USMC

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(Formerly MCWP 3-26)

Air Reconnaissance

US Marine Corps

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ERRATUM

to

MCWP 3-26

AIR RECONNAISSANCE

1. Change all instances of MCWP 3-26, *Air Reconnaissance*, to MCTP 3-20G, *Air Reconnaissance*.

2. Change PCN 143 000142 00 to PCN 147 000024 00.

3. File this transmittal sheet in the front of this publication.

PCN 147 000024 80

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- Location of change
  - Publication number and title
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  - Line number
  - Figure or table number (if applicable)
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Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

DEPARTMENT OF THE NAVY
Headquarters United States Marine Corps
Washington, D.C. 20380-1775

21 July 2003

FOREWORD

Air reconnaissance supports the Marine air-ground task force's (MAGTF's) intelligence warfighting function because it provides critical intelligence that supports the MAGTF's operational planning process. The MAGTF commander uses air reconnaissance to gain intelligence that is vital to the shaping of the battlespace. This intelligence assists the commander in understanding the tactical situation, alerts him to new opportunities, and allows him to assess the effects of MAGTF operations on the threat. Through the proper use of manned and unmanned air reconnaissance assets, commanders within the MAGTF can maximize their forces' effectiveness by optimizing friendly strengths and exploiting the threat's critical vulnerabilities.

Marine Corps Warfighting Publication (MCWP) 3-26, *Air Reconnaissance*, addresses basic air reconnaissance tactics, techniques, and procedures for the planning and execution of air reconnaissance operations. This publication provides commanders and their staffs, aircrews, unmanned aerial vehicle operators, and intelligence analysts with air reconnaissance operational principles and capabilities.

This publication supersedes Fleet Marine Force Manual 5-10, *Air Reconnaissance*, dated 20 May 1991.

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

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Chapter 1
Overview

Marine aviation consists of six functional areas: antiair warfare, offensive air support, assault support, electronic warfare, air reconnaissance, and control of aircraft and missiles. As one of the six functions of Marine aviation, air reconnaissance is an essential warfighting tool because it employs visual observation and/or sensors in air vehicles to acquire critical battlespace information for commanders and decisionmakers at all levels. This information is then converted into intelligence to reduce uncertainties in the planning and execution of Marine air-ground task force (MAGTF) operations. To be effective, air reconnaissance must be responsive, flexible, survivable, and produce imagery products in all weather conditions.

Levels of War

Although air reconnaissance primarily supports the intelligence warfighting function, it also contributes significantly to command and control (C2), maneuver, fires, logistics, and force protection. The information derived from air reconnaissance not only shapes military plans and operations, but it also influences national strategy and policy and military plans and operations. Therefore, air reconnaissance assets, although typically tactical in nature, support decisionmakers at all levels of war; all Marines must be cognizant of their ability to observe and report relevant and valuable information.

Strategic Level

Strategic air reconnaissance provides intelligence information required to form plans and policies at national and international levels. Strategic air reconnaissance operations—

- Locate threat centers of gravity (COGs) and strategic targets.
- Warn of hostile intent and actions.
- Analyze threat deployment and employment.
- Assess damage to threat and friendly targets.
- Determine threat force structure.
- Identify the threat's electronic order of battle (EOB).
- Provide threat indications and warning.

Operational Level

Air reconnaissance performed at the operational level provides information that is crucial to the planning and execution of theater-wide operations that help accomplish the MAGTF commander's or joint force commander's (JFC's) objectives. Operational air reconnaissance operations—

- Provide the intelligence information crucial to understanding a threat's weaknesses in order to develop friendly courses of action (COAs).
- Help define the critical vulnerabilities of a threat's national structure and military capabilities.
- Provide information on terrain; weather; and the threat's size, movement, and situation.
- Provide threat assessment.
- Identify targets.

Tactical Level

At the tactical level, air reconnaissance operations support the following MAGTF objectives:

- Tactical threat warning.
- Mission planning.
- Targeting.
- Combat assessment.
- Threat assessment.
- Target imagery.
- Artillery and naval gunfire adjustment.
- Observation of ground battle areas, targets, or sections of airspace.

Categories

MAGTF aviation provides three categories of air reconnaissance: visual, imagery, and electronic. All of which are employed at the strategic, operational, or tactical level of war. A single mission can employ any or all of these three categories.

Visual Reconnaissance

Visual reconnaissance acquires current information on enemy activities, resources, installations; the weather; and the physical characteristics of a given area. It can be conducted by any airborne platform, fixed- or rotary-wing, and provides immediate information. A visual reconnaissance mission is flown in response to a specific request, but all aircrews must be aware of the need to report information when assigned other types of

missions. Visual reconnaissance can also be used to support the delivery of offensive fires (such as artillery support and naval surface fire support), and it may supplement operational information concerning friendly forces. The limitation of human vision makes the effectiveness of visual reconnaissance susceptible to enemy cover, concealment, and deception techniques.

Imagery Reconnaissance

Imagery reconnaissance detects and pinpoints the location of enemy installations and facilities and concentrations of enemy forces. It also supports terrain analysis. Imagery is recorded from sensors (e.g., cameras, radar, infrared devices) and other collateral equipment in or on the aircraft. It is either optical or nonoptical. To plan and execute MAGTF operations, the Marine Corps relies on a complementary mix of tactical, theater, and national air reconnaissance assets to support its imagery collection requirements.

Optical Imagery

Optical imagery uses a lens to focus light on an image sensor (i.e., still or video cameras) in order to produce high-resolution still images. Optical imagery produces images that are easily interpreted by the analyst. However, optical imagery requires that the targets be illuminated by visible light and also that the view of the target be unobstructed.

Nonoptical Imagery

Infrared and radar sensors capture nonoptical imagery. Unlike optical sensors, nonoptical sensors function regardless of the presence or absence of visible light and can be used at night as well as during the day.

Infrared sensors use thermal differences in objects to capture non-optical imagery; therefore they are highly effective at night and in certain types of weather. However, an infrared sensor is limited by battlefield obscurants and cannot image through clouds.

Radar uses recorded returns to produce images. Light conditions do not affect radar imagery and weather conditions have little affect on radar images, making the radar a true all-weather sensor.

Electronic Reconnaissance

Electronic reconnaissance detects, identifies, and evaluates enemy electromagnetic radiation. If the enemy uses electronic means of fire control, navigation, communications, or air surveillance, electronic interception equipment can recover enemy signals and determine signal direction, source, and characteristics. By analyzing the enemy's electronic emissions (i.e., communications and radar), analysts update the EOB, update technical intelligence, and identify the enemy's critical nodes (e.g., command posts, force concentrations, and high-threat weapons systems).

Principles

Air reconnaissance personnel can maximize intelligence support by applying the principles of integration, accuracy, relevance, and timeliness. Without the application of these principles, air reconnaissance operations generate large amounts of information with questionable intelligence value that can slow the intelligence cycle.

Integration

Air reconnaissance operations and the intelligence process must be fully integrated into operational planning and execution in order to meet MAGTF operational requirements. To be effective, the intelligence information collected during an air reconnaissance mission must be accurate and delivered in a timely manner. To utilize air reconnaissance assets effectively and to identify air reconnaissance collection requirements, the commander considers and integrates the capabilities and limitations of air reconnaissance systems and organizations in the decision-making, planning, preparation, execution, and assessment processes. Similarly, personnel must be fully aware of mission goals while executing air reconnaissance in order to effectively collect requested and nonrequested information.

Accuracy

To best support MAGTF operations, products that are derived from air reconnaissance missions must be accurate and reliable. To achieve accuracy, air reconnaissance cannot just report objects in the battlespace; it must provide as much information as possible for each object so that planners and the commander can have the most complete picture possible. One critical piece of information is an object's position. Geoposition accuracy is a crucial requirement for target acquisition, especially with the employment of global positioning system guided munitions. Air reconnaissance sensors acquire information that enables targeteers to produce target locations or aim points suitable for the accurate employment of weapon systems. Accuracy also aids commanders in defeating enemy deception efforts. For example, a well-trained observer can discern the difference between a real tank and a cardboard mock-up of a tank.

To increase accuracy, extended observation and analysis times are required. However, extended times expose the air reconnaissance asset to greater danger and delays the delivery of intelligence to the commander. Achieving the balance between accuracy and responsiveness is one of the most demanding tasks for air reconnaissance personnel and requires close coordination with planners. To achieve this balance, planners and operators must have detailed knowledge of the enemy's strategies, tactics, capabilities, and culture and of our operational objectives in order to determine air reconnaissance collection requirements.

Relevance

The information collected during an air reconnaissance mission must be relevant to the user. It must be presented in a format that is useful and it must be tailored to the user's needs. Therefore, planning the employment of air reconnaissance assets is based on the asset's capability and its ability to meet user requirements.

Timeliness

Air reconnaissance products must be available in time to plan and execute operations. This principle encompasses the need to identify and state requirements, collect information, and produce intelligence in order to support MAGTF operations in a timely manner. Timely intelligence is essential to prevent the use of surprise by the enemy, conduct a defense, seize the initiative, and use forces effectively. The dynamic nature of air reconnaissance can provide timely information to the commander to increase the tempo of his decisionmaking cycle and to improve his view of the battlespace.

The responsiveness of Marine air reconnaissance is directly linked to the timely delivery of intelligence. Based on established collection or reporting requirements, collected information is disseminated to the appropriate processing agency or user in order to generate mission-specific intelligence. To ensure the timely delivery of both information and intelligence, effective and responsive communications connectivity must be established. This connectivity allows limited MAGTF air reconnaissance assets to be shifted and allocated according to the commander's objectives and priorities. Therefore, commanders must examine the range of missions to be accomplished to ensure that appropriate and sufficient air reconnaissance assets are available.

Prerequisites

Effective air reconnaissance planning and execution involve several basic prerequisites: air superiority, suppression of enemy air defenses (SEAD), cooperative weather, capable platforms and sensors, and flexible control. When any one or a combination of these prerequisites is omitted, air reconnaissance may not be as effective and may expose an aircrew to unnecessary risks.

Air Superiority

Air superiority allows air reconnaissance aircraft to prosecute targets without prohibitive interference from enemy fighter aircraft. This can be achieved by conducting an aggressive antiair warfare or offensive counterair operation prior to conducting air reconnaissance or by tasking aircraft to function as a fighter escort during an air reconnaissance operation. Without air superiority, the enemy can interfere with air reconnaissance aircraft

and prohibit or disrupt our ability to collect air reconnaissance information required to support the MAGTF.

Suppression of Enemy Air Defenses

SEAD allows friendly aircraft to operate in airspace that is defended by enemy defense systems. It creates a sanctuary within which air reconnaissance aircraft can collect information without prohibitive interference from the enemy. Traditionally, SEAD is an artillery responsibility; however, an air reconnaissance mission may be beyond the range of organic artillery and mortars. Therefore, to protect the air reconnaissance mission, aviation combat element (ACE) planners must plan for SEAD requirements when indirect fire assets are not available.

Cooperative Weather

Weather can directly impact any air reconnaissance mission. Inclement weather can cause aircrews and operators to experience prohibitive interference or unacceptable attrition if low ceilings force air reconnaissance platforms performing visual and imagery reconnaissance to acquire targets "under the weather" and in the heart of the antiaircraft artillery (AAA) envelope. Target acquisition and sensor performance can also be adversely affected by inclement weather.

Capable Platforms and Sensors

Historically, target acquisition has been the most difficult task associated with an air reconnaissance mission. To increase the probability for successful target acquisition, air reconnaissance platforms need accurate reconnaissance systems and sensor equipment for both day and night operations.

Flexible Control

A responsive and flexible command, control, and communications (C3) system is required to ensure that air reconnaissance requests are satisfied in a timely manner. Information flow, both up and down the chain of command, with a simple and redundant backup plan is the key to successful control.

Response Time

Forward basing, alert status, and mission classification are techniques used to effectively reduce air reconnaissance response times.

Forward Basing

Forward basing reduces the transit time to and from the battlespace, and it allows air reconnaissance platforms more time on station. However, forward basing will incur additional logistical and force protection requirements.

Alert Status

The alert status is a queuing system that directs air reconnaissance platforms to takeoff in 60, 30, 15, or 5 minute intervals. As the C3 system receives requests for air reconnaissance, the alert status can be changed to provide the air reconnaissance required to support battlespace conditions.

Mission Classification

Mission classification directly impacts the timeliness of air reconnaissance support. Missions are classified as either preplanned or

immediate. Units submit a joint tactical air strike request (JTAR) via the unit's intelligence section for preplanned missions and via the direct air support center (DASC) for immediate missions. See MCWP 2-11, *MAGTF Intelligence Collection Plans*, and MCWP 3-25.5, *Direct Air Support Center Handbook*, for more information on requesting air reconnaissance support.

Preplanned Missions

Preplanned missions are either scheduled or on-call.

Preplanned, scheduled missions are executed at a specific time against a known location or area. Scheduled missions can be dedicated or integrated. Dedicated missions focus solely on collecting air reconnaissance information. Integrated missions increase the efficiency of aviation assets by tasking multirole aircraft to collect air reconnaissance information while performing other missions. For example, an F/A-18D equipped with advanced tactical airborne reconnaissance system (ATARS) is tasked to obtain imagery on a named area of interest in the MAGTF's close battlespace while it is en route to execute a deep air support mission to strike a target in the MAGTF's deep battlespace.

Preplanned, on-call missions involve aircraft that are preloaded for a particular air reconnaissance mission and placed in an appropriate ground/airborne alert status. Aircrews can conduct mission planning based on available information, but not to the same detail as a scheduled mission. On-call missions allow the requesting commander to employ air reconnaissance assets as the tactical requirement arises based on prior mission analysis.

Immediate Missions

Immediate missions meet requests that arise during battle and are generally urgent in nature. Immediate missions cannot be

identified far enough in advance to be included in the air tasking order (ATO). Air reconnaissance assets can be redirected/diverted from other missions via the Marine air command and control system (MACCS) in order to execute an immediate mission request. Although the redirected/diverted aircraft may not be carrying the preferred air reconnaissance equipment, a quick visual or sensor air reconnaissance of the area may provide critical information to exploit an unexpected enemy weakness or maintain the momentum of an attack. Immediate mission response times will vary based on the distance from the area that the asset was launched or diverted.

Air Reconnaissance Support of the MAGTF

Air reconnaissance provides raw intelligence information to commanders and decisionmakers at all levels. This raw intelligence information is then converted into useful intelligence information to reduce uncertainties in the planning and execution of MAGTF operations. Intelligence gathered during air reconnaissance missions provides the MAGTF commander with a rapid means of acquiring visual, imagery, and electronic information on enemy activity and installations and the terrain. To execute air reconnaissance, the Marine Corps relies on a complementary mix of organic, theater, and national air reconnaissance sources in order to support its intelligence, planning, deployment, and operational phases. The MAGTF G-2/S-2 and G-3/S-3 are responsible for considering the full range of United States (US) air reconnaissance capabilities in support of the assigned mission.

Organic air reconnaissance support is provided by Marine aviation squadrons. Marine aviation squadrons are designed to be multimission capable and provide air reconnaissance information in general

support of the MAGTF. While the Marine unmanned aerial vehicle squadron (VMU) is the only dedicated air reconnaissance squadron, all Marine aircraft squadrons are equipped and trained to perform specific air reconnaissance operations; e.g., visual reconnaissance, photographic imagery. See table 1-1 for a list of Marine aviation squadrons and their air reconnaissance capabilities.

Table 1-1. Marine Aviation Squadron's Air Reconnaissance Capabilities.

Squadron	Aircraft	Type of Air Reconnaissance Mission		
		Visual	Imagery	Electronic
Marine attack squadron (VMA)	AV-8B	*	*	*
Marine fighter/attack squadron (VMFA)	F/A-18A/C	*	*	*
Marine fighter/attack (all-weather) squadron (VMFA[AW])	F/A-18D	X	X	*
Marine tactical electronic warfare squadron (VMAQ)	EA-6B	*		X
Marine aerial refueler transport squadron (VMGR)	KC-130	*		*
Marine unmanned aerial vehicle squadron (VMU)	UAV	*	X	
Marine heavy helicopter squadron (HMH)	CH-53D/E	*		*
Marine medium helicopter squadron (HMM)	CH-46E	*		*
Marine light/attack helicopter squadron (HML/A)	UH-1N, AH-1W	X	*	*
Marine medium tilt-rotor squadron (VMM)	MV-22	*		*

Legend:
X Unit is tasked specifically for this type of mission.
* Typically, the unit is not specifically tasked for this type of mission, but it can collect this type of information.

The employment of organic MAGTF air reconnaissance assets within the assigned area of operations is generally not feasible until just before the actual introduction of forces. Therefore, MAGTF commanders must rely on national or theater intelligence assets for predeployment air reconnaissance support. Once MAGTF air reconnaissance assets are employed, the MAGTF will continue to require national and theater support in specific areas to add depth to the air reconnaissance effort and cover gaps in organic collection capabilities. See table 1-2 for a partial list of national and theater assets that can provide air reconnaissance support to the MAGTF. MCWP 2-11 provides more information on requesting air reconnaissance in support of the MAGTF.

Manned

Manned air reconnaissance assets of other Services within the theater may support MAGTF operations. Data produced by these platforms may be transmitted over secondary imagery dissemination system (SIDS) networks for use by the MAGTF. The products from these platforms range from detailed imagery with precise global positioning system coordinates to verbal descriptions of an aircrew's visual reconnaissance. These assets may be requested to perform specific reconnaissance missions for the MAGTF or imagery collected for other purposes may be useful to MAGTF planners.

Unmanned

Unmanned aerial vehicles (UAVs) provide significant advantages over other reconnaissance assets. The greatest advantages of these systems is that they normally do not put friendly personnel at risk and they have a relatively long loiter time. UAV capabilities vary according to system and operational requirements.

Table 1-2. National and Theater Air Reconnaissance Capabilities.

National and Theater Assets	Aircraft	Type of Air Reconnaissance Mission		
		Visual	Imagery	Electronic
Manned				
Navy	E-2C	X		X
Air Force	E-3 (AWACS)	X		X
Air Force	EC-130 (Senior Scout)	X		X
Navy	EA-6B (Prowler)	X		X
Navy	EP-3E (Aries II)	X	X	X
Navy	ES-3A	X	X	X
Navy	F-14 (Tomcat)	X	X	
Navy	F/A-18E/F (Super Hornet)	X	X	
Air Force	F-16C/CJ (Falcons)	X	X	X
Air Force	RC-135	X		X
Air Force	U-2	X	X	X
Army	RC-12 (Guardrail)	X		X
Army	RC-7	X	X	X
Unmanned				
Air Force	RQ-1A (Predator)		X	
Air Force	RQ-4 (Global Hawk)		X	
Army	Shadow		X	
Satellites				
CIA, DIA, NSA, CIO, and NRO	Satellites		X	X

Currently, UAVs are primarily tactical in nature, characterized by specific mission capabilities, and cover a relatively small area. Future systems will provide broader area coverage with more capable sensors.

Satellite

Satellites are an integral part of the military's available reconnaissance resources. They provide weather, imagery (to include multispectral imagery), and electronic reconnaissance information to enhance a commander's mission planning ability. A satellite's primary advantage is its ability to provide worldwide coverage of areas of interest, especially remote or hostile areas where little or no data can be obtained from conventional sources. Other advantages include mission longevity, relative immunity from direct attack, detailed geographic and terrain information, distributing products generated by manned and unmanned air reconnaissance systems, and providing accurate positioning information to weapons and sensor systems. A satellite's limitations include the same atmospheric and weather disturbances that affect most imagery systems. In addition, a satellite's schedule is predictable; therefore, it is vulnerable to denial and deception practices and signature control activities (e.g., emission control, camouflage).

Chapter 2
Command, Control, and Communications

Command and control of the battlespace is critical to operational success. To be effective, command and control must be supported by an effective C3 system that builds a comprehensive picture of the battlespace for the commander. An effective C3 system is essential to fulfilling air reconnaissance's integration principle, and integration is key to Marine aviation's ability to fulfill its air reconnaissance mission.

The MACCS is Marine aviation's principal C3 system. The MACCS's objectives are to enhance unity of effort, integrate elements of the C3 system, and help maintain a commander's situational awareness. Increased situational awareness gives a commander the ability to make accurate tactical decisions faster than the threat and is critical to the success of any military operation.

Tasking Air Reconnaissance Assets

The tasking of air reconnaissance assets requires integrated staff planning. Integrated planning is normally accomplished through the operational planning team (OPT), which is established by the MAGTF G-3. The OPT is manned by liaison representatives of the G-2/S-2 and G-3/S-3. The OPT identifies and prioritizes air reconnaissance operational and intelligence support requirements. The allocation of sorties to support these requirements is reflected in the ATO. The ACE commander is responsible for the execution of the ATO and the conduct of air reconnaissance operations that meet MAGTF collection and operational requirements.

The ACE commander uses the MACCS to plan and execute air reconnaissance assets and to maintain centralized command and decentralized control. Air reconnaissance operations are planned,

coordinated, and controlled by the ACE G-3/S-3 via the Marine tactical air command center (TACC). Intelligence collection requirements, however, are designated by the MAGTF and require close coordination between the Marine Expeditionary Force (MEF) intelligence battalion's intelligence operations center (IOC) and the TACC.

When the tactical situation requires an increased reliance on integrated air reconnaissance, a surveillance and reconnaissance center (SARC) liaison officer may coordinate the mutual control functions shared by the MEF SARC and the TACC. Reliance on standing collection priority lists is not sufficient in fluid situations where every aircraft is filling an "eyes and ears" role; positive coordination is required. A SARC liaison officer to the TACC can track the position of nondedicated assets to satisfy immediate battlefield information requirements. To assist with UAV mission planning and execution, the VMU normally provides a task-organized team to the IOC, which typically operates from within the SARC.

Note

The IOC is not always in close proximity or collocated with the TACC.

The MAGTF commander can also be tasked by the JFC to provide sorties for tasking through the joint force air component commander (JFACC). Tasking normally includes sorties for air defense, long-range interdiction, and long-range reconnaissance. Any sorties in excess of the MAGTF direct support requirements

are also made available to the JFC. The JFACC uses these excess sorties to support the JFC's operations, campaign objectives, or other components of the joint force. Sorties provided for air defense, long-range interdiction, and long-range reconnaissance are *not considered excess sorties*.

The MAGTF commander can also request aviation support from the JFC when organic air reconnaissance assets do not meet MAGTF requirements. Guidelines for the relationship between the MAGTF commander and the JFC regarding aviation assets can be found in—

- JP 0-2, *Unified Action Armed Forces (UNAAF)*.
- JP 3-0, *Doctrine for Joint Operations.*
- JP 3-56.1, *Command and Control for Joint Air Operations.*
- MCWP 3-2, *Aviation Operations.*
- MCWP 3-40.1, *MAGTF Command and Control*.

Marine Air Command and Control System

The MACCS consists of various aviation C2 agencies that provide the ACE commander with the ability to monitor, supervise, and influence air reconnaissance operations. The Marine air control group (MACG) provides, operates, and maintains the VMU and the principal air reconnaissance agencies of the MACCS: the Marine TACC, tactical air operations center (TAOC), and the DASC. See figure 2-1 on page 2-4.

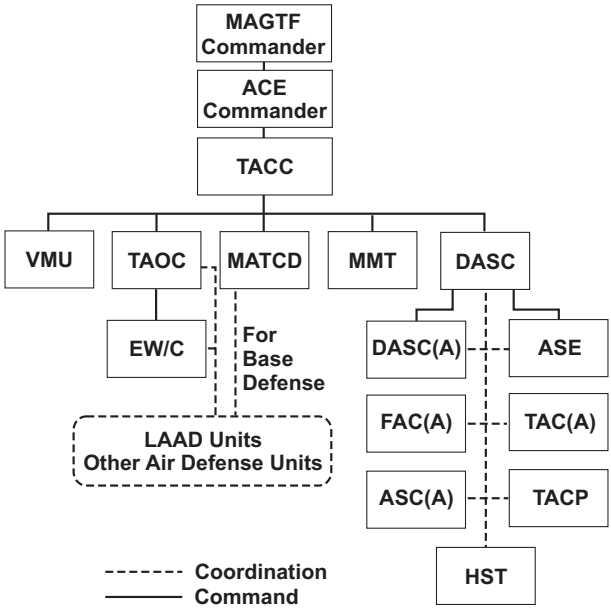


Figure 2-1. Marine Air Command and Control System Organization.

Marine Tactical Air Command Center

Functionally, the Marine TACC is divided into mutually supporting sections: current operations, future operations, future plans, and air combat intelligence. During the planning and execution of air reconnaissance missions, the Marine TACC's future and current operations cells ensure deconfliction and coordination with

surface forces to prevent fratricide. The current operations section executes the current day's ATO and includes deep and close battle cells. These cells—

- Manage all aviation assets assigned or available to the ACE that will be used in the execution of deep and close air reconnaissance operations.
- Provide the ACE commander/senior watch officer (SWO) with the status and results of all deep and close air reconnaissance missions.
- Redirect air reconnaissance assets to locate time-sensitive targets.

The deep and close battle cells do not positively control aircraft. They coordinate routing and provide frequency and contact information for Marine aircraft wings (MAWs), Marine aircraft groups (MAGs), and squadrons in order to retask or divert air reconnaissance missions through MACCS agencies.

See MCWP 3-25.4, *Tactical Air Command Center*, for detailed information on the Marine TACC.

Tactical Air Operations Center

The TAOC is subordinate to the Marine TACC. The TAOC provides positive control of air reconnaissance aircraft en route to and from assigned reconnaissance areas. The TAOC receives friendly aircraft information from the DASC in order to identify aircraft and UAVs. The TAOC disseminates air defense control measures to air reconnaissance aircraft through the DASC. See MCWP 3-25.7, *Tactical Air Operations Center Handbook*, for detailed information on the TAOC.

Direct Air Support Center

The DASC processes immediate air support requests; coordinates aircraft employment with other supporting arms; manages terminal control assets that support ground combat element (GCE) and combat service support element (CSSE) forces; and controls assigned aircraft, UAVs, and itinerant aircraft transiting through DASC-controlled airspace. The DASC uses procedural control for aircraft within its airspace. It does not have a radar capability and relies on communications networks to pass and relay information. The DASC controls and directs air missions (i.e., close air support, assault support, and designated air reconnaissance) that require integration with ground combat forces. Typically, the DASC does not control aircraft conducting deep air support and deep air reconnaissance missions because detailed coordination of these missions is not required with a ground force. However, the DASC does provide air reconnaissance information, such as battle damage assessments (BDAs) and in-flight reports, from air reconnaissance and offensive air support missions to the GCE's senior fire support coordination center (FSCC), when required. See figure 2-2 for a sample in-flight reports.

The DASC controls and coordinates a UAV's in-flight progression into and egression from its assigned reconnaissance areas and monitors its activities while in its working area. The UAV normally enters the airspace control system through the air traffic control element at the UAV's operating airfield.

US MESSAGE TEXT FORMAT INFLIGHT REPORT (INFLTREP)

Aircrew transmits:

"_____, this is _____, INFLTREP, over."
(addressee) (aircrew call sign)

(authentication requested here, as required)

"This is _____, INFLTREP."

Call sign_____

Mission number_____

Location_____
(latitude/longitude, UTM grid, place name)

Time on Target_____

Results_____

Remarks_____
(e.g., target area weather or significant sightings.)

Figure 2-2. In-Flight Report.

After receiving a handoff from the air traffic control element, the DASC provides routing and altitude clearance for the UAV. UAV operators maintain continuous communications with the DASC. The DASC uses airspace control measures to deconflict UAV operations with other aircraft and friendly, surface-delivered fires. UAV operators also supply the DASC with real time surveillance information. This information is then forwarded to the Marine TACC/FSCC by the DASC for use in the intelligence/targeting effort.

The JTAR form (see fig. 2-3 on page 2-8) is used to request air reconnaissance missions. Upon receiving an air reconnaissance support request, the DASC clarifies all information and assigns a request number. Immediate air reconnaissance support requests sent directly from the requesting unit to the

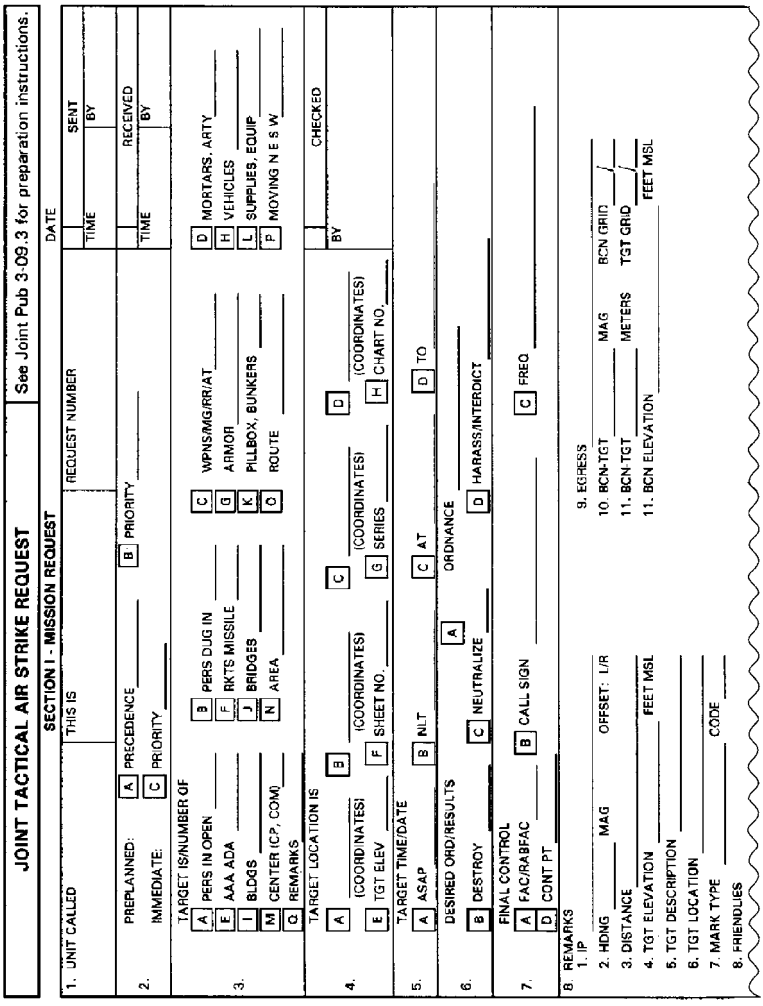
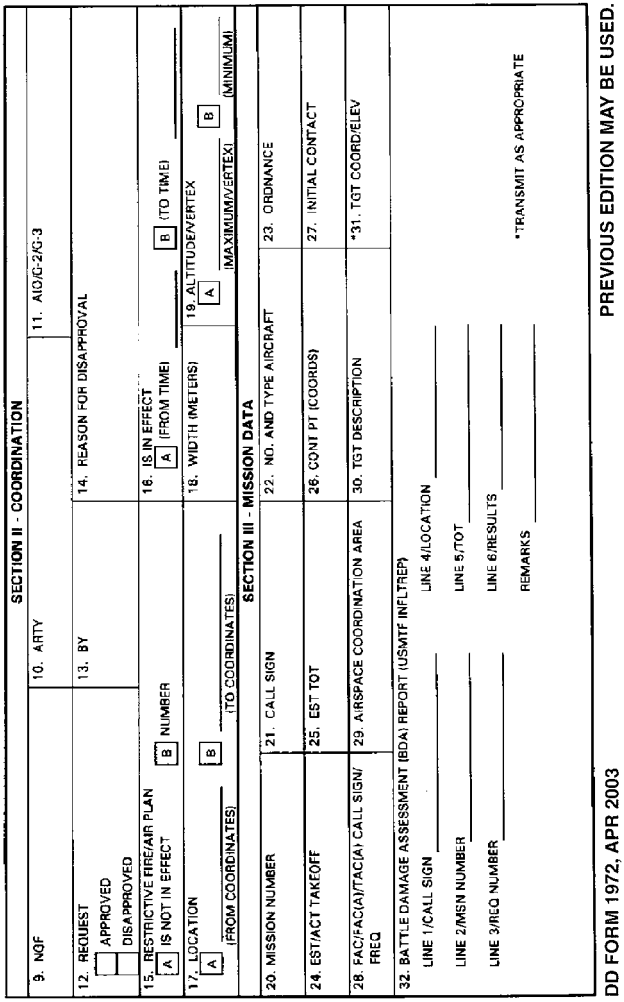


Figure 2-3. Joint Tactical Air Strike Request Form.



SECTION II - COORDINATION

9. NGF
10. ARTY
11. AIO/C-2/G-3
12. REQUEST ☐ APPROVED ☐ DISAPPROVED
13. BY
14. REASON FOR DISAPPROVAL
15. RESTRICTIVE FIRE/AIR PLAN [A] IS NOT IN EFFECT [B] NUMBER
16. IS IN EFFECT [A] (FROM TIME) _____ [B] (TO TIME) _____
17. LOCATION [A] (FROM COORDINATES) [B] (TO COORDINATES)
18. WIDTH (METERS)
19. ALTITUDE/VERTEX [A] (MAXIMUM/VERTEX) [B] (MINIMUM)

SECTION III - MISSION DATA

20. MISSION NUMBER
21. CALL SIGN
22. NO. AND TYPE AIRCRAFT
23. ORDNANCE
24. EST/ACT TAKEOFF
25. EST TOT
26. CONT PT (COORDS)
27. INITIAL CONTACT
28. FAC/FAC(A)/TACA/ CALL SIGN/ FREQ
29. AIRSPACE COORDINATION AREA
30. TGT DESCRIPTION
*31. TGT COORD/ELEV
32. BATTLE DAMAGE ASSESSMENT (BDA) REPORT (USMTF INFLTREP)

LINE 1/CALL SIGN _____ LINE 4/LOCATION _____
LINE 2/MSN NUMBER _____ LINE 5/TOT _____
LINE 3/REQ NUMBER _____ LINE 6/RESULTS _____
REMARKS _____

*TRANSMIT AS APPROPRIATE

DD FORM 1972, APR 2003 PREVIOUS EDITION MAY BE USED.

Figure 2-3. Joint Tactical Air Strike Request Form (Continued).

DASC are approved by the FSCC. The senior FSCC monitoring the tactical air request/helicopter request (TAR/HR) net may approve, disapprove, or modify the request. Since aircrews can pass essential visual reconnaissance reports that are timely to battlefield targeting, coordination between the DASC and the senior FSCC is critical for the coordination and integration of air reconnaissance missions conducted inside the fire support coordination line (FSCL). The DASC then passes this information to the Marine TACC and the senior FSCC.

See MCWP 3-25.5 for more information on the DASC's role in air reconnaissance operations.

Airspace Control

The role of airspace control measures is to increase operational effectiveness. During an air reconnaissance mission, airspace control measures ensure safe, efficient, and flexible use of airspace. Airspace control measures speed the handling of air traffic to and from their assigned air reconnaissance area, minimize the chance of fratricide, and assist air defense units in identifying adversary or civilian aircraft. Airspace control measures are not mandatory or necessary for all missions.

The JFC or MAGTF commander has overall airspace control authority and delegates authority to the appropriate MACCS agencies, who then become responsible for the operation of the airspace control system within the area of operations. Airspace control within the MAGTF is a blending of positive and procedural controls in order to control the airspace. Positive control relies on positive identification, tracking, and direction of aircraft within airspace by electronic means. Procedural control relies on a

combination of previously agreed upon and promulgated orders and procedures. The MACCS uses the following airspace control documents to execute positive and procedural control of aircraft:

- The airspace control plan (ACP) is the foundational airspace control document.
- Airspace control orders (ACOs) identify and provide additions and changes to the ACP.
- Special instructions (SPINS) provide supplemental information and are published in the ATO.

The airspace control authority develops the ACP. After the JFACC/ACE commander's approval, the ACP is forwarded to the JFC or MAGTF commander for final approval. The JFC or MAGTF commander ensures that the ACP does not conflict with any ground element fire support coordinating measures. After final approval, the ACP is promulgated throughout the area of responsibility/joint operations area. Implementation of the ACP is through the ACO, which must be complied with by all components. SPINS identify specific times when air control measures identified in the ACP and ACO are to be activated. It can also contain updates to the rules of engagement, standard conventional loads, and identification criteria.

The type of military operation determines the required airspace control. Airspace control measures can include, but are not limited to, minimum-risk routes (MRRs), special corridors, informal routing, coordinating altitude, restricted operations areas, and airspace coordination areas (ACAs). They can range from positive control of all air assets in an airspace control area to procedural control of all air assets to a combination of control measures. For example, an air reconnaissance aircraft uses a formal MRR to transit to and from its target area. Once inside its assigned area, the air reconnaissance aircraft uses procedural control measures,

such as an ACA to aid in locating targets and to provide combat assessment. See JP 3-52, *Doctrine for Joint Airspace Control in the Combat Zone*, and MCWP 3-25, *Control of Aircraft and Missiles*, for detailed airspace control authority information.

Minimum-Risk Route

An MRR is a formal airspace control measure primarily used by aircraft when crossing the forward line of own troops. The threat, friendly operations, known restrictions, known fire support locations, and terrain impact where an MRR is located. This temporary airspace corridor is recommended for use by UAVs and high-speed, fixed-wing aircraft that present known hazards to low-flying aircraft transiting the combat zone. By defining the airspace corridor, an MRR reduces the chance of fratricide between friendly aircraft and air defense units during return to force. Planners must also remember that limiting friendly aircraft to specific MRRs may also make them more recognizable and vulnerable to enemy surface-to-air systems**.** See figure 2-4.

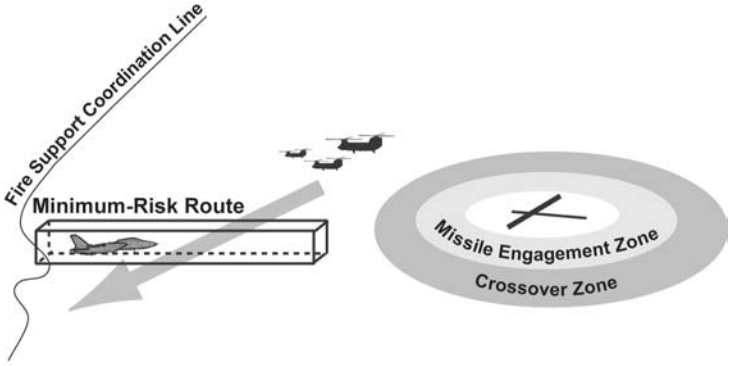


Figure 2-4. Airspace Control Measures.

An MRR also serves as an established flight corridor if communications are lost and aircrews are unable to transmit the appropriate identification, friend or foe (IFF) signals. The MRR provides a predictable, nonthreatening flight profile (ground track, altitude, and airspeed) that aides in the positive identification of the aircraft.

Note

Even if an aircrew cannot gain or maintain radio contact with a friendly force's air control agency, they should continue to broadcast their intentions in order to assist in positive identification of their aircraft.

Special Corridors

Special corridors may be in place when air reconnaissance missions require transit over neutral countries not involved in the theater of operations. Special corridors are international flight plans that have been approved by the country being overflown to deconflict civilian and military aircraft. These established corridors have defined dimensions and should not be confused with MRRs. MRRs are established by the ACP or ACO; special corridors are established by civilian aviation authorities.

Informal Routing

Informal routing is used to deconflict specific air reconnaissance missions from other aircraft and fires where a more formal MRR is not required. The controlling C2 agency establishes informal routes. Informal routes may be listed in the SPINS.

Coordinating Altitude

Coordinating altitude is a procedural method that can separate air reconnaissance aircraft from other fixed-wing and rotary-wing aircraft in the battlespace. This method establishes an altitude that fixed-wing aircraft will not fly below and rotary-wing aircraft will not fly above. The coordinating altitude may be specified in the ACP; however, it will more than likely be specified in the SPINS due to the changing search areas of air reconnaissance missions. Coordinating altitudes are typically associated with UAV air reconnaissance missions.

Restricted Operations Area

A restricted operations area restricts some or all airspace users until termination of the air reconnaissance mission. Typically, a restricted operations area is in effect during UAV missions. It may be established at a remote UAV airfield and encompass the UAV's flight path and reconnaissance area.

Airspace Coordination Area

An ACA defines specific areas of the battlespace that enable the JFC and component commanders to efficiently coordinate and deconflict air reconnaissance missions. An ACA is a block of airspace in the target area where friendly aircraft are reasonably safe from friendly surface fires and other friendly aircraft. The ACA may be formal or informal. It uses lateral, altitude, or timed separation, and it acts as a safety measure for friendly aircraft while allowing other supporting arms to continue to fire in support of the operation.

When air reconnaissance platforms are employed, they may be held at a control point outside their assigned ACA or be given an

altitude restriction to stay above or below the assigned ACA until other friendly aircraft clear the airspace. Aircraft may check in with various controlling agencies as they proceed to their assigned reconnaissance area. The important thing to note is that if aircraft are talking with the controlling agency and are able to transmit the appropriate IFF signal, they can transit direct from their airbase, to their assigned ACA, and back again.

MCWP 3-16B, *The Joint Targeting Process and Procedures for Targeting Time-Critical Targets*, contains more information on ACAs.

Fire Support Coordination Line

Air reconnaissance spots and adjusts artillery and naval gunfire. These missions can be conducted on both sides of the FSCL. The range of potential artillery and naval gunfire support missions from the FSCL often determine how much coordination is required with other forces. Normally, little or no integration with surface forces is required when air reconnaissance is conducted beyond the FSCL. Special operations forces and other surface units operating outside of the FSCL or very close to the FSCL must be deconflicted by air reconnaissance planners and monitored by the MAGTF or equivalent FSCC. The deep battle cell should direct the appropriate deconfliction prior to and during the planning and execution of air reconnaissance missions. Further, it is important for an aircrew to plan for deconfliction of air reconnaissance aircraft transiting over friendly surface forces with other fire support going on inside of the FSCL.

Imagery Intelligence Information Systems and Supporting Communications

The Marine Corps relies on both organic and external collection assets for its imagery. The following paragraphs present MAGTF organic imagery collection assets and key C2-related information that provides commanders real time or near real time information. See figure 2-5. For more information, see MCWP 2-11 and MCWP 2-15.4, *Imagery Intelligence*.

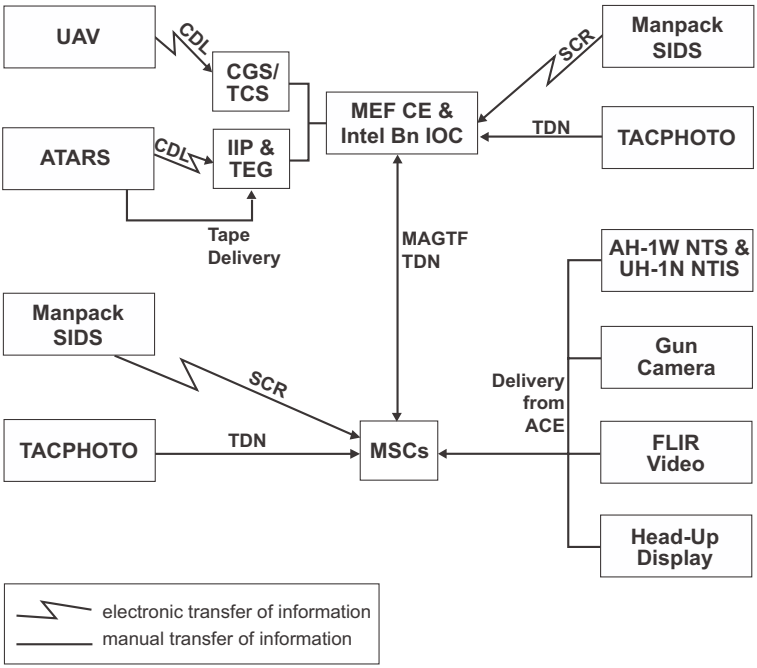


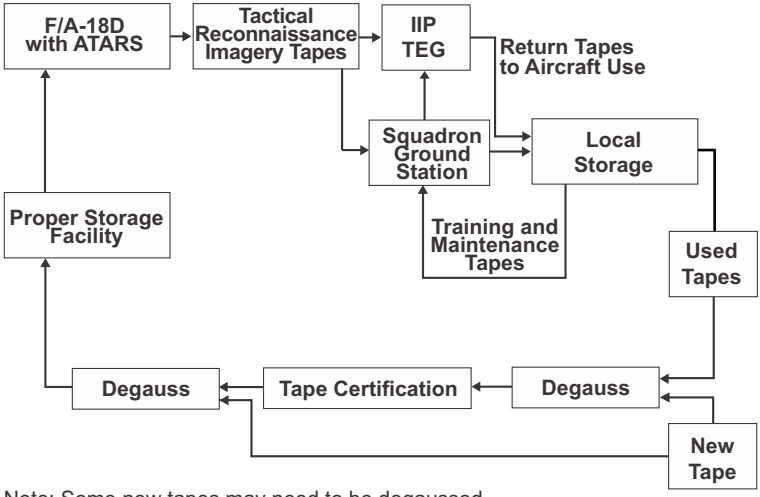
Figure 2-5. Methods of Information Collection.

Advanced Tactical Airborne Reconnaissance System

ATARS suites reside with the F/A-18D squadrons. ATARS-equipped F/A-18Ds provide the MAGTF with an organic, manned aerial imagery reconnaissance capability that supports imagery intelligence operations. ATARS is capable of infrared, electro-optical, and reader imagery collection and provides high resolution, day and night imagery support in all weather conditions through both over flight and long-range standoff. The long-range standoff capability of the F/A-18D is made possible with the installation of an upgraded, all-weather synthetic aperture radar (SAR) system. Imagery is recorded and data-linked via integration with the ATARS sensor suite. The tactical interoperable ground data link (TIGDL-II), common data link (CDL) provides limited near real time capability for dissemination of data on selected critical targets (down-linked to the imagery intelligence platoon [IIP]'s tactical exploitation group [TEG]), with subsequent manual tape download for exploitation of the complete track. See figure 2-6 on page 2-18.

Tactical Exploitation Group

The TEG is a key MAGTF imagery intelligence system and the only imagery exploitation and analysis tool available within the MEF. It is organic to each MEF's intelligence battalion's IIP. The TEG receives, processes, stores, exploits, and disseminates imagery, to include ATARS electro-optical, infrared, and radar imagery; U-2 SAR imagery; and secondary imagery products from the Marine Corps Intelligence Activity (MCIA) and theater joint intelligence center. Additionally, the TEG's equipment suite provides the capability to exploit film-based imagery and output from digital cameras such as manpack SIDS, and heads-up display, forward-looking infrared (FLIR), and gun camera tapes from various tactical aircraft. Once received,



Note: Some new tapes may need to be degaussed.

Figure 2-6. ATARS Imagery Process.

processed, and exploited, the imagery is transmitted over available SIDS device(s), MAGTF tactical data network, or other communications and information system resources. See MCWP 2-15.4 for more information on the mission, tasking, and organization of the intelligence battalion, IIP, and MCIA to provide imagery analysis support for the MAGTF and other commands as directed.

Squadron Ground Station

The squadron ground station interfaces with ATARS tapes only. It does not have a data link capability. VMFA(AW) imagery analysts and aircrews review and exploit ATARS imagery via the squadron ground station. The squadron ground station produces either hard copy (picture) or soft copy format (CD-ROM) products. The soft copy format can be transmitted through SIDS

SECRET Internet Protocol Router Network (SIPRNET). Soft copies of ATARS imagery can be delivered via data communications in a timely manner, providing there is sufficient connectivity, bandwidth, and peripherals. Each MAG has an imagery product library server capable of storing ATARS images for retrieval by other units. The VMFA(AW) squadron also posts imagery on its squadron, MAG, and/or MEF SIPRNET web pages to allow viewing of the imagery by any interested command with access to the SIPRNET.

Unmanned Aerial Vehicles

UAVs provide MAGTFs a valuable aerial reconnaissance and imagery (video and infrared) capability. The Pioneer UAV resides in the VMU squadrons. Key UAV communications and information system resources are discussed in the following subparagraphs. See figure 2-7.

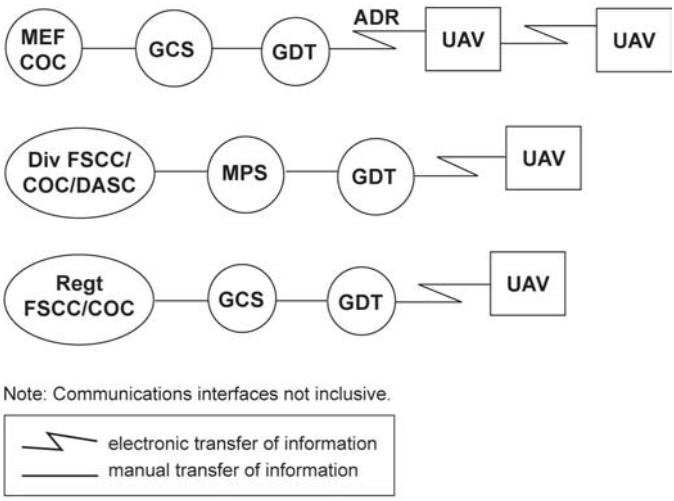


Figure 2-7. UAV System with Control Stations.

Ground Control Station

The ground control station (GCS) is a small, modular, transportable control station for the UAV system. It controls and monitors the operations of the UAV and the installed payload. Since all preflight, takeoff, landing, post-flight, and maintenance procedures and functions can be performed from the GCS, it can be used for controlling the UAV during all mission steps.

Portable Control Station

The portable control station contains a flight control subsystem, a communications subsystem, and a power supply subsystem that allows UAV launch and recovery from a remote site, afloat or ashore, up to 40 kilometers from the GCS. The portable control station allows the external pilot to perform takeoff/landing and flight control until command of the UAV is transferred to the internal pilot in the GCS.

Tracking Control Unit

The tracking control unit controls all UAV tracking and communications functions, manages all up and down-link data processing, and performs preflight and system diagnostic test. The tracking control unit houses all internal communications equipment and antenna subsystem for the GCS and is slaved to it by remoting cables.

Remote Receiving Station

The remote receiving station (RRS) is a miniature television receiver that can be attached or placed in direct support of commanders for real time video pictures, supplemented with voice

intelligence reports received from the GCS. There are two RRSs with each UAV system. Directional antennas allow video reception up to 30 kilometers from the UAV.

Common Ground Station

The common ground station (CGS) is a mobile, tactical multisensor ground station that provides the MAGTF command element with communications connectivity with the Air Force's E-8C Joint Surveillance Target Attack Radar System (JSTARS) and the capability to display, process, and disseminate acquired information. The CGS is organic to the MEF intelligence battalion. The CGS can receive and process moving target indicator, fixed target indicator, and SAR data from E-8C aircraft. It can also receive video data from UAVs, processed sigals intelligence from the intelligence broadcast network, and secondary imagery from theater and national sources.

Tactical Electronic Reconnaissance Processing and Evaluation System

Tactical electronic reconnaissance processing and evaluation system (TERPES) is an integrated, land-mobile, air-transportable data processing system organic to the VMAQ. TERPES' primary mission is to provide ground processing of electronic warfare information, including electronic warfare support and electronic attack, collected by EA-6B aircraft. TERPES supports VMAQ squadrons both land-based and carrier-based, on deployments throughout the world. Its secondary mission is to provide electronic intelligence support to the MAGTF.

Dissemination Element and Command Information Library

MCIA, Quantico, VA, houses the dissemination element and the National Imagery and Mapping Agency's command information library. The dissemination element receives and processes imagery in near real time. The command information library provides the imagery and geospatial center of MCIA's expeditionary warfare information library. The expeditionary warfare information library is an operation knowledge base of imagery, geospatial data, graphics, and all-source data/information used in support of expeditionary warfare planning and execution.

Chapter 3
Planning

Air reconnaissance supports the intelligence warfighting function from the beginning of the planning phase through the execution of MAGTF operations. It provides a means of collecting current information about the terrain, weather, hydrography, and threat situation. Air reconnaissance does not conduct targeting, but it provides target acquisition and collects information used in the intelligence cycle and targeting process. The Marine Corps intelligence system processes raw information or data received from Marine reconnaissance aircraft and disseminates it to commanders and their staffs as analyzed intelligence products.

Air reconnaissance also provides the critical intelligence information required to support the MAGTF planning process. The MAGTF commander uses air reconnaissance to gain information that is vital to the shaping of the battlespace and to gain and maintain tempo. Therefore, commanders, their staffs, and all members of the aircrew involved in the execution of air reconnaissance contribute to the planning process by ensuring a constant flow of information both vertically (within the chain of command) and horizontally (among staff sections). MAGTF and ACE planners use the applicable steps of the Marine Corps Planning Process to contribute to the MAGTF commander's plan. Aircrew and UAV operators use unit and platform specific planning tools to plan for individual missions.

As detailed in Marine Corps Doctrinal Publication (MCDP) 5, *Planning*, all planning activities occur along a hierarchical continuum that includes conceptual, functional, and detailed planning. Along the continuum, air reconnaissance planning occurs at the functional and detailed levels. Air reconnaissance functional

planning occurs at the MAGTF/ACE level and designs supporting plans. Detailed planning is performed by the aircrew and involves scheduling, coordinating, and providing logistics. Although functional planning is typically associated with the MAGTF/ACE and detailed planning is associated with the aircrew, components of both types of planning occur at all levels. See MCDP 5 for more information on the planning hierarchy.

Marine Air-Ground Task Force Planning

The key to planning at the MAGTF level is through appropriate representation of the warfighting functions: command and control, maneuver, fires, intelligence, logistics, and force protection. MAGTF planners use these warfighting functions to integrate the air reconnaissance planning effort and to supervise the execution of the air reconnaissance plan. Within the MAGTF, the OPT serves as the linchpin between future plans, future operations, and current operations sections; and it focuses the MAGTF's planning effort and gathers relevant planning expertise into a cohesive team. Normally, the OPT is built around a core of planners from either the future plans or the future operations sections. The OPT may also be augmented by warfighting function representatives, liaison officers, and subject matter experts needed to support planning. During the planning of air reconnaissance operations, ACE representatives in the OPT identify the ACE's inherent capabilities and limitations for MAGTF planners.

Not only does the MAGTF use an OPT to integrate planning within the MAGTF staff, but an OPT may be formed at the ACE, GCE, and CSSE to integrate planning between the major subordinate command (MSC) and the MAGTF. See figure 3-1. The MSC's command elements and their respective

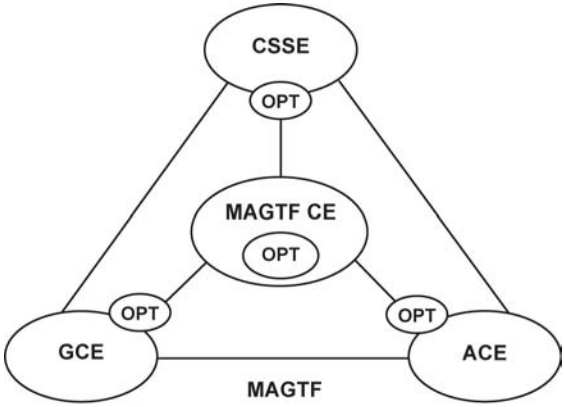


Figure 3-1. Staff Planning Relationships.

OPTs pass information to their common higher headquarters (the MAGTF) while integrating and coordinating efforts amongst themselves.

Mission Analysis

The MAGTF begins the planning process through mission analysis. The purpose of mission analysis is to review and analyze orders, guidance, and other information provided by higher headquarters and to produce a unit mission statement. Mission analysis produces an initial cut on high value targets and identifies intelligence that is critical to mission success. From these and other determinations, the commander identifies the need for air reconnaissance and begins to develop a general air reconnaissance apportionment picture.

Since air reconnaissance is a key source for intelligence preparation of the battlespace (IPB), IPB begins immediately during

mission analysis. The information received from IPB allows the staff to identify or refine COGs and determine critical vulnerabilities; therefore, IPB and the needed air reconnaissance support continues throughout the planning process.

During mission analysis, the commander's critical information requirements (CCIRs) identify information on friendly activities, enemy activities, and the environment in order to maintain situational awareness, plan future activities, and assist in timely and informed decisionmaking. The CCIRs are central to effective information management and direct air reconnaissance apportionment through the collection plan.

The MAGTF commander makes decisions on air reconnaissance apportionment based on recommendations from the GCE, ACE, and CSSE commanders. These apportionment decisions are then codified in the collection plan. The collection plan identifies the MAGTF commander's CCIRs and the assigned assets and identifies gaps in the IPB. These gaps are addressed through requests for information. Requests for information are forwarded to the next higher intelligence organization, which fills the gap with existing intelligence or forwards the request until the gap is filled or assets are retasked to collect the intelligence.

See MCWP 2-1, Intelligence Operations, for more information on intelligence support in planning and conducting MAGTF operations; MCWP 3-16A, *Tactics, Techniques, and Procedures for the Targeting Process*, for more information on air reconnaissance support of the targeting process and target development; and MCWP 3-16B for more information on the targeting process.

Course of Action War Game

COA wargaming assists planners in identifying friendly and possible enemy strengths and weaknesses, associated risks, and asset

shortfalls for each COA. Wargaming these COAs validates the specific conditions that must be established in order to defeat the enemy's COG. It is during this step that high payoff targets are finalized and the air reconnaissance plan is modified. Based on the selected COA, the MAGTF commander apportions aviation assets to achieve the effort required for air reconnaissance. The MAGTF commander may request additional air reconnaissance assets from the JFC to meet MAGTF collection and operational requirements through recommendations from the MAGTF G-2/S-2, MAGTF force fires coordinator, and ACE commander. See MCWP 3-2 for more information on apportionment of MAGTF aviation assets.

Aviation Combat Element Planning

The ACE supports the MAGTF commander's concept of operations, and the ACE's organic aviation assets provide the MAGTF commander with the ability to collect visual, imagery, and electronic reconnaissance in the battlespace. The ACE provides recommendations, identifies its capabilities, and identifies its limitations in support of air reconnaissance operations. The number of air reconnaissance requests, the number of available sorties, and surge requirements determine the ACE's ability to support MAGTF operations. Based on the ACE commander's mission and intent, the ACE staff develops specified and implied tasks to achieve the level of effort required by air reconnaissance in supporting the MAGTF's intelligence collection requirements and concept of operations.

Mission Analysis

During mission analysis, the ACE staff analyzes the MAGTF commander's objectives and guidance. The ACE commander reviews and analyzes orders, guidance, and other information provided by the MAGTF. The ACE commander's intent guides the ACE staff throughout the planning and execution of air reconnaissance. The ACE staff assists the MAGTF in identifying COGs. The following are examples of air reconnaissance missions flown in response to specific requests developed during mission analysis:

- Conduct air reconnaissance, surveillance, and target acquisition (to include imagery collecting and reporting) of designated target areas and areas of interest.
- Provide air reconnaissance for combat search and rescue and tactical recovery of aircraft and personnel.
- Provide air reconnaissance of helicopter landing zones and approach and retirement lanes in support of vertical assaults.
- Provide air reconnaissance information reporting to support MAGTF intelligence requirements and facilitate all-source intelligence operations.
- Provide air reconnaissance information to assist adjusting direct (artillery and naval gunfire) and indirect fire weapons and to support and facilitate deep air support.
- Collect air reconnaissance information to support BDA and combat assessment.
- Provide air reconnaissance to support rear area security.
- Provide and maintain airborne surveillance of enemy activities or areas of interest.
- Provide airborne electronic reconnaissance in identifying the enemy's EOB and threat emitter locations.

- Provide the MAGTF the ability to sustain surveillance in areas of operations.
- Provide rapid and current air reconnaissance information on enemy composition, disposition, activity, and installations.
- Provide observation of ship-to-shore movements.
- Provide imagery to update existing maps and support terrain analysis.

Course of Action Development

During COA development, ACE planners determine what air reconnaissance aircraft and sensors are needed to achieve the desired intelligence information required by the requesting unit. They also identify the resources (e.g., sorties, sensors, logistics, time) required for sustained or surge operations. The following considerations affect the ACE planners' ability to develop the level of effort required by the ACE to support each COA:

- Types of aircraft and sensors available to accomplish the required air reconnaissance requests.
- Support requirements (e.g., SEAD, fighter escort, aerial refueling).
- Air reconnaissance aircraft restrictions (manned or unmanned) and/or types of sensors (e.g., time of day, distance to the target, time on station, weather, visibility, terrain, target area defenses).
- Target acquisition probabilities for the selected air reconnaissance platform and its sensors.
- Time that the air reconnaissance operation will occur.
- Restrictions imposed by rules of engagement.

- MACCS's ability to monitor the battlespace and to provide air reconnaissance operations with the proper cueing and threat warning; specifically, ingress routes, areas assigned for air reconnaissance operations, and egress routes.
- Daily sustained and surge sort rates for each type of aircraft.
- Aircraft maintenance cycles.
- Time required to load, arm, fuel, and service.
- Logistic and maintenance requirements based on aircraft capabilities and sustainment requirements.

Course of Action War Game

COA wargaming determines the effects of weather on the air reconnaissance operation, refines air reconnaissance estimates, and identifies when to surge to achieve the MAGTF commander's information and support requirements through air reconnaissance. Wargaming may also reveal additional logistical and aviation support requirements needed to support MAGTF air reconnaissance operations for selected COAs. It is during this step in the planning process that air reconnaissance force requirements are finalized and the plan for each COA is modified.

Course of Action Comparison and Decision

During COA comparison and decision, the ACE planning staff evaluates all COAs against established criteria. The COAs are then evaluated against each other. The ACE commander selects the COA that is deemed most likely to achieve air reconnaissance objectives in support of the MAGTF commander's concept of operations based on the following questions:

- Does the level of effort required meet the MAGTF commander's objectives?

- Will surge or sustained air reconnaissance operations limit the ACE's ability to support other current or future MAGTF and/or joint operations based on aircraft availability, sensor availability, and logistical support requirements?
- Is the level of risk acceptable?

From the selected COA, the MAGTF's apportionment (percentage) of the aviation effort toward air reconnaissance is translated by the ACE into allocation (number) of sorties for air reconnaissance missions. See MCWP 3-2 for more information on the apportionment and allocation of aviation assets.

Orders Development

During orders development, the ACE staff uses the commander's COA decision, intent, and guidance to develop orders that direct unit actions. The operation order articulates the ACE commander's intent and guidance for air reconnaissance missions. The ATO is a means to disseminate tasking on a daily basis. The ATO provides subordinate units and C2 agencies with projected sorties/capabilities/forces to targets and specific missions. Concurrent with the ATO development, the ACE staff coordinates with prospective squadrons that will be assigned air reconnaissance missions to facilitate continuous information sharing, maintain flexibility, and use time efficiently. See MCWP 3-2 and MCWP 3-25.4 for more information on the operation order and the ATO process.

Transition is the orderly handover of the plan or order as it is passed to those tasked with the execution of the operation. It provides mission executors with the situational awareness and rationale for key decisions that are necessary to ensure a coherent

shift from planning to execution. Transition occurs when the ATO is transmitted and the aircrew conducting the air reconnaissance mission is given specific mission requirements in order to conduct detailed planning.

Aircrew and Unmanned Aerial Vehicle Operators Planning

Upon receipt of a mission, aircrews begin detailed planning and select tactics, techniques, and procedures (TTPs) that offer the best chance of mission success. The commander's intent becomes the mission's purpose and allows planners to adapt to changing situations and to exercise initiative throughout the planning process.

Detailed air reconnaissance planning begins with the analysis of mission, enemy, terrain and weather, troops and support available—time available (METT-T). Once METT-T is completed, other factors (e.g., acquisition, navigation, search patterns) determine the TTPs required to conduct air reconnaissance missions.

METT-T

Mission

Planners study the ATO to understand its objectives, the specified and implied tasks, and the commander's intent or purpose for conducting the mission. This understanding increases the aircrew's situational awareness and facilitates the initiative required to maximize air reconnaissance effectiveness. Missions listed on the ATO are preplanned (scheduled or on-call).

Enemy

By determining key threat characteristics (e.g., composition, disposition, order of battle, capabilities, likely COAs), planners begin to formulate how air reconnaissance can best be employed. From this information, air reconnaissance planners anticipate the enemy's ability to affect the mission and the potential influence that threat actions may have on the mission's TTP.

Levels of enemy threat determine air reconnaissance feasibility and are depicted as low, medium, and high. There is no clear dividing line between the threat levels because air defense systems that present a low or medium threat level for one type of aircraft may present a high threat level for another. A medium threat level during daylight hours may be subdued to a low threat level at night.

Current intelligence updates the threat levels for air reconnaissance operations. C2 requires accurate and timely intelligence updates to ensure effective air reconnaissance execution. A change in threat level may force an escalation in mission risk, which outweighs increased fighter escort or SEAD support.

A change in threat level may also require a change in tactics. For example, if an air reconnaissance aircraft aborts due to a ZSU 23-4 antiaircraft gun in the target area, other air reconnaissance aircraft in the mission would flex from the primary medium altitude profile to a high altitude profile to avoid the ZSU 23-4. This change in medium altitude tactics takes the ZSU 23-4 from a medium threat to a low threat. However, the target may be more difficult to acquire due to visual and/or sensor performance. Threat levels alone do not determine if an air reconnaissance mission should be flown. The final decision is a compromise between mission risk assessment and the need for air reconnaissance information.

Low threat levels allow air reconnaissance operations to proceed without prohibitive interference. Aircrews are free to select tactics that ensure effective use of reconnaissance sensors and collection techniques. A low threat includes small arms and medium antiaircraft weapons and limited optical acquisition AAA with no integrated fire control systems.

Medium threat levels allow acceptable exposure time of friendly aircraft to enemy air defenses. This threat level can restrict air reconnaissance flexibility in the immediate target/objective area. A medium threat includes a limited radar or electro-optic acquisition capability not supported by fully integrated fire control systems and a fully integrated fire control system that is degraded because of terrain, weather, or other factors.

High threat levels exist when the threat has an air defense system that includes integrated fire control systems and electronic warfare capabilities. This threat level severely affects the ability to conduct air reconnaissance operations. A high threat can include—

- Integrated C2 systems.
- Mobile or strategic surface-to-air missiles.
- Early warning radars/electronic warfare assets.
- Integrated AAA fire control systems.
- Interceptor aircraft.

Terrain and Weather

Terrain and weather play a significant role in air reconnaissance operations.

A terrain study is used to determine the best routes, navigational update points, and terrain masking to limit detection by enemy

radar. Terrain may also restrict the type of air reconnaissance sensor that can be used.

Weather influences the capability to acquire, identify, and accurately locate air reconnaissance targets and information and also determines the tactics used. Planners at every level require an understanding of the effects that weather can have on an air reconnaissance aircraft's navigation, sensors, and weapons systems. The weather can also change the mission from low threat to high threat depending on the threat's capabilities and the aircrew's ability to see and defend against enemy surface-to-air missiles. For example, when forced to fly under a cloud layer, it is easier for enemy ground forces to acquire and engage reconnaissance aircraft.

Note

ATARS installed in an F/A-18 SAR allows acquisition of targets in adverse weather.

Troops and Support Available

Ideally, the support required to conduct air reconnaissance missions is identified early in the planning process in order to coordinate its use. Mission support requirements that must be determined include escort, electronic warfare, SEAD, aerial refueling, forward arming and refueling points (FARPs), and C3 systems that include imagery exploitation systems.

Time Available

Planners must estimate the amount of time to plan the mission, effect the necessary coordination, execute the mission, and exploit collected air reconnaissance information. Inadequate time management may result in reduced effectiveness

and increased risk to aircrews, UAV operators, and possibly ground forces.

Acquisition Considerations

During planning, acquisition considerations must address an aircraft's ability to acquire/find the target or area of interest; that is, determine if the target is obscure or easy to locate. The ease or difficulty of locating the object determines the type of aircraft, sensor, and tactics employed. Aircrews and UAV operators use information about the terrain, weather, hydrography, and threat situation to determine the tactics and sensors needed to provide the highest probability of survivability and air reconnaissance mission success. For example, if an area of interest is heavily defended, it may require the use of standoff acquisition sensors that allow an aircrew to collect information from a greater distance, which increases the chances of mission success and aircrew survivability.

Aircrews should consider the following when selecting air reconnaissance tactics and sensors for acquisition:

- Visibility in the target area.
- The sensor's ability to detect thermally significant objects.
- Identifiable objects (e.g., terrain, buildings) near the target that could improve situational awareness and target acquisition and identification.
- The threat's ground to air defenses.
- Contrast and brightness of the target against its background.
- Accurate target coordinates to facilitate precise target location.
- Weather, visibility, and threat and sensor availability determine the type of sensor used.

- Effectiveness of night vision devices and their reduced effectiveness at sunrise and sunset.

Navigation

Airspace control measures in the ACP and ACO simplify and reduce the time required by aircrews to plan navigation routing and to coordinate with friendly air defense and control units. The following are navigational issues that must be considered during planning:

- Determine MRRs or special corridors to and from the battlespace.
- Identify where an ingress route begins or establish control points until the search area is clear.
- Identify controlling agencies that aircrews will check in with as they proceed to their assigned search area.
- Identify the most nonthreatening profile to be followed if the aircrew is unable to communicate or transmit the appropriate IFF signal.

Note

An aircrew's intentions should always be broadcast despite the inability to gain and maintain radio contact with friendly force air control agencies.

Other factors that aircrews must consider during navigation planning of the air reconnaissance mission are as follows:

- Threat.
- Range to target.
- Altitude.

- Navigational update point.
- Minimizing exposure to surface-to-air threats.
- SEAD support requirements.
- Issues that affect the aircraft's altitude (e.g., threat avoidance, denial of threat early warning radar detection, range to the target or area of interest, weather, communications reception, fuel).
- Refueling.
- Identifying navigational update points along the route.

Logistics

Air reconnaissance planners must consider time-on-station, refueling (either airborne or at a FARP), SEAD, and antiair protection of air reconnaissance assets and sensor availability during the planning process. Planners must allow enough time to coordinate and prepare sensors and aircraft configurations. Sensor availability should be determined as soon as possible so that planning time is not wasted on unavailable sensors. Planners must also anticipate utilization rates and plan for resupply accordingly.

Communications

During air reconnaissance operations, communications between the aircraft and the MACCS is critical in order to reduce friction during the execution phase. Communications can be voice, visual, or digital. The key to successful execution is the development of a simple, secure, and redundant communications plan. The fluid environment throughout the battlespace requires reliable communications between aircrews and commanders to ensure that important information is received through in-flight reports.

Force Composition

The composition of the force executing an air reconnaissance mission may include more than just air reconnaissance aircraft. The force may also require and include support from escort or electronic warfare aircraft in order to collect the necessary information and defend against threats.

There are two basic force composition employment options: force concentration and defense in depth. Force concentration employs all airborne assets in a relatively tight formation. Defense in depth requires aircraft to be dispersed to allow for threat reaction.

Search Patterns

Air reconnaissance missions may require aircrews to search for targets with little or no target information. Three basic searches can be conducted: area, route, and specific.

Area searches are limited to a specific area or named area of interest. They are normally used to find targets that may be dug in or to acquire targets not precisely located prior to aircraft launch. Area air reconnaissance may need to be deconflicted with other assets and forces in the area of operation. Procedural controls and ACAs may be established to control aircraft operations.

Route searches search a specific line of communications and acquire enemy activity along critical avenues of approach or target areas of interest. The MAGTF commander may base operational and tactical decisions upon enemy activity in target areas of interest; therefore, the ACE commander should ensure that the air reconnaissance aircrew is aware of all active target areas of interest that may need to be searched.

Specific searches are used to find a particular target, search a specific named area of interest or target area of interest, or to find and acquire high-value time-sensitive targets.

Formations

Formations used by air reconnaissance assets are based on two simple principles: target detection capability and the threat in the area. Due to the mobility of some surface-to-air systems and targets, it is very difficult to provide complete protection from enemy air defenses. When planning air reconnaissance, planners should, at a minimum, consider including an EA-6B and an escort aircraft to be available as a reactive SEAD package. The EA-6B conducts electronic reconnaissance and electronic warfare support over the area, and can suppress threats if they occur. Aircraft capable of employing air-to-air missiles and high-speed antiradiation missile should escort the EA-6B. This offers protection to the EA-6B while adding weapon redundancy to the reactive SEAD package.

The altitude at which fixed-wing reconnaissance aircraft conduct air reconnaissance varies based on the target size and threat. At night, if the threat is not exercising light discipline, targets can be detected many miles away with nigh vision devices. When fixed-wing assets fly in section, the primary visual reconnaissance search area should be between the aircraft. This allows for overlapping search sectors and also facilitates mutual support between the aircraft. If four aircraft are employed, a box formation is used with the trail element elevated. Rotary-wing air reconnaissance assets use terrain flight altitudes and provide mutual support. Each aircraft is assigned specific search responsibilities based on aircraft systems.

Night and Limited Visibility

There are four ways to identify and acquire targets during night and limited visibility: visually, sensor, infrared, and night vision devices. Specific tactical considerations for night and limited visibility operations are essentially the same as for day operations, but some unique points must be considered. For example, using aircraft navigation and formation lights to control tactical formations

Sensor Systems

The ability of aircraft sensors to recognize and acquire targets is crucial to the success of an air reconnaissance mission. See table 3-1 on page 3-20. There are three major planning considerations when selecting the type of sensor: infrared, radar, or night vision devices.

Infrared sensors distinguish objects by differentiating the object's temperature to the background of where the object is located. Infrared sensors are ineffective when target to background temperatures vary by only a few degrees. These sensors are also limited during periods of thermal crossover, which typically occur near sunrise and sunset.

Radar is used in a variety of ways to recognize and acquire targets. Radar locates radar reflective targets (moving or stationary). Terrain and other natural features; e.g., rivers, hills, and mountains, can also be radar-significant to help acquire target areas and specific targets.

Night vision devices provide an aircrew with a sensor that can be employed throughout the flight envelope to enhance safety and tactical execution, regardless of weather or time of day.

Table 3-1. MAGTF Aircraft Sensors.

Type of Aircraft	Type of Air Reconnaissance Mission	Sensor	Remarks
AV-8B	Visual	NVD	Night attack aircraft only
	Imagery (optical)	ARBS Hand-held camera HUD camera	Day attack aircraft only; SIPRNET connectivity required for soft copy
	Imagery (nonoptical)	AGM 65F Maverick APG-65 radar NAVFLIR FLIR	Only aircraft with radar upgrade; aircraft with litening II capability
	Electronic	RWR	
AH-1W	Visual	NVD	
	Imagery (optical)	Hand-held camera NTS TSU	SIPRNET connectivity required for soft copy; low light TV
	Imagery (nonoptical)	NTS	Infrared
	Electronic	RWR	
C-130	Electronic	RWR	
CH-46	Visual	NVD	
	Imagery (optical)	Hand-held camera	SIPRNET connectivity required for soft copy
	Electronic	RWR	

Table 3-1. MAGTF Aircraft Sensors (Continued).

Type of Aircraft	Type of Air Reconnaissance Mission	Sensor	Remarks
CH-53D/E	Visual	NVD	
	Imagery (optical)	Hand-held camera	SIPRNET connectivity required for soft copy
	Imagery (nonoptical)	FLIR	Only on modified aircraft
	Electronic	RWR	
EA-6B	Electronic	On board sensors	National asset
FA-18 A/ C/D	Visual	NVD	FA-18As are receiving night vision goggle upgrade
	Imagery (optical)	ATARS-LAEO ATARS-MAEO Hand-held camera HUD camera LTD/Strike camera	Only F/A-18D designated squadrons; SIPRNET connectivity required for soft copy
	Imagery (nonoptical)	AGM-65F Maverick AGM-84E SLAM APG-65 radar APG-73 radar ATARS-IRLS ATARS-SAR FLIR NAVFLIR	Only lot 11 aircraft and above; only designated squadrons; SIPRNET connectivity required for soft copy
	Electronic	AGM-88 HARM RWR	

Table 3-1. MAGTF Aircraft Sensors (Continued).

Type of Aircraft	Type of Air Reconnaissance Mission	Sensor	Remarks
MV-22	Visual	NVD	
	Electronic	RWR	
UAV	Imagery (optical/nonoptical)	12DS	
UH-1N	Visual	NVD	
	Imagery (optical)	Hand-held camera	SIPRNET connectivity required for soft copy
	Imagery (nonoptical)	NTIS (FLIR)	
	Electronic	RWR	

Theater Battle Management Core System

The theater battle management core system (TBMCS) is a battle management system that is replacing the contingency Theater Air Control System automated planning system (CTAPS). TBMCS provides a complete tool kit to manage and plan the overall war and the daily air war. TBMCS is an Air Force-developed program formed by the consolidation of several existing segments: CTAPS, combat intelligence system, and the wing C2 system. CTAPS is used to plan and execute air operations. The combat intelligence system is used to optimize component and

unit-level intelligence functions and to provide the warfighter with the most accurate and timely intelligence data available. The wing C2 system is an Air Force application used to provide a secure, accurate, timely, and automated system affording a composite view of C2 information for wing commanders and their battlestaffs. The wing C2 system supports effective decisionmaking during exercises and operational contingencies. These systems implement a consistent software architecture that integrates the flow of information among them. TBMCS is a joint system that can be used to—

- Build the target nomination list, the air battle plan, and the ATO.
- Monitor and adjust, if required, the execution of the air battle.
- Plan routes in order to ensure airspace deconfliction.
- Build the ACO.
- Provide weather support.
- Manage resources; e.g., aircraft, sensors, weapons, fuel, and logistics.
- Gather information on the enemy, battle results, and friendly forces.
- Analyze information to determine strategies and constraints.
- Identify potential air reconnaissance areas and targets, and propose an optimal sensor mix.
- Provide for support and protection of ground forces.
- Plan countermeasures and frequency assignments.

See MCWP 3-25.4 for more detailed information on TBMCS and CTAPS.

Chapter 4
Execution

The key to executing air reconnaissance operations is to provide fast, reliable, and accurate information to the MAGTF commander. The timely information obtained through air reconnaissance provides the MAGTF commander with vital intelligence requirements that aid his decisionmaking processes during the planning and execution of an operation.

Requirements

Requesting and Tasking

Proper preparation and prompt submission of requests determine timely and effective air reconnaissance support. After determining that a battlefield situation or mission requires air reconnaissance support, a request is submitted in the form of a JTAR. This format translates information into a standard medium that the appropriate agency can process. Requests are very specific in nature and require clear and concise information from the requesting unit. As much information as possible concerning the supported unit commander's intent, scheme of maneuver, control measures, and fire support plan should be included in the preplanned requests. The quality of air reconnaissance information received by the requesting unit is typically proportional to the quality of the request. Once the JTAR is completed, the request is submitted via voice or message format. When forces are deployed in the field, requests for immediate air reconnaissance support are

transmitted over the tactical air request net to the DASC. Once the request is received, it is processed and tasked for execution.

The type of mission determines how the tasking is routed. Tasking for a preplanned mission requires the JTAR from the requesting unit to be routed via the MEF G-2/G-3, then to the Marine TACC for scheduling on the ATO. The ACE allots sorties for air reconnaissance based on the support required by the main effort, priorities of data collection for intelligence functions, and requests submitted by other units. Tasking for an immediate mission requires the JTAR from the requesting unit to be routed through the DASC. If the DASC has been granted launch and divert authority from the Marine TACC, the DASC communicates directly with the squadron or aircraft/operator to launch or divert the mission. However, if the DASC has not been granted launch or divert authority from the Marine TACC, the SWO in the Marine TACC retains launch and divert authority.

Basing

Where an air reconnaissance aircraft is based determines the type of support required. If operating on land and aboard naval ships, then ordnance, mission equipment, logistic support, etc., are readily available. But these fixed locations are often well removed from the battle area and require aircraft to fly farther to reach air reconnaissance target areas and create a longer turnaround time between missions. If operating from a forward operating base, loitering time in the objective area increases, effective combat radius is extended, and response times are shortened. But preplanned logistic support becomes vital to ensure that sufficient ammunition, fuel, and servicing equipment are in position and ready for use when needed.

Intelligence

Intelligence supports air reconnaissance operations by providing continuously updated information prior to, during, and after mission execution. Readily available and updated intelligence provides aircrews and operators with intelligence that may not have been available during mission planning, and should include enemy surface-to-air and air-to-air threats, capabilities, force dispositions, intentions, and vulnerabilities. Intelligence also includes updated environmental assessments, such as the effects of adverse weather, darkness, and temperatures. Aircrews and operators should receive an updated intelligence brief prior to each air reconnaissance mission. During the mission, aircrews and operators receive and transmit updated intelligence information via the MACCS. Upon the completion of the mission, aircrews and operators meet as soon as possible with the G-2/S-2 for an intelligence debriefing.

The ACE ensures that aircrews and operators provide accurate and updated intelligence information to the maximum extent possible. The following are some of the responsibilities that the ACE provides MAGTF intelligence collection agencies during and after the execution of air reconnaissance missions:

- Ensures video tape recording (VTR) systems are used to the greatest extent possible to assist in the collection of BDA.
- Disseminates MAGTF priority intelligence requirements/intelligence requirements and named areas of interest to appropriate intelligence sections.
- Ensures aircrews are debriefed for tactical information and forwards mission reports to the MAGTF G-2 IOC.
- Forwards in-flight report to the MAGTF G-2/S-2 IOC via the most expedient means.

The MAGTF G-2/S-2 collections management officer creates and maintains the MAGTF visual reconnaissance and surveillance requirements list based on the MAGTF's priority intelligence requirements and intelligence requirements. The visual reconnaissance and surveillance requirements contain prioritized priority intelligence requirements/intelligence requirements, indications, specific orders/requests, associated targets, associated named areas of interest, in-flight reporting requirements, and negative reporting requirements. The visual reconnaissance and surveillance requirements are used to drive pre-mission briefing and post-mission debriefing. The visual reconnaissance and surveillance requirements are forwarded daily to the MAGTF G-3 for inclusion into the ATO SPINS. Any changes to the visual reconnaissance and surveillance requirements are sent immediately to the ACE G-2/S-2. The MAGTF G-2/S-2 also requests the employment of organic ACE aircraft and theater aircraft in support of air reconnaissance missions.

Supporting Operations

Mission requirements and aircraft capabilities drive the type and number of aircraft required to accomplish an air reconnaissance mission, and mission planning identifies the threats and support requirements for air reconnaissance operations. Therefore, aircrews, commanders, and UAV operators need to know how support requirements affect the execution of air reconnaissance missions. Support requirements during air reconnaissance operations can consist of fighter escort, electronic warfare, SEAD, air refueling, and deception techniques. Support requirements are tasked through the ATO and executed by the Marine TACC.

Fighter Escort Employment

Since there is no way that intelligence can predict where or when enemy fighters may attack, fighter escort aircraft provide protection for air reconnaissance aircraft. Fighter escort aircraft may provide one or a combination of: close escort, detached escort, and/or combat air patrol. Close escort fighters maintain contact with air reconnaissance aircraft and provide better situational awareness between the fighters and air reconnaissance aircraft and the threat's relative position. Detached escort fighters normally fly in front or to the side of the air reconnaissance aircraft to screen them from enemy fighters. Combat air patrols provide air reconnaissance aircraft a fighter escort normally from a roving or fixed location in the battlespace. The combat air patrol is positioned to act as a barrier between air reconnaissance aircraft and enemy fighters.

Although many of today's air reconnaissance aircraft have a self-defense capability, providing a fighter escort allows more time for aircrews to concentrate on air reconnaissance tactics while the fighter escort aircraft focuses on sanitizing the battlespace from air-to-air threats. When air reconnaissance aircraft provide their own self-defense, they are typically less effective due to more time taken away from the primary mission and have higher fuel consumption rates, decreased maneuverability, and reduced air-to-air ordnance loads when carrying air reconnaissance sensors and air-to-ground ordnance.

If air reconnaissance aircraft are exposed to enemy air defense systems, it is more than likely that the fighter escort aircraft may be exposed to the same threat. SEAD support may only be sufficient to provide air reconnaissance aircraft protection from the threat. Therefore, fighter escort aircraft may have to avoid the threat, which may make them less effective as fighter escorts.

Rules of engagement may limit/prohibit the circumstances where beyond visual range missiles may be employed. Under very restrictive rules of engagement, mission commanders and planners need to weigh the advantages and disadvantages of having close escort or combat air patrol assets provide fighter support.

Electronic Warfare

Electronic warfare aircraft protect air reconnaissance aircraft through electronic jamming and deception. Electronic jamming denies or disrupts the enemy's ability to detect or track air reconnaissance aircraft electronically. Electronic deception sends misleading information about the air reconnaissance aircraft's speed, altitude, size, and direction. Electronic warfare requires detailed integration and coordination to protect air reconnaissance aircraft exposed to enemy threat air defenses. Electronic warfare aircraft may be tasked with an airborne alert to provide on-call or reactive electronic warfare support for air reconnaissance aircraft. The following are some considerations for electronic warfare support during air reconnaissance operations:

- Preemptive electronic warfare is superior to reactive electronic warfare.
- Tactics and electronic countermeasures to be employed for unanticipated threats.
- Tactics and standard operating procedures that simplify electronic warfare coordination with air reconnaissance assets.
- The length of time electronic warfare support is available for air reconnaissance aircraft.
- Enemy fighter's capability to degrade electronic warfare support.

Electronic warfare interference with communications, command and control systems, and aircraft weapon systems and electronic warfare suites.

Suppression of Enemy Air Defenses

SEAD provides force protection for air reconnaissance aircraft by degrading the effectiveness of enemy air defense systems. SEAD uses supporting arms, i.e., artillery, naval gunfire, and aircraft, with other available means; such as, GCE or electronic warfare, to suppress, neutralize or destroy enemy air defenses. SEAD is integrated with not only air reconnaissance aircraft, but also with other supporting aircraft included in air reconnaissance missions. SEAD aircraft equipped with high-speed antiradiation missiles (HARMs) are typically targeted against enemy air defense early warning, targeting, and fire control radars. Some SEAD fundamentals that support air reconnaissance aircraft follow:

- SEAD effects are short-lived and air reconnaissance aircraft need to minimize their time exposed to enemy air defenses.
- Adherence to air reconnaissance aircraft's routing of flight and timing to maximize SEAD effects.
- SEAD is a suppression tactic, not a destruction tactic for enemy air defenses.
- Pre-emptive SEAD provides the best protection for air reconnaissance aircraft.
- Limited SEAD weapons may require reactive SEAD tactics.

Air Refueling

Air refueling support requirements depend upon mission specifics for air reconnaissance aircraft. In-flight refueling is required

when targets and operating areas are far from the air reconnaissance aircraft's operating bases and are typically annotated on the ATO. Air refueling may also be required to provide extended time on station for an airborne alert, or when aircraft are diverted from another mission to provide the MAGTF with an air reconnaissance capability.

Deception Techniques

Deception techniques can be used against enemy radars, communications intelligence sites, and other enemy assets. Effectively executed deception tactics draw the enemy's interest and forces away from air reconnaissance aircraft and its intended target area. Some deception techniques follow:

- Chaff corridors to deny enemy radar operator's coverage.
- Electronic warfare techniques to present false targets to enemy radars.
- Aircraft give misleading transmissions to deceive enemy communications intelligence sites.
- Decoy aircraft or drones pose a threat from a different direction than the actual route of the air reconnaissance aircraft.
- Pre-emptive changes in altitude and heading to avoid enemy air defenses.

Dissemination

A critical factor to the effective employment of air reconnaissance is communicating and distributing information via mission reports or in-flight reports. By passing time sensitive information, aircraft can

be diverted or additional aircraft assigned to exploit a critical enemy vulnerability. Figure 4-1 is a sample mission report.

PRECEDENCE

FROM:

TO:

INFO:

CLASSIFICATION

SUBJ: MISREP NO. _____/_____Z/MONTH/YEAR

REF: (a) As appropriate.

BODY

1. Air Task/Mission Number or Nickname. Reference the request number, fragmentary order number, or directive causing initiation of the mission.

2. Location Identifier. Target number, line number, approved target designator/identifier, or coordinates of the target or sighting being reported.

3. Time of Target/Time of Sighting. Report at all times by date/time group, using Greenwich Mean Time unless otherwise directed.

4. Results/Sighting Information. This item should contain the pilot/aircrew evaluation of expected results (e.g., percent destroyed, number and type destroyed, or percent of coverage) and concise narrative information on significant sightings (e.g., unusual or new enemy equipment or concentrations of enemy forces observed to include number, speed, and direction, if applicable).

5. Remarks. Includes information and intelligence not specifically mentioned in above items (e.g., enemy defenses encountered; weather data; hostile electronic attacks.).

Figure 4-1. Sample Format of a Mission Report.

When aircrews and operators collect in-flight information (visual, imagery, and electronic), they can establish direct radio contact with other air and ground elements and disseminate combat information in near real time, via the in-flight report. After landing, aircrews should debrief as soon as possible with the squadron's intelligence section (S-2) to complete the mission. This allows for timely dissemination to higher, adjacent, and subordinate commands of the air reconnaissance information acquired during their mission. The squadron's intelligence section extracts information from tapes recorded during the mission and submits the information via the mission report. The collected information is also combined with other intelligence sources to provide the best intelligent picture as possible. In-flight reports and mission reports are forwarded via the Marine TACC to the MAGTF G-2 IOC. See MCWP 3-40.1 and MCWP 3-40.3, *Communications and Information Systems*, for more information on dissemination of air reconnaissance information.

ATARS information is disseminated airborne via the F/A-18D's data link pod to the TEG; providing near real time imagery information in support of the MAGTF. The intelligence support coordinator or G-2/S-2 disseminates the information to the requesting ground and air units.

The VMU may conduct limited imagery exploitation or analysis. Generally UAV imagery is screened by VMU imagery analysts for information of immediate tactical value in accordance with the intelligence collection and reporting criteria stipulated by the intelligence support coordinator or the supported unit's intelligence

officer. In-flight reports can pass information that does not necessarily require imagery, cutting down response time to the customer. Imagery can also be fed to an RRS provided that station is within 30 kilometers of the UAV. The system receives the signal from the UAV, and the images are viewed on screen in real time. Imagery reproduction can be printed out from the UAV video and subsequently hand-carried to the customer. Imagery tapes are delivered by the VMU to the IIP for further detailed post flight imagery analysis. For ease of dissemination, images can be video captured and transmitted digitally as a computer file.

Visual Reconnaissance

Visual reconnaissance operations do not require specialized support equipment. Communications plans provide secure voice transmissions (in-flight reports), message traffic (mission reports), or face-to-face liaison to meet the requirements of disseminating visual reconnaissance information.

Imagery Reconnaissance

Together with communications and information system resources supporting the MACCS, squadrons collecting imagery have sufficient communications and information systems resources to support internal and squadron C2, operations, and intelligence requirements. All squadrons will typically require access to various networks to conduct their operations, to include a SIPRNET and a Nonsecure Internet Protocol Router Network, as well as pertinent local area networks, and wide-area networks.

The VMFA(AW) conducting ATARS missions require support from the TEG to disseminate air reconnaissance information. The TEG is a ground-based imagery processing station. This system consists of three high mobility multipurpose wheeled vehicles (HMMWVs) with trailers and a tactical shelter that are connected together into a single unit. The TEG is configured to receive and disseminate near real time information data linked from ATARS aircraft. The ATARS elctro-optical and SAR imagery can also be accepted by the TEG via tape format recorded in-flight from the F/A-18D's VTR system. Aircrews and imagery analysts use the squadron ground station to view electro-optical, infrared, and SAR imagery data upon completion of air reconnaissance missions. Logistical support also requires one C-141 to airlift the ATARS support equipment, not including power supply/fuel and expeditionary communications.

Marine squadrons have limited capabilities to process or reproduce photographic imagery. The ACE depends on naval support while afloat and the CSSE while ashore to process and reproduce most imagery. Ground support requirements include:

- Personnel to process and reproduce film.
- Film processing equipment.
- Darkroom area for film processing.
- Electrical power.
- Fresh water and waste disposal for photo processing.
- Transport of photo processing equipment and personnel.

Electronic Reconnaissance

TERPES is an integrated, land-mobile, air-transportable data processing system organic to the VMAQ. The primary mission of the

TERPES is to provide ground processing of electronic warfare information, including electronic warfare support and electronic attack, collected by EA-6B aircraft. TERPES supports the VMAQ on deployments throughout the world, both land-based and carrier-based. The secondary mission is to provide electronic intelligence support to the MAGTF. See MCWP 2-15.2, Signals Intelligence, for more information on electronic reconnaissance in support of MAGTF operations.

Capabilities and Limitations

Capabilities

Controllers, operators, and aircrews must be familiar with the capabilities of aviation assets in order to meet air reconnaissance collection requests. The following general guidelines are for all categories of air reconnaissance.

Battlefield Surveillance

Battlefield surveillance is the systematic observation of the battle area in order to provide timely information and combat intelligence. Battlefield surveillance is effective for counterinsurgency tactics or in the early stages of any operation where the situation is not fully developed. Battlefield surveillance is generic in nature and does not concentrate its focus on a particular area.

Area Reconnaissance

Area reconnaissance covers a general area, monitors movement, and detects military activities. The requesting agency determines search area limits, and aircrews determine flight plans to ensure

target coverage. Generally, these collections work in concert with the MAGFT's target areas of interest and named areas of interest. Area reconnaissance is especially effective when the same aircrew surveys the same area of responsibility on a daily basis; consistency allows the aircrew to monitor small or gradual changes that may be overlooked by different crews each day.

Specific Reconnaissance

Specific reconnaissance is employed for point targets and selective information, e.g., detects military, paramilitary, or suspicious civilian activity within suspected or known locations. Specific reconnaissance includes observation of airfields, suspected enemy air defense assets, and logistic depots to determine enemy size or specific traffic patterns.

Route Reconnaissance

Route reconnaissance is a visual observation that occurs over enemy lines of communications, along planned avenues of approach, or over friendly routes of communications that are subject to enemy interdiction. Roads are most often associated with route reconnaissance, but rail lines and rivers can also be included. Route reconnaissance also determines the trafficability of these avenues for future friendly operations as well. Route reconnaissance is performed on a point-to-point or town-to-town basis over a preselected route.

Helicopter Landing Zone Reconnaissance

Helicopter landing zone reconnaissance determines location, characteristics, capacity, suitability, and hazards of potential helicopter landing zones. Helicopter landing zone reconnaissance is conducted sporadically and in a deceptive manner to prevent disclosure of future intentions.

Terrain Analysis

Terrain analysis provides commanders with information on which to base a concept of operation, devise schemes of maneuver, and develop logistic plans. Terrain analysis locates and identifies ground forms, ground covers, and natural obstacles.

Map Correction

Map correction missions update existing maps and air photo mosaics. They clearly define locations to ease map correction and identify locations to facilitate comparison of actual terrain features with maps.

Battle Damage Assessment

BDA is the determination of the effects of attacks on targets. These missions either provide information on prior air strikes for the future targeting cell or the immediate effects of current missions or supporting arms fire. Identifying and reporting remaining enemy assets still on the battlefield is just as important as reporting what has been destroyed.

Observation of Ship-to-Shore Movement

Aircrews provide command elements with continuous information on the progress of surface craft and helicopter waves during amphibious landings. These aircraft can also provide critical communications liaison for missions that are operating over the horizon.

Supporting Arms Coordination

Certain squadrons organic within the MAGTF are capable of coordinating and adjusting supporting arms; to include artillery, air,

and naval surface fire support. HML/A, VMFA(AW), and VMU are trained and equipped to conduct supporting arms coordination.

Limitations

In addition to knowing the capabilities of air reconnaissance aircraft, controllers, operators, and aircrews must be familiar with the limitations of aviation assets in order to correctly task air reconnaissance assets and collect air reconnaissance information. The following are general guidelines for all categories of air reconnaissance.

Visual Limitation

Visual reconnaissance is limited by the eye's ability to detect objects from increased slant range/angles and high track crossing rates. Visual identification of targets during hours of darkness is a challenge, but detection is improved with night vision devices.

Threat Levels

A higher threat level generally decreases the accessibility and quality of air reconnaissance information. If the threat is skillful in the art of camouflage, cover, and concealment, aircrew should be extremely cautious of overly obvious sightings. This lack of camouflage may be a deception technique used to lure visual reconnaissance aircraft into AAA or surface-to-air missile engagement zones. The threat may also destroy or provide false targets to deceive accurate BDA.

Weather and the Environment

Weather is a major factor that influences air reconnaissance tactics. Weather at the target area makes identification difficult and

may change the positioning, altitude, and slant angles of air reconnaissance profiles in order to accomplish the mission. Low ceilings and poor visibility decrease air reconnaissance effectiveness and could abort the entire mission. Battlefield obscurations (smoke, fire, debris) pose the same limitations as bad weather.

Combat Radius

Combat radius affects the ability of some assets to collect any near real time information. Aircraft time on station/combat radius is dependent on target distant factors and tanker availability. An increase of time on station by aerial refueling reduces this limitation, but requires additional planning and coordination.

Communications

Real time information is crucial to maintaining good situational awareness. Communications plans should either provide for secure voice transmissions or provide codewords to pass information in the clear. It is important not to compromise any information to the enemy because of undisciplined airborne communications.

Visual Reconnaissance

Although visual reconnaissance seems simplistic in theory, the concept is sometimes neglected when combined with other intelligence assets (ground reconnaissance, human intelligence, imagery intelligence, and signals intelligence) air reconnaissance becomes a critical capability to maintain situational awareness on the battlefield. Commanders must be aware of visual reconnaissance's capabilities/limitations and emphasize the importance

that visual reconnaissance plays in the MAGTF's intelligence collection plan and supporting arms coordination.

Any MAGTF aviation unit or type of aircraft can perform visual reconnaissance; however, supporting arms coordination requires specialized training and is performed specifically by HML/A, VMFA(AW), and VMU. An aircrew must be cognizant of the need to report all information on enemy activity. Although a sortie on the ATO may not indicate a dedicated air reconnaissance mission, aircrews must understand the implied intent of visual reconnaissance in each aviation sortie and strive to absorb and report as much information as possible.

Binoculars increase the capability of day visual reconnaissance. They give an aircrew a better perspective on objects within a target area, especially when increased stand off is required because of threats. Night vision devices provide visual reconnaissance assets the ability to exploit night operations and dramatically increase the chances of detecting an enemy who employs poor light discipline.

Imagery Reconnaissance

Imagery reconnaissance is broken down into two subsets: optical and nonoptical. Current optical imagery sensors include 35mm photography film, digital cameras, television, and electro-optical sensors, such as the ATARS low altitude electro-optical (LAEO) and medium altitude electro-optical (MAEO) sensors that scan an optical image. Nonoptical imagery assets include infrared and SAR. Imagery reconnaissance equipment, such as ATARS, can produce near real time intelligence when transmitted via data link to ground units, but the majority of systems

organic to the MAGTF still require aircraft to land prior to processing the reconnaissance information.

The HML/A, HMH, VMA, VMFA, VMFA(AW), and VMU within the MAGTF are capable of conducting imagery reconnaissance. Aircrews must be cognizant of the need to report all visual reconnaissance information concerning enemy activity in in-flight reports and mission reports. Currently, the only air reconnaissance platforms capable of transmitting real time imagery information within the MAGTF are F/A-18Ds equipped with ATARS in the VMFA(AW) and Pioneer UAVs in the VMU.

Optical Imagery

Optical imagery is obtained during daylight only and may be taken by hand-held 35 millimeter cameras and digital cameras or on board strike cameras (KB-35 strike camera on the F/A-18). Photographs are divided into different orientations to maximize their use as an intelligence tool. See figure 4-2, on page 4-20, for an example of optical imagery orientations.

Vertical Sensor Coverage

Vertical sensor coverage is taken with the sensor's axis perpendicular to the earth's surface. This produces a scale that is constant throughout the print unless there is a wide variation in an area's elevation. To obtain precise measurements, vertical sensor coverage must be used. Vertical coverage is divided into pinpoint, strip, and area/panoramic coverage.

Pinpoint coverage is a single, vertical print, which covers a specific target. Use pinpoint coverage where depth measurement is not required. It is used to pinpoint small critical areas (e.g., bridges, buildings, troop concentrations) for precise study.

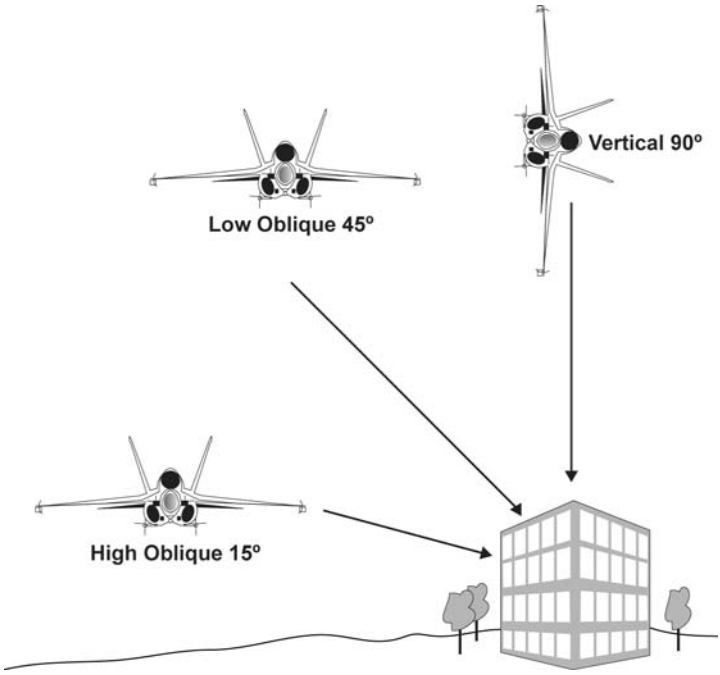


Figure 4-2. Imagery Orientation.

Strip coverage consists of overlapping prints along a flight path. Prints are usually taken at a constant altitude. Coverage is normally of long, narrow targets (e.g., lines of communications, lines of contact, beaches, helicopter approach and retirement routes).

Area/panoramic coverage is used when an area cannot be covered at the desired scale using a single vertical strip. Area/panoramic coverage employs a system of parallel strips that are merged together once developed. It is performed by one or more

aircraft using the same or different sensors and can be performed at the same or different times. These images do not have a constant scale, so it is very difficult to take measurements; however, the center of the image provides a more accurate measurement than its perimeter. Area/panoramic imagery is extremely useful in search operations (scanning from horizon to horizon for new targets). If scale requirements are not critical, area/panoramic coverage vice multi-strip coverage is the preferred method of imaging large area targets. See figure 4-3.

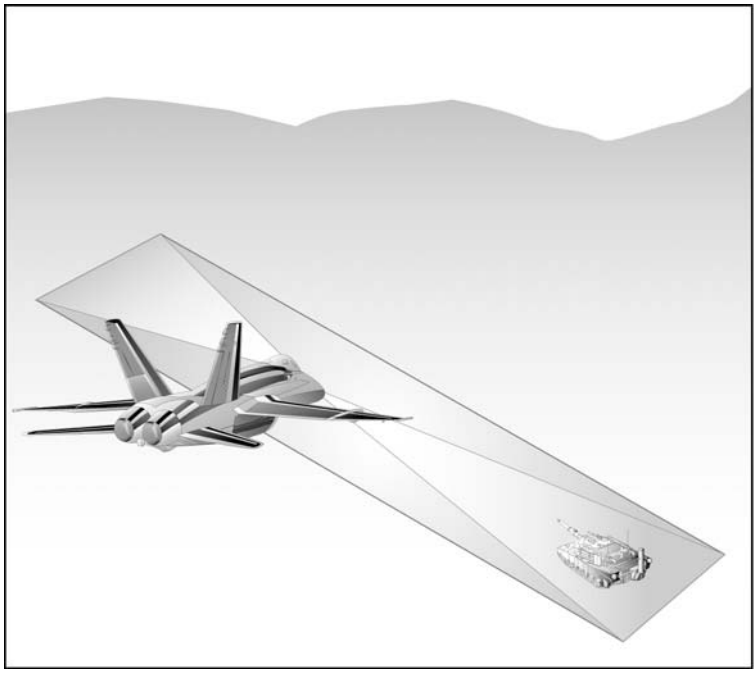


Figure 4-3. Area/Panoramic Coverage.

Oblique Sensor Coverage

Oblique sensor coverage tilts the axis of the sensor away from the vertical to obtain oblique sensor coverage. It can reveal objects that are camouflaged from overhead detection and does not require the aircraft to fly directly over the target. This reduces the possibility of aircraft loss due to enemy air defenses. Angular distortions make precise measurements difficult. Oblique imagery can be taken at high or low oblique angles, as was depicted in figure 4-1.

Electro-optical Imagery

Electro-optical imaging devices monitor the electromagnetic spectrum from the ultraviolet (0.01 micrometers) through the far infrared (1,000 micrometers). Display methods include a scope presentation for instantaneous viewing and imagery recording via the aircraft's VTR. Electro-optical sensors may be pod-mounted or integral to the aircraft/UAV and are usually direct view optics sensors. Electro-optical sensors have day capabilities and do not require processing in order to be viewed for analysis of intelligence information.

Daylight only electro-optical sensors vary in form ranging from digital sensors imbedded in the ATARS to television type sensors. Imagery provided by the ATARS on the F/A-18D can be recorded in tape format or transmitted via data link to the TEG and provide near real time digital imagery. Digital imagery produced through the ATARS can provide the same coverages as photographic imagery: vertical, pinpoint, strip, area, and orientation. The charged-coupled device, low-light level television on AH-1W Cobras, angle rate bombing system on AV-8B Harriers, and day sensor on the Pioneer UAV are three types of television sensors employed in air reconnaissance missions. Some weapons also possess the capability to acquire electro-optical imagery information

while mounted on the aircraft and can data link imagery to the aircraft after a weapon's release. Weapons such as the Walleye and US Air Force's GBU-15 are capable of providing electro-optical imagery on scope presentation for aircrews to detect, identify, and attack targets and to record imagery information.

Nonoptical Imagery

Nonoptical imagery can be obtained during day and night operations by infrared and radar imaging systems.

Infrared Imagery

Infrared imagery is a result of sensing and recording electromagnetic radiations emitted or reflected from a given target surface in the infrared position of the electromagnetic spectrum (approximately 0.72 to 1,000 microns). Infrared imagery collects emitted energy based on temperature and is effective in periods of darkness or reduced visibility. Display methods include a scope presentation for instantaneous viewing and imagery recording on video tape for later use. Infrared sensors may be pod-mounted or integral to the aircraft/UAV and are usually called FLIR devices. The ATARS and Pioneer UAV allow information to be transmitted to ground stations for dissemination and analysis. Weapons with infrared seeker heads, such as the AGM-65F Maverick (prior to employment) and the AGM-84E stand-off load attack missle (prior to weapon impact), are two types of infrared weapons that are capable of displaying a scope presentation that an aircrew can use to detect, identify, and attack targets and to record imagery information.

Radar Imagery

Radar imagery is the recording of radar waves reflected from a given target surface. The SAR of the F/A-18 and AV-8 in the

air-to-ground mode is a valuable aid in locating targets and surveying areas of interest 24 hours a day and in all weather conditions. The F/A-18 and AV-8 can record information via a cockpit video recording system video tape for later dissemination and analysis. ATARS equipped F/A-18D aircraft can collect in a strip or spotlight map mode on the ATARS's digital tape recorders. See figure 4-4.

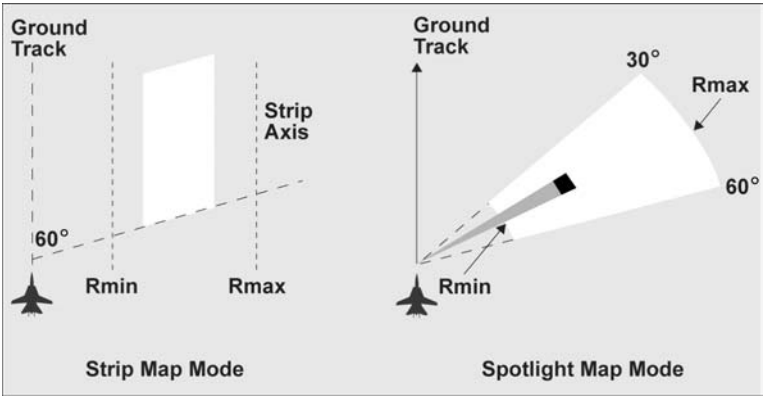


Figure 4-4. Synthetic Aperture Radar Strip and Spot Light Modes.

Assets Available

Marine Light/Attack Helicopter Squadron

The HML/A has some very capable reconnaissance capabilities:

The telescopic sight unit on the AH-1W Cobra is a day-only system with a 2 or 13 power magnification.

The night targeting system on the Cobra has the capability of infrared and low-light television sensors. The night targeting system has multiple magnification capabilities from 2 to 50 times magnification depending on the system. The information is recorded onto 8mm tapes.

The UH-1 Huey has the navigational thermal imaging system (NTIS). This system has selectable 1:1 or 10:1 fields of view. The imagery is recorded on 8mm tapes.

The UH-1N STAR SAFIRE system is a third generation FLIR capable of up to 40 power magnification and is the most capable sensor in the HML/A and rotary-wing MAG.

Marine Medium Helicopter Squadron and Marine Heavy Helicopter Squadron

The HMM and HMH perform image reconnaissance with hand-held cameras. Some CH-53Es are equipped with a FLIR system that can be viewed by aircrews; however, is not currently capable of being recorded.

Marine Attack Squadron

The VMA is comprised of three different types of AV-8B Harriers: day attack, night attack, and radar variant. The day attack Harrier has an angle rate bombing system (ARBS). The ARBS is a day-only system, capable of 6 times magnification, slewable 35 degrees either side of the nose and from 0 to 70 degrees depression angle. The head-up display (HUD) may be recorded by an on board VTR system. An important limitation of the AV-8B is that the 8mm VTR tapes are recorded on a propriety recording system that can only be viewed by a specific player located in the Harrier squadrons. The night attack has the same systems, but adds the capability of a navigational FLIR, again

slaved to aircraft boresight. The radar variant replaces the capability of the ARBS in the nose with the radome of the APG-65 radar in the aircraft.

Marine Fighter/Attack Squadron

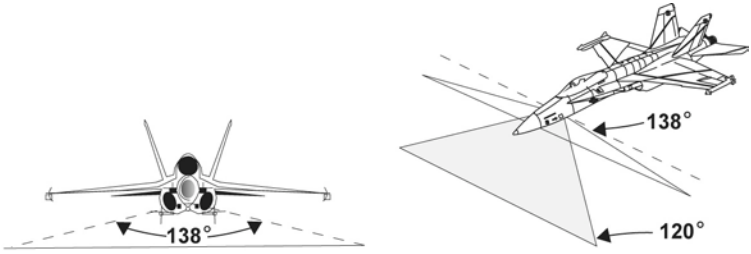
The VMFA and VMFA(AW) have a laser detector tracker pod, which in itself does not have air reconnaissance capabilities. However, in the aft end of the laser detector tracker is the KB-35A strike camera. The KB-35A is a 35mm film, 50mm lens system that is commanded by mission computers to record the target from 4 seconds prior to 10 seconds after computed bomb impact. This camera is slaved to the target and cannot record any oblique imagery.

The F/A-18 Hornet also has the infrared capabilities of the targeting FLIR and navigational FLIR that can supplement reconnaissance data. The navigational FLIR is projected at a 1:1 ratio onto either the HUD or a cockpit display and is boresighted to the longitudinal axis of the aircraft. The Hornet also carries weapon systems like the AGM-65F Maverick and AGM-84E stand-off land attack missile that are capable of importing imagery into the cockpit, which is capable of being recorded by the aircraft's VTR system. The AGM-88 HARM is another weapon carried by the Hornet that is capable of providing aircrews electronic reconnaissance information. Aircrews in VMFAs are also capable of recording SAR imagery from its APG-65 or APG-73 radars and HUD video through the VTR system. The Hornet's air reconnaissance information is recorded onto either 8mm or ¾-inch tapes and must be viewed on an 860-line monitor.

Marine Fighter/Attack (All-Weather) Squadron

The VMFA(AW) possesses the same infrared capabilities as VMFA with the addition of ATARS. ATARS is a digital imaging system

incorporated into the gun bay located in the nose of the F/A-18D. The sensor suite consists of two electro-optical sensors (LAEO and MAEO) and an infrared sensor that are usable in the low to medium altitude envelope. Typically, the LAEO sensor (see fig. 4-5) and the MAEO sensor (see fig. 4-6 on page 4-28) cannot be used simultaneously; however, they can be used simultaneously with the infrared line scanner (IRLS) sensor (see fig. 4-7 on page 4-29). The IRLS provides a high-resolution, picture-like thermograph by showing the



Field of view: 138° for vertical pointing
120° for forward pointing

Number of detectors: 12,000 x 1 pixel array

Detector sweep: push broom

Other characteristics: electronic roll compensation

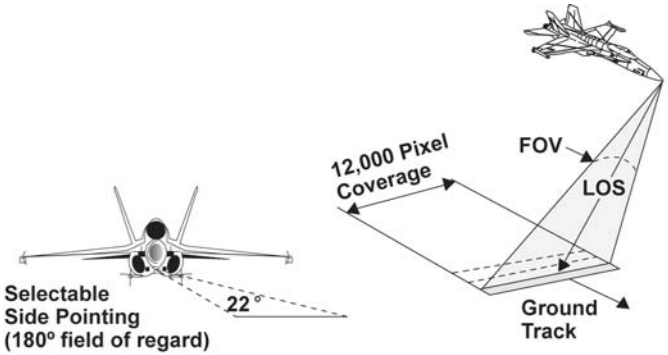
Cockpit display presentation: 1 in 24 pixels

Aircraft envelope for LAEO (not limitations, imagery may degrade outside these parameters):

Altitude: 200–3,000 feet above ground level
Ground speeds: 300–550 knots ground speed

Figure 4-5. Low Altitude Electro-Optical Sensor Characteristics.

differences in radiating thermal energy. A SAR imaging capability exists with an upgrade to the APG-73 radar. The SAR provides imaging capability at long standoff ranges in either a strip imaging mode or spot imaging mode. Included in the nose with the sensors are two digital tape recorders for storing imagery and a reconnaissance management set for controlling the system, processing, and



Field of view: 22°

Side pointing angles: -10° from left wing to -10° from right wing
3 selectable: left, center, right

Number of detectors: 12,000 x 1 pixel array

Detector sweep: push broom

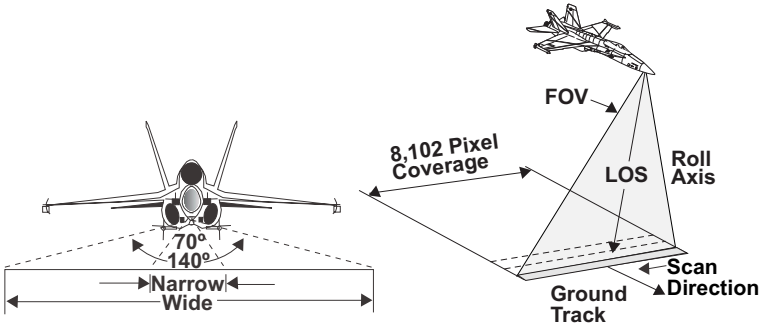
Cockpit display presentation: 1 in 24 pixels

Aircraft envelope for IRLS (not limitations, imagery may degrade outside these parameters):

Altitude: 3,000–20,000 feet above ground level
Ground speeds: 300–550 knots ground speed
Platform pointing angle: referenced to aircraft pitch axis

Figure 4-6. Medium Altitude Electro-Optical Sensor Characteristics.

formatting the data for recording and on board playback and/or transmission to a ground station. A CDL is contained in a separate pod for attachment to the centerline weapon station for those missions where data transmission airborne is required. Each VMFA(AW) will have four aircraft configured to be reconnaissance capable.



Field of view: 140º wide, 70º narrow

Forward pointing angles: vertical -90º

Side pointing angles (available for narrow field of view): left, right, vertical

Electronic roll stabilizer: ±30º

Number of detectors: 12 detectors, 8,102 pixels per line, 1/4 to 5 lines per scan

Detector sweep: infrared line scan

Aircraft envelope for IRLS (not limitations, imagery may degrade outside these parameters):

Altitude: 200–3,000 feet above ground level

Ground speeds: 300–550 knots ground speed

Narrow field of view: minimum altitude = 3.4 x knots ground speed

Wide field of view: maximum altitude = 3,000 feet for 300–380 knots ground speed and 2,500 feet for 380–550 knots ground speed

Figure 4-7. Infrared Line Scanner Characteristics.

Marine Unmanned Aerial Vehicle Squadron

The VMU can support any MAGTF, and its normal employment is as an integral unit of the MAGTF's ACE in support of MAGTF operations. The squadron is also capable of limited independent operations. Each VMU has one system consisting of five air vehicles and one GCS. The RQ-2A, Pioneer, is a short-range, low altitude UAV. The Pioneer is capable of being airborne for up to 4 hours, carries a combination electro-optical/FLIR payload, operates up to 100 nautical miles within line of sight to the GCS, and requires an optimal sensor altitude of 5,000 feet above ground level. The 12DS payload houses a video camera and FLIR system that can be switched from one to the other while the UAV is in flight. The 12DS can detect and recognize targets between 1.5 and 7.7 kilometers from the UAV.

The Pioneer has limitations that must be considered when executing and planning missions. Pioneer limitations can be categorized into two broad areas: weather and support. Weather directly affects the survival of the UAV when it is airborne, as it cannot fly through visible moisture or known icing conditions. Takeoff, landing, and in-flight wind limitations are as follows:

- Headwind limit: 25 knots, gusts to 30 knots.
- Tailwind limit: 5 knots (rocket-assisted takeoff and pneumatic).
- Crosswind limit: 15 knots, gusts to 20 knots.
- Service ceiling: 12,000 feet.

The primary threat to Pioneer UAV operations is electromagnetic. Because the aircraft is radio controlled, this could be friendly interference or enemy attack. Primarily, electromagnetic interference comes from EA-6Bs and radio frequency interference from TRC-170s. Threat radio electronic combat capabilities must be considered when operating the Pioneer UAV. The radar

cross section and infrared signature of the Pioneer are very small; therefore, a UAV can become lost in the midst of other aircraft. Its slow speed also makes it more likely to be filtered out of most radar displays. Although advanced surface-to-air missiles can potentially target a UAV, basic operational characteristics of a UAV mitigate their potential success. Although Pioneer has a loud auditory signature, it is difficult to acquire visually. AAA using barrage or curtain fire presents the highest probability of success for a surface-to-air threat to strike the UAV.Unlike manned aircraft squadrons, the VMU has significant support limitations. UAVs require unique fuel (100 low lead aviation gas), improved runway for operations (minimum of 688 feet by 50 feet), and line of sight communications between the GCS and the UAV. The strategic lift footprint requires five C-5s to lift the squadron's aircraft, ground control equipment, mobile power supplies, rolling stock, and personnel.

Electronic Reconnaissance

The VMAQ is the MAGTF's primary aviation squadron tasked with executing electronic reconnaissance; however, other MAGTF aviation assets also have limited electronic reconnaissance capabilities.

Aircraft conduct electronic reconnaissance during day, night, and all-weather conditions from standoff ranges. This allows aircraft to remain undetected, yet allows electronic warfare systems the ability to detect, identify, and locate enemy emitters. Information is recorded for evaluation, interpretation, and analysis in providing electronic intelligence. Electromagnetic radiations can be analyzed inflight by the aircrew to provide real time

electronic reconnaissance information to other aircraft and ground personnel. Electronic reconnaissance aircraft may be tasked with the following missions:

- Tactical electronic reconnaissance, which allows the MAGTF to detect enemy electromagnetic radiations
- Electronic warfare support, which searches for, intercepts, identifies, and locates sources of radiated electromagnetic energy for immediate threat recognition.

The MAGTF's only air reconnaissance platform that can search for, intercept, identify, and localize sources of radiated electromagnetic energy for immediate threat recognition is the EA-6B Prowler. However, the HML/A, HMH, HMM, VMA, VMFA, VMFA(AW), and VMGR can also acquire electronic reconnaissance information in the battlespace. Threat warning receivers (electronic warfare systems) on board these aircraft can provide the aircrew with the direction of arrival and emitter type to aid in identifying enemy surface-to-air and air-to-air threats. The F/A-18 can also use the HARM as an electronic reconnaissance sensor. An aircrew must be cognizant of the need to report all information concerning enemy threat emitters by passing in-flight reports and completing mission reports post mission.

VMAQ conducts electronic reconnaissance and electronic intelligence operations to maintain EOB, to include selected emitters parameters and localization of nonfriendly emitters. VMAQs also provide threat warnings for friendly aircraft, ships, and ground units. The ALQ-99 tactical jamming system incorporates receivers and external pods for reception and transmission of jamming signals (principally associated with threat air defense radars and its associated command and control). The EA-6B

also employs the USQ-113 communications suite, which provides the ability to collect, record, and disrupt threat communications and can either intercept and jam targeted signals of interest or intercept and digitally record signals of interest. The EA-6B records electronic reconnaissance information onto a recorder reproducer set tape (similar to an 8-track tape). This information can then be extracted using either the tactical EA-6B mission planning system or TERPES.

Operations

Joint and Multinational Operations

Joint air operations are performed with air capabilities/forces made available by other Service components in support of the JFC's operation or campaign objectives or in support of other components of the joint force. The JFC has the authority to exercise operational control, assign missions, direct coordination among his subordinate commanders, and redirect and organize his forces to ensure unity of effort in the accomplishment of his overall mission. The JFACC uses the JFC's guidance and authority and coordinates with other assigned or supporting commanders. As a result, the MAGTF in a joint or multinational operation may have air reconnaissance aircraft from both organic Marine Corps direct support capabilities/forces and capabilities/forces allocated to it by the JFACC. More information about air support in a joint force can be found in JP 0-2, JP 3-0, JP 3-56.1, and MCWP 3-25.

Marine aviation forces capable of air reconnaissance in the joint environment are not exempted from JFC up-front tasking. The JFC may redirect MAGTF sorties for air defense, reconnaissance, and long-range air interdiction if determined that they are required for higher priority missions other than for the MAGTF. The JFACC is the supported commander for the JFC's overall air reconnaissance effort.

Expeditionary Operations

Air reconnaissance operations needed to support an assault are outlined in the air plan annex of the operations plan. Because air reconnaissance missions are usually in high demand during expeditionary operations, the fire support plan should complement the use of aviation, naval gunfire, and artillery fires. Before D-day, air reconnaissance is largely responsible for collecting information in the objective area and providing supporting arms coordination to shape the battlespace.

In advance of the amphibious task force landing, air reconnaissance aircraft collect information on the intended landing area, helicopter landing zones, drop zones, and enemy forces and observe and adjust naval gunfire. On D-day, air reconnaissance aircraft are the primary supporting arms coordination for naval gunfire for the landing force while artillery moves ashore.

Post D-day, air reconnaissance operations will most likely consist of visual reconnaissance missions in support of tactical objectives and deep air support missions that shape the battlespace for subsequent operations. Air reconnaissance missions are flown from aircraft-capable ships when using operational

maneuver from the sea concepts. The air plan is oriented toward missions that have the aircraft returning to the sea base for turnaround maintenance and crew changes, with the possibility of using FARPs ashore. The distance from the sea base to the objective and the aircraft endurance must be balanced against the required response time. Joint and coalition aircraft that are either land-based or carrier-based may augment air reconnaissance missions. Their inclusion places responsibility on the MAGTF for ensuring good communications and coordination with air reconnaissance augmentation forces.

Appendix A
Glossary

Section I. Acronyms and Abbreviations

AAA . . . . . antiaircraft artillery
ACA . . . . . airspace coordination area
ACE. . . . . aviation combat element
ACO . . . . . airspace control order
ACP. . . . . airspace control plan
ADR . . . . . airborne data relay
AH-1W . . . . . attack helicopter (Cobra)
ARBS . . . . . angle rate bombing system
ASC(A) . . . . . assault support coordinator (airborne)
ASE. . . . . air support element
ATARS . . . . . advanced tactical airborne reconnaissance system
ATO. . . . . air tasking order
AV-8B. . . . . attack aircraft (Harrier)
AWACS . . . . . Airborne Warning and Control System

BDA . . . . . battle damage assessment

C-130. . . . . cargo aircraft (Hercules)
C1-41. . . . . Starlifter
C2 . . . . . command and control
C3 . . . . . command, control, and communications
C5 . . . . . Galaxy
CCIR . . . . . commander's critical information requirements
CDL. . . . . common data link
CD-ROM. . . . . compact disc read-only memory

CE . . . . . command element
CGS . . . . . common ground station
CH-46 . . . . . medium assault support helicopter (Sea Knight)
CH-53D/E . . . . . medium/heavy assault support helicopter (Sea/Super Stallion)
CIA . . . . . Central Intelligence Agency
CIO . . . . . Central Imagery Office
COA . . . . . course of action
COC . . . . . combat operations center
COG . . . . . center of gravity
CSSE . . . . . combat service support element
CTAPS . . . . . contingency Theater Air Control System automated planning system

DASC . . . . . direct air support center
DASC(A) . . . . . direct air support center (airborne)
DIA . . . . . Defense Intelligence Agency

EA-6B . . . . . all-weather electronic attack aircraft (Prowler)
EOB . . . . . electronic order of battle
EW/C . . . . . early warning/control

F/A-18 . . . . . fighter attack aircraft (Hornet)
FAC(A) . . . . . forward air controller (airborne)
FARP . . . . . forward arming and refueling point
FLIR . . . . . forward-looking infrared radar
FOV . . . . . field of view
FSCC . . . . . fire support coordination center
FSCL . . . . . fire support coordination line

G-2 . . . . . intelligence officer (major subordinate command)
G-3 . . . . . operations officer (major subordinate command)

G-6 . . . . . communications and information systems officer (major subordinate command)
GCE. . . . . ground combat element
GCS. . . . . ground control station
GDT . . . . . ground data terminal

HARM. . . . . high-speed antiradiation missile
HMH . . . . . Marine heavy helicopter squadron
HML/A . . . . . Marine light/attack helicopter squadron
HMM. . . . . Marine medium helicopter squadron
HMMWV . . . . . high mobility multipurpose wheeled vehicle
HR. . . . . helicopter request
HST. . . . . helicopter support team
HUD . . . . . head-up display

IIP . . . . . imagery intelligence platoon
IFF. . . . . identification, friend or foe
IOC . . . . . intelligence operations center
IPB . . . . . intelligence preparation of the battlespace
IRLS . . . . . infrared line scanner

JFACC. . . . . joint force air component commander
JFC . . . . . joint force commander
JP. . . . . joint publication
JSTARS. . . . . Joint Surveillance Target Attack Radar System
JTAR. . . . . joint tactical air strike request

KC-130 . . . . . multi-role, multi-mission tactical tanker/transport (Hercules)

LAAD . . . . . low altitude air defense
LAEO . . . . . .low altitude electro-optical
LOS . . . . . .line of sight
LTD . . . . . .laser target designater

MACCS. . . . . .Marine air command and control system
MACG. . . . . Marine air control group
MAEO . . . . . medium altitude electro-optical
MAG . . . . . Marine aircraft group
MAGTF. . . . . Marine air-ground task force
MATCD. . . . . .Marine air traffic control detachment
MAW. . . . . .Marine aircraft wing
MCDP . . . . . Marine Corps doctrinal publication
MCIA. . . . . Marine Corps Intelligence Activity
MCWP. . . . . .Marine Corps warfighting publication
MEF. . . . . .Marine Expeditionary Force
METT-T . . . . . .mission, enemy, terrain and weather, troops and support available-time available
mm. . . . . .millimeter
MMT . . . . . .Marine air traffic control mobile team
MPS. . . . . .mission planning station
MRR . . . . . minimum-risk route
MSC. . . . . major subordinate command
MV-22 . . . . . .medium lift, vertical takeoff and tilt-rotor aircraft (Osprey)

NAVFLIR . . . . . navigation forward looking infrared
NRO. . . . . National Reconnaissance Office
NSA. . . . . National Security Agency
NTIS . . . . . .navigational thermal imaging system
NTS . . . . . night targeting system
NVD . . . . . night vision device

OPT . . . . . operational planning team

Rmax . . . . . maximum range
Rmin . . . . . minimum range
RRS . . . . . remote receiving station
RWR . . . . . radar warning receiver

S-2 . . . . . intelligence officer (units and organizations below the major subordinate command level)
S-3 . . . . . operations officer (units and organizations below the major subordinate command level)
S-6 . . . . . communications and information systems officer (units and organizations below the major subordinate command level)
SAR . . . . . synthetic aperture radar
SARC . . . . . surveillance and reconnaissance center
SCR . . . . . single-channel radio
SEAD . . . . . suppression of enemy air defenses
SIDS . . . . . secondary imagery dissemination system
SIPRNET . . . . . SECRET Internet Protocol Router Network
SPINS . . . . . special instructions
SWO . . . . . senior watch officer

TAC(A) . . . . . tactical air coordinator (airborne)
TACC . . . . . tactical air command center (Marine)
TACP . . . . . tactical air control party
TACPHOTO . . . . . tactical photo
TAOC . . . . . tactical air operations center
TAR . . . . . tactical air request
TBMCS . . . . . theater battle management core system
TCS . . . . . tactical control station
TDN . . . . . tactical data network

TEG . . . . . tactical exploitation group
TERPES. . . . . tactical electronic reconnaissance processing and evaluation system
TIGDL . . . . . tactical interoperable ground data link
TSU . . . . . telescopic sighting unit
TTP . . . . . tactics, techniques, and procedures
TV . . . . . television

UAV . . . . . unmanned aerial vehicle
UH-1N . . . . . utility helicopter (Huey)
US . . . . . United States

VMA . . . . . Marine attack squadron
VMAQ. . . . . Marine tactical electronic warfare squadron
VMFA . . . . . Marine fighter/attack squadron
VMFA(AW) . . . . . Marine fighter/attack (all weather) squadron
VMGR. . . . . Marine aerial refueler transport squadron
VMM. . . . . Marine medium tilt-rotor squadron
VMU . . . . . Marine unmanned aerial vehicle squadron
VTR. . . . . video tape recording

Section II. Definitions

air reconnaissance—The acquisition of information by employing visual observation and/or sensors in air vehicles. (JP 1-02)

airspace control order—An order implementing the airspace control plan that provides the details of the approved requests for airspace control measures. It is published either as part of the air tasking order or as a separate document. Also called **ACO**. (JP 1-02)

airspace control plan—The document approved by the joint force commander that provides specific planning guidance and procedures for the airspace control system for the joint force area of responsibility and/or joint operations area. Also call **ACP**. (JP 1-02)

airspace coordination area—A three-dimensional block of airspace in a target area, established by the appropriate ground commander, in which friendly aircraft are reasonably safe from friendly surface fires. The airspace coordination area may be formal or informal. Also called **ACA**. (JP 1-02)

air support request—A means to request preplanned and immediate close air support, air interdiction, air reconnaissance, surveillance, escort, helicopter airlift, and other aircraft missions. Also called **AIRSUPREQ**. (JP 1-02)

air surveillance—The systematic observation of airspace by electronic, visual or other means, primarily for the purpose of identifying and determining the movements of aircraft and missiles, friendly and enemy, in the airspace under observation. (JP 1-02)

air tasking order—A method used to task and disseminate to components, subordinate units, and command and control agencies projected sorties, capabilities and/or forces to targets and specific missions. Normally provides specific instructions to include call signs, targets, controlling agencies, etc., as well as general instructions. Also called **ATO**. (JP 1-02)

antiair warfare—A US Navy/US Marine Corps term used to indicate that action required to destroy or reduce to an acceptable level the enemy air and missile threat. It includes such measures as the use of interceptors, bombers, antiaircraft guns,

surface-to-air and air-to-air missiles, electronic attack, and destruction of the air or missile threat both before and after it is launched. Other measures that are taken to minimize the effects of hostile air action are cover, concealment, dispersion, deception (including electronic), and mobility. Also called **AAW**.

area of interest—That area of concern to the commander, including the area of influence, areas adjacent thereto, and extending into enemy territory to the objectives of current or planned operations. This area also includes areas occupied by enemy forces who could jeopardize the accomplishment of the mission. Also called **AOI**. (JP 1-02)

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

aviation combat element—The core element of a Marine air-ground task force (MAGTF) that is task-organized to conduct aviation operations. The aviation combat element (ACE) provides all or a portion of the six functions of Marine aviation necessary to accomplish the MAGTF's mission. These functions are antiair warfare, offensive air support, assault support, electronic warfare, air reconnaissance, and control of aircraft and missiles. The ACE is usually composed of an aviation unit headquarters and various other aviation units or their detachments. It can vary in size from a small aviation detachment of specifically required aircraft to one or more Marine aircraft wings. The ACE may contain other Service or foreign military forces assigned or attached to the MAGTF. The ACE itself is not a formal

command. Also called **ACE**. (This revised definition will be included in the next edition of MCRP 5-12C.)

battle damage assessment—The timely and accurate estimate of damage resulting from the application of military force, either lethal or non-lethal, against a predetermined objective. Battle damage assessment can be applied to the employment of all types of weapon systems (air, ground, naval, and special forces weapon systems) throughout the range of military operations. Battle damage assessment is primarily an intelligence responsibility with required inputs and coordination from the operators. Battle damage assessment is composed of physical damage assessment, functional damage assessment, and target system assessment. (JP 1-02) In Marine Corps usage, the timely and accurate estimate of the damage resulting from the application of military force. BDA estimates physical damage to a particular target, functional damage to that target, and the capability of the entire target system to continue its operation. Also called **BDA**. (MCRP 5-12C)

battlespace—The environment, factors, and conditions that must be understood to successfully apply combat power, protect the force, or complete the mission. This includes the air, land, sea, space, and the included enemy and friendly forces; facilities; weather; terrain; the electromagnetic spectrum; and the information environment within the operational areas and areas of interest. (JP 1-02) All aspects of air, surface, subsurface, land, space, and electromagnetic spectrum which encompass the area of influence and area of interest. (MCRP 5-12C)

centers of gravity—Those characteristics, capabilities, or sources of power from which a military force derives its freedom of action, physical strength, or will to fight. Also called **COGs**. (JP 1-02)

collection (acquisition)—The obtaining of information in any manner, including direct observation, liaison with official agencies, or solicitation from official, unofficial, or public sources. (JP 1-02)

combat information—Unevaluated data, gathered by or provided directly to the tactical commander which, due to its highly perishable nature or the criticality of the situation, cannot be processed into tactical intelligence in time to satisfy the user's tactical intelligence requirements. (JP 1-02)

combat service support element—The core element of a Marine air-ground task force (MAGTF) that is task-organized to provide the combat service support necessary to accomplish the MAGTF mission. The combat service support element varies in size from a small detachment to one or more force service support groups. It provides supply, maintenance, transportation, general engineering, health services, and a variety of other services to the MAGTF. It may also contain other Service or foreign military forces assigned or attached to the MAGTF. The combat service support element itself is not a formal command. Also called **CSSE**. (This revised definition will be included in the next edition of MCRP 5-12C.)

command and control—The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. Also called **C2**. (JP 1-02)

command element—The core element of a Marine air-ground task force (MAGTF) that is the headquarters. The command element is composed of the commander, general or executive and special staff sections, headquarters section, and requisite communications support, intelligence, and reconnaissance forces necessary to accomplish the MAGTF's mission. The command element provides command and control, intelligence, and other support essential for effective planning and execution of operations by the other elements of the MAGTF. The command element varies in size and composition and may contain other Service or foreign military forces assigned or attached to the MAGTF. Also called **CE**. (This revised definition will be included in the next edition of MCRP 5-12C.)

commander's critical information requirements—A comprehensive list of information requirements identified by the commander as being critical in facilitating timely information management and the decisionmaking process that affect successful mission accomplishment. The two key subcomponents are critical friendly force information and priority intelligence requirements. (JP 1-02) Information regarding the enemy and friendly activities and the environment identified by the commander as critical to maintaining situational awareness, planning future activities, and facilitating timely decisionmaking. Also called **CCIR**. Note: CCIRs are normally divided into three primary subcategories: priority intelligence requirements, friendly force information requirements, and essential elements of friendly information. (MCRP 5-12C)

commander's intent—A concise expression of the purpose of the operation and the desired end state that serves as the initial impetus for the planning process. It may also include the commander's assessment of the adversary commander's intent and an assessment of where and how much risk is acceptable

during the operation. (JP 1-02) A commander's clear, concise articulation of the purpose(s) behind one or more tasks assigned to a subordinate. It is one of two parts of every mission statement which guides the exercise of initiative in the absence of instructions. (MCRP 5-12C)

decentralized control—In air defense, the normal mode whereby a higher echelon monitors unit actions, making direct target assignments to units only when necessary to ensure proper fire distribution or to prevent engagement of friendly aircraft. (JP 1-02) In military operations, a mode of battlespace management in which a command echelon may delegate some or all authority and direction for warfighting functions to subordinates. It requires careful and clear articulation of mission, intent, and main effort to unify efforts of subordinate leaders. (MCRP 5-12C)

direct air support center—The principal air control agency of the US 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. Also call **DASC**. (JP 1-02)

direct air support center (airborne)—An airborne aircraft equipped with the necessary staff personnel, communications, and operations facilities to function as a direct air support center. (JP 1-02) Also called **DASC(A)**.

dissemination—Conveyance of intelligence to users in a suitable form. (MCRP 5-12C)

electronic reconnaissance—The detection, location, identification, and evaluation of foreign electromagnetic radiations. (JP 1-02)

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 electronic warfare are: electronic attack, electronic protection, and electronic warfare support. **a. electronic attack**. That division of electronic warfare involving the use of electromagnetic energy, directed energy, or antiradiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability and is considered a form of fires. 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, radio frequency weapons, particle beams). **b. electronic protection**. That division of electronic warfare involving passive and active means taken to protect personnel, facilities, and equipment from any effects of friendly or enemy employment 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 or localize sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition, targeting, planning and conduct of future operations. Thus, electronic warfare support provides information required for 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, provide targeting for electronic or destructive attack, and produce measurement and signature intelligence. (JP 1-02)

electro-optics—The technology associated with those components, devices and systems which are designed to interact between the electromagnetic (optical) and the electric (electronic) state. Also called **EO**. (JP 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: **a.** detection by enemy sensors; **b.** mutual interference among friendly systems; and/or **c.** enemy interference with the ability to execute a military deception plan. Also called **EMCON**. (JP 1-02)

forward arming and refueling point—A temporary facility—organized, equipped, and deployed by an aviation commander, and normally located in the main battle area closer to the area where operations are being conducted than the aviation unit's combat service area—to provide fuel and ammunition necessary for the employment of aviation maneuver units in combat. The forward arming and refueling point permits combat aircraft to rapidly refuel and rearm simultaneously. Also called **FARP**. (JP 1-02)

forward-looking infrared—An airborne, electro-optical thermal imaging device that detects far-infrared energy, converts the energy into an electronic signal, and provides a visible image for day or night viewing. Also called **FLIR**. (JP 1-02)

ground combat element—The core element of a Marine air-ground task force (MAGTF) that is task-organized to conduct ground operations. It is usually constructed around an infantry organization but can vary in size from a small ground unit of any

type, to one or more Marine divisions that can be independently maneuvered under the direction of the MAGTF commander. It includes appropriate ground combat and combat support forces and may contain other Service or foreign military forces assigned or attached to the MAGTF. The ground combat element itself is not a formal command. Also called **GCE**. (This revised definition will be included in the next edition of MCRP 5-12C.)

head-up display—A display of flight, navigation, attack, or other information superimposed upon the pilot's forward field of view. Also called **HUD**. (JP 1-02)

high payoff target—A target whose loss to the enemy will significantly contribute to the success of the friendly course of action. High-payoff targets are those high-value targets that must be acquired and successfully attacked for the success of the friendly commander's mission. Also called **HPT**. (JP 1-02)

high value target—A target the enemy commander requires for the successful completion of the mission. The loss of high-value targets would be expected to seriously degrade important enemy functions throughout the friendly commander's area of interest. Also called **HVT**. (JP 1-02)

imagery—Collectively, the representations of objects reproduced electronically or by optical means on film, electronic display devices, or other media. (JP 1-02)

imagery exploitation—The cycle of processing and printing imagery to the positive or negative state, assembly into imagery packs, identification, interpretation, mensuration, information extraction, the preparation of reports, and the dissemination of information. (JP 1-02)

information—1. Facts, data, or instructions in any medium or form. **2.** The meaning that a human assigns to data by means of the known conventions used in their representation. (JP 1-02)

infrared imagery—That imagery produced as a result of sensing electromagnetic radiations emitted or reflected from a given target surface in the infrared position of the electromagnetic spectrum (approximately 0.72 to 1,000 microns). (JP 1-02)

intelligence—1. The product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas. **2.** Information and knowledge about an adversary obtained through observation, investigation, analysis, or understanding. (JP 1-02) Also in Marine Corps usage, intelligence is knowledge about the enemy or the surrounding environment needed to support decisionmaking. This knowledge is the result of the collection, processing, exploitation, evaluation, integration, analysis, and interpretation of available information about the battlespace and threat. (MCRP 5-12C)

intelligence cycle—The process by which information is converted into intelligence and made available to users. There are six phases in the cycle: **a. planning and direction**—Determination of intelligence requirements, development of appropriate intelligence architecture, preparation of a collection plan, and issuance of orders and requests to information collection agencies. **b. collection**—Acquisition of information and the provision of this information and the provision of this information to processing elements. **c. processing and exploitation**—Conversion of collected information into forms suitable to the production of intelligence. **d. analysis and production**—Conversion of processed information into intelligence through the integration, analysis, evaluation, and interpretation of all source data and the

preparation of intelligence products in support of known or anticipated user requirements. **e. dissemination and integration**—Delivery of intelligence to users in a suitable from and the application of the intelligence to appropriate missions, tasks, and functions. **f. evaluation and feedback**—Continuous assessment of intelligence operations during each phase of the intelligence cycle to ensure that the commander's intelligence requirements are being met. (JP 1-02) In Marine Corps usage, a six-step process by which information is converted into intelligence and made available to users. The six steps are planning and direction, collection, processing and exploitation, production, dissemination, and utilization. (MCWP 2-1)

intelligence preparation of the battlespace—An analytical methodology employed to reduce uncertainties concerning the enemy, environment, and terrain for all types of operations. Intelligence preparation of the battlespace builds an extensive database for each potential area in which a unit may be required to operate. The database is then analyzed in detail to determine the impact of the enemy, environment, and terrain on operations and presents it in graphic form. Intelligence preparation of the battlespace is a continuing process. (JP 1-02) In Marine Corps usage, the systematic continuous process of analyzing the threat and environment in a specific geographic area. Also called **IPB**. (MCRP 5-12C)

joint force—A general term applied to a force composed of significant elements, assigned or attached of two or more Military Departments, operating under a single joint force commander. (JP 1-02)

joint force air component commander—The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for

making recommendations on the proper employment of assigned, attached, and/or made available for tasking air forces; planning and coordinating air operations; or accomplishing such operational missions as may be assigned. The joint force air component commander is given the authority necessary to accomplish missions and tasks assigned by the establishing commander. Also called **JFACC**. (JP 1-02)

joint force commander—A general term applied to a combatant commander, subunified commander, or joint task force commander authorized to exercise combatant command (command authority) or operational control over a joint force. Also called **JFC**. (JP 1-02)

joint intelligence center—The intelligence center of the combatant command headquarters. The joint intelligence center is responsible for providing and producing the intelligence required to support the combatant commander and staff, components, subordinate joint forces and elements, and the national intelligence community. Also called **JIC**. (JP 1-02)

liaison—That contact or intercommunication maintained between elements of military forces or other agencies to ensure mutual understanding and unity of purpose and action. (JP 1-02)

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

Also called **MACCS**. (JP 1-02) The two major types of control exercised by the MACCS are:

a. air direction—The guidance and supervision which a commander employs to focus his resources on mission accomplishment. Air direction occurs as a sequence of the following activities:

(1) apportionment (air)—The determination and assignment of the total expected air effort by percentage and/or by priority that should be devoted to the various air operations and/or geographic areas for a given period of time.

(2) allocation (air)—The translation of the air apportionment decision into total numbers of sorties by aircraft type available for each operation or task.

(3) tasking—The process of translating the allocation into orders and passing these orders to the units involved. Each order normally contains sufficient detailed instructions to enable the executing agency to accomplish the mission successfully.

(4) fragmentary order—An abbreviated form of an operation order, usually issued on a day-to-day basis, that eliminates the need for restating information contained in a basic operation order. It may be issued in sections.

b. air control—The authority to effect the maneuver of aircraft. The elements of air control are:

(1) air control agency—An organization possessing the capability to exercise air control.

(2) air controller—An individual especially trained for and assigned the duty of the control (by use of radio, radar, or other means) of such aircraft as may be allotted to him for operation within his area.

(3) airspace control—A service which coordinates, integrates, and regulates the use of airspace of defined proportions. It does not include measures to approve, disapprove, deny, or delay air operations.

(4) operational control—With respect to a flight, the exercise of authority over initiating, conducting, or terminating a flight.

(5) positive control—1. A method of airspace control which relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility therein. (JP 1-02) **2.** The tactical control of aircraft by a designated control unit, whereby the aircraft receives orders affecting its movements which immediately transfer responsibility for the safe navigation of the aircraft to the unit issuing such orders.

(6) procedural control—A method of airspace control which relies on a combination of previously agreed and promulgated orders and procedures.

(7) radar control—The operation of air traffic in a radar environment in which heading, altitude, and airspeed of the aircraft are directed by the control facility and radar separation from other traffic is provided.

(8) terminal control—The authority to direct the maneuver of aircraft which are delivering ordnance, passengers, or cargo to a specific location or target. Terminal control is a type of air control. (MCRP 5-12C)

Marine air control group—A command that provides, operates, and maintains the Marine air command and control system, a battle-ready system of command and control agencies fully integrated by rapid, reliable tactical communications. With Stinger and Hawk missile systems, and in conjunction with coor-

dinating the equipment of interceptor aircraft and those ground-based systems, the Marine air control group provides low altitude air defense against low/medium altitude air attacks. Also called **MACG**. (MCRP 5-12C)

Marine aircraft group—The Marine aircraft group is usually administratively and tactically structured by aircraft category as being either a helicopter group or a fixed-wing group. Composite Marine aircraft groups may also be formed for specific missions or unique organizational/geographic considerations. Each Marine aircraft group has a headquarters and maintenance squadron. With a source of supply, the Marine aircraft group is the smallest aviation unit capable of self-sustaining independent operations. Also called **MAG**. (MCRP 5-12C)

Marine aircraft wing—The Marine aircraft wing is the highest level aviation command in the Fleet Marine Force. The Marine aircraft wing is task-organized to provide a flexible and balanced air combat organization capable of providing the full range of combat air operations in a variety of areas without the requirement of prepositioned support, control, and logistic facilities. Only the wing has the inherent capability of performing all six aviation functions. Also called **MAW**. (MCRP 5-12C)

Marine air-ground task force—The Marine Corps principal organization for all missions across the range of military operations, composed of forces task-organized under a single commander capable of responding rapidly to a contingency anywhere in the world. The types of forces in the Marine air-ground task force (MAGTF) are functionally grouped into four core elements: a command element, an aviation combat element, a ground combat element, and a combat service support element. The four core elements are categories of forces, not formal commands. The basic structure of the MAGTF never varies,

though the number, size, and type of Marine Corps units comprising each of its four elements will always be mission dependent. The flexibility of the organizational structure allows for one or more subordinate MAGTFs, other Service and/or foreign military forces, to be assigned or attached. Also called **MAGTF**. (This revised definition will be included in the next edition of MCRP 5-12C.)

Marine air support squadron—The component of the Marine air control group which provides and operates facilities for the control of support aircraft operating in direct support of ground forces. Also called **MASS**.

Marine Corps Planning Process—A six-step methodology which helps organize the thought processes of the commander and staff throughout the planning and execution of military operations. If focuses on the threat and is based on the Marine Corps philosophy of maneuver warfare. It capitalizes on the principle of unity of command and supports the establishment and maintenance of tempo. The six steps consist of mission analysis, course of action development, course of action war game, course of action comparison/decision, orders development, and transition. Also called **MCPP**. Note: Tenets of the MCPP include top down planning, single battle concept, and integrated planning. (MCRP 5-12C)

Marine expeditionary force—The largest Marine air-ground task force and the Marine Corps principal warfighting organization, particularly for larger crises or contingencies. It is task-organized around a permanent command element and normally contains one or more Marine divisions, Marine aircraft wings, and Marine force service support groups. The Marine expeditionary force is capable of missions across the range of military operations, including amphibious assault and sustained operations ashore in any environment. It can operate from a sea base, a land base, or both. It

may also contain other Service or foreign military forces assigned or attached to the MAGTF. Also called **MEF**. (This revised definition will be included in the next edition of MCRP 5-12C.)

multispectral imagery—The image of an object obtained simultaneously in a number of discrete spectral bands. Also called **MSI**. (JP 1-02)

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. Also called **NRT**. (JP 1-02)

oblique air photograph—An air photograph taken with the camera axis directed between the horizontal and vertical planes. Commonly referred to as an "oblique." **a. High Oblique.** One in which the apparent horizon appears. **b. Low Oblique.** One in which the apparent horizon does not appear. (JP 1-02)

operational control—Command authority that may be exercised by commanders at any echelon at or below the level of combatant command. Operational control is inherent in combatant command (command authority) and may be delegated within the command. When forces are transferred between combatant commands, the command relationship the gaining commander will exercise (and the losing commander will relinquish) over these forces must be specified by the Secretary of Defense. Operational control is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish

missions assigned to the command. Operational control should be exercised through the commanders of subordinate organizations. Normally this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Operational control normally provides full authority to organize commands and forces and to employ those forces as the commander in operational control considers necessary to accomplish assigned missions. It does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training. Also called **OPCON**. (JP 1-02)

order of battle—The identification, strength, command structure, and disposition of the personnel, units, and equipment of any military force. (JP 1-02)

radar imagery—Imagery produced by recording radar waves reflected from a given target surface. (JP 1-02)

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

sensor—An equipment which detects, and may indicate, and/or record objects and activities by means of energy or particles emitted, reflected, or modified by objects.

signals intelligence—1. A category of intelligence comprising either individually or in combination all communications intelligence, electronic intelligence, and foreign instrumentation signals intelligence, however transmitted. **2.** Intelligence derived

from communications, electronic, and foreign instrumentation signals. Also called **SIGINT**. (JP 1-02)

situational awareness—Knowledge and understanding of the current situation which promotes timely, relevant, and accurate assessment of friendly, enemy, and other operations within the battlespace in order to facilitate decisionmaking. An informational perspective and skill that foster an ability to determine quickly the context and relevance of events that are unfolding. Also called **SA**. (MCRP 5-12C)

suppression of enemy air defenses—That activity that neutralizes, destroys, or temporarily degrades surface–based enemy air defenses by destructive and/or disruptive means. Also called **SEAD**. (JP 1-02)

surveillance—The systematic observation of aerospace, surface, or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means. (JP 1-02)

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

tactical air operations center—The principal air control agency of the US 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. Also called **TAOC**. (JP 1-02)

time on station—The time that an aircraft can actually spend performing its assigned mission. If does not include the time transiting to and from the operating site. Also called **TOS**. (MCRP 5-12C)

unmanned aerial vehicle—A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semiballistic vehicles, cruise missiles, and artillery projectiles are not considered unmanned aerial vehicles. Also called **UAV**. (JP 1-02)

vertical air photograph—An air photograph taken with the optical axis of the camera perpendicular to the surface of the Earth. (JP 1-02)

visual reconnaissance—The use of visual observation to obtain information about the activities and resources of an enemy or the physical characteristics of a given area. Visual reconnaissance supplements operational information concerning friendly forces and aids offensive actions such as artillery, naval surface fire support, or air support missions. (MCRP 5-12C)

Appendix B
References

Joint Publications (JPs)

0-2	Unified Action Armed Forces (UNAAF)
1-02	Department of Defense Dictionary of Military and Associated Terms
3-0	Doctrine for Joint Operations
3-52	Doctrine for Joint Airspace Control in the Combat Zone
3-56.1	Doctrine for Joint Operations

Marine Corps Doctrinal Publication (MCDP)

5	Planning

Marine Corps Warfighting Publications (MCWPs)

2-1	Intelligence Operations
2-11	MAGTF Intelligence Collection Plans (under development)
2-15.2	Signals Intelligence
2-15.4	Imagery Intelligence
3-2	Aviation Operations
3-16A	Tactics, Techniques, and Procedures for the Targeting Process
3-16B	The Joint Targeting Process and Procedures for Targeting Time-Critical Targets
3-25	Control of Aircraft and Missiles
3-25.4	Marine Tactical Air Command Center Handbook
3-25.5	Direct Air Support (DASC) Handbook

3-25.7 Tactical Air Operations Center Handbook
3-40.1 MAGTF Command and Control
3-40.3 Communications and Information Systems (under development)

Marine Corps Reference Publication (MCRP)

2-1B MAGTF Intelligence Collections (under development)