTF C2 data net. SINCGARS is used at the company level and provides for the MAGTF C2 data net as well as the voice net known as the TAC net at the company level.

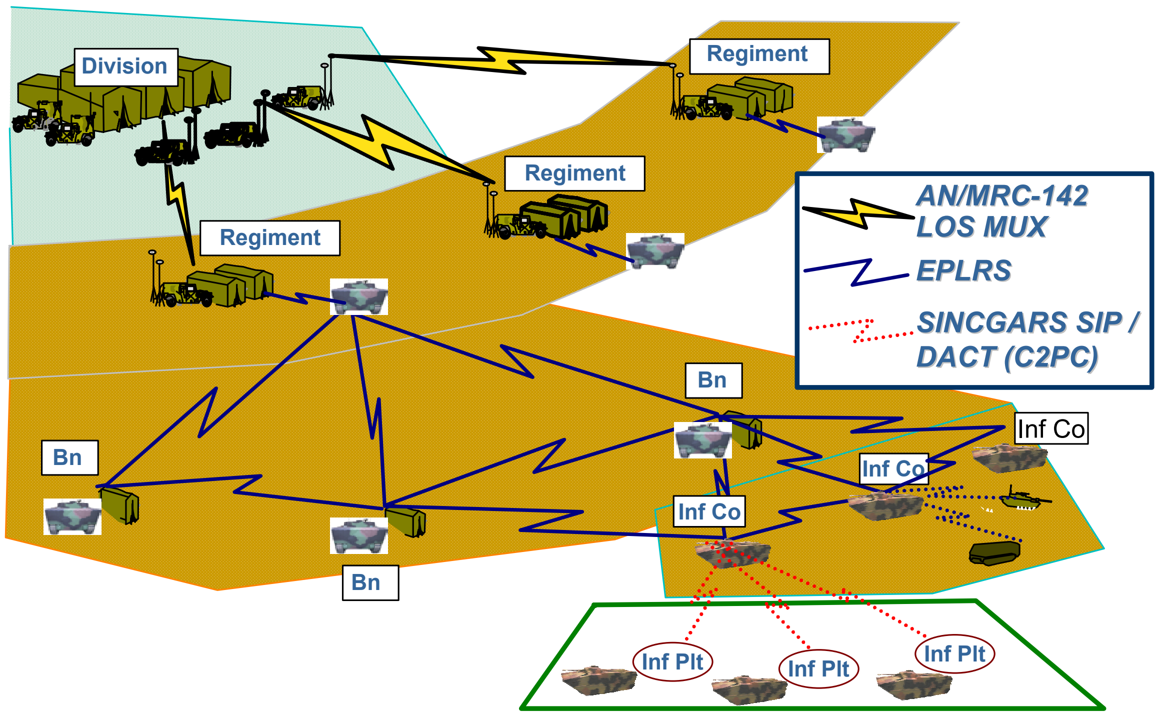


Figure 5-29. Data Communications Topology

Figure 5-30 adds SATCOM to the data architecture during the water maneuver phase of a STOM. The SATCOM capability allows for data (and voice) communications over the horizon (OTH).

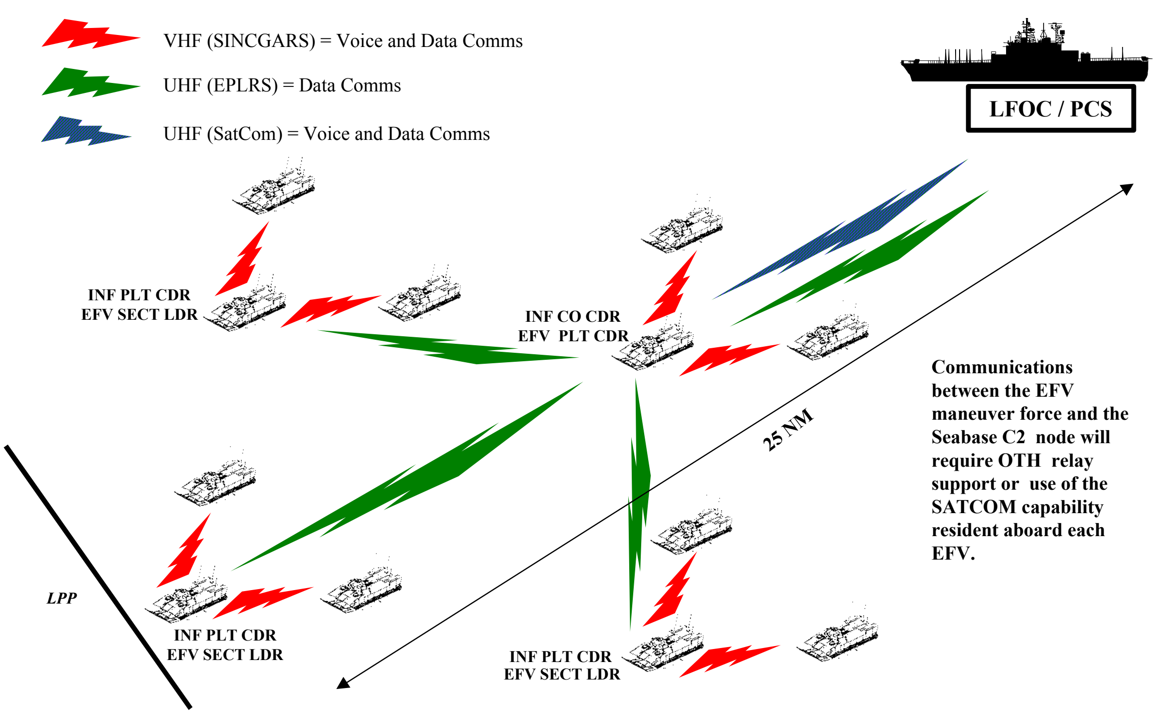


Figure 5-30. STOM Data Architecture, Water Maneuver Phase

b. Tactical Communications for the EFVs

The following figures are guard charts used to develop the tactical communications architecture for both the EFV(P) and the EFV(C). The associated pictures depict the entities on the other end of the EFVs tactical communications. These guard charts and pictures represent a notional communications plan and is representative only; however, they are a good starting point for planning.

(1) Infantry Squad Leader and EFV(P) Vehicle Commander See table 5-3 and figure 5-31 for the tactical communications required by the infantry squad leader and the vehicle commander of an EFV(P).

Note: See table 5-8 for radio allocation for this guard chart and operational view.

Table 5-3. Guard Chart for Infantry Squad Leader and EFV(P) Commander

Legend: **X = Guard** **W = When Directed** **A = As Required**	INF PLT TAC	INF INTRA SQD TAC	MAGTF C2 DATA 1(CTP)	EFV PLATOON TAC	BOAT A (PCS)																
TRANSMISSION TYPE **(V) = Voice** **(D) = Data**	VHF (V)	VHF (V)	VHF (D)	VHF (V)	UHF SAT (V)																
INFANTRY SQUAD LEADER	X	A			W																
EFV VC	A	A	X	X	W																

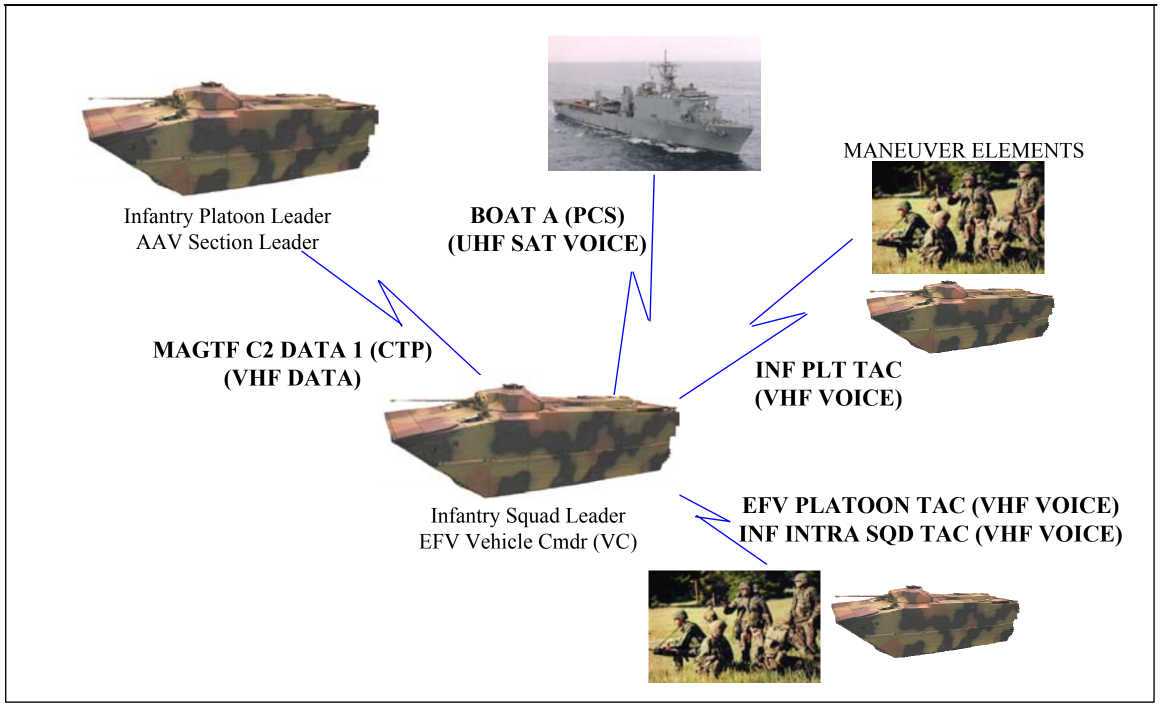


Figure 5-31. Operational View: Infantry Squad Leader EFV(P) Commander

(2) Infantry Platoon Commander and EFV(P) Section Leader See table 5-4 and figure 5-32 for the tactical communications required by an infantry platoon commander and the EFV(P) section leader.

Note: See table 5-9 for radio allocation for this guard chart and operational view.

Table 5-4. Guard Chart for Infantry Platoon Commander and EFV(P) Section Leader

Legend: **X = Guard** **W = When Directed** **A = As Required**	INF COMPANY TAC	INF PLATOON TAC	EFV PLATOON TAC	MAGTF C2 DATA (CTP)	MAGTF C2 DATA (CTP)	MAGTF TAC (OPS/FIRES)	BOAT A (PCS)														
TRANSMISSION TYPE **(V) = Voice** **(D) = Data**	VHF (V)	VHF (V)	VHF (V)	VHF (D)	UHF (EPLRS)	UHF (SAT)	UHF (SAT) (V)														
INFANTRY PLATOON COMMANDER	X	X		X	X	W	W														
EFV SECTION LEADER	A	A	X		X	W	W														

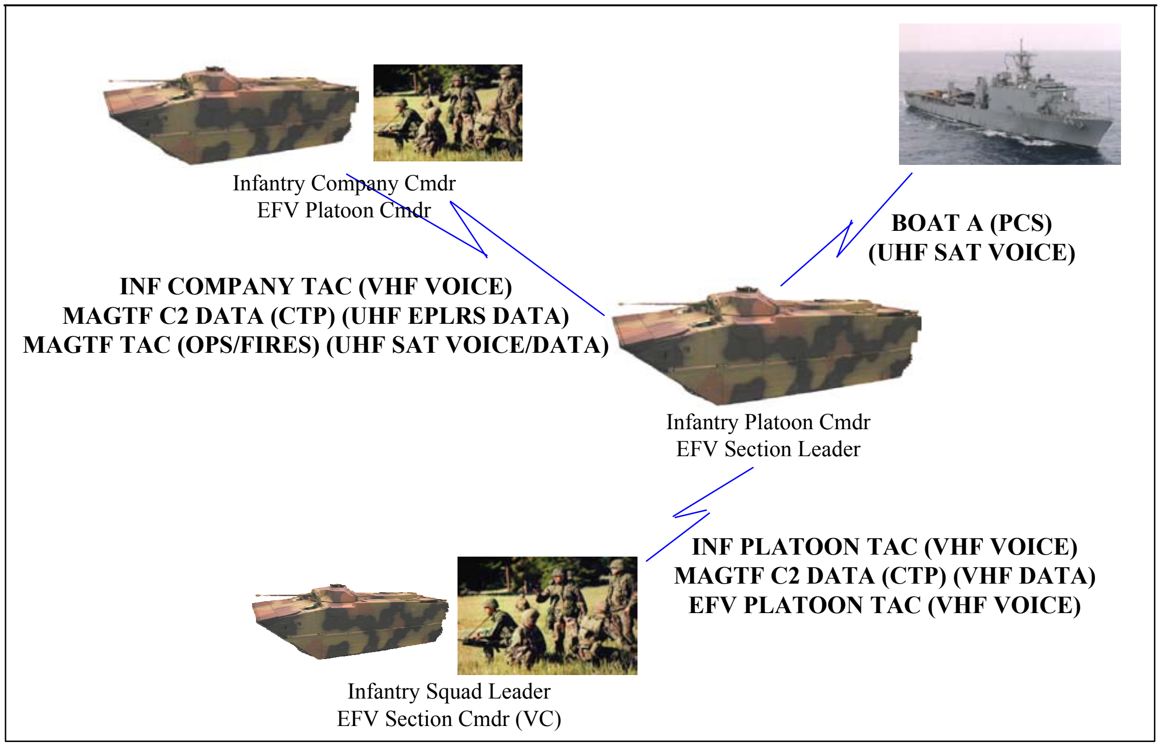


Figure 5-32. Operational View: Infantry Platoon Commander and EFV(P) Section Leader

(3) Infantry Company Commander/FST and EFV(P) Platoon Commander. See table 5-5 and figure 5-33 for the tactical communications required by the infantry company commander/fire support team (FST) and the EFV(P) platoon commander.

An FST is an infantry CO asset. The FST is composed of the FAC, the artillery forward observer (FO), and the mortars FO. The designated FST leader is usually the weapons platoon commander, but can be designated from any of the FST personnel. The infantry CO will orient the FST leader and link to the FST assets via this leader. FST communications paths include the infantry company TAC, weapons platoon TAC (access to 60mm mortars), and the FST organic nets (artillery/mortar COFs, NFG Spot, TACP Local, and FAC TAR/TAD). A FST can be consolidated on one EFV(P) with the infantry CO or distributed among two or three EFV(P)s as oriented by the iInfantry CO to meet the tactical situation.

Note: See table 5-10 for radio allocation for this guard chart and operational view.

Table 5-5. Guard Chart for Infantry Company Commander/FST and EFV(P) Platoon Commander

Legend: **X = Guard** **W = When Directed** **A = As Required**	INF BATTALION TAC 1	INF COMPANY TAC	MAGTF C2 DATA (CTP)	TAD	BATTALION MORTAR (81COF)	ARTY BATTERY COF	MAGTF TAC (OPS/FIRES)	BOAT A (PCS)	NGF GRND SPOT	TACP LOCAL									
TRANSMISSION TYPE **(V) = Voice** **(D) = Data**	VHF (V)	VHF (V)	UHF (EPLRS) (D)	UHF (HAVEQUICK) (V)	VHF (V)	VHF (V/D)	UHF SAT (V/D)	UHF SAT (V)	VHF (V)	VHF (V)									
INFANTRY COMPANY COMMANDER/FST	X	X	X	A	A	A	A	W	A	A									
EFV PLATOON COMMANDER			X					W											

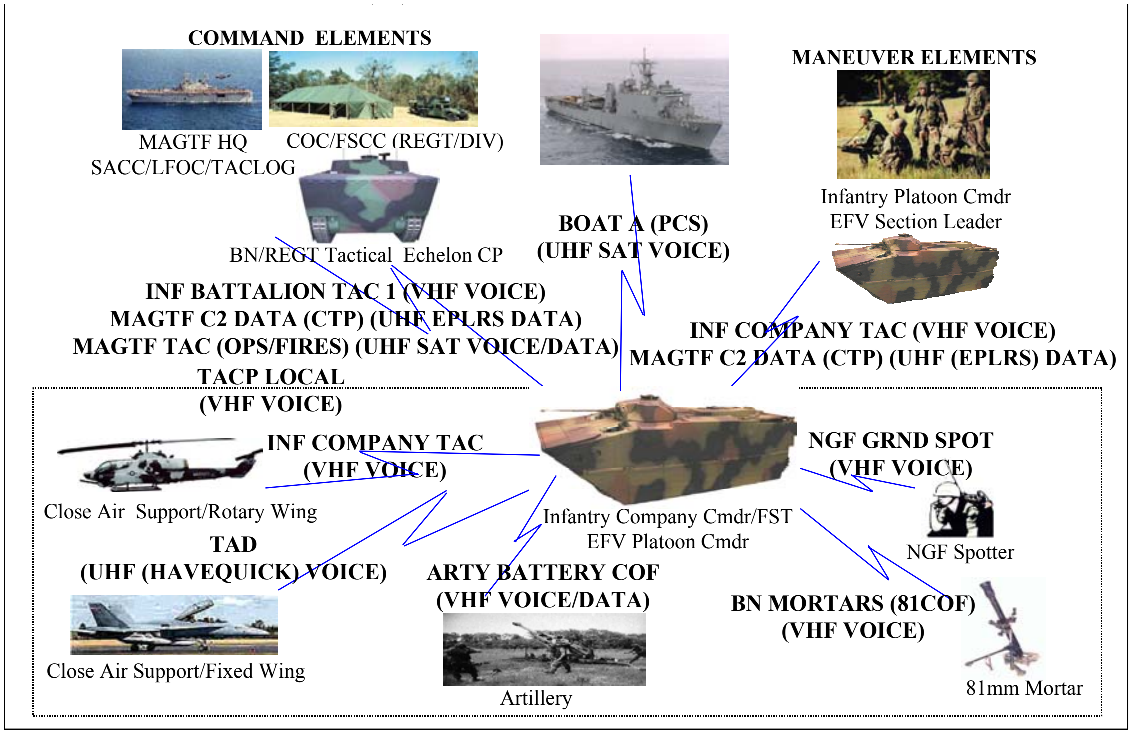


Figure 5-33. Operational View: Infantry Company Commander/ FST and EFV(P) Platoon Commander

(4) BLT Tactical Echelon CP and EFV(C) Vehicle Commander See table 5-6 and figure 5-34 for the tactical communications required by the BLT tactical echelon CP and the EFV(C) vehicle commander (VC).

Note: See table 5-11 for radio allocation for this guard chart and operational view.

Table 5-6. Guard Chart for BLT Tactical Echelon CP and EFV(C) VC

Legend: X = Guard; W = When Directed; A = As Required	MEU TAC 1	MEU TAC 2	MEU FSC	BLT TAC 1	BLT INTEL	EFV PLATOON TAC	BOAT A (PCS)	MAGTF TAC (OPS/FIRES)	MAGTF C2 DATA (CTP)	MAGTF C2 DATA (CTP)	SCOUT SNIPER COMMAND	BATTALION MORTAR (81COF)	TAR/HR	TAD	ARTY BATTERY COF	FIRES NET			
TRANSMISSION TYPE (V) = Voice; (D) = Data	VHF (V)	HF (V)	VHF (V)	VHF (V)	VHF (V)	VHF (V)	UHF SAT (V)	UHF SAT (V/D)	UHF (EPLRS) (D)	UHF (EPLRS) (D)	VHF (V)	VHF (V)	HF (V)	UHF (HAVEQUICK)(V)	VHF (V/D)	UHF (EPLRS) (D)			
BLT TACTICAL ECHELON CP	X	A	X	X	X		W	A	X	X	A	X	A	A	A	A			
EFV (C) VC						X	W												
EFV (P) VC						X	W												

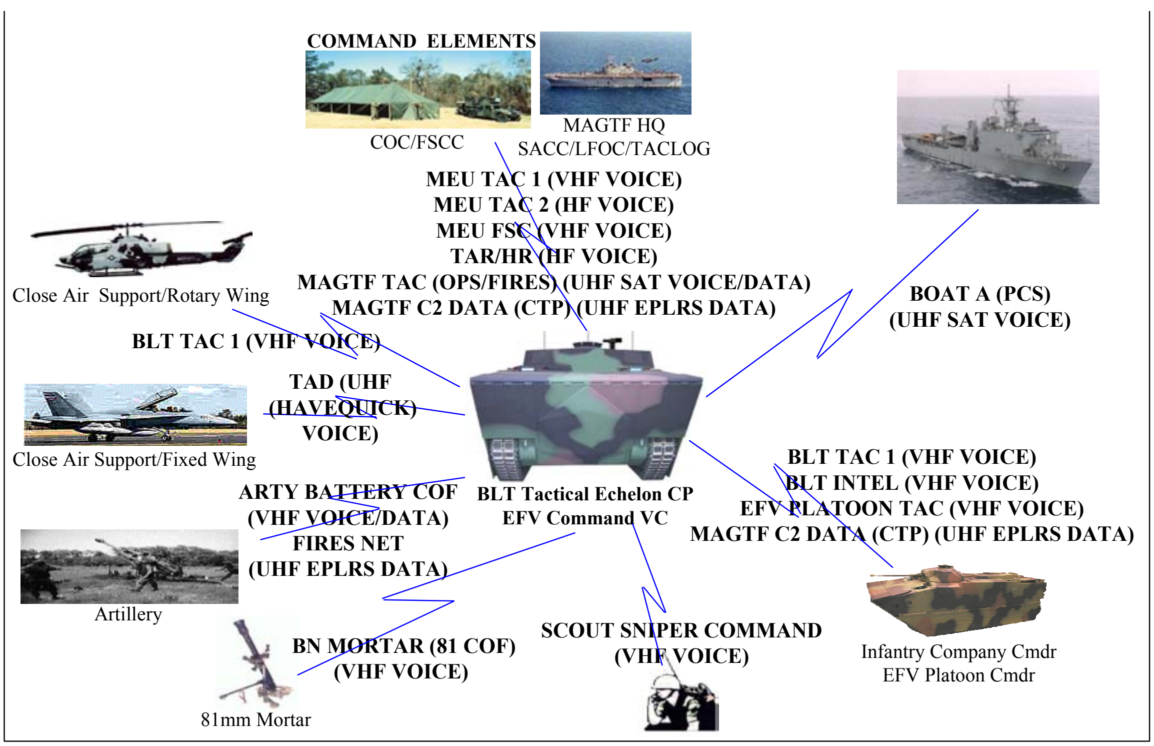


Figure 5-34. Operational View: BLT Tactical Echelon CP and EFV(C) Vehicle Commander

(5) **RLT Tactical Echelon CP and EFV(C) Vehicle Commander** See table 5-7 and figure 5-35 for the tactical communications required by the RLT tactical echelon CP and the EFV(C) vehicle commander (VC).

Note: See table 5-12 for radio allocation for this guard chart and operational view.

Table 5-7. Guard Chart for RLT Tactical Echelon CP and EFV(C) VC

Legend: **X = Guard** **W = When Directed** **A = As Required**	MEB TAC 1	MEB TAC 2	MEB FSC	MEB CMD 1	MEB INTEL	RLT TAC 1	RLT INTEL	RLT FSC	EFV PLATOON TAC	BOAT A (PCS)	MAGTF TAC (OPS/FIRES)	MAGTF C2 DATA (CTP)	MAGTF C2 DATA (CTP)	NAVAL GUNFIRE SUPPORT	TAR/HR				
TRANSMISSION TYPE **(V) = Voice** **(D) = Data**	VHF (V)	HF (V)	VHF (V)	UHF SAT (V/D)	VHF (V)	VHF (V)	VHF (V)	VHF (V)	VHF (V)	UHF SAT (V)	UHF SAT (V/D)	UHF (EPLRS) (D)	UHF (EPLRS) (D)	HF (V)	HF (V)				
RLT TACTICAL ECHELON CP	X	A	X	A	X	X	X	X		W	A	X	X	A	A				
EFV (C) VC									X	W									
EFV (P) VC									X	W									

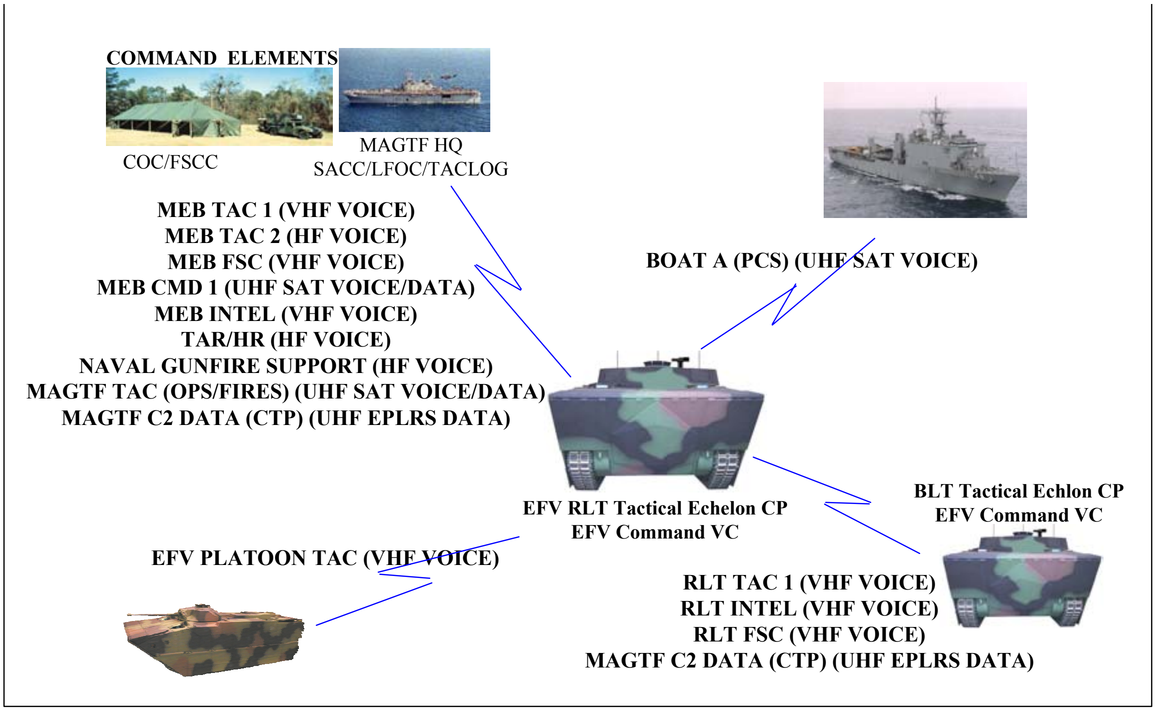


Figure 5-35. Operational View: RLT Tactical Echelon CP and EFV(C) Vehicle Commander

c. Tactical Setup for EFVs

(1) EFV(C) Staffing As stated previously, EFV(C) staffing typically consists of the commander (CO), intelligence officer (S-2), operations officer (S-3), fire support coordinator (FSC), air officer (AO), and sufficient communications personnel. This is true at both the regimental and battalion levels. The EFV(C) vehicle commander (VC) provides additional capabilities utilized by the infantry CO.

The CO is responsible for everything his unit does or fails to do. He cannot delegate his responsibility, or any part of it, although he may delegate portions of his authority.

The S-2 is the principal staff assistant in matters pertaining to the enemy and to the area of operations, which are significant to military planning and operations. The S-2 provides timely accomplishment of command intelligence functions, either by use of assigned resources or through management control and coordination of intelligence means and activities of other elements of the command. The S-2 has staff responsibility for the following:

- Production of intelligence.
- Dissemination of intelligence.
- Counterintelligence.
- Other intelligence (e.g., civil affairs).
- Maps, charts, photographs, and other graphic aids.
- Intelligence training.

The S-3 is the principal staff assistant in matters pertaining to organization, training, and tactical operations. The S-3 has staff responsibility for the following:

- Tactical operations.
- Organization.
- Training.
- Contingency planning.

The FSC performs the general duties of a special staff officer, under the staff cognizance of the S-3, with respect to the coordination and integration of organic and supporting fires. The FSC has staff responsibility for the following:

- Supervising activities of fire support coordination center.
- Determining fire support requirements.
- Assisting in preparation of fire support plan.
- Supervising collection and dissemination of target data.
- Coordinating and integrating supporting fires.
- Maintaining special fire plans to coordinate supporting arms for special situations.

The AO performs the general duties of a special staff officer, under the staff cognizance of the S-3, with respect to aviation matters. The AO has staff responsibility for the following:

- Serving as member of FSCC.
- Determining air support requirements.
- Making target analysis.
- Preparing air support requests.
- Assisting in integration and coordination of air support with other supporting fires.
- Recommending the application of airspace coordination areas and other safe measures to protect supporting aircraft.

The EFV(C) VC provides operational guidance to the embarked infantry commander on the employment/positioning of the EFV(C) to support command and control of the maneuvering embarked EFV(P) infantry units.

The communications personnel's duties in the EFV(C) are discussed in paragraph 5005c(2)(a).

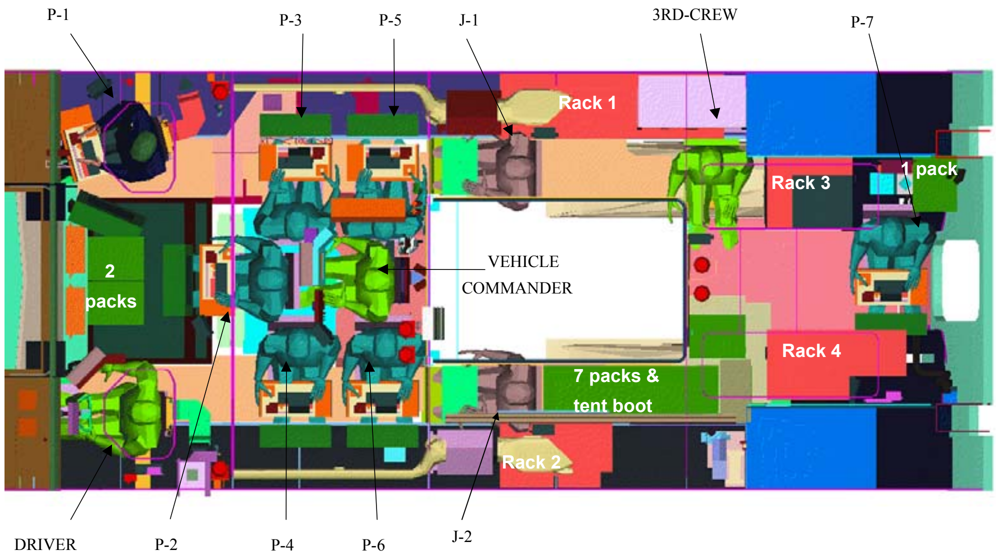


Figure 5-36. EFV(C) INTERNAL LAYOUT
7 Staff Stations (P1 – P7), 3 Crew Stations, 2 Jump Seats (J1, J2), and 4 Communications Gear Racks

The following is an example of a tactical seating arrangement for the EFV(C) (See fig 5-36):

- P1 – Infantry battalion/regimental commander.
- P2 – Infantry battalion/regimental operations officer (S-3).
- P3 – Infantry battalion/regimental Intelligence officer (S-2).
- P4 – Infantry battalion/regimental fire support coordination officer (FSC).
- P5 – Infantry battalion /regimental air officer (AO).
- P6 – Infantry battalion/regimental artillery liaison officer (ALO).
- P7 – Infantry battalion/regimental command and control systems officer (CommO).
- J1 – Infantry battalion/regimental operations chief (Ops Chief).
- J2 – Infantry battalion/regimental naval gun fire liaison officer (NGLO).

Note: All staff workstation are functionally identical; thus, the infantry commander can dictate any seating arrangement desired.

(2) Tactical Communications for EFVs The following paragraphs look at the CommO's responsibilities, provide an example for tactical radio selection for the EFVs, talks about IP addressing, and provides an example of an EFV(C) C4I Assignment Worksheet to include IP Addressing.

(a) EFV(C) CommO's and 3rd Crewman Responsibilities The communications and control systems officer staff position is provided the capability to execute the communications plan, using the Command, Control, and Communications Systems Annex to the Operations Order (Annex K) and the Communications and Electronic Operating Instruction

(CEOI) as detailed in the FMFM-3-30 in all modes of operation. The C4I Suite allows the S6 staff position to:

- Activate and deactivate circuits.
- Conduct net frequency allocation to include the loading and changing of frequencies.
- Conduct the net management functions associated with COMSEC and TRANSEC.
- Conduct word and time of the day, the activities associated with the time division multiple access (TDMA) scheme for EPLRS.
- Conduct the activities associated with tactical satellite communications to include uplink, downlink, and channel requests associated with DAMA.
- Reconfigure the communications systems to support the connectivity (data and voice) requirements of the embarked staff positions.
- Manage voice and data between the voice communications subsystem, the computer network subsystem and the RF communications subsystem.
- Configure the C4I data network for routing from router to router directly or by means of radio or external telephone line.
- Configure modems for the purposes of routing data to an external network.
- Configure the C4I data network, radio nets, and intercom services for voice and data. communications interconnectivity between crew and staff to share communications and navigation information.
- Manage the communications net security.

The EFV(C) third crewman provides direct communications/network support to the embarked infantry communications officer in the preparation, use and maintenance of the C4I suite communications/network equipment to support the embarked infantry commander and staff's requirements for command and control.

(b) Example of Tactical Radio Selection The EFV(P) communications rack contains the radios for the EFV(P), as listed in table 5-1, with the exception of the EPLRS radio. The EPLRS radio comes with its own isolation system and has been mounted separately in the EFV(P). Figure 5-37 shows the communications rack for the EFV(P).

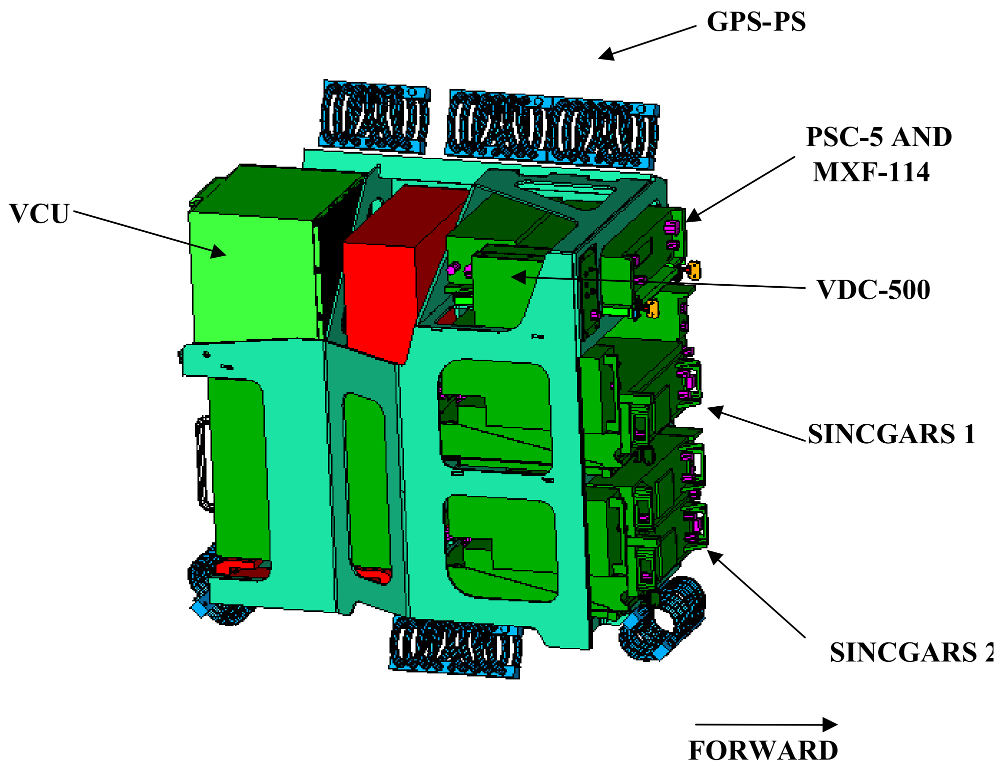


Figure 5-37. EFV(P) Comms Rack

Racks 1, 3, and 4 (no radios in Rack 2) of the EFV(C) contain the communications gear as listed in table 5-2. Figure 5-38 shows EFV(C) rack 1 and its radios.

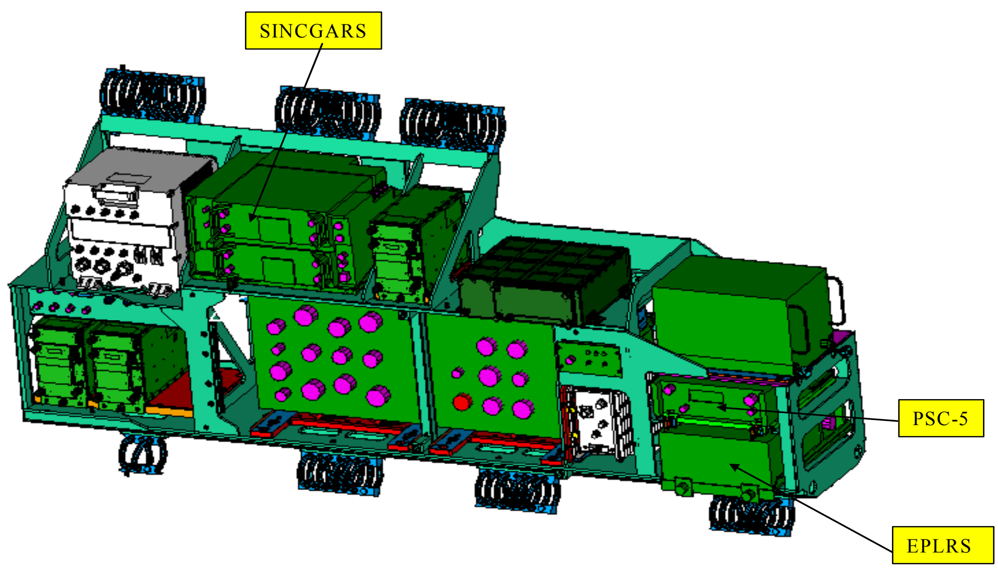


Figure 5-38. EFV(C) Rack 1 Radios

Figure 5-39 shows EFV(C) rack 3 and its radios.

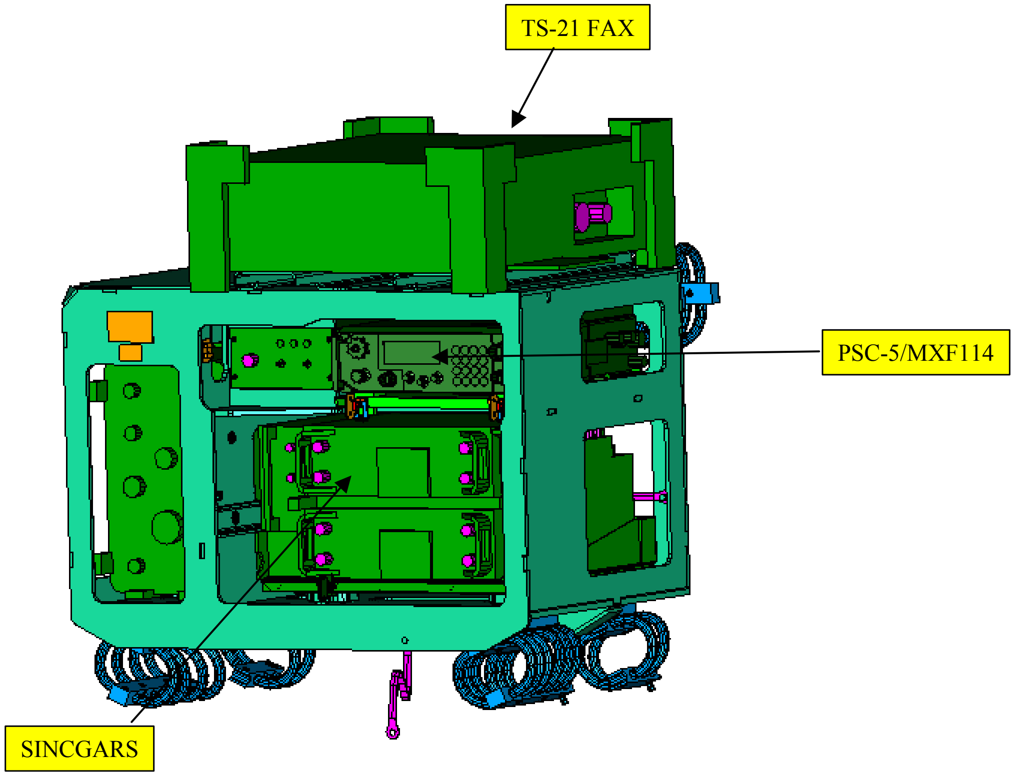


Figure 5-39. EFV(C) Rack 3 Radios

Figure 5-40 shows EFV(C) rack 4 and its radios.

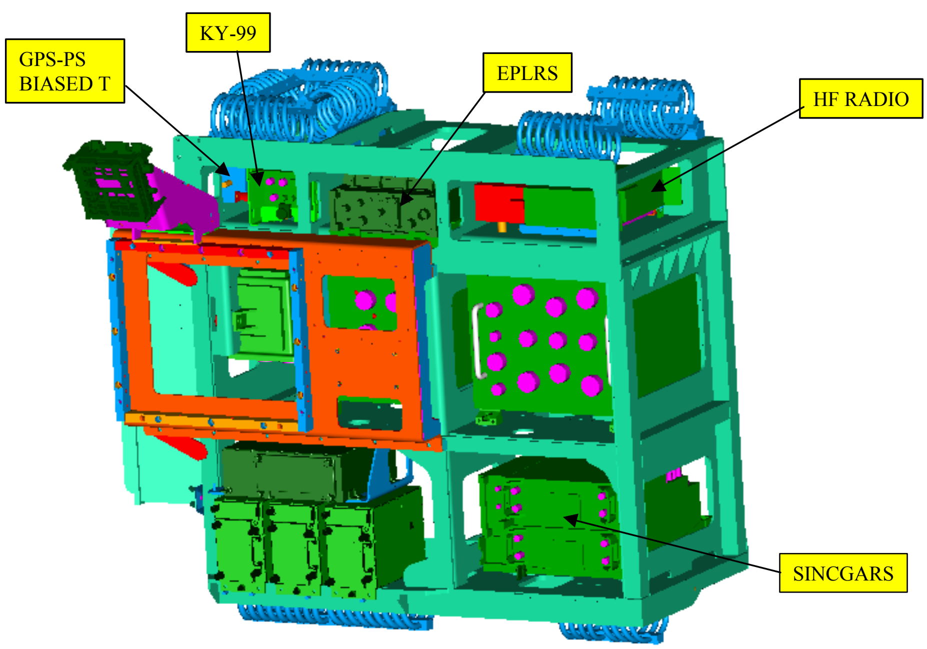


Figure 5-40. EFV(C) Rack 4 Radios

Based on the guard charts shown in this chapter and centered on the BLT tactical echelon CP, the following represents an example of the allocation of the radios during a tactical operation:

Note: The EPLRS Data Network provides connectivity to higher echelon while the SINCGARS Data Network acts as the company data network.

Table 5-8. Radios for EFV(P) - Infantry Squad Leader and EFV VC (from table 5-3 and figure 5-31)

Radio	Power/Frequency	Net	Type
SINCGARS 1	50W	INF PLT TAC	Voice
SINCGARS 2	50W	EFV PLT TAC	Voice
SINCGARS 2	4W	MAGTF C2 Data	Receive data
PSC-5D	VHF SINCGARS	INF INTRA SQD TAC	Voice as required
	UHF SATCOM	Boat A (PCS)	Voice when directed

Table 5-9. EFV(P) - Infantry Platoon Leader and EFV Section Leader (from table 5-4 and figure 5-32)

Radio	Power/Frequency	Net	Type
SINCGARS 1	50W	INF Company TAC	Voice
SINCGARS 2	50W	INF PLT TAC	Voice
SINCGARS 2	4W	MAGTF C2 Data	Send data
PSC-5D	VHF SINCGARS	EFV PLT TAC	Voice
	UHF SATCOM	MAGTF TAC (OPS/Fires)	Voice when directed
	UHF SATCOM	Boat A (PCS)	Voice when directed
EPLRS	UHF	MAGTF C2 Data	Receive data

Table 5-10. Radios for EFV(P) - Infantry Company Commander/FST and EFV Platoon Commander (from table 5-5 and figure 5-33)

Radio	Power/Frequency	Net	Type
SINCGARS 1	50W	INF Battalion TAC 1	Voice
SINCGARS 2	50W	INF Company TAC	Voice
SINCGARS 2	4W	TACP LOCAL	Voice as required
PSC-5D	VHF SINCGARS	Arty Battery COF	Voice as required
	VHF SINCGARS	BN Mortars (81 COF)	Voice as required
	VHF SINCGARS	NGF GRND Spot	Voice as required
	UHF HAVEQUICK	TAD	Voice as required
	UHF SATCOM	MAGTF TAC (OPS/Fires)	Voice/data as required
	UHF SATCOM	Boat A (PCS)	Voice when directed
EPLRS	UHF	MAGTF C2 Data	Send/receive data

Table 5-11. Radios for EFV(C) – BLT Tactical Echelon CP and EFV Command VC (from table 5-6 and figure 5-34)			
Radio	**Power/Frequency**	**Net**	**Type**
Rack 1 SINCGARS	50W	MEU TAC 1	Voice
Rack 1 SINCGARS	4W	MEU FSC	Voice
Rack 3 SINCGARS	50W	BLT TAC 1	Voice
Rack 3 SINCGARS	4W	BLT INTEL	Voice
Rack 4 SINCGARS	50W	EFV Platoon TAC	Voice
Rack 4 SINCGARS	4W		
Rack 1 PSC-5D	VHF SINCGARS	Arty Battery COF	Voice as required
	VHF SINCGARS	Scout Sniper Command	Voice as required
	UHF HAVEQUICK	TAD	Voice as required
	UHF SATCOM	MAGTF TAC (OPS/Fires)	Voice/data as required
	UHF SATCOM	Boat A (PCS)	Voice when directed
Rack 3 PSC-5	VHF SINCGARS	BN Mortar (81 COF)	Voice
Rack 1 EPLRS	UHF	MAGTF C2 Data (CTP)	Send data
	UHF	FIRES NET	Data as required
Rack 4 EPLRS	UHF	MAGTF C2 Data (CTP)	Receive data
Rack 4 HF	HF	MEU TAC 2	Voice as required
	HF	TAR/HR	Voice as required

Table 5-12. Radios for EFV(C) – RLT Tactical Echelon CP and EFV Command VC (from table 5-7 and figure 5-35)			
Radio	**Power/Frequency**	**Net**	**Type**
Rack 1 SINCGARS	50W	MEB TAC 1	Voice
Rack 1 SINCGARS	4W	MEB FSC	Voice
Rack 3 SINCGARS	50W	RLT TAC 1	Voice
Rack 3 SINCGARS	4W	RLT INTEL	Voice
Rack 4 SINCGARS	50W	EFV Platoon TAC	Voice
Rack 4 SINCGARS	4W	RLT FSC	Voice
Rack 1 PSC-5D	UHF SATCOM	MEB CMD 1	Voice/data as required
	UHF SATCOM	MAGTF TAC (OPS/Fires)	Voice/data as required
	UHF SATCOM	Boat A (PCS)	Voice when directed
Rack 3 PSC-5	VHF SINCGARS	MEB INTEL	Voice
Rack 1 EPLRS	UHF	MAGTF C2 Data (CTP)	Send data
Rack 4 EPLRS	UHF	MAGTF C2 Data (CTP)	Receive data
Rack 4 HF	HF	MEB TAC 2	Voice as required
	HF	TAR/HR	Voice as required
	HF	Naval Gunfire Support	Voice as required

(c) Internet Addressing The EFVs require an IP architecture that allows for intercommunication between all hosts/servers/nodes within the vehicles and also allows these vehicle hosts/servers/nodes to communicate with external (to vehicles) hosts/servers/nodes via RF links (and/or landline for the EFV[C]). The current logical IP network architecture is set up as follows:

- Crew vetronics and C4 systems, for the EFV(P) and (C), Copper Distributed Data Interface (CDDI) network.
- EFV(C)'s C4I Suite switched ethernet network.
- EFV(C)'s additional ethernet jacks (supporting the DACTs and/or laptops brought on board for interface with C4I Suite).

The overarching principal is that a unique IP address is needed for all hosts/servers/nodes.

The crew vetronics and C4 systems CDDI network is a unique IP network. Vetronics (the vehicle electronics) provides for the control of the vehicle (mobility, power management, and auxiliary systems). The C4 systems are basically the crews CTP and external data comms. The EFV / infantry regiment/battalion (that the EFVs are assigned to) will request IPs for all vehicles from MEF G-6. At this time there is no automated process to change the IP addresses on the vetronics system. There are some instances in the vehicle that EPROMS will have to be updated to change the IP address of these systems.

The EFV(C)s C4I suite systems will be handled a little differently. Due to the varying system configuration, the BLT or RLT staff will request there own IP addresses based upon the required mission load. Like the crew's vetronics/C4 network there is no automated process to change the IP addresses for the C4I suite; however, all C4I Suite systems can be updated with their TCP/IP information without any firmware changes.

EFV(C)'s C4I suite switched ethernet network is also a unique IP network. Bridging between the crew's vetronics/C4 and the C4I suite networks on the EFV(C) takes place in the hull electronics unit (HEU) utilizing a bridge routing mechanism.

DHCP cannot be used for the jacks for the DACTS and laptops, detailed planning for these IP addresses requires the use of Annex K to outline the IP address for each DACT and laptop.

Note: The static nature of the addressing system currently employed by the Marine Corps does not allow for the dynamic nature of the DHCP capabilities.

To be able to send VMF messages the users in the system must have a unique IP address. There is an address book that resolves the IP address of a user and their name. This is different from email however, because, for example, if the S6 officer leaves one vehicle and boards another he would have to update the address book to reflect the IP address of his new location. This is not an automated process like email.

The subnet masks for these networks are chosen by counting the hosts on each network and then selecting a subnet mask to minimize the use of IP addresses for that network. The remaining task is to assign valid host addresses for each node on each network.

The EFV(P) network systems are depicted in figure 5-41.

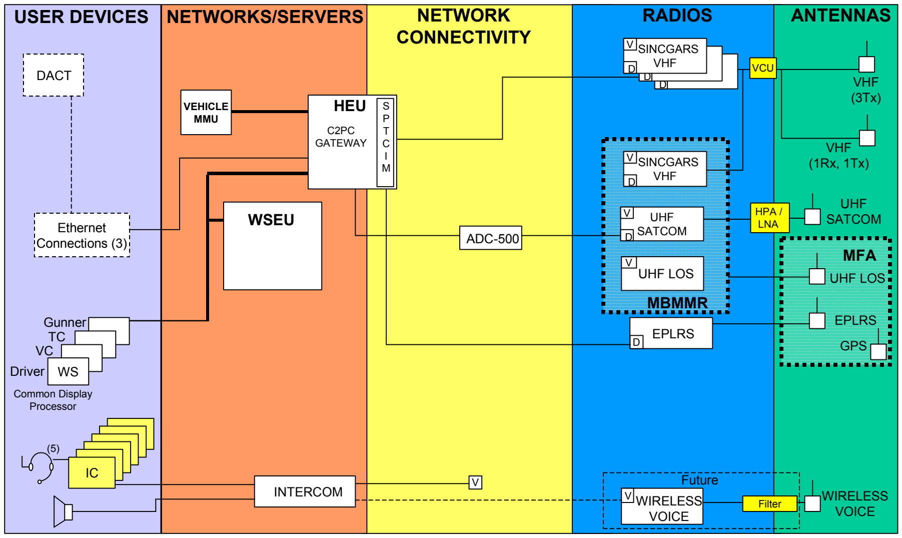


Figure 5-41. EFV(P) C4I Systems

The EFV(C) network systems are depicted in figure 5-42.

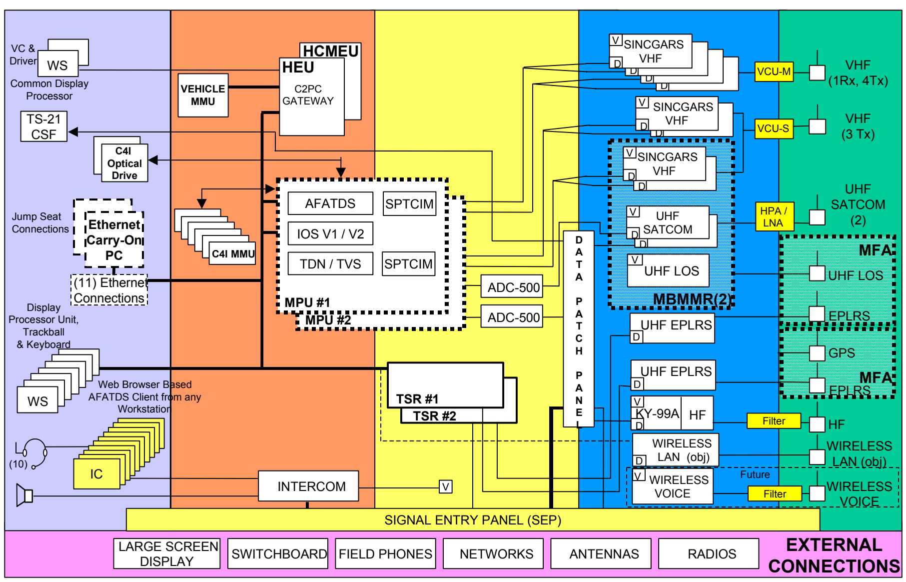


Figure 5-42. EFV(C) C4I Systems

(d) EFV(C) C4I Assignment Worksheet The following represents a rough draft of an EFV(C) C4I Assignment Worksheet with an IP addressing scheme currently used in the SDD EFV(C).

S-6 Representative:____________ Team Personnel:____________

Supported Unit:____________ Report To:____________

Date/Time:____________ Time on Air:____________

Radios

AN/VRC-89 SINCGARS (Frequency/Call Sign/Net Name(TAC)/Crypto/Hopsets/TOD)

Rack 1 (50W)____________
Rack 1 (4W) ____________
Rack 3 (50W)____________
Rack 3 (4W) ____________
Rack 4 (50W)____________
Rack 4 (4W) ____________

PSC-5D SINCGARS

Rack 1____________
Rack 3____________

PSC-5D Havequick

Rack 1 ____________
Rack 3 ____________

PSC-5D SATCOM (Uplink/Downlink/AZ/EL/SAT Description/Net Name/Call Sign/Station on Net)

Rack 1 ____________
Rack 3 ____________

AN/VSQ-2 EPLRS

Rack 1____________
Rack 4____________

AN/PRC-150 HF

Rack 4____________

Notes:

Seating Assignments

P1 ______________________________
P2 ______________________________
P3 ______________________________
P4 ______________________________
P5 ______________________________
P6 ______________________________
P7 ______________________________
J1 ______________________________
J2 ______________________________

IP Addresses

1 (J1) ______________________________
2 (J2) ______________________________
3 ______________________________
4 ______________________________
5 ______________________________
6 ______________________________
7 ______________________________
8 ______________________________
9 ______________________________
10 ______________________________
11 ______________________________

Notes:

Intercom:

Group	P1	P2	P3	P4	P5	P6	P7	J1	J2	VC	Driver	3rd Crew
1												
2												
3												
4												
5												

Notes:

EFV-C1 Network Addresses
Host Address Range (Before Subnetting), /25 network, 4th Octet (.1-.126 for C1)

LRU	COMPONENT	IP ADDRESS (C1)	SNM	
	MAIN EFV(C) SUBNET	205.5.10.0	**/26**	
TSR1	Router (e0 port)	205.5.10.1	**/26**	
TSR2	Router (e0 port)	205.5.10.2	**/26**	
TSR1	Switch (VLAN#1)	205.5.10.3	**/26**	
TSR2	Switch (VLAN#1)	205.5.10.4	**/26**	
MPU1	Switch (VLAN#1)	205.5.10.5	**/26**	
MPU2	Switch (VLAN#1)	205.5.10.6	**/26**	
HEU	Switch (VLAN#1)	205.5.10.7	**/26**	
ADC1	ADC1 (to MPU1)	205.5.10.8	**/26**	
ADC2	ADC2 (to MPU2)	205.5.10.9	**/26**	
MPU2	TDN/Video Server (to Switch)	205.5.10.10	**/26**	
MPU1	TDN Video Server (to Switch)	205.5.10.11	**/26**	
MPU2	Solaris Server 1 (AFATDS)	205.5.10.12	**/26**	
MPU1	Solaris Server 1 (AFATDS)	205.5.10.13	**/26**	
MPU2	Solaris Server 2 (TCO/IAS)	205.5.10.14	**/26**	
MPU1	Solaris Server 2 (TCO/IAS)	205.5.10.15	**/26**	
HEU	Teknor (to Switch)	205.5.10.16	**/26**	
MPU1	TDN Video Server (to Switch)	192.168.1.3	**/24**	Private address for EPLRS
MPU2	TDN Video Server (to Switch)	192.168.1.4	**/24**	Private address for EPLRS
EPLRS1		192.168.1.1	**/24**	Private address for EPLRS
EPLRS2		192.168.1.2	**/24**	Private address for EPLRS
	Spare	205.5.10.17		
	Spare	205.5.10.18		
	Spare	205.5.10.19		
DPU1	DPU1	205.5.10.20	**/26**	
DPU2	DPU2	205.5.10.21	**/26**	
DPU3	DPU3	205.5.10.22	**/26**	
DPU4	DPU4	205.5.10.23	**/26**	
DPU5	DPU5	205.5.10.24	**/26**	
DPU6	DPU6	205.5.10.25	**/26**	
DPU7	DPU7	205.5.10.26	**/26**	
CDPD	CDPD -ethernet (TBD)	205.5.10.27	**/26**	
CDPV	CDPV - ethernet (TBD)	205.5.10.28	**/26**	
	Spare	205.5.10.29		
MPU1	J1P5PER ETH0	205.5.10.30	**/26**	
MPU1	J1P5PER ETH1	205.5.10.31	**/26**	
MPU1	J1R1INLINE ETH0	205.5.10.32	**/26**	
MPU1	J1R1INLINE ETH1	205.5.10.33	**/26**	
MPU1	J7PATCH ETH0	205.5.10.34	**/26**	
MPU1	J7PATCH ETH1	205.5.10.35	**/26**	
MPU2	J1P2PER ETH0	205.5.10.36	**/26**	
MPU2	J1P2PER ETH1	205.5.10.37	**/26**	
MPU2	J1P6PER ETH0	205.5.10.38	**/26**	
MPU2	J1P6PER ETH1	205.5.10.39	**/26**	
MPU2	J1P7PER ETH0	205.5.10.40	**/26**	
MPU2	J1R4INLINE ETH0	205.5.10.41	**/26**	
MPU1	P1R1SEP	205.5.10.42	**/26**	
MPU1	P1R1SEP	205.5.10.43	**/26**	
MPU1	P1R1SEP	205.5.10.44	**/26**	
MPU1	P1R1SEP	205.5.10.45	**/26**	
MPU2	P1R4SEP	205.5.10.46	**/26**	
MPU2	P1R4SEP	205.5.10.47	**/26**	
MPU2	P1R4SEP	205.5.10.48	**/26**	
MPU2	P1R4SEP	205.5.10.49	**/26**	
TSR1	SEP1	205.5.10.50	**/26**	
TSR1	SEP1	205.5.10.51	**/26**	
TSR2	SEP2	205.5.10.52	**/26**	
TSR2	SEP2	205.5.10.53	**/26**	
	Spare	205.5.10.54		
	Spare	205.5.10.55		
	Spare	205.5.10.56		
	Spare	205.5.10.57		

	Spare	205.5.10.58		
	Spare	205.5.10.59		
	Spare	205.5.10.60		
	Spare	205.5.10.61		
	Spare	205.5.10.62		
	Broadcast	205.5.10.63		
	CDDI SUBNET	205.5.10.64	**/29**	
HEU	DyY4 - CDDI	205.5.10.65	**/29**	
CDPV	CDPV - CDDI	205.5.10.66	**/29**	
CDPD	CDPD -CDDI	205.5.10.67	**/29**	
HEU2	DyY4 - CDDI	205.5.10.68	**/29**	
	Spare	205.5.10.69	**/29**	
	Spare	205.5.10.70	**/29**	
	Broadcast	205.5.10.71		
	Teknor/DY4 Bridge SUBNET	205.5.10.72	**/30**	
HEU	Teknor (to DY4/VxWorks)	205.5.10.73	**/30**	
HEU	DY4 VxWorks	205.5.10.74	**/30**	
	Broadcast	205.5.10.75		
TSR1	***Router to EPLRS SUBNET***	205.5.10.76	**/30**	
TSR1	Router (s0.1)	205.5.10.77	**/30**	
TSR1	EPLRS (IP ADDSI)	205.5.10.78	**/30**	EPLRS Address for AFATDS on MPU1
	Broadcast	205.5.10.79		
TSR2	***Router to EPLRS SUBNET***	205.5.10.80	**/30**	
TSR2	Router (s0.1)	205.5.10.81	**/30**	
TSR2	EPLRS (IP ADDSI)	205.5.10.82	**/30**	EPLRS Address for AFATDS on MPU2
	Broadcast	205.5.10.83		
	Spare Network	205.5.10.84	/30	
	Spare	205.5.10.85	/30	
	Spare	205.5.10.86	/30	
	Broadcast	205.5.10.87		
Test	*MPU1 (TVS) SINCGARS SUBNET*	205.5.10.88	/30	
MPU1	SP-TCIM CNR2	205.5.10.89	/30	
	Remote Host	205.5.10.90	/30	
	Broadcast	205.5.10.91		
Test	*MPU1 (TVS) SINCGARS SUBNET*	205.5.10.92	/30	
MPU1	SP-TCIM CNR3	205.5.10.93	/30	
	Remote Host	205.5.10.94	/30	
	Broadcast	205.5.10.95		
Test	*MPU1 (Solaris1) SINCGARS SUBNET*	205.5.10.96	/30	
MPU1	SP-TCIM CNR0	205.5.10.97	/30	SINCGARS Channel 1
	Remote Host	205.5.10.98	/30	
	Broadcast	205.5.10.99		
Test	*MPU1 (Solaris 2) SINCGARS SUBNET*	205.5.10.100	/30	
MPU1	SP-TCIM CNR1	205.5.10.101	/30	
	Remote Host	205.5.10.102	/30	
	Broadcast	205.5.10.103		
Test	*MPU2 (Solaris1) SINCGARS SUBNET*	205.5.10.104	/30	
MPU2	SP-TCIM CNR0	205.5.10.105	/30	
	Remote Host	205.5.10.106	/30	
	Broadcast	205.5.10.107		
Test	*MPU2 (Solaris 2) SINCGARS SUBNET*	205.5.10.108	/30	
MPU2	SP-TCIM CNR1	205.5.10.109	/30	SINCGARS Channel 1
	Remote Host	205.5.10.110	/30	
	Broadcast	205.5.10.111		
Test	*MPU2 (TVS) SINCGARS SUBNET*	205.5.10.112	/30	
MPU2	SP-TCIM CNR2	205.5.10.113	/30	
	Remote Host	205.5.10.114	/30	
	Broadcast	205.5.10.115		
Test	*MPU2 (TVS) SINCGARS SUBNET*	205.5.10.116	/30	
MPU2	SP-TCIM CNR3	205.5.10.117	/30	
	Remote Host	205.5.10.118	/30	
	Broadcast	205.5.10.119		
	Spare	205.5.10.120		

	Spare	205.5.10.121	
	Spare	205.5.10.122	
	Spare	205.5.10.123	
	Spare	205.5.10.124	
	Spare	205.5.10.125	
	Spare	205.5.10.126	
	Broadcast	205.5.10.127	

Network Masks
/21 =
255.255.248.0
/22 =
255.255.252.0
/23 =
255.255.254.0
/24 =
255.255.255.0
/26 = 255.255.255.192
/29 = 255.255.255.248
/30 = 255.255.255.252

(e) EFV(C) Stationary Operations EFV(C) stationary operation scenarios include well-deck operations, expansion into shelters, the incorporation of additional supporting personnel and equipment, and connection to the main battalion, regimental, or other headquarters.

For example, the unit operations center (UOC) COC can function as a main battalion, regimental, or other headquarters for land operations. The UOC COC provides a semi-mobile facility for C2 for the infantry commander and staff, from the division to the battalion levels of command. The UOC COC provides the commander with common operational and tactical information to conduct staff planning and analytical and intuitive decision making. The direction and control of unit operations are exercised primarily through this center. The UOC COC is intended to present, display, and communicate the Marine commander's required C2 information during all aspects of expeditionary maneuver warfare.

The UOC COC provides centralized capabilities that facilitate rapid information processing for the commander and his staff. To accomplish this, the UOC COC is capable of interfacing to any current or planned communications asset. One of these assets is the EFV(C). The EFV(C) provides the infantry commander an “eye on the objective look” while the UOC COC provides a rear echelon facility for use by higher command.

During stationary operations, the EFV(C) is capable of directly interfacing with the UOC COC, via its SEP interfaces and a tent boot for direct access to the UOC COC’s tent. These capabilities allow the Marines to bring higher and lower commanders and their staffs into a uniform working environment as depicted in figure 5-29.

Figure 5-44 depicts the UOC/COC basic module.

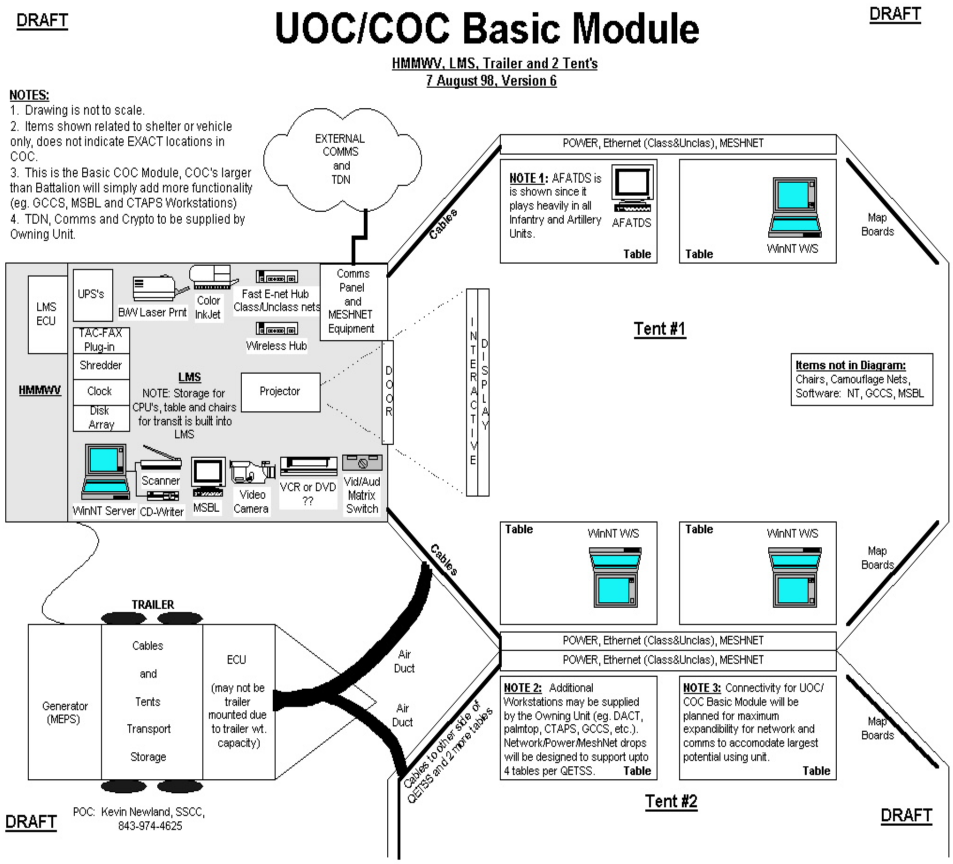


Figure 5-44. UOC/COC Basic Module

Chapter 6 Maintenance Operations

Due to the unique requirements of operational testing, ogistic support for the EFV will be accomplished through a combination of organic support and contractor logistics support until the EFV is fully fielded. Marines will perform organizational and intermediate maintenance in accordance with the Interactive Electronic Technical Manual (IETM) as outlined in the following sections. Depot level maintenance support, supply chain support and product support of the weapon system will be provided by a Total System Support Provider. The single point of support will be responsible for coordinating all commercial and organic support above the intermediate maintenance level in order to ensure EFV readiness and availability. The EFV field service representative (FSR) and the system support package representative (SSPR) will provide on-site support to the warfighter during operational testing as outlined in the following sections.

6001. Interactive Electronic Technical Manual (IETM)

An IETM is a technical manual, (authored) by a contractor and delivered to the Government or prepared by a Government activity, in a digital form on a suitable medium, by means of an automated authoring system; designed for electronic-window display to an end user. IETMs are digital in form and designed for interactive display to the maintenance technicians or system operator end users by means of a computer controlled Electronic Display System (EDS).

The IETM provides Class 5 IETM functionality, utilizes a collection of applications that provide the user electronic access to procedural maintenance data, reference documentation, operational guidance, and logistic and administrative support functions. A commercial off-the-shelf browser provides user interface with the Interactive Electronic Technical Manual Data Base (IETMDB). The IETMDB contains an assemblage of technical information and relationships (i.e., logical links) among the supporting technical information elements (e.g., part numbers, national stock numbers, etc.).

The IETM database is organized into information based on vehicle variant (EFV[P] and [C]), subsystem configuration and relevant information. Each variant is further divided into subsystems that provide information for individual tasks in a logical order of vehicle breakdown. Tasks are standalone modules for general, descriptive, theory, operating, maintenance levels, troubleshooting, parts, and supporting data units containing all information required for completing a task. Each task is assigned an object ID number that remains with the task for the life of the IETM. The object ID is useful for making references to tasks. Tasks can contain logical hyperlinks to other tasks to provide supporting information. In addition, each task contains warnings and cautions as required by IETMs: general content, style, format, and user – interaction requirements (MIL-PRF-87268a) to ensure safe execution of the task.

a. Embedded Logistics and Administrative System (ELAS)

ELAS is the system that collects historical data from vehicle subsystems such as; round count, weapons bore wear, engine hours, vehicle miles, component failures, etc. It replaces the paper version of the vehicle log book, assists the maintainer in completing requisitioning forms, assists the operator with forms and record keeping, and provides a complete vehicle inventory. It is envisioned in the future that data will be transferred from the vehicle via Personal Computer Memory Card International Association (PCMCIA) cards.

b. Current Capabilities

To date the EFV IETM has focused on the tasks necessary to support logistics demonstrations including preliminary battle damage assessment repair (BDAR) tasks, initial electrical and hydraulic schematics/diagrams, initial ELAS functions and initial integrated parts breakout (IPB) usage. This should by no means be considered the final delivery of the EFV IETM. Users should keep in mind that this is a work in progress TM.

c. IETM Access

All approved operator/crew maintenance tasks, maintainer tasks, and troubleshooting procedures (as design permits) can be found in the IETM located on the Portable Maintenance Device (PMD) on-board the EFV. Technical, grammar or format errors found during IETM use should be reported to the FSR at each test site. These errors will be recorded on a formal Data Collection Analysis and Corrective Action System (DCACAS) and reported to the FSR.

d. IETM Familiarization & Training

Training is conducted by a contractor training team to EFV test crews on the proper access and use of the IETM until the EFV is fully fielded. IETM training includes PMD familiarization, proper use of the browser, proper use of all menus to include operator, maintenance, troubleshooting and the use of repair parts information. The below procedures allow a user to access the IETM and perform basic functions:

Note:

At the time of this writing, the design is not finalized for the IETM. These procedures may change as the design becomes more mature.

(1) User Login. The user selects an IETM Icon from the PMD desktop and is then provided a Login Screen (figure 6-1).

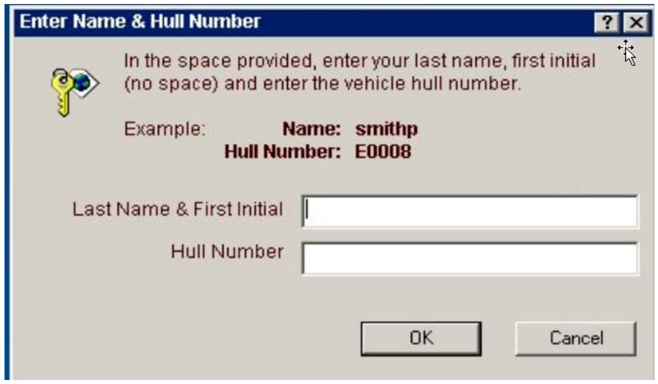


Figure 6-1. IETM Login Screen

(2) User Options Menu – General Options. The user inputs the login information, hits "Enter" or selects "OK" and the User Options Menu (UOM) opens. The user is presented with a UOM initiated to a "General Options" menu screen that allows access to the following functions (figure 6-2 is not all-inclusive):

- Access to IETM and Assisted Troubleshooting
- Start IETM (Manual Browse Mode)
- Update/Restore Data on Memory Device
- Access ELAS Information
- Help With User Options Menu (UOM)
- Close Window (Cancels Screen)

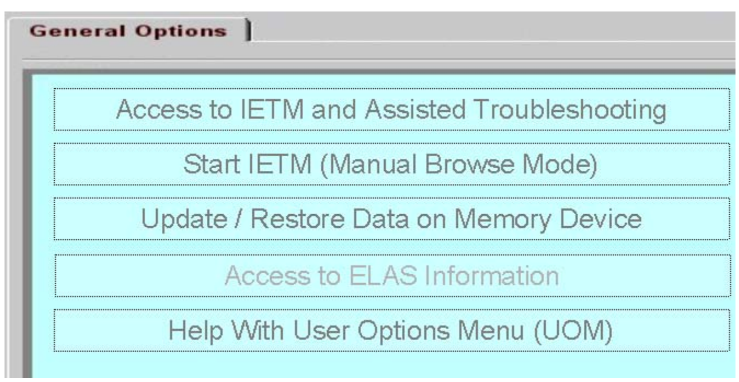


Figure 6-2. General Options Menu Screen

(3) Select User Option. With the PMD initiated to the General Options screen, the user chooses to select "Access to IETM and Assisted Troubleshooting" (figure 2). The system responds by displaying the Data Transfer options menu with the following options (figure 6-3 is not all-inclusive):

- Download Data from Mass Memory Unit (MMU)
- Download Data from PC Memory Card (AKA PCMCIA Device)
- Upload Data to MMU from PMD
- Upload Data to PC Memory Card from PMD
- Inactive "Begin Data Transfer" button
- Close Window (Cancels Screen)
- General Options
- Help Function
- Data Restore options
- Troubleshooting options

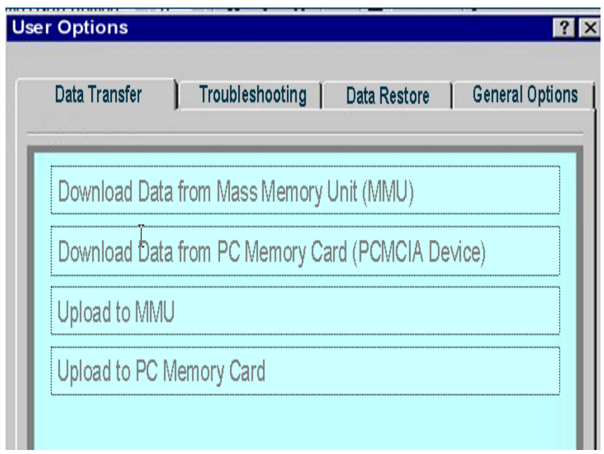


Figure 6-3. Data Transfer Menu Screen

(4) Initiate Data Transfer Menu. From the Data Transfer Menu, the user may choose to select Troubleshooting if the data has already been downloaded or if data hasn't been downloaded may choose to select "Download Data from Mass Memory Unit (MMU)". If a download option is selected, the system will respond by highlighting the selected option and by activating the "Begin Data Transfer" button (not shown) (figure 6-3).

(5) Select Begin Data Transfer. The user chooses to select the "Begin Data Transfer" button. The system responds by displaying a message on the PMD "Ensure that PMD data cable is connected to HEU (figure 6-4). Once connected, select "OK" to proceed with download or select "Cancel" to return to options." The system also responds by providing an "OK" button that allows message acknowledgement, highlighted by default, and a "Cancel" option that cancels the current message and returns the user to the download options screen.

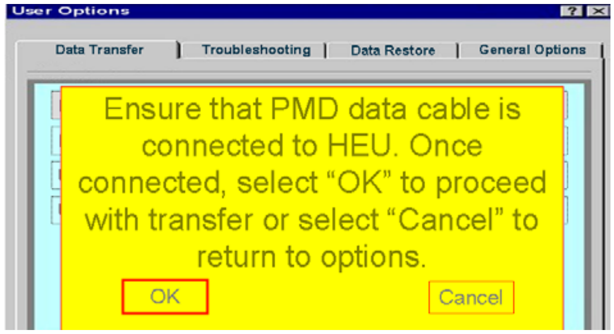


Figure 6-4. Selecting Data Transfer

(6) Tether PMD for Data Transfer. With the vehicle powered up, the user connects the PMD to the Hull Electronics Unit (HEU) via Ethernet interface cable. The system responds by presenting the user with an indicator on the PMD that the connection is confirmed.

(7) Select OK System Downloads Data. The user chooses to select "OK" on the PMD. The system responds by confirming that data is being transferred. If data transfer does not begin, follow error message directions. The system also responds by removing the "Ensure the PMD data cable is connected…" message. If data is available the system responds by displaying a message "Download in Progress. Please wait." (figure 6-5)

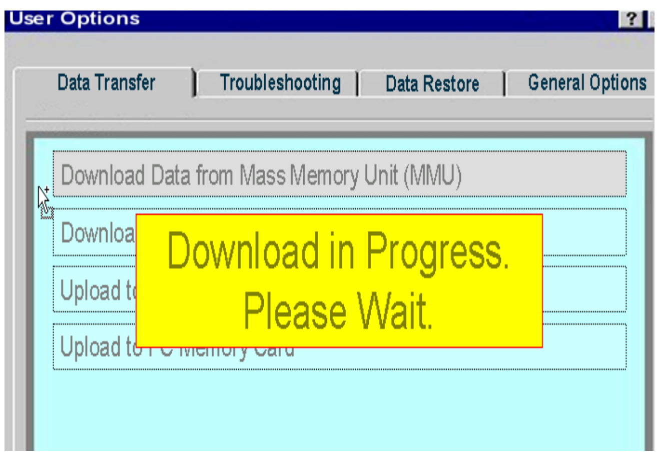


Figure 6-5. IETM Download In Progress Display

(8) Download Complete. The system also ensures that the download has completed successfully. Upon successful completion of data download, the system responds by removing the "Download in Progress…" message and by displaying a message on the PMD "Download has completed successfully. The PMD may be disconnected from the HEU." "OK." The user acknowledges the download complete / disconnect message. The system responds by removing the message from the PMD display and returns to the Data Transfer Options screen (figure 6-6).

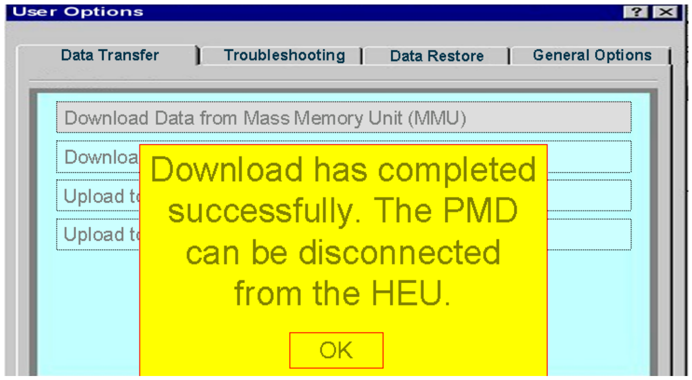


Figure 6-6. Download Complete Screen

(9) Access Troubleshooting Options Screen. The user chooses to select "Troubleshooting" from the Data Transfer menu screen. The system responds by displaying a screen with the following options (figure 6-7):

- Active Warnings and Cautions (W/C)
- Fault History Log
- Active "Manual Entry to IETM" button
- Close Window (Cancels Screen)
- Data Transfer options
- General Options
- Help function

Figure 6-7. Troubleshooting Options Screen

(10) Access W/C list. The user chooses to select "Warnings/Cautions" from the Troubleshooting options screen. The system responds by removing the "Manual Entry to IETM" button and presenting a list/index of active W/Cs (the prioritization is established in "Fault Management" use case). The system also presents an inactive "Assisted Troubleshooting" button along with "Troubleshooting" options, "Data Transfer" options, "General Options" and an active "Help" function button. (see figure 8) If there are no current W/Cs, the system responds by displaying a blank index and presenting a message "No active fault messages generated at this time." "OK". The user chooses to acknowledge the message. The system responds by removing the message.

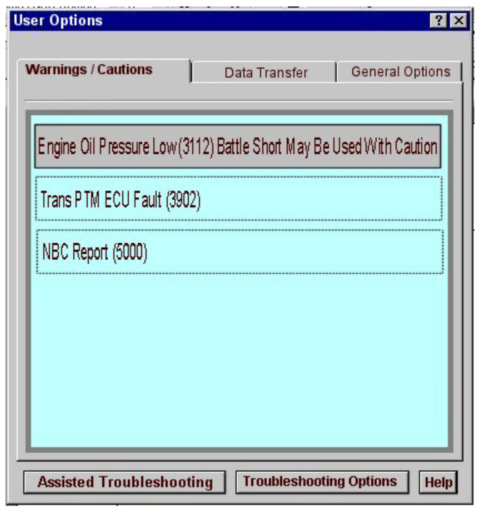


Figure 6-8. Warnings & Cautions Screen

(11) Selecting a W/C. The user chooses to select a W/C from the index. The system responds by highlighting the selected item and activating the "Assisted Troubleshooting" button.

(12) Access IETM Information Through W/C. The user chooses to select "Assisted Troubleshooting" from the W/C screen. The system responds by translating the W/C message Fault Logic Kernel (FLK) into an external IETM startup command that opens the IETM and presents the user with IETM troubleshooting information related to the selected W/C.

(13) End W/C Troubleshooting. The user chooses to close the IETM. The system responds by returning the user to the W/C options with the previous selection still highlighted.

(14) Browse For IETM Information. The user may choose to select " Start IETM (Manual Browse Mode)" for informational browsing purposes. The system would respond by starting the IETM at the beginning/opening screen. The user then chooses to navigate through the IETM by following the menu screens, table of contents or index.

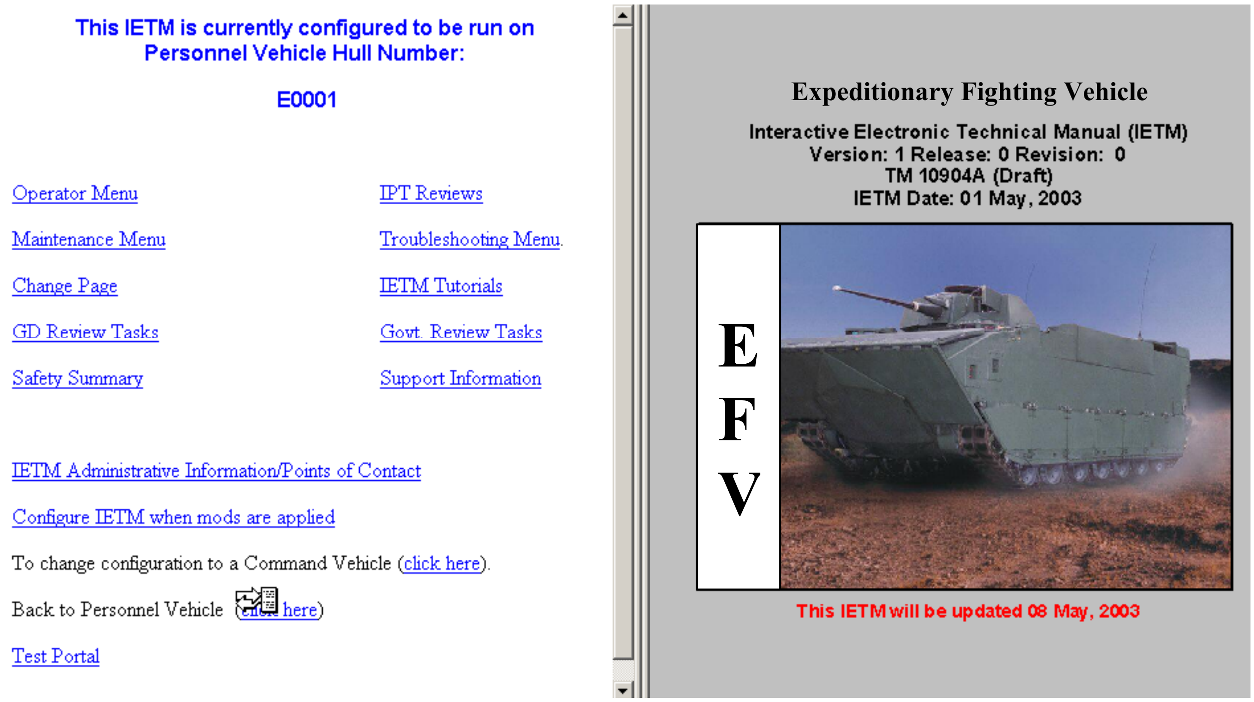


Figure 6-9. IETM Manual Browse Mode Screen

(15) Close IETM. When the user chooses to close the IETM, the system responds by returning to the UOM.

6002. Maintenance Support and Test Equipment

All EFV maintenance done by the USMC must be done using tools, support and test equipment as directed in the EFV IETM.

a. On-Board Tools

All crew level tasks on the EFV(P) are to be accomplished in accordance with the IETM using the 22 on-board tools identified in figure 6-10 to include gun tools. All crew level tasks on the EFV(C) are to be accomplished in accordance with the IETM, using the 17 on-board tools identified in figure 6-10. The IETM references the use of tools that are onboard the vehicle, but do not specify individual tools to be used. Tools are located in the toolbox, on the starboard side of the vehicle forward of the cooling compartment. Gun tools are located in the gun bag on the turret support post.

	22 Personnel Variant On-Board Tools
1	3/4" Drive Ratchet Head
2	3/4" Drive Breaker Bar Head
3	3/4" Drive Handle
4	16" Long 3/4" Drive Extension
5	3" Long 3/4" Drive Extension
6	30mm 3/4" Drive Socket
7	15/16 Opening 3/4" Drive Socket
8	1/2" Drive Ratchet
9	10" Long 1/2" Drive Extension
10	5" Long 1/2" Drive Extension
11	17mm 1/2" Drive Socket
12	16mm 1/2" Drive Socket
13	13mm 1/2" Drive Socket
14	9/16 Opening 1/2" Drive Socket
15	Screwdriver Cross Tip #2
16	Pliers
17	Wrench Adjustable
18	Socket 14mm 1/2" Drive (Gun tool)
19	Wrench L Shaped 6mm Allen Wrench (Gun Tool)
20	Wrench L Shaped 5mm Allen Wrench (Gun Tool)
21	Screwdriver Flat 12" x 3/8" (Gun Tool)
22	Multi-Purpose Upload Wrench (Gun Tool)

	17 Command Variant On-Board Tools
1	3/4" Drive Ratchet Head
2	3/4" Drive Breaker Bar Head
3	3/4" Drive Handle
4	16" Long 3/4" Drive Extension
5	3" Long 3/4" Drive Extension
6	30mm 3/4" Drive Socket
7	15/16 Opening 3/4" Drive Socket
8	1/2" Drive Ratchet
9	10" Long 1/2" Drive Extension
10	5" Long 1/2" Drive Extension
11	17mm 1/2" Drive Socket
12	16mm 1/2" Drive Socket
13	13mm 1/2" Drive Socket
14	9/16 Opening 1/2" Drive Socket
15	Screwdriver Cross Tip #2
16	Pliers
17	Wrench Adjustable

Figure 6-10. On Board Tools for the EFV(P) and EFV(C)

b. Portable Maintenance Device

The Portable Maintenance Device (PMD) is essentially a computer that hooks up to the vehicle Ethernet test jack and can operate under its own battery power or from vehicle power. In SDD, the PMD is a laptop with swappable disk drives and batteries, including a DVD drive. The laptop is common Marine Corps hardware being utilized elsewhere in the fleet. The PMD and its power adapter are stored in the “ballistic valise” or soft case and stored inside a PMD enclosure located on the starboard side behind the troop commander seat. The PMD can access power (from Hull-Remote Acquisition Control

Module No. 5) to charge its battery while in the PMD enclosure, but must be removed from the enclosure and/or the ballistic valise to interface with an Ethernet test jack.

Through its access to the vehicle Ethernet, the PMD allows these software programs to exchange data with the vehicle allowing for more interactive and automatic capabilities. The PMD provides various functions to the EFV User including the IETM, the Embedded Logistics Administrative System (ELAS), and the Software Loader Verifier (SLV) to update and maintain vehicle software. In the future, the PMD may operate as in Instructor Operator Station (IOS) or instructor's controller for the vehicle's Embedded Training (ET) system, and it also may be a controller for the Third Echelon Test System.

c. Third Echelon Test System

The Third Echelon Test System (TETS) is the Marine Corps Common Automated Test Equipment for electronics and optics maintenance support. See figure 6-11 for an illustration. For EFV, manual troubleshooting procedures in the EFV IETM will direct the User to utilize TETS and EFV Application Program Sets (APSs). APSs are comprised of Interface Control Devices (ICDs) such as cables and connectors, Test Program Set (TPS) software, shipping cases, specified IETM tasks and other technical data. Using the ICDs, TETS is hooked to external test points on the EFV Line Replaceable Unit (LRU). Via the ICDs and TPSs software specific to that LRU, TETS receives and analyzes EFV LRU power and data signals. This process provides the User with diagnostics and verification of system, LRU, or circuit card assembly (CCA) condition.

Picture 6-11. AN/USM 657(v)1 Third Echelon Test System (TETS)

d. Slings

Slings for use with EFV include the Integrated Lifting Sling System, a standard Aerial lifting sling, and a Tuflex roundsling. See figure 6-12. If the AAVR7A1 is operating in support of the EFV, it will carry slings as part of its on board equipment.

The sling system requires the use of an overhead lifting device with a maximum hook to floor height of 20 feet for the safe removal and installation of the engine, turret, transmission, power transfer module (PTM), final drive, waterjet, auxiliary power unit (APU), and hydropneumatic suspension units (HSUs) from a EFV-P with turret installed and/or EFV-C with cupola installed. This Integrating Lifting Kit is comprised of: an Engine Sling (T-Sling), a Multi-Purpose Lifting Sling (L-Sling), Adapters (PTM, final drive, waterjet, HSU/APU), and Transmission Spreader Bars with Sling and a

Positioning, Load-Rotor used to link the transmission to the spreader bars for lifting. In addition, until a final Turret sling is designed, the Turret sling will be comprised of adjustable chains or 3 ratchet straps and a ring. This temporary sling is to accommodate different Turret configurations until the Turret configuration is stable enough for the final Turret Sling to be designed.

In addition, the standard aerial lifting sling and the tuflex round sling are to be used in accordance with the IETM to remove engine/exhaust covers and radiators and other miscellaneous items.

Transmission Spreader Bars

L-Sling with Final Drive Adapter lifting Final Drive

L-Sling with PTM Adapter mounted to PTM

Engine installed using Engine (T) Sling

Figure 6-12. Types of EFV Slings

e. Tow Bar

EFV land towing requires towing or being towed by another EFV in either forward or reverse directions at speeds up to 16 kph (10 mph) for a distance up to 16 km (10 miles) without disconnection of the final drives with both EFVs being in weight condition 3 using a tow bar. Weight condition 3 is defined as the EFV with the crew (3), embarked infantry (17) and 100% of fuel, ammunition, POLs, and onboard vehicle equipment (OVE). In order to make turns without the two vehicles hitting each other, a standard Hercules tow bar with an extension of approximately 50 inches is required. Figure 6-13 shows the modified tow bar.

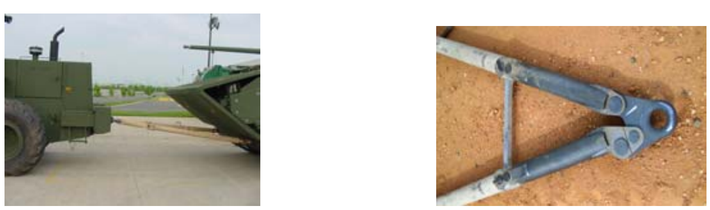


Figure 6-13. EFV 50” Modified Tow Bar

Chains and cables may be used for towing if a tow bar is not available.

f. Nitrogen Charging System

The Nitrogen Charging System is used in accordance with IETM procedures to charge the hydropneumatic suspension units (HSUs) to specified levels. There are 14 HSUs on each vehicle, one for each road wheel assembly, which act as independent shock absorbers as vehicles negotiate various terrain and obstacles. The Nitrogen Charging System is used to charge the HSUs via each HSU's charge port.

At the test sites, the user will see "green" and "red" nitrogen charge carts developed by the EFV contractor to perform the HSU charging service. The contractor will develop an improved red charge cart for test sites in the future. *The appropriate IETM tasks need to be used depending on which nitrogen charge cart is available.*

Figure 6-14. Green and Red Nitrogen Charge Carts (available at test sites)

In addition, the user will also see a few versions of prototypes of a portable Nitrogen Charging System (NCS) (see figure 6-15) that are being designed to provide high-pressure nitrogen (N2) gas which is taken from atmospheric air. The portable NCS is being designed to operate at 28 VDC+/- 4V, to provide a port for oil changing, to pressurize 80 cubic inches volume to 7,000 psig within 20 minutes, to be 34 inches long by 30 inches wide by 24 inches high, and to weigh less than 200 pounds. Each version of the NCS prototypes should be an improved design of its predecessor based upon Marine feedback from test site use.

Figure 6-15. Prototype NCS

i. Intermediate Passenger Helicopter Aircrew Breathing Device (IPHABD) (SDD Only)

The IPHABD, or SRU-40 B/P, is the USMC's emergency self-contained air source designed for use by helicopter crews during emergency water contact. See figure 6-16. The EFV program is utilizing the IPHABDs during the SDD phase of the program as a safety caution. Please note: The IPHABD provides approximately 15 breaths at 33 feet. The IPHABD/SRU 40-B/P integrates a regulator first stage, second stage, on-off valve, and 1.5 cu. ft. aluminum cylinder. The IPHABD/SRU 40 B/P attaches to the LPU-32 life jacket. Specified EFV Marines have been provided the training and equipment to refill and maintain the IPHABDS bottles.

Figure 6-16. US Marine wearing IPHABD, LPU32 and MOLLE Pack.

6003. Maintenance Concept

a. Levels of Maintenance

The EFV maintenance plan encompasses three levels of maintenance as described in the following paragraphs.

(1) Organizational. Organizational maintenance is normally performed by equipment operators or the crew with a limited number of on-board tools and support equipment. Included in organizational maintenance are tasks such as operational inspections (pre-operations, during operations, after operations and pre-water operations), crew preventive maintenance and limited scheduled maintenance tasks.

Crew preventive maintenance tasks are not performed on a scheduled basis (calendar, hours, miles, rounds fired, etc). Instead, they are accomplished before some event. For example, after water operations, the crew may be required to conduct a fresh water rinse of the vehicle and lubricate the towing pintle.

Scheduled maintenance at the organizational level includes those tasks that the crew can be trained to do and which are performed on a scheduled basis. For example, the EFV crew will replace oil filters on a scheduled basis.

(2) Intermediate. Intermediate maintenance is performed by formally trained technicians with a variety of tools, test equipment and support equipment. Intermediate maintenance tasks include troubleshooting and fault isolation, adjustment of components, removal and replacement of components, repair of structure, tubing, cables, and so forth. Intermediate maintenance on the EFV has been divided into two distinct categories (on vehicle and off vehicle tasks) to enable more robust analysis of design performance and more efficient assignment of personnel to accomplish the tasks.

On vehicle tasks are those that can be completed without removing a component from the vehicle. On vehicle tasks can generally be accomplished by entry level technicians with a minimum of supervision. Many of these tasks will be trained to standard either at the entry-level formal school or by mobile training teams. They include removal/replacement of components, fault isolation, limited cable repairs, and so on. These tasks, for the most part, can be accomplished with tools contained in the General Mechanics Tool Kit (GMTK) and several tools contained in the Common Number 1 tool kit.

Off vehicle tasks are those that require removal of a component from the vehicle. These tasks generally require additional tools and support equipment and in most cases, can only be properly accomplished by a more experienced technician. In most cases, these tasks will be trained at an intermediate level school or by mobile training teams. Examples of off vehicle tasks include card replacement in electronic boxes and component replacement on complex items such as the engine.

(3) Depot. Items that cannot be repaired at the intermediate level are candidates for repair at the depot level. The Depot Source of Repair (DSOR) process is used to determine whether an item should be shipped to a depot or discarded at the intermediate level. This process also determines whether the item should be repaired at a government depot or at a private depot (e.g., original equipment manufacturer).

6004. Crew Tasks and Responsibilities

The EFV crew, in addition to operating and performing typical crew tasks on the vehicle will be responsible for some tasks that have been historically associated with maintenance personnel. In keeping with the "fix as far forward as possible" concept, the EFV design has placed an emphasis on accessibility of components and ease of maintenance. This has allowed certain tasks to migrate from maintenance to the crew level. Among these tasks are replacement of filters, changing of fluids and removal and replacement of selected LRUs.

Crew level preventive maintenance checks and services (PMCS) are being determined using reliability centered maintenance (RCM). The use of the RCM process will keep the number and frequency of these tasks to a minimum by ensuring that only those tasks that make sense are scheduled and performed. All PMCS tasks associated with the crew can be performed using only on-board tools and all will be covered in detail in the vehicle's interactive electronic technical manual (IETM).

6005. Maintainer Tasks and Responsibilities

EFV maintainers represent a variety of military occupational specialties (MOS). The primary maintainer, the tracked vehicle repairman, MOS 2142, is responsible for maintenance of most of the vehicle subsystems such as the engine, power train, suspension, hydraulic, and electrical systems.

In addition to the 2142, Marines with communications MOS are crucial to the readiness of the vehicle. Electronic systems repairman, MOS 2844, and ground data communications technician, MOS 2862, will perform troubleshooting and maintenance on the vehicle communication system. In some instances, the Marines will assist the

2142 with repairs to the vehicles electrical system and electronic components. The 06-- will maintain the network infrastructure in the EFV(C).

Welders (MOS 1316) and machinists (MOS 2161) may be engaged from time to time to repair hull structure, threaded components, and brackets.

6006. Troubleshooting

It is important to note the EFV diagnostic design is focused on the primary maintainer, MOS 2142, who will perform most diagnostic and maintenance activities, not the vehicle crew.

However, the crew are responsible for the following:

- Act in accordance with the Cautions and Warnings provided
- Contact the responsible maintainer when something does break
- Communicate the fault codes displayed, suspected faults or failures when obvious, or as a minimum, the symptoms
- Communicate the operating conditions at time of fault/failure recognition
- Communicate false alarms

In some cases a fault code may not be displayed, but a developing problem is obvious to the crew. The first method of determining a problem has developed, or, is about to occur, is through sight, smell, sound or taste. Beyond that, the fault codes exhibited are an indication some incident has occurred and a maintainer is required.

A Marine Corps maintainer or field service representative (FSR) can be contacted using the vehicle communication system. As a last resort, or, in a BDAR situation, it is possible for the crew to access the diagnostics provided.

When something breaks or is about to break, troubleshooting to isolate to the faulty or failed item, can be performed using the physical means identified above, or, by using various diagnostic methods described below.

a. On-Board Diagnostics

A fault may or may not be detected by the diagnostic system. Regardless of how the fault is detected, the procedures below define the course of action in each instance.

Once the system self test (SST) detects a fault, the fault can be isolated to an LRU using the following procedure:

- **Step 1** Connect the portable maintenance device and download the active fault list.
- **Step 2** Launch the Class V IETM

- **Step 3** Select the active fault
- **Step 4** Follow the manual troubleshooting procedure, which enables isolation of the fault to a single LRU.
- **Step 5** Since each manual troubleshooting procedure links to a fault resolving maintenance task, follow the instructions to accomplish removal and replacement of the suspect faulty LRU.
- **Step 6** Once complete, verify the repair operation, to ensure the fault has been remedied.

If the fault condition was not detected by the diagnostic system, but one is suspected, execute the following procedure:

- **Step 1** Launch the Class V IETM
- **Step 2** Scan the list of symptoms and, if found, select the appropriate symptom. If not, go to step 6.
- **Step 3** Follow the manual troubleshooting procedure, which enables isolation of the fault to a single LRU.
- **Step 4** Since each manual troubleshooting procedure links to a fault resolving maintenance task, follow the instructions to accomplish removal and replacement of the suspect LRU.
- **Step 5** Once the LRU has been replaced, verification of the repair action must be performed to ensure the fault has been remedied.
- **Step 6** Given that the symptom was not found in the listing of symptoms, open the IETM manually and select the function associated with the fault.
- **Step 7** Use theory of operations and schematics to perform symptom discernment.
- **Step 8** Once the symptom has been identified, launch the Class V IETM.
- **Step 9** Scan the list of symptoms and select the appropriate symptom.
- Step 10 Follow the manual troubleshooting procedure to isolate the fault to a single LRU.
- **Step 11** Follow instructions to accomplish removal and replacement of the suspect LRU.
- **Step 12** Verify the repair action to ensure the fault has been remedied.

b. Manual Troubleshooting Procedure
The process of isolating a faulty or failed component is to perform manual troubleshooting. The EFV IETM provides the link to MTPs. Access to the IETM can be gained through use of the Portable Maintenance Device (PMD), stored in the ballistic valise located on the starboard side behind the troop commanders seat. See 600b for a description of the PMD.

The fault code displayed by the Common Display Panel – driver or vehicle commander, is related to a MTP. Each MTP has embedded in it the Technical Theory of Operation of a specific function, a cross correlation between fault codes and associated messages and a logic tree for isolating to the component which needs replacement. Further, each MTP describes the tools needed to perform the troubleshooting, the MOS levels/quantity normally required and special documentation, when applicable.

Troubleshooting specific electronics and LRUs may lead the maintainer to the use of a Third Echelon Test System (TETS) and application program sets, described in 6002. Through use of these devices, isolation can be performed to fault groups at the logic card, power supply or backpanel subassembly levels within the suspect LRU.

6007. Field Service Representative (FSR) Responsibilities

During Operations for Test Events and Operational Assessments, the contractor will provide an onsite FSR to support the operators and maintainers for diagnostic and troubleshooting tasks. The FSR is assigned to assist in the advanced diagnostics and troubleshooting tasks associated with the EFV. The FSR will be the conduit between the user and the EFV Technology Center for any technical assistance. FSR responsibilities are as follows:

- Provide advanced diagnostics/troubleshooting assistance
- Provide on-site technical training
- Serve as on-site conduit between the test site and the EFV Technology Center for engineering support
- Receive and issue IETM changes and ensure PMDs are updated
- Receive and issue modification kits
- Ensure modification kits are applied correctly, Data Collector Reports are completed and sent to the EFV Technology Center for "As Maintained" CM and IETM updates, and any modification-related training has been conducted
- Ensure that data collectors are accurately reporting serialized LRU changes for "As Maintained" CM records
- Provide accurate field problem reporting information to the maintenance data collectors
- Assist the data collector in capturing accurate information in the Maintenance Work Orders
- Receive and issue safety alerts
- Validate the IETM tasks with the technicians during the course of repairs, and provide feedback to the EFV Technology Center via DCACAS forms for each validated IETM task
- Provide accurate discrepancy reporting (DCACAS) information to the maintenance data collector for IETM and Process Sheet discrepancies
- Provide feedback through DCACAS on the prototype LRU shipping containers, to include discrepancies and/or recommendations for container design improvements
- Provide feedback through DCACAS on SDD developed slings and special tools and test equipment design, to include discrepancies or improvement recommendations
- Advise the site manager on technical assistance topics and training issues/requirements

- Provide feedback to the EFV Technology Center on all matters pertaining to on-site technical assistance, parts-related problems (e.g. shortages, non-conformance, deficiencies and discrepancies), and problem reporting
- Maintain positive, responsive customer relations with all contractor and USMC personnel
- Report to the field support IPT lead at the EFV Technology Center
- Serve in direct support of the test site manager or senior Marine for operational assessments
- Assist in training replacement and/or new FSRs, as required.

a. FSR Technical Engineering Support
The FSR will maintain a complete recall roster for all facets of engineering support, for utilization during working hours, and after hours. The roster will identify primary, secondary and third line contacts for each IPT. EFV Technology Center Test Support will assist with requests for assistance as needed.

The FSR will use digital methods for data transfer back to the Technology Center for any engineering related issues that cannot be resolved over the phone. Digital transfer will provide both immediacy and precision in conveying the critical information, and may include email of digital pictures with explanations, remote expert technology, video, and transfer of data bus information. Technology Center Test Support Personnel will be responsible for dissemination of the information to the appropriate representatives, and completion of follow-up action to provide resolution back at the test site.

b. FSR Supply Support
On-site parts support will be provided by the system support package representative (SSPR) at each site. The SSPR is responsible for managing the assigned SSP, to include supervision of receipts, issues, inventory, stockage levels and Reorder Points (ROPs). Detailed procedures for parts support is provided in 6008.

6008. Supply Support

Supply support for the EFV will be conducted in accordance with established combat service support element (CSSE) procedures and the EFV Total System Support Concept (TSS).

a. Ordering
The process for supply support will initiate when the need is identified either by a failure (crew will identify when the system is down) of the system or a requirement that is part of the operational testing. After the troubleshooting is performed and the failure is identified the supply support process is initiated. The process should be similar to the following:

- Failure is identified either by instructors (simulating a failure), or crew.
- Once the part is identified the normal procedures in accordance with the LOI's will be followed.

- For example if the LOI calls for a rapid request to be filled out and called in (via radio) or run to the CSSE, Combat Service Support Operation Center (CSSOC) then that is the process to be followed.
- If in garrison (at Camp Wilson) the process may be to open an equipment repair order (ERO), fill out an Equipment Repair Order Shopping List (EROSL) and enter into ATLASS I (follow the procedures outlined in the LOI's).
- After mintenance has filled out the required paperwork whether in MIMMS or ATLASS the request for the support then goes to the supply rep in the CSSOC.
- The CSSE supply Marine will then go to the system support package representative (SSPR) for the DRPM AAA to obtain the requested part by the supported unit. The FSR is a contractor representative who will be located on site. The SSPR will then go to the supply support package (SSP) to issue the part to the CSSE supply Marine. The CSSE supply will then issue the part to the supported unit according to established CSSE procedures.
- If the part is not available from the SSP it will be up to the contractor SSPR to request the part in support of the CSSE. Once the part has been identified to the SSPR it is their responsibility to fill the request.

b. Checking Supply Status

The SSPR will be responsible for the overall status of those spares on hand and those minimum and maximum quantities needed for site support.

6009. Packaging

The packaging concept for the EFV is under development and will be validated prior to vehicle fielding.

6010. Safety and Environmental Issues

a. Safety

The combination of heavy equipment, high speed mobility, limited observation, and an amphibious environment demands that command attention be paid to safety. Carelessness, recklessness, short cuts, or inattention on the part of anyone operating EFVs can result in personnel casualties and severe damage to vehicles. All hands must be continuously instructed, inspected, reminded, and corrected as necessary on safe vehicle operating procedures. Detailed and repeated promulgation of these precautions is mandatory.

(1) Waterborne Safety. Drivers must be aware that under certain conditions, continuous rapid acceleration during water transit may cause the EFV to "submarine" and nose down into the water. This is particularly critical during ship launches and transiting the surf zone. Extreme caution and situational awareness is paramount. If a vehicle begins to take a nose down attitude, the driver must immediately stop accelerating. Additionally, all gear inside the troop compartment must be properly secured.

The best way to retrieve a man overboard is to use a boat hook, life ring or towline. Only as a last resort should a man from the rescue vehicle enter the water.

(2) Land Mode Safety. An EFV will not move until all the areas underneath and around the vehicle have been checked for dismounted personnel. Any time a vehicle is moved in a congested area, regardless of direction, two ground guides will be used. The first ground guide will be positioned in front of the EFV where he can maintain eye contact with the driver and observe the movement of the front of the vehicle in a 180 degree arc. The second ground guide will be positioned at the rear of the vehicle where he can maintain eye contact with the first ground guide and observe the movement of the rear of the vehicle in a 180 degree arc.

No personnel will ride on top of a moving EFV during training. Crewmen may ride with no more than one-third of their bodies out of their respective hatches while on land.

Cargo straps will be used for open cargo hatches at all times to ensure the safety of embarked personnel during land operations.

(3) Operation and Maintenance Restrictions and Limitations. Operation and maintenance restrictions and limitations are detailed in appendix C of the EFV SOP and in the Safety Assessment Reports provided to DRPM AAA from the contractor.

(4) Safety Advisor Process. The program office will issue safety advisories via Navy Message to address critical safety issues associated with the EFV. Safety advisories are located on the safety summary screen of the IETMS.

(5) Maintenance of Use Notices. The program office will issue use notices via Naval Message to address maintenance issues associated with the EFV. Use notices are located in the IETMS.

(6) Personal Protective Equipment (PPE) Required. The following is a list of mandatory safety equipment and a brief explanation of the use of each:

- **CVC (COMM) Helmet** - Provides head and hearing protection. CVC helmets are the only helmet to be worn when operating an EFV.
- **CVC (NOMEX) Suit** - Provides crew fire-retardant protection. This garment is mandatory for all operation.
- **Dust masks** - These masks are provided to protect against non-toxic nuisance dusts and particles.
- **Goggles (Sun, Wind, and Dust)** - Each Marine is issued one pair of goggles that must be worn while operating the vehicle.
- **Goggles (Industrial)** - These goggles are provided to afford eye protection while performing PM/CM. The wearing of these goggles is mandatory while conducting maintenance on the vehicle.

- **Foam earplugs** - These earplugs are provided to afford hearing protection. Wearing of double hearing protection is mandatory while in the vehicle with the engine running. Single hearing protection is mandatory outside of the vehicle and within 25 meters of the vehicle with the engine running.
- **Ear Muffs** - These earmuffs are provided to afford hearing protection. Wearing of double hearing protection is mandatory while in the vehicle with the engine running. Single hearing protection is mandatory outside of the vehicle and within 25 meters of the vehicle with the engine running.
- **Life Preservers** - Provides crew and embarked Marines a dependable floatation device. Unit leaders will ensure all life jackets receive a safety check prior to being worn. All hands embarked aboard any EFV that enters the water will wear serviceable life jackets. Life jackets will include a serviceable CO2 cartridge and a buddy line. Life jackets will be worn around the neck and attach securely at the waist. The unit leader is not authorized to "splash" unless all of the passengers and crew are properly wearing their life jackets.
- **Safety Boots** - Safety boots will be worn at all times by all personnel working on or around the EFV or other heavy equipment.

(7) Medical Support. A corpsman will accompany each EFV operation unless prior approval is granted by appropriate authority. Competent medical personnel or the senior Marine on location must determine a medical emergency. During a MEDEVAC all units on the base Range Safety Control Safety Nets shall stay clear of the net until the MEDEVAC has been completed, unless another unit requires MEDEVAC support.

(8) Emergency MEDEVAC Evacuation Procedures. All hands will be trained on the procedures for requesting an emergency MEDEVAC. All corpsman will carry a MEDEVAC request card. Requests for MEDEVAC will be made to range control. In most circumstances, evacuation by vehicle will be the most effective means of transportation. Good judgment will always be the paramount factor in determining which mode of transportation should be used.

Summary of information required for evacuation of personnel is as follows:

- Emergency (air MEDEVAC)
- Priority (vehicle, air of requested)
- Routine (vehicle)
- RSO, OIC, or senior man present is responsible for the MEDEVAC
- When any type of MEDEVAC occurs notify range control immediately
- Give location of injured personnel
- Number of injured personnel
- Type of MEDEVAC requested air or ground. Medical doctor requested if using air
- Air or ground MEDEVAC will be determined by the RSC OIC or senior man in charge on the scene

- The following information will be delivered by the person that requested the MEDEVAC:
  -Name, grade, and SSN
  -Unit and phone number
  -How accident happened
  -Vehicle involved (if any/what type)
  -Civilian involvement (if any)
  -Maintain and monitor the safety net until the MEDEVAC is secured.

Emergency transportation by helicopter can be authorized when deemed appropriate by medical personnel or the senior Marine present. A helicopter evacuation should be limited to:

- Remote areas not accessible by wheeled vehicles
- Cases requiring immediate hospital treatment such as severe hemorrhage, serious burns, injuries to vital organs, compound fractures, etc.

When requesting medical evacuation by helicopter, contact the range control with the following information:

- Name of caller
- Location of injured person, grip and landmarks if possible
- Number of injured personnel and nature of injury
- Requirement for on-board medical attendant
- How the landing zone will be marked

(9) MISHAP Reporting. Training accident reports will include the information listed below.

Note:
Unless deemed otherwise by competent authority, names and social security numbers of injured personnel will not be relayed over the radio.

The following information must be given to range control:

- Summary description of incident
  -What happened
  -When
  -Where
  -How
- Person(s) killed
  -Name
  -Grade
  -SSN
  -Branch of service
  -Parent command

-Factors that may preclude public release, if any

- Person(s) missing
  -Name
  -Grade
  -DOB
  -SSN
  -Branch of Service
- Person(s) injured
  -Name
  -Grade
  -DOB
  -SSN/blood type
  -Parent command
  -Critical, serious or minor injury, if determined
  -Description of injury, expressed in lay terminology
  -Treatment and evacuation sequence

b. Environmental Compliance
The following guidelines/information are submitted to assist the unit leader to operate in a manner consistent with national environmental protection policies. Further reference can be found in the base HAZMAT SOP and range regulations.

- All unit leaders will take an active role in educating their Marines, and adhering to all environmental regulations. Prior to any field operation, the unit leader will brief the environmental restrictions unique to the training areas to be used and any HAZMAT considerations.
- All vehicles, wheeled or tracked, should stay on established roads or trails whenever possible.
- Vehicles are not permitted in any wetland, including dry streams, rivers and estuaries.
- Vehicles can only be washed at designated wash racks.
- Observe and avoid all conservation areas, critical habitats, endangered or threatened species, environmental restrictive measures (signs, posting and fencing) and wetlands as noted on base environmental maps, natural resource maps, cultural resource maps, base policies and range regulations.
- Cutting and destruction of trees for any purpose is prohibited.
- All hazardous waste/material should be handled and disposed of in accordance with base HAZMAT SOPs and EFV IETM warnings and directions.
- All POL's must be contained in leak proof containers, labeled and stored according to base HAZMAT waste policies. These containers must be placed in a bermed catchment area capable of holding 110% of the POL and free of rain water. An impervious liner must be placed inside the bermed area with the POL stored above.
  - Dumping or disposing of POL or hazardous material is strictly prohibited. All POL must be disposed of in accordance with base environmental policies.

- Units are required to report all HAZMAT spills to battalion HAZMAT. In case of any hazardous material spills beyond the units capabilities to clean up, call battalion HAZMAT for instructions. After hours contact the OOD through the battalion safety net.
- Battalion HAZMAT will make all necessary contacts as required for reporting hazardous material spills.

- Do not drive nails into trees to string communication /barbed wire.
- Recover all field wire used during training.
- Every effort must be made to prevent wildfires. Be current on fire danger ratings (FDR) and training regulations regarding fire. Use of pyrotechnics and smoke grenades may be limited. Open fires are strictly prohibited for training. Smoke grenades and flares should only be used in cleared areas. If a fire occurs while training, report it immediately to range control.
- All tasks will be performed in accordance with all EFV and relevant facility SOPs. ALCON will ensure copies of the SOPs are readily available in all workspaces. Additionally, company commanders will ensure the SOP for EFV operations is maintained on every EFV as a required publication. All personnel should be trained on the policies and procedures governing EFV operations contained in the SOPs.

PRE OPERATIONS CHECKLIST

Before starting engine, complete the following:

STEP 1: CHECK ALL OIL LEVELS AND CONDITIONS.
- Engine (Cold engine check. Must be between the ADD and FULL marks)
- Fuel level (Note: Fuel gauge may not provide accurate readings. Physically check fuel level in all tanks.)
- Power Transfer Module (PTM)/Transmission fluid
- Port and Starboard final drives oil level
- Port and Starboard hydraulic reservoir between 4.5 and 5 gallons

STEP 2: CHECK FOR COOLANT, OIL, HYDRAULIC, AND FUEL LEAKS.
- Check for loose clamps, connectors and lines

STEP 3: ENSURE HYDRAULIC MANIFOLDS MANUAL VALVE CONTROL LEVERS ARE CLOSED. (CHECK THAT ALL VALVE LEVER POSITIONS ARE FLAP DOWN)
- Aft port control manifold
- Aft starboard control manifold
- Starboard distribution manifold
- Port distribution manifold
- Forward control manifold

STEP 4: CHECK PARKING BRAKE LINKAGES AND CABLES

STEP 5: CHECK STEERING LINKAGES AND CABLES

STEP 6: CHECK BATTERY TERMINALS

STEP 7: CHECK HULL POWER DISTRIBUTION UNIT (HPDU) NORMAL SINCGARS SWITCH ON HPDU PANEL (NOTE: VEHICLE POWER IS OFF TO PERFORM TEST)

STEP 8: CHECK PORTABLE FIRE EXTINGUISHERS IN DRIVER AND TROOP COMPARTMENTS

STEP 9: ENSURE PORT AND STARBOARD FUEL VALVES ARE OPENED

STEP 10: CHECK TROOP AND CREW SEAT BELTS

STEP 11: ENSURE WATER JET DOORS ARE CLOSED AND FREE OF DEBRIS

STEP 12: CHECK REVERSE DOORS

STEP 13: ENSURE COOLING FANS ARE FREE OF DEBRIS

STEP 14: CHECK RAMP HINGE PINS

STEP 15: CHECK TOWING EYES AND TOW PINTLE FOR TIGHT HARDWARE AND DAMAGE (NOTE: ENSURE PINTLE IS LOCKED IN THE CLOSED POSITION)

STEP 16: CHECK SUSPENSION FOR LOOSE OR DAMAGED HARDWARE

- Check Hydropneumatic Suspension Unit's (HSU's) and Idler Track Tensioner's (ITT's) for visible leaks
- Oil level and condition of roadwheels, idlers and support rollers

STEP 17: CHECK SPONSON FOR GOUGING

STEP 18: CHECK FOR HULL/ARMOR DAMAGE AND MISSING HARDWARE

STEP 19: ENSURE SKIRTS ARE SECURE

STEP 20: CHECK BOWFLAP FORWARD TOWING EYES FOR LOOSE MOUNTING HARDWARE

STEP 21: CHECK ANTENNAS FOR DAMAGE. ENSURE ANTENNA AND LOCKING NUTS ARE SECURE

STEP 22: CHECK NAVIGATION LIGHT AND MOUNT FOR DAMAGE OR WATER INTRUSION. ENSURE THAT EXTERNAL AND INTERNAL CABLE CONNECTIONS ARE SECURE.

STEP 23: CHECK LIFTING EYES/MOORING CLEATS

STEP 24: ENSURE GUN BARREL IS LOCKED IN PLACE

STEP 25: CHECK FOR PORT AND STARBOARD FUEL CELL LEVELS/LEAKS

STEP 26: CHECK FUEL CAPS TO ENSURE THEY ARE SECURE

STEP 27: CHECK TRANSOM FOR DAMAGE

STEP 28: INSPECT CREW AND TROOP HATCHES

STEP 29: CHECK AND STOW OVE GEAR

STEP 30: VEHICLE MASTER POWER (RECORD AND PROCESS ALL ACTIVE WCA'S)

STEP 31: CHECK AUTOMATIC FIRE EXTINGUISHING SYSTEM (AFES)
- Pull safety pins
- Ensure fire bottle pressure is GREEN

STEP 32: ENSURE THAT HATCH AND RAMP SENSORS ARE OPERATIONAL

STEP 33: COMPLETE DRIVER STATION PREPARATION
- Check driver thermal viewer operation and picture
- Check thermal image at troop commander station

STEP 34: ENSURE THAT TRANSMISSION AND POWER TRANSFER MODULE MANUAL OVERRIDE LEVERS ARE IN NEUTRAL POSITION.

After starting engine, complete the following:

STEP 1: CHECK CONTROL DIGITAL PANEL – DISPLAY (CDP-D) FOR CORRECT READINGS
- Engine oil pressure
- Battery voltage is 28 volts
- Hydraulic fluid level reads between 4.5 and 5 gallons (Port/Starboard) (Note: Screen gauges indicate 1 to 2 gallons low, verify with visual check to determine difference between gauge and actual levels)
- Coolant temperature reading
- Record and process all active WCA's

STEP 2: CONDUCT NUCLEAR, BIOLOGICAL AND CHEMICAL (NBC)/ENVIRONMENTAL CONTROL SYSTEM (ECS) FUNCTION CHECK. CHECK NBC INLET IS CLEAR
- Ensure AHU filter is installed

STEP 3: WARM ENGINE TO 50C, SHUT ENGINE OFF AND CHECK ENGINE OIL LEVEL WITHIN TWO MINUTES

STEP 4: CHECK PTM/TRANSMISSION OIL AFTER 5 MINUTES

STEP 5: CHECK AUXILIARY POWER UNIT (APU) COOLANT LEVEL

STEP 6: APU FUNCTION CHECK
- Ensure APU fuel valve is open
- Check APU oil level
- Start APU and run for 5 minutes

STEP 7: STOP APU AND CHECK OIL AND COOLANT LEVELS WHILE HOT

STEP 8: CHECK NAVIGATION SYSTEM

STEP 9: CHECK HORN, HEADLIGHTS AND TAILLIGHTS

STEP 10: CHECK EGRESS LIGHTING

STEP 11: RECORD ACTIVE WCA'S UNDER VEHICLE POWER COLUMN

STEP 12: DEPLOY BOW AND INSPECT
- Inspect hydraulic lines
- Actuate track cover doors

STEP 13: DEPLOY TRANSOM FLAP AND INSPECT

STEP 14: DEPLOY CHINES AND CHECK
- Check hull plugs

STEP 15: CONDUCT INTERCOM/RADIO CHECKS

STEP 16: CONDUCT TURRET FUNCTION CHECK
- Prepare gunner station for operation
- Prepare VC station for operation
- Check muzzle break cover
- Record messages: Vehicle power turret power. Process and record all FC WCA's
- Check that turret guards properly close
- Conduct 360 degree turret rotation (Check deck, hatch and sub turret clearance – manual, powered and stab mode)
- Check that depressurization switches are present on engine bulkhead
- Check hatch firing inhibits and overrides
- Check exhaust fan and link eject door arm for safe operation (Note: Weapons are physically verified mechanically safe)
- Verify eject door is closed (Note: Gun select switch is MAIN and WEAPONS are safe)

STEP 17: CHECK TRACK TENSION

STEP 18: CHECK TROOP COMMANDER COMPUTER MODULATING SITE (CMS) AND DIGITAL THERMAL VIEWER (DTV) VIEWING ON CDP

STEP 19: CONDUCT SAFETY BRIEF FOR EMBARKED TROOPS (SEE APPENDIX B AND C)

STEP 20: COMPLETE AND SUBMIT EMBARKED PERSONNEL MANIFEST.

EMBARKED TROOPS -WATER OPERATIONS SAFETY BRIEF

A Pre-Water Operations Safety Brief is required prior to every operation afloat and is normally given by the vehicle commander. The purpose of the safety brief is to acquaint the embarked troops with the safety features of the vehicle, proper conduct while afloat, and inform them of safety precautions required for water operations. The following is an example of a Pre-Water Operations Safety Brief:

1. VEHICLE COMMANDER WILL PROVIDE EMBARKED TROOPS WITH A VEHICLE CAPABILITY BRIEF PRIOR TO WATER OPERATIONS.

2. WEAR HELMET AND DOUBLE HEARING PROTECTION AT ALL TIMES WHILE EMBARKED ABOARD THE VEHICLE.

Hearing and eye protection is required when standing within 25 meters of an operational vehicle.

3. NO SMOKING. SMOKING IS NOT PERMITTED WITHIN 25 METERS OF THE VEHICLE.

Vehicle fire suppression systems could be activated.
Fuel and coolant system leaks could result in fire.

4. WEAR SEAT RESTRAINTS AT ALL TIMES.

Troop Commander reference, OPERATE SEAT RESTRAINT

5. STAY CLEAR OF ALL OPEN HATCHES WHEN THE VEHICLE IS MOVING.

6. AT NO TIME WILL MORE THAN ONE PERSON OCCUPY THE TROOP COMMANDER'S STATION.

7. AT NO TIME WILL THE TROOP HATCHES (TOPSIDE) BE OPENED WITHOUT PERMISSION FROM THE VEHICLE COMMANDER.

8. RIDING TOPSIDE ON THE VEHICLE IS PROHIBITED.

9. STAY CLEAR OF TURRET AT ALL TIMES.

Turret actuates rapidly; stay clear of turret basket areas.
The turret elevation bar swings into port and starboard alleys and could result in severe injury.
Equipment could become caught on an operating turret and could result in severe injury.

10. DO NOT TOUCH HANDLES, LATCHES, RADIOS OR FIRE EXTINGUISHERS.

11. SHOW EACH MARINE THE FIRE SUPPRESSION MANUAL ACTIVATION HANDLE LOCATIONS, BOTH INTERNAL AND EXTERNAL

The Vehicle Commander will initiate any manipulation of systems.
The Vehicle Commander will command the activation of any fire suppression systems.

12. SHOW EACH MARINE THE BELOW AREAS BEFORE OPERATIONS COMMENCE. NOTE: THE REQUIREMENT TO ACCESS THE HYDRAULIC MANIFOLDS IN AN EMERGENCY. EMBARKED MARINES MUST BE PREPARED TO MOVE WHEN CREWMAN ACCESS IS REQUIRED IN AN EMERGENCY. BE AWARE OF BURN HAZARD AREAS AT ALL TIMES.

Cooling systems
Hydraulic lines and manifolds
Hull Electronics Unit (HEU)
Control & Display Panels (CDPs)
Hull Power Distribution Unit (HPDU)
Power Transfer Module (PTM) wings
Engine and transmission panels
Dome Lights
Exhaust Covers (external)

13. TOXIC GASES MAY ACCUMULATE INSIDE THE VEHICLE IF PERSONNEL STOW GEAR IN THE VICINITY OF THE AIR HANDLING UNITS (AHU) INTAKE GRILLS. ALWAYS KEEP AHU INTAKE GRILLS CLEAR TO PREVENT RESTRICTING AIR FLOW.

14. ALL EQUIPMENT MUST BE PROPERLY STOWED.

Equipment that is not properly stowed will affect egress paths.
Equipment that is not properly stowed could cause serious injury.

15. REPORT ANY HAZARDOUS CONDITIONS IMMEDIATELY TO THE 5TH STATION AFT; IN THE EVENT THIS IS NOT POSSIBLE, NOTIFY THE NEAREST CREWMAN.

Fire
Flooding
Fluid leaks
Noticeable excessive fumes or heat
Troop casualties

Due to internal vehicle noise, this will be signaled by grasping both hands above head and repeated until relayed to the Marine occupying the 5th Station Aft.

16. WHEN EMBARKED ABOARD THE VEHICLE WITH WEAPONS, MARINES WILL KEEP THEIR WEAPONS IN CONDITION FOUR WITH THE MUZZLE POINTED TO THE DECK. THE VEHICLE COMMANDER WILL INITIATE ALL WEAPON CONDITION CHANGES. NO FUSED ORDNANCE WILL BE BROUGHT ABOARD OR WITHIN 50 METERS OF THE VEHICLE.

17. THE VEHICLE COMMANDER IS IN COMMAND OF THE VEHICLE AND EMBARKED MARINES AT ALL TIMES.

18. CONDUCT PFD/HABD BRIEF

Embarked troops will receive a PFD/HABD demonstration prior to any water operations.

19. DISABLED VEHICLE EVACUATION DRILLS (WATER)

Marines will be given a period of instruction and will perform water emergency debarkation drills to the satisfaction of the Vehicle Commander and the Test Director. The hand and arm signal to initiate vehicle evacuation is tapping the top of head rapidly with one hand. The hand and arm signal for a hazardous condition is grasping both hands above the head.

EMBARKED TROOPS - LAND OPERATIONS SAFETY BRIEF

A Land Operations Safety Brief is required prior to every operation and is normally given by the vehicle commander. The purpose of the safety brief is to acquaint the embarked troops with the safety features of the vehicle, proper conduct while operating, and inform them of safety precautions required for land operations. The following is an example of a Pre-Land Operations Safety Brief:

1. VEHICLE COMMANDER WILL PROVIDE EMBARKED TROOPS WITH A VEHICLE CAPABILITY BRIEF PRIOR TO WATER OPERATIONS.

2. STAND CLEAR OF THE VEHICLE AT ALL TIMES.

The Driver and Vehicle Commander have a limited field of view. Do not approach vehicle unless directed to do so by Vehicle Commander. The minimum safe distance for ground troops is 25 meters day operations, 50 meters night operations. Vehicle appendages could actuate at any time and could result in severe injury or death. Vehicle cooling fans will create a debris hazard. Wear eye protection at all times.

3. WEAR HELMET, EYE, AND DOUBLE HEARING PROTECTION AT ALL TIMES WHILE EMBARKED ABOARD THE VEHICLE.

Hearing and eye protection is required when standing within 25 meters of an operational vehicle.

4. NO SMOKING. SMOKING IS NOT PERMITTED WITHIN 25 METERS OF THE VEHICLE.

Vehicle fire suppression systems could be activated. Fuel and coolant system leaks could result in fire.

5. SHOW MARINES THE TRIP HAZARDS IN RAMP AREA.

6. STAY CLEAR OF RAMP AT ALL TIMES.

The ramp activates rapidly. A crush hazard is present. The horn will sound three blasts to indicate stand clear before activation of the ramp. Carbon monoxide and nitric oxide build up around the ramp area and proximity to the exhaust ducts.

7. DO NOT STAND ON RAMP FOR PROLONGED PERIODS OF TIME BE AWARE OF COOLING FAN BLAST WHEN MOUNTING OR DISMOUNTING THE VEHICLE.

The fans create a large amount of airborne debris that could obscure vision and or result in eye injury.

8. WEAR SEAT RESTRAINTS AT ALL TIMES.

9. OPERATE SEAT RESTRAINT MARINES WILL STAY CLEAR OF ALL OPEN HATCHES WHEN THE VEHICLE IS MOVING.

10. AT NO TIME WILL MORE THAN ONE PERSON OCCUPY THE TROOP COMMANDER'S STATION.

11. AT NO TIME WILL THE PERSONNEL DOOR OR TROOP HATCHES (TOPSIDE) BE OPENED WITHOUT PERMISSION FROM THE VEHICLE COMMANDER.

12. RIDING TOPSIDE ON THE VEHICLE IS PROHIBITED.

13. STAY CLEAR OF TURRET AT ALL TIMES.

Turret actuates rapidly; stay clear of turret basket areas. The turret elevation bar swings into port and starboard alleys and could result in severe injury. Marines gear could become caught on an operating turret and result in severe injury.

14. NO PERSONNEL ARE TO BE ON TOP OF THE VEHICLE WHEN THE TURRET IS POWERED. DO NOT MOUNT OR DISMOUNT THE VEHICLE WHEN MOVING.

The command to mount or dismount will be given by the Vehicle Commander. The command to dismount will be relayed to the Marine occupying the 5th Station Aft when appropriate.

15. DO NOT TOUCH HANDLES, LATCHES, RADIOS, ETC.

16. SHOW EACH MARINE THE FIRE SUPPRESSION MANUAL ACTIVATION HANDLE LOCATIONS, BOTH INTERNAL AND EXTERNAL.

The Vehicle Commander will initiate any manipulation of systems. The Vehicle Commander will command the activation of any fire suppression systems. Toxic gases may accumulated inside the vehicle if personnel stow gear in the vicinity of the Air Handling Units (AHU) intake grills. Always keep AHU intake grill clear to prevent restricting air flow.

17. ALL EQUIPMENT MUST BE PROPERLY STOWED.

Equipment that is not properly stowed will affect egress paths. Equipment that is not properly stowed could cause serious injury.

18. SHOW EACH MARINE THE BELOW AREAS BEFORE OPERATIONS COMMENCE. NOTE THE REQUIREMENT TO ACCESS THE HYDRAULIC MANIFOLDS IN AN EMERGENCY. EMBARKED MARINES MUST BE PREPARED TO MOVE WHEN CREWMAN ACCESS IS REQUIRED. BE AWARE OF BURN HAZARD AREAS AT ALL TIMES.

Cooling systems
Hydraulic lines and manifolds
Hull Electronics Unit (HEU)
Control & Display Panels (CDPs)
Hull Power Distribution Unit (HPDU)
Power Transfer Module (PTM) wings
Engine and transmission panels
Dome Lights
Exhaust Covers (external)

19. REPORT ANY HAZARDOUS CONDITIONS IMMEDIATELY TO THE 5TH STATION AFT; IN THE EVENT THIS IS NOT POSSIBLE, NOTIFY THE NEAREST CREWMAN.

Fire
Flooding
Fluid leaks
Noticeable excessive fumes or heat
Troop casualties
Due to internal vehicle noise, this will be signaled by grasping both hands above head and repeated until relayed to the Marine occupying the 5th Station Aft.

20. WHEN EMBARKED, MARINES WILL KEEP THEIR WEAPONS IN CONDITION FOUR WITH THE MUZZLE POINTED TO THE DECK. THE VEHICLE COMMANDER WILL INITIATE ALL WEAPON CONDITION CHANGES. NO FUSED ORDNANCE WILL BE BROUGHT ABOARD OR WITHIN 50 METERS OF THE VEHICLE. THE VEHICLE COMMANDER IS IN COMMAND OF THE VEHICLE AND EMBARKED MARINES AT ALL TIMES.

21. EMERGENCY EVACUATION DRILLS (LAND)

Marines will be given a period of instruction and will perform four land emergency debarkation drills. (One using the ramp as the egress path, one employing the personnel door (with the Marine occupying 5th Station Aft operating the personnel door), one using the troop hatches (topside), and one using the Turret and Troop Commander's hatches.)
The hand and arm signal to initiate vehicle evacuation is tapping the top of head rapidly with one hand. The hand and arm signal for a hazardous condition is grasping both hands above the head.

EMBARKED TROOPS - 5TH STATION AFT LAND OPERATIONS DUTIES

The purpose of this brief is to inform the crewman occupying the 5th station aft of his safety duties and responsibilities during land vehicle operations.

OVERVIEW

During operations involving embarked personnel, a Marine will occupy the 5th Station Aft in the troop compartment. This Marine will be trained by the Vehicle Commander on the duties of this station and the functions of any associated equipment. The 5th Station Aft occupant will be provided with an operational flashlight for use in checking the ramp, ramp locking mechanism, and personnel door when the ramp is closed.

1. PRIMARY DUTY.

The primary duty of the Marine occupying the 5th Station Aft is to function as the eyes and ears of the Vehicle Commander to ensure the safety of embarked personnel.

2. THIS MARINE, BY REMAINING IN ICS CONTACT WITH THE VEHICLE COMMANDER, WILL:

Ensure the safe operation of the ramp
Serve to inform embarked personnel of emergency situations
Assist in maintaining good order and discipline aboard the vehicle.

3. IN THE EVENT OF AN EMERGENCY EVACUATION, THIS MARINE WILL BE ABLE TO PERFORM THE DUTIES ASSIGNED TO THIS STATION. IF SPECIAL INSTRUMENTATION HAS BEEN INSTALLED ABOARD THE VEHICLE (SUCH AS WBGT OR CO MONITORS), THIS STATION WILL MONITOR SUCH INSTRUMENTATION. THIS MARINE MUST DEMONSTRATE PROFICIENCY WITH THE FOLLOWING VEHICLE FUNCTIONS:

Functions of the ICS equipment located at this station, to include the use of a CVC helmet.
Functions of the Ramp and Personnel Door, to include locking mechanisms.
Functions of the topside Troop Hatches, to include locking mechanisms.
Functions and location of the Troop Compartment portable fire extinguisher.

4. SPECIFIC DUTIES:

- Ramp Raising and Lowering Operations
- Upon embarkation of troops ensure seatbelts are secured.

- Ensure the ramp path is clear of personnel and equipment and that ramp locking dogs are not deployed.
- Once embarked troops are secure, verify that the ramp path is clear and report to the Vehicle Commander "RAMP AREA CLEAR." (As the ramp is raised, monitor its progress and insure objectives remain clear of its path.)
- Should a safety hazard arise while the ramp is in motion (either raising or lowering), report over the ICS "STOP RAMP, STOP RAMP, STOP RAMP."
- Subsequent to the ramp being raised, insure that the ramp locking mechanism engages properly.
- Ensure the Personnel Door is closed and properly locked. This door will only be opened with the permission of the Vehicle Commander.
- Report to the Vehicle Commander "RAMP UP AND SECURED."
- The Vehicle Commander will inform the Marine occupying the 5th Station Aft prior to the ramp being lowered. The Marine at the 5th Station Aft will verify that it is safe for the ramp to be lowered and report "RAMP AREA CLEAR."
- Subsequent to the ramp being lowered and has stopped its motion, report to the Vehicle Commander "RAMP DOWN."
- When leaving the vehicle, disconnect CVC cord, remove CVC helmet and place the helmet on the seat. Put on kevlar helmet and exit vehicle using the ramp.

5. DURING MOUNTED OPERATIONS.

- During mounted operations, relay appropriate information from the Vehicle Commander and Troop Commander to embarked personnel. The Vehicle Commander will notify the 5^{th} Station Aft when dismounting is imminent.
- Should embarked troops report an unsafe condition (visual signal of hands clasped above helmet), report this to the Vehicle Commander.
- Notify the Vehicle Commander immediately should any hatch or door become unsecured during movement.
- Ensure that equipment stowage does not create the potential for inadvertent movement of the manual hydraulic toggles located in the Troop Compartment.
- If special instrumentation has been installed aboard the vehicle (such as WBGT or CO monitors), notify the Vehicle Commander in the event that the monitors' alarms are activated.

6. EMERGENCY EVACUATION DUTIES.

Upon hearing the Vehicle Commander announce to "prepare to evacuate the vehicle", the Marine occupying the 5th Station Aft will obtain the attention of embarked troops by repeating the command loudly (and rapidly tap top of helmet with hand).

- Once the vehicle has stopped, embarked troops will unfasten seat belts and prepare to rapidly dismount.

- Upon hearing the Vehicle Commander announce “evacuate through (designated egress path)”, the Marine occupying the 5th Station Aft will repeat the command and point to the appropriate egress path.
- Should the designated egress path be the ramp, the Marine at the 5th Station Aft will verify it is safe to lower the ramp and report “RAMP AREA CLEAR.” Once the ramp is lowered, he will report “RAMP DOWN”, exit the vehicle and assist Marines in evacuating. Once the troop compartment is evacuated he will notify the Vehicle Commander and proceed to the muster area.
- Should the designated egress path be the personnel door, the Marine at the 5th Station Aft will unlock and open the door and report “PERSONNEL DOOR OPEN.” He will then exit the vehicle, ensure personnel door is locked open, and assist Marines in exiting via the personnel door. Once the troop compartment is evacuated, he will notify the Vehicle Commander and then unlock the personnel door from it’s locked-open position, close it, and proceed to the muster area.
- Should the designated egress path be the topside troop hatches, the Marine at the 5th Station Aft will command the embarked troops beneath those hatches to unlock, open, and lock back the hatches. He will then assist Marines in exiting via the troop hatches. Once the troop compartment is evacuated, he will notify the Vehicle Commander and then proceed to the muster area.
- Should the designated egress path be through the forward hatches, the Marine at the 5th Station Aft will proceed with the rest of the Marines forward. Upon exiting the vehicle, he will inform the Vehicle Commander that the vehicle is clear and exit the vehicle through the appropriate hatch.

7. AFT PORTABLE FIRE EXTINGUISHER

The Marine occupying the 5th Station Aft will know the location, removal procedures, and operating procedures of the aft portable fire extinguisher. The fire extinguisher will be employed in accordance with the directions of the Vehicle Commander.

EMBARKED TROOPS - 5TH STATION AFT WATER OPERATIONS DUTIES

The purpose of this brief is to inform the crewman occupying the 5th station aft of his particular safety duties and responsibilities during land vehicle operations.

OVERVIEW

During water operations involving embarked personnel, a Marine will occupy the 5th Station Aft in the troop compartment. This Marine will be trained by the Vehicle Commander on the duties of this station and the functions of any associated equipment. The 5th Station Aft occupant will be provided with an operational flashlight for use in checking the ramp, ramp locking mechanism, and personnel door when the ramp is closed.

1. PRIMARY DUTY.

The primary duty of the Marine occupying the 5th Station Aft is to function as the eyes and ears of the Vehicle Commander to ensure the safety of embarked personnel.

2. THIS MARINE, BY REMAINING IN ICS CONTACT WITH THE VEHICLE COMMANDER, WILL:

Ensure the safe operations of the ramp
Serve to inform embarked personnel of emergency situations
Assist in maintaining good order and discipline aboard the vehicle.

3. IN THE EVENT OF AN EMERGENCY EVACUATION, THIS MARINE WILL BE ABLE TO PERFORM THE DUTIES ASSIGNED TO THIS STATION.

4. IF SPECIAL INSTRUMENTATION HAS BEEN INSTALLED ABOARD THE VEHICLE (SUCH AS WBGT OR CO MONITORS), THIS STATION WILL MONITOR SUCH INSTRUMENTATION.

5. THIS MARINE MUST DEMONSTRATE PROFICIENCY WITH THE FOLLOWING VEHICLE FUNCTIONS:

- Functions of the ICS equipment located at this station, to include the use of a CVC helmet.
- Functions of the Ramp and Personnel Door, to include locking mechanisms.
- Functions of the topside Troop Hatches, to include locking mechanisms.
- Functions and location of the Troop Compartment portable fire extinguisher.

6. SPECIFIC DUTIES DURING MOUNTED OPERATIONS.

- Upon embarkation of troops ensure seatbelts are secured.
- Ensure that equipment stowage does not create the potential for inadvertent movement of the manual hydraulic toggles located in the Troop Compartment.
- Subsequent to the ramp being raised, insure that the ramp locking mechanism engages properly.
- Ensure the Personnel Door is closed and properly locked. This door will only be opened with the permission of the Vehicle Commander.
- Relay appropriate information from the Vehicle Commander and Troop Commander to embarked personnel. The Vehicle Commander will notify the 5th Station Aft when dismounting or evacuation is imminent.
- Should embarked troops report an unsafe condition (visual signal of hands clasped above helmet), report this to the Vehicle Commander.
- Notify the Vehicle Commander immediately should any hatch or door become unsecured during movement.
- If special instrumentation has been installed at this position (such as WBGT or CO monitors), notify the Vehicle Commander in the event that the monitors' alarms are activated.

7. DISABLED VEHICLE EVACUATION DUTIES.

- Upon hearing the Vehicle Commander announce to "PREPARE TO EVACUATE THE VEHICLE", the Marine occupying the 5th Station Aft will obtain the attention of embarked troops by repeating the command loudly and rapidly tapping the top of his helmet with his hand.
- Once the vehicle has stopped, embarked troops will unfasten seat belts and prepare to rapidly dismount.
- Upon hearing the Vehicle Commander announce "EVACUATE THROUGH (DESIGNATED EGRESS PATH)", the Marine occupying the 5th Station Aft will repeat the command and point to the appropriate egress path.
- Should the designated egress path be the topside troop hatches, the Marine at the 5th Station Aft will command the embarked troops beneath those hatches to unlock, open, and lock back the hatches. He will then assist Marines in exiting via the troop hatches. Once the troop compartment is evacuated, he will notify the Vehicle Commander and secure the topside troop hatches.
- Should the designated egress path be through the forward hatches, the Marine at the 5th Station Aft will proceed with the rest of the Marines forward. Upon exiting the vehicle, he will inform the Vehicle Commander that the vehicle is clear and exit the vehicle through the appropriate hatch.

8. AFT PORTABLE FIRE EXTINGUISHER.

- The Marine occupying the 5th Station Aft will know the location, removal procedures, and operating procedures of the aft portable fire extinguisher.
- The fire extinguisher will be employed in accordance with the directions of the Vehicle Commander.

WEAPON CONDITIONS

DESCRIPTION

All weapons in the Marine Corps inventory employ weapons conditions to demonstrate the state of fire readiness and safety. Weapons handling procedures provide a consistent and standardized way for a Marine to handle, operate, and employ a weapon safely. A weapon's readiness/safety status is described by one of four conditions. The steps in the loading and unloading process take the weapon through four specific conditions of readiness for live fire.

1. THE FOLLOWING WEAPON CONDITIONS APPLY TO THE MK-46 WEAPONS STATION MK-44 30MM AUTOMATIC GUN.

Condition 1 - (Battle Carry) - **Battle Carry AP.** AP ammunition is selected on the 30mm gun feeder, the ghost round has been cycled in AP, the manual safety is on *FIR*E, and the electric safety is engaged.
Condition 1 - (Battle Carry) - **Battle Carry HE.** HE ammunition is selected on the 30mm gun feeder, the ghost round has been cycled in HE, the manual safety is on *FIR*E, and the electric safety is engaged.
Condition 2 - Rounds are loaded into the 30mm gun feeder, the ghost round is cycled, and the electric and manual
safeties are engaged.
Condition 3 - Rounds are loaded into the 30mm gun feeder, the ghost round has not been cycled, and the electric and manual safeties are engaged.
Condition 4 - Rounds are loaded into both ready boxes just past their respective forwarders.

2. M240C 7.62MM COAX MACHINE GUN.

Condition 1 - (Battle Carry) - Rounds are loaded onto the feed tray, the cover assembly is closed, the bolt is to the rear, the manual safety is on *FIR*E, and the electric safety is engaged.
Condition 2 - Does not apply to the M240 series machine gun.
Condition 3 - Rounds are loaded onto the feed tray, the cover assembly is closed, the bolt is forward, the manual safety is on *FIR*E, and the electric safety is engaged.
Condition 4 - Rounds are loaded into the ready box and feed chute. The weapon is clear; the bolt is forward, and the manual safety is on *FIR*E.
Infantry are embarked Condition 4, told by the Vehicle
Commander when to go Condition 3, and assume Condition 1 once
disembarked (they chamber a round or charge their weapons once
clear of the vehicle's ramp).
References: FM 23-4, FMFM 1-3, SAWIC-4000, SLAM FY 1995,
MBST Handbook

3. M-16 WEAPONS CONDITIONS.

Condition 1: Filled magazine inserted, round in chamber, bolt forward, safety on, ejection port cover closed.
Condition 2: Condition 2 pertains to weapons with external hammers.
Condition 3: Filled magazine inserted, chamber empty, bolt forward, safety on, ejection port cover closed.
Condition 4: Magazine removed, chamber empty, bolt forward, safety on, ejection port cover closed.

Infantry are embarked Condition 4, told by the Vehicle Commander when to go Condition 3, and assume Condition 1 once disembarked (they chamber a round or charge their weapons once clear of the vehicle's ramp).

4. References: FM 23-4, FMFM 1-3, SAWIC-4000, SLAM FY 1995, MBST Handbook M249 (SAW), M240-G WEAPONS CONDITIONS.

Condition 1: Filled magazine (SAW) or linked ammunition in place (magazine well or feed tray), Bolt locked to rear (open bolt weapon), weapon on safe.
Condition 2: Condition 2 pertains to weapons with external hammers
Condition 3: Filled magazine (SAW) or linked ammunition in place (magazine well or feed tray), bolt forward on empty chamber, weapon on safe.
Condition 4: Ammunition is removed from the weapon, bolt forward on an empty chamber, weapon on safe.

RECOMMENDED EFV(P) RIFLE COMPANY & INFANTRY BATTALION LOAD CONFIGURATIONS

Based Upon an Infantry Battalion supported by an Assault Amphibian Company of 44 EFV(P)s and 2 EFV(C)s. Loads will vary based upon mission, varying attachments, and on deck unit strength.

1. RIFLE PLATOON, REINFORCED WITH A MACHINE GUN SQUAD, EMBARKED ABOARD THREE EFV(P)S (THREE RIFLE PLATOONS PER RIFLE COMPANY, EMBARKED ABOARD A TOTAL OF NINE EFV(P)S).

Assumes the 81mm Mortar FO is replaced by the Organic Infantry Capability.

Rifle Platoon Commander, MG Squad Leader, Rifle Squad, and Corpsman

Personnel	Qty
Plt Cdr	1
Rifle Squad	13
RTO	1
MG Sqd Leader	1
Corpsman	1
	17
Weapons	
M-16	13
M-203	3
M-249 SAW	3
PREDATOR	3
M-9	1
Equipment	
17 Packs	
Class V	

Platoon Sergeant, Rifle Squad, and Machine Gun Team

Personnel	Qty
Plt Sgt	1
Rifle Squad	13
MG Team	3
	17
Weapons	
M-16	13
M-203	3
M-249 SAW	3
PREDATOR	3
M-240G MG	1
M-9	1
Equipment	
17 Packs	
Class V	

Rifle Platoon (Continued)

Platoon Guide, Rifle Squad, and Machine Gun Team

Personnel	Qty
Plt Guide	1
Rifle Squad	13
MG Team	3
	17
Weapons	
M-16	13
M-203	3
M-249 SAW	3
PREDATOR	1
M-240G MG	1
M-9	1
Equipment	
17 Packs	
Class V	

2. RIFLE COMPANY COMMANDER, EXECUTIVE OFFICER, 60MM MORTAR SECTION, AND ASSAULT SECTION, REINFORCED WITH TWO JAVELIN TEAMS, A FORWARD AIR CONTROL TEAM, AND A NAVAL GUN FIRE SPOT TEAM, EMBARKED ABOARD THREE EFV(P)S.

Rifle Company Commander's Hqs Tractor, with one FAC Team, two Assault Teams, and one Javelin Team

Personnel	Qty
Rifle Co Cdr	1
1st Sgt	1
Wpns Plt Cdr	1
RTO	2
Aslt Teams (2)	4
FAC Team	4
JAV Team	2
Corpsman	2
	17
Weapons	
M-16	8
MK 153 SMAW	2
Javelin	1
M-9	9
Equipment	
Packs	17
Class V	

Rifle Company Executive Officer's Hqs Tractor, with NGF Spot Team, two Assault Teams, and one Javelin Team

Personnel	Qty
Rifle Co XO	1
Co GySgt	1
MG Sect Ldr	1
Aslt Teams (2)	4
NGF Spot Tm	4
JAV Team	2
Corpsman	4
	17
Weapons	
M-16	7
MK 153 SMAW	2
Javelin	1
M-9	10
Equipment	
Packs	17
Class V	

60mm Mortar Section, with two Assault Teams, and 2 Corpsmen

Personnel	Qty
Wpns Plt Sgt	1
Mortar Sect	10
Aslt Teams (2)	4
Corpsmen	2
	17
Weapons	
M-16	6
MK 153 SMAW	2
M-9	11
60mm Tube	3
Equipment	
Packs	17
Bipods	3
Baseplates	3
Sights	3
Class V	(54 Rds @ EOA)

3. 81MM MORTAR PLATOON EMBARKED ABOARD SIX EFV(P)S.

Organized for split Section operations.

Platoon Hq and 81mm Mortar Squad

Personnel	Qty
Plt Hq	4
81mm Sqd	6
	10
Weapons	
M-16	8
M-203	1
PREDATOR	1
81mm Tube	1
Equipment	
Packs	10
Bipod	1
Baseplate	1
Sight	1
Class V	(28 Rds)

1st Section Hq, one 81mm Mortar Squad, and Fire Direction Center slice

Personnel	Qty
1st Sect Hq	3
81mm Sqd	6
FDC	5
	14
Weapons	
M-16	12
M-203	1
PREDATOR	1
81mm Tube	1
Equipment	
Packs	14
Bipod	1
Baseplate	1
Sight	1
Class V	(28 Rds)
FDC Equipment	

81mm Mortar Platoon (Continued)

Two 81mm Mortar Squads

Personnel	Qty
81mm Sqd	6
81mm Sqd	6
	12
Weapons	
M-16	12
81mm Tube	2
Equipment	
Packs	12
Bipod	2
Baseplate	2
Sight	2
Class V	(55 Rds @ EOA)

81mm Plt Sgt, one 81mm Mortar Squad, and Fire Direction Center slice

Personnel	Qty
Plt Sgt	1
81mm Sqd	6
FDC	5
	12
Weapons	
M-16	10
M-203	1
PREDATOR	1
81mm Tube	1
Equipment	
Packs	10
Bipod	1
Baseplate	1
Sight	1
Class V	(28 Rds)

81mm Mortar Platoon (Continued)

2nd Section Hq, and one 81mm Mortar Squad

Personnel	Qty
2nd Sect Hq	3
81mm Sqd	6
	9
Weapons	
M-16	8
M-203	1
PREDATOR	1
81mm Tube	1
Equipment	
Packs	9
Bipod	1
Baseplate	1
Sight	1
Class V	(28 Rds)

Two 81mm Mortar Squads

Personnel	Qty
81mm Sqd	6
81mm Sqd	6
	12
Weapons	
M-16	12
81mm Tube	2
Equipment	
Packs	12
Bipod	2
Baseplate	2
Sight	2
Class V	(55 Rds @ EOA)

4. COMBAT ENGINEER PLATOON EMBARKED ABOARD THREE EFV(P)S.

If a Combat Engineer Platoon is attached to the Infantry Battalion and the 81mm Mortar Platoon is embarked aboard the six EFV(P)s of the AA Company General Support Section, then three additional EFV(P)s are required from the AA Battalion Headquarters Company. This assumes that three Combat Engineer/Drivers and three Combat Engineer/Assistant Drivers (by T/O) will man designated wheeled vehicles (by T/E) for follow on operations ashore/changes in mission support requirements.

Platoon Commander, and Combat Engineer Squad

Personnel	Qty
Plt Cdr	1
Sqd Ldr	1
Team Ldr	2
Cbt Engr	6
Corpsman	1
	11
Weapons	
M-16	10
M-9	1
Equipment	
Packs	11
Demo Kit	
Lane Mark Kit	
Class V Kit	

Platoon Sergeant, and Combat Engineer Squad

Personnel	Qty
Plt Sgt	1
Sqd Ldr	1
Team Ldr	2
Cbt Engr	6
Corpsman	1
	11
Weapons	
M-16	10
M-9	1
Equipment	
Packs	11
Demo Kit	
Lane Mark Kit	
Class V Kit	

Combat Engineer Platoon (Continued)

Platoon Guide, and Combat Engineer Squad

Personnel	Qty
Plt Cdr	1
Sqd Ldr	1
Team Ldr	2
Cbt Engr	6
Corpsman	1
	11
Weapons	
M-16	10
M-9	1
Equipment	
Packs	11
Demo Kit	
Lane Mark Kit	
Class V Kit	

5. INFANTRY BATTALION TACTICAL ECHELON COMMAND POST, EMBARKED ABOARD TWO EFV(C)s AND TWO EFV(P)s.

Organized for Alpha and Bravo Command operations.

Alpha Command EFV(C)

Personnel	Qty
P1	1
P2	1
P3	1
P4	1
P5	1
P6	1
P7	1
J1	1
J2	1
	9
Weapons	
M-9	9
Equipment	
Packs	7
Carry On	See Appendix J

Infantry Battalion Tactical Echelon Command Post (Continued)

Alpha Command Chase EFV(P)

Personnel	Qty
Technicians	2
Security	4
Medical	1
	7
Weapons	
M-16	6
M-9	1
Equipment	
Packs	7
Support Equip.	See Appendix J

Bravo Command EFV(C)

Personnel	Qty
P1	1
P2	1
P3	1
P4	1
P5	1
P6	1
P7	1
J1	1
J2	1
	9
Weapons	
M-9	9
Equipment	
Packs	7
Carry On	See Appendix J

Infantry Battalion Tactical Echelon Command Post (Continued)

Bravo Command Chase EFV(P)

Personnel	Qty
Technicians	2
Security	4
Medical	1
	7
Weapons	
M-16	6
M-9	1
Equipment	
Packs	7
Support Equip.	See Appendix J

DISABLED VEHICLE EVACUATION PROCEDURES – LAND OPERATIONS

The Vehicle Commander will initiate Disabled Vehicle Evacuation under the following circumstances: vehicle fire/discharge of AFES, excessive fuel, coolant, hydraulic leak, or when determined necessary.

1. VEHICLE COMMANDER DUTIES:

a. Order Driver to stop the vehicle and order "PREPARE TO EVACUATE VEHICLE" over the ICS.
b. As situation permits, inform Unit Commander of situation by radio.
c. Dependent upon the nature and circumstances of the emergency, DETERMINE APPROPRIATE EGRESS PATH for embarked personnel (ramp, personnel door, troop hatches, forward hatches) and order "EVACUATE VEHICLE THROUGH (appropriate egress path)."
d. SUPERVISE evacuation of the vehicle, instruct crew as required (including activation of AFES if required).
e. EXIT VEHICLE at VC hatch and DISMOUNT VEHICLE at Driver's station.
f. GET ACCOUNTABILITY of crew, equipment, and weapons (coordinate with Troop Commander for embarked personnel).
g. REPORT to Unit Commander.

2. DRIVER DUTIES:

a. STOP VEHICLE on command from Vehicle Commander, PLACE SHIFT SELECTOR IN NEUTRAL and LOCK PARKING BRAKE.
b. Activate EMERGENCY EGRESS LIGHTS.
c. On command from Vehicle Commander, sound horn and LOWER RAMP (only if ramp is the designated egress path).
d. TAKE POSSESSION of the portable fire extinguisher.
e. On command from Vehicle Commander, STOP ENGINE. (Only on command from Vehicle Commander, execute emergency engine shut down.)
f. STAND BY internal fire pull handles until embarked personnel have evacuated the vehicle.
g. On command from Vehicle Commander, turn VEHICLE POWER OFF and EXIT VEHICLE at Driver's station carrying the portable fire extinguisher. (Only on command from Vehicle Commander, execute emergency power down.)
h. Assist Vehicle Commander in determining accountability of embarked personnel.

3. GUNNER DUTIES:

a. Upon receiving order to prepare to evacuate the vehicle, CENTER GUN over front slope and engage turret azimuth lock.
b. Turn TURRET POWER OFF.
c. If ammunition is uploaded, UNLOAD, CLEAR, and SAFE WEAPONS. (As situation permits. See Notes below.)
d. Upon receiving order to evacuate vehicle, EXIT VEHICLE through Gunner's hatch and dismount at Driver's station.
e. STAND BY external fire pull handles until directed otherwise by Vehicle Commander.

4. 5TH STATION AFT DUTIES:

a. Upon receiving order to prepare to evacuate the vehicle, announce in troop compartment "PREPARE TO EVACUATE" and give visual signal of rapidly tapping top of helmet.
b. Upon receiving order to evacuate, announce "EVACUATE THROUGH (designated egress path)" and point in the direction of egress path. (Open Personnel Door if designated the egress path.)
c. EXIT VEHICLE through designated egress path while maintaining accountability of embarked personnel.
d. REPORT to Vehicle Commander when all embarked personnel have exited the vehicle using the wireless ICS or visual signal of thumbs up.

5. EMBARKED PERSONNEL DUTIES:

a. Upon receiving order to prepare to evacuate vehicle, PASS ON THE VISUAL SIGNAL. Once vehicle comes to a complete stop, RELEASE SEAT BELTS.
b. Upon receiving order to evacuate the vehicle, EXIT VEHICLE through designated egress path.
c. Embarked personnel MUSTER 25 meters from the port side of vehicle.
d. TROOP COMMANDER verifies accountability of embarked personnel, equipment and weapons and REPORTS to Vehicle Commander.

NOTES

*In the event of an ICS failure, all commands will be passed from Marine to Marine verbally and visually down their respective aisleways.

*To prohibit clogging of egress path, personal equipment will be worn and weapons carried during evacuation on land. Stowed equipment will not be removed from vehicle until such time as the vehicle has been determined to be safe for re-boarding. Only the Vehicle Commander or Unit Leader may authorize re-boarding of the vehicle subsequent to a Disabled Vehicle Evacuation.

*If the situation permits, the vehicle weapons will be unloaded, cleared, and safed. If the situation requires immediate evacuation (e.g, fire), the main gun should be placed on safe, and, if possible, the coaxial machinegun unloaded, cleared and the mechanical safe engaged. However, at no time should accomplishment of these tasks take precedence over the safety of the crew. Subsequent to evacuation, the Vehicle Commander will advise the Unit Commander regarding weapons status.

DISABLED VEHICLE EVACUATION PROCEDURES – WATER OPERATIONS

The Vehicle Commander will initiate Disabled Vehicle Evacuation under the following circumstances: vehicle flooding, vehicle fire/discharge of AFES, excessive fuel, coolant, or hydraulic leak.

1. VEHICLE COMMANDER DUTIES:

a. Order Driver to stop the vehicle and order "PREPARE TO EVACUATE VEHICLE" over the ICS.
b. As situation permits, inform Unit Commander by radio.
c. Dependent upon the nature and circumstances of the emergency, DETERMINE APPROPRIATE EGRESS PATH for embarked personnel (troop hatches, forward hatches, turret hatches) and order "EVACUATE VEHICLE THROUGH (appropriate egress path)."
d. Turn TURRET POWER OFF.
e. RAISE VC SEAT and DROP SEAT PAN to clear egress path.
f. OPEN STARBOARD TURRET GUARD.
g. EXIT VEHICLE at VC hatch; remain on ICS as appropriate.
h. SUPERVISE evacuation of the vehicle, instruct crew as required (including activation of AFES if required).
i. SECURE ALL OPEN HATCHES, as appropriate, to prevent swamping of the vehicle.
j. GET ACCOUNTABILITY of crew (coordinate with Troop Commander). An accurate muster of crew and embarked personnel is especially important since any one of several support craft may have recovered individuals.
k. REPORT status to Unit Commander.

2. DRIVER DUTIES:

a. STOP VEHICLE on command from Vehicle Commander and PLACE SHIFT SELECTOR IN NEUTRAL.
b. Activate EMERGENCY EGRESS LIGHTS.
c. ENGAGE ALL BILGE PUMPS and set HPDU electric bilge pump switches to "High".
d. RECLINE SEATBACK to lowest position and SLIDE SEAT FORWARD to clear egress path.
e. STAND BY internal fire pull handles until embarked personnel have evacuated the vehicle.
f. On command from Vehicle Commander, STOP ENGINE. (Only on command from Vehicle Commander, execute emergency engine shut down.)
g. On command from Vehicle Commander, turn VEHICLE POWER OFF and EXIT VEHICLE at Driver's station if sea-state allows. (Only on command from Vehicle Commander, execute emergency power down.) If Driver's hatch is awash due to

sea-state, exit via the VC Hatch. After evacuation has been completed, SECURE HATCH, if possible, to prevent swamping of vehicle.

h. As directed, ASSIST VEHICLE COMMANDER in securing open hatches.

i. Assist Vehicle Commander in determining accountability of embarked personnel.

3. GUNNER DUTIES:

a. Upon receiving order to prepare to evacuate the vehicle, CENTER GUN and engage turret azimuth lock.

b. Turn TURRET POWER OFF.

c. If ammunition is uploaded, UNLOAD, CLEAR, and SAFE WEAPONS. (As situation permits. See Notes below.)

d. LOWER GUNNERS SEAT to lowest position and SLIDE SEAT AFT as far as possible to clear egress path.

a. OPEN PORT TURRET GUARD; stow KNEE GUARD.

b. EXIT VEHICLE through Gunner's hatch. If Gunner's hatch is awash due to sea-state, exit via the VC Hatch. SECURE HATCH UPON EXITING, if possible, to prevent swamping of vehicle.

c. ASSIST EMBARKED PERSONNEL in evacuating the vehicle.

d. ASSIST VEHICLE COMMANDER in securing all opened hatches.

4. 5TH STATION AFT DUTIES:

a. Upon receiving order to prepare to evacuate the vehicle, announce in troop compartment "PREPARE TO EVACUATE" and give visual signal of rapidly tapping top of helmet.

b. Upon receiving order to evacuate, announce "EVACUATE THROUGH (designated egress path)" and point in the direction of egress path.

c. EXIT VEHICLE through designated egress path while maintaining accountability of embarked personnel.

d. REPORT to Vehicle Commander when all embarked personnel have exited the vehicle using the wireless ICS or visual signal of thumbs up.

e. When directed by Vehicle Commander, DISMOUNT VEHICLE on the downwind, down-sea side and proceed to nearest support craft for recovery.

5. EMBARKED PERSONNEL DUTIES:

a. Upon receiving order to prepare to evacuate vehicle, pass on the visual signal and RELEASE SEAT BELTS and REMOVE ALL GEAR with the exception of Personal Flotation Device (PFD), Helicopter Air Breathing Device (HABD), and helmet.

b. Occupants of aisle seats VERIFY AISLE SEATS ARE STOWED and that seats do not obstruct egress path.

c. Upon receiving order to evacuate the vehicle, EXIT VEHICLE through designated egress path.

d. TRANSFER TO SUPPORT CRAFT or INFLATE PFD AND PREPARE TO ENTER THE WATER on command of the Vehicle Commander on the downwind, down-sea side and proceed to nearest support craft for recovery. If

Troops must enter the water, they must remain together in pairs (using the Buddy System).

e. TROOP COMMANDER may EXIT VEHICLE at Troop Commander's station if sea-state allows. If Troop Commander's hatch is awash due to sea-state, exit via the VC Hatch.

f. TROOP COMMANDER verifies accountability of personnel, and REPORTS to Vehicle Commander. TRANSFER TO SUPPORT CRAFT or INFLATE PFD AND PREPARE TO ENTER THE WATER on command of the Vehicle Commander on the downwind, down-sea side and proceed to nearest support craft for recovery.

NOTES

* In the event of an ICS failure, all commands will be passed from Marine to Marine verbally and visually down their respective aisleways.

* Personal weapons **will not** be carried during evacuation on water. Stowed equipment will not be removed from vehicle until such time that the vehicle has been determined to be safe for re-boarding. Only the Vehicle Commander or Unit Leader may authorize re-boarding of the vehicle subsequent to a Disabled Vehicle evacuation.

* If the situation permits, the vehicle weapons will be unloaded, cleared, and safed. If the situation requires immediate evacuation (e.g, vehicle in danger of submerging), the main gun should be placed on safe, and, if possible, the coaxial machinegun unloaded, cleared and the mechanical safe engaged. However, at no time should accomplishment of these tasks take precedence over the safety of the crew. Subsequent to evacuation, the Vehicle Commander will advise the Unit Commander regarding weapons status.

EQUIPMENT STOWAGE FOR THE EFV(C)

The following presents a representative list of items that the embarked infantry staff may choose to bring aboard the EFV(C), adding to their capability to perform their tactical assignments.

Equipment List for EFV(C):

1. Pens, Markers, Staples, Protractor, Paper Clips, Alligator Clips, (Carried in helmet bag or other small bag)
2. Stapler (1) (Carried in helmet bag or other small bag)
3. Binders for Log Books (3) (S2, S3, S4, AO, FSC, ALO, etc.)
4. Paper (1 roll of thermal paper for the TS-21)
5. Duck Tape (2 Rolls) (Carried in helmet bag or other small bag)
6. Maps (9) with map case (approximately 2'x 2' x 2')
7. Map Board (1) (approximately 4' x 4' x 2")
8. Map Overlay Material
9. Laptops/IOWs (2) with Laptop Bag
10. CDs (25) (Carried in helmet bag or other small bag)
11. CYZ-10 (1) (carried by a Marine)
12. KOI-18 (1) (carried by a Marine)
13. Operational Manuals (FMFM, MCWP, OH, Annex K, CEOI, etc.) (10) (each is approximately 8 ½" x 11" x 1")
14. Chem Lights (2 boxes distributed around vehicle) (Carried in helmet bag or other small bag)

EQUIPMENT STOWAGE FOR EFV(C)'s CHASE EFV(P)

The following presents a representative list of items that the EFV(C)'s Chase EFV(P) may carry as support equipment for the EFV(C) infantry staff.

1. Printer (1)
2. Laptops/IOWs (5) with Laptop Bag
3. GPS/PLGRS (1)
4. UHF - PRC-113 (1) with battery
5. VHF – PRC-119 (1) with battery
6. UHF Satcom only - PSC-5 (1) with battery
7. UHF - EPLRS RT-1720 (1) with battery
8. OE-254 antenna – VHF
9. HF – PRC-150 (1) with battery
10. Extra Batteries (10) (2 per for the Stowed Radios)
11. Antenna - HF
12. Extra CVC Helmets (3)
13. Sand Bags – Empty
14. Secure S2 Safe for Op Orders (H-20", W-20", D-24") with one drawer
15. Concertina Wire (2 rolls per vehicle) – mounted externally
16. MREs (3 days for C and Chase personnel)
17. Water (3 days for C and Chase personnel)
18. Tent
19. Field Desks (2)
20. Packs for EFV(C) Jump Seat Personnel (2)

TABLE	FOCUS
I Crew Defense (Device/Simulation Gunnery) PGS	To Be Inserted
II Crew Proficiency (Device/Simulation Gunnery) PGS	To Be Inserted
III Crew Practice 1 (Sub-cal live-fire)	To Be Inserted
IV Crew Practice 2 (Full-caliber live-fire)	EFV Table IV, Crew Practice 2, is evaluated by the following situation, tasks, and standards: (1) Situation: ***Given an EFV in a stationary position, authorized allocation of ammunition, suitable live-fire range with targets, during the day and night,*** *(2)* Task: ***engage and destroy, single or multiple, stationary or moving, vehicle and infantry targets.*** (3) Standards: ***The crew must achieve a minimum of a "P" rating on 5 of 7 engagements with 1 of the 5 being an NBC engagement and 1 of the 5 being a night engagement.*** (4) Performance Steps: Refer to Gunnery Table IV
V Crew Practice 3 (Full-caliber live-fire)	EFV Table V, Crew Practice 3, is evaluated by the following situation, tasks, and standards: (1) Situation: ***Given an EFV in a stationary or moving posture, authorized allocation of ammunition, suitable live-fire range with targets, during the day and night,*** (2) Task: ***engage and destroy, single or multiple, stationary or moving, vehicle and infantry targets.*** (3) Standards: ***The crew must achieve a minimum of a "P" rating on 6 of 8 engagements with 1 of the 6 being an NBC engagement and 2 of the 6 being night engagements.*** (4) *Performance Steps:* Refer to Gunnery Table V
VI Qualification (Full-caliber live-fire)	EFV Table VI, Crew Qualification, is evaluated by the following situation, tasks, and standards: (1) Situation: ***Given an EFV in a stationary or moving posture, authorized allocation of ammunition, suitable live-fire range with targets, during the day and night,*** (2) Task: ***engage and destroy, single or multiple, stationary or moving, vehicle and infantry targets.*** (3) Standards: ***The crew must achieve a qualified rating (distinguished, superior, or qualified).*** (4) *Performance Steps:* Refer to Gunnery Table V **Distinguished** = Trained (T) on at least 9 of 10 total engagements. **Superior** = Trained (T) on 8 of 10 engagements with 1 of the 8 being an NBC engagement and 2 of the 8 being night engagements. **Qualified** = Trained (T) or needs practice (P) on 7 of 10 engagements with 1 of the 7 being an NBC engagement and 2 of the 7 being night engagements. **Unqualified =** Untrained (U) on 4 or more engagements or "U" on two NBC engagements, or "T" or "P" on only 1 night engagement.
Engagement evaluation criteria for crew gunnery is: **T** = GO on all task standards, a GO on all critical subtask standards and leader subtask standards, and no more than one NO-GO on a non-critical subtask standard. **P** = GO on all task standards and a GO on all critical subtask standards, with a NO-GO on one or more leader subtask standards or a NO-GO on two or more non-critical subtasks standards. **U** = NO-GO on one or more task standards or NO-GO on one or more critical subtask standards.	

TABLE	FOCUS
VII NBC (Full-caliber live-fire) (This is an annual training requirement.)	To Be Inserted
VIII Water Assault (Full-caliber live-fire)	To Be Inserted
IX Section Practice (Device/Simulation Gunnery)	To Be Inserted
X Section Practice (Full-caliber live-fire)	To Be Inserted
XI Section Qualification (Full-caliber live-fire)	To Be Inserted

TABLE IV Crew Practice 2

EFV Table IV, Crew Practice 2, is evaluated by the following situation, tasks, and standards:
(1) Situation: ***Given an EFV in a stationary position, authorized allocation of ammunition, suitable live-fire range with targets, during the day and night,***
(2) Task: ***engage and destroy, single or multiple, stationary or moving, vehicle and infantry targets.***
(3) Standards: ***The crew must achieve a minimum of a "P" rating on 5 of 7 engagements with 1 of the 5 being an NBC engagement and 1 of the 5 being a night engagement.***
(4) Performance Steps: Refer to Gunnery Table IV

ENG #	EFV POSTURE	SHOOTER	TARGET TYPE/RANGE/POSTURE	WEAPON SYSTEM FEED SELECTION	TGT EXPOSURE	EFV EXPOSURE
Day						
1	Stationary	Gunner	1 BMP1400-1600/STA	30MM (AP Feed)	50	**
2	Stationary	Gunner	1 BTR 900-1100/STA	30MM (HE Feed)	50	
3	Stationary	Commander	1 BMP 1600-1800/STA	30MM (AP Feed)	50	
4	Stationary	Gunner	1 BMP1400-1600/MOV *Troops 700-900/STA	30MM (AP Feed) Coax	50 50	
Night						
5	Stationary	Gunner	1 BMP 1000-1200/MOV *Troops 500-700	30MM (AP Feed) Coax	60 60	
6	Stationary	Commander	1 BTR 1300-1500/MOV	30MM (HE Feed)	60	
7	Stationary	Gunner	RPG Tm 1200-1400/STA *Truck 700-900/STA	30MM (HE Feed) Coax	60 60	

Ammunition	**Loading Plan**
TP/TP-T 110 (INCLUDES 10 ZERO ROUNDS) 7.62 300 (INCLUDES 50 ZERO ROUNDS)	HE Feed 45 AP Feed 55

* Multiple targets will be presented in the shooter's field of vision
** EFV Exposure times not applicable on this table

TABLE V Crew Practice 3

EFV Table V, Crew Practice 3, is evaluated by the following situation, tasks, and standards:
(1) Situation: ***Given an EFV in a stationary or moving posture, authorized allocation of ammunition, suitable live-fire range with targets, during the day and night,***
(2) Task: ***engage and destroy, single or multiple, stationary or moving, vehicle and infantry targets.***
(3) Standards: ***The crew must achieve a minimum of a "P" rating on 6 of 8 engagements with 1 of the 6 being an NBC engagement and 2 of the 6 being night engagements.***
(4) *Performance Steps:* Refer to Gunnery Table V

ENG #	EFV POSTURE	SHOOTER	TARGET TYPE/RANGE/POSTURE	WEAPON SYSTEM FEED SELECTION	TGT EXPOSURE	EFV EXPOSURE
Day						
1	Stationary (NBC)	Gunner	1 BTR 1200-1400/STA *1 BMP 1800-2000/MOV	30MM (HE Feed) 30MM (AP Feed)	50 50	18 29
2	Moving (Retrograde)	Gunner	1 Truck 1600-1800/STA *Troops 700-900/STA	30MM (HE Feed) Coax	26 12	26 12
3	Stationary (NBC)	Commander	1 BTR 1700-1900/STA *RPG Tm 800-1000/STA	30MM (HE Feed) Coax	50 50	28 13
4	**Moving	Gunner	1 BMP 1800-2000/MOV *1 BTR 1800-2000/STA	30MM (AP Feed) 30MM (HE Feed)	32 29	32 29
Night						
5	Stationary	Gunner	1 BTR 1200-1400/MOV *Truck 700-900/STA	30MM (HE Feed) Coax	60 60	22 14
6	Stationary	Commander	1 BMP 1800-2000/STA	30MM (AP Feed)	60	23
7	**Moving (NBC)	Gunner	1 BTR 1600-1800/STA *Troops 500-700/STA	30MM (HE Feed) Coax	30 18	30 18
8	Stationary	Gunner	1 BMP 1600-1800/MOV *Troops 800-1000/STA	30MM (AP Feed) Coax	60 60	26 11

Ammunition	**Loading Plan**
TP/TP-T 110 (INCLUDES 10 ZERO ROUNDS)	HE Feed 45
7.62 300 (INCLUDES 50 ZERO ROUNDS)	AP Feed 55

* Multiple targets will be presented in the shooter's field of vision

** EFV will move at 8-12 MPH

TABLE VI CREW QUALIFICATION

EFV Table VI, Crew Qualification, is evaluated by the following situation, tasks, and standards:
(1) Situation: ***Given an EFV in a stationary or moving posture, authorized allocation of ammunition, suitable live-fire range with targets, during the day and night,***
(2) Task: ***engage and destroy, single or multiple, stationary or moving, vehicle and infantry targets.***
(3) Standards: ***The crew must achieve a qualified rating (distinguished, superior, or qualified).***
(4) *Performance Steps:* Refer to Gunnery Table V
Distinguished = Trained (T) on at least 9 of 10 total engagements.
Superior = Trained (T) on 8 of 10 engagements with 1 of the 8 being an NBC engagement and 2 of the 8 being night engagements.
Qualified = Trained (T) or needs practice (P) on 7 of 10 engagements with 1 of the 7 being an NBC engagement and 2 of the 7 being night engagements.
Unqualified = Untrained (U) on 4 or more engagements or "U" on two NBC engagements, or "T" or "P" on only 1 night engagement.

ENG #	EFV POSTURE	SHOOTER	TARGET TYPE/RANGE/POSTURE	WEAPON SYSTEM FEED SELECTION	TGT EXPOSURE	EFV EXPOSURE
			Day			
1	Stationary	Gunner	1 BTR 1300-1500/MOV *Troops 900-1100/STA	30MM (HE Feed) Coax	50 50	21 11
2	Stationary	Commander	1 BMP 1900-2100/STA	30MM (AP Feed)	50	23
3	Stationary (NBC)	Gunner	1 BMP 1700-1900/STA *RPG Tm 800-1000/STA	30MM (AP Feed) Coax	50 50	28 13
4	**Moving (NBC)	Commander	1 BTR 1200-1400/STA	30MM (HE Feed)	24	24
5	**Moving	Gunner	1 BMP 1000-1200/MOV *1 BTR 1800-2000/STA	30MM (AP Feed) 30MM (HE Feed)	23 29	23 29
			Night			
6	Stationary	Gunner	1 BTR 1200-1400/MOV *Truck 700-900/STA	30MM (HE Feed) Coax	60 60	22 14
7	Stationary	Commander	1 BMP 1800-2000/STA	30MM (AP Feed)	60	23
8	**Moving (NBC)	Gunner	1 BTR 1600-1800/STA	30MM (HE Feed)	30	30
9	**Moving (retrograde)	Gunner	1 BMP 1100-1300/MOV	30 MM (AP Feed)	24	24
10	Stationary	Gunner	Troops 1300-1500/STA *Troops 600-800/STA	30MM (HE Feed) Coax	60 60	12 10

Ammunition	Loading Plan
TP/TP-T 150 (INCLUDES 10 ZERO ROUNDS)	HE Feed 45
7.62 300 (INCLUDES 50 ZERO ROUNDS)	AP Feed 55

* Multiple targets will be presented in the shooter's field of vision

** EFV will move at 8-12 MPH

Basic Gunnery	
Classroom Instruction	**Target Acquisition** Crew search, Detection, Location, Identification, Classification, Confirmation **Crew Duties** **Fire Commands** **Engagement Techniques** **Weapon Characteristics, Capabilities** **Weapon Operations** **Laser Training**
Recognition Of Combat Vehicles (ROC-V)	Forward Looking Infra-Red (FLIR) training Vehicle ID training
Gunnery Skills Test (GST)	Bore-sighting, Zeroing, Upload both weapons, Download both weapons, Disassembly/Assembly of both weapons.
Basic Turret Components Functions (BTCF)	Characteristics, Function, Capabilities, Operation, Turret programming, Pre-fire procedures, Turret manipulation exercises.
Intermediate Gunnery	
Tables 1-8	The crew intermediate gunnery trains and evaluates single vehicle crew's abilities to engage stationary and moving, single and multiple targets with turret mounted weapon systems in a simulated combat environment. The EFV crew will conduct engagements during day and night or other limited visibility conditions from stationary and moving EFVs on land and water.
Advanced Gunnery	
Tables 9, 10, and 11	Section advanced gunnery training will develop and evaluate skills while performing tactical collective tasks integrated with device and live-fire.
Sustainment Gunnery	
	This is based on the unit's strengths and weaknesses that the master gunner and commander have identified during training analysis in order to maintain crew's proficiency. It may include basic gunnery skills training, simulation, device gunnery, sub-caliber, and full-caliber live fire.

TASK STANDARDS

Engagement task standards require the crew to hit a given target with an appropriate number of rounds and type of ammunition without exposing the EFV beyond own vehicle exposure time.

Note: *Partial credit for an engagement will not be given. A crew must kill all targets in an engagement in accordance with the appropriate engagement standards to receive credit for the overall engagement.*

A. Target Kill Standards.

The kill standards for crew gunnery are in Table 8-1. These kill standards identify minimum hits required to achieve a kill on a given target type. These kill standards are valid for training or qualification purposes. They do not necessarily reflect reality in combat. Crews receive an untrained rating if they fail to achieve a kill in accordance with Table 8-1 or if they use ammunition that is not designated for destroying a target in accordance with Table 8-2.

30MM Point Targets	**Hit minimum of 3 rounds**
30MM Area	**Suppress with a Z pattern**
Coax Point Targets	**Hit with a minimum of 5 rounds**
Coax Area Targets	**Suppress with a Z pattern**

Table 8-1. Target kill Standards Chart

TARGETS	**Designated Ammunition and Maximum Range (meters)**		
	AP	**HE**	**Coax**
Light-Armored	**2000**		
Unarmored		**2000**	**1200**
Troops		**1201-2000**	**1200**

Table 8-2. Target ammunition requirements.

Note: *Some ammunition types can destroy other types of targets and some are effective at greater ranges than shown in Table 8-2; however, Table 8-2 identifies the ammunition standard for EFV gunnery.*

B. EFV Exposure Matrixes. EFV exposure matrixes are used to determine the EFV crew's allowable exposure time to a given target. There are 3 matrixes, light-armored, unarmored, and troops. The light/unarmored, and troop matrixes are based on threat target's time to hit an EFV (Tables 8-3 and 8-4). This methodology is based on various threat weapon systems capabilities.

(1) *Matrix condition.* Times in the light-armored/unarmored, and troop matrixes are based on the worst-case threat targets of the given category. There are three conditions that apply to the threat target. Any one, or a combination of these conditions gives the EFV crew additional time to engage the target because it takes the threat additional time to engage the EFV:

- NBC environment.

- Moving EFV.
- Moving threat target.

(a) NBC environments affect the threat's ability to rapidly engage an EFV. Therefore, the threat needs more time to place a hit on the EFV than it does during normal conditions.

(b) It is more difficult for the threat to hit a moving EFV. Therefore, the threat needs more time to place a hit on the moving EFV.

(c) It is more difficult for the threat on the move to place effective fire on an EFV. Therefore, a moving threat target needs more time to place a hit on an EFV than it does if the threat is stationary.

(d) To determine the allowable exposure time to a given target, the EFV Crew Evaluator (ECE) must know the following:

• Target category—
— Light-armored
— Unarmored/Fortified Positions.
— Dismounted troops.
• Number of target conditions—
— Normal conditions.
— 1, 2, or 3 additional conditions.

• Target range.

Range (Meters)	Target Conditions			
	Normal (seconds)	1 Condition (seconds)	2 Condition (seconds)	3 Condition (seconds)
400	11	12	16	17
500	12	13	17	18
600	13	14	18	19
700	14	15	19	20
800	14	17	20	21
900	15	18	21	22
1,000	16	19	22	24
1,100	17	20	23	25
1,200	18	21	24	26
1,300	18	22	26	28
1,400	19	23	27	29
1,500	20	24	28	30
1,600	21	25	29	32
1,700	22	26	30	33
1,800	22	28	31	35
1,900	23	29	32	36
2,000	24	30	33	37
2,100	25	31	34	38
2,200	26	32	36	40
2,300	26	33	37	41
2,400	27	34	38	42
2,500	28	35	39	43

Table 8-3. EFV Exposure to Light-armored/Unarmored/ Fortified Position target timing Matrix.

Range (meters)	Target Conditions		
	Normal (seconds)	1 Condition (seconds)	2 Condition (seconds)
300	8	10	13
400	9	10	14
500	9	11	14
600	9	11	15
700	10	12	16
800	10	12	16
900	11	13	16
1,000	11	13	16
1,100	12	14	17
1,200	12	14	17
1,300	12	15	18
1,400	12	15	19
1,500	13	16	19
1,600	13	17	20
1,700	14	17	21
1,800	14	18	21
1,900	15	18	22
2,000	15	19	23
2,100	16	19	23
2,200	16	20	24
2,300	17	20	25
2,400	17	21	25
2,500	18	21	26

Table 8-4. EFV Exposure to dismounted troop targets matrix.

(e) Once the ECE knows the target category, conditions, and range, he refers to the applicable exposure matrix. When using an exposure matrix, the ECE looks at the left-hand column for the target range. He then follows that row to the right until it intersects with the number of conditions that applies to that target. The number in the corresponding box is the maximum allowable EFV exposure time to that target.

(f) For targets that are not at 100-meter increments, the ECE rounds the range up or down to the nearest 100 meters; for example, 1,536 meters is rounded dawn to 1,500 meters; 1, 668 meters is rounded up to 1,700 meters.

Note: *When alternate targets must be used, such as substituting a stationary for moving target, the ECE uses the conditions that apply to the alternate target.*

(2) ***Timing procedures.*** The ECE must record EFV exposure times for each task fired, even when computers are used. Exposure time is the time the firing EFV is exposed to any threat target(s). Timing procedures apply for single, simultaneous as well as multiple target engagements. During multiple target engagements, each target is timed separately. Timing is determined as outlined below; variations are not permitted.

Note. *A simultaneous engagement is one with two or more weapons engaging one or more targets at the same time.*

a. Moving/moving-retrograde EFV engagements. In a moving engagement, the firing EFV is exposed, in the open, once it moves. Target exposure (presentation) indicates threat engagement time has begun.

Time starts when the target or simultaneous targets are fully exposed (target lock) or the first round is fired (whichever occurs first).

Timing stops for each target in an engagement when the target is killed or that target's exposure time has expired.

b. Stationary engagements. In a stationary engagement the firing EFV must start in a turret-defilade position, move into a hull-defilade position to engage target(s), and then return to the turret-defilade position.

• ***Time starts*** when one of the following conditions occurs:
— When a crew fires the first round.
— All targets are fully exposed (target lock) and the firing vehicle is stopped in a hull-defilade position.

• ***Time stops*** for each individual target if during an engagement one of the following conditions occurs:

— The target is killed.
— During or after an engagement, the firing vehicle *begins* to move back into a turret-defilade position.
— Target exposure time has expired.
— For coax/machine gun area engagements, time stops when the Z pattern is started on the target area.
— For coax/machine gunpoint engagements, time stops when targets receive 5 hits.

- *Time Resets* before the firing vehicle returns to the hull-defilade position.

c. **EFV Exposure Standard.** If a crew is exposed to a target longer than the allotted time (Table 8-3, 8-4), the crew receives an untrained rating for the engagement.

Note 1: *On ranges that do not have defilade positions, markers must be placed in the ground to assist the ECE in determining when the firing vehicle is exposed and when it has returned to a defilade position. The vehicle must move at least one vehicle length when moving into and out of the defilade position.*

Note 2: *On computer-controlled ranges, scenarios must be adjusted to ensure multiple targets are programmed to lift at the same time, if possible.*

CRITICAL SUBTASK STANDARDS

Critical subtask standards evaluate the crew's ability to engage targets in less than optimal operating conditions. If the crew does not meet all of the applicable subtask standards, the engagement task standards cannot be met. Therefore, the crew is assessed an untrained rating on the given engagement task.

a. Crew engages target(s) using the auxiliary sight.

(1) Gunner's engagement: Gunner must use the auxiliary sight to engage targets.
(2) Commander's engagement: Commander must use the auxiliary sight to engage targets.

b. Crew engages target(s) in an NBC environment.

(1) Vehicle crew must be in MOPP 4
(2) All crewmembers must restore intra-vehicular communication.
(3) Vehicle commander must restore radio communication with exercise controllers.

c. Crew engages target(s) using manual controls.

(1) Gunner must place traverse drive select lever in manual position.
(2) Gunner must engage target(s) using the traverse and elevation manual hand cranks and auxiliary trigger.

d. Commander engages target(s) using the commander's hand station.

e. Crew does not engage friendly target(s).

(1) Crew must identify target(s) as friendly.
(2) Crew does not fire on friendly target(s).
(3) Crew must report friendly target(s) in sector to exercise controllers.

LEADER SUBTASK STANDARDS

The leader subtask evaluates the EFV commander's ability to control the crew, vehicle, and weapon systems. Without this control, engagements will not be synchronized and efficiency will suffer.

a. EFV commander uses proper fire commands for each engagement.

(1) EFV commander must include the required two elements of a fire command in proper sequence when either Battle-sight or Precision fire command is given.

- Alert.
- Ammunition and or weapons.
- Description. (required)
- Direction.
- Range.

- Execution. (required)
- Termination.

.

Note: *If targets are not exposed simultaneously (3 seconds or more separation), the commander may use 2 single-target fire commands.*

b. Commander ensures the most-dangerous target is engaged before least dangerous.

c. Commander ensures the proper ammunition and weapon system for the target(s) are selected in accordance with Table 8-3, 8-4 and unit engagement criteria.

d. Commander ensures the vehicle moves at least one vehicle length when going from a turret-defilade to a hull-defilade position and when returning.

e. Commander ensures gunner does not fire before receiving the command to fire.

NONCRITICAL SUB-TASK STANDARDS

Non-critical sub-task standards apply to the techniques and procedures crews should use for successful engagements. If these sub-task standards are not met, the crew can still meet the engagement task standards.

a. Commander or gunner must use proper response terms in support of the leader subtask standards.

b. Commander or gunner uses proper engagement techniques.

c. Driver uses proper driving techniques.

d. Crew uses proper defensive techniques.

REFIRES FOR QUALIFICATION ON TABLE VI

A crew or crews that fail to achieve a distinguished, superior, or qualified rating will re-fire for qualification. The highest rating a crew re-firing for qualification can obtain is Qualified.

a. A crew will re-fire only engagements in which a "U" rating is received.

b. A crew will only re-fire the number of engagements required to obtain a qualified rating.

ALIBIS

For Crew Qualification, Table VI, the Battalion Commander and the Master Gunner are the deciding authorities on alibis. All alibi engagements will be re-fired. Alibis are only given for the following conditions:

a. Range equipment failures.

b. Vehicle equipment failures that are not the result of crew error.

c. Conditions not related to the firing vehicle or crew.

EFV CREW SCORE SHEET

ECEs use the EFV Crew Score Sheet to record the results of gunnery engagements. When annotating results on this form, evaluators must print all entries accurately and legibly.

***Note**: The EFV crew score sheet will be kept with the Company and the Battalion Master Gunners for a period of 2 years.*

Ammo Type	Kill Standard Indicator	Target Description	Ammo Allocation
HEI-T* (point)	3 rounds (beyond 1000M)	Light Armored Target (BTR-60, Truck, Water Craft) Urban (concrete walls, buildings) Infantry (RPG Team, Field Fortification)	10 Rounds
HEI-T* (area)	Z pattern	Dismounted Infantry	15 Rounds (Infantry Squad is base)
APFSDS-T	3 rounds	BMP	10 Rounds
Coax (Point)	5 rounds (Within 1000M)	RPG, Sagger Team, Unarmored vehicles	50 Rounds
Coax (Area)	Z Pattern 20-30 round burst (Within 1000M)	Dismounted Infantry	100 Rounds

***HEI-T/HEI-T delay 1/1 mix**

ADVANCED GUNNERY TARGETS

Target arrays should be consistent with the type of threat forces a crew will normally encounter. Based on the mission-essential task list, the commander determines the number and types of targets to be engaged. At no time will the number of targets exceed the number of rounds allocated.

a. Thermal Targets. In all cases, thermal targets should be used to represent accurate thermal signatures of threat vehicles.

b. Target Signature. When appropriate to the scenario, hostile fire simulators can be used to simulate the threat vehicle(s) firing at the team.

c. Target Exposure Time. The following target exposure times are used for tables:

(1) Indirect-fire engagements will be presented for 90 seconds.

(2) All offensive (direct-fire) engagements will be presented for 50 seconds (day) or 60 seconds (night).

(3) Ml defensive (direct-fire) engagements will be presented in depleting target arrays for 40 seconds (day) and 50 seconds (night).

NOTE: If troop targets are presented in a defensive engagement, they will be presented in the final target array.

EVALUATION PROCEDURES AND STANDARDS FOR SECTION GUNNERY TABLES

The following evaluation procedures and standards apply to team gunnery. The evaluation procedures allow teams to train and practice the skills normally performed in combat. Evaluators use after-action reviews to critique teams upon completion of the tables. Crew duties are not rated on these tables; however, a team is penalized if an individual crew fails to perform sound tactical maneuvering or achieve target hits.

a. Evaluation Procedures Evaluators will use the performance checklists in accordance with current doctrine to evaluate section on tactics.

(1) *Start time.* Engagement times are used to provide the evaluator with a tool to critique team engagements. Engagement start time begins—

• When the first team vehicle, on the move, is exposed to the threat.

• When the first team vehicle, in the defense, stops in a hull-down position or fires the first round. Depending on the tactical scenario, target exposure times should allow the team to report and determine the most desirable course of action (that is, indirect fire).

(2) *Stop time.* The following conditions determine engagement stop times:

• The team leader announces CEASE FIRE, and all team vehicles have returned to the defilade position.

• All targets are killed.

• All team vehicles return to defilade positions for the final time.

(3) *Alibi criteria.* Same as table 6 crew qualification addresses alibi criteria. No other alibi criteria can be used.

b. Evaluation Standards. Terrain, weather, and distance between engagements dictate course time. Tactical tasks can be conducted at a nearby training area and combined with the gunnery

portion if range areas are not extensive enough to allow tactical maneuvering; however, this is an exception.
Commanders should integrate the tactical and gunnery tasks to maximize the training effectiveness of these tables.
(1) The team must achieve, as a minimum, a GO on 70 percent of the tactical tasks on the scout team tables—an equivalent of 420 points on each table.
(2) The team must achieve, as a minimum, a 70 percent target kill rate on gunnery tasks during each table—an equivalent of 280 points on each table.

SCORING PROCEDURES

Each table uses a 1,000-point system for the areas of tactics and gunnery. The breakdown of scoring is as follows.
a. *Tactics* is worth 60 percent or a total of 600 points. Evaluators will use the performance checklists in accordance with doctrine. These checklists will accurately reflect their METL. Commanders can use the formula illustrated in the Tactical Evaluation Scoring Formula for determining total tactical points or, at the commander's option based on METL importance, point values can be assigned for each task. Total cumulative tactical points will not exceed 600.

Divide the number of tactical tasks passed by the number of tactical tasks possible to establish a percentage:

TASKS PASSED	TASKS POSSIBLE	PERCENTAGE
29	31	93%

Convert the percentage to a decimal and multiply the decimal by 600 possible tactical points:

.93 X 600 = 558

The resulting number is the points awarded for the tactical evaluation of the tables.

Tactical Evaluation Scoring Formula

b. *Gunnery* is worth 40 percent or a total of 400 points. To determine the number of gunnery points awarded, the evaluator uses the target destruction matrix. The target destruction matrix can be used for all target presentations to include BFV-mounted weapons, indirect-fire, and dismounted engagements in accordance with established destruction criteria for each weapon system.

RATINGS

Teams will be rated by the following standards:
• **Distinguished** - Combined score of 900 points or higher that must include a minimum of 420 (70 percent) tactical and 280 (70 percent) gunnery points.
• **Superior** - Combined score of 800 to 899 points that must include a minimum of 420 (70 percent) tactical and 280 (70 percent) gunnery points.
• **Qualified** - Combined score of 700 to 799 points must include a minimum 420 (70 percent) tactical and 280 (70 percent) gunnery points.

• **Unqualified** - Combined score of 699 points or less, or team fails to achieve 420 (70 percent) tactical points or 280 (70 percent) gunnery points.

EFV CREW SCORE SHEET

1.DATE	2. RANGE:	3.UNIT:	4. TABLE 3 4 5 6 7 8
5. VEH ID:	6.COMMANDER	7. GUNNER:	8. DRIVER:

9. DAY ECE: ______________________________ **Int:**_________

10. NIGHT ECE: ______________________________ **Int:** ______-__

11. ENG #	12. TASK STANDARDS			13. CRITICAL TASKS					14. LEADER TASKS					15. NON CRITICAL SUBTASKS				16. RATING	17. REMARKS
	A	B	(N/G)	A	B	C	D	E	A	B	C	D	E	A	B	C	D	T,P,U	
a.																			
b.																			
c.																			
d.																			
e.																			
f.																			
g.																			
h.																			
i.																			
j.																			

18. QUALIFICATION RATING- D S Q UQ

19. MASTER GUNNER ____

TARGETS DESTROYED									TARGETS PRESENTED																										
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
5	334	286	250	224	200	182	166	154	142	132	124	118	110	104	100	96	90	86	84	80	76	74	72	68	66	64	62	60	58	56	54	52	51	50	50
6	400	343	300	268	240	218	200	184	172	160	150	142	132	126	120	114	108	104	100	96	92	88	84	82	80	78	74	72	70	68	66	64	62	60	60
7		400	350	312	280	254	234	214	200	186	174	164	156	148	140	132	126	122	116	112	108	104	100	96	92	90	88	84	82	80	78	76	74	72	70
8			400	356	320	290	266	245	228	214	200	188	178	168	160	152	146	140	132	128	124	118	114	110	106	102	100	96	94	92	88	86	84	82	80
9				400	360	328	300	276	258	240	226	212	200	190	180	172	164	156	150	144	138	132	128	124	120	116	112	108	106	102	100	96	94	92	90
10					400	364	334	308	286	266	250	234	222	210	200	190	182	174	166	160	154	148	142	138	132	128	124	122	118	114	112	108	106	102	100
11						400	366	338	314	294	276	258	244	232	220	210	200	192	184	176	170	162	158	152	146	142	138	132	130	126	122	118	116	112	110
12							400	370	342	320	300	282	266	252	240	228	218	208	200	192	184	178	172	166	160	154	150	146	142	136	132	130	126	122	120
13								400	372	346	326	306	288	274	260	248	236	226	216	208	200	192	186	180	176	168	162	158	152	148	144	140	136	132	130
14									400	374	370	330	312	294	280	266	254	244	234	224	216	208	200	194	186	180	176	170	164	160	156	152	148	144	140
15										400	376	352	334	316	300	286	272	260	250	240	230	222	214	206	200	194	188	182	176	172	166	162	158	154	150
16											400	376	366	336	320	304	290	278	266	256	246	238	228	220	214	206	200	184	188	182	178	172	168	164	160
17												400	378	358	340	334	312	296	284	272	262	252	242	234	226	220	212	206	200	194	188	184	178	174	170
18													400	378	360	342	328	314	308	288	276	266	258	248	240	232	226	218	212	206	200	194	190	184	180
19														400	380	362	346	330	316	304	292	282	272	262	254	246	238	230	224	218	212	206	200	194	190
20															400	380	364	348	334	320	300	296	286	276	266	258	250	242	236	228	222	216	210	206	200
21																400	382	366	350	336	324	312	300	290	280	270	262	254	248	240	234	228	222	216	210
22																	400	382	366	352	338	326	314	304	294	284	276	266	258	252	244	238	232	226	220
23																		400	384	368	354	340	328	318	306	296	288	278	270	262	256	248	242	236	230
24																			400	384	370	356	342	332	320	310	300	290	282	274	266	260	252	246	240
25																				400	384	370	358	344	334	322	312	304	294	286	278	270	264	256	250
26																					400	386	372	358	346	336	326	316	306	298	288	282	274	266	260
27																						400	386	372	360	348	338	328	318	308	300	292	284	276	270
28																							400	386	374	362	350	340	330	320	312	302	294	288	280
29																								400	386	374	362	352	342	332	322	314	306	298	290
30																									400	388	376	364	352	342	334	324	316	308	300
31																										400	388	376	364	354	344	336	326	318	310
32																											400	388	376	366	356	346	336	328	320
33																												400	388	378	366	356	348	338	330
34																													400	388	378	368	358	348	340
35																														400	388	378	368	358	350
36																															400	390	378	370	360
37																																400	390	380	370
38																																	400	390	380
39																																		400	390
40																																			400

Target destruction matrix.

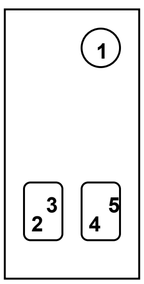
FIRE SUPPORT CONCEPTS

Fire Support Team Concepts / Nets (+ Inf Co Tac)

81mm FO Team (2)	(FO & RTO)	Bn Mortar COF (VHF, V/D)
Arty FO Team (3)	(FO, Fire Spt Man, & RTO)	Arty Btry COF (VHF, V/D)
FAC Team (4)	(FAC, & 3 RTO)	TAR/TAD (UHF/VHF, V/D)
NGF Spot Team (3)	(NGF Sptr, SFCP Man, & RTO)	NGF Spot/SFCP Local (HF/VHF V/D)
Wpns Plt Cdr (2)	(Wpns Plt Cdr & RTO)	Inf Co Tac (VHF V)

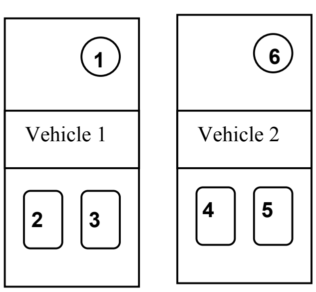
Note: Digital messaging can be supported via the TC position Common Display Panel (CDP) using C2PC VMF messaging capability.

Configuration #1 – 1 EFV Consolidated FS Team (Analogous to AAVP7A1 Company Commander's Trac)/Open Hatches



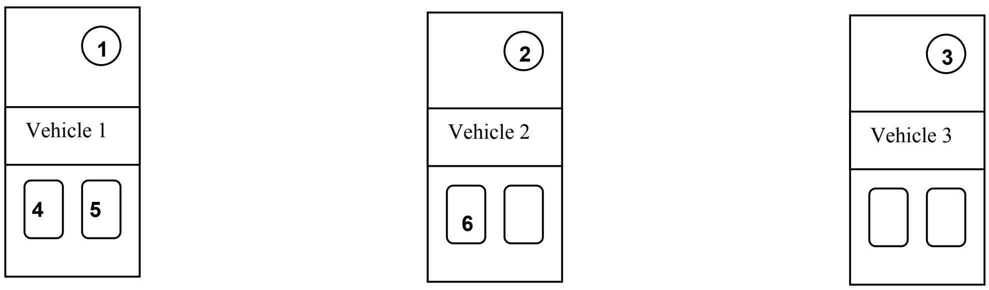
Communications: Company TAC, Weapons Platoon TAC (access to 60mm mortars) and FS team organic Nets (COFs, Spot, TAR/TAD)
Position 1: Company Commander (Intercom and CDP (digital messaging))
Position 2: Designated FiST Leader (Intercom) (Weapons Platoon Commander)
Positions 3-5: Arty FO, Mortar FO, FAC, etc.
Company Commander will orient the FiST Leader and link to FS team assets via FiST leader. FS team members will maintain their own communications (COFs, TAR, Spot) nets and will employ these while mobile/stationary via "their attached FS organic radios". The Company Commander may choose to maintain the team within the vehicle or may employ the team dismounted. When dismounted, the Company Commander will maintain his TC position effectively using the EFV communications and weapons system capabilities to support his orientation of the dismounted team. Communications from the team to the Company Commander may be linked via wireless intercom or the TAC 1 net via a radio asset that can be "tied" to a radio frequency established aboard the EFV. Note: FiST Leader may be designated from any of the FS team personnel, not just the Weapons Plt Commander.

Configuration #2 – 2 EFV Distributed FS Team/Open Hatches (Within AA Plt HQ Sect)



Communications: Company TAC (between two TC positions), Weapons Platoon TAC – access to 60mm mortars (Vehicle 2), Arty COF(Vehicle, and FAC TAR and TAD.
Position 1/Vehicle 1: Company Commander (Intercom and CDP (digital messaging))
Position 2: Mortar FO (Intercom)
Positions 3: Mortar FO, NGF Spot
Position 6/ Vehicle 2: FiST Leader (Intercom and CDP (digital messaging))
Position 4: Arty FO (Intercom)
Position 5: FAC (TAR/TAD)
Company Commander (Vehicle 1) will orient the FiST Leader (Vehicle 2) via TAC 1. Company Commander will link to Mortar FO via intercom. FiST Leader will link to Arty FO via intercom. The Arty FO and Mortar FO may choose to access COF net via set radio frequency on EFV radio suite. The FAC and the NGF Spot will maintain their own communications (TAR/TAD, Spot) nets and will employ these while mobile/stationary via "their attached FS organic radios". The Company Commander may choose to maintain the team within the vehicles or may employ the team dismounted. When dismounted the Company Commander will maintain his TC position effectively using the EFV communications and weapons system capabilities to support his orientation of the dismounted team. Communications between the FiST leader to the other FS team members in Vehicle 1 will be

Configuration #3 – 3 EFV Distributed FS Team/Open & Closed Hatches (Within AA Plt HQ Sect)



Communications: Company TAC (between three vehicles), Mortar COF (Vehicle 1), Weapons Platoon TAC – access to 60mm mortars (Vehicle 2), Arty COF (Vehicle 2), and FAC TAR/TAD (Vehicle 3), Spot (Vehicle 1/Position 5 - team HF and VHF radios).
Position 1/Vehicle 1: Company Commander (Intercom)
Position 4: Mortar FO (Intercom and CDP (digital messaging))
Position 5: NGF Spot (HF/VHF)
Position 2/Vehicle 2: FiST Leader (Intercom and CDP (digital messaging))
Position 2: Arty FO (Intercom)
Positions 3/Vehicle 3: FAC (Intercom and CDP (digital messaging))
Company Commander (Vehicle 1) will orient the FiST Leader (Vehicle 2) and FAC (Vehicle 3) via TAC 1. Company Commander will link to Mortar FO via intercom. FiST Leader will link to Arty FO via intercom. The FAC will employ radios aboard his track to support TAR/TAD links. Mortar FO (Vehicle 1) and Arty FO (Vehicle 2) will access COF net via set radio frequency on EFV radio suite. The NGF Spot (Vehicle 1) will maintain his own communications (Spot/SFCP Local) nets and will employ these while mobile/stationary via "his attached FS organic radios". The Company Commander may choose to maintain the team within the vehicles or may employ the team dismounted. When dismounted the Company Commander will maintain his TC position effectively using the EFV communications and weapons system capabilities to support his orientation of the dismounted team. Communications between the FiST leader to the other FS team members in Vehicles 1 and 3 will be over TAC 1. Note: FS team positions are interchangeable. Further distribution of the FiST across the full platoon of EFV's (FS team member occupying a TC position) supporting the infantry company is possible. This allows each FS Team member to monitor TAC1, and access additional net to send Calls for Fire/Joint Tactical Air Requests over standard FS nets.

EFV AT SEA RECOVERY – CONCEPT OF OPERATIONS

1. PURPOSE

To provide an initial concept for the "at sea recovery" of a disabled Expeditionary Fighting Vehicle (EFV), crew, and embarked troops, when employed in a variety of potential training and operational scenarios. The concept was developed due to the potential capability gap in this area as the Navy – Marine Corps team transforms to Marine Corps Strategy 21, Expeditionary Maneuver Warfare, and other sea basing concepts. As such, it will be used to further develop and refine EFV At Sea Recovery techniques and procedures. This concept describes a potential "system of systems," providing factors to be considered when determining the appropriate means of recovery with the resources available.

2. GENERAL

The development of the Ship-to-Objective Maneuver (STOM) concept, and the underlying desire to commence amphibious operations from farther out to sea, has led to a greatly expanded battlespace within the littoral region. The EFV provides the capability for the surface assault element of the Landing Force to maneuver across this expanded battlespace from launch areas located over-the-horizon (OTH) to littoral penetration points along the shoreline. This capability allows for increased force protection, greater opportunities for surprise and deception, and the opportunity to consider varied landing site options dependent upon the situation ashore. The capability to initiate surface movement from OTH, however, also increases the time and distance previously associated with the "at sea recovery" of disabled assault amphibian vehicles (AAVs). Historically, disabled AAVs have been recovered (towed by another AAV) to the nearest safe haven, either to a ship or to nearest suitable landing site ashore.

3. DEVELOPMENT OF THE EFV RECOVERY PLAN

Prior to any exercise or operation involving EFV waterborne activities, local commanders must develop a Recovery Plan to accomplish the safe and efficient recovery of disabled EFVs, crew, and embarked troops. As part of the Operational Risk Management (ORM) process, this plan should include an examination of the environment, identification of the resources available to execute recovery efforts, and how these resources will be employed to reduce the associated risks involved.

4. DEFINING THE ENVIRONEMNT

There are several types of environments that will influence EFV at sea operations and recovery planning. These environments include:

a. Waterborne Range. This pertains to the range relative from the shoreline the EFVs will be operating. These are broken down into three areas:

- Near-shore operations (Within 3 nautical miles or closer to shore)
- Mid-range operations (Greater than 3 nautical miles from shore)
- Over-the-horizon operations (25 nautical miles from shore)

b. Training versus Operations. This pertains to the general nature of the EFV operations. These are broken down into two areas:

- A training scenario, where safety is always paramount. This includes an environment that allows movement of amphibious ships or craft in support of a disabled EFV. It also includes an environment that allows for the potential employment of designated rescue EFVs and “free boats”(EFVs without embarked troops).
- An operational scenario, where commanders may be required to mitigate or accept varying levels of risk, dependent upon the tactical situation and resources available. This includes a threat environment that prohibits movement of amphibious ships or craft in support of a disabled EFV. It also includes an environment where, given the desired build up rate of combat power ashore, employment of designated rescue EFVs and free boats is undesirable.

c. Without Embarked Troops versus With Embarked Troops. This pertains to whether the Assault Amphibian unit is accomplishing specific unit activities (normally in a training environment), or providing combat support to an embarked infantry unit, either during scheduled training exercises or contingency operations.

d. With Amphibious Ship versus Without Amphibious Ship. This pertains to the general nature of the EFV operations, whether training with or without an amphibious assault ship, or contingency operations which may or may not (i.e., extended shore-to-shore movements) include the presence of amphibious assault ships.

e. Description of the Environment. The matrix provided below illustrates one method of presenting the EFVs operating environment to assist in the development of the Recovery Plan. Descriptions should consider EFV operations that may include varying environments during the execution of various training exercises or operations. Prevailing weather and visibility conditions will also influence the environment.

Define the Environment	Near-Shore Ops </= 3 NM	Mid-Range Ops > 3 NM	OTH Ops 25 NM
Training			
Without Ship(s)		✓	
With Ship(s)	✓		✓
Without Embarked Troops			✓
With Embarked Troops	✓		
Operations			
Without Ship(s)			✓
With Ship(s)	✓		
Without Embarked Troops		✓	
With Embarked Troops	✓		✓

Objectives & Environment

Figure 1.

5. IDENTIFICATION OF RESOURCES

Dependent upon the environment, the senior exercise or operational planners must have knowledge of, and access to, those resources available to develop and execute the Recovery Plan. Identification of potential recovery resources are critical to development of the plan. These resources can be categorized into three areas:

a. Resources Organic to the Assault Amphibian Unit. These resources are those available to the AA unit through the existing manpower and equipment within the unit. These resources will normally be available during EFV operations. They include:

- Other EFVs (for designation as primary or alternate rescue vehicles)
- EFV onboard safety & recovery equipment (outlined in paragraph 5.3 below)
- Corpsmen
- Maintenance personnel
- Repair Parts
- AAVR7A1 "Like Capability" (Recovery vs Repair)

b. Resources External to the Assault Amphibian Unit. These resources are those that can be available to the AA unit, dependent upon the environment and locale of the EFV operations.

- SAR assets (provided by post or station, or available deployed assets)
- LCU or LCU(R) (potential troop transfer platform or tow asset)
- Amphibious ship (varying capabilities, dependent upon ship class)
- LCAC recovery winch (for ship's so equipped)
- Ship's boat complement (potential troop transfer platform or ferrying of LCAC winch lead)

- Over-the-horizon communications assets (C2 and medivac coordination)
- Medical facility (either ashore or afloat)
- Designated combat service support activity or ship where repairs are to be accomplished
- U.S. Coast Guard (potential resource, dependent upon the environment and locale)

c. Individual EFV Safety/Recovery Equipment. The following equipment is aboard the EFV:

- Trained crew and embarked troops
- Fully equipped personal flotation device worn by crew and embarked troops
- Auxiliary power unit (APU) to provide back up power to lights, bilge pumps and radio
- Radios (three VHF/SINCGARS, one MBMM UHF/VHF capable radio)
- Emergency egress lighting system (sensor activated)
- Day/night signaling equipment (November flag, 4 pyrotechnics, battle lantern)
- Navigation beacon/light (to assist in locating disabled EFV, visual and IR spectrum)
- Tow lines (2)
- Sea-tow quick release mechanism (hatchet as back-up)
- Boat hook
- First aid kit

d. Resource Identification Matrix. The matrix below illustrates one method of comparing the EFV operating range environment and the availability of amphibious ships with the availability of other required (R) and optional (O) resources in a training environment. It is anticipated that OTH training will not take place without the presence of an amphibious ship. Similar resource identification will take place during planning for contingency operations, but will also include the tactical situation.

Environment / Resources	Near Shore w/ Ship	Near Shore w/out Ship	Mid Range w/ Ship	Mid Range w/out Ship	OTH w/Ship
Aslt Phib Unit Resources					
Designated EFV Rescue Vehicles	R	R	R	R	R
Freeboats (Embarked Troops)	O	O	R	R	R
Corpsmen	R	R	R	R	R
Maintenance Personnel	R	R	R	R	R
Designated Repair Capability	R	R	R	R	R
USMC Resources					
SAR Assets (Helo)	O	O	R*	R	R*
OTH Comm Assets (C2/Medevac)					R*
SOMS Boat Assets (Transfer)	O	O	O	O	R*
Medical Facility	R*	R	R*	R	R*
Designated Recovery Asset (Land)	R	R	R	R	R
USN Resources					
Ship (Ready to close on EFV pos)	O		R		R
Ships Boats (Terminal Assistance)	R		R		R
LCAC Winch (Terminal Assistance)	O		O		O
LCU/LCU(R) (Transfer/Tow)	O		O		O
SAR Assets (Helo)	O		R*		R*
OTH Comm Assets (C2/Medevac)					R
Medical Facility	R*		R*		R*
Designated Repair Ship (CSSE)**	O		R		R

Figure 2.

* - Indicates the resource should be available through either the USMC or the USN.

** - The ship which will embark USMC maintenance/combat service support elements capable of accomplishing EFV repairs.

6. RECOVERY PLAN DEVELOPMENT

Once the environment and available resources have been examined and identified, formal recovery planning can be accomplished. This planning should include appropriate representation from the units involved with the training exercise/contingency operation, to include, at a minimum, the AA unit, the supported infantry unit, and ship representatives. Whenever recovery resources external to the AA unit are considered as part of the plan's development, representation from the applicable organization is required to insure proper coordination is accomplished during the pre-exercise/operation briefing process.

7. CONCEPT OF OPERATIONS

Based upon an examination of the factors described above, the Recovery Plan is developed to meet the required level of ORM, as determined by the senior commander. Descriptions of potential recovery operations are provided below.

a. Training/Near-Shore. The following describes the concept of operations for recovery of a disabled EFV in a training environment, during near shore operations, with or without embarked troops, and with or without the presence of an amphibious ship.

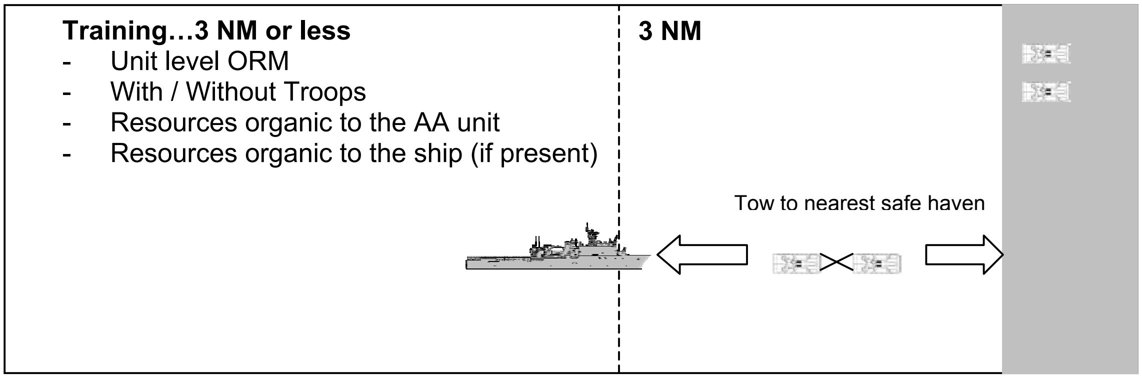


Figure 3.

- Prior to training activities, AA unit level ORM is conducted.
- The AA unit will always designate Primary and Alternate EFV Rescue Vehicles to accomplish towing to the nearest safe haven. These vehicles may either be afloat or remain ashore, and will always monitor the appropriate radio frequency and be observant for visual emergency signals. Towing operations will be executed in accordance with standard operating procedures.
- If troops are embarked, the AA unit may designate a "free boat" (empty EFV) to be used in the event a troop transfer is required prior to, or during, towing operations. Troop transfers will be executed in accordance with standard operating procedures. This vehicle may either be afloat or remain ashore and will always monitor the appropriate radio frequency and be observant for visual emergency signals.
- If training is conducted with an amphibious ship, the EFV will be towed to the nearest safe haven by either of the designated rescue vehicles. This towing will continue until such time the disabled EFV is safely grounded and removed from wave action, either through the surf zone or within the ship's well deck.
- Communications will be conducted in accordance with standard operating procedures via VHF assets. This will include communications between the AA unit afloat, the designated rescue vehicles, free boats (when employed), the ship (if present), and range control (if required by local regulations).

b. Training/Mid-Range. The following describes the concept of operations for recovery of a disabled EFV in a training environment, during mid-range operations, with or without embarked troops, and with or without the presence of an amphibious ship.

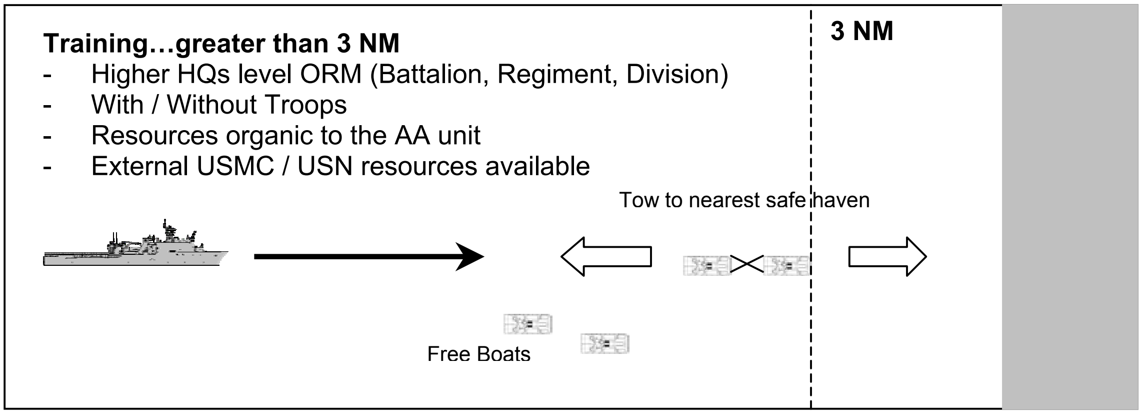


Figure 4.

- Prior to training activities, ORM is accomplished by the senior organization conducting the training exercise to insure appropriate resources are available. Employment of local post/station and available USN SAR assets should be considered in recovery planning. These assets may either be on-call or on-station during mid-range training activities.
- The AA unit will always designate Primary and Alternate EFV Rescue Vehicles to accomplish towing to the nearest safe haven. These vehicles may either be afloat or remain ashore, and will always monitor the appropriate radio frequency and be observant for visual emergency signals. Towing operations will be executed in accordance with standard operating procedures.
- If troops are embarked, the AA unit will designate "free boats" (empty EFVs) to be used in the event a troop transfer is required prior to, or during, towing operations. Troop transfers will be executed in accordance with standard operating procedures. This vehicle will move with the EFV unit formation afloat, and will always monitor the appropriate radio frequency and be observant for visual emergency signals.
- If training is conducted with an amphibious assault ship, the ship must be prepared to move toward the disabled EFV under tow to shorten the distance to the nearest safe haven, and be ballasted in such a manner to recover the EFV while being towed by the rescue vehicle.
- Towing will continue until such time the disabled EFV is safely grounded and removed from wave action, either through the surf zone or within the ship's well deck.
- Communications will be conducted in accordance with standard operating procedures via VHF assets. This will include communications between the AA unit afloat, the designated rescue vehicles, free boats (when employed), the ship (if present), and range control (if required by local regulations).

c. Training/OTH. The following describes the concept of operations for recovery of a disabled EFV in a training environment, during OTH operations, with or without embarked troops, and with the presence of an amphibious ship.

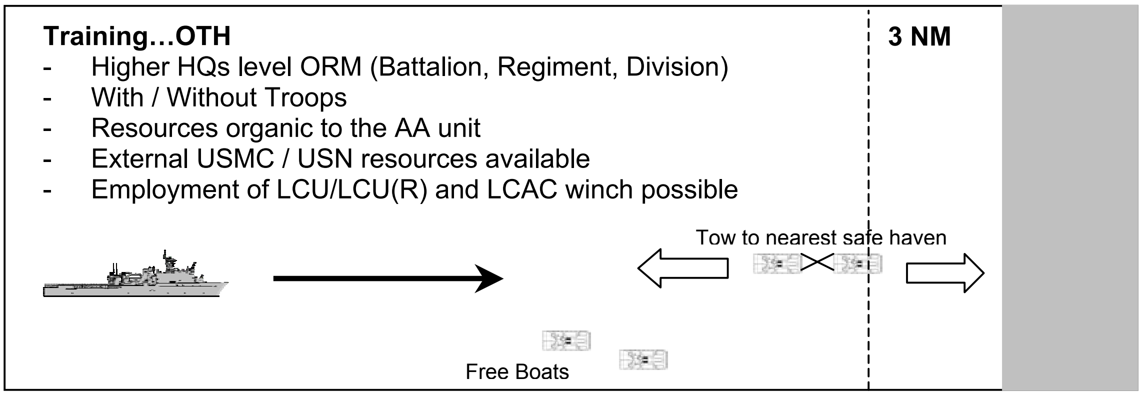


Figure 5.

- Prior to training activities, ORM is accomplished by the senior organization conducting the training exercise to insure appropriate resources are available. Local post/station and available USN SAR assets must be considered in recovery planning. These assets should be on-station during training activities.
- The AA unit will always designate Primary and Alternate EFV Rescue Vehicles to accomplish towing to the nearest safe haven. These vehicles may either be afloat or remain ashore and will always monitor the appropriate radio frequency and be observant for visual emergency signals. Towing operations will be executed in accordance with standard operating procedures.
- If troops are embarked, the AA unit will designate "free boats" (empty EFVs) to be used in the event a troop transfer is required prior to, or during, towing operations. Troop transfers will be executed in accordance with standard operating procedures. This free boat will move with the EFV unit formation afloat and will always monitor the appropriate radio frequency and be observant for visual emergency signals.
- If training is conducted with an amphibious assault ship, the ship must be prepared to move toward the disabled EFV under tow to shorten the distance to the nearest safe haven, and be ballasted in such a manner to recover the EFV while being towed by the rescue vehicle.
- Towing will continue until such time the disabled EFV is safely grounded and removed from wave action, either through the surf zone or within the ship's well deck. Consideration should be given to taking a disabled EFV under tow by an appropriately equipped LCU or LCU(R) (in the event another EFV is not available in a suitable period of time).
- Local communications will be conducted in accordance with standard operating procedures via VHF assets. This will include communications between the AA unit, the designated rescue vehicles, and free boats (if present). However, OTH communications must also be maintained between the AA unit afloat and the ship.

d. Operations/OTH/With Ship. The following describes the concept of operations for recovery of a disabled EFV in an operational environment, during OTH operations, with or without embarked troops, and with the presence of an amphibious ship. The threat could prohibit movement of the amphibious ship to close the nearest safe haven distance. When considering defining the nearest safe haven, the threat situation must be considered.

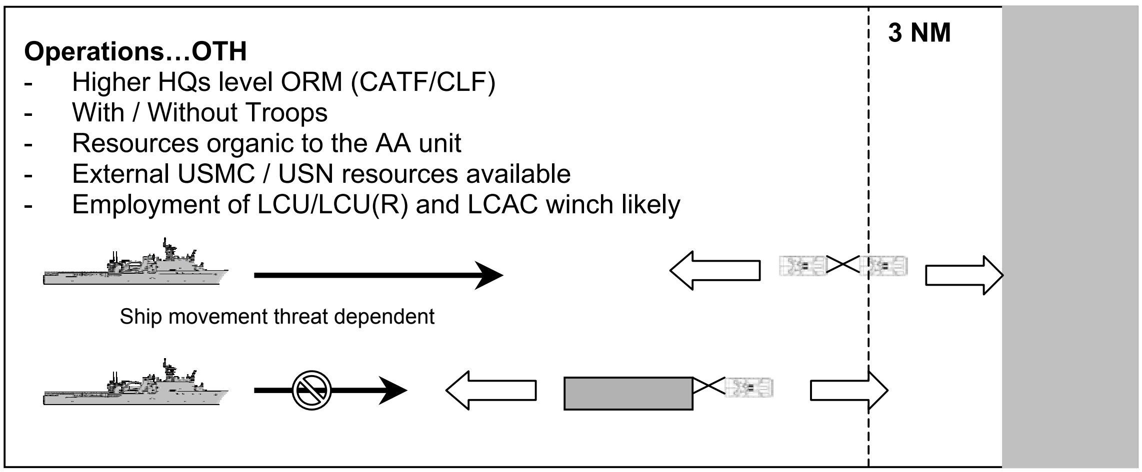


Figure 6.

- Prior to combat operations, ORM is accomplished by the senior organization conducting the operation to insure appropriate resources are available. Available USMC and USN SAR assets must be considered in recovery planning. These assets should be available as designated by the recovery plan.
- The AA unit will always designate Primary and Alternate EFV Rescue Vehicles to accomplish towing to the nearest safe haven. These vehicles may either be afloat or remain ashore and will always monitor the appropriate radio frequency and be observant for visual emergency signals. Towing operations will be executed in accordance with standard operating procedures.
- If troops are embarked, and if available, the AA unit will designate "free boats" (empty EFVs) to be used in the event a troop transfer is required prior to, or during, towing operations. Troop transfers will be executed in accordance with standard operating procedures. This vehicle will move with the EFV unit formation afloat and will always monitor the appropriate radio frequency and be observant for visual emergency signals. Special attention must be given to "bump" plans, and the ability to execute such plans given prevailing weather conditions.
- Threat dependent, the ship must be prepared to move toward the disabled EFV under tow to shorten the distance to the nearest safe haven, and be ballasted in such a manner to recover the EFV while being towed by the rescue vehicle. Consideration should be given to taking a disabled EFV under tow by an appropriately equipped LCU or LCU(R) (in the event another EFV is not available in a suitable period of time).

- Towing will continue until such time the disabled EFV is safely grounded and removed from wave action, either through the surf zone or within the ship's well deck.
- Local communications will be conducted in accordance with standard operating procedures via VHF assets. This will include communications between the AA unit, the designated rescue vehicles, and free boats (if present). However, OTH communications must also be maintained between the AA unit afloat and the ship.

8. POTENTIAL CAPABILITY REQUIREMENTS

This concept of operations requires examination of capabilities and/or procedures not normally associated with the recovery of assault amphibians at sea. These include:

- Examination of ORM procedures relative to OTH operations. The surface assault element will be potentially dispersed across a much larger battlespace than during conventional training/combat operations.
- Examination of USMC and USN SAR capabilities relative to OTH operations. Again, the surface assault element will be widely dispersed.
- Amphibious ship role in the recovery process (movement to disabled EFVs to close the nearest safe haven distance).
- Potential employment of the LCU or LCU(R) as a tow capability for a disabled EFV. This should include available power to conduct the tow, tow line interfaces, sea-tow quick release mechanisms, and the ability to conduct troop transfers.
- Potential employment of the LCAC recovery winch (for ship's so equipped), not unlike the winching technique employed with earlier LST class ships.
- Potential role of ship's boat complement, employed to provide "terminal assistance" should the LCAC winch lead require ferrying to the disabled EFV (after towing by the LCU or LCU(R)).
- Potential procedures to be employed when a disabled EFV, configured in the High Water Speed Mode (suspension raised, appendages deployed) is unable reconfigure to the Transition Mode (suspension deployed) and must be brought ashore or aboard ship.
- Potential employment of a "at sea emergency sustainment kit". This might include air or surface deliverable portable water transfer pumps to assist in maintaining EFV buoyancy, a life raft, and other applicable survival equipment.

APPENDIX N. DATA FOR EFV (P)

1. GENERAL

Weight:

Empty: **65,853 pounds (less fuel, ammo, crew, infantry)**

Combat Equipped: 75,031 pounds (full fuel, ammo, crew, infantry)

Center of Gravity:

Longitudinal: **122.3 inches aft of Final Drive**

Transverse: **+/- 1.0 inch of Vehicle Centerline**

Vertical: **18.5 inches above Final Drive**

Mean Transition Sea Water Draft: **76 inches (approx.)**

Mean High Speed Configured Draft: **57 inches (approx.)**

Freeboard at Bow: **19 inches (approx.)**

Freeboard at Stern: **10 inches (approx.)**

Unit Ground Pressure

Soft Soil: **9.9 psi**

Hard Surface: 25 psi avg., 178 psi peak

Fuel Capacity: **338 gallons**

Total Vehicle Coolant Capacity: **50 gallons, 50/50 ethylene glycol/water**

2. PERFORMANCE

Horsepower (Sea) to Weight Ratio (Combat Equipped): **72.1 HP/ton**

Horsepower (Land) to Weight Ratio (Combat Equipped): **22.7 HP/ton**

Drawbar Pull (Max. at Stall Tractive Effort): **45,600 lbs. On Level, Firm Terrain**

Cruising Range

Land at 25 MPH: **345 Miles**

Water at 25 knots: **55 Nautical Miles**

Cruising Speed

Land: **25 MPH**

Water: **25 knots**

Maximum Speed Forward

Land: **45 MPH**

Water (High Speed): **25 knots**

Water (Transition Speed): **9 knots**

Maximum Speed Reverse

Land: **15 MPH**

Water: **4 knots**

Obstacle Ability: **8-foot trench span, 3-foot vertical wall**

Maximum Forward Grade (Combat Equipped): **60%**

Maximum Side Slope (Combat Equipped): **40%**

Ground Clearance (Combat Equipped): **16 inches**

Minimum Turning Radius

Land: **Pivot**

Water (High Speed): **185 Meters While On-plane**

Water (Transition): **Pivot**

Objective Surf Transit: **Negotiate 8-foot plunging surf or Maintain planing speed in 3-foot significant wave height**

3. ENGINE

Make: **MTU**
Model: **MT 883 Ka 524**
Type: **4 cycle, 12 cylinder, 90 degree vee, water cooled, turbo-charged**
Bore: **5.7 inches / 144 mm**
Stroke: **5.5 inches / 140 mm**
Displacement: **1669 cubic inches / 27.35 l**
Compression Ratio: **12.5:1**
Fuel: **Multi-fuel**
Rated Power (hp//kW)
Land: 850 hp/ 635 kW @ 2500 RPM
Sea: 2703 hp/ 2016 kW @ 3250-3350 RPM
Maximum Torque:
Land: 2291 lbs..-ft. / 3106 N-m @ 1700 RPM
Sea: 4369 lbs..-ft. / 5824 N-m @ 3250 RPM
Oil Capacity: **31 gallons / 112 liters, 15W-40 Oil**
Engine Coolant: **50/50 Ethylene Glycol/Water**

4. POWER TRAIN

Transmission: **Allison 6-Speed Transmission**
Type: **Hydrokinetic with Infinitely Variable Steering, HD World Transmission (WT), Packard Electronic Controls**
Maximum Converter Torque Multiplication: 1:78:1
Gear Ratios Forward:
First Speed: 6.606:1
Second Speed: 3.113:1
Third Speed: 2.151:1
Fourth Speed: 1.407:1
Fifth Speed: 1.075:1
Sixth Speed: 0.945:1
Final Drive Ratios: **4.125:1**
Overall maximum Torque Ratio (Engine to Sprocket): **48.5:1**
Power Transfer Module, Transmission, & Heat Exchanger System Capacity:
35 gal. 15W-40 Oil
Final Drive Capacity: **4.5 gallons each, 15W-40 Oil**

5. MARINE DRIVE TRAIN

Water Jet Pumps:
Qty: **2**
Horsepower: **1,311 hp /each**
Total Thrust**: 23,900 pounds**
Steering and Reverse by Jet Deflectors
Location**: Port and Starboard, Aft**

Waterjet-PTM Ratio: **3.0074:1**

6. RUNNING GEAR

Type: **Hydropneumatic Suspension, Front Sprocket, Rear Idler**
Number of Wheels: **14 Roadwheels Per Side (7 Pair); 22.75-inch dia.**
Number of Support Rollers: **2 Per Side**
Sprocket: **Number of Teeth: 11**
Feet per Revolution: 5.5
Number of Damped Stations: **3 Per Side**
Number of Undamped Stations: **4 Per Side**
Track: **Steel, Double Pin, Rubber Bushed, with Replaceable Pads**
Number of Shoes: **102 Maximum Per Side**
Pitch: **6 inches**
Weight per Shoe: **25 pounds (maximum)**
Weight per Side: **2550 pounds (maximum)**
Hub Capacity: **14 oz. of 15W-40 Oil**

7. ELECTRICAL

Nominal Voltage: **28VDC**
Generator: **800 Amp, 28VDC**
Battery:
Volts: 24 V Battery Packs (2x12V in Series)
Type: OPTIMA
Quantity: 6 - Aux bus + 2 - Vetronics bus

8. VEHICLE COMMUNICATION SYSTEM

Radios: **3 VHF SINCGARS (Voice/Data)**
1 Multiband (SATCOM/HAVEQUICK II/SINCGARS) (Voice/Data)
1 EPLRS - every fourth Personnel Variant (Data)
Cosite: **1 VHF Cosite Unit (reduction of self interference)**
Intercom: **5 Stations (Vehicle Commander, Driver, Gunner, Troop Commander, and 5th Station Aft); Army VIC-3 (Wireless option is a future capability)**
Server: **1 NT (C2PC Gateway)**
Workstations: **3 (Vehicle Commander, Troop Commander, Driver) with 10.4" display/CPU, keypad, and task lighting.**

9. PROTECTION

14.5mm AP at 300 meters
155/152mm Fragments at 15 meters

10. FIRE EXTINGUISHERS

Automatic Fire Sensing and Suppression System (AFSSS)

Number of Bottles: **2 ea, 225 cu. in., Engine/Transmission Compartment**
1 ea, 64 cu. in., APU Compartment
4 ea, 310 cu. in., Crew Compartment

Capacity: **Engine/Transmission Compartment - 8 lbs. each Dry Chemical**
APU - 2.5 lbs. Dry Chemical
Crew Compartment - 9.5 lbs. FM-200, 0.4 lbs. Dry Chemical each

Number of Sensors: **20**

Portable Fire Extinguisher:

Number: **2**
Capacity: **2.5 lbs. each**
Location: **Driver and Port Aft Bulkhead Adjacent to Ramp**

11. VISION AND SIGHTING REQUIREMENT

Vehicle Commander: **360 Field of Vision**
Troop Commander (TC): **120 Field of Vision**
Driver: **120 Field of Vision**
Combined TC and Driver: **270 Field of Vision**
Driver's Ground Intercept: **10 meters**
Driver's Thermal Viewer

12. PERSONNEL COMPLEMENT

Crew: **3 (Vehicle Commander, Gunner, Driver)**
Combat Equipped Marines: **17**

13. ARMAMENT AND AMMUNITION

Main: **30mm Mk44 Mod 1 Automatic Gun**

Main-AP:

Ready Rounds: **55**
Stowed Rounds: **60 (0 During HWS Operations)**

Main-HE:

Ready Rounds: **160**
Stowed Rounds: **120 (0 During HWS Operations)**

Traverse: **360 degree Continuous**
Elevation: **+ 45 degree, - 10 degree**

Secondary:

M240 Machine Gun, 7.62mm Coax
Ready Rounds: **600**
Stowed Rounds: **800**

Full Solution, Digital Fire Control:

2nd Generation FLIR

14. NAVIGATION EQUIPMENT

Integrated Global Positioning System (GPS) and Inertial Navigation Unit (INU)
C2PC for Maps, Route Planning and Navigation

15. OTHER

Bilge Pumps: **3 hydraulic pumps, (fwd stbd, engine compartment, aft port), capacity >100 gpm each**
2 electric pumps, (fwd port, aft stbd) capacity > 30 gpm each

Auxiliary Power Unit:

Engine:	**Kubota D-722T**
Type:	**4 cycle, water-cooled diesel**
Rating:	**22.7 hp @ 3600 rpm, intermittent**
Coolant:	**50/50 Propylene Glycol/water**
Oil:	**15W-40**
Alternator Output:	**380 Amps @ 28 VDC**
Hydraulic Output:	**3500 PSI @ 2.2 GPM**
	500 PSI @ 2.2 GPM Continuous
Hydraulic Inlet Pressure:	**70 PSIG**

NBC/Climate Controlled Collective Protection
Micro-Climate Masks for Crew/Macro-Climate Cooling

Smoke Grenade Launchers:	**Turret:**	**8 rds**
Cargo Space Volume:	**350 Cubic Feet**	
Hydraulic Capacity:	**35 gallons, MIL-H-46170**	
Air Conditioning Coolant:	**R-134a**	

APPENDIX O. DATA FOR EFV (C)

1. GENERAL

Weight:

Empty: **69,967 pounds (less fuel, ammo, crew, staff)**

Combat Equipped: 76,412 pounds (full fuel, ammo, crew, staff)

Center of Gravity:

Longitudinal: **125.15 inches aft of Final Drive**

Transverse: **+/- 1.0 inch of Vehicle Centerline**

Vertical: **<20 inches above Final Drive**

Mean Transition Sea Water Draft: **76 inches (approx.)**

Mean High Speed Configured Draft: **57 inches (approx.)**

Freeboard at Bow: **19 inches (approx.)**

Freeboard at Stern: **10 inches (approx.)**

Unit Ground Pressure

Soft Soil: **9.9 psi**

Hard Surface: 25 psi avg., 178 psi peak

Fuel Capacity: **338 gallons**

Total Vehicle Coolant Capacity: **50 gallons, 50/50 ethylene glycol/water**

2. PERFORMANCE

Horsepower (Sea) to Weight Ratio (Combat Equipped): **70.7 HP/ton**

Horsepower (Land) to Weight Ratio (Combat Equipped): **22.2 HP/ton**

Drawbar Pull (Max. at Stall Tractive Effort): **45,600 lbs. On Level, Firm Terrain**

Cruising Range

Land at 25 MPH: **345 Miles**

Water at 25 knots: **55 Nautical Miles**

Cruising Speed

Land: **25 MPH**

Water: **25 knots**

Maximum Speed Forward

Land: **45 MPH**

Water (High Speed): **25 knots**

Water (Transition Speed): **9 knots**

Maximum Speed Reverse

Land: **15 MPH**

Water: **4 knots**

Obstacle Ability: **8-foot trench span, 3-foot vertical wall**

Maximum Forward Grade (Combat Equipped): **60%**

Maximum Side Slope (Combat Equipped): **40%**

Ground Clearance (Combat Equipped): **16 inches**

Minimum Turning Radius

Land: **Pivot**

Water (High Speed): **185 Meters While On-plane**

Water (Transition): **Pivot**

Objective Surf Transit: **Negotiate 8-foot plunging surf or Maintain planing speed in 3-foot significant wave height**

3. ENGINE

Make: **MTU**
Model: **MT 883 Ka 524**
Type: **4 cycle, 12 cylinder, 90 degree vee, water cooled, turbo-charged**
Bore: **5.7 inches / 144 mm**
Stroke: **5.5 inches / 140 mm**
Displacement: **1669 cubic inches / 27.35 l**
Compression Ratio: **12.5:1**
Fuel: **Multi-fuel**
Rated Power (hp//kW)
Land: 850 hp/ 635 kW @ 2500 RPM
Sea: 2703 hp/ 2016 kW @ 3250-3350 RPM
Maximum Torque:
Land: 2291 lbs.-ft. / 3106 N-m @ 1700 RPM
Sea: 4369 lbs.-ft. / 5824 N-m @ 3250 RPM
Oil Capacity: **31 gallons / 112 liters, 15W-40 Oil**
Engine Coolant: **50/50 Ethylene Glycol/Water**

4. POWER TRAIN

Transmission: **Allison 6-Speed Transmission**
Type: **Hydrokinetic with Infinitely Variable Steering, HD World Transmission (WT), Packard Electronic Controls**
Maximum Converter Torque Multiplication: 1:78:1
Gear Ratios Forward:
First Speed: 6.606:1
Second Speed: 3.113:1
Third Speed: 2.151:1
Fourth Speed: 1.407:1
Fifth Speed: 1.075:1
Sixth Speed: 0.945:1
Final Drive Ratios: **4.125:1**
Overall maximum Torque Ratio (Engine to Sprocket): **48.5:1**
Power Transfer Module, Transmission, & Heat Exchanger System Capacity:
35 gal. 15W-40 Oil
Final Drive Capacity: **4.5 gallons each, 15W-40 Oil**

5. MARINE DRIVE TRAIN

Water Jet Pumps:
Qty: **2**
Horsepower: **1,311 hp /each**
Total Thrust: **23,900 pounds**
Steering and Reverse by Jet Deflectors
Location: **Port and Starboard, Aft**

Waterjet-PTM Ratio: **3.0074:1**

6. RUNNING GEAR

Type:	**Hydropneumatic Suspension, Front Sprocket, Rear Idler**
Number of Wheels:	**14 Roadwheels Per Side (7 Pair); 22.75-inch dia.**
Number of Support Rollers:	**2 Per Side**
Sprocket:	**Number of Teeth: 11**
	Feet per Revolution: 5.5
Number of Damped Stations:	**3 Per Side**
Number of Undamped Stations:	**4 Per Side**
Track:	**Steel, Double Pin, Rubber Bushed, with Replaceable Pads**
Number of Shoes:	**102 Maximum Per Side**
Pitch:	**6 inches**
Weight per Shoe:	**25 pounds (maximum)**
Weight per Side:	**2550 pounds (maximum)**
Hub Capacity:	**14 oz. of 15W-40 Oil**

7. ELECTRICAL

Nominal Voltage:	**28VDC**
Generator:	**800 Amp, 28VDC**
Battery:	
Volts:	**24 V Battery Packs (2x12V in Series)**
Type:	**OPTIMA**
Quantity:	**6 - Aux bus + 2 - Vetronics bus**

8. VEHICLE COMMUNICATION SYSTEM

Radios:	**6 VHF SINCGARS (Voice/C2PC)**
	2 Multiband (SATCOM, HAVEQUICK II, or SINCGARS)
	2 EPLRS (C4I Data)
	1 HF (ALE)
Cosite:	**2 VHF Cosite Units (reduction of self interference)**
Intercom:	**12 Stations (3 channel, redundant, keypads, LCD)**
	(Wireless option is a future capability)
Servers:	**4 Solaris (2 AFATDS, 2 IOS),**
	2 NT (TDN, C2PC)
Router/Switch:	**2 Ethernet switches**
	2 Routers
	1 KG-84 (land-line bulk encryption)
Staff workstations:	**7 18” display/CPU, keyboard, table, lighting.**
Workstations:	**2 10.4” display/CPU, keypad, lighting.**
Jump seats:	**2 fold-down seat & table, and Ethernet**

9. PROTECTION

14.5mm AP at 300 meters
155/152mm Fragments at 15 meters

10. FIRE EXTINGUISHERS

Automatic Fire Sensing and Suppression System (AFSSS)
Number of Bottles: **2 ea., 225 cu. in., Engine/Transmission Compartment**
1 ea, 64 cu. in., APU Compartment
4 ea., 310 cu. in., Crew Compartment
Capacity: **Engine/Transmission Compartment - 8 lbs.. each Dry Chemical**
APU - 2.5 lbs. Dry Chemical
Crew Compartment - 9.5 lbs.. FM-200, 0.4 lbs.. Dry Chemical each
Number of Sensors: **20**
Portable Fire Extinguisher:
Number: 2
Capacity: 2.5 lbs.. each
Location: Staff Position #4 (behind Driver), Staff Position #7 (Aft Port)

11. VISION AND SIGHTING REQUIREMENT

Vehicle Commander: **360 Field of Vision**
Driver: **120 Field of Vision**
Combined VC and Driver: **270 Field of Vision**
Driver's Ground Intercept: **10 meters**
Driver's Thermal Viewer

12. PERSONNEL COMPLEMENT

Crew: **3 (Vehicle Commander, Driver, 3rd Crewman)**
Staff: **7**

13. ARMAMENT AND AMMUNITION

M240 Machine Gun, 7.62mm
Ready Rounds: 600
Stowed Rounds: 800

14. NAVIGATION EQUIPMENT

Integrated Global Positioning System (GPS) and Inertial Navigation Unit (INU)
C2PC for Maps, Route Planning and Navigation

15. OTHER

Bilge Pumps: **3 hydraulic pumps, (forward stbd, engine compartment, aft port) capacity >100 gpm each**

2 electric pumps, (forward port, aft stbd) capacity > 30 gpm each

Auxiliary Power Unit:

Engine:	**Kubota D-722T**
Type:	**4 cycle, water-cooled diesel**
Rating:	**22.7 hp @ 3600 rpm, intermittent rating**
Coolant:	**50/50 Propylene Glycol/water**
Oil:	**15W-40**
Alternator Output:	**380 Amps @ 28 VDC**
Hydraulic Output:	**3500 PSI @ 2.2 GPM**
	500 PSI @ 2.2 GPM Continuous
Hydraulic Inlet Pressure:	**70 PSIG**

NBC/Climate Controlled Collective Protection

Micro-Climate/Macro-Climate Cooling

Smoke Grenade Launchers:	**Turret: 8 rds**
Hydraulic Capacity:	**35 gallons, MIL-H-46170**
Air Conditioning Coolant:	**R-134a**

APPENDIX P. GLOSSARY

Section I. Acronyms

AA....assault amphibian [unit]
AAV.... amphibious assault vehicle
ADDRAC.... alert, direction, description, range, assignment, control
ADCON.... administrative control
AF....amphibious force
AO....air officer or area of operations
AOA.... amphibious objective area
AP....attack position
APC.... armored personnel carrier
AT....antitank
ATF.... amphibious task force
ATGM.... antitank guided munition

BAS....battalion aid station
BDA.... battle damage assessment
BGC.... boat group commander
BHL....battle handover line
BLT....battalion landing team
BP....battle position

C2....command and control
C2PC....command and control personal computer
C4I....command, control, communications, computers and intelligence
CAS....close air support
CATF.... commander, amphibious task force
CCO....central control officer
CDP....common display processor
CE.... combat equipped
CIC.... combat information center
CL....combat load
CLF.... commander, landing force
COC.... combat operations center
CP....command post
CSS.... combat service support
CSSA....combat service support area
CSSE....combat service support element
CTP....common tactical picture
CVC.... combat vehicle commander

D-day.... unnamed day on which operations commence or

are scheduled to commence
DACT...data automated communications terminal
DASC.......................
DF ....diesel fuel
DP .... dismount point
DPICM.............................dual purpose improved conventional munitions
DS .... direct support
DT......................................developmental testing

EA ....engagement area
EFV.........................expeditionary fighting vehicle
EMW...................expeditionary manuever warfare
EPLRS........................enhanced position location reporting system
FAC....................................forward air controller
FEBA .... forward edge of the battle area
FM....................................... field manual (Army)
FO ....forward observer
FPL..final protective line
FSC .... fire support coordinator
FSCC...................fire support coordination center
FSSG..........................force service support group

GCE.................................ground combat element
GPS .... global positioning system
GS ....general support

H&S ....headquarters and service
HE ....high explosive
HF .... high frequency
H-hour..........................specific time an operation or exercise begins

IFV.................................infantry fighting vehicle
INU...................................inertial navigation unit
IOS..........................intelligence operations server
IOW................intelligence operations workstation
IPB .... intelligence preparation of the battlespace
IR...infrared

JP..joint publication

LAAD ....low altitude air defense
LAN...local area network
LAR.........................light armored reconnaissance
LARC......................lighter, amphibious resupply, cargo
LAV .... light armored vehicle
LCAC...................... ...landing craft air cushion
LCM.........................landing craft, mechanized
LCU...................................landing craft, utility
LCVP ....landing craft, vehicle, personnel

LD .... line of departure
LF .... landing force
LFSP .... landing force support party
LHA .... general purpose amphibious assault ship
LHD .... landing helicopter dock
LMC .... linear mine clearing
LOA .... limit of advance
LOC.......................... lines of communications
LOS... line of sight
LPD .... landing platform dock
LSD .... landing ship dock

MAGTF.................. Marine air-ground task force
MBA .... main battle area
MCDP .... Marine Corps doctrinal publication
MCRP .... Marine Corps reference publication
MCT............................ maintenance contact team
MCWP .... Marine Corps warfighting publication
mech .... mechanized
MEF .... Marine expeditionary force
METT-T .... mission, enemy, terrain and weather, troops and support available—time available
MEU............................ Marine expeditionary unit
MEU(SOC) .... Marine expeditionary unit (special operations capable)
MOS .... military occupational specialty
MOUT .... military operations on urbanized terrain
MRF .... mobile riverine force
MSR .... main supply route
MST .... maintenance support team
MTF .... mechanized task force

N-2 .... Navy component intelligence staff officer
N-3 .... Navy component operations staff officer
NAU.................................... network access unit
NBC .... nuclear, biological, and chemical
NCG .... naval control group
NCO .... noncommissioned officer
NGF... naval gunfire
NWP............................ naval warfare publication

OEM................................ on-equipment material
OP .... observation post
OPCON .... operational control
OPORD .... operation order
OTAR...................................... over the air re-key
OTH .... over the horizon

PCO....................................primary control officer
PCS ....primary control ship
PDF .... principal direction of fire
PLD .... probable line of deployment
PLGRS ....precision lightweight global positioning system (GPS) receiver system
PLRS ....position location reporting system
PM................................. preventive maintenance
POL......................petroleum, oils, and lubricants

QLP .... quiet landing procedure

R-day..redeployment day
RAM/RS .... reliability, availability, and maintainability/rebuild to standard
RCS......................RF communications subsystem
rein ....reinforcing
RFPA..................radio frequency power amplifier
RHA .... rolled homogenous armor
RLT ....regimental landing team
RP.. release point
RPM .... revolutions per minute
R&S................... reconnaissance and surveillance
RT ....rescue team

S-1 ....manpower staff officer
S-2 .... intelligence staff officer
S-3 .... operations staff officer
S-4 .... logistics staff officer
S-6 .... communications and information systems officer (units and organizations below the major subordinate command level)
SCS .... secondary control ship
SFP..................................support by fire position
SINCGARS................ single-channel ground and airborne radio system
SLAP........................sabot light armor penetrator
SOC............................ special operations capable
SOP ....standing operating procedure
SP .... start point
STOM.........................ship to objective manuever
SUROB .... surf observation report

TACON..tactical control
TC .... troop commander
T/E..table of equipment
TI..technical instruction
TL... troop load
TLOC .... tactical logistics operations center

TM... Marine Corps technical manual
TOW ....tube-launched, optically-tracked, wire-command link guided missile
TRP .... target reference point

UCD...user control units
UGWS........................up-gunned weapons station
UHF....................................... ultrahigh frequency
US .... United States

VC..vehicle commander
VCS..................voice communications subsystem
VHF...................................... very high frequency

WGO ....wave guide officer

Section II. Definitions

amphibious force—An amphibious task force and a landing force together with other forces that are trained, organized, and equipped for amphibious operations. Also called **AF**. (JP 1-02)

amphibious operation—A military operation launched from the sea by an amphibious force, embarked in ships or craft with the primary purpose of introducing a landing force ashore to accomplish the assigned mission. (JP 1-02)

amphibious task force—A Navy task organization formed to conduct amphibious operations. The amphibious task force, together with the landing force and other forces, constitutes the amphibious force. Also called **ATF**. (JP 1-02)

amphibious vehicle employment plan—A plan showing in tabular form the planned employment of amphibious vehicles in landing operations, including their employment after the initial movement to the beach. (JP 1-02)

approach lane—An extension of a boat lane from the line of departure toward the transport area. (JP 1-02)

approach march—Advance of a combat unit when direct contact with the enemy is imminent. Troops are fully or partially deployed. The approach march ends when ground contact with the enemy is made or when the attack position is occupied. (JP 1-02)

armored personnel carrier—A lightly armored, highly mobile, full-tracked vehicle, amphibious and air-droppable, used primarily for transporting personnel and their individual equipment during tactical operations. Production modifications or application of special kits permit use as a mortar carrier, command post, flame thrower, antiaircraft artillery chassis, or limited recovery vehicle. Also called **APC**. (JP 1-02)

assault schedule—See **landing schedule**.
(JP 1-02)

assault wave—See **wave**. (JP 1-02)

backshore—The area of a beach extending from the limit of high water foam lines to dunes or extreme inland limit of the beach. (JP 1-02)

base of fire—Fire placed on an enemy force or position to reduce or eliminate the enemy's capability to interfere by fire and/or movement with friendly maneuver element(s). It may be provided by a single weapon or a grouping of weapons systems. (MCRP 5-12C)

battle damage repair—Essential repair, which may be improvised, carried out rapidly in a battle environment in order to return damaged or disabled equipment to temporary service. (JP 1-02)

beaten zone—The area on the ground upon which the cone of fire falls. (JP 1-02)

central control officer—The officer designated by the amphibious task force commander for the overall coordination of the waterborne ship-to-shore movement. The central control officer is embarked in the central control ship. Also called **CCO**. (JP 1-02)

close air support—Air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces. Also called **CAS**. (JP 1-02)

counterattack—Attack by part or all of a defending force against an enemy attacking force, for such specific purposes as regaining ground lost or cutting off or destroying enemy advance units, and with the general objective of denying to the enemy the attainment of the enemy's purpose in attacking. In sustained defensive operations, it is undertaken to restore the battle position and is directed at limited objectives. (JP 1-02)

covering force—1. A force operating apart from the main force for the purpose of intercepting, engaging, delaying, disorganizing, and deceiving the enemy before the enemy can attack the force covered. **2**. Any body or detachment of troops which provides security for a larger force by observation, reconnaissance, attack, or defense, or by any combination of these methods. (JP 1-02)

cross-attachment—The exchange of subordinate units between units for a temporary period. (MCRP 5-12C)

decentralized control—In military operations, a mode of battlespace management in which a command echelon may delegate some or all authority and direction for warfighting functions to subordinates. It requires careful and clear articulation of mission, intent, and main effort to unify efforts of subordinate leaders. See also **centralized control**. (MCRP 5-12C)

demonstration—1. An attack or show of force on a front where a decision is not sought, made with the aim of deceiving the enemy. **2**. (DOD only) In military deception, a show of force in an area where a decision is not sought made to deceive an adversary. It is similar to a feint but no actual contact with the adversary is intended. (JP 1-02)

electromagnetic pulse—The electromagnetic radiation from a strong electronic pulse, most commonly caused by a nuclear explosion that may couple with electrical or electronic systems to produce damaging current and voltage surges. Also called **EMP**. (JP 1-02)

envelopment—An offensive maneuver in which the main attacking force passes around or over the enemy's principal defensive positions to secure objectives to the enemy's rear. See also **turning movement**. (JP 1-02)

exploitation—1. Taking full advantage of success in military operations, following up initial gains, and making permanent the temporary effects already achieved. **2**. Taking full advantage of any information that has come to hand for tactical, operational, or strategic purposes. **3**. An offensive operation that usually follows a successful attack and is designed to disorganize the enemy in depth. See also **pursuit**. (JP 1-02)

feint—In military deception, an offensive action involving contact with the adversary conducted for the purpose of deceiving the adversary as to the location and/or time of the actual main offensive action. (JP 1-02)

flanking attack—An offensive maneuver directed at the flank of an enemy. See also **frontal attack**. (JP 1-02)

forward edge of the battle area—The foremost limits of a series of areas in which ground combat units are deployed, excluding the areas in which the covering or screening forces are operating, designated to coordinate fire support, the positioning of forces, or the maneuver of units. Also called **FEBA**. (JP 1-02)

frontal attack—**1**. An offensive maneuver in which the main action is directed against the front of the enemy forces. **2**. In air intercept, an attack by an interceptor aircraft that terminates with a heading crossing angle greater than 135 degrees. (JP 1-02)

global positioning system—A satellite constellation that provides highly accurate position, velocity, and time navigation information to users. Also called **GPS**. (JP 1-02)

guard—**1**. A form of security operation whose primary task is to protect the main force by fighting to gain time while also observing and reporting information, and to prevent enemy ground observation of and direct fire against the main body by reconnoitering, attacking, defending, and delaying. A guard force normally operates within the range of the main body's indirect fire weapons. **2**. A radio frequency that is normally used for emergency transmissions and is continuously monitored. UHF band: 243.0 MHZ; VHF band: 121.5 MHZ. See also screen. **3**. A military or civilian individual assigned to protect personnel, equipment, or installations, or to oversee a prisoner. (JP 1-02)

hydrography—The science which deals with the measurements and description of the physical features of the oceans, seas, lakes, rivers, and their adjoining coastal areas, with particular reference to their use for navigational purposes. (JP 1-02)

inner transport area—In amphibious operations, an area as close to the landing beach as depth of water, navigational hazards, boat traffic, and enemy action permit, to which transports may move to expedite unloading. (JP 1-02)

landing beach—That portion of a shoreline usually required for the landing of a battalion landing team. However, it may also be that portion of a shoreline constituting a tactical locality (such as the shore of a bay) over which a force larger or smaller than a battalion landing team may be landed. (JP 1-02)

landing craft and amphibious vehicle assignment table—A table showing the assignment of personnel and materiel to each landing craft and amphibious vehicle and the assignment of the landing craft and amphibious vehicles to waves for the ship-to-shore movement. (JP 1-02)

landing diagram—A graphic means of illustrating the plan for the ship-to-shore movement. (JP 1-02)

landing force—A Marine Corps or Army task organization formed to conduct amphibious operations. The landing force, together with the amphibious task force and other forces, constitute the amphibious force. Also called **LF**. (JP 1-02)

landing force support party—A temporary landing force organization composed of Navy and landing force elements, that facilitates the ship-to-shore movement and provides initial combat support and combat service support to the landing force. The landing force support party is brought into existence by a formal activation order issued by the commander, landing force. Also called **LFSP**. (JP 1-02)

landing plan—**1**. In amphibious operations, a collective term referring to all individually prepared naval and landing force documents that, taken together, present in detail all instructions for execution of the ship-to-shore movement. **2**. In airlift operations, the sequence, method of delivery, and place of arrival of troops and materiel. (JP 1-02)

landing schedule—In an amphibious operation, a schedule that shows the beach, hour, and priorities of landing of assault units, and which coordinates the movements of landing craft from the transports to the beach in order to execute the scheme of maneuver ashore. (JP 1-02)

landing sequence table—A document that incorporates the detailed plans for ship-to-shore movement of nonscheduled units. (JP 1-02)

line of departure—**1**. In land warfare, a line designated to coordinate the departure of attack elements. **2**. In amphibious warfare, a suitably marked offshore coordinating line to assist assault craft to land on designated beaches at scheduled times. Also called **LD**. (JP 1-02)

main battle area—That portion of the battlefield in which the decisive battle is fought to defeat the enemy. For any particular command, the main battle area extends rearward from the forward edge of the battle area to the rear boundary of the command's subordinate units. (JP 1-02)

Marine air-ground task force—The Marine Corps principal organization for all missions across the range of military operations, composed of forces task-organized under a single commander capable of responding rapidly to a contingency anywhere in the world. The types of forces in the Marine air-ground task force (MAGTF) are functionally grouped into four core elements: a command element, an aviation combat element, a ground combat element, and a combat service support element. The four core elements are categories of forces, not formal commands. The basic structure of the MAGTF never varies, though the number, size, and type of Marine Corps units comprising each of its four elements will always be mission dependent. The flexibility of the organizational structure allows for one or more subordinate MAGTFs to be assigned. Also called **MAGTF**. (JP 1-02)

mechanized operations—Tactical operations designed to maximize the ground mobility, protection, shock action, and firepower of combat vehicles to concentrate combat power rapidly against the enemy. Combat power is generated by the massed employment of tanks and by enhancing the mobility of the forces through the use of assault amphibious vehicles and other ground mobility means. (MCRP 5-12C)

over-the-horizon amphibious operations—An operational initiative launched from beyond visual and radar range of the shoreline. (JP 1-02)

penetration—In land operations, a form of offensive which seeks to break through the enemy's defense and disrupt the defensive system. (JP 1-02)

petroleum, oils, and lubricants—A broad term which includes all petroleum and associated products used by the Armed Forces. Also called **POL**. (JP 1-02)

primary control officer—In amphibious operations, the officer embarked in a primary control ship assigned to control the movement of landing craft, amphibious vehicles, and landing ships to and from a colored beach. Also called **PCO**. (JP 1-02)

primary control ship—In amphibious operations, a ship of the task force designated to provide support for the primary control officer and a combat information center control team for a colored beach. Also called **PCS**. (JP 1-02)

pursuit—An offensive operation designed to catch or cut off a hostile force attempting to escape, with the aim of destroying it. (JP 1-02)

raid—An operation, usually small scale, involving a swift penetration of hostile territory to secure information, confuse the enemy, or to destroy installations. It ends with a planned withdrawal upon completion of the assigned mission. (JP 1-02)

rear area—For any particular command, the area extending forward from its rear boundary to the rear of the area assigned to the next lower level of command. This area is provided primarily for the performance of support functions. (JP 1-02)

reconnaissance in force—An offensive operation designed to discover and/or test the enemy's strength or to obtain other information. (JP 1-02)

riverine operations—Operations conducted by forces organized to cope with and exploit the unique characteristics of a riverine area, to locate and destroy hostile forces, and/or to achieve or maintain control of the riverine area. Joint riverine operations combine land, naval, and air operations, as appropriate, and are suited to the nature of the specific riverine area in which operations are to be conducted. (JP 1-02)

scheduled wave—See **wave**. (JP 1-02)

screen—1. An arrangement of ships, aircraft and/ or submarines to protect a main body or convoy. **2**. In cartography, a sheet of transparent film, glass, or plastic carrying a "ruling" or other regularly repeated pattern which may be used in conjunction with a mask, either photographically or photomechanically, to produce areas of the pattern. **3**. In surveillance, camouflage and concealment, any natural or artificial material, opaque to surveillance sensor(s), interposed between the sensor(s) and the object to be camouflaged or concealed. **4**. A security element whose primary task is to observe, identify, and report information, and which only fights in self-protection. See also flank guard; guard. **5**. (DOD only) A task to maintain surveillance; provide early warning to the main body; or impede, destroy, and harass enemy reconnaissance within its capability without becoming decisively engaged. (JP 1-02)

sea state—A scale that categorizes the force of progressively higher seas by wave height. This scale is mathematically co-related to the Pierson- Moskowitz scale and the relationship of wind to waves. (JP 1-02)

sector of fire—A defined area which is required to be covered by the fire of individual or crew served weapons or the weapons of a unit. (JP 1-02)

spoiling attack—A tactical maneuver employed to seriously impair a hostile attack while the enemy is in the process of forming or assembling for an attack. Usually employed by armored units in defense by an attack on enemy assembly positions in front of a main line of resistance or battle position. (JP 1-02)

strong point—A key point in a defensive position, usually strongly fortified and heavily armed with automatic weapons, around which other positions are grouped for its protection. (JP 1-02)

suppressive fire—Fires on or about a weapons system to degrade its performance below the level needed to fulfill its mission objectives, during the conduct of the fire mission. (JP 1-02)

surf zone—The area of water from the surf line to the beach. (JP 1-02)

turning movement—A variation of the envelopment in which the attacking force passes around or over the enemy's principal defensive positions to secure objectives deep in the enemy's rear to force the enemy to abandon his position or divert major forces to meet the threat. (JP 1-02)

wave—1. A formation of forces, landing ships, craft, amphibious vehicles or aircraft, required to beach or land about the same time. Can be classified as to type, function or order as shown: a. assault wave; b. boat wave; c. helicopter wave; d. numbered wave; e. on-call wave; f. scheduled wave. **2**. (DOD only) An undulation of water caused by the progressive movement of energy from point to point along the surface of the water. (JP 1-02)