MCWP 3-25.10

Low Altitude Air Defense Handbook



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FOREWORD

Marine Corps Warfighting Publication (MCWP) 3-25.10, *Low Altitude Air Defense Handbook*, complements and expands on the information in MCWP 3-25, *Control of Aircraft and Missiles*, MCWP 3-25.3, *Marine Air Command and Control System Handbook*, and Fleet Marine Force Manual (FMFM) 5-50, *Antiair Warfare*, to show how low altitude air defense (LAAD) supports and implements warfighting.

Designated for Marine air-ground task force (MAGTF), naval expeditionary force, and joint force commanders, their staffs, and MAGTF officers and noncommissioned officers, MCWP 3-25.10 provides doctrinal principles, tactics, techniques, and procedures for execution of the LAAD aspect of antiair warfare. It discusses the planning, execution, operations, and employment of LAAD assets, and their integration into the MAGTF or joint/multinational integrated air defense system.

This publication also describes the LAAD battalion—the sole provider of LAAD assets in the Marine Corps—and its role, functions, organization, and potential command relationships.

By investigating these areas, MCWP 3-25.10 provides the requisite information needed by commanders and staffs to understand and evaluate the operational principles and capabilities of LAAD employment options.

MCWP 3-25.10 supersedes FMFM 5-52, *Employment of the Low Altitude Air Defense Battalion*, dated 22 October 1990.

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

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Unless otherwise stated, whenever the masculine or feminine gender is used, both men and women are included.

Low Altitude Air Defense Handbook

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Chapter 1

Fundamentals

Maneuver warfare fundamentals dictate that the Marine Corps' fighting units be able to move rapidly in the Marine air-ground task force (MAGTF) battlespace. Often, this need for battlespace mobility cannot support large, long-range weapons systems to engage the threat. Man portable, surface-to-air missile systems evolved to provide the MAGTF with close-in, low altitude defense against air attack. These weapons and their operators are organic to the low altitude air defense battalion.

MISSION

The mission of the LAAD battalion is to provide close-in, low altitude surface-to-air weapons fires in defense of the MAGTF. LAAD battalions defend forward combat areas, maneuver forces, vital areas, installations, and/or units engaged in special or independent operations.

TASKS

The LAAD battalion—

- Maintains a primary capability as a highly mobile, man portable or vehicle-mounted, surface-to-air weapons component of the MAGTF that can deploy rapidly in the assault echelon of an expeditionary operation.

- Provides surface-to-air weapons support for units engaged in special or independent operations.
- Provides for the separate deployment of subordinate batteries and platoons to accommodate special tactical situations and task organization.
- Plans and coordinates requirements for liaison and communications with appropriate commands to ensure the most effective integration of LAAD units within the integrated air defense system.
- Provides early warning of hostile air threats to other components of the air defense system.

BATTALION ORGANIZATION

The LAAD battalions are subordinate units of the Marine air control group (MACG). All Marine aircraft wings have one LAAD battalion except the 1st Marine Aircraft Wing. It has a LAAD battery vice battalion. The LAAD battalion is comprised of a battalion headquarters, headquarters and service (H&S) battery, and two firing batteries. See figure 1-1.

Battalion Headquarters

The battalion headquarters is organized to provide command of subordinate batteries and to accomplish command and staff functions necessary to fulfill the battalion's mission.

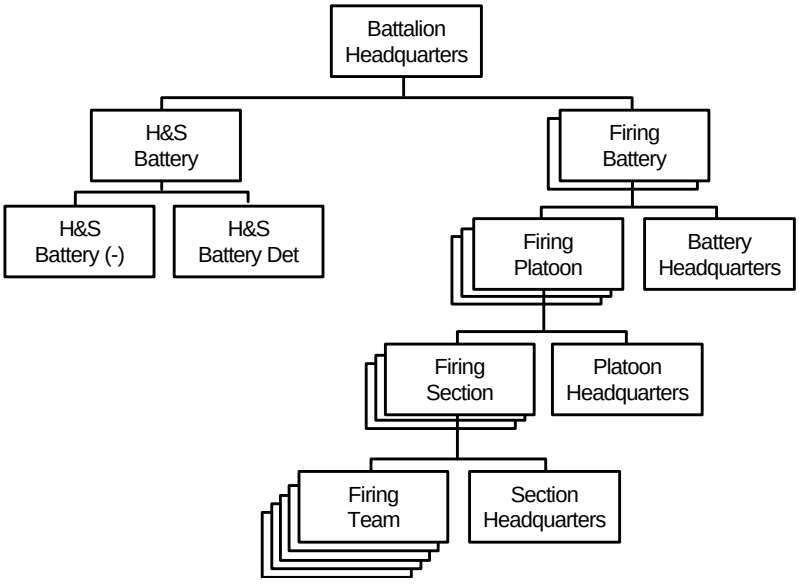


Figure 1-1. LAAD Battalion Organization.

Headquarters and Service Battery

The H&S battery is organized and equipped to provide the battalion with supply, logistics, communications, motor transportation, computer or information systems, and administrative support. It can be divided into a headquarters and service battery minus (-) and a headquarters and services battery detachment. Division allows the H&S battery to deploy separately to support two geographically separated firing batteries. Depending on the size and scope of the operation, the H&S battery may be augmented with personnel from the battalion headquarters for additional administrative, intelligence, operational, or logistical support.

Firing Battery

The firing battery provides the personnel and Stinger weapon systems. Each firing battery is composed of 30 Avenger and 15 man portable Stinger teams. Distribution of the Avenger and man portable firing teams is determined by the commander's task organization. Each firing battery has a battery headquarters and three firing platoons. Platoons are composed of a platoon headquarters and three firing sections. The platoon headquarters consists of the platoon commander, the platoon sergeant, and two radio operators or drivers.

The firing section is the *smallest tactical unit* of the LAAD battalion. Each firing section consists of a section headquarters and five firing teams. The section leader and two radio operators or drivers comprise the section headquarters.

The firing team consists of a team leader and a gunner/driver. Both team members require knowledge of basic field radio communications, target detection, and aircraft recognition. Normally, the gunner/driver fires the Stinger missile, allowing the team leader to evaluate targets and make engagement decisions. During periods of intense enemy air activity, both team members may act as gunners to increase the team’s rate of fire.

COMMAND RELATIONSHIPS

An understanding of command relationships is vital to all operations. The LAAD commander’s conduct of operations can vary greatly depending on who gives the LAAD unit its mission, who establishes air defense priorities and control measures, who establishes engagement criteria, who provides administrative and logistical support, and who plans for their employment. These aspects are

normally addressed by the existing or established command relationship.

The authority vested in a commander must be commensurate with the responsibility assigned (Joint Pub 0-2, *Unified Action Armed Forces [UNAAF]*). Inherent in command is the authority that a military commander lawfully exercises over subordinates and confers authority to assign missions and to demand accountability for their attainment. A commander can gain additional authority from his superior in the form of command relationships that place other commanders and their assets under his authority.

Command relationships strongly influence a commander's ability to carry out the mission. In fact, the command relationships established between LAAD unit commanders and other commanders provide the basic criteria that define the commander's conduct of LAAD operations.

Command relationships specify the degree of authority one commander has over another commander and are used to allocate assets (units) to a commander. Several commanders may exercise some degree of authority over a particular LAAD unit commander. Although each level of authority is important, operational control (OPCON), tactical control (TACON), and support are the command relationships most applicable to LAAD units. Although not command relationships, other levels of authority such as administrative control (ADCON) and direct liaison authorized (DIRLAUTH) are also critical to the LAAD unit in determining essential coordination relationships.

Operational Control

When a commander exercises operational control over a low altitude air defense unit commander, the commander has the authority

to direct the LAAD unit commander to accomplish specific missions, usually limited by function, time, or location. Inherent with operational control is the authority to exercise or delegate operational or tactical control of, establish support relationships for, and designate coordinating authorities to the attached or assigned low altitude air defense unit.

Operational control does not include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training. It may include such authority when specified in the assignment or attachment order.

The commander exercising operational control has the authority to—

- Give direction, as necessary, to carry out the assigned mission.
- Prescribe the chain of command.
- Task-organize, as necessary, to carry out the assigned mission.
- Employ tactically.
- Assign command functions.
- Plan for and coordinate the unit's actions.
- Suspend from duty and recommend reassignment of any officer.
- Establish an adequate system of control for local air defense or ground defense, and delineate such areas of operation.
- Delineate a functional responsibility.

Tactical Control

Tactical control is the command authority over assigned or attached forces, commands, or military capabilities or forces made available for tasking. Tactical control is limited to the detailed and usually local direction and control of movements or maneuvers necessary to accomplish assigned missions or tasks.

Tactical control is inherent in operational control. The commander exercising tactical control of a unit has the authority to control and direct the tactical movement of the unit and the application of the unit's organic weapons fires.

Tactical control does not provide organizational authority or authoritative direction for administrative and logistic support. The commander of the LAAD unit or the commander delegated administrative control continues to exercise command authorities unless otherwise specified in the attachment or assignment order.

Assignment or Attachment. An assignment or an attachment is simply a transfer of forces. A low altitude air defense unit can be assigned or attached to another unit under an operational control or tactical control status.

The relatively permanent placement of one unit into another organization outside the organic chain of command is known as an assignment. The difference between assignment and attachment is the period of time the relationship exists. An attachment is relatively temporary, while an assignment is more permanent. For example, a LAAD section deploying with a Marine expeditionary unit (MEU) is normally assigned OPCON to the MEU because the relationship is relatively permanent.

An attachment is the temporary placement of units or personnel in an organization outside the normal chain of command. Low altitude air defense units are usually attached when a purely support relationship is inadequate or the tactical situation makes it necessary for air defense assets to temporarily deploy with other units to accomplish the assigned mission. For example, a LAAD section may be attached TACON to a mission commander performing a heliborne assault, a noncombatant evacuation operation, or a raid. In these cases, a unit is attached because of the temporary duration of the transfer of forces.

Support

Support is a command authority. A support relationship is established by a superior commander between subordinate commanders when one organization should aid, protect, complement, or sustain another force while maintaining the normal chain of command. For example, the MAGTF commander may direct a low altitude air defense battery to be in direct support of a Marine regiment. In a support relationship, the battery commander can accomplish the mission and still maintain the normal chain of command within the battalion.

The MAGTF commander approves support relationships between the ground combat element (GCE) and the aviation combat element (ACE). He also establishes MAGTF air defense priorities before any low altitude air defense assets are given support missions. *A support relationship does not necessarily imply logistical or administrative support.* This responsibility is retained by the commander exercising administrative control of the unit.

There are four types of support relationships: general, direct, close, and mutual. The two support relationships most commonly used by low altitude air defense units are general support and direct support.

Close and mutual support relationships are not usually formally established within the MAGTF context; however, low altitude air defense units may find themselves in such relationships during joint or multinational operations.

General Support. General support is support given to the supported force as a whole, not just to a subdivision. The low altitude air defense unit commander should ensure that—

- Air defense priorities are established based on the needs of the entire force.

- Low altitude air defense units are not associated with the maneuvering of any particular component as this may leave a gap in air defense coverage.

- Low altitude air defense units maintain communications with the Marine air command and control system to ensure that critical information is disseminated to all levels within the integrated air defense system. The coordination for LAAD units in general support should consist of security, coordination with adjacent units, dissemination of early warning information, and advising units on passive defense and small arms defense from air attack.

- Logistical needs, such as the resupply of missiles, food, fuel, and maintenance support, are provided by the low altitude air defense battalion or battery headquarters and services detachment via the chain of command. Timely resupply may be difficult, since LAAD sections are normally dispersed widely throughout the integrated air defense system. When possible, receive support from adjacent or supported units to reduce the time it takes for critical resupply to reach the sections.

- Security from ground attack is coordinated with the supported unit. The LAAD commander should conduct liaison with the

commander whose zone of action they are operating in to ensure that units are aware that low altitude air defense units are moving through their zone of action.

Direct Support. Direct support is support given to another force that requires the supporting force to answer to the supported commander's request for assistance. In direct support—

- The supporting low altitude air defense unit is immediately responsive to the supported unit's requirements for air defense.
- The supported unit commander establishes local air defense priorities.
- Low altitude air defense units operate within the supported unit's zone of action.
- The supporting low altitude air defense units go where the supported unit goes in order to maintain coverage of the established air defense priorities.
- Low altitude air defense units maintain communications with the supported unit to receive critical information such as modifications to rules of engagement, early warning, cueing, and any essential intelligence.
- Low altitude air defense units coordinate local security requirements. Security is not always provided while in a direct support role.
- Low altitude air defense units may be directed to augment local security. The senior LAAD representative should brief the supported unit commander on the detrimental effects the lack of crew rest may have on the quality of air defense provided. The

supported unit commander should determine the priority for air defense versus perimeter security. This coordination should also provide LAAD units with proper procedures for maneuvering throughout the supported unit's zone of action.

- When low altitude air defense units in direct support are dispersed widely, it is difficult for the parent LAAD unit to provide logistical support even it they may retain administrative control. LAAD commanders in direct support should coordinate with supported unit commanders to enhance logistical support.

- Low altitude air defense units maintain communications with the Marine air command and control system, when feasible. This allows LAAD teams to receive critical early warning and cueing information.

General versus Direct Support

Establishment of Air Defense Priorities. In a general support role, air defense priorities are established by the MAGTF commander. In direct support roles, the supported unit commander establishes local air defense priorities in concert with the MAGTF commander's guidance.

Planning for the Employment of Air Defense Assets. In general support, the low altitude air defense unit commander plans for the employment of air defense assets in context with the MAGTF/ACE commander's guidance. In direct support, the LAAD commander plans for the employment of air defense assets in coordination with the supported unit commander's concept of operations and scheme of maneuver.

Establishment of Liaison and Communications. In general support, low altitude air defense units establish communications with

Marine air command and control system nodes where available or appropriate. In direct support, LAAD units maintain liaison or communications with the supported unit commander and any Marine air command and control system (MACCS) nodes that are available.

Planning for Logistical Support and Physical Security. In general support, the arrangement for logistical support and physical security is established by the operations order. In direct support, coordination for logistical support and physical security is made with the supported unit.

Close Support. Close support is that action of the supporting force against targets or objectives which are sufficiently near the supported force as to require detailed integration or coordination of the supporting action with fire, movement, or other actions of the supported force. For example, a close support relationship could be established between a LAAD battery and an Army air defense artillery battery given the mission of protecting a vital area from air attack. A close support relationship would exist to facilitate integration and coordination of their respective surface-to-air fires and surveillance sectors.

Mutual Support. Mutual support is that support units render each other against an enemy, because of their assigned tasks, their position relative to each other and to the enemy, and their inherent capabilities. Mutual support occurs continuously throughout the battlespace. For example an infantry company provides ground security to a LAAD section that, in turn, provides air defense to the infantry company.

Administrative Control. Administrative control includes more than authority over administrative matters and personnel management. It is the direction or exercise of authority over subordinate or other organizations with respect to administration and support.

ADCON includes organization, control of resources and equipment, personnel management, unit logistics, individual and unit training, readiness, mobilization, demobilization, and discipline, and other matters not included in the operational missions of the subordinate or other organizations. The degree of administrative control may be delegated by the MAGTF commander to subordinate commanders and exercised at any echelon at or below the commander's level.

When LAAD teams are dispersed widely over the battlefield, the commander delegated administrative control has a challenging mission. The commander is not only responsible for getting supplies to LAAD units, but the commander must also determine resupply priorities and, if applicable, determine which units will receive items with limited availability.

Direct Liaison Authorized. DIRLAUTH is the authority granted by a commander (any level) to a subordinate to directly consult or coordinate an action with a command or agency within or outside of the granting command. DIRLAUTH is more applicable to planning than operations and always carries with it the requirement of keeping the commander granting direct liaison authorization informed. For example, the commander exercising operational control may designate DIRLAUTH to a LAAD unit to coordinate administrative or logistical support from another unit in close proximity. Direct liaison authorized is a coordination relationship, not an authority through which command may be exercised.

Figure 1-2 on page 1-14 depicts the command relationships as applicable to the LAAD unit.

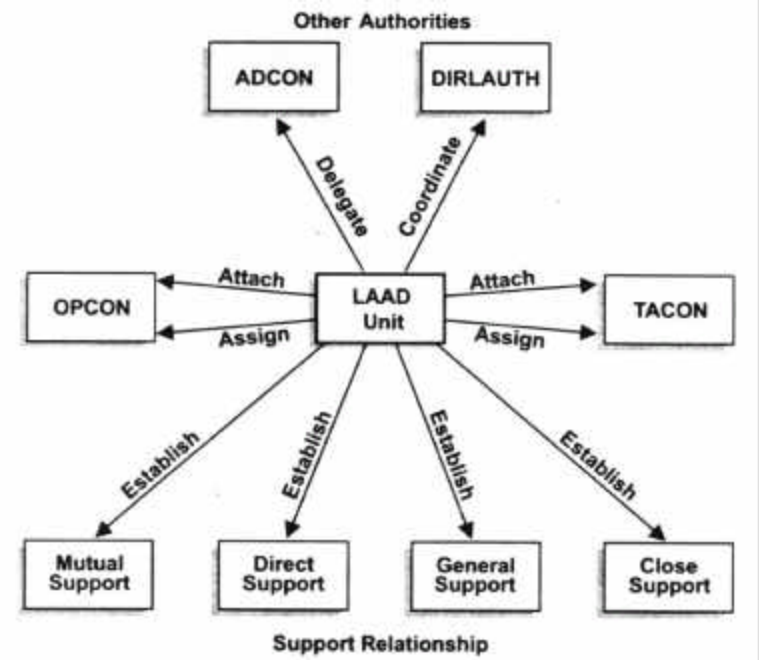


Figure 1-2. LAAD Command Relationships.

BASIC CRITERIA FOR LAAD UNIT EMPLOYMENT

Four specific questions a unit commander must be able to answer are—

Q. Who do I work for?

A. A low altitude air defense unit commander receives his mission and tasks from the commander who exercises OPCON authority as established by a command relationship.

Q. What is my mission?

A. The low altitude air defense unit commander receives the mission from the commander who exercises operational control. That commander may be the LAAD unit commander's immediate superior commander. Missions are often assigned in the form of support relationships. When the LAAD commander is assigned a support relationship, the chain of command established by a command relationship does not change. The LAAD unit commander remains under the command of the commander with operational control regardless of the support relationships established. A support relationship simply indicates which unit gets priority benefit of the low altitude air defense unit’s capabilities.

Q. Who establishes the criteria on which my teams base their engagement decisions?

A. Low altitude air defense teams can engage aircraft based on the rules of engagement. Air defense control measures assist air defenders in making engagement decisions. Air defense control measures are established by the ACE commander; however, if LAAD units participate in operations that do not allow them to maintain communications with the Marine air command and control system, the ACE commander may delegate the authority to establish local air defense control measures to another commander on the scene.

Q. Who is going to provide my unit with administrative and logistics support?

A. The commander delegated administrative control over the low altitude air defense unit is responsible for providing administrative and logistical support. The establishing directive should delineate exactly who is providing logistical and administrative support to whom and how much will be provided. However, since LAAD units are often dispersed widely across the battlefield, the commander with administrative control may make arrangements for LAAD units to be resupplied by the supported unit or through units operating in close proximity.

Table 1-1 summarizes the answers to some questions LAAD unit commanders may have when operating under different command relationships.

Information in the table contains broad guidelines. Detailed relationships and responsibilities will always be mission, enemy, terrain and weather, troops and support available, and time available (METT-T) dependent. For all command relationships, the unit commander delegated ADCON IAW the attachment or assignment order or the establishing directive provides the LAAD unit with logistical and administrative support.

Table 1-1. LAAD Command Relationship Matrix.

	Who establishes air defense priorities and control measures?	**Who gives direction and exercises local control of LAAD unit?**	**Who gives LAAD unit its mission?**	**Who does planning for the employment of LAAD assets?**	**With whom should LAAD unit establish communications or liaison?**
OPCON	Cdr with OPCON IAW MAGTF cdr's guidance	Cdr with OPCON unless TACON has been delegated	Cdr with OPCON	Cdr with OPCON unless otherwise stated in attachment or assignment order	Cdr exercising OPCON
TACON	Cdr with OPCON	Cdr with TACON	Cdr with OPCON	Cdr with OPCON unless otherwise stated in attachment or assignment order	Cdr exercising TACON and any MACCS nodes available
Direct Support	Supported unit cdr establishes local priorities IAW MAGTF cdr's guidance	Supported cdr unless otherwise stated in establishing directive	Supported cdr	LAAD unit cdr IAW supported cdr's concept of operations and scheme of maneuver	Supported cdr and any MACCS nodes available
General Support	MAGTF cdr	LAAD unit cdr	Supported cdr	LAAD unit cdr IAW MAGTF cdr's guidance	Supported cdr(s) and any MACCS nodes available

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Chapter 2

Stinger Weapon System

The low altitude air defense battalion's ability to task-organize its units, coupled with Stinger's inherent mobility and flexibility in employment, give the MAGTF commander a maneuver-oriented low altitude air defense capability that can support all types of tactical operations.

DESCRIPTION

The Stinger weapon system is a man portable (34.5 pounds), shoulder-fired, supersonic missile system designed to counter high-speed, low-level, ground attack aircraft. Stinger is effective against helicopters, unmanned aerial vehicles, and observation and transport aircraft. Once fired, Stinger uses proportional navigation algorithms to guide the missile to a predicted intercept point. The Stinger missile can be used as a man portable air defense system (MANPAD) when the weapon is fired from the gunner's shoulder, mounted aboard the Avenger weapons system, or mounted in the light armored vehicle-air defense variant (LAV-AD).

Stinger reprogrammable microprocessor (RMP) (the Stinger missile's most recent variant) is a dual-channel, passive infrared (IR) and ultraviolet (UV) tracking seeker and proportional navigational guidance missile system. The spectral discrimination of the seeker detector material, when supercooled by the argon gas in the battery coolant unit, enables Stinger to acquire, track, and engage targets in any aspect (incoming, outgoing, or crossing). Stinger is a true "fire

and forget" missile, requiring no inputs from the gunner once the weapon is fired. This allows the gunner to take cover, move to an alternate position, or engage additional targets. Stinger also possesses an integral identification, friend or foe (IFF) subsystem to assist the gunner in identifying friendly aircraft. The Stinger missile is comprised of the guidance, tail, propulsion, and warhead sections. The tail assembly consists of four folding tail fins that provide roll and stability while the missile is in flight. See figure 2-1.

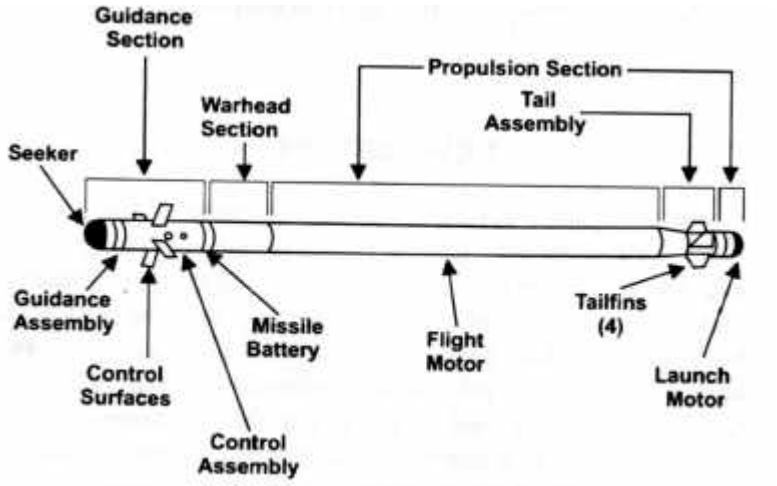


Figure 2-1. Stinger Missile.

Guidance Section

The guidance section consists of a seeker assembly, a guidance assembly, a control assembly, a missile battery, and four control surfaces (or wings) that provide in-flight maneuverability.

Warhead Section

The warhead section consists of a fuze assembly and the equivalent of one pound of high explosives encased in a pyrophoric titanium cylinder. The fuze is extremely safe and makes the missile exempt from any hazards of electromagnetic radiation to ordnance conditions. The warhead can be detonated by penetrating the target, impacting the target, or self-destruction. Self-destruction occurs 15 to 19 seconds after launch.

Propulsion Section

The propulsion section consists of a launch motor and a dual-thrust flight motor. The launch motor ejects the missile from the launch tube. The missile coasts a safe distance (about 9 meters) from the gunner before the dual thrust flight motor ignites and provides a sustained 22 gravity acceleration that arms the missile. After the gunner arms the missile, a sustained flight phase maintains missile velocity until the propellant is consumed. Then the missile enters a free flight period in which the motor has burned out, but the missile maintains a degree of maneuverability prior to interception or self-destruction.

STINGER WEAPON ROUND

The Stinger weapon round (fig. 2-2 on page 2-4) is shipped from the ammunition supply point in a crush resistant, hardened, reusable aluminum box. It is certified for immediate firing. This box is called the weapon round container, but is more commonly referred to as a mono box. Stinger rounds are packaged in a thin, wood-sided box surrounding a foam insert in which the missile is packed. The boxes are known as “lettuce crates” because of their similarity to produce boxes. The Stinger weapon round consists of a missile

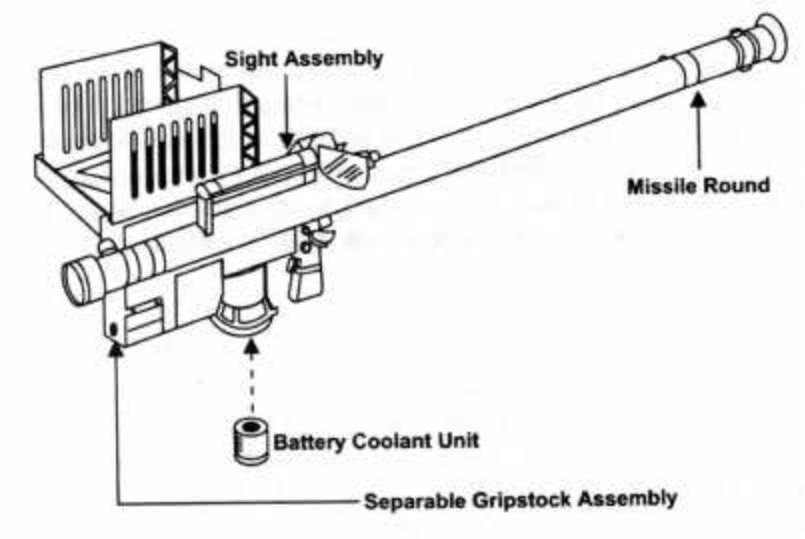


Figure 2-2. Stinger Weapon Round.

round, a separable gripstock assembly, and up to three battery coolant units (BCUs). The gripstocks are shipped separately from the missile to enhance security during shipping.

Missile Round

The missile round consists of a Stinger missile sealed in a launch tube with an attached sight assembly. The sight assembly allows the gunner to range and track an aircraft. Two acquisition indicators are mounted on the sight assembly. The first, a speaker, allows the gunner to hear the IR acquisition signal and IFF tones when interrogations are made through the IFF subsystem. The second indicator is a bone transducer that allows the gunner to "feel" the IR acquisition signal on the cheekbone. Also attached to the sight is a clear plastic

eye shield that protects the gunner's left eye when the missile is fired.

Separable Gripstock Assembly

The gripstock consists of the gripstock assembly and the IFF antenna assembly. The gripstock assembly contains all of the circuits and components required to prepare and launch the missile as well as the interface for the IFF subsystem. The gripstock is of a clamshell design so that internal components and circuitry within the gripstock can be serviced by qualified technicians at depot-level maintenance. After the missile is launched, the gripstock is removed from the launch tube for attachment to a missile round.

When the IFF antenna assembly is unfolded and the IFF interrogator is connected to the weapon, the gunner can interrogate aircraft and receive coded replies. The gripstock also houses the auxiliary unit interface, where the reprogrammable microprocessor read-only memory (ROM) module is located. It is accessed through an interface connector cover on the left side of the gripstock. The read-only memory module provides not only additional capability, but built-in economy into the Stinger missile program as a whole. Since the missile is fully digital, the ROM module allows for advanced guidance and tracking technology to be added to the missile without purchasing new missiles. Advanced counter-countermeasure technology can update current missiles in the same manner. The read-only memory interface allows technicians to access the electronics section and install the updated modules into the missiles. This is not an operator-level function and requires support from the Naval Warfare Systems Center.

Battery Coolant Unit

The battery coolant unit contains a thermal battery that provides power for pre-flight system operations and a supply of argon gas to cool the IR detector in the missile seeker. Once activated, the BCU supplies electrical power and seeker coolant until the missile is launched or for a maximum of 45 seconds. The battery coolant unit is removed from the gripstock BCU well and discarded immediately after use.

IFF SUBSYSTEM

The identification, friend or foe subsystem allows the gunner to electronically interrogate an aircraft to determine if the aircraft is a friend, possible friend, or unknown. See figure 2-3. The IFF subsystem notifies the gunner of the results of an interrogation using a sequence of audible tones. Once the gunner issues an IFF challenge, the remainder of the sequence is automatic. The IFF subsystem *does not* identify hostile aircraft or prevent Stinger from firing at friendly aircraft.

The identification, friend or foe subsystem is coded in either a complex, cryptographic secure form (Mode IV) or a simpler form (Mode III). All United States combat aircraft are equipped with transponders to provide Mode III and Mode IV replies; however, some aircraft, including commercial and allied nation aircraft, can only provide Mode III replies. Since Mode IV is secure, a friendly Mode IV reply is considered a “true friend” reply. A Mode III reply is considered an “unknown” reply.

A Stinger’s IFF response or lack of response does not constitute authority to fire on a target. IFF responses merely assist gunners in determining the true nature of a target. Weapons control statuses,

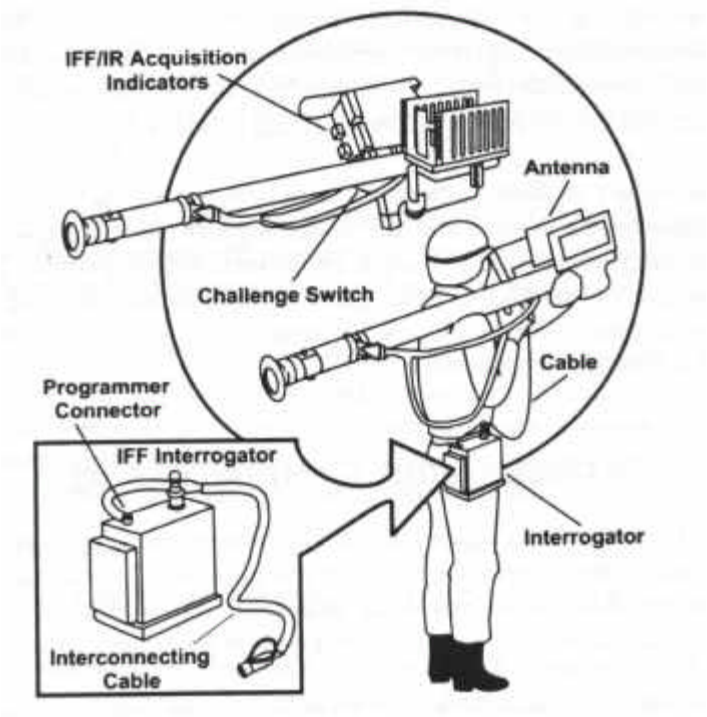


Figure 2-3. IFF Subsystem.

identification criteria, and rules of engagement for the operation provide the guidelines for identification and engagement of targets.

The interrogator can be programmed to operate in Mode IV only, or simultaneously in Mode III and Mode IV. It can operate in Mode IV for 2 days, operating on two sets of IFF Mode IV codes, without being recharged or reprogrammed. Within 2 days, a recharged battery should be installed and the unit reprogrammed. Unless reprogrammed, the system automatically shifts from Mode IV to Mode III. It remains in Mode III until batteries are discharged or the

system is reprogrammed. Before an IFF interrogator is reprogrammed, a freshly charged battery pack should be inserted. Battery packs should be charged for a minimum of 4 hours. A fully charged battery normally provides for approximately 800 interrogations or 30 days of battery power before requiring recharge.

Programmer or battery chargers, code input computers, shipping and storage containers, and key codes support the IFF subsystem. This equipment is located at the firing section headquarters. Each firing section has 10 IFF interrogators. Unit standing operating procedures specify distribution of interrogators between firing teams and the section headquarters.

STINGER NIGHT SIGHT (AN/PAS 18)

The AN/PAS-18 is a rugged, lightweight thermal imaging sight that mounts on the Stinger weapon round to provide a 24-hour mission capability. The unit is designed to detect both fixed-wing and rotary-wing aircraft beyond the maximum range of the Stinger missile.

The primary function of the AN/PAS-18 is to enhance the operation of the Stinger missile system. It operates in the same region of the electromagnetic spectrum as the Stinger missile and detects any infrared source the missile can detect. This capability also allows a secondary function of night area surveillance.

Operating passively in the infrared spectrum, the AN/PAS-18 allows the gunner to perform target acquisition and weapon firing during total darkness and under reduced visibility conditions (e.g., fog, dust, and smoke). In a clear sky environment, day or night, the AN/PAS-18 can detect fixed-wing aircraft at high altitude in a tail aspect to the horizon. In optimal conditions, detection can be in excess of 20 to 30 kilometers. The AN/PAS-18 is least effective in

detecting fixed-wing aircraft at low altitude coming directly toward the operator. As the exhaust plume is hidden by the body of the aircraft, the aircraft may not be detected until it is within 8 to 10 kilometers of the operator. The detection range increases when an aircraft's aspect changes, providing a view of the plume (side aspect to rear aspect).

The AN/PAS-18 has a 12 by 20° field of view. It is ready for operation within 10 seconds of powering up. The receiver is powered by a lithium battery that provides 6 to 12 hours of battery life.

The AN/PAS-18 is a second generation night vision device and does not have the resolution to make aircraft identification determinations. Due to bulk of the device, long periods of searching and scanning should be avoided. The weight of the night sight and the missile reduces the time a gunner can shoulder the weapon.

TACTICAL DEFENSE ALERT RADAR

The tactical defense alert radar (TDAR) is not a component of the Stinger weapon system but is an associated piece of equipment used to detect targets. The tactical defense alert radar is a lightweight, early warning detection device designed to be a rugged, transportable radar system that provides LAAD units with an organic cueing, alerting, and early warning capability. The TDAR is designed to provide a surveillance capability to the unit when early warning and cueing is not available from more capable sensors such as the long-range air surveillance radars of the tactical air operations center.

The tactical defense alert radar consists of an antenna array, rotating pedestal, quadripod, transceiver unit, and display terminal. See figure 2-4 on page 2-10. The display terminal can be remoted over 100 meters from the radar transceiver. While the TDAR is transportable

in the high-mobility, multi-purpose wheeled vehicle (HMMWV), it cannot be operated from the back of a moving HMMWV. The TDAR can be powered by the HMMWV portable generator, commercial power, or 24-volt, direct current power supply.

The tactical defense alert radar provides low altitude air defense units with a 20 kilometer detection capability against fixed-wing aircraft and an 8 to 10 kilometer detection capability against rotary-wing aircraft and unmanned aerial vehicles. The tactical defense alert radar's maximum detection altitude is 10,000 feet. Although the TDAR may be employed from the firing battery to the firing section level, it is ideal for use at the section level due to its relatively short range.

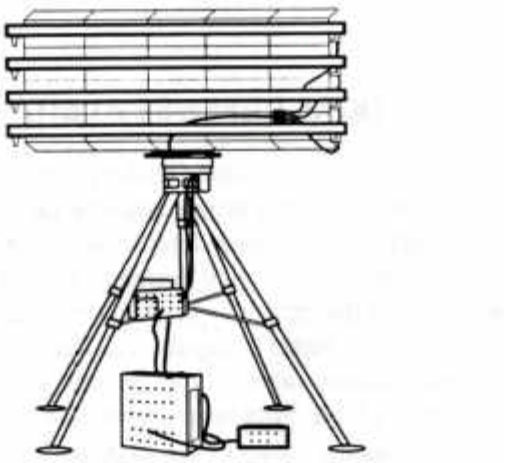


Figure 2-4. Tactical Defense Alert Radar.

REMOTE TERMINAL UNIT

A common tactical air picture is developed from sensor systems within the joint air defense network. Radar-equipped units of the Marine air command and control system, Air Force command and reporting centers and elements, the airborne warning and control system, and Navy Aegis ships are among the agencies and systems that contribute to this picture. The air picture developed by the radars is shared among air defense units through a network of data links such as tactical digital information link (TADIL) A, B, and J. For example, an E-3 AWACS aircraft may send air tracks to other air defense units via TADIL A, where the picture is combined with the presentation from each units' own radar picture. At the tactical air operations center, air surveillance information generated from its organic sensors and from other data link participants is forwarded to a ground-based air defense unit via Army tactical data link 1. This information can be combined with the ground-based air defense unit's organic radar picture and sent to low altitude air defense units via ground-based data link (GBDL). Transferring the air track data to the Stinger units provides Stinger sections with a recognized air picture that provides early warning and cueing to assist in the engagement process.

Ground-based data link is passed to low altitude air defense units through the remote terminal unit. The remote terminal unit is a ruggedized, mircrocomputer or radio combination integrated system. It has the capability to retransmit a ground-based data link signal. This enables a section to "daisy chain" ground-based data links to distant elements and to send local air defense radar pictures back through the GBDL network and into the common tactical air picture.

Ground-based air defense units can provide a ground-based data link capability that enhances the situational awareness of remotely

positioned gunners by providing them with a low- to medium-altitude air picture and weapons cueing. The source of this data link could be a ground-based air defense fire unit configured with a fire direction unit, a stand-alone continuous wave acquisition radar-based fire direction unit, a stand-alone TDAR-based fire direction unit, or a combination of these configurations.

The short-range air defense remote terminal unit configuration consists of a VHF radio system and the remote terminal unit computer that receives the air picture, converts it to a local geographic position, and presents the common tactical air picture in near-real-time using common symbology on the situational display. The remote terminal unit computer is connected to a VHF-FM frequency-hopping radio (i.e., SINCGARS [single-channel ground and airborne radio system]) through a digital data buffer that processes the information received over ground-based data link for display on the terminal.

LAAD TEAM ORGANIC VEHICLE (MANPAD)

In addition to being able to shoot and communicate, low altitude air defense units must also be able to move to accomplish their mission. Low altitude air defense teams should deploy with their organic HMMWVs whenever possible.

Although not a component of the Stinger missile system, the HMMWV should be considered part of the weapon system. The HMMWV allows the low altitude air defense team to—

- Keep pace with a rapidly moving ground force.
- Move rapidly to alternate positions.
- Carry its full, basic load of six missiles.

- Reach missile resupply points.

- Carry the ancillary equipment and supplies necessary to accomplish the team mission (e.g., batteries, ammunition, cryptographic equipment, radios, IFF equipment).

Situations which force the team to deploy without the HMMWV should be minimized. Without its vehicle, the low altitude air defense team can fulfill only a portion of the mission for which it was designed and equipped. If the team is to be employed without the vehicle, extensive coordination and planning should be conducted to provide the logistical support necessary to continue the mission.

LAAD TEAM ORGANIC VEHICLE (AVENGER)

The Avenger weapon system includes a 360°, rotating turret mounted on a heavy HMMWV chassis with an upgraded suspension and 200 amp alternator. The baseline configuration consists of a gunner's turret with missile pods mounted on each side. Each missile pod, called the standard vehicle-mounted launcher, can hold four missiles that can be removed and fired in the MANPAD employment configuration. The rotation of the turret and the elevation of the standard vehicle-mounted launcher is accomplished by electric motors powered by batteries carried in the base of the weapons system. The vehicle's power system is in parallel with the Avenger battery set. A .50 caliber machine gun is also part of the system armament. It affords a measure of self-protection by providing additional coverage of the Stinger missile's inner launch boundary. See figure 2-5 on page 2-14.

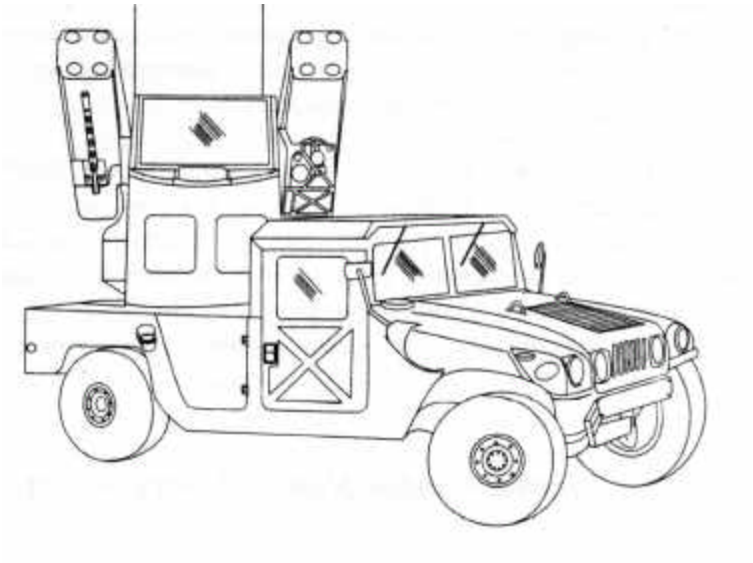


Figure 2-5. The Avenger Weapon System.

The Avenger weapons system has an unobstructed, 360° field of fire and can engage at elevations between -10 and +70°. The modular design of Avenger allows complementary missiles and/or rockets to be installed on the launch arms in addition to (or in place of) Stinger missiles. The gunner has sufficient visibility out of the turret for visual target acquisition, tracking, and engagement. A combination glass sight is used through which the gunner looks to aim the missiles and on which a driven reticle display is projected. The driven reticle indicates the aiming point of the missile seeker to confirm to the gunner that the missile seeker is locked onto the desired target.

Avenger's sensor package includes a forward-looking, infrared (FLIR), carbon dioxide, eye-safe laser range finder and a video autotracker. These sensors provide Avenger with a target acquisition capability in battlefield obscuration at night and in adverse weather. Range data from the laser range finder is processed by the Avenger fire control system to provide a fire permit for missile and gun use. A driven reticle and other data are displayed on the forward-looking infrared display in the same manner as the optical sight.

The turret drive is gyro-stabilized to automatically maintain the missile pod aiming direction regardless of the vehicle motion. The turret drive control is operated by the gunner with a hand controller on which the missile and gun controls are placed. The gunner can transfer tracking control to an automatic turret drive control system that uses signals for the uncaged missile seeker of the FLIR video autotracker to track the target until the gunner is ready to fire. The firing sequence is entirely automated, including superelevation and lead, so that the gunner need merely push the fire button to initiate the fire sequence and immediately select and prepare the next missile for firing. These systems enable Avenger to accurately and rapidly launch missiles.

Avenger is equipped with two VHF-FM frequency-hopping radios (i.e., SINCGARS) and an integrated remote terminal unit. When this capability is tied into the Marine air command and control system, Avenger can be configured to automatically slew to a target that appears on the radar display. This capability is known as "slew to cue." Targets pointed out by ground-based air defense units, tactical air operations center operators, or the LAAD section leader can be accepted or rejected by the gunner. Until the gunner responds to the cue, the gunner maintains complete control of the Avenger turret. If the gunner accepts a pointer, the turret automatically slews to the azimuth of the target. The gunner then resumes

control of the turret and completes the engagement process by acquiring, tracking, and engaging the target. "Slew to cue" is a capability inherent to any radar picture.

EQUIPMENT INITIATIVES

Among the planned improvements to low altitude air defense equipment is the common aviation command and control system (CAC^2S). Another initiative in the realm of low altitude air defense, although not organic to the Marine aircraft wing, is the air defense variant of the light armored vehicle.

Common Aviation Command and Control System

The CAC^2S will be fielded to all major Marine air command and control agencies and activities to replace their current command and control suites. CAC^2S is envisioned to be a multi-role air command, control, and communications suite that will support the necessary software and external interfaces to conduct all facets of Marine air command and control from a single, modular system. When equipped with a common aviation command and control system node, a low altitude air defense unit's situational awareness will increase dramatically. The unit will be able to view and contribute to the common tactical air picture; pass and receive data link commands via TADIL A, B, or J; receive the air tasking order; and review subsequent airspace control orders and special instructions.

Light Armored Vehicle (Air Defense Variant)

The light armored vehicle (air defense variant) consists of what equates to an Avenger turret mounted on the chassis of a light armored vehicle (LAV)-25. The system maintains all the capabilities of the LAV-25 and Avenger with subtle differences. The turret

is modified to fit the light armored vehicle and does not have the large crew space of Avenger. The crew compartment inside the light armored vehicle allows two operators with separate windows in the turret to search and scan the air from inside the vehicle. The turret can slew 360° and has the same standard vehicle-mounted launcher configuration as Avenger. The .50 caliber machine gun was replaced by a 20 millimeter chain gun that provides antiair capability against aircraft within the inner launch boundary of a Stinger and a significant ground target engagement capability. Each standard vehicle-mounted launcher carries four Stinger missiles that can be fired in rapid succession. (See fig. 2-6.) The LAV-AD can shoot on the move at speeds up to 30 miles per hour and can operate as an amphibious vehicle. The crew consists of a vehicle commander, two Stinger gunners, and a driver. The crew can

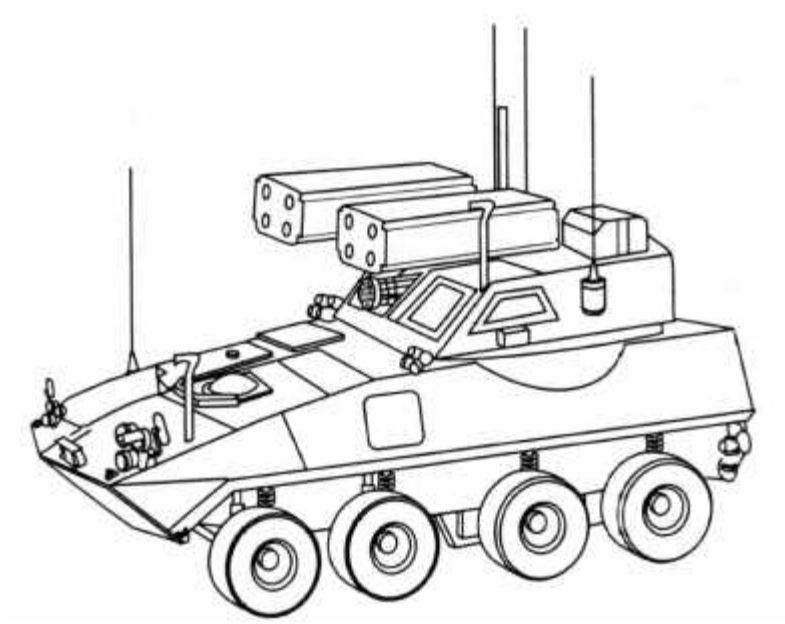


Figure 2-6. LAV-AD.

communicate within the vehicle by intercom and externally via HF, VHF/FM, and UHF communications nets. The LAV-AD SINCGARS radio suite is similar to the Avenger's radio suite and allows for the integration of the remote terminal unit and ground-based data link.

Although the LAV-AD is not an organic weapon system to the Marine aircraft wing, it is important to be aware of its associated organization, configuration, and operating characteristics. Stinger gunners and other Marines with Stinger backgrounds could be assigned to the light armored reconnaissance battalion to employ the LAV-AD. Although the tactics, techniques, and procedures associated with LAV-AD operations are still under development, it is likely the LAV-AD will be used in much the same manner as an Avenger-equipped LAAD unit in direct support of a maneuver element.

The current concept of employment states that the primary mission of the LAV-AD is to provide local air defense for the light armored reconnaissance battalion, operating well forward of the fire support coordination line. It also outlines the planned table of organization that calls for an antiair warfare officer to command the LAV-AD company and Stinger staff noncommissioned officers and gunners to serve as crewmembers.

Chapter 3

Planning

The MAGTF provides protection against aircraft and missile attack through the development of an integrated air defense system. Key to this tenet is the detailed yet flexible planning necessary to ensure the integrated air defense system provides defense in depth. Weapons are employed to be mutually supporting. Command functions are centralized, while control of assets is decentralized to the lowest practical level. Low altitude air defense units significantly contribute to the planning and execution of integrated air defense operations. FMFM 5-70, *MAGTF Aviation Planning*, discusses planning requirements for the aviation combat element. Marine Corps Order (MCO) 3501.9B, *Marine Corps Combat Readiness Evaluation System* (MCCRES), Volume VIII, outlines specific planning requirements for the low altitude air defense battalion. Although the planning activities for LAAD, as outlined below, are sequential, many are conducted simultaneously.

INITIAL PLANNING

After receiving an initiating directive from the MAGTF commander (in situations involving amphibious operations) or after receiving an operation plan's initiating order, LAAD planners begin the initial planning phase. Considerations for this phase include—

- Analyzing the assigned mission, to include the aviation combat element and MAGTF missions, commanders' intent, and concept of operations to derive specified and implied tasks.

- Requesting the MAGTF or supported unit commander's guidance concerning vital areas to be defended and assisting in the identification of air defense priorities.

- Determining the mission, concept of operations, scheme of maneuver, and disposition of defended assets or supported units.

- Conducting liaison and initiating coordination efforts with the amphibious task force to determine low altitude air defense requirements for emergency air defense of the amphibious task force.

- Developing the aviation estimates of supportability. Low altitude air defense unit input should summarize significant aspects of the situation as they might influence any course of action proposals and should evaluate how low altitude air defense units can best be employed to support the contemplated courses of action. Prepared for the ACE commander by the tactical air command center's future plans section, the aviation estimates of supportability provide an end product that includes a recommended course of action for the MAGTF commander. At a minimum, the aviation estimates of supportability will include—

  - The contemplated course(s) of action that can best be supported by the aviation combat element.

  - Salient disadvantages of less desirable courses of action.

  - Significant aviation (to include command and control) limitations and problems of an operational or logistic nature.

INTELLIGENCE PLANNING

Low altitude air defense intelligence planning focuses on the enemy's air order of battle and capabilities. Intelligence planning considerations will include—

- Examining the enemy's capabilities with respect to MAGTF capabilities, limitations, and intentions. Efforts should address air, ground, and electronic orders of battle; reconnaissance capabilities; and terrorist or unconventional warfare capabilities.
- Developing information requirements in the form of simple, concise requests.
- Examining threat capabilities, limitations, weapons, tactics, and doctrine and accounting for these factors when developing the battalion's concept of operations.
- Conducting a well-planned intelligence preparation of the battlespace.

COMMUNICATIONS PLANNING

Low altitude air defense units require extensive communications for air defense coordination within the Marine air command and control system. Information on low altitude air defense voice communications is presented in appendix A. Planning considerations for communications connectivity include—

- Developing necessary communications connectivity for deployed LAAD units. This includes single-channel radio and ground-based data link connectivity with supported units and adjacent Marine air command and control system agencies.

- Identifying cryptographic hardware and software necessary for secure communications.

- Identifying alternative paths of communication available for use should the primary means be unavailable or unusable.

AIR DEFENSE SPECIFIC PLANNING

Surveillance capabilities of radar-equipped agencies within the MAGTF, amphibious task force, and joint force that can provide early warning and cueing to low altitude air defense units must be considered.

Positions must be determined for low altitude air defense battery commanders, platoon commanders, and section leaders. These positions should enhance control of subordinate units; allow for coordination with adjacent Marine air command and control system agencies and supported units; and facilitate critical information flow within the integrated air defense system.

Lame duck procedures must be established for friendly aircraft when their communications, navigation, and IFF capabilities are degraded or inoperable because of battle damage or equipment malfunction. These procedures allow friendly aircraft to safely ingress through a MAGTF-controlled airspace.

Lame duck procedures must be well-planned (detailed but simple), well-briefed, and disseminated to all friendly aircrews and operators within the integrated air defense system and the Marine air command and control system. Procedures must allow for different situations as an aircraft with considerable battle damage may be unable to reach numerous control points at specific altitudes and air speeds. Aircrews must understand that failure to adhere to lame

duck procedures may result in engagement by friendly air defense systems.

The impact of airspace control measures, air defense measures, and air defense procedures on low altitude air defense operations must be evaluated.

The most effective grid reference system and reporting procedures for manual cross tell must be determined. Manual cross tell procedures are outlined in appendix B.

Combat service support procedures that support the low altitude air defense units' concepts of employment and operations to include missile resupply, maintenance, and replacement of combat essential supply items must be developed.

The air defense appendix to the operations order (based on an analysis of the enemy air order of battle and own systems' capabilities and limitations) must be developed. Emphasis should be placed on—

- Centralized or decentralized operations procedures.
- Autonomous operations procedures.
- Rules of engagement.
- Air defense warning conditions.
- Air defense states of alert.
- Air defense weapons control statuses.
- Air defense identification procedures.

- Lame duck procedures.
- Air command and control casualty plans or procedures.
- Weapons engagement zone configuration.
- Methods of coordination or deconfliction.
- Return to force procedures.
- Emissions control measures.
- Track telling or cross tell procedures.
- Data link configuration, connectivity, and priority.
- Communications prioritization.
- Control procedures.
- Agency casualty plans.
- Engagement authority.
- Identification authority.

WEAPONS EMPLOYMENT PLANNING

Commanders determine the best use for the MAGTF's limited organic air defense resources. Air defense of the MAGTF should achieve a balance between defensive effectiveness and economy of force. LAAD weapon employment planning is a command responsibility.

Developing Air Defense Priorities

A MAGTF commander facing an air threat must plan for the employment of the air defense assets. The MAGTF commander evaluates the mission, the unit's assets, and the available air defense assets when establishing air defense priorities. This determination is based on criticality, vulnerability, recuperability, and the threat.

Criticality is the degree to which the asset is essential to mission accomplishment. To determine criticality, the commander prioritizes unit assets by considering which of them, if damaged or destroyed—

- Are capable of preventing the execution of the unit's mission.
- Will cause immediate and serious interference with execution of the unit's mission.
- Can ultimately cause serious interference with the execution of the unit's mission.
- Could cause limited interference with the execution of the unit's mission.

Vulnerability is the characteristics of a system that cause it to suffer a definite degradation (incapability to perform the designated mission) as a result of having been subjected to a certain level of effects in an unnatural (manmade) hostile environment. It is the degree to which an asset can survive on the battlefield. Consideration should be given to the asset's survivability after attack, its specific role in the overall operation, the degree to which the asset can disperse or displace to another position, the degree to which it can provide its own air defense, and the amount of protection afforded by passive air defense measures (cover, camouflage, concealment, dispersion, deception, and protective construction).

Recuperability is the degree to which the asset can be recovered from inflicted damage. Recuperability is measured in terms of time, equipment, and available manpower.

Threat characteristics are used to determine which weapon(s) provide the most economical air defense of the asset. Targeting information provided by intelligence estimates, historical enemy attack methods, enemy location and strength, type of enemy aircraft and ordnance, and enemy doctrine are all useful in determining which assets require active air defense protection.

Developing the Air Defense Plan

Once the supported commander prioritizes assets from an air defense standpoint, the supported commander and the supporting LAAD unit commander begin developing the air defense plan. It should address command and control warfare strategies, detailed weapons control and engagement procedures, guidance for employment of weapon systems, delineation of responsibilities, and interface relationships for exchanging air defense information.

The employment principles of weapons mass, weapons mix, mobility, and integration provide the basis for air defense planning and for the employment of air defense weapons. The MAGTF's success in attaining and maintaining air superiority is determined by how these principles are applied.

Weapons Mass. Weapons mass is achieved by allocating sufficient air defense resources to successfully defend vital assets.

Weapons Mix. Weapons mix offsets the limitations of one air defense system with the capabilities of other air defense systems. Defending an asset with the proper mix of air defense weapons complicates the enemy's strategy. An effective mix of air defense

weapons forces enemy pilots to defend themselves against several types of air defense weapons in order to accomplish their missions. The MAGTF uses fighter aircraft, surface-to-air missiles, small arms, and crew-served weapons to achieve an effective air defense weapons mix.

Mobility. Mobility permits military forces to move from place to place while retaining the ability to fulfill their primary mission. Air defense systems should be highly mobile and rapidly deployable to provide continuous protection for maneuver elements and to enhance their own survival.

Integration. Integration is the close coordination of effort and unity of action that results in the most efficient use of each individual air defense system within the total air defense plan. The result of proper integration is the conservation of air defense fires by eliminating unnecessary multiple engagements of the same target by different air defense units.

Developing the LAAD Employment Plan

When positioning individual fire units to defend a specific asset or area, the low altitude air defense unit commander considers six air defense employment guidelines in conjunction with the air defense employment principles. These guidelines assist the low altitude air defense planner to maximize the effectiveness of the missile, to maximize the use of terrain, to ensure responsiveness to the MAGTF commander's air defense priorities, and to increase the survivability of the firing teams. The guidelines are balanced fires, weighted coverage, overlapping fires, mutual support, early engagement, and defense in depth.

Balanced Fires. Balanced fires are achieved by positioning air defense units to permit approximately equal defensive fires in all

directions. Balanced fires take on added importance when facing a 360^{o} threat (fig. 3-1).

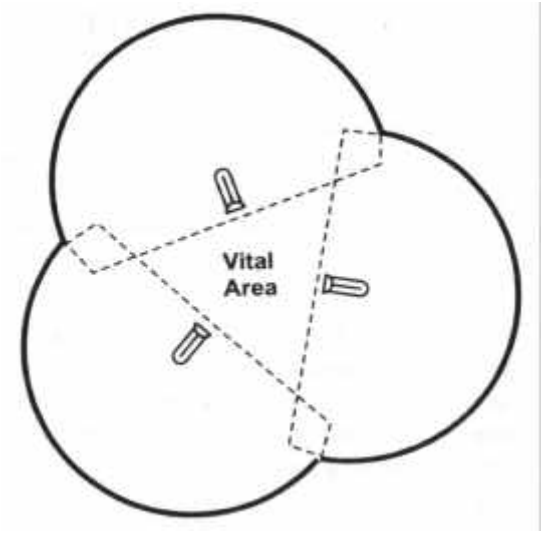


Figure 3-1. LAAD Balanced Fires.

Weighted Coverage. Weighted coverage is achieved by concentrating air defense weapons toward known enemy locations, unprotected unit boundaries, or likely enemy attack corridors (fig. 3-2).

Overlapping Fires. Low altitude air defense teams are normally positioned so that the engagement zone of one team overlaps the engagement zones of adjacent teams. This positioning reduces the likelihood that an aircraft can slip through the defense without being engaged by at least one low altitude air defense team. The maximum distance between teams to provide overlapping fires should not be greater than 4,000 meters (fig. 3-3).

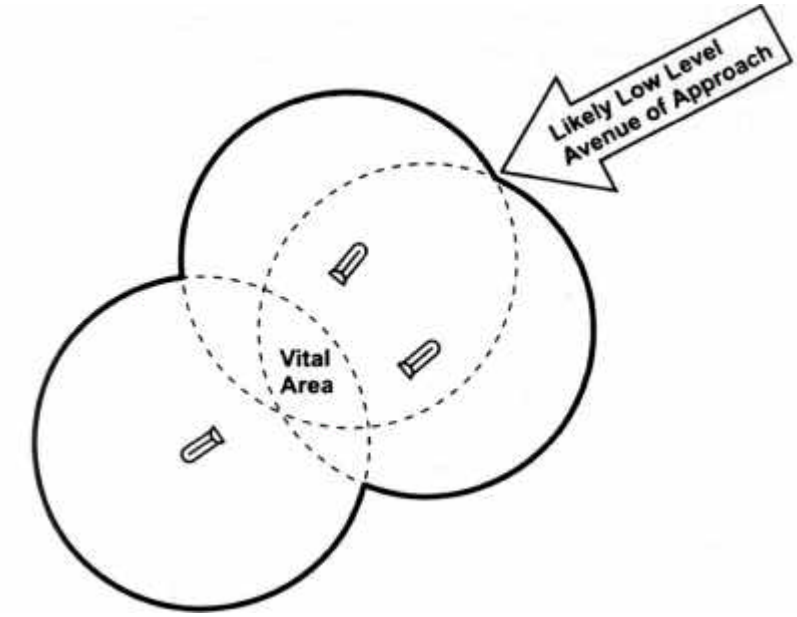


Figure 3-2. LAAD Weighted Coverage.

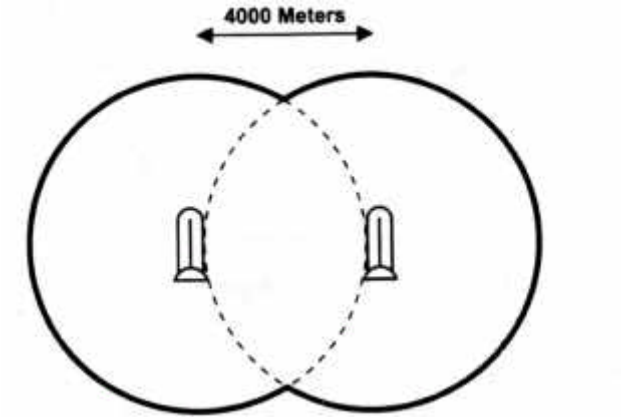


Figure 3-3. LAAD Overlapping Fires.

Mutual Support. Mutual support is that support which units render each other against an enemy because of their assigned tasks, their position relative to each other and to the enemy, and their inherent capabilities (Marine Corps Reference Publication [MCRP] 5-2A, *Operational Terms and Graphics*). Among low altitude air defense teams, mutual support is normally, but not always, characterized by overlapping fires. Positioning individual fire units so that effective fires can be delivered into the dead zone surrounding an adjacent fire unit is an example of mutual support. For planning purposes, low altitude air defense units should be positioned no more than 2,000 meters apart to provide mutual support. Mutual support enhances the survivability of all air defense assets (fig. 3-4).

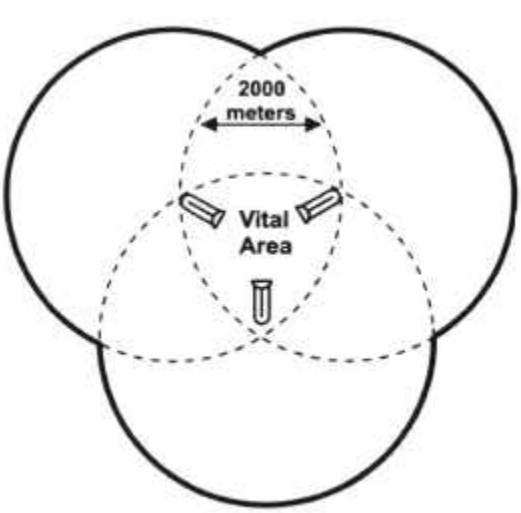


Figure 3-4. LAAD Mutual Support.

Early Engagement. Low altitude air defense teams should be positioned far enough out to permit engagement of enemy aircraft prior to ordnance release. The enemy's ordnance release line varies with

the type of aircraft and ordnance employed. For planning purposes, 1,500 meters is a good ordnance release line figure to use for low altitude pop-up attacks. In some cases, ordnance may be released up to 10,000 meters from the target. When developing air defense plans, probable threat tactics, flight profiles, and ordnance capabilities should be considered (fig. 3-5).

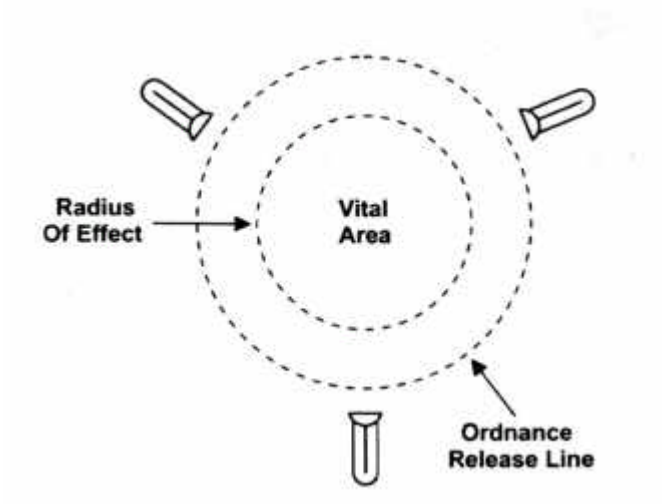


Figure 3-5. LAAD Early Engagement.

Defense in Depth. Defense in depth is the siting of mutually supporting defense positions designed to absorb and progressively weaken attack, prevent initial observations of the whole position by the enemy, and to allow the commander to maneuver the reserve (MCRP 5-2A). Among low altitude air defense units, defense in depth is achieved by positioning air defense fire units so that enemy aircraft encounter an ever-increasing volume of fire as they approach a specific defended asset or area (fig. 3-6, page 3-14).

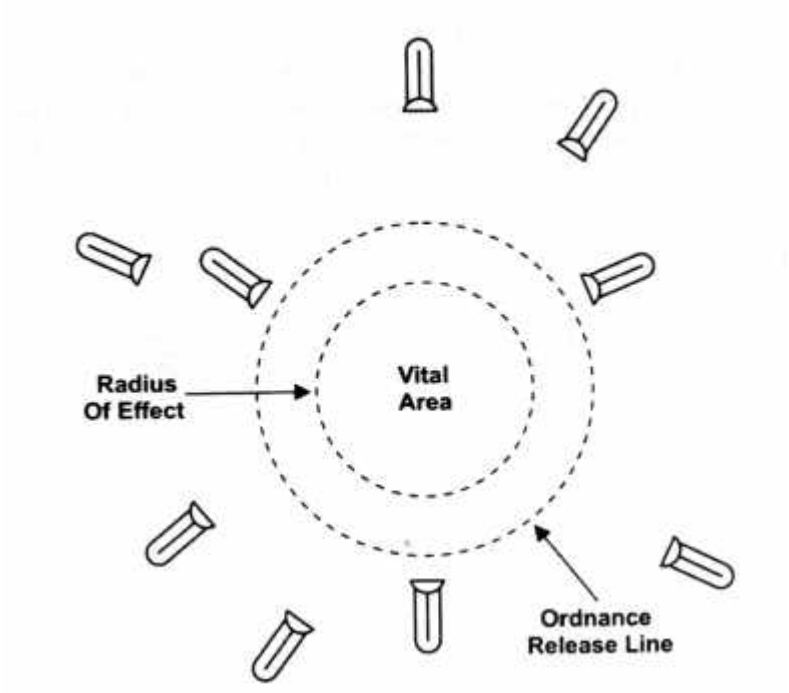


Figure 3-6. LAAD Defense in Depth.

Low altitude air defense teams may not be available in sufficient numbers to defend all the supported unit commander's assets. The low altitude air defense unit commander should advise the supported unit commander of any deficiency and make recommendations on how best to employ the available teams. Balancing the desires of the supported unit against the air defense assets available is a challenge faced by low altitude air defense commanders at all levels. As such, following all of the air defense employment guidelines is seldom possible.

To determine the proper mix of these guidelines for any tactical situation, the low altitude air defense commander should consider the—

- Supported unit's mission and scheme of maneuver or defense plan.
- Supported unit commander's air defense priorities.
- Number of LAAD teams available.
- Terrain (topography and availability).
- Nature of the threat, to include air delivery methods and tactics.
- Priority of targets by aircraft type.
- Capabilities of other ACE or MACCS agencies to support the MAGTF's air defense requirements.
- Command and control criteria.
- Location and coverage of other (including adjacent) air defense units or assets.
- Logistical support requirements.

Selecting LAAD Team Firing Positions

Mission accomplishment is the prime consideration in site selection. Cover, concealment, and camouflage should also be considered when a choice of sites is available. Particular attention should be given to unobstructed fields of fire, masking clearance, and backblast area. Terrain features that present a masking problem for

employment of Stinger or line of sight communications should be avoided. Primary and alternate firing positions should be selected.

The team leader selects the best firing position within the area selected by the section leader or platoon commander. This site becomes the team's primary position. Although terrain evaluation and orientation precedes the selection of a position, it is a continuous process.

After an engagement in a forward area, the team may have to move quickly to an alternate position. Alternate positions should not be located far from the primary position. Alternate positions should cover the same sector of fire as the primary position.

If time permits, routes into and out of primary and alternate positions should be reconnoitered and selected. Routes should afford cover between positions. When choosing available positions, the advantages and disadvantages of each must be weighed. When compromises are necessary, mission performance at the position is the determining factor.

Observation and Fields of Fire. Low altitude air defense teams depend primarily on visual means for detection and recognition of their targets. Optimally, a team's firing position should provide team members all-around visibility and allow them to fire in any direction. Often, selecting firing positions that provide all-around visibility is not possible. At a minimum, the firing position must allow coverage of the team's assigned sector. Firing positions should also minimize the masking effects of vegetation and terrain, while maximizing cover and concealment for team members and their equipment. The team may have to use separate, but closely linked, positions for observation and firing.

Cover and Concealment. Team positions should also afford low altitude air defense gunners some element of cover from the effects of the enemy's direct and indirect fires, as well as concealment from ground and air observation. These factors should not outweigh the position's primary requirement for having unobstructed observation and fields of fire over the assigned sector of fire.

Accessibility for Team Vehicles and Resupply. Primary and alternate firing positions should give the low altitude air defense team ready access to its organic vehicle. The team's position should be accessible by HMMWV for resupply of missiles, food, and water.

Security from Ground Attack. Low altitude air defense teams depend on the units they are supporting for defense against ground attack. This generally requires that the teams be positioned within, or very near, the perimeter of the supported unit. This is particularly true when LAAD teams are supporting units in forward areas. *Positioning the teams too close to the supported unit can seriously diminish their effectiveness.* When the supported unit comes under enemy air attack, LAAD teams are forced to take cover, suppressing their antiair defense capabilities. Stinger's launch signature could also inadvertently compromise the supported unit's location.

Communications. Firing positions should offer good line-of-sight communications with the section leader.

Safety Requirements. The missile must be fired from an open position while the gunner is standing. The selected firing position should be clear of dry brush and other materials that may ignite when the weapon is fired.

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Chapter 4

Operations

The MAGTF commander uses low altitude air defense assets to provide close-in, short-range air defense to the ground maneuver elements and vital areas. These assets add depth to the MAGTF's integrated air defense system through integration with air defense agencies of the Marine air command and control system and the amphibious or joint task force.

Section I

General

LAAD COMMAND AND CONTROL

Command and control is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission (Joint Pub 1-02).

The full potential of any military force cannot be realized without effective command and control. The MAGTF's air defense command and control should provide for the prompt engagement of hostile aircraft and missiles while ensuring the safety of friendly

aircraft and unite all of the MAGTF's air defense weapons into a cohesive integrated air defense system.

Command and control of low altitude air defense units is especially challenging because units are dispersed throughout the battlespace, rely upon secure voice communications, and need to maintain high mobility to enhance mission effectiveness and unit survivability.

Key requirements for the command and control of widely-dispersed, highly-mobile low altitude air defense units are centralized command (by the aviation combat element commander through the Marine air command and control system), decentralized control (down to the firing team leader level), and reliable and effective communications.

Centralized Command

The MAGTF should have a command and control system that allows the aviation combat element commander to direct individual air defense units. This system provides for the economical use of the MAGTF's limited air defense assets.

The MAGTF commander normally establishes the air defense engagement policies, unless already dictated by higher authority. Based on these policies, the aviation combat element commander develops and issues air defense control measures. These measures give the MAGTF's air defense units the criteria to determine whether an aircraft is hostile and establish the degree of control placed on air defense weapons. Air defense control measures are normally the only higher-level control exercised over the firing of low altitude air defense weapons.

Centralized command does not imply that all of the MAGTF's air defense units are actually controlled from a single location. The

integrated air defense system requires the capability to function under decentralized control to capitalize on the maximum range capabilities of its air defense weapons and to react quickly to a dynamic battlespace.

Decentralized Control

The elapsed time for low altitude air defense engagements from target detection to target flyover is measured in seconds. Enemy pilots often employ high-speed, low-level tactics to penetrate our air defense coverage. When the enemy uses these types of air attack maneuvers, team leaders do not have enough time to request permission to engage from a higher authority. Additionally, because of the possibility for imprecise track correlation, low altitude air defense teams cannot engage specific tracks based solely on radar data. The team must visually identify the aircraft and engage based upon the rules of engagement and identification criteria.

The authority for mission execution should be delegated to the lowest possible level to allow low altitude air defense weapons to engage enemy aircraft before the enemy can inflict damage on friendly forces. For maximum responsiveness, firing control of teams should be decentralized to the firing platoon commander or to the firing teams.

COMMAND POSTS OR COMBAT OPERATIONS CENTER

Low altitude air defense commanders direct and control the operations of their units from their command posts. A command post is a unit's or subunit's headquarters where the commander and the staff perform their activities. In combat, a unit's or subunit's headquarters is often divided into echelons: tactical, main, and rear. The echelon in which the unit or subunit commander is located is called the

command post (Joint Pub 1-02). Command posts are established by low altitude air defense commanders from the section through the battalion level.

A combat operations center (COC) is the primary operational agency required to control the tactical operations of a command that employs ground and aviation combat, combat support, and combat service support elements or portions thereof. The combat operations center continually monitors, records, and supervises operations in the name of the commander and includes the necessary personnel and communications to do the same (Fleet Marine Force Reference Publication [FMFRP] 0-14, *Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms*).

The COC is normally located at the main echelon. When the commander is physically located at the main echelon, it is called the command post. Necessary staff personnel (normally the S-2 and S-3 officers in the case of a battalion COC) supervise battalion operations, obtain and relay intelligence and combat information, and make recommendations to the commander from the COC. The internal arrangement, operation, and displacement of the COC should be prescribed in the unit's standing operating procedures. For the staff to function properly, communications from the COC to subordinate units, adjacent Marine air command and control system agencies, and higher headquarters should be established and maintained.

Low altitude air defense units often choose to collocate their COC with other agencies of the Marine air command and control system to enhance weapons cueing and situational awareness. Regardless of the location, low altitude air defense unit COCs must have the connectivity required to command and control subordinate units.

The low altitude air defense battalion may also operate a battalion rear echelon. When the commander is physically located at the rear echelon, it becomes the command post. A battalion rear echelon is established to coordinate administrative and logistical matters. The S-1 and S-4 officers usually coordinate the establishment, operations, and movement of the battalion rear echelon.

The battalion commander may form a command group to operate away (normally forward at the tactical echelon) from the main echelon or COC. A command group is a small party that accompanies the commander when he departs the command post (main echelon) to be present at a critical action. The party is organized and equipped to suit the commander and normally provides local security and other personal assistance for the commander as he requires. (FM 101-5-1/MCRP 5-2A, *Operational Terms and Graphics*).

The command group has no fixed organization. Personnel and equipment comprising it are selected by the commander for a particular situation. In addition to the commander, the command group may consist of the S-2 officer, S-3 officer (for a battalion command group), and communications personnel. Regardless of its composition and location, the command group must have the communications means to control operations, maintain communications with the COC, and communicate with higher headquarters.

For a battalion, the S-1 officer, in conjunction with the communications officer and headquarters commandant (who is normally the commanding officer of headquarters and service battery), selects the exact site for the command post or combat operations center and prescribes the general interior arrangement. The headquarters commandant provides the working parties to erect the command post or combat operations center and is responsible for local security of the facility.

A unit's main echelon should be organized for sustained 24-hour operations. The best way to prepare for continuous operations is to train that way. Commanders and primary staff officers must integrate their assistants into command post operations during high tempo training exercises and not only during periods of relatively low activity.

When establishing command posts or COCs, the commander must consider the following:

- The message center, if established, should be located in a secure location near an accessible entrance to the combat operations center to ensure the physical security of sensitive material and to expedite the arrival and departure of messengers.

- Vehicles located near the command post or COC should be kept to a minimum. Dispersion, concealment, and camouflage measures must be taken to prevent their detection. Consider establishing a dismount point outside of the command post or COC compound to reduce the number of vehicles within the compound.

- Siting of radio sets may influence the location and internal arrangement of the command post or COC. Using radio remote control equipment decreases the risk of detection by the enemy.

- The switchboard is located where it is free from noise and interference.

- The area selected for command post or COC status boards should be fairly level and open so that the status boards can be easily seen and are readily accessible.

CONCEPT OF EMPLOYMENT

Marine Expeditionary Force

One or more low altitude air defense battalions are typically employed to support Marine expeditionary force operations. The lead echelon of a Marine expeditionary force normally deploys with one low altitude air defense battery in support. The senior low altitude air defense element normally establishes its combat operations center at or near the sector antiair warfare coordinator's operational facility.

Marine Expeditionary Unit

Other than small arms and machine guns, the Marine expeditionary unit normally does not have an organic air defense capability except for its LAAD assets. A low altitude air defense platoon (three sections) normally supports a MEU; however, due to high operational tempo, limited Stinger gunners, and limited amphibious shipping, a reinforced section (five teams) often deploys with the Marine expeditionary unit. If a Marine air control group detachment is not employed with the MEU, the aviation combat element commander may give the senior low altitude air defense representative the authority to coordinate air defense operations directly with the commander, amphibious task force's (CATF's) air warfare commander.

Since control of aviation assets is not normally phased ashore during Marine expeditionary unit operations, the CATF's air warfare commander establishes air defense control measures for the MEU. A low altitude air defense representative may be located within the amphibious task force's supporting arms coordination center or combat information center to receive this information and pass it to LAAD personnel ashore.

When the Marine expeditionary unit is sent ashore, it is supported from its amphibious ready group ships. The MEU depends greatly on shipboard facilities for communications and maintenance. Only those elements, supplies, and equipment needed for the operation are deployed ashore. The early establishment of forward operating bases ashore for helicopters and short takeoff and vertical landing aircraft is often critical to the rapid execution of MEU operations. If forward operating bases are planned, their air defense requirements should be included in the Marine expeditionary unit's low altitude air defense allocation planning.

Special Purpose MAGTF

A special purpose MAGTF is a nonstanding MAGTF temporarily formed to conduct a specific mission for which a standing MAGTF is either inappropriate or unavailable. Special purpose MAGTFs are organized, trained, and equipped to conduct a wide variety of missions. Low altitude air defense unit participation is situationally dependent.

INTERAGENCY RELATIONSHIPS

Low altitude air defense units must be able to effectively interact with other agencies of the Marine air command and control system in order to contribute to the integrated air defense system. Specifically, interagency relationships are normally formed with the sector antiair warfare coordinator, tactical air operations center, direct air support center, Marine air traffic control detachment, and the tactical air command center.

LAAD and SAAWC or TAOC

The low altitude air defense battalion's combat operations center is normally collocated with the sector antiair warfare facility at the tactical air operations center. Low altitude air defense assets provide the tactical air operations center with low altitude air surveillance information, through visual sightings, tactical defense alert radar detected targets, and engagement reports. The sector antiair warfare coordinator (SAAWC) coordinates with the low altitude air defense battalion for air defense planning within the sector antiair warfare coordinator's sector. The sector antiair warfare coordinator also provides the low altitude air defense battalion's combat operations center with direction regarding air defense warning conditions and weapons release conditions. The tactical air operations center provides low altitude air defense units with early warning and cueing for engagement of air tracks.

The ground-based air defense representative in the sector antiair warfare facility normally serves as the primary conduit for information exchange between the SAAWC and the low altitude air defense battalion's COC. A low altitude air defense representative may also be included as part of the tactical air operations center's crew to facilitate information exchange between low altitude air defense units and the tactical air operations center.

LAAD and DASC

Low altitude air defense units provide the direct air support center (DASC) with information on aircraft sightings and engagements that may affect air support operations. In turn, the direct air support center keeps low altitude air defense units informed of friendly aircraft that are operating in the vicinity.

During amphibious operations, the LAAD combat operations center may initially be established at the direct air support center site. Following establishment of the tactical air operations center, the LAAD combat operations center normally collocates with the sector antiair warfare facility. However, a low altitude air defense representative may remain at the direct air support center to assist in information exchange between the two entities.

LAAD and MATCD

Low altitude air defense units may operate in support of a base defense zone established around a forward operating base. The LAAD unit commander coordinates fires within the base defense zone with Marine air traffic control detachment (MATCD) personnel. Marine air traffic control personnel provide early warning information and friendly aircraft location information to low altitude air defense units operating in the base defense zone. See appendix C for more information on base defense zone operations.

LAAD and TACC

The tactical air command center (TACC) is the agency ultimately responsible for air defense of the Marine air-ground task force's area of operations. It also serves as the aviation combat element commander's command post. Low altitude air defense units provide the tactical air command center with engagement information forwarded through the air defense chain of command, and provide subject matter experts to assist in developing of air defense courses of action for future operations. The tactical air command center is the approval authority for changes to air defense alert conditions and weapons release conditions within the MAGTF's area of operations, and provides guidance on current rules of engagement that cannot be clarified at lower levels.

AIR DEFENSE CONTROL MEASURES

Air defense control measures aid the aviation combat element commander in designing an air defense system that protects the friendly force and its aircraft while enabling air defense units to identify and engage hostile aircraft at the maximum ranges of their weapons envelopes. These measures are established by the MAGTF commander based on recommendations from the aviation combat element commander.

Air defense control measures include rules of engagement, identification criteria, air defense warning conditions, weapons control statuses, airspace control measures, and states of alert. A description of low altitude air defense states of alert is presented in appendix D.

METHODS OF TARGET ENGAGEMENT

The method of target engagement a low altitude air defense team uses is determined by the number of enemy aircraft in a particular air attack. A multiple target air attack is an attack by two or more aircraft flying the same course, at the same speed, less than 1,000 meters apart. All other attacks are single target air attacks.

Single Target Air Attack

All single target air attacks are engaged using a SHOOT-SHOOT-LOOK method. The first missile is fired (SHOOT) as soon as the requirements for an engagement are met. A second missile is fired (SHOOT) if the first missile does not hit the target or appears to have failed to achieve guided flight. Upon firing the first missile, the gunner immediately readies another weapon and proceeds to regain visual track and acquire the infrared tone of the target. (The gunner should not waste time watching the flight of the missile.)

Next, an evaluation (LOOK) of the missile's success is made. The team leader observes the flight of the missile, makes the kill evaluation, and if time permits, directs the gunner to launch another missile. Under certain circumstances, particularly in the case of multiple axis air attacks, the team leader may launch a missile. Multiple engagements of an aircraft, particularly from multiple positions, increase the likelihood of destroying the target by varying the aspect from which the missiles track on the target.

Multiple Target Air Attacks

Multiple target air attacks are engaged using the SHOOT-NEW TARGET-SHOOT method. This method requires launching as many missiles as possible at successive aircraft in the air attack. When practical, fire coordination within a team is effected by voice command of the team leader. When faced with multiple targets of equal threat, both team members engage targets. The team leader should direct the gunner to fire at the lead (or right) hostile target in the sector of fire. The team leader engages the trailing (or left) hostile target. The section leader may also direct the use of multiple teams, possibly enabling Stinger shots from different aspects. What may appear to be an incoming target to one team may be a crossing target for another team. Kill probability can be increased by engaging from the more effective crossing aspect.

LAAD UNIT AIR SURVEILLANCE CAPABILITIES

Low altitude air defense units can be deployed in support of every MAGTF element from the forward maneuver elements to the vital support bases in the rear. Trained in aircraft recognition and airspace surveillance techniques, low altitude air defense units can provide the MAGTF with aircraft detection and identification information. Low altitude air defense units can supplement other air

defense agencies, particularly those with ground-based radar systems, with low altitude visual and electronic surveillance capabilities. Low altitude air defense unit surveillance information can be quickly disseminated to MAGTF units through the Marine air command and control system. A risk assessment must be done when operating in a high threat environment to determine individual team surveillance sectors. Teams can be given a 360^{o} sector, but commanders should realize that the larger the sector, the more likely the LAAD team will fail to see a target. A common threat sector in a high threat environment is no more than 45^{o} to either side of the team's primary threat axis. Supported units can contribute additional personnel for air watches to enhance air surveillance.

Low altitude air defense unit visual surveillance and tactical defense alert radar information, coupled with radar information available from nonorganic radar, contribute to the air picture formation. Low altitude air defense units in *direct* support of forward maneuver units may provide the earliest visual detection of approaching aircraft; however, as they are moving with the supported units, they are not able to provide continuous air surveillance. Conversely, low altitude air defense units in *general* support of the MAGTF can be positioned in radar blind spots to provide a detection and identification capability. Used effectively, low altitude air defense units can provide a formidable low altitude surveillance network for the MAGTF.

Employment of the tactical defense alert radar requires additional operational and logistical considerations that must be weighed against the specific requirements of each mission. The advantage that early warning from a tactical defense alert radar provides (in the absence of any other cueing) can increase operational effectiveness of the low altitude air defense unit. On the other hand, tactical defense alert radar employment carries additional power, fuel, personnel, and transportation requirements.

The aviation combat element commander must weigh the benefits of surveillance by these units to the firepower tradeoffs that may occur. If the air threat is significant enough, the cost of increased surveillance may be prohibitive, and the commander may opt to mass LAAD assets along likely avenues of approach near the defended assets at the expense of overall situational awareness.

LAAD UNIT ALERTING AND CUEING

Due to the Stinger system's reaction time and its limited weapon firing envelope, low altitude air defense units need the earliest possible notice (alerting) of air threats in their area. Providing LAAD units with specific threat location information (cueing) allows them to engage enemy aircraft as soon as the aircraft become visible in the LAAD units' areas. LAAD unit leaders extract threat information from all available sources as rapidly as possible and disseminate the information over all available nets to optimize weapons employment. Proper employment of the tactical defense alert radar can significantly enhance the ability of section leaders to provide their teams with organic alerting and cueing information. This relieves the teams from total dependence on other Marine air command and control system agencies and visual air search. The tactical defense alert radar is especially useful during independent operations when no other MACCS radars are available. The supported unit commander and the LAAD commander should weigh the practicality of tactical defense alert radar employment and the potential for compromise of the radiation footprint against the benefits of alerting and cueing.

MANUAL CROSS TELL

Manual cross tell allows cueing information to be passed as non-real-time tracks among agencies that may or may not have the capability to participate in an active digital information link system. For agencies such as the tactical air command center, tactical air operations center, and ground-based air defense units who are data link participants, manual cross tell offers a backup track sharing method when the data link is degraded or inactive. Manual cross tell procedures are not solely designed as backup to data links. They are designed to maximize the sharing of time-critical information within the integrated air defense system.

Cueing information is crucial for low altitude air defense unit engagements. Manual cross tell provides the primary method by which cueing information is disseminated to dispersed LAAD units. Because information is passed manually, often over multiple communications nets or through a number of stations, there is a great opportunity for information to be misunderstood or inaccurately transmitted. Increasing the number of stations required to relay information increases the likelihood of error and the time required to pass information. To effect manual cross tell, LAAD units should determine the method and reference system for use and thoroughly brief subordinate units. Commanders should ensure that their subordinates train with these methods on a regular basis to maintain proficiency and accuracy.

LAAD FIRING TEAM INTEGRITY

A low altitude air defense team is best employed as a two-man partnership. The team concept is built around specific responsibilities within the team structure. As such, team integrity should not be compromised. Logistical requirements are doubled in the support of

two individuals vice one team. Individual gunners cannot maintain the high level of awareness over the extended time periods required for air defense operations. Two-man teams afford individuals moments of mental relaxation between periods of focused concentration.

SPECIFIC LAAD WEAPON APPLICATIONS

Low altitude air defense units can be employed in a variety of roles. The most common applications are point defense, surveillance or weapon gap filler, convoy defense, and in defense of a maneuver unit.

Point Defense

Within the area to be defended, certain assets are prioritized for defense against air attack. Commanders may be able to accept limited amounts of damage in some areas and unable to accept any damage in others. In these cases, low altitude air defense units can be assigned to defend a specific vital installation, agency, MAGTF component, or geographical location. This mission is the most common assigned to low altitude air defense units.

Conversely, certain types of air threats may have priority for engagement over others. This is especially true when the MAGTF has limited air defense assets. As an example, the MAGTF commander may choose to allow enemy helicopters to go unchallenged for a period of time and save limited air defense resources for higher priority fixed-wing targets.

Surveillance or Weapon Gap Filler

The surveillance or weapon gap filler mission is similar to point defense but emphasizes coverage within a network of coverage. Key avenues of approach, terrain masking effects, and expected threat density dictate low altitude air defense employment to supplement or reinforce other air defense sensors or weapons. The mission is calculated as part of a MAGTF defense in depth. The limited number of air defense assets available to defend multiple vital areas usually preclude the use of LAAD assets as gap fillers for other weapons systems or as surveillance gap fillers.

Defense of Convoys

Units traveling in convoy are typically exposed and therefore vulnerable to air attack. Combining organic small arms and machine guns with supporting low altitude air defense teams can provide a convoying unit with close-in air defense. Stinger can be employed to defend a convoy by prepositioning teams along the convoy's route, integrating teams into the convoy column, and using a combination of these methods if enough assets are available.

The method employed is contingent upon the available air defense resources, the anticipated number of enemy aircraft, the location of critical points along the route, and the length of the convoy route.

Low altitude air defense teams may be prepositioned at critical points along the convoy's route if the route is relatively secure from ground attack and time permits the teams to occupy firing positions ahead of the convoy. Critical points are those locations that force the convoy to slow or halt, making the convoy especially vulnerable to enemy air attack. Examples of critical points are bridges, road junctions, and refueling points. Should the TACON commander decide to preposition LAAD assets at critical points, careful

planning is needed to ensure that the convoy has adequate air defense protection in the areas between the critical points.

When low altitude air defense teams are integrated into the convoy to provide air defense, their specific positioning depends on the length of the convoy and the number of available teams. It is important to position teams near the front and rear of the convoy and to distribute additional teams an equal distance throughout the rest of the column. Enemy aircraft normally attack convoy columns linearly, either directly from the front or rear of the column. When tactically feasible, teams integrated into the convoy should be located less than 3,000 meters from one another to provide overlapping fires, forcing the attacking aircraft to enter the engagement envelope of at least one LAAD team.

When air attack is imminent or in progress, low altitude air defense teams move their vehicles off the road and quickly dismount. Teams assume a firing position from which the aircraft can be seen and Stinger can be safely fired. When possible, teams engage the aircraft on its first pass before it can make an attack run on the convoy. When the column is attacked, the massed fires of all available small arms, machine guns, and Stinger are placed on the attacking aircraft to destroy it, drive it away, or cause its ordnance delivery to be ineffective. After the immediate threat of air attack has subsided, teams remount and pass other vehicles as necessary to resume its assigned position within the convoy.

With Avenger, convoy defense can be conducted on the move or from a static location. With adequate warning, Avenger should be employed from a static position to increase kill probability. The Avenger's slew-to-cue feature enhances the team's ability to rapidly engage targets while providing convoy protection either in the static mode or on the move. These capabilities make Avenger optimally suited for convoy defense operations.

Defense of a Maneuver Unit

Low altitude air defense units providing air defense for maneuvering units are generally closer to the forward edge of the battle area than those defending static assets. When LAAD teams are supporting a maneuver unit, there are two methods to use.

Deploy Teams Behind the Maneuver Unit. When teams deploy behind a maneuver unit, they follow the unit by successive bound. Teams should remain approximately 500 meters behind the maneuver unit. Section leaders should maintain close coordination with supported units to avoid having the maneuver unit outrun its supporting low altitude air defense protection.

Deploy Teams With the Formation. Low altitude air defense teams may be deployed within the maneuver unit's formation. Teams can have their own transportation or be mounted on vehicles organic to the supported unit on a share-a-ride basis. If teams are mounted and traveling when warning of air attack is received, they should dismount from their vehicle as quickly as possible and immediately occupy the best firing positions available.

SUPPLY AND MAINTENANCE

Standard ammunition resupply procedures are used by low altitude air defense units for both small arms ammunition and Stinger missiles. The low altitude air defense unit requisitions and assumes custody of the missiles designated as its prescribed load at the beginning of the operation. The combat load for each team is situationally dependent. Missile load-out is determined by the LAAD commander after considering the expected threat and planned resupply procedures. Footmobile team members can be expected to

carry no more than one missile. Teams in HMMWVs equipped with a missile ready rack can deploy with up to six missiles.

As missiles are expended, requests for resupply originate from the low altitude air defense teams and are forwarded to the section leaders. Section resupply requests are consolidated at the platoon, battery, or battalion level before being submitted to the combat service support element. The low altitude air defense commander may assign a representative or support element to work with the combat service support element to coordinate resupply efforts.

Several methods can be used to perform missile resupply. The combat service support element can deliver missiles to designated ammunition transfer points that are manned by personnel from the LAAD battalion's headquarters and service battery. H&S battery personnel can deliver missiles to the firing section leaders. Firing teams then pick up their missiles from their section leaders at a mutually acceptable time and location. H&S battery personnel and platoon sergeants may use ground or combat service support assets (such as logistics trains) and/or LAAD battalion assets to resupply missiles to section leaders. Firing teams pick up their missiles from their section leaders.

The combat service support element, in an emergency, may deliver missiles directly to teams by air or surface means. All low altitude air defense personnel should be aware of the procedures to coordinate emergency resupply. Coordination is made through the direct air support center for air assets to deliver missiles. The fire support coordination center effects the necessary coordination and communication procedures for emergency resupply.

It is important to remember that the low altitude air defense battalion has no organic vehicles larger than a HMMWV. The use of

nonorganic vehicles (such as 5-ton trucks) during large scale resupply missions is necessary.

FIVE-PARAGRAPH ORDER

Low altitude air defense unit employment requires detailed coordination and planning. Operation orders, applicable standing operating procedures, and doctrinal publications provide much of the basis for conducting low altitude air defense planning. Appendix E contains a sample five-paragraph order format that can be used by ground-based air defense commanders.

Section II

Environments

AMPHIBIOUS OPERATIONS

The low altitude air defense battalion and its representatives participate in planning for and execution of all phases of an amphibious operation.

Embarkation of LAAD Units

For embarkation planning purposes, a low altitude air defense team consists of a team leader, a gunner/driver, and a HMMWV. Although the commander may choose to *employ* a team without its HMMWV, a team should not *deploy* without it. The team vehicle is an employment option, not a deployment option.

Movement to the Amphibious Objective Area

During the movement of the amphibious task force to the amphibious objective area, the responsibility for antiair warfare rests with the commander, amphibious task force. The CATF controls antiair operations and exercises airspace control through the air warfare commander. Carrier-based Navy and Marine Corps fighter aircraft and air defense-capable ships normally provide air defense for the amphibious task force.

If the amphibious task force is attacked, or intelligence indicates that an air attack is imminent, the CATF and the commander, landing force may agree to employ embarked landing force air defense assets to provide emergency defense of the amphibious task force

(EDATF) (e.g., air-to-air capable helicopters, AV-8B Harriers, and low altitude air defense units). The commitment of air defense units for EDATF operations may result in the potential loss or expenditure of landing force air defense resources before the assault. Whenever feasible, shipboard employment of embarked low altitude air defense units should be planned before embarkation. Preplanning helps to ensure that the commander, amphibious task force, has an adequate number of Stinger systems available for emergency defense of the amphibious task force. A LAAD representative should participate in the amphibious assault planning process.

Preassault

After the amphibious task force arrives in the amphibious objective area, the CATF remains responsible for air defense. As the landing force prepares for the assault, any landing force air defense assets supporting the amphibious task force should be replaced by either Navy or joint task force assets to allow landing force air defense assets to be dedicated to the assault.

Depending on the size of the amphibious objective area and the anticipated air threat, the CATF may choose to establish multiple antiair warfare sectors. Each sector will be controlled by a sector antiair warfare coordinator subordinate to the force air warfare commander.

During the Assault

Low altitude air defense units usually land in the first waves and early follow-on waves to support the ground combat element as it pushes ashore. LAAD units will be extremely limited in their ability to provide low altitude air defense for the assault waves because of limited cueing and limited or difficult communications with higher agencies. During this stage, LAAD units will most likely

provide a limited point defense capability in direct support of the assault elements. They may also be used to establish point defense of the beachhead until further LAAD and ground-based air defense assets can be brought ashore to establish an integrated air defense system.

Passage of Control and Post-Assault Operations

Once the MAGTF's tactical air command center becomes fully operational and all required communications are established with senior and subordinate agencies, the commander, landing force, will request that control of the amphibious objective area's airspace and aviation assets be passed ashore.

Once control is passed ashore, command of all landing force aviation and air defense assets is exercised by the aviation combat element commander, who is responsible to coordinate the employment of antiair warfare weapons as the situation dictates. Air defense warning conditions and weapons control statuses are normally established by the tactical air command center and are disseminated through the Marine air command and control system.

MOUNTAIN OPERATIONS

Mountain operations favor the use of small, lightly equipped maneuver units. The nature of mountainous terrain normally affords these units with good cover and concealment. Other than small arms and machine guns, Stinger may be the only air defense weapon system that can accompany and provide close-in air defense protection for these units. Dismounted low altitude air defense operations are common in mountainous environments. Helicopters can be used to preposition teams on key terrain features or near likely avenues of approach.

Terrain masking of Marine air command and control system radars and difficulty in establishing line of sight communications may limit early warning and cueing for LAAD teams. To counter this effect, continuous visual observation should be maintained, particularly along likely low-level air attack routes. Remote observation posts within radio range of the low altitude air defense team firing positions may improve the chances for early detection of approaching aircraft.

Low altitude air defense units rely on radios for communications. Hills and trees degrade distance and quality of frequency modulated radio transmissions. The use of long wire antennas and relays can ease these problems.

JUNGLE OPERATIONS

Jungle operations present unique challenges to low altitude air defense operations. Small maneuver units are usually employed and movement on foot or by vehicle can become very difficult. When combined with dense vegetation, relatively minor terrain features can become major obstacles to movement. As such, defensive action is considerably aided by natural features.

Dense vegetation offers good concealment for maneuver units. Enemy air attacks will probably be directed against combat service support units, supply lines, and exposed field artillery units; however, maneuver units are vulnerable when they cross open areas such as rice paddies or rivers.

Low altitude air defense teams defending convoys are normally positioned within the convoys. Stinger firing positions that offer 360^{o} observation and fields of fire are difficult, if not impossible, to find. Teams defending static assets located in jungle areas may have

to clear trees and underbrush to make firing positions. These positions should only be occupied while engaging aircraft and then vacated rapidly. Cleared areas are easily detected and attacked from the air.

Jungle conditions generally reduce detection and identification ranges. This may require teams to be positioned closer together or more teams than usual be assigned to defend a particular asset.

Thick vegetation, high humidity, and rugged, hilly terrain reduce the range of FM radios. Special purpose one-fourth wavelength antennas are optimal for use in the jungle environment. Extensive use of wire communications may also be necessary.

Rust, corrosion, and fungus increase the maintenance effort. Repair parts, ammunition, and other items should be kept in sealed containers until needed. Electronic equipment should be left on, if possible. Heat from equipment helps eliminate the moisture that causes corrosion. Personnel must be well-trained and acclimated to the jungle.

DESERT OPERATIONS

The Stinger system is well-suited for desert operations. It can be stored in temperatures up to 160^{o}F and operated in temperatures up to 140^{o}F.

The low, flat terrain found in most desert areas offers advantages to both low altitude air defense gunners and the attacking enemy aircraft. In the absence of masking terrain and obstacles, LAAD gunners are usually able to detect and engage enemy aircraft at greater ranges. Conversely, attacking enemy aircraft can more easily locate and attack their targets in a desert environment, as there are fewer

terrain features and less vegetation to mask visual and infrared detection. LAAD gunners should also be aware of weather conditions, as blowing sand can make it almost impossible to visually detect and identify aircraft. In areas where blowing sand is common, airspace control measures and the rules of engagement may have to be modified to enhance aircraft identification and allow LAAD engagements.

Low, flat desert terrain mandates friendly force dispersion to prevent detection and engagement at long ranges. Dispersion aids passive air defense. Careful planning should be conducted to ensure that the dispersion of forces does not create gaps in the air defense coverage.

Locations offering good cover and concealment are difficult to find in the desert. Vehicle tracks leading into firing positions must be erased or covered since they are easily spotted from the air. If the terrain makes adequate concealment difficult, teams should resist unnecessary movement while in position. If the teams are engaging aircraft, they should move between alternate firing positions every 1 or 2 hours if the state of alert allows. Dust or sand clouds from missile backblast reveals the team's position, necessitating a rapid move to a new location.

Low altitude air defense teams must move rapidly to survive and to keep up with the high-speed tactics of mechanized maneuver units. In some desert areas, the team's HMMWV may not be able to keep up with the supported unit's tracked or wheeled vehicles. Similar vehicles should be provided to carry the low altitude air defense unit's personnel and equipment. Teams require mobility equal to or greater than that of the supported force.

Fast-moving operations and great distances between units are characteristics of desert operations. They require reliance on radio, vice

wire, for communications as most units are within radio line-of-sight of each other. Of concern, however, is that lack of moisture and the extreme heat may cause frequency modulation radio ranges to be reduced by as much as 30 percent. Dipole or other directional antennas should be used where possible to increase the range of frequency modulation radios.

Dust and sand can be deadly to equipment. Vehicle cooling and electrical systems are vulnerable to extreme heat. All vehicles should carry extra water for personnel as well as the engine cooling system. Cooling systems should be checked several times a day. The eroding effect of sand on moving metal parts requires more frequent cleaning of individual weapons and equipment air filters. Preventive maintenance on all equipment should be increased in the desert.

COLD WEATHER OPERATIONS

The Stinger weapons system is also well-suited for cold weather operations. It can be stored at temperatures as low as -50^{o}F and operated at temperatures above -40^{o}F.

Operations in cold weather pose significant leadership, operational, and logistical challenges for low altitude air defense units. While LAAD operational necessities remain relatively unchanged, safety and health hazards presented by cold weather operations may necessitate the formation of four-man teams to ensure that sufficient personnel and equipment are onhand to function effectively. For safety, as well as logistical considerations, two vehicles should be used. Two vehicles provide additional space to carry the larger amounts of personal equipment required to survive in an arctic environment. With four Marines, a LAAD team can establish a personnel rotation that allows two Marines to maintain normal team

operations, while the other two Marines rest, warm themselves, and prepare hot fluids and food for the team on watch.

Low altitude air defense teams and other personnel in close vicinity to Stinger positions operating in extreme cold (-25^{o}F or below) should hold their breath for about 20 seconds during and after firing the Stinger. At these temperatures, the exhaust from the missile may crystallize into a form of ice fog. If inhaled, toxic fumes may thaw inside the lungs, causing injury or death. Ice fog also obstructs the gunner's vision and compromises team location. This effect makes planning for alternate supplementary firing positions particularly important. Additionally, in extreme cold weather, the backblast hazard area for a Stinger missile is approximately *three times larger than normal.*

Heavy snow and ice causing poor driving conditions may require units to move on foot. Footmobile low altitude air defense teams are limited to carrying one missile per team member. Other members of the supported unit may be designated to carry additional missiles. Resupply may have to be made by air and/or oversnow vehicles.

Missile warmup time is increased in extreme cold weather. Bulky, heavy clothing and gloves also increase the time required to perform the engagement sequence. Extreme and prolonged cold has an adverse effect on all weapons and equipment; sluggish operations, malfunctions, and broken parts are common. More time should be allowed for preventive maintenance. Extreme cold more than doubles the time it takes to perform simple maintenance tasks. Special attention should be given to batteries. In extreme cold, batteries have decreased power levels and drain more quickly.

URBANIZED TERRAIN OPERATIONS

Ideally, urbanized areas are bypassed and isolated by attacking forces; however, the massive growth of urban centers has made their avoidance in tactical operations difficult. Basic air defense doctrine does not change when units operate on urbanized terrain. The air defense employment principles of weapons mix, weapons mass, mobility, and integration still apply on urbanized terrain.

The defender has distinct advantages in urbanized areas. Superior protection, cover, and concealment are abundant. Attacking and defending enemy forces will likely capitalize on these advantages by locating command posts, supplies, and combat service support units within urbanized areas. The inherent cover and concealment provided to these critical assets enhance the degree of passive air defense protection against air attack and minimize the need for inordinate amounts of active air defenses.

Stinger is the most viable active air defense system for deployment within urbanized areas. It is highly mobile, very effective, and minimally hampered by operations on urbanized terrain. Low altitude air defense teams on rooftops and parking garages generally have good line-of-sight observation and fields of fire. Surrounding hillsides may also provide good firing positions.

As supported units move through urbanized areas, some low altitude air defense teams should remain in overwatch positions while others move to take up new firing positions on other rooftops. This tactic allows teams to keep up with the supported unit and ensures a continuous watch against enemy aircraft. Small arms and machine guns may also be used to supplement Stinger.

When developing an air defense plan for combat in an urbanized area, commanders should consider that—

- Enemy air targets such as principal lines of communications (e.g., roads, rail networks, and bridges) are often found in and around built-up areas.

- Good firing positions may be difficult to find and occupy for long-range air defense missile systems in the built-up areas.

- Movement between positions is normally restricted in built-up areas.

- Long-range systems can provide air defense cover from positions on or outside of the edge of the city.

- Radar masking and degraded communications reduce air defense warning time for all units. Air defense control measures should be adjusted to permit responsive air defense within this reduced warning environment.

- The positioning of air defense weapons in built-up areas is often limited to more open areas without masking, such as parks, fields, and rail yards.

- LAAD teams provide protection for infantry battalions the same as in any operation. When employed within the built-up area, rooftops normally offer the best firing positions.

- MANPAD assets will likely be employed by the enemy from rooftops. It is important to maintain the security of the rooftops to reduce the enemy MANPAD threat and assist in the maintenance of local air superiority.

- Heavy machine guns emplaced on rooftops can augment the air defense effort.

NIGHT OPERATIONS

While the Stinger system can be employed at night without night vision devices, its effectiveness depends on the gunner's ability to identify, acquire, and range the target. Thermal imaging sights organic to low altitude air defense units improve the gunner's ability to detect targets at night. However, thermal imaging sights are not always conducive to effect positive identification of targets or, because of a narrow field of view, to conduct adequate surveillance of an assigned sector. Avenger, with its associated forward looking infrared sight, enhances the gunner's ability to detect and acquire targets at night and in adverse weather; however, nighttime employment of the Avenger is still limited by the operator's inability to visually identify targets.

Visual identification is usually required by the rules of engagement prior to firing. Typically, LAAD units are placed in a weapons hold status during the hours of darkness, as there is no means available to the gunner to make a positive identification at night. When air defense is paramount, the ACE commander may perform the risk assessment and decide to alter the weapons release condition (to weapons free) and air defense control measures to allow LAAD teams to engage targets at night, which will also increase the risk of fratricide.

Low altitude air defense units operating at night also have to contend with the impact on personnel readiness and combat capability that results from sustained 24-hour operations. Commanders have to manage states of alert and rotate LAAD teams and Avenger crews to maintain the capability to defend the air defense priorities day and night.

Low altitude air defense units normally use the hours of darkness to move, rest, resupply, and perform maintenance on their equipment.

They may be supporting a unit in a static position or a stationary asset. At nightfall, they may move from their firing positions to positions affording better security against ground attack (e.g., listening posts, observation posts, or within the perimeters of friendly units). When supporting a unit that is moving at night, low altitude air defense units normally move with the unit. Remaining within the unit's formation provides the best security from ground attack. Before first light, the teams deploy to their firing positions so they are ready to engage aircraft as soon as visibility permits.

If the MAGTF commander authorizes LAAD night engagements, the rules of engagement should be very specific on visual identification criteria. Nighttime rules of engagement should be carefully thought out, widely published, and strictly followed to maximize LAAD weapon capabilities and to provide acceptable safety for friendly aircraft. A weapons free Stinger missile engagement zone or restricted operating zone is sometimes used around high value assets such as a headquarters. This air control measure allows low altitude air defense units to engage hostile targets with minimal restrictions, thereby increasing their effectiveness. Friendly aircraft should remain outside the restricted operating zone until notified that all low altitude air defense units have been placed in a weapons hold status.

NUCLEAR, BIOLOGICAL, AND CHEMICAL OPERATIONS

Low altitude air defense units must be able to function effectively in a nuclear, biological, and chemical (NBC) environment. To do so, low altitude air defense units must be able to disperse rapidly; operate with degraded or lost command, control, communications, or combat service support; function on or near contaminated areas;

function effectively in all levels of mission oriented protective posture (MOPP) equipment; and function effectively without detailed guidance.

As with any other MAGTF unit, low altitude air defense unit performance will be degraded when forced to operate in MOPP gear. While wearing mission oriented protective posture equipment, it is more difficult to visually acquire and identify targets. It is also more difficult to perform the Stinger engagement sequence. Communications are usually adversely affected as well, making it more difficult to receive target cueing and coordinate team employment at all echelons. To be effective while wearing MOPP equipment, units must often practice all aspects of LAAD operations in a simulated NBC contaminated environment. Adherence to the concept of centralized command and decentralized control is also important when working through NBC conditions. A thorough understanding of the commander's intent, flexibility in the air defense plan, aggressiveness in execution, and the judicious use of initiative and common sense in operations will enhance the effectiveness of low altitude air defense units when operating in a nuclear, biological, or chemically contaminated environment.

Section III

Other Operations

COMBAT SERVICE SUPPORT OPERATIONS

Low altitude air defense commanders determine combat service support requirements, priorities, and allocations for effective employment and sustainment of their units after establishment of mission assignment and support relationships. Commanders consider their requirements for supply, maintenance, transportation, deliberate engineering, and health services during the planning phase. Combat service support for LAAD units is identical to that of any other MAGTF unit; however, the widely dispersed nature of low altitude air defense operations makes careful and detailed combat service support planning more difficult.

The commander with administrative authority over a low altitude air defense unit is responsible for providing that unit with combat service support. Often, it is difficult for the commander exercising administrative control to provide widely dispersed LAAD units with timely resupply. Logistical support may be provided by a supported or adjacent unit, dependent upon the tactical situation and the resupply capability of the supported or adjacent unit. Logistics support of this type should be prearranged between the staffs of the involved units. The operation order should clearly state how low altitude air defense units will be sustained.

The low altitude air defense battalion has organic combat service support capabilities in supply, maintenance, transportation, and health services. Of these capabilities, transportation is normally the major limiting factor in organic support of low altitude air defense

units. Low altitude air defense operations are inherently mobile operations and are transportation intensive. The LAAD battalion has enough organic transportation to move its teams; however, it cannot support extended day-to-day operations without dedicated external support such as 5-ton trucks, water trailers, and diesel refuelers.

When operating as part of a Marine expeditionary force, the low altitude air defense battalion relies primarily on the Marine aircraft wing for external combat service support. When subordinate LAAD units operate as part of a MAGTF smaller than a Marine expeditionary force, they obtain combat service support from a variety of sources. Logistical support of low altitude air defense units operating with a Marine expeditionary unit is normally accomplished through the Marine expeditionary unit's tactical-logistics group. The senior low altitude air defense representative should coordinate the unit's logistical requirements with the Marine expeditionary unit's logistics officer (S-4).

HELICOPTERBORNE OPERATIONS

The concept of rapid tactical mobility through the extensive use of helicopters is an integral part of Marine Corps doctrine. Helicopters enable low altitude air defense units to occupy firing positions that would normally not be accessible by wheeled or tracked vehicles. In addition to the standard methods of employing helicopters, rappelling, fastrope, and special patrol insertion and extraction techniques greatly enhance the LAAD unit's ability to provide effective air defense for supported units. Using these techniques, low altitude air defense teams can quickly deploy to sites on hilltops and other terrain features that lack adequate areas for helicopter landing

zones. These sites can give teams increased surveillance and overwatch capabilities, allowing them to detect and engage hostile aircraft at the maximum range of the Stinger system.

Consideration must be given to mobility restrictions placed on low altitude air defense units when they are positioned by helicopter. Because the Stinger's launch signature is highly visible, the enemy can quickly locate the team's firing position. To enhance team preservation, detailed redeployment planning for LAAD units should be done before they are placed in remote sites.

AVENGER OPERATIONS

Avenger was developed to offset limitations in firepower, to enhance the detection of targets at night and in adverse weather, and to shoot on the move when employed with man portable air defense HMMWV-configured low altitude air defense teams. Because of its shoot-on-the-move capability and pedestal mounted configuration, Avenger is perceived as a system designed to operate in direct support of maneuvering ground forces; however, as the Avenger is mounted on the heavy HMMWV, it achieves no more speed or mobility than the MANPAD-configured HMMWV. Avenger also has no armor to protect the crew from direct or indirect fire, and it has a fairly large and distinct visual signature that cannot be adequately camouflaged. The Avenger system is limited in its ability to ford water obstacles. Depths of water greater than 30 inches can damage the slip ring of the turret in the bed of the HMMWV. Avenger employment may therefore be similar to the employment of man portable air defense HMMWV-equipped teams except in a surveillance role. The sensor suite that is contained within Avenger is unparalleled by any other system directly available to most supported commanders, and may dictate the surveillance task.

Avenger Employment

The addition of Avenger into the arsenal of low altitude air defense unit equipment provides increased flexibility and firepower to the Stinger section. Although Avenger is usually considered a general support weapon system, the added versatility and technology incorporated into Avenger allows the Stinger section to increase employment options. Stinger employment planners should take into consideration the composition of sections while planning so that Avenger and man portable air defense teams are assigned appropriate missions. Sections rarely have the need to be composed of both Avenger and MANPAD teams. The difficulties in planning for mixed weapon systems are greater than those of planning for like weapons.

Avenger Employment at Night

Avenger possesses an enhanced ability to acquire targets at night due to the incorporation of the forward looking infrared device mounted to the side of the Avenger turret. This capability reduces the need for heavy and bulky MANPAD Stinger night sights. Turret slew time and the gunner's ability to scan the sky at night limit the size of the search sector that can be supported. Planners should consider reducing the nighttime sectors assigned to Stinger platoons based on the focal view of the forward looking infrared, wide angle or narrow view. The section leader then can determine the field of view setting for the forward looking infrared sight and position individual Avenger teams so that their forward-looking infrared coverages overlap. This allows teams to search and scan the assigned sector vertically, eliminating the delay of turret slew time and decreasing target acquisition time.

Chapter 5

Training

Marine leaders have the responsibility to establish and conduct technical and tactical training to enable their Marines to successfully accomplish the unit's mission. The complexities of amphibious, joint, and multinational operations highlight the importance of individual and unit level training for low altitude air defense Marines.

INDIVIDUAL TRAINING

Training requirements for employment of the Stinger weapon system are standardized by MCO P3500.19, *Aviation Training and Readiness (T&R) Manual, Volume V, Marine Air Command and Control System (MACCS)*. The T&R Manual specifies training events and position requirements necessary for these personnel to attain position designations. Follow-on formal training is available to those Marines who demonstrate military occupational specialty proficiency.

Formal Schools

Entry Level Training. Entry level training for antiair warfare officers and Stinger gunners is conducted at the U.S. Army Air Defense School, Fort Bliss, Texas.

Stinger Officers Course. This 3-week course focuses on training in aircraft identification, Stinger missile operating characteristics, Stinger employment, and the application of air defense principles. Opportunities are provided to track simulated targets in the moving

target simulator, conduct terrain analysis, and observe live tracking and live-missile firing.

Stinger Gunners Course. This 6-week course focuses on enlisted gunners' initial training in Stinger operation and maintenance. The course emphasizes the engagement process, aircraft identification, and employment of the Stinger missile through lectures and tracking exercises in the moving target simulator. The course culminates with a live missile fire exercise. Gunners receive training on missile operating characteristics and the Avenger weapon system.

Graduate-Level Training

Weapons and Tactics Instructor Course. Antiair warfare officers exhibiting requisite technical and tactical proficiency may be selected by their commands to attend the Weapons and Tactics Instructor (WTI) course. The WTI course is a 6-week graduate-level school, held at Marine Corps Air Station, Yuma, Arizona, designed to provide advanced training and practical application regarding the planning and execution of the six functions of Marine aviation. Students receive specific instruction in the areas of Marine air command and control system and air defense planning considerations. The weapons and tactics instructor course is geared toward the mid-level captain who would return to the low altitude air defense battalion and assist in the training of personnel. Prerequisites for WTI attendance include experience in Marine expeditionary force exercises and specific T&R syllabus events up to the battery level. Upon completion of the weapons and tactics instructor course, officers are eligible for the military occupational specialty 7277 designation, weapons and tactics instructor.

LAAD Section Leaders Course. The low altitude air defense section leaders course is conducted simultaneously with the weapons and tactics instructor course. The course includes many of the same classes the WTI students receive, providing an overview of the six

functions of Marine aviation and the Marine air command and control system. Students plan and execute approximately 12 separate evolutions under the supervision of 2 enlisted instructors and the low altitude air defense division head. Enlisted personnel from the direct air support center, tactical air operations center, and Marine air traffic control detachment participate in many of the classes and in the flight phase of this course. The course provides a deeper understanding and appreciation for the complexities associated with employment of the Marine air command and control system.

WTI Commanders Course. Held at Marine Corps Air Station, Yuma, Arizona, the 3-day weapons and tactics instructor commanders course provides field grade officers an opportunity to examine and discuss issues affecting the Marine air command and control system and considerations for its employment.

On-the-Job Training

The *Training & Readiness Manual,* Volumes I and V, provide information on individual training and qualification criteria for Marine air command and control system personnel. Specific academic and practical application training standards for low altitude air defense antiair warfare officers and gunners are outlined in Volume V (chapter 5). Officers and enlisted personnel complete separate training syllabi. A different syllabus is established for enlisted personnel functioning at the platoon sergeant or section leader position. Tracking of individual readiness is computed by the aviation training and readiness information management system. Refer to MCWP 3-25.3, *Marine Air Command and Control System Handbook*, for detailed discussion on levels of training.

Stinger Gunner Training Devices

Field Handling Trainer. The field handling trainer has the same size, weight, and external appearance as the Stinger weapon round but is totally inert. Its controls and mechanical operation are also the same. Stinger gunners use the field handling trainer to practice the basic manual skills of weapon handling, operation, sighting, and ranging. Gunners can practice mating or removing the gripstock and inserting or removing the battery coolant unit. Unlike the Stinger weapons system, the field handling trainer does not provide gunners with indications of target acquisition and has no IFF capability.

Guided Missile Training Set. The guided missile training set consists of a tracking head trainer, five rechargeable nickel-cadmium batteries, an IFF simulator with cable, and a shipping and storage container. It is used to develop and maintain proficiency in tracking aircraft and firing the Stinger weapon. The tracking head trainer has the same appearance as the weapon round except for a performance indicator assembly strapped near the aft end of the launch tube. Weighing about 38 pounds, its rechargeable battery looks like the battery coolant unit except that it is approximately 3 inches longer and twice as heavy. A fully charged battery produces a minimum of 15 training missions of 47 seconds each. The IFF simulator provides the operator with random, simulated IFF interrogation responses. The performance indicator displays the gunner's progress during a simulated engagement. It provides indications that the gunner has—

- Correctly performed the engagement sequence.
- Committed a correctable error (e.g., a procedural error that can be corrected before squeezing the firing trigger).
- Committed an uncorrectable error (e.g., squeezing the firing trigger out of sequence).

- Allowed the 47-second timer to run down, which shuts down the trainer.

Moving Target Simulator II. The moving target simulator II (MTS II) provides representative sights and sounds of aircraft expected to be encountered by Stinger gunners. One to three gunners can be trained simultaneously in the MTS II. Environmental realism is achieved by using a large 40-foot diameter, 360^{o} display area that displays authentic aircraft presentation (with up to three active targets), selectable background scenery and weather conditions, and stereophonic sound. Accurate infrared signatures are computer controlled to indicate target range, type, and attitude. Infrared countermeasures (in the form of flare drops) are also available. When a gunner scores a target kill, the target explodes. The missile's flight path is also shown. Each of the U.S. based active duty low altitude air defense battalions have an MTS II.

Stinger Launch Simulator. The Stinger launch simulator is a low-cost, gunner proficiency training device. It is composed of a standard Stinger launcher with an externally mounted captive seeker. All indications received by the gunner during training are identical to those for the tactical weapon round up to and including launch. The Stinger launch simulator uses an eject motor to launch an inert missile to a range of approximately 170 meters (557 feet) with a maximum altitude of 43 meters (141 feet). Normal range safety requirements and operating procedures for the Stinger launch simulator are detailed in Technical Manual (TM) 08319A-12, *Technical Manual Operators and Organizational Maintenance Instructions STLS (Stinger Launch Simulator).*

Captive Flight Trainer. The captive flight trainer is a training tracking device much the same as the tracking head trainer discussed above. It is modified for the standard Avenger vehicle-mounted launcher and may eventually be used with the light armored vehicle, air defense variant. It allows vehicle-mounted sys-

tems to track aircraft and conduct engagements in a training environment. Each captive flight trainer has an on-board storage capability for argon gas to cool the seeker head. These training devices are recharged by Stinger personnel who are specially trained in the operation of the single-chamber unit that pressurizes the argon gas from a supply bottle into the captive flight trainer or the tracking head trainer.

Institutional Conduct of Fire Trainer. Institutional conduct of fire trainer (ICOFT) is a self-contained training set that allows simulated Avenger engagements from a computer-based simulation program. Similar to the moving target simulator, the institutional conduct of fire trainer displays preprogrammed flight profiles on a monitor in front of the gunner. The gunner sits in the ICOFT, which is configured identical to an Avenger turret, and performs all actions required in an engagement. The gunner's actions are recorded by a computer that provides immediate feedback to the operator. The institutional conduct of fire trainer simulates the sounds of a battlefield and displays ground and air activity within the specific profile that is flown.

PLATOON, SECTION, AND TEAM TRAINING

Platoon, section, and team training provide the means by which future low altitude air defense battalion leaders are developed, and it should be incorporated into the daily routine and training plan. Small-unit training is designed to take a basically trained Marine, fine tune those skills, and develop an ability to handle increased responsibilities. Moreover, small unit leadership training develops and reinforces procedures used by the battalion to accomplish its mission.

Platoon Training

Platoon training should include field and garrison training for individual sections that are working together to become a synergistic force to fulfill platoon responsibilities. Platoon headquarters exercises, communication exercises, and deployment/redeployment drills should be conducted on a regular basis in accordance with battalion standard operating procedures and military occupational specialty specific handbooks. Areas of focus in platoon training should include—

- Five-paragraph orders (issuing and receiving).
- Preventative and field maintenance of equipment.
- Convoy operations.
- Platoon-level tactical movement.
- Reporting procedures.
- Communications procedures.
- Integration training with other elements of the Marine air command and control system.

Section Training

Sections are the smallest tactical element of Stinger assets and may be expected to perform their mission away from normal platoon-level employment. Standard operating procedures should be consistent, yet provide the ability for the section to operate away from the platoon headquarters. Section-level training should include developing or conducting the following:

- Five-paragraph order.

- Convoy procedures.
- Tactical movement.
- Global positioning system navigation.
- Reporting procedures.
- Lost communication procedures.
- Integration training.
- Preventative and field maintenance training.
- Communications procedures.

Team Training

Team training cannot be overemphasized. The team level is where low altitude air defense Marines spend the majority of their time. A carefully cultivated relationship between the team leader and assistant gunner should exist. Each team member should know the strengths and weaknesses of the other and should strive to offset those weaknesses. Teams are dependent upon each other for survival on the battlefield and should possess a strong sense of loyalty.

Each team should have a routine that is followed every time they deploy. Though it is not necessary to develop a standard operating procedure for each team, team members should have a clear understanding of the process to be followed each time they arrive at a position. Team members should attend tracking training in the moving target simulator II individually and as a team. The team leader should be a mentor to the assistant gunner, developing skills and

teaching sound practices for tactical employment. Elements of team training should include—

- Setting up the team.
- Selecting the team position.
- Tracking live and simulated aircraft.
- Reporting procedures.
- Navigating (global positioning system [GPS]).
- Engaging aircraft.
- Identifying aircraft.
- Developing the five-paragraph order.

Training Devices

The training devices used for individual training are also used to augment team, section, and platoon-level training. Some devices are employed to support aircrew training. One such device is the Smokey surface-to-air missile (SAM).

The Smokey SAM is a training device that helps aircrews visualize the backblast and smoke signature created when a short-range surface-to-air missile is fired at their aircraft. They are for non-tactical visual training and are employed solely for aircrews. Personnel who handle and launch Smokey SAMs may have any military occupational specialty; however, because the Smokey SAM igniter and rocket motor contain explosive material, personnel who operate them must have adequate operating, safety, and handling training. Marines who operate these training devices are normally part

of the battlefield realism section of the Marine aircraft wing headquarters' G-3.

UNIT TRAINING

Unit training is required to prepare the low altitude air defense battalion to perform its wartime mission. Unit training can take many forms, including command post exercises, simulated exercises, and field training exercises. During unit training, low altitude air defense battalion personnel are intimately involved in preparing training plans and coordinating with higher, adjacent, and subordinate command and control and support units. Command post exercise and field training exercise evolutions are generally conducted at the Marine aircraft wing or higher level. Unit participation in Marine air command and control level training can be accomplished at low-dollar costs while maintaining an effective, stimulating forum geared toward Marine air command and control system integration training. Examples of this type of training include the Marine aviation planning problem, Marine air command and control system integrated simulated training exercise, and joint service training exercises. Refer to MCWP 3-25.3 for a more detailed discussion of Marine air command and control system level training opportunities.

EVALUATING TRAINING

The success of individual, crew, and unit training must be qualitatively measured to identify training deficiencies and create a baseline for designing future training. For unit training, identified needs should be stated as training objectives for upcoming exercises. The Marine Corps Combat Readiness Evaluation System (MCCRES) is a key evaluation tool used to identify unit training needs. The

Marine Corps Combat Readiness Evaluation System is a standardized evaluation program designed to measure a unit's warfighting readiness. The Marine Corps Combat Readiness Evaluation System specifies mission performance standards that agencies are expected to perform during their wartime mission. Though formal unit evaluations are usually performed every two years, units are encouraged to conduct informal MCCRES evaluations each time crew- or unit-level training is conducted. By employing Marine Corps Combat Readiness Evaluation System standards as a baseline for training, units can easily identify training needs and orient their training toward improving on previously identified training deficiencies.

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Appendix A

LAAD Communications Nets

Due to the wide dispersion and mobility of low altitude air defense units, radio is the primary means of communications. Wire should be used in any static situation where practical. The low altitude air defense battalion uses internal and external communications nets.

INTERNAL NETS

The low altitude air defense battalion command net (HF) is established between the battalion headquarters (net control) and subordinate batteries to provide administrative and logistics support.

The LAAD command net (HF) is established between the battery (net control) and subordinate platoons. It provides administrative and logistics support and coordinates the tactical employment of low altitude air defense platoons.

Low altitude air defense weapon control nets (HF) are established between a platoon commander (net control) and section leaders. This net provides subordinate or senior elements with current air defense warning conditions, weapon control statuses, and pertinent information on hostile, unknown, and friendly aircraft. Several nets may be required.

Each low altitude air defense section leader (net control) uses the LAAD team control net (VHF) to control teams and to relay air defense warning conditions, weapons control statuses, and pertinent information on friendly, enemy, and unknown aircraft. Multiple

LAAD team control nets, usually one per section, are normally required. The LAAD team control net may also be used by teams to pass aircraft sighting reports, engagement reports, position reports, status reports, and resupply requests to section leaders.

EXTERNAL NETS

In addition to communications between echelons of the low altitude air defense battalion, communications must be established between a LAAD unit and the unit it is working for or supporting (as established by command and support relationships) or the unit providing it with local security.

The low altitude air defense commander and the commanders of these units will determine the best means for establishing communications (e.g., radio, wire, or messenger). To communicate with Marine air command and control system agencies and aviation combat element organizations, low altitude air defense units may employ the nets listed below. Depending on the size of the MAGTF and the scope of the enemy air threat, some or all of these nets may be activated. Example nets follow.

The tactical air command net (HF/VHF) provides the primary means by which the aviation combat element commander provides operational tasking to subordinate units or agencies. Multiple nets may be required.

The antiaircraft intelligence net (HF) provides a means to report targets by various ground-based air defense units. It may also be used by the tactical air operations center to pass selected early warning contacts to ground-based air defense units.

The antiaircraft control net (HF) provides a means to control ground-based air defense units. The types of information passed on this net include target assignments, fire direction orders, weapons status commands, battery status reports, and progress of engagement reports.

The combat information detection net (HF) provides a means for reporting unidentified or hostile aircraft, including initial contact reports, tracking, amplifying, and final dispositions reports.

The command action net (HF) provides a means for command-level coordination of antiair warfare actions by exchanging information on ground-based air defense unit employment, assignment of air targets, and interceptor or missile coordination.

The Marine air control group command net (HF) provides a means for the Marine air control group commander to exercise command, administrative, and logistics functions with subordinate units.

The ACE command net (HF/VHF) provides a means for the aviation combat element commander to exercise command, administrative, and logistics functions with subordinate units. Multiple nets may be employed.

ALTERNATE COMMUNICATIONS PATHS

All low altitude air defense battalion personnel should be aware of alternate communications nets. If they cannot communicate over the standard nets, low altitude air defense battalion personnel should use any available nets to maintain continuous communications between echelons. Possible alternate nets include the—

- Infantry Battalion/Regimental Tactical Net (HF/VHF).

- Fire Support Coordination Net (HF/VHF).
- Tactical Air Request/Helicopter Request Net (HF/VHF).
- Air Operations Control Net (HF).
- Command Action Net (HF/VHF).
- Direct Air Support Net (HF).

FMFM 3-30, *Communications*, provides a detailed description of MAGTF radio nets.

If a total loss of communications occurs, immediate action to reestablish communications must be taken by all affected units. Until communications are restored, engagements may be conducted, based on the established rules of engagement. Unless otherwise directed by the applicable operations order or local combat standing operating procedures, low altitude air defense units will remain in the last directed weapons control status and state of alert.

Appendix B

Manual Cross Tell

Although diversified methods are used to pass aircraft location information, one of the most expeditious and effective methods for low altitude air defense units is manual cross tell. Air defense units and agencies use several types of manual cross tell. Regardless of the type of cross tell procedure used, information included in a manual cross tell report should include—

- Track number.
- Track location.
- Identification.
- Number and type (if known).
- Heading.
- Altitude.
- Amplifying information.
- Time of report.

The format for manually reporting tracks is specified in the air defense annex to operations orders and local standing operating procedures.

The principal types of manual cross tell used by low altitude air defense units are the Cartesian coordinate grid system, the polar grid system, and the polar coordinate system.

THE CARTESIAN COORDINATE GRID SYSTEM

The Cartesian coordinate grid system is a manual cross tell system that uses four quadrants delineated by an X and a Y axis (fig. B-1).

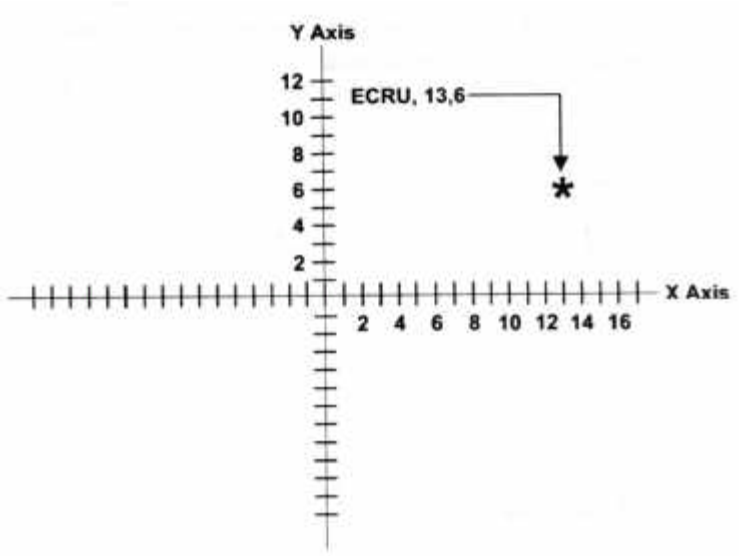


Figure B-1. Cartesian Coordinate Grid System.

The X-Y axes can either be oriented to true north, grid north, or magnetic north. (If oriented to true north or grid north, operators must account for magnetic declination.) The center of the grid,

known as the Cartesian coordinate reference point, is normally a geographic point that is compatible to all participating agencies. Each rectangular quadrant of the grid system is color-coded. The Cartesian coordinate reference point and the colors assigned to each quadrant are explained in the air operations annex to the MAGTF operations order.

For ease of depiction, the X-Y axes lines are normally marked at 5-nautical mile increments, but any common system of measurement could be used (i.e., statute miles or kilometers). Although the grid is commonly marked in increments of 5, it is the responsibility of the individual reporting the track to extrapolate the target's location to the nearest single nautical mile (or whatever unit of measurement is being used). The information is prepared for transmission by reading—

- Northwest quadrant—left and up.
- Northeast quadrant—right and up.
- Southeast quadrant—right and down.
- Southwest quadrant—left and down.

The track information is passed with the quadrant color designation first, followed by the X coordinate location, then the Y coordinate information. For example, if the northeast quadrant's color designator was ECRU, the target located at the * in figure B-1 would be reported as "ECRU (the quadrant color), 13 (the X axis location), 6 (the Y axis location)."

More information on the track, including its heading, altitude, etc., would be passed as amplifying information.

POLAR GRID SYSTEM

The polar grid system is a circular coordinate system that uses magnetic bearing (in degrees) and distances (in nautical miles or kilometers) from a specified reference point. The polar grid system (see fig. B-2) uses an easily recognizable feature (a tactical air navigation marker or other location specified in the air tasking order's special instructions) as its center and is aligned to magnetic north. The polar grid system is composed of 10° radials, which originate from the grid's center and are further divided into 10-nautical mile range bands. Each 10-nautical mile range band is given an alphabetic designator, beginning with "A" from the origin. Broad brush references can be made using only the radial (to the nearest 10°) and the range band (to the nearest 10 nautical mile). More precise cross tell can be accomplished using the exact radial (to the nearest degree), the range band alphabetic, and the exact number of nautical miles within that range band.

An unknown aircraft detected in the vicinity of the * in figure B-2 could be reported as "one bogey, 080D, heading west." As a precise reference example, two hostile aircraft detected at the + would be reported as "two bandits, 104C6, heading west." This report is derived from the exact magnetic radial (104°) and the range (26 nautical miles) from the grid's origin, that places it 6 nautical miles into the C band of the grid.

POLAR COORDINATE SYSTEM

Similar to the polar grid system, the polar coordinate system uses a known location as its center point and reports tracks using only radials (magnetic degrees) and miles from its center point. The + in figure B-2 would be reported as "two bandits, 140°/26 miles, heading west" under the polar coordinate system.

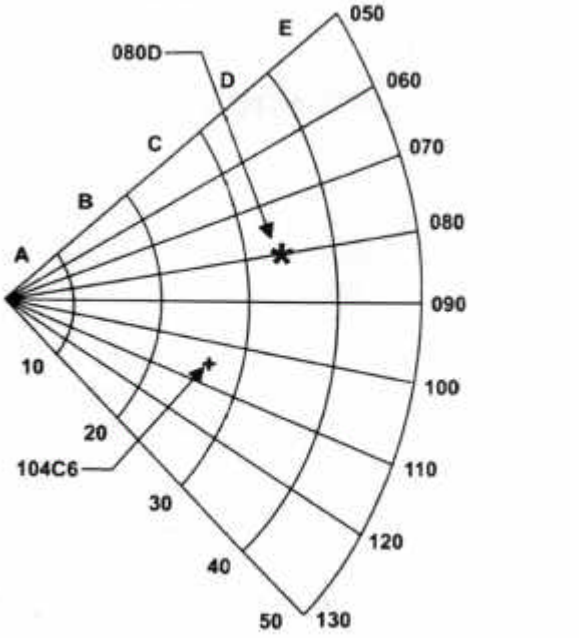


Figure B-2. Polar Grid System.

(reverse blank)

Appendix C

Base Defense Zone Procedures

The base defense zone (BDZ) is a destruction area established around an air facility, an air site, or a forward operating base to allow for the launch and recovery of friendly aircraft while maintaining an air defense posture. Base defense zones are limited to the engagement envelope of the short-range air defense weapons systems defending that base. In the case of the MAGTF, low altitude air defense battalion assets employ at base defense zones.

Base defense zones have specific entry and exit, as well as identification friend or foe (IFF) procedures associated with their use. Low altitude air defense assets will integrate with the Marine air traffic control detachment operating at the airfield around which the BDZ has been established. Preplanned base defense zones are published in the airspace control plan, while requests for activation of base defense zones are made to the aviation combat element commander. Three critical elements are required to establish a base defense zone:

- A controlling agency (e.g., Marine air traffic control detachment, tactical air operations center, or a joint/multinational air traffic control system).
- A radar.
- A weapon system.

BDZ AREA OF OPERATIONS

The Marine air traffic control detachment, in concert with the Marine air command and control system and any host nation air traffic control agencies, define the base defense zone's procedures. Base defense zone dimensions are predicated on the maximum engagement capability of the short-range air defense (SHORAD) system and not on the dimensions of the controlled airspace (i.e., Class D airspace).

MATCD AND LAAD INTEGRATION

The Marine air traffic control detachment has the requisite doctrine, forces, equipment, and capabilities to effectively manage and control a base defense zone. The success of the base defense zone depends on integration of the SHORAD and Marine air traffic control detachment personnel.

The low altitude air defense section leader responsible for supervising Stinger fires within the base defense zone physically locates in the Marine air traffic control detachment's control and communications subsystem at a control scope along with the approach controller. The approach controller monitors the assigned airspace and provides cueing to the LAAD section leader. The section leader's control scope should depict the airspace, individual team positions, sectors of responsibility, and the manual cross tell system. The approach controller provides the section leader with cueing on all air tracks within the airspace. The section leader provides cueing and aircraft position updates to teams. The detailed entry, exit, and IFF procedures that are required for the launch and recovery of friendly aircraft within a base defense zone are monitored by the Marine air traffic control detachment's tower, departure, approach,

and radar controllers to ensure friendly aircraft are passed safely through established air defenses.

Base defense zone operations may be conducted 24 hours a day. At least two sections of Stinger assets are required to conduct the sustained mission. Avenger is the weapon of choice because its forward-looking infrared sensor, remote terminal unit, and slew-to-cue capability make it the optimal asset for use in defense of a base defense zone.

PLANNING CONSIDERATIONS

The planning considerations critical to the success of base defense zone employment include the threat, terrain, night operations, asset availability, integration with air traffic control, communication architecture, and command and control. To a lesser extent, logistics and missile resupply must be preplanned but are not as critical to success.

A thorough analysis of the threat is important when planning a base defense zone. Detailed analysis of threat aircraft (e.g., likely avenues of approach, day or night capabilities, ordnance, delivery techniques, and infrared countermeasure capabilities) help establish a more effective defense. Every threat cannot be countered solely by LAAD assets within the base defense zone. A cohesive integrated air defense system must be in place to provide destruction in depth against attacking aircraft.

Teams should not be positioned directly on the approach or departure corridors of the base defense zone. Friendly aircraft transiting these corridors may present a hostile profile for individual teams and increase the risk of fratricide, particularly if a hostile aircraft is

following a friendly aircraft. Search sectors should overlap the corridors to allow surveillance and adequate coverage without unnecessarily placing the teams or friendly aircraft at risk.

Teams should be emplaced into individual positions using the global positioning system to ensure grid location accuracy. Grid locations can be applied to the control scope within the control and communications subsystem for viewing by the section leader. This application facilitates correlation of tracks with respect to the team position and may allow for a more responsive engagement of the threat, particularly at night.

Night positions should be no more than 2 kilometers apart and search sectors should be reduced as much as possible to decrease acquisition time. Search sectors should be consistent with the narrow field of view of the FLIR. This improves night acquisition of targets without the requirement to slew the Avenger turret. By overlapping the fields of view between adjacent positions and scanning vertically (vice horizontally), a seamless coverage can be established during darkness or reduced visibility.

When repositioning, teams should move one team at a time to allow for continuing coverage of the zone during the redispersion of assets. (This may become a very time consuming process and will require detailed planning to one team to move, set up, and become operational before moving a second team.) All movement should be completed prior to the end of evening nautical twilight.

The section leader is the cornerstone for low altitude air defense participation in base defense zone operations. The section leader is responsible for numerous tasks that ensure the seamless operation of multiple, simultaneous activities. Some of the key actions the

section leader must take in conjunction with establishing a base defense zone are to—

- Establish liaison with the Marine air traffic control detachment commander.
- Establish communications with teams and platoon headquarters.
- Plot team positions, search sectors, and the manual cross tell system on the control and communications subsystem's radar scope.
- Cue teams based on air traffic control identification.
- Report and disseminate critical information.

The integration requirements for the base defense zone cannot be overstated. Constant dialog and information sharing must occur among the section leader, the teams, and the approach controller to effectively sort the aircraft as they enter the BDZ.

COMMAND AND CONTROL

The process of command and control within the base defense zone is accomplished through the communications link between the section leader and the Stinger teams. Weapon control statuses may not apply to BDZ operations. Aircraft are engaged based on their classification by air traffic control assets through electronic means (e.g., IFF), determination of noncompliance with pre-briefed approach procedures, lack of voice communications, or visual identification by low altitude air defense teams. The constant dialogue between the section leader and the approach controller provides the teams with a steady flow of friendly and threat air activity within the base defense zone.

Teams that lose communications with the section leader immediately revert to a weapons tight control status during daylight hours, weapons hold at night, and assume a point defense role until restoration of communications with the section leader. Likewise, if air traffic control radars and data links to the Marine air command and control system are inoperable or not providing a recognized air picture, all low altitude air defense assets within the base defense zone revert to a point defense role. Point defense allows gunners to prosecute engagements of hostile aircraft in accordance with the established rules of engagement and weapons control status.

COMMUNICATIONS

Communications are critical to the success of the base defense zone. The section leader maintains a direct link to the teams via the LAAD team control net while the communicator maintains HF communications with the platoon commander. The section leader may also choose to monitor the air traffic control detachment doctrinal nets that link the MATCD to the Marine air command and control system. These links provide redundant paths for critical information flow regarding friendly or hostile cueing, lame duck calls, updates to air defense warning conditions, states of alert, resupply information, and engagement reports. These paths also provide multiple opportunities to build and maintain situational awareness for the destruction area as a whole.

Implementation of these procedures will depend on the tactical situation and the MAGTF commander’s air defense priorities.

Appendix D

LAAD States of Alert

Generally, air defense warnings dictate the alert state for all organizations including those not dedicated to air defense. The most difficult decision for commanders of dedicated air defense units is determining which personnel and weapons are ready *immediately* to do battle and which can be placed on a lesser alert to perform maintenance and let the crew rest.

A state of alert (SOA) establishes the maximum allowable period of time in which the air defense unit must be able to engage a target. The time associated with each state of alert provides a frame of reference for the air defense battle manager to determine the level of readiness of low altitude air defense units within the integrated air defense system. In many cases, LAAD units can engage aircraft from their assigned positions in much less time.

The state of alert for each missile unit is normally determined by the senior air defense commander (typically the sector antiair warfare coordinator) giving consideration to the air defense warning condition and alert status imposed by higher headquarters. Subordinate commanders may order their unit to a higher state of alert, but never to a lesser state of alert than imposed by higher headquarters. Normally, the command element of the low altitude air defense unit determines states of alert for their subordinate units in conjunction with the SAAWC. When a prescribed state of alert cannot be assumed for any reason (e.g., equipment malfunction), higher headquarters must be notified immediately.

Unless otherwise dictated by the applicable operation order or local tactical standing operating procedures, the following states of alert apply to low altitude air defense units (see table D-1):

- **SOA A (Battle Stations).** Marines are in their assigned firing positions. All communications nets are manned. At the team level one member is scanning all visible avenues while the other is searching the threat sector. Missiles are ready to fire immediately. Units assume that an air attack is imminent.

- **SOA B (5 Minutes).** Marines are in the immediate vicinity of their firing positions and can engage a target within 5 minutes. No movement in or out of the team position occurs. All communications nets are monitored. At the team level, both gunners are alert. One team member maintains surveillance over the team's assigned sector of fire at all times. At least two missiles are ready to fire within 10 seconds. Units assume that an air attack is probable.

- **SOA C (1 Hour).** Marines are in the general vicinity of their positions and can engage a target within 1 hour. Only mission essential movement and resupply take place. All communications nets are monitored. One team member maintains surveillance over the team's assigned sector of fire at all times. At least two missiles are readily available. Units assume that an air attack is probable.

- **SOA D (4 Hours).** Marines have 4 hours before they have to be capable of engaging a target. This time is used for movement, resupply, maintenance, improving positions, and rest. Communications nets are monitored as directed. Units assume that an air attack is improbable.

Table D-1. LAAD States of Alert.

	A Battle Stations	B 5-Minute Alert	C 1-Hour Alert	D 4-Hour Alert
Surveillance	Assigned sector and all visible avenues of approach	Assigned sector	Assigned sector	Not required
Communications	All nets	All nets	All nets	As directed
Movement	None	None	Mission essential within immediate vicinity of position	As required
Maintenance	None	None	Preventive	As required
Resupply	Delivered to team level only in critical circumstances	Delivered to team level only in critical circumstances	Mission essential routine distribution IAW section SOPs	Mission essential routine distribution IAW section SOPs
Weapons	2 missiles ready to fire	2 missiles ready to fire within 10 seconds	2 missiles readily available	Basic load on hand
Rest	None	None	1 Marine as required	As required

(reverse blank)

Appendix E

Ground-Based Air Defense Five-Paragraph Order Format

This format does not list every subject that could be included in a ground-based air defense order nor do all the subjects have to be included. The drafter must analyze the audience that will receive the order and tailor the format and information. Operations orders, applicable standing operational procedures, and doctrinal publications should be referenced in lieu of standard, well-known information internal to the order.

I. Situation

a. General

b. Enemy Forces

- Ground forces disposition
- Aircraft number, type, and location (fixed-wing, rotary-wing, and unmanned aerial vehicles)
- Enemy aircraft ability to range air defense priorities
- Expected threat axes and likely avenues of approach
- Expected times of attack

- Ordnance and delivery techniques
  - Standoff weapons
  - Air-to-surface missiles
  - Targeting capabilities (FLIR, TV opitces, laser guidance, command guidance, etc.)
- Electronic attack capabilities
- Electronic warfare support capabilities
- Night capabilities
- Infrared countermeasures capabilities
- Nuclear, biological, and chemical capabilities
- Surface-to-surface threat
- Special operations or terrorist threat
- Most likely enemy course of action

c. Friendly Forces

- Higher
- Adjacent
- Supporting

d. Attachments and Detachments
e. Assumptions

II. Mission

III. Execution
a. Commander's Intent
b. Concept of Operations
c. Tasks
d. Coordinating Instructions
- Time of departure or time to be operational
- Initial air defense warning condition, weapons control status, state of alert
- Agency exercising engagement authority and identification authority
- Autonomous operations procedures
- Origin points (friendly or hostile)
- Destruction area (BDZs [base defense zones], MEZs [missile engagement zones], FEZs [fighter engagement zones])
- Location of combat air patrols and orbit areas
- Surveillance coverage and gaps
- Primary threat axes

- Minimum risk routes
- Rules of engagement
- Firing doctrine guidance
- Self-defense criteria
- Lame duck procedures or risk assessment
- Manual cross tell procedures
- Liaison requirements
- Alternate site locations
- Consolidation points
- Rehearsals and inspections, as required
- Actions to be taken upon enemy contact
- Casualty plans
- Nuclear, biological, and chemical mission-oriented protective posture conditions and decontamination plans

IV. Administration and Logistics

a. Rations
b. Fuel and Water
c. Medical
d. Missile Load-Out and Resupply Procedures
e. Handling of Enemy Prisoners of War

f. Contact Team Locations and Request Procedures

V. Command and Signal

a. Command

- Your location and the next higher unit's location
- Succession of command

b. Signal

- Current period for aviation communications electronic operating instructions (ACEOI)
- Frequencies/call signs (primary and alternate)
- Required communications nets to be monitored (include platoon combat operations centers [COCs] and battalion command posts)
- Prioritization and restoration of communications nets
- Data link reference points and battery address (including information for ground-based data link)
- Lost/alternate communications procedures
- Crypto change-over times
- Challenge and password
- Brevity codes
- Required reports (times required, paths of transmission, responsibility for submission)

- Emission control (EMCON)/electronic protection procedures to include radiation control (RADCON) plan and ZIPLIP condition
- Plan for air tasking order distribution

Appendix F

LAAD Report Formats

LAAD battalions and units use the following report formats to pass information. The formats are programmed into the remote terminal unit, allowing for ease of submission and transmission.

LAAD EARLY WARNING/LEAKER REPORT

Date time group of report

1. Number or type of aircraft

2. Location or heading

3. Time (if not immediate)

Note: (flash report, pass via real voice)

SALUTE REPORT

Date time group of report

1. Size	(S)quad (P)latoon (C)ompany (B)attalion (O)ther
2. Activity	(O)ffensive prep

(D)efensive prep
(C)onvoy
(O)ther

3. Location _____

4. Unit (M)ech infantry
(DI)smounted infantry

5. Time seen _____

6. Equipment (AC)aircraft
(S)emi-auto mg
(A)ntitank weapons
(M)ines
(T)anks
(ART)illery
(TR)ucks
(B)oats

7. Comments _____

NBC-1 REPORT

Date time group of report

1. Type of report (N)uclear
(B)iological
(C)hemical

2. Position of observer _____
Direction of attack _____
Direction _____ dgs

3. DTG attack began or ended _____/_____

4. Location of attack _____

5. Means of delivery
   (A)ircraft
   (ART)illery
   (M)issiles

6. Type of burst
   (A)irburst
   (S)urface
   (SUB)surface
   (SPR)ay

7. Type of agent
   (N)erve
   (B)lister
   (BL)ood
   (C)hoking
   (I)rritant
   (U)nknown

8. Comments _____

CASEVAC REQUEST (TEAM LEADER LEVEL)

Date time group of report

1. Call sign of requesting party _____
2. Number of injured _____
3. Type of injury _____
4. Status of injured _____
5. Location of injured grid _____
6. Amplifying instructions or comments _____

ENGAGEMENT REPORT

Date time group of report

1. Unit (call sign or tm #)

2. Aircraft number or type

3. Time of engagement

4. Location of engagement

   Polar _____
   Cartesian _____
   Mgrs _____
   Lat or long _____

5. Number of missiles/rounds fired

6. Results

   (K)ill
   (M)iss
   (D)amage

AIR DEFENSE STATUS MESSAGE

Date time group of report

1. Air defense warning condition
   (W)hite
   (Y)ellow
   (R)ed

2. Weapons control status
   (F)ree
   (T)ight
   (H)old

3. States of alert
   (A) Battle stations
   (B) 5-minute alert
   (C) 1-hour alert
   (D) 4-hour alert

4. Effective DTG

FREQ INTERFERENCE REPORT

Date time group of report

1. Type of report

2. Unit location and time

3. Frequency affected

4. Equipment affected
   (FM)Radio or VHF
   (N)AVAID
   (S)AT comm
   (AM)Radio or HF
   (R)adar
   (O)ther _____

5. Strength of interference
   (W)eak
   (M)edium
   (S)trong

6. Comments or any amplifying instructions

TACTICAL LOCATION REPORT

Location will be sent IAW OPORD (i.e., Grid/Cartesian/Lat/Long)

Date time group of report

1. Bn COC _____
2. Bn (jump CP) _____
3. Alpha btry COC _____
4. Alpha btry (jump CP) _____
5. Bravo btry COC _____
6. Bravo btry (jump CP) _____
7. Alpha btry 1st plt CP _____
8. 1st sec /# of teams _____
9. 2nd sec /# of teams _____
10. 3rd sec /# of teams _____
11. Alpha btry 2nd plt CP _____
12. 1st sec /# of teams _____
13. 2nd sec /# of teams _____
14. 3rd sec /# of teams _____
15. Alpha btry 3rd plt CP _____
16. 1st sec /# of teams _____
17. 2nd sec /# of teams _____
18. 3rd sec /# of teams _____
19. Bravo btry 1st plt CP _____
20. 1st sec /# of teams _____
21. 2nd sec /# of teams _____
22. 3rd sec /# of teams _____
23. Bravo btry 2nd plt CP _____
24. 1st sec /# of teams _____
25. 2nd sec /# of teams _____
26. 3rd sec /# of teams _____
27. Bravo btry 3rd plt CP _____
28. 1st sec /# of teams _____
29. 2nd sec /# of teams _____
30. 3rd sec /# of teams _____

COMMUNICATIONS STATUS REPORT

Date time group of report

1. Reporting unit call sign _____ or unit _____

2. Down radio equipment
   - SINCGARS _____
   - AN/PRC-104 _____
   - AN/MRC-138 _____

3. Down antennas
   - RC-292 _____
   - OE-254 _____
   - AS-2259 _____
   - AT-1011 _____
   - AS-3900/VRC _____
   - AS-3683/PRC _____
   - AS-4266/PRC _____

4. Down ky equipment
   - KY-99 _____
   - AN/CYZ-10 _____

5. Down misc equipment
   - AN/PSC-2 _____
   - KL-43D _____
   - AN/UPS-3 _____
   - AN/GRA-39 _____
   - PWR SUPP _____

6. Circuit outages Unit/Net/DTG of last contact

7. Comments or requests _____

MOVEMENT ORDER

Date time group of report

1. Relocation position grid _____

2. Time released from current mission/_____
   Mission start time (DTG) _____

3. Time to be operational (DTG)

4. Comments (amplifying instructions)

LAAD STATUS OR LOGISTICS REPORT

Date time group of report

1. Personnel OFF/SNCO/ENL ___/___/___

2. Missiles
   # OP _____
   # NON-OP _____
   # needed _____

3. IFF
   # OP _____
   # NON-OP _____

4. TDAR
   # OP _____
   # NON-OP _____

5. RTU GBDL capable
   _____up
   _____ down

6. Vehicles
   Type_____ # OP _____
   # NON-OP_____
   Type_____ # OP _____
   # NON-OP_____
   Type_____ # OP _____
   # NON-OP_____

7. Crypto Type_____ # OP _____
   # NON-OP_____

8. Pol resupply (in gallons) Diesel _____
Mogas _____
Oil _____
Whitegas _____
Antifreeze _____
Brake fluid _____
CLP _____
Other _____

9. Water resupply _____ gal

10. Battery resupply Type _____ _____ ea
Type _____ _____ ea
Type _____ _____ ea
Type _____ _____ ea

11. Ammo resupply Type _____ _____ ea
Type _____ _____ ea
Type _____ _____ ea
Type _____ _____ ea

12. Chow resupply _____ cases of MREs

13. Location or time for resupply _____

14. Comments _____

JOINT TACTICAL AIR STRIKE REQUEST

1. Unit called this is _____ Request # _____

2. A Preplanned _____ C Precedence _____
B Immediate _____ Priority _____

3. Target is or number of
A Pers in open _____/_____

B Pers dug in _____/_____
C WPNS/MG/RR/AT _____/_____
D MORTARS/ARTY _____/_____
E AAA, ADA _____/_____
F RKTS, missile _____/_____
G Armor _____/_____
H Vehicles _____/_____
I Bldgs _____/_____
J Bridges _____/_____
K Pillbox bnkrs _____/_____
L Supplies, equip _____/_____
M Cntr (CP, COM) _____/_____
N Area _____/_____
O Route _____/_____
P Moving NESW _____/_____
Q Remarks _____

4. Target location is
   A _____ (Coordinates)
   B _____ (Coordinates)
   C _____ (Coordinates)
   D _____ (Coordinates)
   E Target elevation _____
   F Sheet # _____
   G Series _____
   H Chart # _____

5. Target time or date
   A ASAP _____
   B NLT _____
   C AT _____
   D TO _____

6. Desired ORD or results
   A Ordnance _____
   B Destroy _____
   C Neutralize _____

D Harass or interdict _____

7. Final control
   - A FAC/RASFAC _____
   - B Call sign _____
   - C Freq _____
   - D ASRT _____
   - E Freq (Transmit as appropriate) _____
   - F FIX/CONT PT _____

8. Remarks
   - A IP _____
   - B Hdng _____ MAG Offset L/R
   - C Distance _____
   - D Tgt elevation _____ Feet msl
   - E Tgt description _____
   - F Tgt location _____
   - G Mark type _____ Code _____
   - H Friendlies _____

9. Egress _____

10. BCN-Tgt _____ MAG BCN Grid _____/_____

11. BCN-Tgt _____ Meters Tgt Grid _____/_____

12. BCN elevation _____ Feet msl

ASSAULT SUPPORT REQUEST

1. Unit called This is _____ Request # _____

2. Request for
   - A Helicopter _____
   - B Fixed-wing _____

3. Mission categories
   - A Preplanned _____ Precedence _____
   - B Priority _____

C Immediate _____ Priority _____

4. Type mission
   A Tactical _____
   B Administrative _____

5. Mission is
   A Assault transport _____
   B Logistical support _____
   C Air evacuation _____
   D Medevac _____
   E Aerial delivery _____
   F C2 _____
   G Trap _____
   H SAR _____
   I Illumination _____
   J Special ops _____
   K Other _____

6. Payload is
   A Troops _____
   B External cargo/wt _____/_____
   C Internal cargo/wt/cu _____/_____/_____
   Largest item (LXWXH) _____/_____/_____

7. Instructions

	Pickup time	Coordinates	LZ time	Coordinates
A	_____	_____	_____	_____
B	_____	_____	_____	_____
C	_____	_____	_____	_____
D	_____	_____	_____	_____

8. LZ description
   A Wind direction/velocity _____/_____
   B Elevation_____ Feet msl
   C Size _____

D Obstacles_____
E Friendly pos _____ dir/dist _____/_____
F Enemy pos _____ dir/dist _____/_____
G Last fire received time/type _____/_____ dir/dist _____/_____

9. Lz will be
   A Unmarked _____
   B Marked _____ with color _____

10. Remarked with
   A Panels _____
   B Smoke _____
   C Flares _____
   D Mirror _____
   E Lights _____
   F NAVAID _____
   G Other _____

11. Lz Description
   A Pickup zone call sign _____/frequency (color code) _____
   B Lz call sign _____/frequency (color code) _____

12. Remarks _____

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Appendix G

Glossary

Section I. Acronyms and Abbreviations

ACE ..... aviation combat element
ADCON ..... administrative control
at ..... antitank
ASRT ..... air support radar team
AWACS ..... Airborne Warning and Control System
BCN ..... beacon
BCU ..... battery coolant unit
BDZ ..... base defense zone
bldgs ..... buildings
bnkrs ..... bunkers
btry ..... battery
CAC^2S ..... common aviation command and control system
CASEVAC ..... casualty evacuation
CATF ..... commander, amphibious task force
CLP ..... cleaning lubricant protectant
cntr ..... centers
cont pt ..... control point
COC ..... combat operations center
comm ..... communications
CP ..... command post
crypto ..... cryptological
cu ..... cubic
DASC ..... direct air support center
dgs ..... degrees
det ..... detachment

DIRLAUTH ..... direct liaison authorized
DOD ..... Department of Defense
DTG ..... dtae-time group
EDATF ..... emergency defense of the amphibious task force
EMCON ..... emission control
enl ..... enlisted
FAC ..... forward air controller
FEZ ..... fighter engagement zone
fix ..... fixed
FLIR ..... forward-looking infrared
FM ..... frequency modulation
FMFM ..... Fleet Marine Force manual
FMFRP ..... Fleet Marine Force reference publication
GBDL ..... ground-based data link
GCE ..... ground combat element
GPS ..... global positioning system
H&S ..... headquarters and service
hdng ..... heading
HF ..... high frequency
HMMWV ..... high mobility, multipurpose wheeled vehicle
IAW ..... in accordance with
ICOFT ..... institutional conduct of fire trainer
IFF ..... identification, friend or foe
IP ..... initial point
IR ..... infrared radiation
LAAD ..... low altitude air defense
lat/long ..... latitude/longitude
LAV-AD ..... light armored vehicle-air defense
LZ ..... landing zone
MACCS ..... Marine air command and control system
MACG ..... Marine air control group
MAG ..... Marine aircraft group
MAGTF ..... Marine air-ground task force
MANPAD ..... man portable air defense

MAPP.....Marine aviation planning problem
MCCRES..... Marine Corps Combat Readiness Evaluation System
MCO.....Marine Corps order
MCRP.....Marine Corps reference publication
MCWP.....Marine Corps warfighting publication
MEF.....Marine expeditionary force
METT-T .....mission, enemy, terrain and weather, troops and support available, time-available
MEU.....Marine expeditionary unit
MEZ ..... missile engagement zone
mg.....machine gun
MGRS ..... Military Grid Reference System
misc.....miscellaneous
MOPP.....mission-oriented protective posture
MRE.....meal, ready-to-eat
MTS.....moving target simulator
NBC.....nuclear, biological, and chemical
off .....officer
OP..... observation post
OPCON ..... operational control
ORL.....ordnance release line
pers .....personnel
RADCON.....radiation control
RAS.....rear area security
rkts.....rockets
RMP ..... reprogrammable microprocessor
ROM.....read-only memory
rr .....railroad
RTU.....remote terminal unit
SAAWC ..... sector antiair warfare coordinator
SAM.....surface-to-air missile
sec..... section
SHORAD ..... short-range air defense

SINCGARS..... single-channel and airborne radio system
SNCO..... staff noncommissioned officer
SOA ..... state of alert
SOP.....standing operating procedure
T&R .....training and readiness
TACC.....tactical air command center
TACON.....tactical control
TADIL .....tactical digital information link
TAOC .....tactical air operations center
TDAR .....tactical defense alert radar
tgt .....target
TM .....technical manual
tm ..... team
UHF ..... ultra high frequency
UNAAF..... Unified Action Armed Forces
UV..... ultraviolet
VHF ..... very high frequency
wps.....weapons
wt .....weight
WTI.....weapons and tactics instructor

Section II. Definitions

A

active air defense—Direct defensive action taken to nullify or reduce the effectiveness of hostile air action. It includes such measures as the use of aircraft, air defense weapons, weapons not used primarily in an air defense role, and electronic warfare. (Joint Pub 1-02)

administrative control—Direction or exercise of authority over subordinate or other organizations in respect to administration and support, including organization of Service forces, control of resources and equipment, personnel management, unit logistics, individual and unit training, readiness, mobilization, demobilization, discipline, and other matters not included in the operational missions of the subordinate or other organizations. Also called ADCON. (Joint Pub 1-02)

air control—Air control is the authority to direct the physical maneuver of aircraft in flight or to direct an aircraft or SAW unit to engage a specific target. (MCWP 3-25)

air control agency—An organization possessing the capability to exercise air control. (FMFRP 0-14 under "Marine air command and control system")

air defense—All defensive measures designed to destroy attacking enemy aircraft or missiles in the Earth's envelope of atmosphere, or to nullify or reduce the effectiveness of such attack. (Joint Pub 1-02)

air direction—The guidance and supervision which a commander employs to focus his resources on mission accomplishment. Air direction occurs as a sequence of the following activities: apportionment, allocation, tasking, and fragmentary orders. The authority to regulate the employment of air resources (aircraft and surface-to-air units) to maintain a balance between their availability and the priorities assigned for their usage. (MCWP 3-25)

airspace management—The coordination, integration, and regulation of the use of airspace of defined dimensions. (Joint Pub 1-02)

antiair warfare—A US Navy/US Marine Corps term used to indicate that action required to destroy or reduce to an acceptable level the enemy air and missile threat. It includes such measures as the use of interceptors, bombers, antiaircraft guns, surface-to-air and air-to-air missiles, electronic attack, and destruction of the air or missile threat both before and after it is launched. Other measures which are taken to minimize the effects of hostile air action are cover, concealment, dispersion, deception (including electronic), and mobility. (Joint Pub 1-02)

area of operations—An operational area defined by the joint force commander for land and naval forces. Areas of operation do not typically encompass the entire operational area of the joint force commander, but should be large enough for component commanders to accomplish their missions and protect their forces. Also called AO. (Joint Pub 1-02)

area of responsibility—1. The geographical area associated with a combatant command within which a combatant commander has authority to plan and conduct operations. 2. In naval usage, a predefined area of enemy terrain for which supporting ships are responsible for covering by fire on known targets or targets of opportunity and by observation. Also called AOR. (Joint Pub 1-02)

C

command and control—The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. Also called C^2. (Joint Pub 1-02)

D

direct liaison authorized—That authority granted by a commander (any level) to a subordinate to directly consult or coordinate an action with a command or agency within or outside of the granting command. Direct liaison authorized is more applicable to planning than operations and always carries with it the requirement of keeping the commander granting direct liaison authorized informed. Direct liaison authorized is a coordination relationship, not an authority through which command may be exercised. Also called DIRLAUTH. (Joint Pub 1-02)

J

joint operation—An operation carried on by a force which is composed of significant elements of the Army, Navy or the Marine Corps, and the Air Force, or two or more of these Services operating under a single commander authorized to exercise unified command or operational control over joint forces. Note: A Navy/Marine Corps operation is not a joint operation. (FMFRP 0-14)

L

lame duck procedures—Lame duck procedures are established for friendly aircraft when their communications, navigation, and IFF capabilities are degraded or inoperable because of battle damage or equipment malfunction. They allow friendly aircraft to safely ingress through a MAGTF controlled airspace. Lame duck procedures must be well-planned (detailed but simple), well-briefed, and disseminated to all friendly aircrews and operators within the integrated air defense system and Marine air command and control system. They must allow for different situations. For example, an aircraft with considerable battle damage may not be able to go to numerous control points at specific altitudes and air speeds. Aircrews must understand that failure to adhere to lame duck procedures may result in engagement by friendly air defense systems. (FMFM 5-50)

M

Marine air command and control system—A system which provides the aviation combat element commander with the means to command, coordinate, and control all air operations within an assigned sector and to coordinate air operations with other Services. It is composed of command and control agencies with communications-electronics equipment that incorporates a capability from manual through semiautomatic control. Also called MACCS. (Joint Pub 1-02)

O

operational control—Transferable command authority that may be exercised by commanders at any echelon at or below the level of combatant command. Operational control is inherent in combatant

command (command authority). Operational control may be delegated and is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish missions assigned to the command. Operational control should be exercised through the commanders of subordinate organizations. Normally this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Operational control normally provides full authority to organize commands and forces and to employ those forces as the commander in operational control considers necessary to accomplish assigned missions. Operational control does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training. Also called OPCON. (Joint Pub 1-02)

P

passive air defense—All measures, other than active air defense, taken to minimize the effectiveness of hostile air action. These measures include deception, dispersion, and the use of protective construction. (Joint Pub 1-02)

positive control—A method of airspace control which relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility therein. (Joint Pub 1-02) The tactical control of aircraft by a designated control unit, whereby the aircraft receives orders affecting its movements which immediately transfer responsibility for the safe navigation of the aircraft to the unit issuing such orders. (FMFRP 0-14)

procedural control—A method of airspace control which relies on a combination of previously agreed and promulgated orders and procedures. (Joint Pub 1-02)

R

rules of engagement—Directives issued by competent military authority which delineate the circumstances and limitations under which United States forces will initiate and/or continue combat engagement with other forces encountered. Also called ROE. (Joint Pub 1-02)

T

tactical air command center—The principal US Marine Corps air command and control agency from which air operations and air defense warning functions are directed. It is the senior agency of the US Marine air command and control system which serves as the operational command post of the aviation combat element commander. It provides the facility from which the aviation combat element commander and his battle staff plan, supervise, coordinate, and execute all current and future air operations in support of the Marine air-ground task force. The tactical air command center can provide integration, coordination, and direction of joint and combined air operations. Also called Marine TACC. (Joint Pub 1-02)

tactical air control center—The principal air operations installation (land- or ship-based) from which all aircraft and air warning functions of tactical air operations are controlled. Also called Navy TACC. (Joint Pub 1-02)

tactical air direction center—An air operations installation under the overall control of the tactical air control center (afloat)/tactical air command center, from which aircraft and air warning service

functions of tactical air operations in an area of responsibility are directed. Also called TADC. (Joint Pub 1-02)

tactical control—Command authority over assigned or attached forces or commands, or military capability or forces made available for tasking, that is limited to the detailed and, usually, local direction and control of movements or maneuvers necessary to accomplish missions or tasks assigned. Tactical control is inherent in operational control. Tactical control may be delegated to, and exercised at any level at or below the level of combatant command. Also called TACON. (Joint Pub 1-02)

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Appendix H

References and Related Publications

Joint Publications

0-2	Unified Action Armed Forces (UNAAF)
1-02	Department of Defense Dictionary of Military and Associated Terms
3-0	Doctrine for Joint Operations
3-01.5	Doctrine for Joint Theater Missile Defense
3-02	Joint Doctrine for Amphibious Operations
3-52	Doctrine for Joint Airspace Control in the Combat Zone
3-54	Joint Doctrine for Operations Security
3-56.1	Command and Control for Joint Air Operations
5-0	Doctrine for Planning Joint Operations

Fleet Marine Force Manuals

3-30	Communications
5-1	Organization and Function of Marine Aviation
5-30	Assault Support
5-50	Antiair Warfare
5-70	MAGTF Aviation Planning

Fleet Marine Force Reference Publications

0-14	Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms
5-61	ICAC^2: Multiservice Procedures for Integral Combat Airspace Command and Control
5-62	TAGS: Multiservice Procedures for the Theatre Air-Ground System
5-71	Aviation Planning Documents

Marine Corps Doctrinal Publications

1	Warfighting
1-3	Tactics
5	Planning
6	Command and Control

Marine Corps Warfighting Publications

3-25	Control of Aircraft and Missiles
3-25.3	Marine Air Command and Control System Handbook
3-25.5	Direct Air Support Center Handbook
3-25.6	Sector Antiair Warfare Coordinator Handbook
3-25.7	Tactical Air Operations Center Handbook
3-25.8	Marine Air Traffic Control Detachment Handbook

Marine Corps Reference Publications

5-2A	Operational Terms and Graphics

Naval Warfare Publications

3-01.01	Antiair Warfare
3-01.10	Antiair Warfare Commander's Manual

Marine Corps Orders

P3500.19	Aviation Training and Readiness Manual, Vol V, Marine Air Command and Control System (MACCS)
3501.9B	Marine Corps Combat Readiness Evaluation System (MCCRES)Vol VIII, Marine Command and Control System (MACCS)

Technical Manuals

08319A-12	Technical Manual Operators and Organizational Maintenance Instructions STLS (Stinger Launch Simulator)
9-1425-429-12	Operator's and Organizational Maintenance Manual: Stinger Guided Missile System

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