

Chapter VIII

AIR AND MISSILE DEFENSE

1. Background

In air and missile defense operations, both the Army and the Marine Corps use the same basic doctrine, principles, employment guidelines, and IFF procedures. Air and missile defense are all defensive measures designed to destroy attacking aircraft or missiles in the earth's envelope of atmosphere or to nullify or reduce the effectiveness of such attacks. Air defense and missile defense operations provide force protection and contribute to the joint force's freedom of action. Air defense operations provide for protection of friendly forces, bases, lines of communication, and selected geopolitical assets through passive air and missile defense, active defense, and offensive operations, supported by a command, control, communications, computers, and intelligence (C4I) system. Protection encompasses the employment of aircraft, interceptor missiles, surface-to-air systems, weapons not primarily used in an air defense role, deception, operations security (OPSEC), cover and concealment, dispersion, early warning, and electronic protection.

2. Terminology

The following Joint Pub 1-02 terms serve as a common basis for approaching integrated air and missile defense operations:

a. **Passive Air Defense.** Passive air defense encompasses 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.

b. **Active Air Defense.** Active air defense is direct defensive action taken to nullify 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.

c. **Air Defense Action Area.** Air defense action area is an area and the airspace above it within which friendly aircraft or surface-to-air weapons are normally given precedence in operations except under specified conditions.

d. **Air Defense Area.** Air defense area is a specifically defined airspace for which air defense must be planned and provided.

e. **Air Defense Artillery.** Air defense artillery is weapons and equipment for actively combating air targets from the ground.

f. **Air Defense Identification Zone (ADIZ).** ADIZ is airspace of defined dimensions within which the ready identification, location, and control of airborne vehicles are required.

g. **Air Defense Operations Area.** Air defense operations area is an area and the airspace above it within which procedures are established to minimize mutual interference between air defense and other operations. It may include designation of an air defense area, air defense action area, ADIZ, and/or firepower umbrella.

h. **Firepower Umbrella.** Firepower umbrella is an area of specified dimensions defining the boundaries of the airspace over a naval force at sea within which the fire of ships' anti-aircraft weapons can endanger aircraft and within which special procedures have been established for the identification and operation of friendly aircraft.

i. **Weapons Engagement Zone (WEZ).** WEZ is airspace of defined dimensions within which the responsibility for engagement of air threat normally rests with a particular weapons system.

(1) Fighter Engagement Zone (FEZ). FEZ is that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with fighter aircraft.

(2) High-altitude Missile Engagement Zone (HIMEZ). HIMEZ is that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with high altitude surface-to-air missiles.

(3) Low-altitude Missile Engagement Zone (LOMEZ). LOMEZ is that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with low-to-medium altitude surface-to-air missiles.

(4) Short-range Air Defense Engagement Zone (SHORADEZ). SHORADEZ is that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with short range air defense weapons.

(5) Joint Engagement Zone. Joint Engagement is that airspace of defined dimensions within which multiple air defense systems (surface-to-air missiles and aircraft) are simultaneously employed to engage air threats.

j. Weapons-free Zone. Weapons-free zone is an air defense zone established for the

protection of key assets or facilities, other than air bases, where weapons systems may be fired at any target not positively recognized as friendly.

3. DRB Operations

The mission of Army ADA is to protect the force and selected geopolitical assets from aerial attack, missile attack, and aerial surveillance.

a. Army Air and Missile Defense Equipment. Two categories of weapons comprise the Army's land based ADA arsenal. The first category, high-to-medium altitude air defense (HIMAD) systems include the Patriot and Hawk systems. These systems detect, interrogate, track, and perform fire control functions at extended ranges and in virtually all weather conditions, day or night. Although these systems are not found at the DRB level, HIMAD coverage may be available from the MEF when Army units operate under its control, the Army corps, or echelons above corps. Forward area air defense systems including the Bradley Stinger Fighting Vehicle (BSFV), Avenger system, and Stinger Man-portable Air Defense System (MANPADS) provide low altitude air defense coverage of selected combat, combat support, or combat service support units and critical assets. Table VIII-1 describes the types and characteristics of Army air defense weapons systems.

Table VIII-1. Types and Characteristics of Army Air Defense Weapons

WEAPON	NUMBER SYSTEMS/UNIT	RANGE
Patriot	48/Corps Bn	50 km - Air Breathing Threat TBM - Classified
Hawk	18/Corps Bn	40 km
BSFV (Stinger)	24/Div Bn 8/Btry	4 km
Avenger (Stinger)	54/Corps Bn 24/Div Bn 8/Btry	4 km
MANPADS (Stinger)	40/Div Bn 8-12/Btry	4 km

b. DRB Air Defense Equipment. The DRB employs the BSFV, Avenger, Stinger MANPADS, and sensors as described below:

(1) BSFV. The BSFV combines the mobility and armor protection of the Bradley fighting vehicle with the air defense capabilities afforded by the Stinger missile. The BSFV affords the crew survivability and the speed commensurate with the mechanized force it supports. The Stinger team maintains a basic load of 6 missiles. The team must dismount to engage aerial platforms.

(2) Avenger. The Avenger is a lightweight, highly mobile and air transportable surface-to-air missile system mounted on the HMMWV. Operated by a 2-man crew, the Avenger can provide 24-hour air defense coverage against UAVs, rotary-wing and low altitude fixed-wing aircraft. The fire unit integrates 8 Stinger missiles in 2 turret-mounted launch pods, a .50-caliber machine gun, FLIR, eye-safe laser rangefinder, IFF, heads-up optical sight, and a computerized fire control system. The gyro stabilized turret permits the gunner to launch a missile or fire the machine gun on the move or from a stationary position. The Stinger missiles carried on the Avenger weapon system are also capable of being reconfigured in a MANPADS configuration.

(3) Stinger. Stinger is a man-portable, shoulder-fired, infrared-homing (heat seeking) guided missile system. It requires no control from the gunner after firing. Stinger has an IFF subsystem that aids the gunner and team chief in identifying friendly aircraft. Limited visibility operations at night restrict the gunners' ability to see and identify the target.

(4) Sensors. The ground based sensor (GBS) provides the air defense unit with automated target acquisition and air track identification (including IFF). The GBS

provides 360-degree azimuth coverage for target acquisition and tracking of fixed- and rotary-wing aircraft and UAVs out to a range of 40 km. It provides target location and the capabilities of acquisition and tracking in electronic countermeasures (ECM) and clutter. The FAAD C3I system processes detected targets and, if appropriate, alerts and cues forward area air defense system fire units or MANPADS teams. A 5-ton cargo truck or HMMWV (for the downsized version) serves as the prime mover for the 24-hour, all weather-capable GBS.

c. DRB ADA Organization. The ADA battalion commander tailors the DRB ADA organization to meet the situation. A typical heavy division's DRB ADA battery normally consists of 2 BSFV platoons (4 BSFVs per platoon—total 8 BSFVs); 1 MANPADS platoon (total 10 MANPADS); a sensor section (total 2 sensors) from the battalion headquarters; a maintenance platoon; and a headquarters platoon. The battery is augmented by 1 or more Avenger platoons if the threat (e.g., cruise missile or UAVs) warrants this task organization. An Avenger platoon has 4 Avenger weapon systems. The ADA battalion commander may send the assistant division air defense officer (ADADO) and FAAD C3I capabilities to allow engagement and force operation linkage to external EW sources.

d. Command and Control (Divisional Air Defense Units Only). Based on recommendations from the senior supporting air defense commander, the maneuver brigade commander determines the priorities for air defense coverage, allocation of available air defense assets, and air defense command and support relationships. The battery commander (or senior supporting air defense commander) supports brigade operations based on the unit mission, commander's intent, and concept of operations. Successful synchronization of brigade operations hinges on including the ADA officer early and continuously in the planning process. (See Figure VIII-1.)

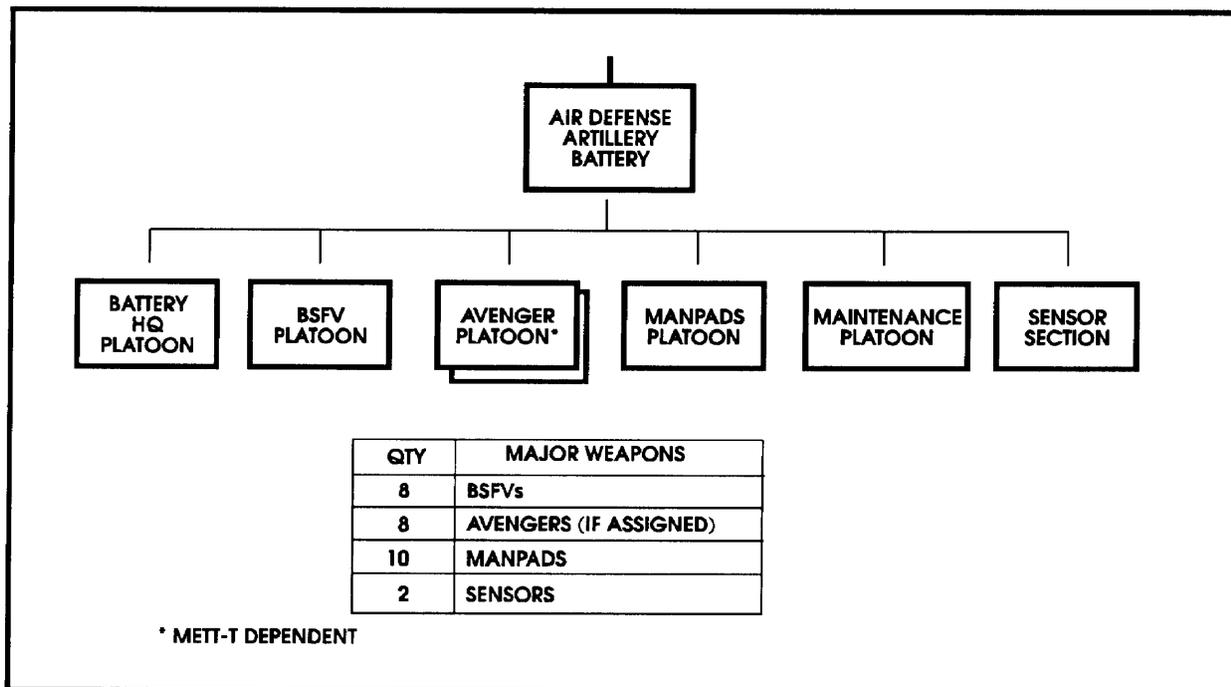


Figure VIII-1. DRB ADA Battery

e. Operations.

(1) Passive Air Defense. The entire DRB has a role in passive air defense. Measures taken to minimize the effects of hostile air actions include the use of cover, concealment, camouflage, deception, dispersion, and protective construction. Early warning is essential in alerting the maneuver force that hostile air action is imminent and protective measures must be initiated. Early warning is accomplished by planning, deploying, and employing sensors with the appropriate communications networks. Sensors are generally employed along air avenues of approach to observe named areas of interest and decision points normally designated by the brigade S2. During offensive operations, sensors are employed throughout a zone to provide early warning. Covering and security forces' task organization normally include FAAD sensors and Avenger for early engagement of threat aerial platforms, with particular focus on surveillance platforms.

(2) Active Air Defense. Maneuver brigades conducting combat operations use

organic or attached assets to directly attack hostile aircraft and missiles. These assets include friendly tanks, crew-served weapons, intelligence and electronic warfare systems, attack helicopters, and specific air defense weapons systems.

(3) FAAD C3I System. DRB air defense systems operate within the larger air defense system that governs division and corps level air defense operations. The FAAD C3I provides automated assistance in FAAD operations. The FAAD C3I system consists of the following subsystems: air battle management operations center (ABMOC), A2C2, sensor/C2, battery command posts, platoon/section command posts, and fire units.

(a) Equipment. These subsystems are equipped with computers, displays, voice, and data communications equipment to aid the accumulation, processing, and distribution of a correlated air picture and C3I data. To accomplish the radio frequency communications among the subsystems deployed within an area of operations, the digital data components of the subsystem are connected by SINCGARS/

Enhanced Position Location Reporting System (EPLRS) and the Joint Tactical Information Distribution System (JTIDS).

- JTIDS. JTIDS receives air track data from external track sources.

- EPLRS. EPLRS is used for internal data communications. It also nets the sensor/C3I subsystems, the ABMOC, and the A2C2 to exchange air track data, formulates an air picture, and subsequently disseminates air track data, plus battle management data, to all levels of command posts and fire units simultaneously.

- SINGARS. SINGARS provides voice and data communications capabilities.

- Simplified Handheld Terminal Unit (SHTU). SHTU performs subsystem functions in command and control and provides the air picture to the section CPs and fire units.

(b) Early Warning. The ABMOC and air defense A2C2 receive air tracks from external sources such as the Airborne Warning and Control System (AWACS) and HIMAD air defense units. The ABMOC transmits those tracks to sensors tactically located throughout the battlefield. The sensors receive that data and correlate with their own data (40 km GBS) and send that data to units for engagement. Voice procedures still accomplish early warning to maneuver forces: battery to brigade and platoon to battalion.

4. MEF (FWD) Operations

All MAGTFs conduct air and missile defense as part of the AAW function as described in Chapter VII. Successful AAW gains and maintains air superiority. AAW is based on destruction in depth and begins as far forward as possible with offensive AAW. Offensive AAW attacks enemy aircraft and missile assets before they launch or assume

an attacking role. Destruction or neutralization of enemy airfields, radars, and air defense systems is achieved through preemptive measures, SEAD, and local air superiority. Air defense is conducted to destroy or nullify the effectiveness of enemy air, missile attacks, and surveillance against MAGTF forces and/or facilities. MAGTF air defense is classified as either passive or active.

a. Passive Air Defense. Passive air defense reduces the effects of enemy air attack or surveillance. Passive measures include such indirect techniques as cover, concealment, camouflage, and deception.

b. Active Air Defense. Active air defense is direct action conducted against enemy air assets that are in an attacking or surveillance role. Active air defense employs fixed- and rotary-wing aircraft, missiles, artillery, and electronic warfare.

5. Command and Control

The ACE commander, through his TACC, coordinates MAGTF AAW. Mutual support and centralized command and coordination/decentralized control facilitate AAW. Mutual support is accomplished by positioning AAW weapons so that each air target is within range of several air defense systems, both concurrently and sequentially. Centralized command and coordination permit the best use of available forces while decentralized control permits minimum reaction time and maximum flexibility. The sector anti-air warfare coordination (SAAWC) manages the MAGTF's air defense battle. Depending on the size of the MAGTF area of operations, there may be more than one SAAWC. Under SAAWC guidance, the TAOC provides control of AAW assets and AAW surveillance of assigned airspace. AAW surveillance and control are augmented through separately established early warning/control sites. Like the SAAWC, one or more TAOCs with accompanying early warning control site(s) are employed within a MAGTF's area of operations. Factors influencing the number

of TAOCs and early warning control sites employed within an area of operations include the geographical size, terrain features impacting on radar acquisition, and anticipated air activity in the area. Figure VIII-2 portrays the MAGTF air defense system.

a. The SAAWC. The SAAWC operates from a SAAWC operations facility that normally collocates with the TAOC. The operations facility furnishes the SAAWC and staff the capability to coordinate and direct TAOC operations to survey and direct MAGTF AAW assets within its assigned area. The facility receives representatives from various MACCS organizations, but primarily from the TAOC. The SAAWC executes responsibilities for coordination and management of all active AAW assets within assigned area through these functional representatives.

b. The TAOC. The TAOC provides control, management, and surveillance of assigned assets and airspace. TAOC

personnel detect, identify, and control the intercept of hostile aircraft and missiles. Early warning control sites are established to supplement organic TAOC radar coverage if required. The SAAWC coordination of overall AAW operations facilitate the ability of the TAOC to concentrate on real-time control of fighter aircraft and surface-to-air weapons.

6. MEF (FWD) Air and Missile Defense Organizations and Equipment

a. Assets. Organic ACE assets include fixed- and rotary-wing aircraft and surface-to-air missiles (SAMs). The fixed- and rotary-wing aircraft are organic to ACE aircraft squadrons; missile assets are organic to Hawk and Stinger AAW units.

(1) Aircraft. Almost any of the fixed- or rotary-wing ACE aircraft have some AAW capability. As a minimum, any aircraft may be tasked as an AAW surveillance platform. Attack helicopters may be employed as AAW

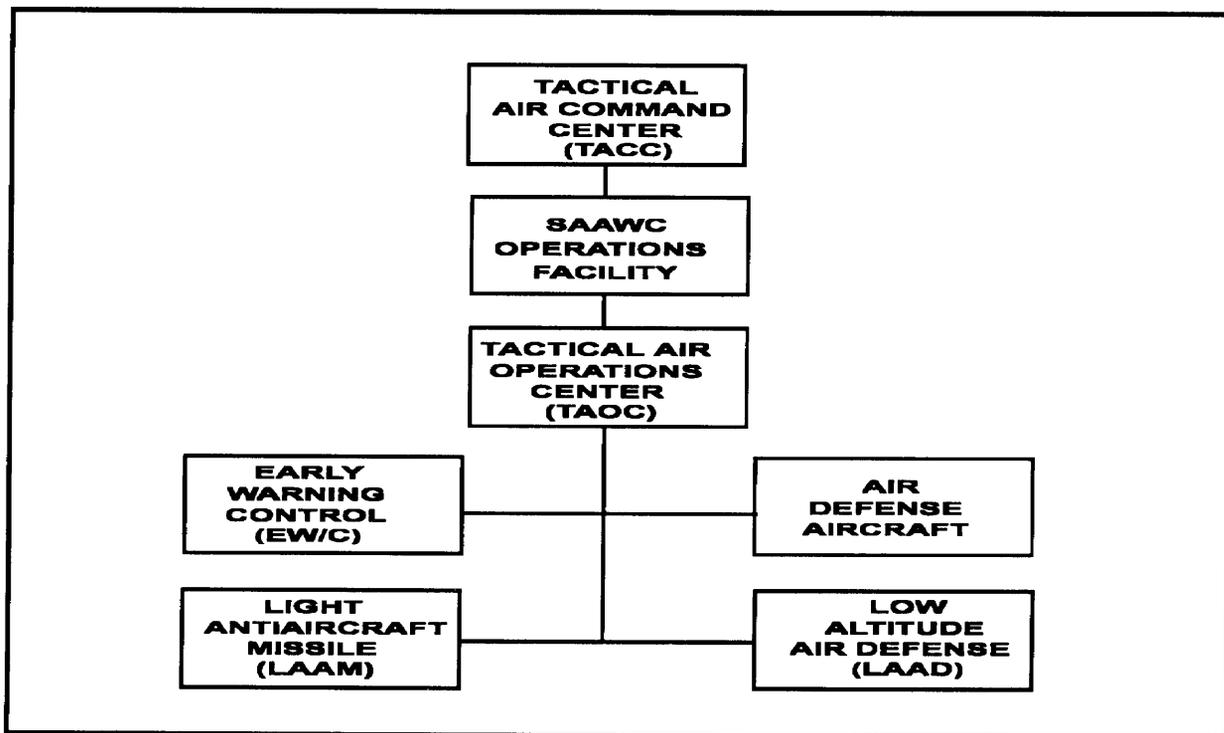


Figure VIII-2. MAGTF Air Defense System

assets when armed with air-to-air weapons. The primary MAGTF fixed-wing AAW asset is the F/A-18 Hornet; however, the AV-8 Harrier may be employed in a secondary AAW role. Employment of fixed- and rotary-wing aircraft in AAW roles will be dependent on the existing situation. Chapter VII detailed MAGTF aircraft capabilities.

(2) Surface to Air Missiles. MAGTF SAM capabilities are organic to the LAAM and low altitude air defense (LAAD) units.

(a) LAAM Units. LAAM units are equipped with the Hawk surface-to-air missile system. LAAM units provide all-weather, day and night, medium-range air defense. The LAAM battalion is composed of a headquarters and service battery and 3 firing batteries. Each firing battery includes 2 firing platoons of 2 firing sections each, and 1 sensor acquisition section (SAS). The SAS has 1 continuous wave acquisition radar (CWAR), 1 pulse acquisition radar (PAR), and 2 high-power illuminator radars (HIPIR). Each firing platoon includes 3 launchers with 3 missiles per launcher. Each platoon is capable of engaging 2 targets simultaneously. Though task organized to meet anticipated air threat, 1 or more LAAM firing batteries normally support a MEF (FWD) (12 Hawks per battery); a LAAM battalion (36 Hawks) normally supports a MEF. When paired with the TAOC's AN/TPS-59 long-range air surveillance radar, the Hawk system has a limited capability to engage short-range theater ballistics missiles.

(b) LAAD Units. LAAD firing units currently employ MANPADS and the Avenger missile system. LAAD units provide low-altitude, short-range air defense for forces in forward combat areas or other assigned areas. The LAAD battalion consists of a headquarters and service battery and 2 firing batteries. Each of the 2 firing batteries has 3 firing platoons equipped with 15 Stinger teams each. Smaller MAGTFs (i.e., MEUs) are supported by platoons as appropriate to METT-T considerations. MEF

(FWD) and MEF-sized MAGTFs are supported by LAAD batteries and battalions, respectively. Organic HMMWVs provide firing teams high mobility. Fire team leaders exercise final firing authority for LAAD teams.

b. AAW Surveillance and Control Systems. MAGTF AAW surveillance and control systems are limited to ground-based systems. Ground-based surveillance capabilities include TAOC and MATCD surveillance radars, Hawk acquisition radars, electrooptic systems, and LAAD team visual surveillance.

(1) The long-range radars of the TAOC provide range surveillance out to 300 nautical miles (NM), limited by LOS and earth curvature restrictions. They provide primary radar azimuth, range, and altitude information up to 100,000 feet (ft). In addition, they provide identification of friendly aircraft through electronic interrogations. The TAOC's primary air surveillance radar is being modified to provide a 400 NM, 500,000 ft altitude ceiling capability to provide the MAGTF an organic TBM detection capability.

(2) The shorter-range radars of the TAOC, which can deploy as gap-filler radars for the longer range radars, are limited by the same LOS factors. They provide primary radar azimuth and range up to 150 NM. They also have a capability to electronically identify friendly aircraft.

(3) The short-range MATCD surveillance radars provide primary and secondary radar azimuth, range, and altitude information in the airfield areas.

(4) The Hawk search radar provides roughly the same surveillance capability as the shorter-range TAOC radars (120 km) with an altitude coverage to 55,000 ft. Secondary radar is provided by a separate platform with limited IFF discrete decode capability.

(5) The Hawk low-altitude acquisition radar provides excellent low-level surveillance coverage in azimuth and ranges out to 80 km and up to 10,000 ft.

(6) The Hawk tracking radar is limited in its surveillance function by field of view, operator load, weather, and other environmental factors; therefore, it is only an augmenting system.

(7) LAAD visual acquisition is particularly good against low-altitude targets when teams are placed along ingress routes and given limited sectors to cover. Altitude, weather, and environmental factors severely limit their surveillance capability.

7. Integrated Air and Missile Defense Operations

a. Command and Support Relationships. Relationships between air defense units and other units may be either command or support. The JFC establishes relationships based on the estimate of the situation and the recommendation of the area air defense commander (AADC).

(1) Command Relationships.

(a) Operational Control. The parent organization retains administrative and logistic responsibilities, unless the order states otherwise, when placing an air defense unit OPCON to another unit. OPCON is appropriate for tactical operations of generally short duration requiring dedicated air defense.

(b) Attachment. The supported force provides administrative and logistic support to attached air defense units. An air defense unit may be attached to a maneuver unit on an extended, independent operation where the parent air defense battalion cannot provide effective support.

(c) Further Attachment or OPCON. When possible, air defense units

attached or OPCON to maneuver units are further attached or placed under the operational control of an air defense unit within the maneuver force.

(2) Support Relationships.

(a) Direct Support. A direct support mission furnishes a specific element of the joint force dedicated air defense support.

(b) Reinforcing. An air defense unit with a reinforcing mission augments the coverage of another air defense unit committed to a specific element of the force. Assigning this mission commits both the reinforcing and reinforced air defense units to that specific element.

(c) General Support Reinforcing. A general support reinforcing mission results in an air defense unit supporting the force as a whole with a second priority to augmenting the coverage of another air defense unit.

(d) General Support. Air defense units with general support missions support the force as a whole.

Table VIII-2 describes the recommended command and support relationships and inherent responsibilities to guide the planning and operational employment of air defense outfits.

b. Organizing for Combat.

(1) Organizing air defense units for combat proceed from the application of four basic employment principles of *weapons mass*, *weapons mix*, *mobility*, and *integration* to METT-T conditions.

(a) Weapons Mass: The allocation of a sufficient amount of air defense resources to destroy the enemy air threat to the defended asset.

Table VIII-2. Inherent Responsibilities of Air Defense Standard Tactical Missions

An air defense unit with a mission of—	Has air defense priority established by—	Have the air defense units located by—	Have the air defense units positioned by—	Establishes liaison with—	Establishes communications with—
General Support (GS)	(1) The supported commander. (2) The supported commander through the reinforced air defense commander	The commander assigning the mission in coordination with the supported force ground commander	The air defense fire unit commander in coordination with the local ground commander	As required by commander assigning GS mission	As required by commander assigning GS mission
General Support Reinforcing (GSR)	The supported commander through the reinforced air defense commander	The commander assigning the mission in coordination with the supported force ground commander	Air defense fire unit commanders in coordination with the reinforced air defense unit commander and the local ground commander	As required, but including the reinforced air defense commander	As required, but including the reinforced air defense unit
Reinforcing (R)	The supported commander through the reinforced ADA commander	The reinforced air defense commander in coordination with the supported force ground commander	Air defense fire unit commanders with approval of the reinforced air defense unit commander and the local ground commander	As required, but including the reinforced air defense commander	As required, but including the reinforced air defense air defense unit
Direct Support (DS)	The supported commander	The DS air defense commander with approval of the local ground commander	Air defense fire unit commanders with the approval of the local ground commander	Supported unit commander	Supported unit

(b) Weapons Mix: The employment of a complementary family of weapons, wherein the capabilities of one system offset the limitations of another system.

(c) Mobility: The ability of a unit to maneuver as easily as the unit it is supporting.

(d) Integration: Synchronized employment of air defense units and systems within the concept of operation and scheme of maneuver.

(2) Considerations for Air Defense Task Organization. The joint force seeks to deploy the best possible weapons mass and mix to support the scheme of maneuver. The supported force's mission, commander's intent, and concept of operation drive force

task organization. Additional considerations include—

(a) Proportional weighing of the main effort.

(b) Allocation of available assets to protect critical force assets in priority.

(c) C3 capabilities.

(d) Logistics supportability: Can the ADA unit support itself completely or will it need assistance from the supported unit?

(e) Impact of other air defense assets in the area of operation.

(f) Air defense assets are not held in reserve.

(g) Preclusion of excessive unit movement.

(h) Assigned mission consistent with situation.

(i) Task organization accommodates transitions to branches or sequels to the operational plan.

c. Liaison.

(1) DRB-MEF Liaison Requirements. The DRB requires 2 liaison teams to establish necessary air defense liaison with the MEF. Recommended team personnel include a company grade officer, an experienced noncommissioned officer, and one enlisted specialist; team equipment consists of an AM/FM radio-equipped HMMWV. One team collocates with the SAAWC operations facility/TAOC as subject matter experts on the DRB's air defense capabilities and employment and facilitates information flow and exchange. A second

team collocates with the Marine TACC to assist in airspace coordination and air defense planning and operational execution.

(2) MEF (FWD) Corps Liaison Requirements. The MEF (FWD) normally provides 2 liaison elements to the corps that facilitate planning and advice on the MAGTF's air defense capabilities and employment. One element collocates with the corps A2C2 element at the corps main to assist in air defense planning; the second collocates with the corps ADA brigade TOC to coordinate air defense execution.

d. Air Defense Control Measures.

Joint Pub 3-56.1 governs use of air defense control measures germane to USA-USMC operations. Figures VIII-3 and VIII-4 depict dissemination of measures during integrated operations between the MEF and DRB and between the corps and MEF (FWD) respectively.

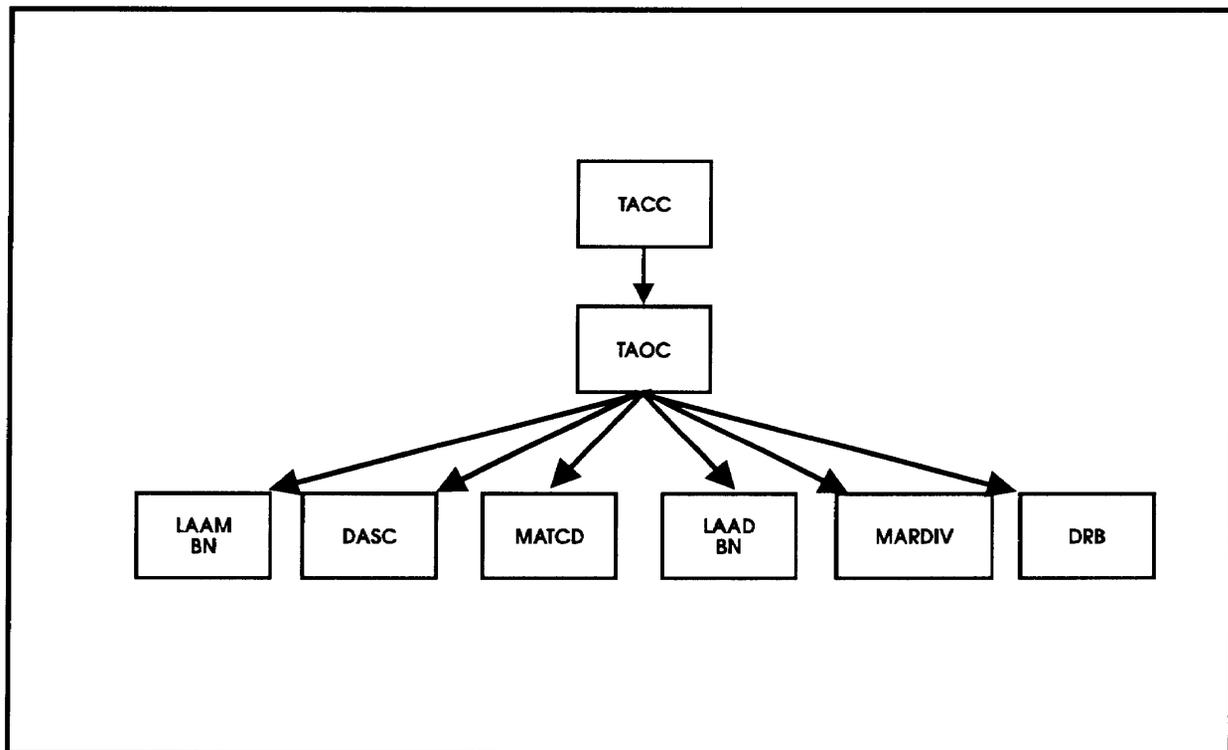


Figure VIII-3. MEF Air Defense Control Measures Dissemination

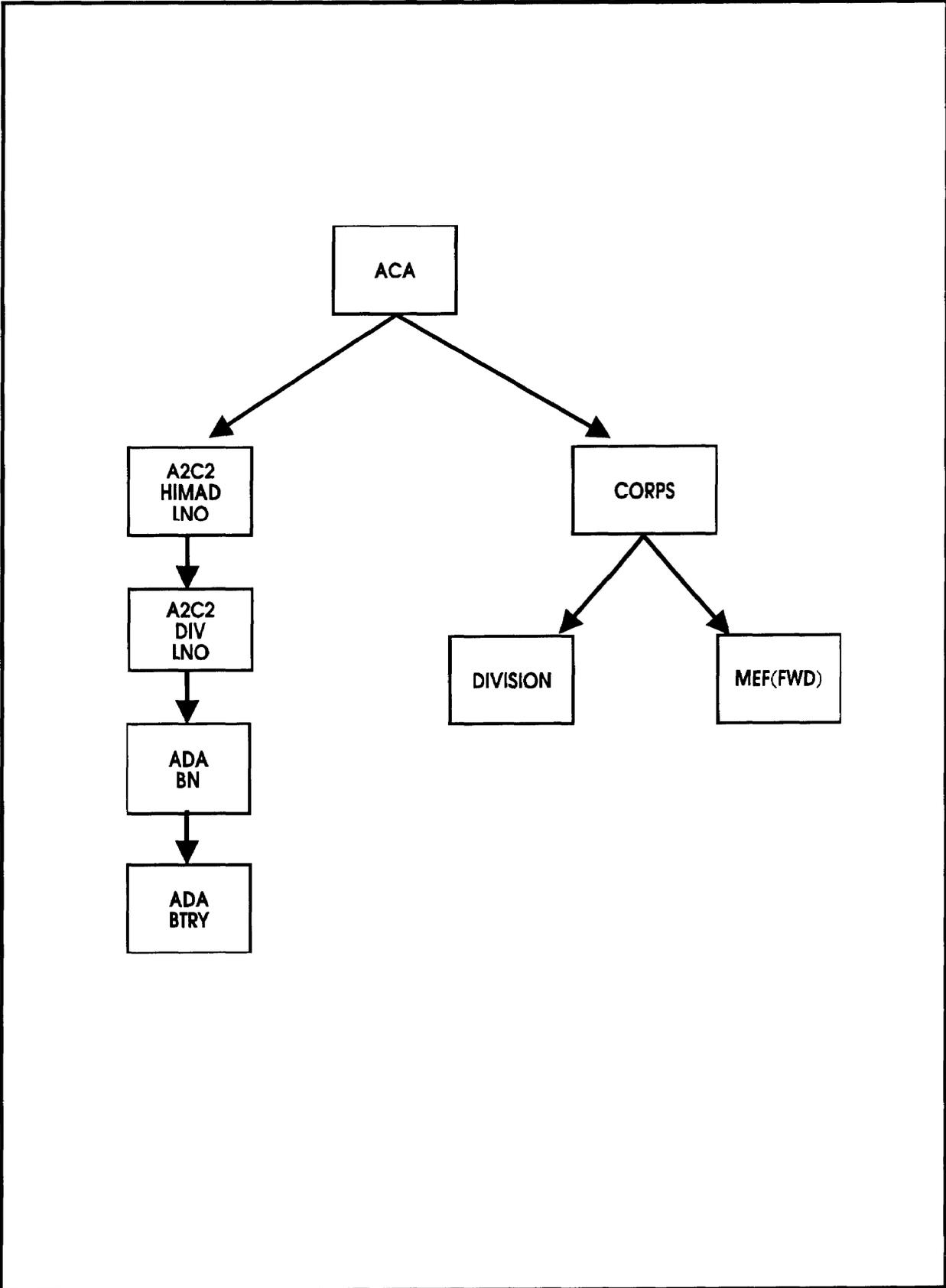


Figure VIII-4. Corps Air Defense Control Measures Dissemination