MCWP 3-25.7

Tactical Air Operations Center Handbook

U.S. Marine Corps

PCN: 143 00012 00

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DEPARTMENT OF THE NAVY
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FOREWORD

The Marine air command and control system (MACCS) provides the Marine aviation combat element (ACE) commander with the means to exercise control of those organic and nonorganic aviation assets necessary to support Marine air-ground task force (MAGTF) operations. Fleet Marine Force Manual (FMFM) 5-60, *Control of Aircraft and Missiles,* addresses basic planning considerations for MACCS operations, employment, and inter-operability among MACCS and joint Service agencies.

Marine Corps Warfighting Publication (MCWP) 3-25.7, *Tactical Air Operations Center Handbook*, complements and expands on the information in FMFM 5-60 by focusing on the details of the tactical air operations center (TAOC) operations and the role the TAOC plays in integrated MAGTF, joint, and multinational operations. Designated for MAGTF, naval expeditionary force, and joint force commanders and staffs, MCWP 3-25.7 highlights TAOC—

- Organization
- Equipment
- Planning considerations
- Operational fundamentals
- Employment options

By investigating these areas, MCWP 3-25.7 provides the requisite information needed by commanders and staffs to understand and evaluate the operational principles and capabilities of various TAOC employment options.

Recommendations for improving this publication are invited from commands as well as directly from individuals. Forward suggestions using the User Suggestion Form format to—

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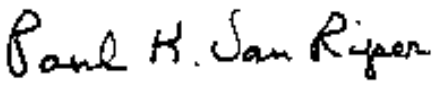

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Tactical Air Operations Center Handbook

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Chapter 1

Fundamentals

The tactical air operations center (TAOC) is the Marine air command and control system's (MACCS's) principal air defense agency that conducts airspace control and management. Personnel and equipment are provided by the Marine air control group's (MACG's) Marine air control squadron (MACS).

Through radar inputs from its organic sensors and data link information from other military radar units (MRU), the TAOC provides real-time surveillance of assigned airspace in addition to air direction, positive aircraft control, and navigational assistance to friendly aircraft. Its primary function, to conduct and coordinate antiair warfare (AAW), is accomplished through the direction, coordination, and employment of various air defense weapons systems which include interceptor aircraft and ground-based air defense (GBAD) weapons.

FUNCTION

The TAOC provides air surveillance and control of aircraft and surface-to-air weapons (SAWs) for AAW in support of the Marine air-ground task force (MAGTF).

ROLE

The TAOC—

- Provides airspace control, management, and surveillance for its designated sector or area of interest (AOI).
- Provides navigational assistance, including itinerant air traffic control, to friendly aircraft.
- Detects, identifies, and controls the intercept of hostile aircraft and missiles.
- Deploys early warning and control (EW/C) sites to supplement or enhance the TAOC's radar coverage.
- Assumes agency coordination functions of the alternate tactical air command center (Alt TACC) or alternate tactical air direction center (Alt TADC) for limited or specified periods when required or directed.

TASKS

The TAOC—

- Recommends employment of assigned weapons and surveillance means.
- Recommends air defense sectors, subsectors, and weapon engagement zones (WEZ) for itself and component elements.
- Deploys sensors and communications systems to provide air surveillance.

- Detects, identifies, and classifies all aircraft and missiles within its assigned sector.
- Displays and disseminates appropriate air/ground information to designated adjacent, higher, and subordinate agencies (such as the Marine tactical air command center [TACC], another TAOC, the direct air support center (DASC), and Marine air traffic control detachments (MATCDs), GBAD units, and aircraft.
- Selects and assigns appropriate weapons to engage and destroy the enemy air threat.
- Controls fires of subordinate air defense elements.
- Functions as an Alt TACC/Alt TADC when directed for limited or designated periods of time.
- Interfaces with adjacent and higher air defense agencies.
- Manages air defense resources.
- Coordinates and executes emission control (EMCON) conditions in its assigned sector.
- Conducts itinerant air traffic control and provides navigational assistance to friendly aircraft.

TAOC ORGANIZATION

The TAOC crew is the heart of its air defense operations. TAOC crews are task-organized to meet specific mission requirements. A notional TAOC crew is functionally divided into four sections: command, surveillance, traffic, and weapons (see fig. 1-1).

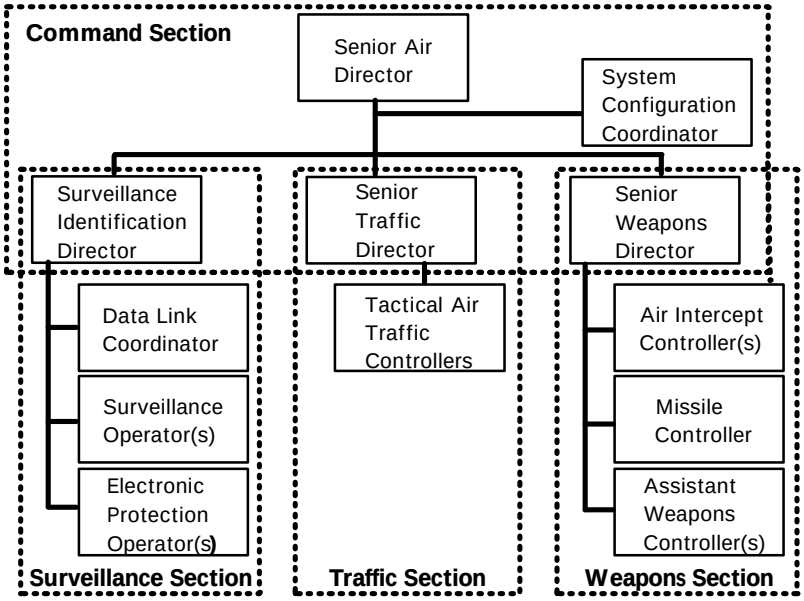

Figure 1-1. Notional TAOC Crew Organization.

Command Section

The command section supervises the functioning of the surveillance, traffic, and weapons sections. The command section includes the SAD, surveillance identification director (SID), senior traffic director (STD), senior weapons director (SWD), and the system configuration coordinator (SCC).

Senior Air Director. The SAD is responsible for the TAOC's detailed operations. The SAD ensures that proper coordination occurs among the various TAOC sections, directs ongoing

maintenance through the SCC, and assigns casualty roles to crew members.

Surveillance Identification Director. The SID is responsible to the SAD for the detection, identification, and classification of all radar inputs within the TAOC's assigned sector and for coordinating electronic protection (EP) within the sector. The SID also supervises the exchange and correlation of aircraft position and identification information with other control agencies and coordinates all TAOC data link operations.

Senior Traffic Director. The STD is responsible to the SAD for the coordination and routing of all air operations in the TAOC's assigned sector. The STD assumes responsibility for the control of aircraft not engaged in air defense and conducts aircraft handovers with other agencies as required.

Senior Weapons Director. The SWD is responsible to the SAD for the proper employment of air defense weapons. The SWD evaluates the threat and, in accordance with the aviation combat element (ACE) commander's AAW plan and rules of engagement (ROE), assigns weapons to negate the threat. As the SWD directly supervises engagements, the SWD effects the coordination of threat engagements between and across multiple weapons engagement zones (WEZs) (i.e., assignments, disengagements, reen- gagements).

System Configuration Coordinator. The SCC is responsible to the SAD for equipment readiness and ongoing maintenance efforts. When required, the SCC conducts manual reconfiguration of computer and communications equipment to optimize TAOC operations or in response to equipment failures.

Surveillance Section

The surveillance section detects, identifies, and classifies all targets within the TAOC's assigned sector. Headed by the SID, this section correlates air tracks reported from all sources and also manages the air picture developed within the TAOC and transmitted via data links or voice cross tell nets. The section employs EP and supervises the EMCON conditions set by the TACC. The section consists of the data link coordinator (DLC), surveillance operators (SOs), and EP operators (EPOs).

Data Link Coordinator. The DLC is responsible to the SID for the TAOC's data link configuration. The DLC manages data link configuration by initiating directed changes to degraded links with subordinate agencies and recommending changes to degraded links to adjacent and senior agencies.

Surveillance Operator. The SO, under the direction of the SID, monitors radar inputs, initiates or monitors the acquisition of air tracks, performs preliminary identification, and updates track data as required.

Electronic Protection Operator. The EPO, under the direction of the SID, operates the TAOC's EP and EMCON functions. The EPO also coordinates with radar operators for initiation of EP activities at the radar itself.

Traffic Section

The traffic section is supervised by the STD. It provides airspace management for enroute, itinerant, and orbiting aircraft such as airborne warning and control system (AWACS) aircraft; airborne command posts; transiting or orbiting close air support

(CAS)/deep air support (DAS); and aerial refueling (AR) missions. The section also consists of one or more tactical air traffic controllers (TATCs). The TATC is responsible to the STD for detailed airspace management within the TAOC's assigned sector for all missions not controlled by the weapons section. Cognizance begins when aircraft enter the TATC's assigned area or are handed over to the TAOC by another agency and continues until the aircraft exit the assigned area or are handed off to another enroute or terminal control agency. In addition to providing navigational assistance, the TATC transmits friendly and threat situational awareness information to aircraft entering or transiting through the assigned sector. The TATC also initiates tactical digital information link (TADIL) C data links with all appropriately equipped aircraft and maintains track symbology on all aircraft under TATC control.

Weapons Section

The weapons section, under the supervision of the SWD, makes weapons assignments in accordance with the ROE and the AAW plan. The section provides for control of all aircraft on AAW missions and the management of SAWs in the TAOC's assigned sector. In addition to the SWD, one or more air intercept controllers (AICs), a missile controller (MC), and one or more assistant weapons controllers (AWCs) form the weapons section.

Air Intercept Controller. The AIC is responsible for the control of AAW missions from the point the aircraft is handed off from the traffic section until that mission is returned to the traffic section. The AIC is responsible for the successful intercept of hostile airborne targets assigned by the SWD. The AIC controls combat air patrol (CAP) aircraft and augments surveillance efforts in his assigned zone with CAP aircraft radar.

Missile Controller. The MC controls applicable SAW engagements within the TAOC's sector. The MC usually coordinates and operates Army tactical data link 1 (ATDL-1) data links with surface-to-air missile (SAM) assets.

Assistant Weapons Controller. The AWC provides assistance to the AIC and/or MC, including entering data on aircraft tracks, monitoring tracks, monitoring radio nets, and maintaining aircraft missile control logs. The AWC operates TADIL-C data links with appropriately equipped aircraft as directed by the AIC. During the conduct of hostile target intercepts, the AWC provides the AIC/MC information about the heading, altitude, and speed of the hostile target.

EW/C Crew Configuration

The EW/C crew is task-organized as directed by the TAOC. The EW/C crew will normally be capable of limited air surveillance and weapons control.

CREW BRIEFINGS

TAOC crew briefs are adapted to mission requirements and are normally conducted before crew members assume duty. Appendix A outlines the minimum contents of a brief as required by Marine Corps Order (MCO) 3501.9B, *Marine Corps Combat Readiness Evaluation System (MCCRES)*.

Chapter 2

System Description

The TAOC consists of operator shelters, air surveillance radars, communications equipment, and mobile electric power (MEP) (i.e., generator) equipment. This equipment allows air defense control officers, tactical air defense controllers, and air control electronics operators to maintain air situational awareness and to effectively control, coordinate, and manage air defense employment within the TAOC's assigned sector.

TACTICAL AIR OPERATIONS MODULES

The hub of the TAOC is the AN/TYQ-23(V)1 tactical air operations module (TAOM) (fig. 2-1). Each TAOC has four TAOMs. The TAOM is a transportable, modularized, automated command and control shelter designed to conduct AAW control and coordination functions for the MAGTF. The TAOC's modular concept allows TAOMs to operate in stand-alone configurations or to be combined with other TAOMs to increase system capability and redundancy. Each TAOM contains the mission-essential equipment (i.e., computers, operator positions, and digital and voice communications) required to provide limited command and control (C^2) functions. TAOMs can be dispersed up to 500 meters apart from one another and functionally connected over fiber-optic cables. Similar cables allow dispersing TAOC radars up to two kilometers from a TAOM. Radars can also be remoted up to 40 kilometers from the TAOC and interfaced to the TAOC over remote radar data links. The TAOC's modularity concept allows the build-up or scale-down of system capacity without disrupting C^2 air command and control operations. It also allows echeloning C^2 air defense command and control as the battle progresses. TAOM shelter and environmental control unit (ECU) pallet data are shown in tables 2-1 and 2-2.

Transportability

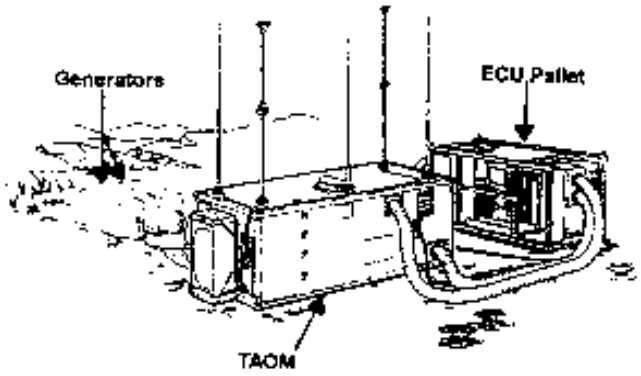

Figure 2-1. TAOM with ECU Pallet.

The TAOM's transportability permits deployment of an air control capability that can manage a wide variety of air situat-ions. The TAOM may be transported by commercial or military air, land, or sea vehicles or it may be towed using an M-1022 mobilizer. The TAOM travels with most of its equipment packaged inside the shelter (module), including antennae and some power cables. A separate storage pallet houses the remainder of the equipment, such as the ECUs (which are B0007 heating and air conditioning units; chemical, biological and radiological [CBR] protection equipment; and the fiber-optic cables).

Versions

The AN/TYQ-23 was produced in two versions: Version 1 (V)1 for the US Marine Corps (called the TAOM), and Version 2 (V)2 for the US Air Force (sometimes called modular control equipment [MCE]). (Actually, the term "TAOM" applies to either version of the AN/TYQ-23, as dictated by common usage. A shortened acronym, "OM," is also commonly used to refer to a module or shelter in either the US Air Force or US Marine Corps system.)

Table 2-1. TAOM Shelter Specifications.

Length	**20 feet**
Width	**8 feet**
Height	**8 feet**
Square	**160 square feet**
Cube	**1,280 cubic feet**
Weight	**16,500 pounds (approximately)**
Power requirements	**120/208 volts, 60 hertz, 23 kilowatts, 3 phase, 4 wire**

Table 2-2. ECU Pallet Specifications.

Length	**12 feet**
Width	**7 feet**
Height	**8 feet**
Square	**86 square feet**
Cube	**688 cubic feet**
Weight	**6,500 pounds (approximately)**
Power requirements	**120/208 volts, 60 hertz, 30 kilowatts, 3 phase, 4 wire**

The two versions respond to the different tactical requirements of the US Marine Corps and US Air Force. These different requirements are satisfied with TAOM hardware which, for the most part, is the same for both Services and with software which is mostly common to both versions. The major differences between the two versions are the display symbols on the operator console units (OCUs) and the method by which the radar data is processed. The US Marine Corps version employs a TAOM interface group (TIG) at each

radar site that formats the radar data and sends it to the TAOM, essentially unprocessed. At the TAOM, data from all local (organic) radars are combined into tracks. The US Air Force version employs an MCE interface group (MIG) located at the radar site. The MIG, unlike the TIG, preprocesses the radar data and generates tracks. The tracks are then sent to the TAOM, where they are combined into system tracks. The symbols displayed at the OCUs are designed to match each Service's requirements and differ accordingly.

Functions

The TAOM provides a full range of air command, control, and communications (C^3) capabilities necessary to conduct air defense including—

- Air surveillance.
- Weapons control.
- Tactical air traffic control.
- Electronic warfare (EW).
- Communications.
- Simulation and training.
- Monitoring and testing.

Operator Interface

Each TAOM contains four OCUs. Each OCU is the primary operator-to-TAOM interface. The OCU provides the operator with the means to display radar surveillance data from up to four sensors; activate and exercise digital data links with surface, shipborne, and airborne data link platforms; conduct AAW control of interceptor aircraft and GBAD units by either voice or data communication; and conduct tactical air traffic control for friendly aircraft.

Voice Communications

Each TAOM contains internal radio equipment (IRE) to support voice and data communications. In addition to its internally housed ultrahigh frequency (UHF), very high frequency (VHF), and high frequency (HF) radios,

the TAOM has the capability to introduce externally controlled radios and point-to-point circuitry from outside the TAOC to augment the TAOC's communication requirements. Each TAOM also internally houses the required cryptographic instruments needed to encrypt its radios. Additionally, each TAOM contains secure voice telephone capability and has the capability to introduce both two-wire analog and four- wire digital telephonic communications devices. The TAOC's voice capabilities depend on the number of TAOMs deployed and the external communications support available. Table 2-3 lists specific TAOM voice communications capabilities.

Data Communications

The TAOC can exchange surveillance data with data link- equipped agencies such as the US Air Force's control and reporting centers (CRC) and control and reporting elements (CRE); US Army Patriot systems; US Navy airborne tactical data systems (ATDS) and naval tactical data systems (NTDS) units; AWACS aircraft; GBAD units; and appropriately equipped interceptor aircraft over TADILs. The TAOC can also interface with North Atlantic Treaty Organization (NATO) ground-based agencies over the NATO air defense ground environment (NADGE) data link, known as NATO Link 1. Interface modes and capabilities are—

- TADIL-A (Link 11) is a netted, half-duplex (poll-response) digital data link normally used for connectivity between ATDS and NTDS platforms. TADIL-A requires a net control station (NCS) which is a machine function designed to synchronize the track reporting of TADIL-A participating units (PUs). TADIL-A data is encrypted through a KG-40A encryption device. The carrier for TADIL-A data is HF and/or UHF communication media.

- TADIL-B (Link 11B) is a point-to-point, full duplex data link conducted between two reporting units (RUs) which include appropriately equipped MRUs and GBAD systems. TADIL-B data is simultaneously received and transmitted between RUs. TADIL-B operations are normally conducted over multichannel radio (MUX), satellite communication, telephone lines, or cables and are generally limited to providing

Table 2-3. TAOM Voice Communications Capabilities.

Item	Quantity
KY-58 (external)	7
ANDVT.KY-75 with RCU	4 (internal/external)
HYX/HYP-57	12
KG-84	13
KG/KGX-40	1
RT-524/R-442 (VHF)	3
External Radios*	12
AN/GRC-171V2/4 (UHF)	4
Harris HF Radio	2/1**
KY-68 Secure Telephone	1
Telephone	4
Direct Access Trucks	4
* Refers to the number of external radios which may be added to the 3 VHF, 4 UHF, and 2 HF radios internal to each TAOM.	
** One HF radio can be removed and replaced with a third computer. Five computers provide maximum system capabilities.	

connectivity between ground-based units. TADIL-B is encrypted by a KG-84A/C encryption device.

- TADIL-C (Link-4A) is a netted data link conducted between the TAOC and F-14 and F/A-18 aircraft. TADIL-C data links can be configured for one-way, limited two-way, and full two-way. TADIL-C data links are conducted over UHF radio and are unencrypted.

- ATDL-1 data links are point-to-point digital data links established between the TAOC and Hawk units. ATDL-1 links operate and are encrypted in the same manner as TADIL-B links.

- NATO Link 1 is a point-to-point data link which functions similarly to TADIL-B links except that Link 1 is not encrypted, and does not transmit digital orders.

The TAOC can conduct a point-to-point unit-level message switch (ULMS) data link to receive and transmit air tasking order (ATO) information and other weapons-related data. The TAOC's data link capabilities are determined by the number of TAOMs operating as part of the TAOC. See table 2-4.

Table 2-4. TAOC Data Link Capabilities.

# TAOMs	1	2	3
Point-to-point Data Links*	11	22	24
TADIL-A	1	1	1
TADIL-C	1	1	1
Remote Radars	2	4	4
*Point-to-point data links include TADIL-B, ATDL-1, and NATO Link 1 links.			

Automated Functioning

The TAOM provides certain automated functioning capabilities which significantly enhance the operator's ability to conduct surveillance, traffic, and weapons functioning. Two of the primary automated functions include aircraft identification and weapons control modes.

Automated Aircraft Identification Modes. Identification of friendly aircraft can be assisted through automatic identification, friend or foe (IFF) correlations. Operators enter friendly Mode I, II, and/or III information into the TAOC data base. The data base will make a correlation between the ATO-entered information and the squawks reported by aircraft. If a correlation is made between the Mode I/III tables and/or the Mode II ATO data, the air track will be classified as designated in the ATO file.

Mode IV responses are also used in the identification process through automatically performed Mode IV tests. When the TAOC is operating in the low threat mode, Mode IV interrogations are not performed automatically. In the medium threat mode, a track's recommended identity (based on automatic identification) is compared to its current identity. If a high or low confidence Mode IV response is received after a manual Mode IV interrogation

and the track's identity is unknown, assumed friend, or assumed enemy, the track's identification will automatically be changed to unknown/assumed friend. When operating in the high threat mode, automatic Mode IV interrogation is performed on all tracks with an identification of unknown/assumed friend. A track with an identity of unknown is automatically updated to a friend when a high confidence Mode IV response is received or unknown/assumed friend when a low confidence response is received.

Additional automated identification capabilities are available through execution of a series of parameters entered into the TAOC's data base. The identification/classification subprogram will track recommend classification based on the results of up to 10 different tests including aircraft profile, IFF, and proximity to designated vital area(s).

Automated Weapons Control Modes. The TAOC's automated weapons control modes can provide significant assistance to the TAOC crew regarding threat ranking and intercept feasibility. The TAOC has three weapons control modes: manual, semiautomatic, and automatic.

In the manual mode, the TAOC will not conduct automatic weapons trials or engagements. Trialing and weapons assignments are conducted by the operator.

In the semiautomatic mode, the system acts in an advisory capacity. Tracks are threat-ranked based on their proximity to vital areas, speed/heading, and their assigned identity. All available weapons systems are trialed against hostile or faker tracks, beginning with the highest-ranked threat. The system will display the three shortest time-to-intercept (TTI) solutions based on available GBAD, airborne interceptor, or alert interceptor availability. The operator may then choose to accept or reject the recommended action. In the semiautomatic mode, the TAOC will continue to try all hostile and faker tracks until they are engaged or until no other weapons are available to intercept the threat.

The automatic mode functions similarly to the semiautomatic mode except that when the TTIs are compared, the system will automatically assign the weapon with the shortest TTI to engage the target. Multiple weapons will be assigned to raid-sized groups. Two weapons will be engaged against raid sizes of few; four weapons will be assigned against raid sizes of many. When

the raid size is designated as few or many, GBAD assets may be the preferred weapon based on TTI and hot missile inventories. Dissimilar weapons will not be simultaneously engaged against the same target, thus reducing the chance of fratricide.

Countermeasures

The TAOC has several automatic capabilities designed to enhance its survivability against electronic and direct attack. These capabilities include automatic activation of an EMCON plan and identification and threat ranking of antiradiation missiles (ARMs). The EMCON capabilities allow the TAOC operator to enter protective measures into the TAOC data base should an ARM threat be detected. When a track is identified as a probable ARM threat, the TAOC will automatically initiate the predetermined EP measures plan entered into the data base. This EP plan may include radar blinking and blanking and activation of ARM decoys. The system's data base also provides operators with the opportunity to designate operational parameters to assist in identifying possible ARMs. These tests are based on speed and time-to-go thresholds and the missile's heading angle (the angle between the missile's heading and a line from the missile's heading to a TAOC radar). Tracks meeting the designated criteria are classified as ARMs.

RADARS

The TAOC's organic radars provide the air picture necessary to efficiently control and manage air defense within its assigned sector. The TAOC can accept and process data from as many as four radars at a time. However, each TAOC has only three organic radars; one AN/TPS-59 and two AN/TPS-63B.

AN/TPS-59 Radar Set

The AN/TPS-59 (fig. 2-2) is a solid state radar designed to provide long-range air surveillance. The AN/TPS-59 is a three-dimensional (bearing, range, and target altitude), linear-phased array radar which operates in the

D band (1215-1400 megahertz [MHz]). The radar set consists of three shelters and an antenna which is transported on three single-axle trailers. Specifications are shown in table 2-5. The radar control shelter accommodates two position display consoles which are capable of providing a planned position indicator (PPI) display, range height indicator (RHI) display, or both displays simultaneously. The radar's 54 transmitters are arranged in 54 rows and operated indpendently of each other which allows redundancy; 16 rows can be non-operational before the radar is considered degraded. The AN/TPS-59 also has the capability of operating in the two-dimensional mode should its general purpose computer fail. The AN/TPS-59 radar suite includes four ARM decoy pallets. Theater missile defense (TMD) enhancements to the AN/TPS-59 radar improve its range and altitude detection capabilities to 400 nautical miles and 500,000 feet respectively against ballistic missile targets.

AN/TPS-63B Radar Set

The AN/TPS-63B radar (fig. 2-3) is a transportable, lightweight radar designed to provide short- to medium-range, two-di-mensional (bearing and range) air surveillance information to the TAOC. The AN/TPS-63B radar is also a D band emitter (1250-1350 MHz) and has a selectable search range of 80, 120, or 160 nautical miles up to 40,000 feet in altitude. Because of its single shelter design, the AN/TPS-63B is considered the TAOC's primary assault radar. The radar contains a single display console and can be employed in a stand-alone mode to provide earlywarning information. Each MACS has two AN/TPS-63B radars. Details on the AN/TPS-63 shelter are in table 2-6.

COMMUNICATIONS

The MACS table of equipment (T/E) provides UHF, VHF, and HF communications capabilities in addition to those located internally to the TAOM. The TAOC is also supported through the MACS's wire, telephonic, and switchboard assets.

MOBILE ELECTRIC POWER

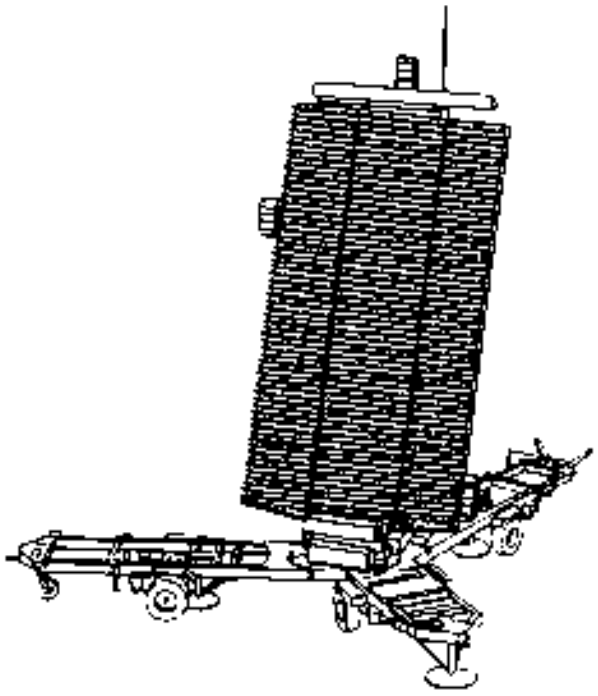

Figure 2-2. AN/TPS-59 Radar.

The MACS provides its own 60 and 400 Hz mobile electric power (MEP) to support TAOC operations.

TAOC CAPABILITIES

System Redundancy

Table 2-5. AN/TPS-59 Radar Specifications.

	Length (in feet)	Width (in feet)	Height (in feet)	Square Feet	Cubic Feet	Weight in pounds (approx)
Three Shelters	12	8	8	89	629	6,000
Two Antenna Trailers	22.5	8	8	180	1,395	9,000
One Additional Antenna Trailer	18	8	7	147	978	9,000
	System Power Requirements: 120 volts, 400 Hertz, 50 kilowatts, 3 phase					

The TAOC has the capability to automatically reconfigure its system operations should one of the TAOMs become inoperative. This redundancy is accomplished through designation of primary and secondary main computer systems, redundant data and voice control buses, and passive electro-optical relays located at the radar ports.

Echelon Capability

The TAOC can move to alternate locations with uninterrupted operations. During such movements, the TAOC usually delegates increased responsibilities to its EW/C site to maintain agency connectivity and continue to provide medium-range surveillance and limited control of aircraft and missiles.

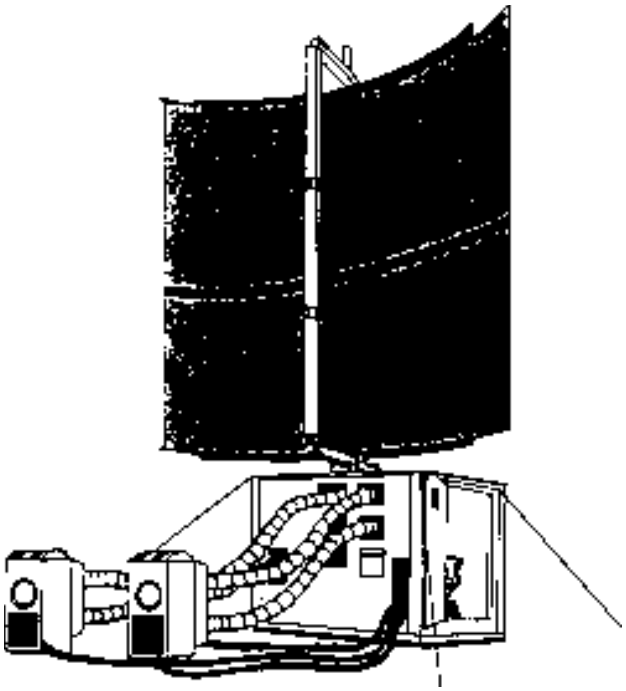

Figure 2-3. AN/TPS-63B Radar.

TAOC LIMITATIONS

Electronic Signature

The TAOC has a large electronic signature generated by its air surveillance radars and voice and data communication equipment. Effective planning and employment of EMCON measures are paramount to maximizing survivability.

Table 2-6. AN/TPS-63 Shelter Specifications.

Length	10 feet
Width	8 feet
Height	8 feet
Square	80 square feet
Cube	640 cubic feet
Weight	7,800 pounds (approximately)
Power requirements	120/208 volts, 60 hertz, 30 kilowatts, 3 phase

Low Altitude Air Surveillance

Because the TAOC employs ground-based radar systems, its radar coverage is susceptible to line of site (LOS) limitations. These occur from curvature of the earth and terrain features within the radar's search range and can preclude effective low-altitude coverage. Use of high ground for radar emplacement, airborne sensors, dispersion of sensors, incorporation of other radar units' air picture, and visual observation can be used to minimize terrain masking affects on the TAOC.

Transportability

Though the MACS T/E provides for organic motor transport capability required to employ the TAOC, the assets are limited. Materials handling equipment (MHE) is always required for emplacement in rough terrain and transportation must come from outside sources.

TAOC SYSTEM UPGRADES

Joint Tactical Information Distribution System

Each MACS will receive one Joint Tactical Information Distribution System (JTIDS) module (JM) to increase/augment its ability to interoperate with joint service air C^2 agencies through operation on the TADIL-J digital data network. The JM (radio terminal set AN/TSC-131) is a standard integrated command post shelter which contains a JTIDS 2H terminal, multiplexer, and associated equipment (including antennas and cryptographic equipment) required to remote the JM. The JM will be a mobile and rapidly deployable system that can be employed as an unmanned shelter electronically collocated with the TAOC or operated in a stand-alone mode to rebroadcast received messages to other JTIDS-capable command, control, communications, computers, and intelligence (C^4I) platforms.

Contingency Theater Automated Planning System

Contingency Theater Automated Planning System (CTAPS) equipment will be introduced to the TAOC to allow direct receipt of the joint ATO. The TAOC will receive the ATO via a CTAPS remote terminal or through the appropriate CTAPS software hosted on a workstation within the sector anti-air warfare facility (SAAWF). SAAWF workstations will be capable of receiving ATO data from CTAPS and transferring the data to the TAOC's data base via a gateway to the TAOC's digital data bus (DDB).

M-1022A1 Mobilizer

To alleviate mobility problems associated with the TAOC, actions are underway to procure the M-1022A1 mobilizer for the MACS. The M-1022A1 consists of a pair of dollies which are bolted to the ends of the TAOM shelter, thus allowing the TAOM to be towed behind a 5-ton vehicle. Designed to operate on improved surfaces (i.e., paved or gravel roads), the mobilizer incorporates a hydraulic lift system capable of lifting the TAOM 10-18 inches off the deck. The mobilizer can also be used to facilitate TAOM

loading/offloading from aircraft and shipping. Each MACS will receive five M-1022A1 mobilizers.

Theater Missile Defense Upgrades

Various modifications will be made to TAOC equipment to upgrade its theater missile defense (TMD) capabilities. Concentrating on the theater missile (TM) threats most likely to influence a MAGTF (i.e., shorter-range theater ballistic missiles [TBMs] and cruise missiles [CMs]), TAOC modifications will primarily focus on the TAOM and the AN/TPS-59.

TAOM Modifications. The TAOM will be modified to receive, process, and distribute, and/or forward TBM target data to AAW and GBAD units capable of engaging and destroying the target and other C^2 agencies via digital data communications.

AN/TPS-59 Radar. The radar will be modified to provide increased ability to detect, track, and process TBM targets and distribute those targets to the TAOM. In the near-term configuration, the AN/TPS-59 is connected to a TAOC via fiber optic cable for passing air breathing target (ABT) information and to the air defense communications platform (ADCP) via a point-to-point data link for passing TBM tracks. When the AN/TPS-59 is connected to the ADCP, three TBM messages are passed:

- The ballistic missile message: Contains vector and other descriptive data and covariance data.
- The reference point message: Contains launch point and impact point data.
- The data update request message: Contains multiple missile update capability and data selection capability.

Along with this upgrade, the AN/TPS-59 system will be reduced from three to two shelters. The number of planned position indicators will change from two to one, with the planned position indicator becoming digitized.

Cooperative Engagement Capability

The TAOC's TAOMs and AN/TPS-59 radar will be upgraded to incorporate the Navy Cooperative Engagement Capability (CEC). The CEC system is designed to fuse data from multiple sensors to provide near-continual tracking and fire quality control data to air C^2 and GBAD units. This capability will significantly enhance both Navy and Marine capabilities to track both ABT and TBM targets and engage these targets at maximum range.

Marine Corps Airborne Early Warning System

The Marine Corps Airborne Early Warning System (MCAEW) system will provide the TAOC with enhanced low-altitude air surveillance. MCAEW is envisioned to be a light-weight radar employed on an aviation platform (unmanned aerial vehicle [UAV], helicopter, fixed-wing aircraft) which will transmit the radar picture back to the TAOC over a UHF/VHF remote radar link.

Passive Sensor

Procurement of a passive sensor capability for the TAOC is being examined. The passive sensor is designed to detect airborne targets without radar emissions.

Gap-Filler Radar

MCO 3501.9B lists the following considerations:

- Level ground within 10 degrees.
- Spatial requirements (e.g., antennas, RF hazards).
- Logistics supportability.
- Camouflage and concealment.
- Trafficability and access.
- Emergency destruction and/or movement.
- Drainage.
- Defendable.
- Radar coverage of assigned airspace/vital area.

Specific Siting Requirements

Once all of the general site considerations have been examined, specific requirements for particular equipment configuration must be examined.

Minimum Area Requirements. The amount of area required for a TAOC is based on how many TAOMs are to be collocated. The horizontal plane (footprint) of a single TAOM is 8 feet by 20 feet. In addition to the physical dimensions of the shelter, horizontal and vertical accesses must be considered for cable access, ducting, cable runs, etc. A clearance of 4 feet is needed on each side of the shelter, and 10 feet is needed on each end. Therefore, the minimum area required for a single shelter is 16 feet by 40 feet.

In addition to the TAOM ISO shelter area, the pallet assembly's area requirements must be considered. The minimum area required to contain a TAOM with its pallet assembly situated perpendicular to and the TAOM at the end opposite the TAOM's door is 16 feet by 47 feet.

If the TAOM is to be mobile-loaded during operation, additional area must be added to the area calculations to allow for prime mover maneuvering.

Antenna Area Requirements. The TAOM can be employed with ground- or roof-mounted antennas. Since roof-mounted antennas do not increase the footprint, they are not addressed here. As ground mounted antennas must be placed within a finite distance from their associated TAOM, each antenna's specific area requirements must be closely considered when selecting a TAOM site. Specific area requirements for each of the TAOM's antennas in a ground-mounted configuration are—

- HF Whip. The space required to install the HF whip antenna with guide lines is 30 feet in diameter. The overall height of the antenna assembly is 27.2 feet.

- UHF Antenna. The assembled UHF antenna's height is 22 feet, 6 inches. The recommended minimum installation area for the UHF antenna is 32 feet in diameter.

- VHF Antenna. The overall height of the assembled antenna is 21 feet, 10 inches. The recommended minimum installation area for the VHF antenna is 32 feet in diameter.

- HF Sloping Dipole. The erected antenna assembly is 21 feet tall and occupies an area 260 feet in diameter.

Radar Area Requirements. Care must be taken when emplacing radars to ensure no physical masking degrades radar coverage. Specific space requirements for the AN/TPS-63B are 30 by 30 feet to set-up. The AN/TPS-59 requires 100 by 200 feet to set-up.

Equipment Separation Requirements

Distance Between TAOMs and Ground-Mounted Antennas. Three factors determine the distance between a TAOM and its ground-mounted antennas: personnel safety, antenna isolation requirements, and hardware limitations. Each TAOM ground-mounted antenna's individual requirements are—

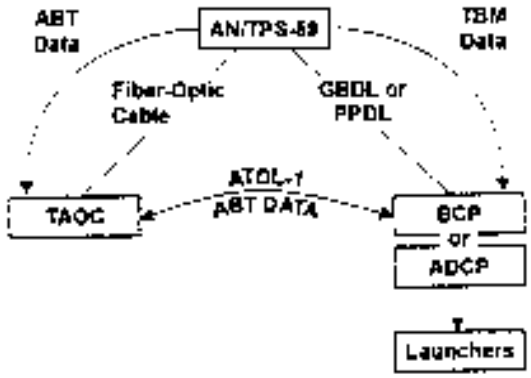

Figure 4-1. Iterim TMD Information Flow.

- HF Whip. The separation between two HF whip antennas should be a minimum of 400 feet. Because of these separation constraints, two HF antennas cannot be roof-mounted on the same shelter and used at the same time. Special attention should be given to radiation patterns and reflective areas of the antennas.

- UHF Antenna. The separation between two UHF antennas should be a minimum of 20 feet. Special attention should be given to radiation patterns and reflective areas of the antennas.

- VHF Antenna. The separation between two VHF antennas should be a minimum of 40 feet. Special attention should also be given to the radiation patterns and reflective areas of the antenna.

- HF Sloping Dipole. If multiple HF sloping dipole antennas are to be co-located, the separation between antennas should be a minimum of 260

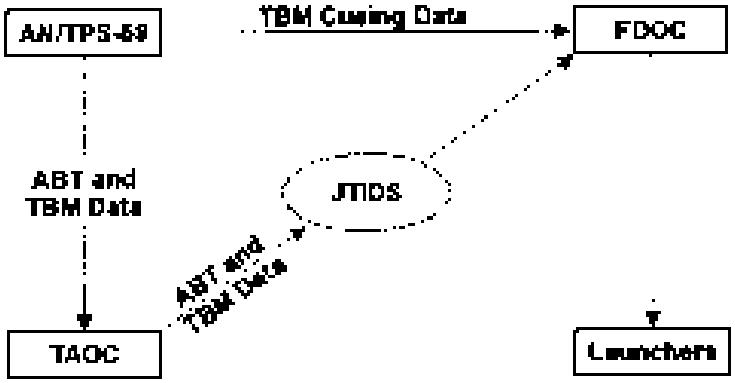

Figure 4-2. Midterm TMD information flow.

feet mast-to-mast. Special attention should also be given to the radiation patterns and reflective areas of the antennas.

Distance Between TAOMs and Radars. The distance between a TAOM and a radar set is determined by the method of interface. The TAOM can interface with a radar set by one of two methods: direct connection (fiber-optic cables) or indirect connection (remote radio sets). If fiber-optic cables are used, the maximum distance between the TAOM and a radar set is limited to the length of the fiber-optic cables. The length of a TAOM's radar interface fiber-optic cable is 2,000 meters or 6,560 feet; therefore, a directly coupled radar set must be within a 6,560-foot radius from the TAOM. Operators should allow for adequate cable slack to prevent cable connector stress which could damage the connectors when planning the TAOM-to-radar separation distances. If the remote radar interface capability of the TAOM is used, the maximum distance between the TAOM and radar is limited to the range of the radio (10 to 20 miles, depending on conditions).

Distance Between TAOMs. The minimum distance recommended between collocated TAOMs is 8 feet. This distance allows access to shelter cable connection panels, environmental control ducting, and adequate roof-mounted antenna separation. The maximum distance allowed between

TAOMs is dictated by the inter-TAOM bus fiber-optic cables. The length of the inter-TAOM cables are 500 meters or 1,640 feet; therefore; the actual separation allowed between TAOMs must be less than 500 meters. When planning TAOM separation, allow for adequate cable slack to prevent cable connector stress. Excessive stress on the connectors could cause damage.

Distance Between TAOM and Pallet Assembly. The pallet assembly must be located within 25 feet of its associated TAOM.

Distance Between TAOMs and Power Sources. The TAOM requires 120/208 v, 3-phase, 50/60 Hz, wye configured prime power. It is obtained from either tactical generators or commercial power systems. Site location for prime power generators is determined by the location of the equipment they supply.

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Chapter 5

Training

Every Marine Corps leader has the responsibility to establish and conduct technical and tactical training for Marines to successfully accomplish the unit's mission. The tools available to assist leaders in establishing the base for an effective training plan are relevance, standardization, efficiency, and specificity. Due to the complexities of amphibious, joint, and multinational operations, the importance of individual, crew, and unit level training for TAOC controllers and operators cannot be understated. The impact from meaningful, quality training will reflect on a Marine's proficiency.

INDIVIDUAL TRAINING

TAOC controller and operator training requirements are standardized by MCO P3500.19, *Training and Readiness (T&R) Manual*. It specifies training events and position requirements necessary for controllers and operators to progress through various level qualifications. Follow-on formal training is available to those Marines who demonstrate military occupational specialty (MOS) proficiency.

Formal Schools

Entry Level Training. Entry level training for air defense control officers (MOS 7210), tactical air defense controllers (MOS 7236), and air control electronics operators (MOS 7234) is conducted at the Air School, Marine Corps Communication-Electronics School (MCCES), Marine Corps Air-Ground Combat Center, Twentynine Palms, California.

Air Defense Control Officer Course (ADCOC). The ADCOC provides instruction regarding TAOC system capabilities, employment and crew operations; system configuration; surveillance, traffic, and weapons functioning; principles of air defense; and air intercept control.

Air Control Electronics Operator Course (ACEOC). The ACEOC provides the same instructional package as the ADCOC withstanding the air intercept control training portion.

Tactical Air Defense Controller Course (TADCC). The TADCC provides intercept control training to corporals and sergeants carrying an interim MOS 7236 designation. Upon successful course completion, the Marine will receive a permanent MOS 7236 designation. The ACEOC is a prerequisite for TADCC attendance.

Graduate Level Training. Air defense control officers (MOS 7210) and tactical air defense controllers (MOS 7236) exhibiting technical and tactical proficiency may be selected by their commands to attend mid- and high-level MOS training. Training includes the Navy Fighter Weapons School (TOPGUN), Marine Division Tactics Course (MDTC), and the Weapons and Tactics Instructor (WTI) course.

TOPGUN. TOPGUN provides controllers with advanced training in threat and friendly air tactics; weapons systems capabilities; and Naval power projection doctrine. Prerequisites for TOPGUN include qualification as a SWD and successful completion of at least 350 ground-controlled intercepts.

Marine Division Tactics Course. The MDTC provides controllers with ground and practical application instruction in doctrine, tactics, and weapons employment considerations for a division or more of Marine fighters in a multi-bogey environment as part of an integrated air defense system. The MDTC is taught by instructors from Marine aviation weapons and tactics squadron 1 (MAWTS-1).

Weapons and Tactics Instructor Course. The WTI course provides students advanced training and practical application on planning and execution of the six functions of Marine aviation. MOS 7210 students receive specific instruction in MACCS and TAOC planning and SAAWC/TAOC operational execution. Prerequisites for WTI attendance include SAD qualification with MEF-level exercise experience. Upon completion, students receive the MOS 7277 (weapons and tactics instructor) designation.

Follow-on Schools. Additional formal schools are available for field grade officers, including the Air Defense Control Officers Senior Course (ADCOSC) and the WTI Commanders Course.

Air Defense Control Officers Senior Course. Conducted at the Air School, MCCES, Marine Corps Air-Ground Combat Center, Twentynine Palms, California, the ADCOSC is designed to provide MACCS field grade officers with instruction on TAOC

and air defense capabilities and limitations. Conducted as a symposium, the ADCOSC provides insight to air defense operations and planning considerations.

WTI Commanders Course. Held at MCAS, Yuma, Arizona, the WTI Commanders Course provides field grade officers with an opportunity to examine and discuss issues affecting the MACCS and considerations for MACCS employment.

On-the-Job Training

Most TAOC controller and operator MOS training is conducted at the squadron level. Requirements for both academic and practical application training and position qualification for TAOC controllers and operators is specified in MCO P3500.19. A specific T&R syllabus exists for MOS 7210 air defense control officers, MOS 7236 tactical air defense controllers, and MOS 7234 air control electronics operators. Tracking of individual readiness is computed by the aviation training and readiness information management system (ATRIMS). TAOC controller and operator training is conducted at four progressive levels. Completion of each level equates to reaching a given combat readiness percentage (CRP).

Combat Capable Training. Combat capable training is completed at the MCCES entry level school and includes the basic skills training required by TAOC personnel to operate TAOC equipment and function as a TAOC crew member.

Combat Ready Training. Combat ready training includes additional training in tactics and weapons systems in both permissive and restrictive threat environments to raise the skill level of TAOC personnel.

Combat Qualification Training. Upon completion of this phase, TAOC operators and controllers will be proficient in the employment of the weapons system in a sophisticated threat environment.

Full Combat Qualification Training. Completion of this training phase indicates the Marine is proficient in the employment of the weapons system in integrated operations in all threat environments.

Special Qualifications. MCO P3500.19 provides guidance for TAOC crew members to attain designations as instructors for various T&R levels, flight supervisors, simulator operators and programmers, and in specific crew positions.

CREW TRAINING

For TAOC controllers and operators, maintenance personnel, and the SAAWC staff, TAOC crew training is normally effected through the use of the TAOM's built-in simulation capability. The TAOM's simulation program provides operators with the ability to design air defense scenarios of varying complexity based on the crew's training requirements. Crew training need not include the entire crew, but may be designed to specifically challenge an individual TAOC section (e.g., surveillance, traffic, or weapons) on its functioning and procedures. Crew training drills are extremely important for identifying crew shortcomings, enhancing inter-crew coordination, testing air control procedures, and preparing the crew to interface with external agencies.

UNIT TRAINING

Unit training involves that training required to prepare the TAOC to perform its mission. Unit training can take on many forms, including command post exercises (CPXs), simulated exercises (SIMEXs), and field training exercises (FTXs). During unit training, MACS personnel are intimately involved in preparing training plans and coordinating with higher, adjacent, and subordinate C^2 and support elements.

Marine Aviation Planning Problem Exercises

Marine Aviation Planning Problem (MAPP) exercises are low cost, low overhead training which allow commanders to train their staffs to perform special integration and control functions in a simulated environment. MAPP exercises are particularly effective for determining command and control requirements to support possible contingencies.

MACCS Integrated Simulated Training Exercise

The MACCS Integrated Simulated Training Exercise (MISTEX) is a MACG locally-produced exercise which involves detailed preparation of a simulated scenario and its subsequent execution at the MACCS level. The MISTEX can serve to prepare units for upcoming FTXs or contingencies. Individual Marine participation in filling a crew position during a MISTEX is a T&R requirement for position qualification.

Joint Service Training Exercises

Similar to the MISTEX, Joint Service Training Exercises (JSTEs) provide integrated systems training that incorporates the challenges of integrating the MACCS in joint operations. JSTE scenarios have been developed to support joint C^2 training for probable contingency operations worldwide.

Other Unit Training

In addition to CPX and SIMEX type training, the MACS often deploys to the field to participate in FTXs. Field training provides a unit with the most beneficial training opportunities available, living and operating in conditions similar to that which would be expected in real world operations.

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. Evaluation tools to identify training deficiencies are MCO 3501.9B, *MCCRES*, and MCO P3500.19. The MCCRES is a standardized, Headquarters Marine Corps directed evaluation program designed to measure a unit's warfighting readiness. It specifies mission performance standards (MPS) which agencies are expected to perform during their wartime mission. MCO P3500.19 specifies individual performance standards.

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Appendix A

Crew Briefing Guide/Format

OPERATIONS BRIEF

The operations brief should be developed based on planning conducted at the MACCS (MACG) planning staff level. As such, it will incorporate specifics from the MACCS commander's brief, however, it must be appropriately tailored for the TAOC. The operations brief should incorporate specific issues to the MACS, beyond the scope of the commander's brief, which are required for effective TAOC employment.

The operations brief is designed to provide the MACS operations officer/TAOC detachment commander with a standardized, comprehensive, and concise format to brief critical TAOC crew members and the SAAWC for an operation or exercise. The briefing format will then allow TAOC crews to develop and present their crew briefs prior to execution.

The format for this operations brief is not designed to script every possible item that could be included in a TAOC crew brief, nor do all the items listed need to be included. The individual developing and presenting this brief must analyze the information presented in the MACCS commander's brief, determine which information is critical to the TAOC's mission accomplishment, and tailor his brief to meet these needs. The operations brief format follows:

General Situation

Enemy Forces

- Ground forces disposition:
  - Enemy troop locations
  - Forward edge of the battle area (FEBA)
  - Projected movements
- Locations of known/suspected airbases
- Number, type, and variant of aircraft:
  - Fixed-wing
  - Rotary-wing
  - UAVs
- Possible loadouts/ordnance/delivery techniques:
  - Air-to-surface missiles (ARM/general/theater)
  - Precision guided munitions (forward-looking infra-red radar [FLIR]/TV/laser/command)
  - Iron bombs
  - NBC capabilities
  - Infrared countermeasures (IRCM) capabilities
- Enemy air capability to target air defense priorities

- EW threat:
  - Airborne/ground electronic warfare support (ES) systems/ capabilities
  - Airborne/ground electronic attack (EA) systems/capabilities
- Locations/systems/capabilities of SAM threat
- Surface-to-surface threat to C^3 and air defense priorities
- Special operations/terrorist threat
- Expected air threat axis and likely avenues of approach
- Expected times of attack
- Most likely enemy course(s) of action

Friendly Forces

- Airfields and locations/divert
- Aircraft mission, locations and loadouts:
  - Fixed-wing
  - Rotary-wing
  - UAVs
- C^3 agencies, capabilities, and locations

Commander's Intent

- Main effort/friction areas
- Strengths to exploit
- Vulnerabilities enemy may exploit
- TAOC mission

Joint/Multinational Interoperability Issues

- Interface with JFACC/ACA/AADC
- Airspace control area/sectors
- Air defense area/region/sector
- Interface with International Civil Aviation Organization (ICAO) and host nation air traffic control (ATC) facilities
- ATO input and receipt means/procedures

Command, Control and Communications Employment Plan

- Air defense priorities
- Surveillance coverage and radar contracts
- Responsiveness to the threat
- Destruction area (BDZs/MEZ/FEZ/crossover zones/points/joint engagement zones [JEZs])

- Data links:
  - Connectivity/configurations
  - Interface control unit (ICU)/interface coordination officer (ICO)
- Manual cross tell procedures
- Orbit areas (AEW/CAP/tankers/CAS stacks/EA/ES)
- Routing (minimum risk routes [MRR]/fade/bugout/IFF turn on and off lines)
- Airspace coordination areas (ACAs)
- Additional airspace control measures
- NAVAID (tactical air navigation system[TACAN]/VHF omnidirectional range [VOR]/nondirectional beacon [NDB]) loca- tions
- Lame duck procedures
- CAP management and control
- Tanker management and control
- AEW/airborne agency coordination procedures
- Aircraft handover procedures
- Initial air defense warning condition/weapons control status
- Initial states of alert (aircraft/Hawk/Stinger/air defense artillery [ADA])

- Initial GBAD/CAP mode of control:
  - Authority to change mode
  - Procedures for autonomous operations
- ROE:
  - Identification (ID) authority
  - Engagement authority
  - ID criteria
  - Commit criteria
  - Self-defense criteria
  - Impact of night on ROE
- Tactical recovery of aircraft and personnel (TRAP)/medical evacuation (MEDEVAC):
  - Assets/locations
  - Casualty collection points
  - Zones/safe areas
- Communications:
  - Planned and exceptions; current period for communications-electronics operating instructions (CEOI)
  - Critical information flow

- Communications assignments:
  - Frequencies/callsigns
  - Required comm nets to be monitored
  - Prioritization for restoration
- Data link specifics:
  - Data link reference point (DLRP)/unit system coordinate center (USCC)
  - NCS
  - Frequencies/nets/callsigns
  - Addresses (Btrys/PUs/RUs)
  - Track blocks
- Crypto change times
- EMCON/EP plan to include RADCON and ZIPLIP procedures
- Codewords
- Required reports (equipment/frequency interference reports (FIR)/meaconing, intrusion, jamming, and interference (MIJI) to include required times or time of event)
- ATO distribution to subordinate agencies
- Intelligence connectivity

- Casualty procedures:
  - Functional degradation
  - Data link and voice communications
- Delegation of authority:
  - CAP launch
  - WEZ activation/deactivation
  - RADCON management

Time Hack

Questions

TAOC CREW BRIEF

Principal TAOC crew members conduct organized briefings prior to assuming the watch. Crew briefs should be as detailed as practical, however, may be abbreviated to expedite the group brief and concentrate on TAOC section particulars either prior to or immediately following the crew's mass brief. The normal briefing order is the—

- SAD (Introductory Comments)
- Intelligence representative
- SCC
- SID
- STD
- SWD
- SAD
- SAAWC/ACE commander/senior watch officer (SWO)

The minimum required information to be passed in the TAOC crew mass brief is specified in MCO 3501.9B. This information, combined with other additional useful information, is outlined on the following pages.

Intelligence Representative

- Weather:
  - Current airfield/operating area conditions
  - 6-hour forecast for airfield(s)/operating area
  - Divert field conditions
  - Contrail layer
- Friendly ground situation
- Friendly air situation
- Enemy ground situation:
  - Special operating forces (SOF) and activities
  - Operations impacting on friendly operations
- Enemy air situation to include the air order of battle:
  - Locations of known or suspected airbases
  - Number and type of suspected aircraft threat
  - Possible ordnance loads and configurations
  - Aircrew training level
  - Missile order of battle
  - High-speed antiradiation missile (HARM) capabilities and tactics

  - Attack profiles
- Enemy naval order of battle
- Enemy electronic order of battle
- Enemy surface-to-surface weapons capabilities
- Enemy surface-to-air capabilities and locations
- Vulnerability windows
- NBC capabilities and employment means

System Configuration Coordinator

- System configuration/equipment status:
  - Mass memory units (MMU) (to include Master MMU)
  - Radar interface units (RIU)
  - Computer units (CU)
  - Communication interface units (CIU) (to include Master CIU)
  - DDB
  - Printer units (PRU)
  - Data communication units (DCU)
  - Data terminal sets (DTS)

- Communication configuration/status:
  - Direct access trunks (DAT)
  - Single destination (SD) nets
  - Multidestination (MD) nets
  - UHF nets/channelization
  - Crypto assignments
  - Switchboard access
  - Phone numbers
  - Hot lines
  - Other circuits
  - Data communication:
    - TADIL-A
    - TADIL-B
    - TADIL-C
    - ATDL-1
    - Link 1
    - ULMS
    - SAAWC
  - Radar voice control access units (VCAU)

  - SAAWC VCAU
- Radar availability
  - AN/TPS-59 radar, IFF, Mode IV
  - AN/TPS-63 radar, IFF, Mode IV
- Seating positions
  - VCAU assignments
  - Alternate positions
- System degradation and manual reconfiguration procedures
- Crypto changeover times
- Authentication devices and location
- Troop information and threat condition
- Required reports

Surveillance Identification Director

- TAOC's sector of responsibility:
  - Warning areas
  - Civil air routes
  - Restricted areas
  - Area restrictions

  - High-density airspace control zone (HIDACZ)
- Area entry/exit points
- Available radars to include minimum and maximum range
- Terrain features affecting radar detection
- Threat air axis and likely avenues of approach
- Surveillance section (i.e., SOs') sectors of responsibility (Sectors should overlap between SOs)
- TAOC acquisition, threat, and auto ID modes
- System configuration:
  - Sector inhibits
  - Censor areas
  - Clutter gates
  - Declination
  - Radar tilt
  - Radar throttling
  - Threat zones
  - Hostile/missile profile data
- Identification criteria:
  - IFF/selective identification feature (SIF) information

  - IFF turn on/off lines
  - Mode I, II, and III information
  - Aircraft identification profiles
- Classification criteria (with flow chart)
- Theater/national asset identification assets and capabilities
- Data link configuration:
  - Responsibilities (i.e., ICU, track data coordinator [TDC], force track coordinator [FTC], NCS, etc.)
  - Participants with PU/RU assignment
  - Track block assignments
  - Primary/alternate configurations
  - Processing of near-real time (NRT) tracks
  - Filters
- Manual cross tell procedures
- EMCON:
  - RADCON plan
  - ZIPLIP procedures
  - EP plan/procedures
  - ARM profiles/parameters

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)

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

airspace control authority - The commander designated to assume overall responsibility for the operation of the airspace control system in the airspace control area. (Joint Pub 1-02) Also called ACA.

area air defense commander - Within a unified command, subordinate unified command, or joint task force, the commander will assign overall responsibility for air defense to a single commander. Normally, this will be the component commander with the preponderance of air defense capability and the command, control, and communications capability to plan and execute integrated air defense operations. Representation from the other components involved will be provided, as appropriate, to the area air defense commander's headquarters. (Joint Pub 1-02) Also called AADC.

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. (Joint Pub 1-02) Also called AO.

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. (Joint Pub 1-02) Also called AOR.

B

base defense zone - An air defense zone established around an air base and limited to the engagement envelope of short-range air defense weapons systems defending that base. Base defense zones have specific entry, exit, and identification, friend or foe procedures established. (Joint Pub 1-02) Also called BDZ.

C

counter air - A US Air Force term for air operations conducted to attain and maintain a desired degree of air superiority by the destruction or neutralization of enemy forces. Both air offensive and air defensive actions are involved. The former range throughout enemy territory and are generally conducted at the initiative of the friendly forces. The latter are conducted near or over friendly territory and are generally reactive to the initiative of the enemy air forces. (Joint Pub 1-02)

D

data link - The means of connecting one location to another for the purpose of transmitting and receiving data. (Joint Pub 1-02)

deep air support - Air action against enemy targets at such a distance from friendly forces that detailed integration of each mission with fire and movement of friendly forces is not required. Deep air support missions are flown on either side of the fire support coordination line; the lack of a requirement for close coordination with the fire and movement of friendly forces is the qualifying factor. (FMFRP 0-14) Also called DAS.

direct air support - Air support flown in direct response to a specific request from the supported unit. (FMFRP 0-14)

direct air support center - The principal air control agency of the Marine air command and control system responsible for the direction and control of air operations directly supporting the ground combat element. It processes and coordinates requests for immediate air support and coordinates air missions requiring integration with ground forces and other supporting arms. It normally collocates with the senior fire support coordination center within the ground combat element and is subordinate to the tactical air command center. (FMFRP 0-14, proposed modification to Joint Pub 1-02) Also called DASC.

direct air support center (airborne) - An airborne aircraft equipped with the necessary operations and communications facilities, and manned by the essential personnel, to function in a limited role, as a DASC. (FMFRP 0-14, proposed modification to Joint Pub 1-02) Also called DASC(A).

E

electronic warfare - Any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. Also called EW. The three major subdivisions within EW are: electronic attack, electronic protection, and electronic warfare support.

a. electronic attack - That division of electronic warfare involving the use of electromagnetic or directed energy to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability. Also called EA. EA includes 1. actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum, such as jamming and electromagnetic deception, and 2. employment of weapons that use either electromagnetic or directed energy as their primary destructive mechanism (lasers, RF weapons, particle beams).

b. electronic protection - That division of electronic warfare involving actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy emloyment of electronic warfare that degrade, neutralize, or destroy friendly combat capability. Also called EP.

c. electronic warfare support - That division of electronic warfare involving actions tasked by, or under direct control of, an operational commander to search for, intercept, identify, and locate sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support provides information required for immediate decisions involving electronic warfare operations and other tactical actions such as threat avoidance, targeting, and homing. Also called ES. Electronic warfare support

data can be used to produce signals intelligence (SIGINT), communications intelligence (COMINT), and electronics intelligence (ELINT). (Joint Pub 1-02)

emission control - The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities while minimizing, for operations security (OPSEC): a. detection by enemy sensors; b. minimize mutual interference among friendly systems; and/or c. execute a military deception plan. (Joint Pub 1-02) Also called EMCON.

essential elements of information - The critical items of information regarding the enemy and the environment needed by the commander by a particular time to relate with other available information and intelligence in order to assist in reaching a logical decision. (Joint Pub 1-02) Also called EEI.

F

forward operating base - An airfield used to support tactical operations without establishing full support facilities. The base may be used for an extended time period. Support by a main operating base will be required to provide backup support for a forward operating base. (FMFRP 0-14) Also called FOB.

future operations section - That portion of the tactical air command center and aviation combat element commander's battlestaff responsible for the detailed planning and coordination of all future air operations conducted by the aviation combat element in support of the Marine air-ground task force. The future operations section plans for and publishes the next air tasking order(s) (normally a 48 to 72-hour period). (FMFRP 0-14) Also called FOS.

G

gap filler radar - A radar used to supplement the coverage of the principal radar in areas where coverage is inadequate. (Joint Pub 1-02)

H

high-density airspace control zone - Airspace designated in an airspace control plan or airspace control order, in which there is a concentrated employment of numerous and varied weapons and airspace users. A high-density airspace control zone has defined dimensions, which usually coincide with geographical features or navigational aids. Access to a high-density airspace control zone is normally controlled by the maneuver commander. The maneuver commander can also direct a more restrictive weapons status within the high-density airspace control zone. (Joint Pub 1-02) Also called HIDACZ.

I

identification - The process of determining the friendly or hostile character of an unknown detected contact. (Joint Pub 1-02)

J

joint force air component commander - The joint force air component commander derives authority from the joint force commander who has the authority to exercise operational control, assign missions, direct coordination among subordinate commanders, redirect and organize forces to ensure unity of effort in the accomplishment of the overall mission. The joint force

commander will normally designate a joint force air component commander. The joint force air component commander's responsibilities will be assigned by the joint force commander (normally these would include, but not be limited to, planning, coordination, allocation, and tasking based on the joint force commander's apportionment decision). Using the joint force commander's guidance and authority, and in coordination with other Service component commanders and other assigned or supporting commanders, the joint force air component commander will recommend to the joint force commander apportionment of air sorties to various missions or geographic areas. (Joint Pub 1-02) Also called JFACC.

joint theater missile defense - The integration of joint force capabilities to destroy enemy theater missiles in flight or prior to launch or to otherwise disrupt the enemy's theater missile operations through an appropriate mix of mutually supportive passive missile defense; active missile defense; attack operations; and supporting command, control, communications, computers, and intelligence measures. Enemy theater missiles are those that are aimed at targets outside the continental United States. (Joint Pub 1-02) Also called JTMD.

L

low-altitude missile engagement zone - In air defense, 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. (Joint Pub 1-02) Also called LOMEZ.

low level transit route - A temporary corridor of defined dimensions established in the forward area to minimize the risk to

friendly aircraft from friendly air defenses or surface forces. (Joint Pub 1-02) Also called LLTR.

M

Marine air command and control system - A US Marine Corps air command and control 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. (FMFRP 0-14, proposed modification to Joint Pub 1-02)

Marine air-ground task force - A task organization of Marine forces (division, aircraft wing, and service support groups) under a single command and structured to accomplish a specific mission. The Marine air-ground task force components will normally include command, aviation combat, ground combat, and combat service support elements (including Navy Support Elements). Three types of Marine air-ground task forces which can be task organized are the Marine expeditionary unit, Marine expeditionary force (forward), and Marine expeditionary force. Also called MAGTF. The four elements of a MAGTF are:

a. command element (CE) - The MAGTF headquarters. The CE is a permanent organization composed of the commander, general or executive and special staff sections, headquarters section, and requisite communications and service support facilities. The CE provides command, control, and coordination essential for effective planning and execution of

operations by the other three elements of the MAGTF. There is only one CE in a MAGTF.

b. aviation combat element (ACE) - The MAGTF element that is task organized to provide all or a portion of the functions of Marine Corps aviation in varying degrees based on the tactical situation and the MAGTF mission and size. These functions are air reconnaissance, antiair warfare, assault support, offensive air support, electronic warfare, and control of aircraft and missiles. The ACE is organized around an aviation headquarters and varies in size from a reinforced helicopter squadron to one or more Marine aircraft wing(s). It includes those aviation command (including air control agencies), combat, combat support, and combat service support units required by the situation. Normally, there is only one ACE in a MAGTF.

c. ground combat element (GCE) - The MAGTF element that is task organized to conduct ground operations. The GCE is constructed around an infantry unit and varies in size from a reinforced infantry battalion to one or more reinforced Marine division(s). The GCE also includes appropriate combat support and combat service support units. Normally, there is only one GCE in a MAGTF.

d. combat service support element (CSSE) - The MAGTF element that is task organized to provide the full range of combat service support necessary to accomplish the MAGTF mission. CSSE can provide supply, maintenance, transportation, deliberate engineer, health, postal, disbursing, enemy prisoner of war, automated information systems, exchange, utilities, legal, and graves registration services. The CSSE varies in size from a MEU service support group (MSSG) to a force service support group (FSSG). Normally, there is only one combat service support element in a MAGTF. (proposed change to Joint Pub 1-02)

Note: A fourth type of MAGTF which can be task-organized is the special purpose force.

Marine air traffic control mobile team - A task organized element provided by the Marine air traffic control detachment to perform control of friendly aircraft operating within the assigned base defense zone of a forward operating base air facility/air site. The mobile team provides visual flight rules (VFR) air traffic control services within its assigned terminal control area and base defense zone. Normally, a fully manned and equipped mobile team capability can be provided on a 24-hour basis for up to 72 hours without resupply or augmentation. (FMFM 5-50) Also called MMT.

minimum-risk route - A temporary corridor of defined dimensions recommended for use by high-speed, fixed-wing aircraft that presents the minimum known hazards to low-flying aircraft transiting the combat zone. (Joint Pub 1-02) Also called MRR.

missile engagement zone - The airspace of defined dimensions within which the responsibility for engagement normally rests with missiles. (FMFM 5-60) Also called MEZ. MEZs may be designated within the missile intercept zone (MIZ).

mutual support - 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. (Joint Pub 1-02)

N

naval tactical data system - A complex of data inputs, user consoles, converters, adapters, and radio terminals interconnected with high-speed, general-purpose computers and its stored programs. Combat data is collected, processed, and composed into a picture of the overall tactical situation which enables the force commander to make rapid, accurate evaluations and decisions. (Joint Pub 1-02) Also called NTDS.

near real time - Pertaining to the timeliness of data or information which has been delayed by the time required for electronic communication and automatic data processing. This implies that there are no significant delays. (Joint Pub 1-02)

O

offensive air support - Those air operations conducted against enemy installations, facilities, and personnel to directly assist the attainment of MAGTF objectives by the destruction of enemy resources or the isolation of his military force. (FMFRP 0-14) Also called OAS.

offensive antiair warfare - Those operations conducted against enemy air assets and air defense systems before they can be launched or assume an attacking role. Offensive antiair warfare operations in or near the objective area consist mainly of air attacks to destroy or neutralize hostile aircraft, airfields, radars, air defense systems, and supporting areas. (FMFRP 0-14) Also called OAAW.

operations security - A process of identifying critical information and subsequently analyzing friendly actions attendant to military operations and other activities to:

a. Identify those actions that can be observed by adversary intelligence systems.

b. Determine indicators hostile intelligence systems might obtain that could be interpreted or pieced together to derive critical information in time to be useful to adversaries.

c. Select and execute measures that eliminate or reduce to an acceptable level the vulnerabilities of friendly actions to adversary exploitation. (Joint Pub 1-02) Also called OPSEC.

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)

R

rules of engagement - Directive 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. (Joint Pub 1-02) Also called ROE.

S

sector antiair warfare coordinator - An individual designated by the aviation combat element commander to function as his air defense battle manager. He functions to the extent of authority delegated to him by the aviation combat element commander. The sector antiair warfare coordinator is responsible for coordination and management of all active air defense weapons (aircraft and surface-to-air weapons) within his assigned sector. (FMFRP 0-14) Also called SAAWC.

T

tactical air operations center - The principal air control agency of the Marine air command and control system responsible for airspace control and management. It provides real time surveillance, direction, positive control, and navigational assistance for friendly aircraft. It performs real time direction and control of all antiair warfare operations, to include manned interceptors and surface-to-air weapons. It is subordinate to the tactical air command center. (FMFRP 0-14, proposed modification to Joint Pub 1-02) Also called TAOC.

theater missile - A missile, which may be a ballistic missile, a cruise missile, or an air-to-surface missile (not including short-range, non-nuclear, direct fire missiles, bombs, or rockets such as Maverick or wire-guided missiles), whose target is within a given theater of operation. (Joint Pub 1-02)

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Appendix D

References and Related Publications

Allied Tactical Publications (ATP)

8	Doctrine for Amphibious Operations
33	NATO Tactical Air Doctrine
40	Doctrine and Procedures for Airspace Control in the Combat Zone
42	Counter-Air Operations

Joint Publications (Joint Pub)

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	Joint Doctrine for Countering Air and Missile Threats (under development)
3-01.5	Doctrine for Joint Theater Missile Defense
3-52	Doctrine for Joint Airspace Control in the Combat Zone
3-56.1	Command and Control for Joint Air Operations

Navy Publications

10-1 (C)	Composite Warfare Commander's Manual (U)
10-1.21A (C)	Antiair Warfare Commander's Manual (U)
32 (C)	Antiair Warfare (U) . . . From the Sea: Preparing the Naval Service for the 21st Century"

Fleet Marine Force Manuals (FMFMs)

1	Warfighting
3-1	Command and Staff Action
3-30	Communications
5-1	Organization and Function of Marine Aviation
5-50	Antiair Warfare
5-60	Control of Aircraft and Missiles
5-70	MAGTF Aviation Planning

Fleet Marine Force Reference Publications (FMFRPs)

0-14	Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms
5-57	AWACS-ADO Multi-Service Procedures for Airborne Warning and Control System Ground-Based Air Defense Operations
5-71	MAGTF Aviation Planning Documents

Marine Corps Orders (MCOs)

P3500.19	Training and Readiness (T&E) Manual
3501.9B	Marine Corps Combat Readiness Evaluation System (MCCRES)