MCWP 3-21.1

Aviation Ground Support

U.S. Marine Corps

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FOREWORD

Marine Corps Warfighting Publication (MCWP) 3-21.1, *Aviation Ground Support*, applies the philosophy in Marine Corps Doctrinal Publication (MCDP) 4, *Logistics*, and MCDP 3, *Expeditionary Operations*, to Marine aviation ground support. It is the link between MCWP 3-2, *Aviation Operations*, and the tactics, techniques, and procedures contained in other Marine aviation and logistic publications. In establishing the doctrinal basis for the planning and execution of aviation ground support, this publication provides the basis for employment of aviation ground support of the Marine air-ground task force (MAGTF) air combat element (ACE) during the prosecution of war and other operations in support of the Marine Corps mission.

This publication is intended primarily for commanders and staff officers who are responsible for the planning and execution of aviation operations. The MCWP 3-21.1 should be read by Marines supported by or involved in the execution of aviation operations. It is also intended for other doctrine centers, joint and multinational staffs, professional military educational activities, and other activities requiring an understanding of Marine aviation ground support. The MCWP 3-21.1 provides a common basis for understanding Marine aviation ground support and the manner in which the MAGTF can tactically exploit those capabilities. Marine aviation ground support is an integral part of the MAGTF as it extends the ACE's tactical reach and flexibility.

This manual is authoritative in nature but requires judgment in application.

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

/s/
EDWARD HANLON, JR.
Lieutenant General, U.S. Marine Corps
Commanding General
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Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

Aviation Ground Support

Table of Contents

Chapter 1. Fundamentals

MAGTF Support 1-1
Functions 1-2
Organization 1-4
Marine Wing Support Group 1-4
Marine Wing Support Squadron 1-6
Operations 1-8
Logistic Support 1-9
Training 1-10

Chapter 2. Functions

Airfield Support 2-1
Photo Services 2-2
Weather Services 2-2
Expeditionary Airfield Services 2-4
Aircraft Rescue and Fire Fighting 2-9
Aircraft and Ground Refueling 2-11
Explosive Ordnance Disposal 2-13
Air Base Support Functions 2-14
Air Base Commandant 2-15
Internal Airfield Communications 2-17
Essential Engineer Services 2-20
Motor Transport 2-23
Field Messing Facilities 2-24
Medical Services 2-24
Organic and Support Unit Personnel Training 2-25
Nuclear, Biological, and Chemical Defense 2-25

Security and Law Enforcement Services 2-26
Base Camp Fire Protection and Prevention 2-28

Chapter 3. Airfield Operations at Forward Operating Bases
Classification 3-2
Main Air Base 3-2
Air Facility 3-2
Air Site 3-3
Air Point 3-3
Support Organizations 3-4
Engineer Operations Division, Marine Wing Support Squadron 3-5
Engineer Support Battalion, Force Service Support Group 3-5
Naval Construction Force 3-5

Chapter 4. Air Base Ground Defense
Fundamentals 4-1
Threat 4-3
Levels 4-3
Conditions 4-5
Planning 4-5
Command and Control 4-7
Marine Air-Ground Task Force 4-7
Aviation Combat Element 4-8
Organization 4-8
Base Defense Operations Center 4-9
Host-Nation Support 4-13

Chapter 5. Base Recovery After Attack
Organization 5-2
Aviation Ground Support Operations Center 5-2
Damage Assessment Teams 5-3

	Damage Assessment and Response Teams	5-4
	Minimum Operating Strip Selection Team	5-5
	Aircraft Rescue and Firefighting Team	5-6
	Explosive Ordnance Disposal Section	5-6
	Nuclear, Biological and Chemical Defense Team	5-6
	Roving Controller	5-6
	Rapid Runway Repair Organization	5-6
	Communications	5-7
	Requirements	5-8
	Methods	5-9
Chapter 6.	**Rapid Runway Repair Operations**	
	Planning	6-1
	Threat Munitions	6-1
	Categories of Damage	6-2
	Considerations	6-3
	Organization	6-4
	Crater Crew	6-5
	Support Crew	6-6
	Hauling Crew	6-6
Chapter 7.	**Forward Arming and Refueling Point Operations**	
	Planning Considerations	7-2
	Location	7-3
	Employment Techniques	7-6
	Refueling Methods	7-8
	Equipment	7-9
	Personnel Requirements	7-10
	Defense	7-11
	Ground	7-12
	Air	7-12
	Communications	7-13
	Layout Considerations	7-14

Routing and Aircraft Control Procedures 7-15
Cold Refueling Procedures 7-16
Hot Refueling Procedures 7-16
Pre-Operational Procedures 7-17
Emergency Fire and Rescue Procedures 7-18
Additional Procedures 7-18
Emergency Breakdown and Evacuation 7-18
Night Operations 7-18
Ordnance 7-19
Crew-Served Weapons 7-19
Safety 7-19

Chapter 8. Deployment Planning
Predeployment 8-1
Requirements 8-1
Task Organization 8-3
Logistical Preparation 8-4
Deployment 8-6
Fly-In Echelon 8-6
Follow-on Echelon 8-8
Aviation Logistics Support Ship 8-8
Maritime Prepositioning Ships 8-8
Operations 8-8
Reconstitution and Redeployment 8-10

Appendices
A Forward Arming and Refueling Point Survey A-1
B Base Camp Fire Protection and Prevention B-1
C Air Base Ground Defense Planning Checklist C-1
D Base Recovery After Attack Worksheets D-1
E Airfield Site Survey E-1
F Glossary F-1
G References and Associated Publications G-1

Chapter 1. Fundamentals

As the nation's force in readiness, the Marine Corps provides great versatility and flexibility to deal with situations across the range of military operations. Fighting as an integrated air-ground team, the Marine air-ground task force (MAGTF) is a task-organized force comprised of four elements: command element; ground combat element (GCE); aviation combat element (ACE); and combat service support element (CSSE).

The MAGTF's ability to project power is heightened by the ACE's ability to deploy and operate in close proximity to the fighting. Potential operating sites range from urban areas containing established aviation facilities to areas with the crudest and most austere facilities. The MAGTF requires responsive air support for all types of operating areas.

MAGTF SUPPORT

Marine aviation provides the MAGTF commander with a unique force. The ACE is ready for deployment and capable of fulfilling the MAGTF fire support and maneuver requirements across the spectrum of war. This can range from military operations other than war to large-scale, sustained combat operations.

Marine aviation performs six functions in support of the MAGTF: anti-air warfare, offensive air support, assault support, electronic warfare, air reconnaissance, and control of aircraft and missiles. Through these six functions, the ACE greatly enhances the MAGTF's capabilities to conduct maneuver warfare.

Marine aviation provides significant advantages in terms of speed, flexibility, shock, and technology allowing the Marine Corps to impose its will upon the enemy. Through Marine aviation's function of offensive air support, accurate and destructive firepower can be brought to bear upon the enemy. Used at the right time and place, Marine avia-

tion can capitalize and exploit fleeting opportunities created throughout the battlespace.

The ACE is organized and equipped to facilitate early deployment. Marine aviation is expeditionary in nature and organizes, trains, and equips for expeditionary operations. The ACE's expeditionary ability sets it apart from the aviation organizations of other Services. Marine aviation can operate from aircraft carriers, amphibious ships, or shore-based forward operating bases (FOBs).

As an extension of sea-based aviation in littoral warfare, FOBs provide the ACE the capability to phase warfighting assets ashore in support of sustained operations. Essential to the success of FOBs are certain infrastructure and ground support requirements that facilitate flight operations. These requirements are commonly referred to as aviation ground support (AGS). AGS enhances the expeditionary nature of the ACE. Chapter 3 provides amplifying information on FOB employment.

FUNCTIONS

AGS consists of ground support functions required (less aircraft supply, maintenance, and ordnance) for sustained air operations at FOBs and air bases. AGS directly supports the employment of the six functions of Marine aviation. It is the critical component that gives Marine aviation its expeditionary capability. AGS consists of numerous ground functional capabilities that support MAGTF aviation assets in austere environments.

Functions such as expeditionary airfield (EAF) services, aircraft rescue and fire fighting (ARFF), aircraft refueling, and weather services are unique to the aviation community. Other functions such as engineer services, motor transport, communications, and field messing enable the ACE to conduct expeditionary operations.

These functions allow the ACE to project its assets ashore and generate sorties at a rate beyond that capable from sea-based platforms. AGS is

compatible with U.S. Navy (USN) aircraft and can support and accommodate U.S. Army (USA) rotary-wing aircraft and most U.S. Air Force (USAF) aircraft. The Marine wing support groups (MWSGs) and subordinate Marine wing support squadrons (MWSSs) provide the ACE with the following 14 AGS functions, which are discussed in detail in chapter 2.

- Internal airfield communications.
- Weather services.
- EAF services.
- ARFF.
- Aircraft and ground refueling.
- Explosive ordnance disposal (EOD).
- Essential engineer services.
- Motor transport (MT).
- Field messing facilities.
- Routine and emergency sick call and aviation medical functions.
- Individual and unit training of organic personnel and selected personnel of support units.
- Nuclear, biological, and chemical (NBC) defense.
- Security and law enforcement services.
- Air base commandant functions.

ORGANIZATION

The MWSGs and their subordinate MWSSs are the agencies responsible for AGS within the Marine air wings (MAWs).

Marine Wing Support Group

The original MWSGs began in the 1970s by merging the Marine air base squadron, wing engineer squadron, wing transportation squadron, wing engineer repair squadron, and headquarters and headquarters squadron (H&HS). By the late 1980s, the MWSG evolved into its present configuration. The MWSG was developed to place AGS functions within the MAW under a single commander.

The MWSG is a deliberate and careful balance of centralized command with decentralized control. A typical MWSG contains four MWSSs: two organized and equipped to support fixed-wing Marine aircraft groups (MAGs), (MWSS [FW]), and two are organized and equipped to support rotary-wing MAGs, (MWSS [RW]). Figure 1-1 shows the MWSG organization.

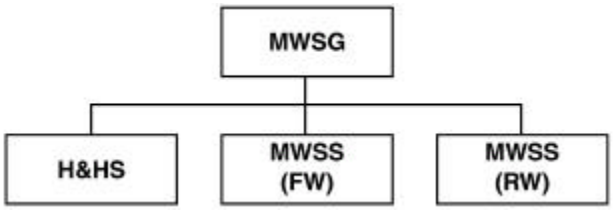


Figure 1-1. Marine Wing Support Group Organization.

The MWSG headquarters includes a personnel support detachment that provides administrative support to the MWSG as well as serving as the remain-behind element in the event of a group-level deployment. The mission of the MWSG is to provide essential ground support requirements (less aircraft supply, maintenance, and ordnance) to a designated

MAW. The MWSG is organized and equipped for employment as an integral unit in support of the MAW.

Structured to provide task-organized or fully deployable elements in support of the garrison or deployed posture of the MAW, the MWSG assigns a supporting MWSS to a specified MAG, airfield or FOB. The MWSG exercises administrative, operational, and logistical control of the MWSSs and ensures that the MAW receives the required AGS. When deployed, the MWSG will collocate with the MAW headquarters while its MWSSs locate with and provide direct support to a specified MAG at an airfield or FOB.

Currently, there are three active MWSGs and one reserve MWSG. Both MWSGs within 2d and 3d MAW possess four deployable MWSSs each and operate expeditionary airfields at Bogue Field, NC, and Twenty-nine Palms, CA, respectively. The MWSG within 1st MAW, unlike the other groups, possesses only one MWSS (FW) and one MWSS (RW). The MWSG headquarters within 4th MAW, and its four reserve MWSSs, are split into detachments located throughout the continental United States.

The MWSG headquarters is the key to efficient and effective use of AGS within the ACE, both in combat and in garrison. It provides the MAW commanding general with a commander who can supervise, prioritize, and coordinate AGS employment for the entire MAW, to include the Marine air control group (MACG), the MAW headquarters, as well as the MAGs.

Specifically, the MWSG—

- Develops courses of action to establish and sustain multiple airfields or FOBs and associated AGS.

- Analyzes support requirements for each MWSS at each FOB, as well as additional expeditionary aviation support missions, and realigns personnel and equipment between MWSSs as necessary to accomplish the mission.

- Coordinates with the wing headquarters on any support issues that exceed the capabilities of the MWSG.

- Conducts FOB and AGS planning, as part of wing course of action development, pertaining to the deployment and employment of MWSG assets in support of the wing mission for a commanders in chief (CINCs) operations plan or contingency.

- Oversees and redistributes AGS assets in support of training, exercises, and operations.

- Oversees the readiness posture of MWSSs.

Marine Wing Support Squadron

A subordinate element of the MWSG, the MWSS is organized to provide essential AGS requirements to a designated fixed- or rotary-wing component of the ACE and supporting or attached MACG elements. MWSSs are essentially the same in organization, structure, and capability except that the MWSS (FW) has aircraft arresting gear and a larger tactical airfield fuel dispensing system (TAFDS) capability.

The MWSS (RW) has a larger helicopter expedient refueling system (HERS) capability than the MWSS (FW) and no arresting gear. Regardless of the MWSS configuration or designation, an MWSS with augmentation may be tasked to support both rotary- and fixed-wing operations simultaneously if the situation dictates.

To support ACE units, the MWSS conducts airfield operations, maintenance and ordnance functions, and the 14 AGS functions. MWSS does not conduct air traffic control and aircraft supply. In garrison, the MWSS provides personnel to support the fleet assistance program between MAWs and the commander Marine Corps air bases.

Through fleet assistance program agreements, Marine Corps air stations gain needed personnel to maintain operations, while the MWSGs

are able to maintain occupational proficiency for their personnel. Figure 1-2 shows the table of organization (T/O) elements of the MWSS.

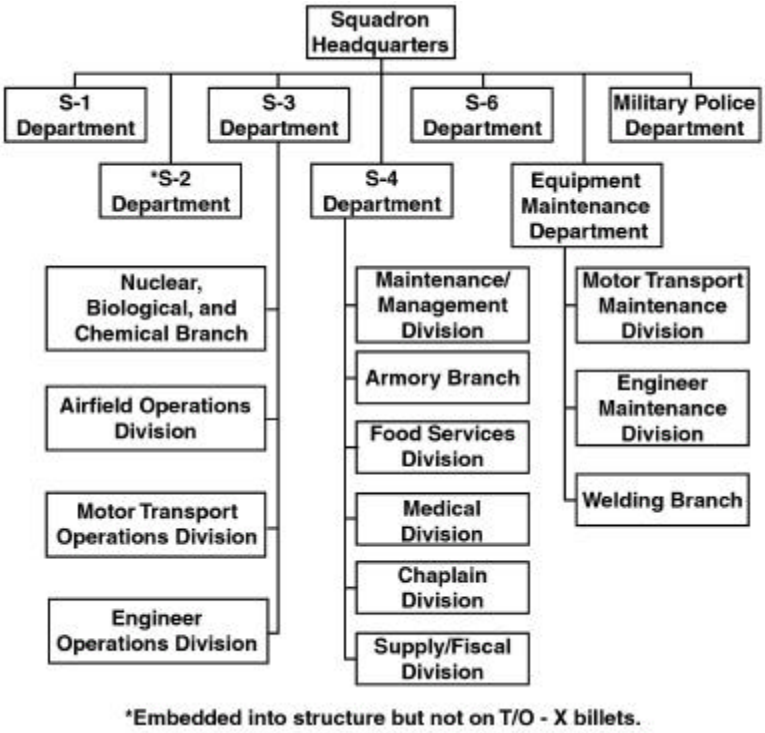


Figure 1-2. Marine Wing Support Squadron.

The MWSS is structured to accomplish its missions in combat. The MWSS performs many of its wartime AGS functions on a daily basis. Each staff section conducts its traditional staff role with the operations and logistics sections responsible for the other functions as noted in Figure 1-2. The S-3 operations officer maintains supervisory cognizance of the three major operations divisions that make up the MWSS, while the S-4 logistics officer maintains supervisory cognizance over the preponderance of the supporting services divisions/branches. Refer

to Marine Corps Reference Publication (MCRP) 5-12D, *Organization of Marine Corps Forces*, for general T/O information.

The MWSS also possesses an organic capability to conduct—

- Organizational (1st and 2d echelon) maintenance of assigned engineer, motor transport, communications, field food service, NBC defense equipment, and weapons.

- Intermediate (3d and limited 4th echelon) maintenance on EAF systems equipment.

- Organizational (2d echelon) maintenance of engineer and motor transport equipment support for supported unit(s), except for the elements of the MACG.

OPERATIONS

MWSG provides AGS to the ACE. The MWSS is the operational arm of the MWSG. The MWSS provides the ACE with the 14 functions of AGS both in garrison and deployed. While deployed, the MWSS operates from an aviation ground support operations center (AGSOC). The AGSOC is the nucleus for the coordination and execution of AGS services and functions. From the AGSOC, the MWSS commander supervises MWSS divisions and manages squadron activities.

The squadron S-3 runs the AGSOC, which includes representation from the other squadron's staff and operational sections (i.e., S-1, S-2, S-4, S-6, NBC, airfield operations, engineer operations, and MT operations). The S-3 must have the capability to receive, prioritize, assign, and track AGS activities. To respond to changes in operations, tempo, and environment, the AGSOC must be flexible. It functions much like the force service support group (FSSG) combat service support operations center (CSSOC). The AGSOC processes AGS requests from customers and tasks subordinate elements to respond. It manages the AGS

effort and provides the center of control for other activities important to operations, which include—

- Airfield operations.
- Air base ground defense (ABGD).
- Base recovery after attack (BRAAT).
- Rapid runway repair (RRR) operations.
- Forward arming and refueling point (FARP) operations.

The AGSOC setup, internal functioning, and staffing are operationally driven and therefore change as the situation and the mission dictate. The operation of the AGSOC is established in the unit standing operating procedures.

LOGISTIC SUPPORT

In addition to the AGS, the ACE will require aviation logistic support and CSS to operate ashore. The Marine aviation logistics squadron (MALS) and the MAGTF CSSE provide aviation logistic support capabilities to the ACE.

The MALS provides logistic support, which includes aviation supply and maintenance support for the aircraft, aviation support equipment, and aviation armament and ordnance equipment. Refer to Marine Corps Warfighting Publication (MCWP) 3-2, *Aviation Operations*, for more information on the role of a MALS in support of Marine aviation.

The MAGTF CSSE provides CSS to the MWSS as required. The MWSS determines, requests, and coordinates CSS from the CSSE. See MCWP 4-11, *Tactical-Level Logistics*, for more information.

The CSSE provides the following combat service support (CSS) functions:

- Disbursing.
- Postal.
- Dental.
- Motor transport line haul.
- Bulk liquids line haul.
- Intermediate level maintenance.
- Exchange services.
- Arrival airfield control group and departure airfield control group support.

TRAINING

The MWSG and MWSS are a compilation of various aviation-specific and ground military occupational specialties. These specialists must maintain occupational proficiency while integrating their abilities to perform the 14 AGS functions. The MWSS should use applicable training and readiness standards and individual training standards to train its Marines as individual specialists.

As a unit, the MWSS should train to the standards established within the unit's mission performance standards and Marine Corps Order (MCO) 3501.7. *Marine Corps Combat Readiness Evaluation System (MCCRES); Volume XIII, Marine Wing Support Group Units*. To proficiently perform the duties of BRAAT and RRR, the squadron should establish semiannual training in these areas.

The weapons and tactics instructors (WTI) course given by Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) provides MWSG and MWSS officers with extensive training in the planning and execution of AGS in support of the ACE. Refer to the MAWTS-1 web site (www.tecom.usmc.mil/mawts1) for details of WTI and the AGS curriculum.

Chapter 2. Functions

The 14 AGS functions are divided into airfield and air base support.

AIRFIELD SUPPORT

Airfield support functions are those activities and tasks necessary to establish and operate the flight line at an FOB. The five airfield support functions are—

- Weather services.
- EAF services.
- ARFF.
- Aviation and ground refueling.
- EOD.

The MWSS airfield operations division provides the preponderance of airfield support functions. At established airfields and FOBs, airfield operations division provides the technical expertise, equipment, and personnel necessary to operate the flight line (e.g., emergency response, aircraft arrestment, aviation refueling, EOD response, managing flight line hours, lighting and marking, establishing parking).

Although air traffic control is important to the operation of an airfield, the Marine air traffic control (MATC) detachment does not fall under the airfield operations division. MATC falls directly under the operational control of the tactical air command center (TACC). Figure 2-1 on page 2-2 shows the organization of the airfield operations division.

Figure 2-1. Airfield Operations Division.

Photo Services

Although not identified as one of the five airfield support functions, the photo branch within the MWSS is a viable entity of the airfield operations division. The photo branch is primarily used to provide photographic records of incidents occurring at the airfield or FOB. The photo branch also assists the MWSS by providing photographic support for site surveys and construction projects.

Weather Services

The ACE requires current, precise weather information and forecasts over a large area for operational planning, execution, and flight safety. The ACE is concerned with weather conditions at widely dispersed FOBs, weather conditions en route to destinations and targets, and conditions at arrival airfields. Each MWSS possesses two weather support units: the weather services branch and the Marine expeditionary force (MEF) weather support team (MST).

Weather Services Branch

The weather services branch is manned, equipped, and tasked to provide continuous collection, processing, production, and dissemination of weather data, forecasts, and tactical decision aids for ACE operations. It is the primary source for meteorological and oceanographic (METOC) information for the MAGTF. Chief of Naval Operations

Instruction (OPNAVINST) 3710.7, *NATOPS General Flight and Operating Instructions*, provides aviation requirements for flight weather briefings. MCWP 3-35.7, *MAGTF Meteorological and Oceanographic Support*, provides the information needed for the commander to understand, plan, and conduct MAGTF METOC operations.

The weather services branch provides essential data for electronic warfare, aircraft target acquisition, and engagement while simultaneously providing theater and worldwide weather capabilities to the MAGTF. This branch also provides vapor/liquid/solid tracking forecasts to assist in NBC defense preparation and operations. MWSSs equipped with meteorological mobile facility (replacement) (MetMF [R]) will support aviation operations at FOBs. The MetMF (R) communication subsystem has the capability to read the Navy's fleet multichannel broadcast to receive METOC data. Dissemination of METOC products to the MAGTF requires command, control, communications, computers, and intelligence local area network (LAN), wide area network (WAN), and SECRET internet protocol router network (SIPRNET). The MetMF (R) can operate semi-autonomously or as part of a weather network. Maintenance and supply of the weather equipment are performed by the supporting MALS.

To facilitate the safe operation of aircraft at an FOB, the weather services branch provides—

- A continuous surface weather observation program.
- Upper atmospheric soundings.
- Terminal aerodrome forecasts for the airfield and local area (5 nautical mile radius).
- Local area severe weather warnings and advisories.
- Climatological, astronomical, and tidal data.
- Sea and surf conditions.

- Aviation weather briefs required by the current edition of OPNAVINST 3710.7.
- Electro-optic tactical decision aids for mission planning and weapons system optimization.
- Electromagnetic-effects products (e.g., electro-optical tactical decision aid) for mission planning and optimization of electronic warfare support, electronic attack, and electronic protection.
- Target area, ingress/egress, mission, and staff weather briefings.
- Pilot-to-meteorological services on authorized radio frequencies.
- Staff weather briefings, a vital part of the intelligence preparation of the battlespace, to identify the impact weather will have on planned operations.

The weather services branch provides situational parameters and forecast products for assessing impacts on friendly and enemy capabilities. Littoral operations require continuous assessment of mesoscale features in dynamic land/sea interface. Mission success, in part, depends on the commander's ability to evaluate METOC impacts on battlefield operations, personnel, power projection, weapons selection, and electromagnetic and electro-optical systems. Diurnal (daily) changes as well as synoptic (overall) weather features affect friendly and enemy maneuver, engagement, and communications.

Marine Expeditionary Force Weather Support Team

The MST provides direct, tactical METOC support to MAGTF command elements, other than the ACE.

Expeditionary Airfield Services

The EAF is a shore-based aviation support system that permits landing force aircraft to operate from FOBs within effective range of ground forces. EAF is a construction concept used to develop or enhance

FOBs and should not be confused with a concept of employment for Marine aviation. Although an FOB may be a simple grass landing zone (LZ) supporting helicopter operations, the installation and use of one or more EAF subsystems (e.g., fresnel lens, airfield lighting) will add versatility and durability to the site selected.

The EAF goal is to provide the ACE commander with flexible, rapidly deployable, self-sustaining, and survivable forward bases to support the ACE during expeditionary operations. Prior to selecting an FOB site, ACE and AGS planners should consider the availability and use of host nation (HN) airfields, abandoned or captured airfields, highways, and parking lots before constructing an EAF. EAF equipment is designed to provide the MAGTF commander with maximum flexibility and ability to plan, deploy, and operate. Primarily suited for short-term deployments, EAF equipment can be used to support extended operations. The Marine Corps defines expeditionary in terms of mindset, equipment, organization, and employment. The definition of expeditionary airfield includes the use of a variety of semi-prepared runways, with or without the employment of AM-2 matting.

EAF expertise is resident within the MWSG, and the use of aircraft recovery equipment requires extensive formal training. EAF expertise is also essential in supporting EAF installation and operations; EAF-specific survey, liaison, reconnaissance party (SLRP) tasks; survey airfield construction; and air base ground defense. EAF personnel and equipment require Naval Air Systems Command (NAVAIR) compliance, Marine Corps forces certification, naval funding, and naval aviation maintenance program adherence. EAF equipment is certified for operation per Naval Air Systems Command Instruction (NAVAIRINST) 13800.12B, *Certification of Expeditionary Airfield AM-2 Mat Installations, Aircraft Recovery Equipment, Visual/Optical Landing Aids, and Marking/Lighting Systems*, and NAVAIRINST 13800.13B, *Certification of Shore-Based Aircraft Recovery Equipment and Visual/Optical Landing Aids Systems*.

The EAF subsystems include—

- Airfield surfacing.
- Aircraft arrestment.
- Airfield terminal guidance landing.
- Communications.
- Airfield lighting and marking.

Airfield Surfacing System

Airfield surfacing requires formal training and familiarization with equipment characteristics and design requirements (e.g., aircraft spacing, clearances, and fueling; airfield configurations; revetments; and ordnance safety arcs). The airfield surfacing system provides quick, responsive, and direct support to the ACE commander. MWSS's ability to provide airfield surfacing enhances ACE's scheme of maneuver. The airfield design and construction must be in accordance with NAVAIR certification requirements. Sixty-five percent of AM-2 matting installations involve planning aircraft parking, thus requiring first-hand knowledge of aviation intricacies (i.e., aircraft mix, characteristics, fueling requirements, and ordnance). See NAVAIR 51-60A-1, *Airfield Mat and Accessories*, and NAVAIR 00-80T-115, *Expeditionary Airfields Forward Operating Bases NATOPS Manual*, for AM-2 matting requirements.

Aircraft Arrestment System

The aircraft arrestment system is only found within the table of basic allowance (TBA) for the MWSS (FW). Applicable NAVAIRINSTs and Naval Air Training and Operating Procedures Standardization (NATOPS) dictate arrestment requirements for specific aircraft by type, model, and series after an airfield is established.

The expeditionary arresting gear is essential to the operation of EAF and enables the ACE to operate from host nation or captured airfields

that lack sufficient operating surface. Marine expeditionary aircraft arrestment systems provide high-cycle operations and the capability to recover U.S. tailhook-equipped aircraft. Emergency arrestment of disabled aircraft is critical to the forward basing concept. Use of expeditionary recovery equipment reduces the required minimum operational strip length for aircraft by providing arrestment for tailhook-equipped aircraft. Additionally, expeditionary recovery equipment provides overrun protection for aircraft during aborted takeoffs and during inclement weather or adverse runway surface conditions. Requirements are stated in NAVAIR 51-5EAA-2, *M21 Expeditionary Aircraft Recovery System*.

Airfield Terminal Guidance Landing Systems

The fresnel lens optical landing system (FLOLS) is an aviation-unique system that requires formal training to operate, NAVAIR compliance, and Marine Corps forces certification. This system ensures safe approach and landings, similar to aircraft carrier landing aids, by providing a predetermined glide slope and touchdown point for fixed-wing aircraft during day and night operations. The glide slope information is calibrated for an optimum touchdown point to facilitate safe arresting gear engagement.

Enhancement programs are managed by the Naval Air Warfare Center, Lakehurst, NJ (NAVAIR subsidiary). Aircraft terminal guidance requirements are stated in NAVAIR 51-40ABA-14, *Fresnel Lens Optical Landing System (FLOLS) MK 8.* Maintenance procedures are regulated by OPNAVINST 4790.2, *The Naval Aviation Maintenance Program (NAMP)*.

Communications

The EAF branch should have dedicated access to ultra high frequency (UHF), very high frequency (VHF), and high frequency (HF) radio assets to monitor aircraft activity during routine and emergency operations. In addition, EAF branch communicates with other elements operating aboard an FOB (i.e., airfield operations, fuels, military police, ARFF, medical, and air traffic control). Internal and external communications should be conducted through a single radio system

assigned to individual sections. Sections will be responsible for maintaining and programming their radio system.

The AN/PRC-139 portable hand-held radio system provides EAF services branch with an internal/external, multiprogrammable communication system critical to operating an FOB or conducting expeditionary arresting gear operations. These radios are the primary communication assets used to provide connectivity between various airfield service organizations. Because these radios are TBA items, they are not the direct responsibility of the squadron S-6; however, the S-6 will provide technical advice and account for these assets when planning.

Airfield Marking and Lighting Systems

The airfield marking and lighting system consists of three principal components that are phased into the operation. Refer to NAVAIR 51-40ABA-7, *Lighting and Marking Systems for Expeditionary Airfields*, NAVAIR 51-40ABA-18, *Lighting and Marking for EAF Bare-Based Airfields*, NAVAIR 51-40ACB-1, *Airfield Emergency Portable Marker Light Battery Powered Type 1*, and NAVAIR 51-40ACB-2, *Portable Light Set Heliport*, for further information regarding the airfield marking and lighting systems.

Field Marker Lights. The field marker lights (FML) provide lighting during the initial phase (0-24 hours) of the airfield lighting operation. FML are man-portable, battery-operated, radio remote-controlled lights that provide airfield marking and lighting at night and during inclement weather. These lights also possess an infrared (IR), night vision device (NVD) compatible capability.

Minimum Operating Strip Lighting System. The minimum operating strip lighting system (MOSLS) provides lighting during the intermediate phase (24-72 hours) of the airfield lighting operation. To mark and light FOB runway surfaces, the MOSLS provides night, inclement weather, and IR lighting capability.

EAF Hardwire Lighting System. This system provides lighting for the semi-permanent phase (72 hours and beyond) of the airfield lighting

operational categories. Unlike the FML and the MOSLS, the hard wire system only supports airfield marking and illumination at night and during inclement weather. It does not possess an IR capability.

Tactical Landing Zone

The EAF services branch possesses the capability to conduct expedient tactical landing zone (TLZ) site surveys, selection, and marking. This capability is critical when conducting FOB operations forward of main operating bases. The TLZ provides flexibility through expandability by allowing the KC-130 to air land resupply and rapid ground refuel forward operating units and provides the ACE with the ability to project aviation power forward and sustain operations. The proper execution of a TLZ site survey provides the commander with critical information regarding the potential TLZ sites (i.e., surface load bearing capabilities, LZ dimensions, safety zone, and expandability).

Although the MATC mobile team (MMT) of the MACG has the capability to conduct expedient TLZ site surveys and selection, only the MWSS possesses the equipment and training necessary within the MAW to conduct soil suitability testing of potential TLZ sites. The MWSS maintains equipment that can determine the shearing strength of soils, asphalt surfaces and sub-grades, as well as soil analysis equipment, which can determine the gradation, compression, and content of the soil.

Other Equipment

All-weather, air traffic control services necessary to support air operations are resident within the MACG. Refer to MCWP 3-25.8, *Marine Air Traffic Control Detachment Handbook*, regarding MATC employment at airfields and FOBs.

Aircraft Rescue and Fire Fighting

An aviation-unique capability found only in the MAW MWSG, ARFF provides immediate and responsive rescue and fire fighting for airfield

emergencies at an FOB. ARFF is the first response for airfield, aircraft, and medical emergencies.

ARFF personnel are trained and equipped to handle aircraft emergencies. They possess the requisite knowledge of aircraft and safety hazards associated with rescue procedures, and they provide structural fire protection and fire inspector functions for air base facilities. ARFF personnel are trained in the use of extrication equipment for government and civilian vehicle mishaps. ARFF personnel are school-trained, federally certified, emergency-services technicians. They are also trained in emergency first aid procedures, to include hazardous materials emergency response, containment, and cleanup.

Extrication of aircrew involved in an aircraft mishap requires specialized equipment that is maintained by the ARFF branch, whose personnel are fully trained and proficient in its use. Mishaps involving aircraft present unique safety circumstances including flammable liquids, ordnance, and ejection seats. ARFF personnel receive specialized training in structural fire protection and methods of extinguishment as part of their formal schooling. Additionally, they receive quarterly training in the use of extrication equipment (e.g., jaws of life, air bags, rescue saws). ARFF personnel are also capable of conducting crash and salvage operations associated with an aircraft mishap.

Tactical and geographical considerations, dispersal of aircraft, and availability of finite assets within ARFF units are some of the factors that dictate ARFF support capabilities. A thorough review of ARFF requirements should be conducted during the planning phase for any operation, deployment, exercise, or expeditionary type training evolution. The MAGTF commander is responsible for establishing ARFF requirements on a case-by-case basis. Table 2-1 identifies minimum response requirements for active FOBs and air base facilities.

Refer to NAVAIR 00-80R-14, *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14-1, *NATOPS U.S. Navy*

Table 2-1. Minimum ARFF Requirements.

FOB/Facility	Requirements
Main base	2,000 gal/1,000 gpm (2 x P-19 ARFF vehicle)
Air facility	1,000 gal/500 gpm (1 x P-19 ARFF vehicle)
Air site	(AV-8B operations recommend one twin-agent unit)
Air point	(No requirement unless otherwise specified within NATOPS)

Aircraft Emergency Rescue Information Manual, and NAVAIR 00-80R-20, *NATOPS U.S. Navy Aircraft Crash and Salvage Operations Manual (Ashore)*, for information regarding ARFF requirements and employment.

Aircraft and Ground Refueling

The ACE is responsible for bulk fuel support and daily management of bulk fuel for airfields and FARPs. The MWSS provides bulk fuel support to organizations within the boundary of the airfield, including support to other Services' aircraft if directed in the theater bulk fuel plan. Each MWSS possesses the personnel and equipment to fulfill this responsibility and maintains the capability to store and distribute large quantities of bulk fuel for the ACE.

The MWSS has the capability to fuel both fixed- and rotary-wing aircraft and to provide ground fueling to other ACE assets (i.e., mobile electric generators, tactical motor transport, field messing facilities, and AGS equipment). MACG, MALS, and Marine unmanned aerial vehicle squadrons possess tactical generators and motor transport assets without refueling capability.

MWSS can deliver fuel to aircraft while engines are not operational (cold refueling) or while they are operational (hot refueling). Naval Warfare Publication (NWP) 55-3-AH1, *AH-1 Tactical Manual*, Volume 1 (Rev. D) (NAVAIR 01-110HC-IT), and NAVAIR 00-80T-109, *Aircraft Refueling NATOPS Manual*, cover aviation ground refueling operations. These refueling operations can be conducted at established

airfields or at remote, austere FOB locations such as FARPs. This expeditionary fuel distribution capability provides flexibility to the ACE commander by allowing aircraft to refuel closer to the operational battle area thus increasing aircraft turnaround speed and extending the force's combat radius. MWSS aviation and ground fueling allows the commander to use speed and information to overcome mass. See chapter 7 and appendix A for details regarding FARP operations. TAFDS, HERS, M970 refueler trailer, and six containers together (SIXCON) modular system are MWSS's aviation and ground refueling assets.

The Tactical Airfield Fuel Dispensing Systems

The TAFDS is an aviation-specific system exclusively designed for aircraft. It consists of six 20,000-gallon collapsible tanks and can store up to 120,000 gallons of fuel. Experienced personnel can establish a TAFDS site within 48 hours.

MWSS (FW) possesses six complete TAFDS and can store the equivalent of 720,000 gallons of fuel at a time, which allows simultaneous refueling of 12 aircraft from 12 refueling points. MWSS (RW) rates 4 TAFDS for a total storage capacity of 480,000 gallons, which allows simultaneous refueling of 12 aircraft from 12 refueling points.

Helicopter Expedient Refueling System

The HERS is an aviation-specific system exclusively designed for aircraft refueling. The system carries eighteen 500-gallons pods for a storage capacity of 9,000 gallons. The MWSS (RW) rates seven HERS systems for a total storage capacity of 63,000 gallons, while the MWSS (FW) rates two HERS for a total storage capacity of 18,000 gallons. Experienced personnel can establish a HERS site within 4 hours. Because of its flexibility and mobility, it is ideally suited to support FARP operations.

M970 Refueler Trailer

Each MWSS rates 10 M970 refueler trailers for a total mobile storage and distribution capability of 50,000 gallons. The M970 can be used to either fuel or defuel aircraft. The M970 is well suited to support FOB operations over smooth terrain.

Six Containers Together Modular System

SIXCON modules are the principal assets used by the MWSS to meet the ACE's ground refueling requirements. SIXCON consists of five 900-gallon containers and one pump module per system. Each MWSS rates four SIXCONs to support the ACE ground refueling operations for a total storage capacity of 16,000 gallons. Because SIXCONs can be loaded on either 5-ton trucks or Logistics Vehicle Systems (LVSs), it is well suited for FARP operations over rough terrain.

Explosive Ordnance Disposal

The EOD mission contributes to the mobility of the MAGTF by providing access to terrain, installations, and facilities otherwise denied due to hazards from unexploded ordnance (UXO). EOD units neutralize the hazards associated with UXO that are beyond the capabilities of other specialties. EOD personnel provide ordnance technical intelligence and improvised explosive device (IED) response. The EOD mission is accomplished by detecting, identifying, rendering safe, recovering, evaluating, disassembling, and final disposition of conventional weapons, NBC weapons, and IEDs. EOD units possess the capability to perform their mission in every environment.

Each MWSS EOD section consists of two teams that provide EOD support to the designated MAG and direct support to the FOBs established by their parent command. The mission of MWSS EOD section includes, but is not limited to, five specific areas:

- BRAAT.
- Tactical recovery of aircraft and personnel.
- FARP.
- Aircraft recovery support.
- Force protection.

MWSS EOD teams, located within the airfield operations division, provide the ACE the capability to handle hazards associated with UXO. MWSS EOD task-organizes response detachments, consisting of a minimum of two Marines, to support ACE elements. The MWSS EOD team provides the ACE the capability to respond to hung weapons, stuck ammunition, and munitions jettisoned from an aircraft. At times, armed ordnance may be partially suspended from an aircraft or ammunition may jam within the aircraft's guns. The MWSS EOD teams also provide the ACE commander with the ability to promptly and safely clear area denial munitions during BRAAT operations.

Though MAW and force service support group (FSSG) EOD units are structured and equipped to perform EOD tasks, the roles in which the teams function are unique to each organization. EOD units in the FSSG focus primarily on ground ordnance and their methods of employment, while the MWSS EOD teams focus on aviation ordnance, explosive hazards, the aircraft associated with them. Because of the small number of specialized EOD personnel within the MAW to support the ACE, the teams may need to be augmented when the scheme of maneuver requires the use of multiple FARPs or during BRAAT operations. Refer to Fleet Marine Force Manual (FMFM) 13-8, *MAGTF Explosive Ordnance Disposal*, for further information regarding EOD employment and capabilities.

AIR BASE SUPPORT FUNCTIONS

Air base support functions are those activities necessary to establish and maintain air base operations, to include base camp operations. The air base support includes:

- Air base commandant functions.
- Internal airfield communications.
- Essential engineer services.

- Motor transport.
- Field messing facilities.
- Routine and emergency sick call and aviation medical functions.
- Organic and support unit personnel training.
- NBC defense.
- Security and law enforcement services.

Air Base Commandant

Because the MWSS provides the necessary functions and organization to plan, develop, improve, construct, maintain, and support the daily requirements of an airfield or FOB, the ACE commander normally designates the MWSS commanding officer or appointed representative to perform the role of the air base commandant. The air base commandant reports directly to the ACE commander in matters pertaining to air base planning and daily logistic requirements.

Planning

Under the air base commandant, the MWSS staff is responsible for designing the air base master plan (ABMP) for each FOB from which the ACE operates. The air base commandant will plan, develop, establish, and maintain the air base layout, to include the airfield layout and base camp design.

This planning and development requires extensive coordination with units that may be operating from the air base or FOB (e.g., ACE headquarters, squadrons, MACG, Marine wing communications squadron [MWCS], MALS, CSSE, naval construction forces [NCF], base defense operations center [BDOC], and other ABGD organizations).

When developing an ABMP, the air base commandant must consider the following:

- Ammunition supply point (ASP).
- TAFDS.
- Aircraft parking.
- Revetments.
- MATC and associated radar equipment.
- Air operations.
- ARFF.
- M-21 arresting gear.
- TACC.
- Billeting.
- Messing.
- Individual unit command centers.
- Communication facilities and networks.
- Power distribution.
- Water production and storage.
- Runway layout.
- Electrical power requirements.
- Road networks.
- Local airfield security.

In addition to the ABMP, the air base commandant coordinates the planning and development of BRAAT, NBC defense, and ABGD. This planning requires integration with low altitude air defense (LAAD) for air defense around the FOB and tenant aviation units that can provide close air support (CAS) and protective fires.

Logistic Requirements

The development and implementation of the ABMP requires the efficient use and application of the 14 AGS functions provided by the MWSS. After the FOB is established, the air base commandant is responsible for the following routine logistic tasks:

- Laundry.
- Showers.
- Trash collection.
- Field messing.
- Water production.
- Latrine servicing.
- Airfield shuttle service.
- Personnel augmentation.

Internal Airfield Communications

The dynamic nature of airfield operations necessitates dedicated and readily available communication support. While MACG provides the assets and coordination to support the ACE's external communications and command, control, and coordination requirements, MWSS provides assets and coordination to support the internal communications requirements at established airfields and FOBs. The communications

assets resident within the MWSS link ACE units and supporting agencies located at the airfield and FOBs.

The MWSS S-6 department has a variety of communications equipment ranging from HF, UHF, and VHF radios to telephone switchboards. MWSG communications responsibilities include:

- Tactical telephone service in and about the airfield, including tenant ACE units.
- Intra-airfield radio communications.
- Airfield security and ground transportation management.
- Communications between the airfield and its adjacent facilities, such as ASP and petroleum, oils, and lubricants (POL) sites.
- Wire systems installation, operations, and maintenance.
- LAN access for tenant ACE units and the resident MWSS sections.

Tactical Telephone Service

Operations may allow for the transition from radio to telephone to improve reliability and security; reduce cost; and access commercial and defense service networks. Tactical telephone service gives an ACE the capability to install LAN, WAN, and other data systems critical for sharing information between commands and activities. LAN connectivity is the most efficient method for rapid movement of information and is essential for dissemination of critical operational information.

To provide tactical telephone service outside of the airfield, MACG equipment and personnel are used to maintain a multichannel radio link to higher agencies and adjacent airfield communications elements. Defense Switched Network (DSN), SIPRNET, and NIPRNET access are pre-established through multichannel radio communications.

Airfield Security

Complex airfield defense and security operations require immediate organic radio and wire line communications to link various units and organizations. It is imperative that force protection and air base security communications are established and maintained between the BDOC and air base tenant units.

Activities that provide early warning, traffic control, and access control must be incorporated into the communications architecture of the air base to maintain integration and control of air base defense operations. These organizations may be fixed or mobile, thus requiring both radio and telephone communications. Chapter 4 details the organizations and functions of ABGD operations.

Ground Transportation

Radio communications are necessary to manage ground transportation around the airfield or FOB. The MWSS S-6 department provides the necessary radio and wire line communications for the AGSOC to coordinate transportation movements. This includes, but is not limited to—

- Convoys to and from FOBs sites such as FARPs.
- Ground movement of personnel and equipment in and around the airfield.
- Logistic support of the ACE, including resupply and the movement of ordnance.
- Mobile security patrols in and around the airfield.
- Aircraft mishap recovery.

Airfield and Adjacent Facilities

The MWSS is responsible for establishing and maintaining communications in and around the airfield or FOBs, including ACE units operating adjacent to the airfield or FOB. Because of the large footprint and hazardous nature of unit operations, some ACE units will locate outside

the airfield or air base area. The ACE ASP and the MWSS bulk fuel storage and water production sites are generally located away from the airfield or FOB. Because of this geographic separation, the support squadron should make a special effort to ensure these organizations are integrated into the ACE's communications architecture.

Essential Engineer Services

One of the key elements to ground service support is the engineer services provided by the engineer operations division. The MWSS engineer operations division is organized to provide the full range of general engineering support (less fuel) to designated ACE components. Figure 2-2 shows the engineer operations division's organization. Additional information regarding engineer support can be found in MCWP 3-17, *Engineering Operations*.

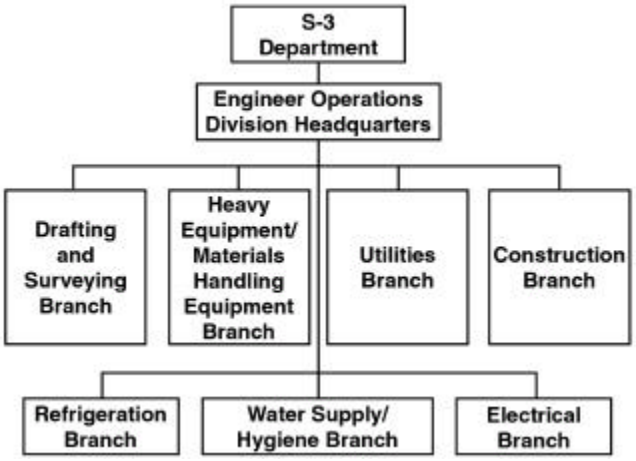


Figure 2-2. Engineer Operations Division.

The three main categories of engineer services provided by the engineer operations division are general engineering services, utilities, and material handling and heavy equipment services.

General Engineering Services

The engineer operations division provides a host of general engineering services necessary to support the ACE during operations. The following list includes tasks that the engineer operations division must provide per their T/O mission:

- Engineer reconnaissance and survey.
- Construction and maintenance of mission-essential base camp requirements, to include—
  - Revetments for TAFDS and HERS.
  - Temporary bunkers.
  - Temporary aircraft parking areas.
  - Strong-back framing for work and billeting tentage.
- Technical and equipment assistance for erection and construction of prefabricated shelters and K-Span structures.
- Development, improvement, and maintenance of airfield and air base drainage systems.
- Camouflage expertise, equipment, and assistance to support ACE camouflage requirements.
- Technical expertise in assessing bomb damage and providing the personnel and equipment necessary to perform RRR.
- Limited mine detection capability.
- Limited combat engineer services (e.g., countermobility, obstacles).
- Construction, improvement, and maintenance of vertical/takeoff and landing (VTOL) and vertical/short takeoff and landing (V/STOL) facilities, not to exceed 900 feet.

Utilities

The MWSS possesses a host of equipment to provide mobile electric power to ACE airfield, base camp, and satellite locations. To increase habitability during sustained operations, the MWSS is equipped to produce and store sufficient quantities of potable water to support the ACE and to provide for personal hygiene (showers and laundry). The engineer operations division also maintains the refrigeration units that can support the messing and medical needs at the air base. Although the T/O allows for separate branches for electrical, refrigeration, and water supply/hygiene, these branches work under and within the utilities branch.

Heavy Equipment and Materials Handling Equipment Services

The engineer operations division maintains the personnel and equipment necessary to repair, improve, and maintain existing roads within the ACE operating area; construct and maintain expedient roads; and meet the material handling equipment (MHE) needs of the ACE during deployment, buildup, and support operations. The division also has the equipment necessary to support base recovery and RRR. Because the MWSS possesses insufficient earth moving assets to accomplish large-scale runway repair or construction, it will require either reinforcement or augmentation from other engineer units from other MWSSs, the CSSE or the NCF.

When first deploying to an FOB or existing airfield, engineer operations division sends drafting and surveying branch personnel and engineers to the site to properly design and layout the base camp and air base area. Early physical reconnaissance can confirm the utility of landing sites that were proposed prior to the operation, as well as identify future upgrade and repair requirements. The information gathered can then be transposed into graphical representation through the use of computer-aided design (CAD) software. This information includes necessary utilities support, temporary shelters, and limited vertical and horizontal construction previously identified.

The MWSS is tasked mainly with expeditionary construction and is only required to maintain proficiency in constructing, improving, and maintaining V/STOL facilities not to exceed 900 feet. Any deliberate engineering support requirements that exceed the MWSS's capabilities would be assigned to the engineer element of the CSSE or the NCF supporting MAGTF operations.

These organizations possess the personnel, equipment, and expertise to perform the preponderance of deliberate engineering, which include:

- Planning and constructing base camps.
- Improving unpaved roads.
- Constructing airstrips in excess of 900 feet.
- Repairing and improving existing bare-base airfields.
- Constructing EAF-type facilities.
- Repairing heavy airfield damage.

Motor Transport

The MWSS motor transport (MT) operations division provides the ACE with intrabase MT support, while the CSSE provides interbase MT support. Because MAGs and their respective squadrons do not have organic MT assets on their table of equipment (T/E), the MWSS maintains the MT assets necessary to fulfill the MT needs for the supported MAG.

FOB buildup requires rapid planning and the use of MWSS equipment without competing with other MEF requirements for support. Daily movement of ordnance, personnel, supplies, and equipment at an air base is essential to ACE operations. MT operations division provides light-, medium-, and heavy-lift MT tailored to ACE requirements.

Numerous containers and shelters within each MAG and MACG require lift within air base confines and within close proximity of the air base. A large number of shelters exceed the cross-country capacity of a 5-ton truck and require LVS support. This need for organic lift is magnified when required to establish and sustain FARP sites. The ASP requires dedicated daily support to move ammunition from storage sites to where it can be built up and loaded on aircraft. In addition to providing MT vehicle support, the MWSS trains and licenses ACE personnel who use MWSS vehicles to meet their MT requirements.

Field Messing Facilities

MWSS possesses the ability to erect and operate a dining facility in a field environment. This ability serves to further enhance an air base's independence, mobility, and expeditionary nature. The capability to serve hot meals in the field and during irregular airfield working hours enhances the morale and quality of life of ACE personnel.

The MWSS field messing capability allows uninterrupted support of ACE operations. Because of logistical concerns associated with field messing functions, the field mess hall must be integrated with its parent and supporting agency during the deployment planning and preparation phases.

Medical Services

Each MWSS possesses an organic medical section to support the ACE. The MWSS medical support section comes equipped with sufficient medical equipment and supplies to establish a flight line aid station to provide medical care to one FOB and its tenant units. In addition to routine sick call, flight line aid stations provide aviation medicine, preventative medicine, laboratory, X-ray, and pharmacy services support.

Organic and Support Unit Personnel Training

The MWSS will normally be assigned the responsibilities for air base operations, air base commandant, ABGD, and BRAAT. The MWSS does not possess the personnel to perform these tasks. Each is manpower intensive and requires augmentation, cooperation, and participation from the entire ACE and other air base tenant units. Personnel assigned to the MWSS possess the technical knowledge and skills to perform and train augment personnel to accomplish required tasks. In addition to providing training to support critical activities, MWSS also trains and licenses ACE personnel in the operation of motor vehicles.

Nuclear, Biological, and Chemical Defense

The MWSS possesses an organic NBC defense capability as well as the preponderance of the equipment necessary to support and conduct NBC defense and decontamination operations for the ACE. Because NBC defense is a subfunction of BRAAT and a responsibility of the MWSS, the ACE will normally consolidate its NBC defense personnel and operations under the MWSS for management and execution. The senior ranking NBC technician, normally from the MAG, will supervise and coordinate NBC defense activities through the MWSS AGSOC. The MWSS must coordinate NBC defense activities with the other MWSS-supervised activities (i.e., BRAAT, RRR, airfield operations, air base operations, and air base defense operations).

A thorough and effective NBC defense plan requires extensive coordination and participation by ACE units. Marines must continuously train for NBC operations because of the severe environmental limitations. The ACE should schedule rehearsals and implement NBC defense into daily operations to accomplish the mission without creating additional casualties. Rapid and proper reaction to an NBC attack is critical for the ACE to remain effective. The MWSS NBC branch can assist in the coordination of the following ACE NBC defense activities.

Detailed Troop Decontamination

The detailed troop decontamination (DTD) team is formed from ACE squadron augments. DTD team members and MWSS NBC personnel must have a close relationship to ensure that proper training, supervision, and confidence are maintained. Personnel decontamination is the responsibility of the contaminated unit.

Detailed Equipment Decontamination

The detailed equipment decontamination (DED) team is formed from squadron members and MWSS NBC personnel. Team members must have a close relationship to ensure that proper training, supervision, and confidence are maintained. Equipment decontamination is the responsibility of the contaminated unit. Equipment, including aircraft, vehicles, weapons, and 782 gear, must be decontaminated properly to use it again.

Monitor/Survey

Essential to NBC defense, monitor/survey (M/S) teams maintain continuous monitoring of the area of operations (AO) for NBC attack. If contamination is a factor, team members reconnoiter alternate routes and potential areas to set up DTD and DED sites. M/S teams identify contaminated areas, calculate downwind hazards, alert and advise affected units, and compile and send the NBC 4 Report to the area control center team. Refer to chapter 6 for additional information on the M/S teams' role during RRR.

Security and Law Enforcement Services

The MWSS military police (MP) department provides security and law enforcement services to the ACE. The primary mission of the MWSS military police at the FOB is to provide flight line security and security to critical ACE activities. Additionally, the MP department will provide criminal investigation, traffic control, mobile security patrols, crowd control, and enemy prisoner of war handling. Representing the core of the ACE's ABGD, the MP department includes standing, mobile, and reaction forces. Because of their unique capabilities and

training, military police are ideally suited to train ABGD augments in the use of deadly force, small arms, and small unit defensive tactics.

The defense of an airfield includes both active and passive measures, as well as three-dimensional defense of aircraft ingress/egress routes and FARPs. Defensive measures require security force discipline to avoid collateral aircraft damage resulting from target engagement on the flight line.

A trained core unit of military police and thorough understanding of airfield defense are required to execute ABGD. Refer to chapter 4 for the role of the MP department during ABGD operations.

Flight Line and Critical Airfield Security Services

The MWSS MP department provides security for the flight line and other critical ACE facilities. MWSS MP members organize and train guard force, ABGD force, and rear area security platoon personnel from the MWSS and supported units in force protection, ground defense procedures, and weaponry. Because aircraft are considered high-value targets by the enemy, the flight line requires controlled access and heightened security.

Traffic Control/Enforcement, Convoy Escort, and Accident Investigation

The MWSS MP department is responsible for the control and enforcement of established traffic regulations in and around the airfield. The MP department is equipped with hard backed, high mobility multi-wheeled vehicles (i.e., M-1043 HMMWV) and automatic and crew-serve weapons to assist them in their security mission. Training, equipment, and experience enable the MWSS military police to provide security for ACE logistic convoys and FARP operations and to conduct ground accident investigations.

Straggler and Refugee Control

MWSS military police can erect and control temporary holding facilities for stragglers and refugees. However, prolonged commitment to straggler and refugee control degrades the military police's ability to

provide security for aviation units. Because of the high manpower requirements and increased security risks, stragglers and refugees should be quickly relocated to off-base collection points or other appropriate facilities.

Criminal Investigations, Physical Security Surveys, and Related Activities

MWSS MP criminal investigators provide timely response to reported crimes. Physical security surveys are essential in determining the security needed at operational aviation facilities. Since security and defense are continuous throughout an operation, the need for upgrading security measures by identifying vulnerabilities is dependent upon timely and continuous surveys performed by trained personnel. Upgrading security measures will ensure the commander has a strong security posture.

Base Camp Fire Protection and Prevention

At FOBs, the MWSS ARFF branch is normally responsible for minimum response requirements (i.e., ARFF and structural fire protection) for the ACE base camp, ASP, and other facilities within proximity of the main base or air facility, unless adequate HN capability is available. If HN firefighting support is used, the HN training, tactics, organization, and equipment must be thoroughly reviewed.

In addition to minimum response requirements to support aviation operations, one crash structural vehicle should be maintained in a fully manned condition to permit ready response to ACE base camp fire emergencies. Additional equipment above the minimum response should be planned for and provided to support the broad range of fire protection required at FOBs. An example of a fire protection plan is provided in appendix B.

Chapter 3. Airfield Operations at Forward Operating Bases

To provide timely aviation support, the ACE has the capability to operate from sea- or shore-based airfields. When conducting shore-based operations, the ACE should use existing facilities. If facilities are inadequate or nonexistent, construction forces of MWSS, engineer support battalion (ESBn) of the FSSG or NCF (Seabees) employ prefabricated material (expeditionary airfield matting) to complete FOBs.

FOBs increase responsiveness through basing flexibility and aircraft dispersal by decreasing distances to areas requiring support. The following methods of employing an FOB allow aircraft to operate ashore closer to the supported area:

- Occupying HN airfields if available and tactically acceptable (used during Operations Desert Shield and Desert Storm).

- Using abandoned or captured airfields that reduce construction and support equipment deployment requirements (employed during World War II and Operation Desert Storm).

- Using roads, highways or parking lots if existing airfields are not available in sufficient quantity or are unsuitably located. (During Operation Desert Shield, the Al Ghar airfield's parking lot was used as a landing area for rotary-wing aircraft to reduce crowding at Al Jubayl airfield).

- Constructing an EAF (used during Operations Desert Shield and Desert Storm).

An EAF is a construction concept. A type of FOB, an EAF is constructed using prefabricated materials and engineer construction support. The construction of an EAF may meet the FOB employment concept as dictated by the mission to be accomplished. The versatile EAF concept and materials can be used to support other FOB concepts

and expand an existing facility to meet MAGTF needs. Because of the extensive time, manpower, and equipment required to construct an EAF, it should be the last FOB employment method considered.

CLASSIFICATION

FOBs are classified in relation to their size, location, and characteristics in the form of airfield services, logistical supportability, and maintenance capability. Main air base, air facility, air site, and air point are the four FOB classifications from which the ACE will operate.

Main Air Base

A main air base is a secure airfield capable of supporting sustained operations ashore. The base handles aircraft up to and including C-5B and C-17. Task organization requirements determine support agencies and required facilities. At a minimum, the main air base includes an intermediate maintenance activity (IMA) support and full ground, logistic, and engineering functions required to support current and future needs.

Air Facility

An air facility is a secure airfield capable of supporting squadron-sized elements and associated organizational maintenance activities (OMAs). The facility sustains operations at a combat sortie rate and supports staging and replenishment of forward sites (e.g., FARPs). Normally, major maintenance functions are not performed at an air facility. An air facility stages aviation ordnance. Rough terrain-capable support equipment move and maintain aircraft and load ordnance. An air facility can be an airfield, road segment, matted runway (EAF) or clear, level ground.

Air Site

An air site is a secure location where aircraft preposition to reduce response time. The site is suitable for fully loaded and armed aircraft to land and await preplanned or immediate missions. Operations are normally limited to receiving and launching previously loaded aircraft. Fuel and ordnance can be staged at an air site, but the site does not receive routine logistic support and contains minimum personnel. Operational requirements determine air site capability. Upon completion of a mission, aircraft must return to either a main base or air facility for refueling, weapons loading, and maintenance.

Air Point

Air points are designed to support specific tactical missions at predetermined geographical locations. Air points are further broken down into FARPs or lager points.

Forward Arming and Refueling Point

FARPs are normally temporary, transitory facilities established for a specific mission and duration. Organized, equipped, and deployed by the ACE commander, a FARP is normally located closer to the tactical area of operation than the aviation unit's AGS area. A FARP permits combat aircraft to rapidly and simultaneously refuel and rearm. The objective at the FARP is to minimize response time and decrease turnaround time in support of combat operations. To reduce flight time, the FARP is located as close to the objective area or the forward line of own troops (FLOT) as the tactical situation allows.

FARP personnel providing support to the ACE include—

- Fuelers.
- Ordnance personnel.
- Plane captains.

- Site controllers.
- Communicators.

Aviation maintenance is generally restricted to minor repairs and adjustments performed by aircraft plane captains and crew chiefs. Normal equipment directly supporting FARP operations may include—

- Tactical bulk fuel systems.
- Ordnance loaders.
- Communications.
- Lighting.
- ARFF.

Lager Point

Lager points are secure locations at which aircraft rendezvous, marshal or position between missions. These points are also used while awaiting completion or activation of an assigned mission. Lager points can be isolated and independent or adjacent to airfields, air facilities, air sites or FARPs. Communications should be the only support required.

SUPPORT ORGANIZATIONS

FOB construction, maintenance, and repair support the effective employment of the ACE. Construction details include employment flexibility, responsiveness, and dispersal of aircraft assets to enhance survivability. The MAGTF uses a variety of engineer organizations to construct and maintain FOBs.

Engineer Operations Division, Marine Wing Support Squadron

The MWSS engineer operations division constructs and provides sustained support to FOBs, air points, and air sites. See chapter 2 for additional information regarding engineer services.

Engineer Support Battalion, Force Service Support Group

ESBn has a greater engineer capability than the MWSS. Specializing in expedient construction, the ESBn augments or reinforces the ACE's efforts to construct FOBs. See MCWP 3-17 for more information.

Naval Construction Force

Under MAGTF operational control, the NCF reinforces and augments the MAGTF's general engineering capabilities and provides civil engineering construction. The NCF constructs and maintains main air bases and air facilities, including RRR. NCF construction is preferred over ESBn construction of main air bases, air facilities, and EAFs. Tactical orientation, personnel, and equipment requirements make NCF support less feasible at air sites and air points. See MCWP 4-11.5, *Seabee Operations in the MAGTF*, for more information.

Chapter 4. Air Base Ground Defense

ABGD is an ACE term, synonymous with rear area security (RAS), which defines base security operations at an airfield or FOB. ABGD encompasses the application of RAS as defined in MCWP 3-41.1, *Rear Area Operations*, Joint Publication (JP) 3-10, *Joint Doctrine for Rear Area Operations*, and JP 3-10.1, *Joint Tactics, Techniques, and Procedures (JTTP) for Base Defense*. The MAGTF rear area is that area extending rearward from the rear boundary of the GCE to the MAGTF rear boundary.

A major disruption in logistic and support functions in the MAGTF's rear areas will adversely affect combat operations. Units must defend themselves in rear areas, but if they are unable to do so, the MAGTF will move combat forces from the forward edge of battle to the rear. Moving forces to the rear will reduce the MAGTF combat strength.

Expeditionary maneuver warfare concepts such as operational maneuver from the sea, ship-to-objective maneuver, and sea-based logistics define operations that reduce the total forces ashore and require the MAGTF and its supporting agencies to operate primarily from sea-based platforms. These concepts will reduce many of the present RAS concerns; however, there will always be a requirement for RAS if substantial Marine Forces move ashore, especially if the ACE transitions from sea-based to shore-based operations.

FUNDAMENTALS

Although the MAGTF commander has overall responsibility for RAS, the first fundamental of RAS is individual responsibility. The MAGTF commander will normally divide the RAS area of responsibility into smaller areas and assign them to subordinate commanders. The ACE commander is normally assigned the responsibility of providing the security measures for the air base(s) from which the ACE is operating.

The second fundamental of RAS is unit responsibility. When executing RAS or unit defense, unit commanders can take the following active and passive measures:

- Active measures—
  - Training units in antiarmor and air defense.
  - Organizing units for defensive operations.
  - Equipping support and augment personnel with weapons and munitions.
  - Conducting security patrols and using aerial reconnaissance.
  - Using observation and listing posts.
  - Providing traffic and access control to vulnerable facilities and activities.
  - Providing security to convoys.
  - Positioning LAAD units in depth within objective area.
  - Integrating CAS and close fire support.
  - Establishing defensive positions and obstacles.
- Passive measures—
  - Camouflaging, dispersing, and using natural cover.
  - Establishing redundancy in critical facilities.
  - Hardening installations.

- Using deception measures.
- Establishing dummy installations and positions.

The third RAS fundamental is that GCE assets should be tasked with security missions in the MAGTF rear area only in emergencies and to the minimum extent.

The fourth fundamental is that security measures are proportionate to the threat. RAS measures should be sufficient to handle the threat while diminishing the impact of support units in performing their primary missions.

THREAT

Enemy forces will attempt to disrupt rear areas to reduce CSS to the main battle. CSS facilities, air bases, lines of communications (LOC), and operations centers are considered high priority targets for the enemy in the MAGTF's rear area. The enemy will try to—

- Disrupt MAGTF combat operations by forcing MAGTF commanders to use combat forces to stabilize their rear area.
- Force CSS and AGS units to maintain a high security posture thus degrading their capability to perform their primary functions.
- Cause the MAGTF loss of equipment, mobility, and ability to resupply.

Levels

Commanders must consider the enemy force's capabilities and potential impact on operations. During ACE operations, ABGD planners need to pay close attention to enemy threat organization, equipment, and potential damage to air bases and aviation operations. JP 3-10

divides the enemy threat into three levels, which commanders should use while planning and developing base security measures.

Level I

Unit, base, and base cluster self-defense measures are used to handle Level I threats. Examples of Level I threats include—

- Enemy-controlled agents.
- Enemy sympathizers.
- Terrorism.
- Demonstrations and riots.

Level II

These threats exceed the capabilities of local self-defense measures and require the employment of response forces. Local self-defense measures must be able to contain the threat until response forces arrive. Examples of Level II threats include—

- Small tactical units.
- Unconventional warfare forces.
- Guerrillas.

Level III

These threats exceed local security measures and response force's capabilities and may require timely commitment of GCE tactical combat forces. (The ACE is incapable of handling Level III threats.) Level III threats consist of large tactical force operations (e.g., airborne, helicopterborne, amphibious, infiltration) and major air operations.

Conditions

The base commander sets the threat conditions (THREATCONs) based on the increased likelihood of attack. Refer to JP 3-10.1 and JP 3-07.2, *Joint Tactics, Techniques, and Procedures (JTTP) for Antiterrorism*, for further information regarding THREATCON descriptions, measures, and required actions. The four THREATCONS above NORMAL are—

- ALPHA.
- BRAVO.
- CHARLIE.
- DELTA.

PLANNING

RAS planning starts at the theater CINC or joint force commander (JFC) level. The CINC or JFC assigns responsibilities for joint rear area (JRA) security to subordinate component commanders, such as the MAGTF commander. Efficient JRA security planning and execution requires effective and timely command and control. To plan and execute efficient JRA security, the MAGTF commander must—

- Ensure effective and timely command and control.
- Define the roles and responsibilities of each subordinate element within the MAGTF's RAS plan.
- Identify the AO.
- Designate the MAGTF's RAS coordinator (RASC).

- Assign security responsibilities for—
  - CSS and ACE facilities along main supply routes and LOC at remote sites located away from major CSS or ACE facilities.
  - Air defense and fire support systems.
  - Other specific security responsibilities.

Once the MAGTF commander has identified the ACE's responsibilities, the ACE commander can develop the area security measures. Depending on the tactical distribution of ACE forces, the ACE commander may be responsible for several areas or bases.

The MWSS at an air base or FOB is typically assigned the mission of planning and executing security measures for that site. The MWSS should incorporate every asset at its disposal when developing the ABGD plan. These assets include the use and integration of air base tenant units, general fire support agencies, ACE air defense agencies, CAS, and available intelligence agencies within the ACE, MAGTF, and theater. The MWSS is responsible for planning, executing, and supervising ABGD operations for the ACE or air base commander, to include ensuring active and passive security measures can be implemented in a timely manner. Although the MWSS may develop the ABGD plan, the ACE commander or air base commander is the approving authority for the plan. ABGD security measures must be coordinated with the next senior JRA control agency.

ABGD planners should anticipate the likely enemy action based on current threat assessments and build their security measures appropriately. Through thorough planning, coordination, and control, ABGD planners can develop a strong rear area defensive posture that will limit the enemy's ability to disrupt ACE and airfield operations. The ultimate goal of RAS and ABGD planning is to develop a defense architecture that will locate, fix, and destroy the enemy in rear areas before the enemy can disrupt MAGTF operations.

Refer to JP 3-10, JP 3-10.1, and MCWP 3-41.1 for further information regarding JRA security and RAS planning. Appendix C contains a checklist for RAS and ABGD planning.

COMMAND AND CONTROL

At the JFC level, JRA security measures are coordinated and maintained by the joint rear area coordinator through the joint rear tactical operations center (JRTOC). The JRTOC is the senior JRA command and control agency. Subordinate component commanders must coordinate their security measures with the JRTOC.

Marine Air-Ground Task Force

JRA security measures at the MAGTF level are coordinated and maintained by the RASC through the rear area operations center (RAOC). The RASC has RAS coordinating authority over subordinate elements of the MAGTF. The RASC will assign a tactical security officer (TSO) to supervise security operations within the RAOC. Unit commanders assigned an AO or base within the MAGTF's AO will assign a TSO and establish a security operations centers for their respective areas. The RAOC assists the RASC in coordinating RAS operations with the other subordinate operations centers to ensure effective and timely command and control throughout the MAGTF's rear area. In addition to organic personnel staffing, the RAOC may include a fire support coordinator, an air liaison officer, and an NBC representative.

The MAGTF commander could assign the responsibility of RASC to the CSSE commander. In this scenario, the RASC will either establish the RAOC in or adjacent to the CSSOC. The TSO and manning for the RAOC normally comes from the FSSG G-2 and G-3. The FSSG G-3 tactical readiness and training section has infantry officers within its structure ideally suited to perform these tasks. In the event that the CSSE and the ACE are collocated, the CSSE will normally serve as the RASC. The CSSE is usually best equipped and staffed to manage the RAS mission.

Aviation Combat Element

The MAGTF commander normally assigns the security responsibilities of the air bases and FOBs to the ACE commander, especially if the ACE is geographically separated from the GCE and CSSE. When two or more air bases are functioning individually, the ACE commander usually assigns MWSS commanders as the TSO for their respective air base. When two or more MWSSs are collocated at a single air base, the MWSG commander will designate one MWSS commander as the TSO while the other MWSS commander provides augmentation to support security operations. In both of these scenarios, the MWSS commander assigned as the TSO will establish a BDOC either within or adjacent to the AGSOC.

BDOC manning normally comes from the MWSS structure. The squadron gunnery sergeant, an infantry staff noncommissioned officer, should assist in managing the BDOC and ABGD operations. With an infantry background, the squadron gunnery sergeant is ideally suited to assist the TSO in planning, coordinating, and executing the ABGD plan. Refer to JP 3-10, JP 3-10.1, and MCWP 3-41.1 for additional information regarding RAS and base defense command and control.

ORGANIZATION

Organization of ABGD is situationally dependent and should incorporate the fundamentals of JRA security and MAGTF RAS. The ACE should have sufficient ground defense to provide the appropriate response to threat Levels I and II with limited reliance on GCE assistance or other outside augmentation. ACE ABGD requires GCE augmentation in Level III threat situations.

ABGD forces should include standing, mobile, and response forces to ensure round-the-clock force protection and unimpeded aviation operations. The organization of ABGD should be proportional to the threat while limiting the impact on the ACE's ability to provide the six functions of Marine aviation to support the MAGTF. See figure 4-1.

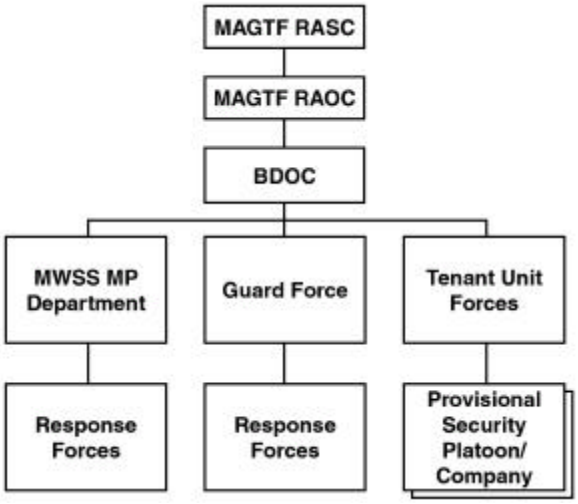


Figure 4-1. ABGD Organization.

Base Defense Operations Center

The BDOC is the nucleus for the ACE rear area defense. The BDOC provides the management, tasking, and supervision for the ACE's ABGD forces and operations. The ACE commander is ultimately responsible for ABGD but normally delegates that authority to the MWSS commander.

Through the squadron AGSOC, the MWSS commander controls and supervises the operation of the BDOC. Although the MWSS S-3 operations officer will supervise operations assigned to the squadron, the MWSS commander will assign another officer, normally the MP department officer in charge (OIC), to oversee ABGD operations.

The BDOC will consist of the security/ABGD OIC, the security/ABGD staff noncommissioned OIC, S-2, and the senior supervisor for each subordinate security and guard force within the organization.

The BDOC's responsibilities include, but are not limited to, the following functions:

- Planning, coordinating, and controlling ABGD within the ACE's assigned AO or base.
- Planning and coordinating ground fire and CAS with other agencies to support ABGD.
- Integrating ground base antiair defense (LAAD) into ABGD.
- Coordinating and assigning ABGD responsibilities with other air base tenant units.
- Coordinating and supervising the activities of ABGD agencies.
- Coordinating ABGD operations with higher agencies (e.g., air base commander, RASC, senior RAOC).
- Monitoring unit movement and facility positions within the ACE AO.
- Monitoring current threat assessment within the ACE AO.
- Identifying security augmentation requirements beyond ACE capability to the RASC.
- Organizing and training organic and augment personnel to perform ABGD.
- Establishing and maintaining communications with ABGD organizations.
- Providing sufficient forces to meet the three levels of RAS threat response.

Military Police Department

During combat operations, the MP department maintains its T/O structure and usually forms the nucleus for ABGD and security operations. The MP department is typically responsible for providing—

- Flight line security.
- Traffic control.
- Law enforcement.
- Mobile security patrols.
- Response forces as required during ABGD.
- Training other security forces in—
  - Weapons.
  - Procedures.
  - Organization.
  - Communications.
  - Rules of engagement.
  - Use of deadly force.

The MWSS MP department will coordinate its operations with other MAGTF MP forces to ensure proper integration. The MWSS MP department provides the air base with a standing force to defend against the enemy until response forces arrive to handle Level II threats. The BDOC can employ the MP department in some capacity to react to the three levels of threat.

Guard Forces

Interior guard forces, also known as camp guard, are formed from an augment pool of personnel from the air base's tenant units. The size of this force is situationally dependent on security requirements and the watch schedule required.

The guard force provides standing security for critical ACE facilities and areas. The force's responsibilities include, but are not limited to—

- Providing security to the—
  - ACE TACC.
  - Other critical command posts.
  - ACE armory compound.
  - Air base roving patrols.
  - ASP.
- Manning sentinel posts around the air base.
- Providing personnel to respond as required to meet the threat.

Guard forces usually fall under the control of the guard chief, who is the senior staff noncommissioned officer from the guard force pool. The guard chief supervises the execution, training, and schedule for the guard force. Located within BDOC, the guard chief is subordinate to the security/ABGD OIC. The guard force must rely on assistance from response forces to handle Level II threats. The BDOC can employ the guard force to respond to the three levels of threat.

Tenant Unit Forces

As the level of enemy threat increases, the ACE commander may require all or parts of each tenant organization to support ABGD. During Level III threats, tenant units will secure and defend a previously

identified sector within the ABGD until GCE forces arrive. Tenant units will fall under the control of the TSO and BDOC. These units' specific organization, responsibilities, and level of response are assigned in the ABGD plan.

Response Forces

Response forces are those forces purposely standing by to quickly respond to emergencies and increased threat posture beyond the capabilities of the dedicated security forces. The response force is the principal force the BDOC will use to respond to a Level II threat, but the BDOC may employ it to respond to a Level III threat until other forces arrive. Normally, MP and guard force shifts in the rest phase of their post-standing schedule are specifically assigned the responsibility of response duty. A typical MP or guard force watch rotation is 6 to 8 hours on post, 6 to 8 hours on response duty, and the remaining time off duty.

Provisional Security Forces

The RASC may assign the ACE to provide personnel and equipment to either augment or form provisional security forces. These forces consist of provisional mobile security platoons and helicopter security forces formed from augment personnel of various units. MCWP 3-41.1 covers the organization, responsibilities, and employment of these provisional security forces.

Host-Nation Support

Friendly HNs may provide invaluable civil and military assistance to U.S. forces throughout the operational continuum. This assistance can significantly contribute to support of the joint force and security of the JRA. The HN may provide a range of security forces from local police forces to military organizations. HN support may be incorporated into security planning and operations. Refer to JP 3-10 for more information regarding HN support and JRA security.

Chapter 5. Base Recovery After Attack

BRAAT activities center on restoring an installation's mission capabilities after an enemy attack. The airfield commander will activate the air base's BRAAT plan. During BRAAT, the MWSS AGSOC is responsible to the ACE for base recovery and base support activities. The MWSS will be required to operate emergency power generators and provide other essential services to keep vital facilities and utilities in operation. Initial actions include—

- Damage assessment of the airfield and facilities.
- Minimum operating strip (MOS) selection.
- Search and rescue.
- Medical actions.
- EOD.
- Debris cleanup.
- Isolation of damaged utilities.
- Fire fighting.
- NBC contamination monitoring.

Because substantial damage is expected following an attack, the ACE must repair damage quickly to be capable of supporting aircraft launch and recovery operations. To ensure this task is accomplished, the BRAAT process has been broken down into the following elements:

- Command and control of BRAAT operations.
- BRAAT planning.

- Airfield damage assessment.
- UXO.
- MOS selection and layout.
- RRR employment.
- Aircraft arresting gear systems.
- MOS marking and lighting.
- Airfield lighting.

ORGANIZATION

BRAAT effectiveness is a direct result of centralized control and decentralized execution of specialized elements.

Aviation Ground Support Operations Center

As the nucleus for BRAAT operations, the MWSS AGSOC is responsible for collecting, analyzing, prioritizing, and reporting information pertaining to the status of the air base. See figure 5-1. As the focal point for the air base's recovery efforts, the AGSOC—

- Develops the airfield commander's recovery plan with repair priorities.
- Directs the recovery activities after the commander approves the recovery strategy and monitors the recovery progress.
- Directs the activities of the damage assessment teams (DATs), damage assessment and response teams (DARTs), ARFF, EOD, NBC defense and decontamination teams, roving controller, and RRR OIC.

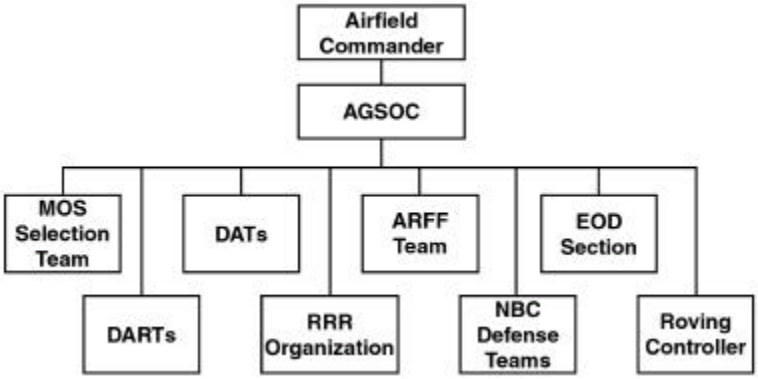


Figure 5-1. BRAAT Organization.

Damage Assessment Teams

DATs are responsible for reconnoitering and surveying the airfield for damage such as craters, spalls, and UXOs on the runway, taxiway, and other facilities that directly support aircraft operations. The DATs report airfield damage directly to the AGSOC. Normally, four teams are required for a main air base and two teams are required for an air facility. The number of teams should be based on the number of runways and airfield operating surfaces that need to be maintained. Often, the more DATs that can be fielded, the quicker battle damage can be determined and the airfield recovered. To shorten airfield restoration time, runway damage assessment and UXO assessment can be done simultaneously.

The DAT is organized to conduct ground assessment of UXO locations and bomb damage. These assessments are conducted on foot or from hardened vehicles. DATs record airfield damage on the DAT record sheet and report the information to the MOS selection team using the NATO Pavement Reference Marking System. See appendix D for sample BRAAT worksheets. A DAT normally consists of—

- Team leader.

- Two EOD technicians (or one EOD technician and one trained explosive ordnance reconnaissance agent [EOR]).
- Radio operator/driver.
- Spall damage assessor (military occupational specialty 7011).
- Two crater damage assessors (military occupational specialty 1371).

Damage Assessment and Response Teams

DARTs assess damage to designated critical facilities, report the presence of UXO, and isolate utility disruptions. Three teams are normally sufficient for a main air base. The number and personnel skill mix vary in a DART, permitting each DART to perform damage assessment on a variety of systems. Personnel chosen should have technical expertise appropriate to the type damage to be assessed (electrical, mechanical or structural). The following is a recommended priority list for damage inspection:

- Command posts and control facilities directly related to combat flying squadrons.
- Communications facilities.
- POL and munitions facilities.
- Fire stations.
- Medical facilities.
- Utility plants and distribution stations.

Minimum Operating Strip Selection Team

After an airfield has been attacked, the MOS selection team is established in the AGSOC to receive airfield damage reports from the DATs and to determine the usable areas of the airfield for aircraft launch and recovery. The MOS selection team normally consists of—

- Team leader who—
  - Performs the quality control of the MOS selection process.
  - Calculates the estimated repair time required to repair the runway and access routes.
  - Recommends the MOS location to higher authority.
- Data recorder who receives coordinates of airfield damage and UXO from the DAT and records this information on an MOS selection team record sheet. (Appendix D contains sample MOS selection worksheets.)
- Data plotter who takes the information from the data recorder and plots the airfield damage and UXO locations on the airfield map (scale: 1 inch equal to 100 feet) located in the AGSOC.
- MOS selector who identifies potential MOS with access routes by using templates that should correspond to the type of aircraft operating at the airfield and their MOS requirements.

Collected information is presented to the team leader who calculates the time required to repair craters and spalls and to remove or render safe any UXOs located on the MOS. Once the MOS has been selected and approved by the air base commander, the repair information is passed to the RRR OIC who organizes teams to accomplish the physical repair effort.

Aircraft Rescue and Firefighting Team

The ARFF team is responsible for critical airfield firefighting requirements, to include structural fire fighting. ARFF personnel are also used for search and rescue operations. These personnel are trained in first aid and are equipped with first aid kits, litters, blankets, and tools.

Explosive Ordnance Disposal Section

MWSS EOD section is responsible for accurately identifying and classifying UXO, performing render safe procedures on selected ordnance, and overseeing the activities of others in a hazardous UXO environment. The senior MWSS EOD technician will locate in the AGSOC.

Nuclear, Biological and Chemical Defense Team

NBC defense teams are responsible for the operation of the airfield NBC survey teams, plotting NBC contamination, and advising the AGSOC on NBC hazards and recommending the appropriate MOPP level for the conditions.

Roving Controller

The roving controller reports the status of the recovery activities to the AGSOC. During BRAAT operations, the roving controller is the mobile eyes and ears for the AGSOC.

Rapid Runway Repair Organization

The AGSOC forwards the airfield recovery plan, depicting the MOS requiring immediate repair, to the RRR OIC. The RRR OIC, typically the engineer operations division OIC, directs the horizontal construction engineering operation and field operations of the crater, support, and hauling crews. RRR organization, planning considerations, airfield threat, and damage categories are discussed in chapter 6.

COMMUNICATIONS

Communication is the most vital part of an efficient BRAAT operation. Table 5-1 shows recommended BRAAT communication architecture.

Table 5-1. BRAAT Communication Architecture.

BRAAT Unit Nets	MWSS Command	ABGD Command	BRAAT Command	RRR Command	RRR Coordination
AGSOC	P	P	P		
DATs			P		
DARTs			P		
ARFF team	P		M		
EOD section	P		M		
NBC defense teams	P	M	M		
Roving controller			P		
RRR OIC			P	P	
Crater crew chief				P	CC NET
Crater repair crews					CC NET
FOD cover crews					CC NET
Support crew chief				P	SPT NET
Crater support crew					SPT NET
MT detachment					SPT NET
Maintenance detachment					SPT NET
Fuels detachment					SPT NET
Spall repair crews					SPT NET
Aircraft recovery crew					SPT NET
Clearing/sweeping crew					SPT NET
MOS lighting/marking crew					SPT NET
M21 arresting gear crew					SPT NET
Hauling crew chief				P	HAUL NET
Hauling crew					HAUL NET
P = primary coordination M = monitor			CC NET = crater crew network SPT NET = support network HAUL NET = hauling crew network		
If possible, each sub-RRR agency should have its own internal network to coordinate its activities.					

Requirements

To maximize limited communication resources, the requirements of each BRAAT section must be fully understood.

Aviation Ground Support Operations Center

The AGSOC must be able to communicate with its subordinate agencies during BRAAT. Initially, DATs and DARTs have the highest priority for communications. Based on damage reports from the DATs and DARTs, the AGSOC develops the airfield recovery plan for the airfield commander. Once approved, the plan is passed to the following organizations for implementation:

- RRR organization.
- ARFF team.
- EOD section.
- NBC defense teams.
- Roving controller.

Rapid Runway Repair Organization

The RRR OIC must have communications with the AGSOC to receive the airfield recovery plan showing the selected MOS requiring immediate repair. In addition, the RRR OIC receives problem area information from the roving controller. The RRR OIC directs the airfield recovery process through the RRR organization. To facilitate efficient recovery operations, the RRR OIC must have adequate communications with RRR crews.

Aircraft Rescue and Firefighting Team

The ARFF team receives airfield recovery directions from the AGSOC. ARFF directs its firefighting and rescue teams to put out fires on parked aircraft, hangars, and other air base structures.

Explosive Ordnance Disposal Section

MWSS EOD section receives the airfield recovery plan from the AGSOC after completion of the DAT and DART missions. The senior MWSS EOD technician assigned to the AGSOC directs the MWSS EOD teams to the priority areas requiring UXO removal.

Nuclear, Biological and Chemical Defense Teams

NBC defense teams receive direction from the AGSOC. Normally, the ACE NBC officer is assigned to the TACC and coordinates NBC defense through the AGSOC.

Roving Controller

The roving controller reports on the progress of repairs and alerts the commander of developing problems. In addition, the roving controller reports material shortfalls and equipment problems to the RRR OIC.

Methods

The BRAAT communications plan must be developed before BRAAT employment. Telephone, radio/field telephone, messenger, and a combination of methods are BRAAT communications options.

Telephone

The first communication method choice is the base organic telephone network, which may be damaged during enemy attack.

Radio/Field Telephone

Radios or field telephone systems may be the only choice in an FOB without an established telephone network. Advantages to radios are their portability and number of frequencies. Field telephones may require too much time to install, which can hamper the repair effort.

Messenger

A messenger may be used to pass information from location to location. This method becomes personnel intensive, time consuming, and may lead to late or poorly passed information.

Combination

The primary communication plan for BRAAT should include a combination of methods and incorporate remaining alternatives as backup options. A backup plan will save time and confusion in the event that one of the communication methods is not available.

Chapter 6. Rapid Runway Repair Operations

RRR is an integral part of the BRAAT operations outlined in chapter 5. A type of large-scale, horizontal construction engineering operation, RRR is conducted on short notice but without the aid of construction drawings or standardized plans. After an enemy attack, the ACE must repair damage quickly to support aircraft launch and recovery operations. The ACE can expect to repair—

- Airfield surfaces (i.e., runways, taxiways, and parking aprons).
- Permanent structures.
- Communications facilities.
- Utilities (i.e., commercial and expeditionary).
- Base camp areas.
- Airfield support areas (e.g., ordnance, fuels, maintenance).

PLANNING

Actual repairs and damage estimates will be based on the threat munitions used during the attack and categories of damage. The goal of RRR planning is to be ready for the worst-case scenario. RRR planning is normally based on historical data to determine specific needs for a particular air base. The S-2 can provide the MWSS with additional information regarding threat munitions damage capabilities to assist in RRR planning.

Threat Munitions

Threats to an air base come from the following surface-to-surface and air-to-surface delivered ordnance:

- Conventional general-purpose bombs.

- Runway cratering munitions.
- Mines.
- Antipersonnel submunitions.
- Missiles.
- Area denial munitions, (e.g., chemical and biological, naval gunfire, artillery, mortars).

The airfield may also be covered with large quantities of UXO, which vary in size and type and can significantly hinder BRAAT operations. The UXO must be identified and removed or rendered safe as quickly as possible if BRAAT and RRR are to be successful. The MWSS EOD personnel, as part of the DAT and DART teams, will be responsible for locating and clearing UXO after attack. EOR agents may augment the EOD team in locating UXOs per Joint Army Regulation 415-30/Air Force Regulation 93-10, *Troop Construction and Engineering Support of the Air Force Overseas*.

Categories of Damage

Threat munitions used to attack an airfield can create various forms of damage, which are classified into four categories. Appendix D contains graphic depictions of the following categories of damage.

Spalls and Scabs

Spalls and scabs are craters less than 5 feet in diameter that do not penetrate the runway base course and subgrade. This type of damage is generally caused by—

- Small bombs with air burst fuses.
- Small-caliber artillery fire.
- Small rocket fire.

- Other small-caliber, contact-fused munitions.

Small Craters

Less than 20 feet in diameter, small craters penetrate the pavement, base course, and possibly the subgrade of the runway, but may not cause pavement upheaval. Small craters usually are caused by—

- Small bombs weighing less than 500 pounds.
- Specially designed bomblets.
- High-angle, medium-caliber naval gunfire with time-delay fuses.
- Large rocket fire.

Large Craters

These craters are 20 feet or more in diameter. Large craters penetrate the pavement, base course, and subgrade of the runway and always cause pavement upheaval. Large craters are caused by high-angle, large-caliber naval gunfire with time-delay fuses and medium to large bombs weighing 500 or more pounds.

Camouflets

Camouflets are deep, small diameter craters, which are normally caused by large penetration-type projectiles with time-delay fuses.

Considerations

An increase in the diversity and lethality of the threat's air- and surface-launched weapons requires planning for RRR materials, procedures, and techniques to recover bomb-damaged runways and taxiways. RRR requirements are usually identified early in the BRAAT planning cycle to ensure personnel are trained and familiar with their duties following an attack. See the RRR Personnel and Equipment Requirements in appendix D. Planners must consider the requirements for and availability of personnel, equipment, and repair materials when developing an RRR organization plan.

Personnel

The ACE and MWSS will assign personnel to fill specific billets within the RRR organization. Under ideal situations, there should be one repair crew and one foreign object damage (FOD) cover crew for every crater that must be repaired. Units will normally supply the manpower their T/O allows. Other supported units on the airfield may be required to fill billets in the RRR organization.

Equipment

After personnel requirements and availability have been determined, the MWSS will determine equipment availability for RRR by using the Equipment Availability Matrix in appendix D.

Repair Materials

RRR repair materials include fill materials, FOD cover, spall repair materials, and other materials necessary for crater repairs. Based on the construction of the existing airfield, environmental factors, material availability, and FOD cover being used, RRR planners will ensure adequate quantities of repair material are ordered or on-hand to make the necessary repairs following an attack. The Material Availability Matrix, provided in appendix D, will assist in tracking and recording necessary quantities. Refer to U.S. Army Training Circular 5-340, *Air Base Damage Repair (Pavement Repair)*, and the *Navy/Marine Corps Runway Crater Repair Handbook*, which detail the procedures used for crater and spall repair and for FOD cover applications.

ORGANIZATION

The RRR is organized to rapidly repair airfield operating strips (figure 6-1). The AGSOC forwards the airfield recovery plan, depicting the MOS requiring immediate repair, to the RRR OIC. The RRR OIC is responsible for directing the field operations of the crater, support, and hauling crews during repair operations. In addition, the RRR OIC receives problem area information from the roving controller.

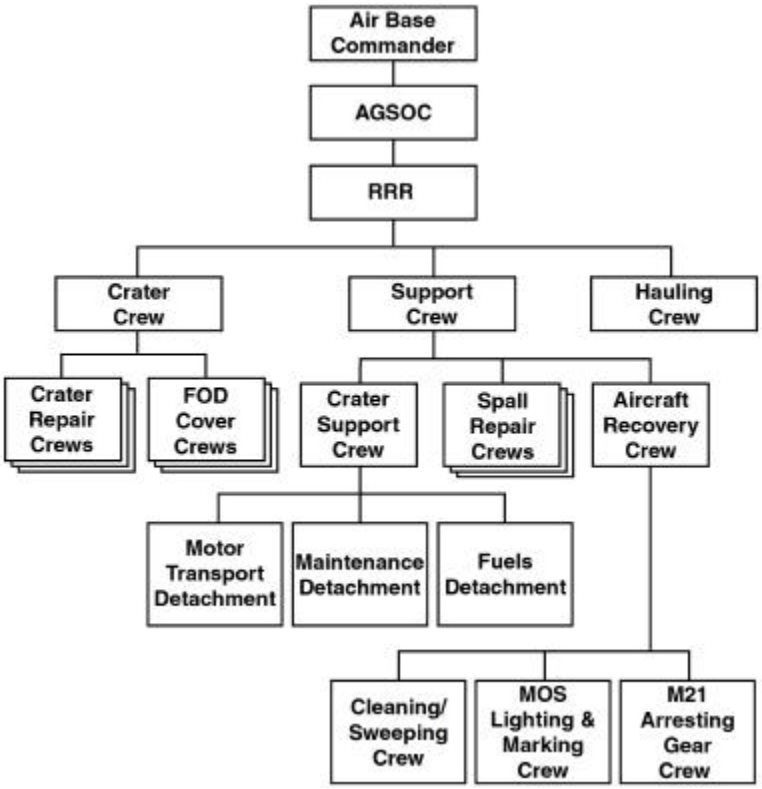


Figure 6-1. RRR Organization.

Crater Crew

The crater crew chief, typically an engineer, supervises and directs the actions of the crater repair crews and the FOD cover crews. The crater crew chief coordinates equipment in the field and ensures crater repairs are done correctly.

Crater Repair Crews

The crater repair crews are responsible for removing debris and ejecta from around the craters. The crews are also responsible for backfilling the craters in preparation for the installation of an FOD cover. The

number of crater repair crews depends on the availability of personnel and equipment at the airfield.

Foreign Object Damage Cover Crews

FOD cover crews are responsible for installing the operating surface over a crater repair. The number of FOD cover crews depends on the availability of personnel, equipment, and FOD cover material.

Support Crew

The support crew chief supervises and directs the actions of the support crew. The support crew consists of the crater support crew, the spall repair crews, and the aircraft recovery crew.

Crater Support Crew. This crew consists of an MT, maintenance, and fuels detachment. The crater support crew is responsible for additional MT support, field maintenance, and refueling of equipment supporting the RRR effort.

Spall Repair Crews. These crews are responsible for repairing spalls located on the MOS. The number of spall repair crews is based on the amount of damage and the availability of personnel and equipment.

Aircraft Recovery Crew. This crew consists of the clearing and sweeping crew, the MOS lighting and marking crew, and the arresting gear crew. This crew is responsible for the removal of debris from the MOS; placement of the runway remaining markings; centerline painting; edge markers and lighting on the MOS; and the placement, operation, and repairs of the aircraft arrestment gear.

Hauling Crew

The hauling crew chief supervises and directs the actions of the hauling crew. The hauling crew ensures adequate crater repair materials, including fill and FOD cover material, are delivered to the craters on time. The number of hauling crews depends on the availability of personnel and equipment at the airfield.

Chapter 7. Forward Arming and Refueling Point Operations

The FARP mission is to provide fuel and ordnance necessary for highly mobile and flexible helicopter and fixed-wing operations. The size of the FARP varies with the mission and the number of aircraft to be serviced. Normally, FARPs are temporary, transitory facilities established for a specific duration and mission. The scope of flight operations in the FARP area should include, but are not limited to, individual aircraft, sections, or divisions of aircraft requiring ordnance and refueling.

The objective of a FARP is to minimize response time and decrease turnaround time in support of sustained operations. Minimizing flight time to and from the FARP and reducing the refueling and rearming time within the FARP achieves this objective. Fueling and arming of assault support aircraft can be accomplished in about 20 to 30 minutes, while processing an attack aircraft may take up to 45 to 50 minutes. In both instances, fueling takes 10 to 15 minutes and ordnance uploading takes up the rest of the time. The overriding factor in estimating FARP processing time revolves around the ordnance requirements. The processing times depend on environmental factors, aircraft armament, and support personnel proficiency.

FARP operations should be considered aviation operations, while FARP planning, coordination, and execution are logistic responsibilities of the requesting unit. FARPs are not exclusive AGS operations, because the following ACE organizations can participate in the execution of a FARP:

- MWCS communications personnel, MMT, and LAAD.
- MALS maintenance and ordnance personnel.
- MAG or squadron assets.

Because of the extensive ACE involvement in FARP operations, an aviator is typically selected to fill the FARP OIC position. The knowledge and experience in logistics, aircraft refueling, and security resident in the MWSS make it the ideal source for providing the second in command of the FARP.

The FARP OIC deconflicts and interacts with the various agencies outside of the FARP (e.g., TACC, direct air support center [DASC], LAAD, pilots), while the senior MWSS representative manages and supervises the activities internal to the FARP. Refer to appendix A and NAVAIR 00-80T-109 for details regarding FARP operations. Appendix A also provides a checklist to assist in planning. See the FARP organization in figure 7-1.

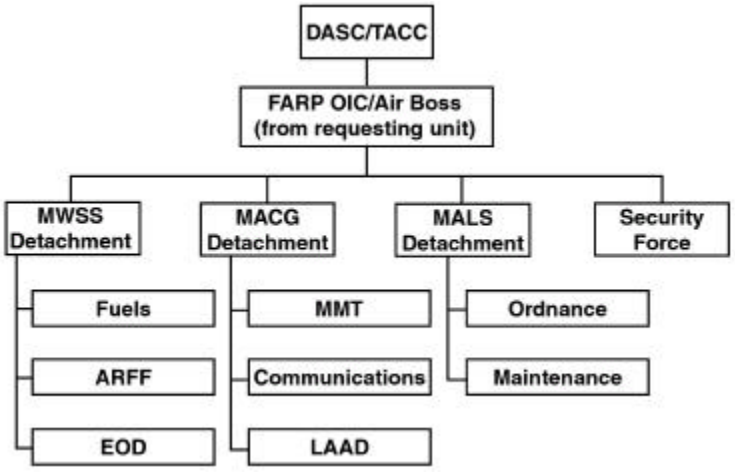


Figure 7-1. FARP Organization.

PLANNING CONSIDERATIONS

A FARP extends the combat radius of aircraft and reduces their turnaround time to the objective. Combat radius should be considered in terms of distance and time. If there is any doubt that the fuel and ordnance available for a mission is insufficient, a FARP should be

planned. FARP planners should consider location, employment techniques, refueling methods, equipment, and personnel requirements. In addition, planners should consider the following:

- Distance to, and the stability of, the forward edge of the battle area (FEBA) or forward line of own troops (FLOT).
- Required time-on-station.
- Security requirements for the FARP.
- Enemy's ability to destroy the FARP with indirect fire.
- Availability of adequate road networks.
- Distance between the FARP and the nearest bulk fuel and ordnance supply points.
- Command and control requirements.
- Proximity to the main supply route (MSR).
- Coordination with the logistical effort.

Location

Mission, enemy, terrain and weather, troops and support available-time available (METT-T) should dictate where the FARP site is located. The tactical dispersion of the FARP depends on the terrain. The location must allow sufficient area for ground vehicles, aircraft operations, and material movement, and should provide terrain masking for cover and concealment.

Enemy radar should be assumed to be on any high ground or prominent terrain occupied by enemy forces. To determine the available radar mask, a line-of-sight (LOS) analysis is made of the FARP location. Three or four points with routes leading to the FARP and masked from

radar detection are established and used by aircraft going to the FARP. Leaving the FARP, aircraft return to a masked point and then, if required, move with high speed to resume their assigned missions. By using such passive security measures, aircraft can avoid having the FARP directly detected by radar.

FARPs should be established outside a missile engagement zone (MEZ). The Doppler radar returns from a large number of helicopter rotor systems close in makes it difficult to track other targets in the vicinity. Therefore, FARPs should be placed behind the MEZ or out of LOS with the LAAD units near the MEZ.

Return to force procedures should be thoroughly planned with the TACC's air defense staff. Windows of time and/or specific routes should be planned for in advance so that air defense units are expecting friendly aircraft in their vicinity and are better able to identify returning aircraft, particularly in reduced visibility. Specific routes and corridors enable the air defense system to maintain the most advantageous weapons condition and as much reaction time as possible to protect the MAGTF.

Ideally, the FARP will be located approximately 17 to 25 kilometers from the FEBA or FLOT. This positioning ensures it is far enough to the rear to prevent enemy artillery preparatory fires from targeting the FARP, yet allows the quick turnaround of aircraft and logistical transportation supporting the operation. The FARP should be established on the inbound, return or outbound route relative to the objective. Each route has distinct advantages and disadvantages.

Inbound Route

A FARP established on an inbound route—

- Ensures aircraft do not have to wait for fuel through staggered takeoff and arrival schedules.

- Allows assault forces to preposition closer to the objective area.

- Provides the mission commander the opportunity to make a final analysis of the situation before continuing to the objective area.
- Allows the mission planners flexibility for time lost because of aircraft mechanical problems and possible redistribution of loads.
- Allows an aircraft to enter the objective area with the maximum fuel possible.
- Provides the ability for aircraft to return to their base while they still have sufficient fuel remaining in the event the FARP is not operational or is detected by the enemy.
- Allows embarked troops from assault support aircraft to augment the FARP security force.
- Serves as a designated alternate fueling site when minimum fuel levels are reached.

A disadvantage of a FARP established on an inbound route is that the massing of assets for final coordination can provide a prime target of opportunity for the enemy.

Return Route

A FARP established on the return route is used by aircraft leaving the objective area to receive fuel and ordnance resupply before returning to the objective. To confuse enemy antiair defenses, the return route is not on either the inbound or outbound route. A FARP established on a return route—

- Allows the mission commander the opportunity to change the plan before aircraft return to the objective area.
- Allows an aircraft to reenter the objective area with the maximum fuel and ordnance possible.

A FARP established on a return route has the following disadvantages:

- Congestion and refueling delays can be caused when aircraft departing the objective area simultaneously converge on the FARP.
- The enemy can detect the FARP if aircraft departing the objective area are pursued to the FARP site.
- A detected, destroyed, or inoperable FARP may not be able to refuel aircraft departing the objective area.

Outbound Route

A FARP established on an outbound route gives aircrews the option to bypass the FARP if fuel is not required.

A FARP established on an outbound route has the following disadvantages:

- Congestion and refueling delays can be caused when aircraft returning to base converge on the FARP at the same time.
- The enemy can detect the FARP if aircraft departing the objective area are pursued to the FARP site.
- A detected, destroyed, or inoperable FARP may not be able to refuel aircraft departing the objective area.
- Personnel departing an objective area on assault helicopters may not easily augment security for the FARP because prior briefing with ground forces may be limited.

Employment Techniques

In a sophisticated threat environment, a FARP may be required to move frequently. In a low-intensity situation with a static front and little enemy air activity, the requirement for FARP displacement will be reduced. Depending on the situation, multiple FARPs may be

employed or a single FARP may be relocated to different sites. The mobility of a FARP or multiple FARP locations provide the commander increased responsiveness and capabilities.

During establishment of multiple FARP sites or relocation of a single FARP, the new FARP should be operational before the old FARP is shut down. Speed of movement to establish the FARP site is of prime importance, and adequate time to set up equipment should be planned.

The mode of transportation used to establish FARPs should depend on the urgency of the mission. FARP employment techniques are mobile, aerial-delivered, and a combination of aerial- and ground-delivered.

Mobile

Mobile or truck-mounted FARPs are the most common means of employment. These FARPS are easy to coordinate, logistically flexible, and do not require support outside the ACE or tie up valuable aviation assets. Mobile FARPs are preferred when the tactical situation, terrain, and time allow for the movement of ground assets into the desired location.

Mobile FARPs usually support a specific mission and number of aircraft. These FARPs establish, execute their mission, and return to the origination site. Because resupply of the mobile FARP may be necessary, planners must consider—

- Availability of adequate road networks.
- MSRs.
- Distance to the FARP.
- Timing.
- Security requirements.
- Threat.

Aerial-Delivered

The use of assault support assets is an alternate means of establishing a FARP. Aerial-delivered FARPs are used in tactical operations requiring rapid emplacement, initial stocking and resupply or displacement which may not be accomplished by ground transportation due to time, distance, inadequate road networks, terrain or enemy. Aerial resupply of the FARP should be limited because of the large quantities of fuel and ammunition and other priorities placed on assault support helicopters. In addition, continued aerial resupply of the FARP can increase the probability of detection by enemy electronic warfare surveillance equipment and visual reconnaissance.

Combination of Aerial- and Ground-Delivered

A combination of aerial- and ground-established FARPs may be operationally desirable under certain situations. For example, if an attack helicopter squadron receives a rapid commitment order, the FARP may be initially established by air with enough Class III (bulk POL) and V (ordnance) supplies for one turnaround per helicopter. Continued operation could then rely on surface transportation for sustainment.

Refueling Methods

Aircraft use either the hot or cold refueling method. The preferred method is hot refueling because it is faster than cold refueling. NAVAIR 00-80T-109 provides depictions of typical hot and cold FARP layouts.

Hot Refueling

The term hot refueling describes refueling of an aircraft with the aircraft engines operating. Aircraft authorized to hot refuel are equipped with a closed-circuit refueling receiver and single-point pressure refueling receiver that incorporate an automatic fuel shutoff capability.

Cold Refueling

This refueling method is accomplished by shutting down the engines, turning off all switches, and, for helicopters, waiting until the rotor

blades have stopped turning and are secured. Pressure and open-port methods are used in cold refueling.

Equipment

The MWSS possesses a variety of fueling assets that can support FARP operations. Each asset is employed based on mission requirements, FARP location, and availability.

Helicopter Expedient Refueling System

The HERS is an expeditionary aircraft fuel dispensing system designed for use in forward areas for primarily attack helicopters. The HERS is helicopter transportable and can be inserted far forward in the battle area. This system is capable of employing eighteen 500-gallon pods with supporting components and a total fuel capacity of 9,000 gallons. The HERS can be rapidly installed, and it shares common components with the TAFDS that is also in the MWSS inventory. This system must be replenished often to give extended fuel support.

M-970 Refueler

The M-970 fuel trailer is a 5,000-gallon, fuel-dispensing semitrailer designed for under- and over-wing aircraft refueling. The fuel trailer is equipped with a filter separator, recirculation system, and two refueling systems (one for under-wing and one for over-wing servicing). Normal fuel capacity is 5,000 gallons for highway travel and 3,800 gallons for cross-country travel. The M-970 is not designed as a rough terrain vehicle asset; therefore, site location and accessibility are critical concerns when employing this asset to support FARP operations.

SIXCON Tank Module

The SIXCON tank module is primarily used for storing, transporting, and dispensing bulk liquids. This container can be transported by helicopter, LVS or 5-ton truck. Five fuel storage modules and one 125-gallons-per-minute fuel pump module join together to form an 8- by 8- by 20-foot, International Organization for Standardization/American National Standards Institute-configured module that can pump and

store approximately 4,500 gallons of fuel. Each module can hold approximately 900 gallons. Weight distribution for some SIXCON tank modules manufactured without baffles may render total load as top-heavy; therefore, caution must be taken when configuring SIXCON modules for FARP operations.

Personnel Requirements

The FARP OIC or air boss (normally a pilot) supervises and directs FARP operations, to include fuels section, ARFF team, EOD section, ordnance crew, maintenance crew, and security personnel. A corpsman and radio operators will also be assigned to the FARP OIC or air boss.

Fuels Section

A minimum of six personnel are required for hot refueling aircraft when operating a two-point system: one line noncommissioned officer (NCO), one pump operator, and a nozzle operator and a refuel point operator at each point. Eleven personnel are required to operate a four-refueling point site: a line NCO, two pump operators, and a nozzle operator and a refueling point operator at each of the four refueling points. For planning purposes, a FARP should have a line NCO for every four points, a pump operator for every pump, and a nozzle operator and a refuel point operator at each refueling point. The nozzle operator is a crew chief, plane captain or a qualified person per NAVAIR 00-80T-109. Additionally, it is highly recommended that taxi directors be used at each refueling point for terminal guidance.

ARFF Team

Normally, one ARFF crew and rescue vehicle will support a FARP. The extent of ARFF support at the FARP depends on the size and complexity of the operation. Refer to NAVAIR 00-80R-14 to identify the minimum ARFF requirements needed at FOBs.

EOD Section

Because of the limited number of EOD technicians within an MWSS, EOD employment must be done judiciously; therefore, the situation

and operational requirements will determine EOD participation during FARP operations. EOD personnel can provide assistance during FARP operations, but they are primarily employed to clear UXO along movement routes and within the FARP site.

Ordnance Crew

A minimum crew of four trained ordnance personnel is normally required during any arming/dearming or loading/downloading sequence. The mission and ordnance requirements will determine the number and type of ordnance personnel to support the FARP. Flying squadron ordnance personnel may be required to conduct arming/dearming or loading/downloading sequence and IMA personnel may be required to build and assemble ordnance at the FARP.

Maintenance Crew

Based on the mission and availability of personnel, maintenance crews may or may not be included within the FARP organization. Normally, maintenance activities within the FARP are limited. In most cases, maintenance personnel are on call. If a problem exists beyond the maintenance crew's capabilities, additional ACE maintenance personnel and equipment are brought to the FARP to effect necessary repairs.

Security Forces

Security personnel will normally come from established ACE security forces. These forces may or may not include military police. The composition of the security force is based on the situation, mission, and threat. These forces provide security for convoys en route to the FARP and for FARP personnel and equipment during operations. Besides focusing on ground-related threats, FARP security forces may include LAAD assets to combat air threats.

DEFENSE

The FARP defense is broken down into ground and air defenses.

Ground

Organic personnel, including technicians and security forces (military police and/or guard force), provide the principal FARP ground defense. Reconnaissance personnel and GCE assault force personnel passing through the FARP may also be integrated into the FARP's defense for limited periods.

Reconnaissance personnel can be used to ensure that the designated FARP location is suitable for FARP operations and can provide initial security until FARP security forces are in place. In addition, reconnaissance personnel can provide zone intelligence updates, which can be passed to the aircraft commander (airborne). Because aircraft must off-load nonessential personnel during refueling operations, disembarked assault forces may be used to augment the FARP defense while they are within the FARP and waiting to load the aircraft.

A tactical air control party can also be inserted into the FARP to provide a link with most supporting arms. CAS for the FARP may consist of organic and nonorganic rotary- and fixed-wing assets. However, integration of any of these units and assets into the FARP defense requires extensive planning and coordination before execution to reduce confusion and delays.

Air

Air defense could encompass rotary- and fixed-wing escorts of assault support aircraft and the integrated air defense of LAAD. LAAD personnel may be employed either separately, inserted into the FARP site area with the reconnaissance or assault forces or accompany the FARP personnel moving into the FARP site. Either way, the LAAD OIC or section leader must be involved in the FARP planning to ensure LAAD personnel are properly integrated into the FARP defensive plan.

To plan the FARP air defense, the LAAD section leader should be thoroughly briefed on the FARP operations (e.g., types and number of

aircraft, aircraft approach and departure direction). The LAAD section leader normally is located in close proximity with the air boss or FARP OIC to receive current aircraft information. In most cases, the LAAD section leader receives current situational awareness from the FARP communications links.

COMMUNICATIONS

FARP operations require external and internal communications. The FARP OIC or air boss requires external communications to higher headquarters and pilots in the aircraft.

Internal communications requirements are necessary to command and control the following organizations within the FARP:

- MWSS detachment.
- MWCS detachment.
- MALS detachment.
- LAAD.
- Security detachment.

The MWCS is responsible for the external communications requirements, while the MWSS is responsible for the internal requirement. Agencies within the FARP will monitor the FARP control net.

Each organization may have its own internal frequency to coordinate their specific functions. Fuels, ARFF, and EOD use the air operations net and maintenance and ordnance use the maintenance control net.

The FARP should have both UHF and VHF capability. The number and types of frequencies within the FARP are mission dependent. If there is no MATC detachment at the FARP, aircraft will switch to FARP control on approach to receive terminal guidance.

The FARP frequencies, call signs, and radio procedures should be briefed during the aviator's mission brief. Once the aircraft are within the FARP, the majority of fueling and ordnance operations should not use radio communication.

Radio transmissions shall be kept to a minimum during dearming, refueling, and arming procedures. Aircraft and ground personnel should make initial contact with one another before aircraft enter the FARP. Table 7-1 shows the communications architecture normally employed during FARP operations.

Table 7-1. FARP Communications Architecture.

FARP Units/Nets	HD-1 (DASC)	FARP (UHF)	FARP Control (VHF)	Airfield Operations[1] (VHF)	Maintenance Control[1] (VHF)
DASC	P				
FARP OIC/air boss	M	P	P		
AGS NCOIC		M	P	P	
Fuels				P	
ARFF		M	M	P	
EOD				P	
Maintenance NCOIC			P		P
Maintenance					P
Ordnance					P
LAAD		P	M		
MMT	M	P			
Security NCOIC[2]			P		
P=primary coordination net			M=monitor		

[1]The airfield operations and maintenance control net use handheld radios.
[2]Security forces should have their own control frequency, if possible.

LAYOUT CONSIDERATIONS

The FARP layout will be predicated on the type of FARP (hot or cold), the equipment used, the number of refueling points required, the types

of aircraft being serviced, and the ordnance support requirements. Appendix A provides some layout configurations typically used when conducting FARP operations. These layouts and others can be tailored to fit specific missions as long as NATOPS safety restrictions are met. Refer to NAVAIR 00-80T-109 for specific aviation ground refueling requirements, procedures, and limitations. When designing the FARP layout, planners must consider the following:

- The space between aircraft and refueling points must accommodate the largest helicopter expected to utilize the FARP. The standard layout should accommodate aircraft sizes up to the CH-53E.

- Wind direction must be calculated to accommodate aircraft landing, refueling, and take off.

- Fueling equipment must be placed on high ground within the FARP site, because fuel vapor, which is heavier than air, collects in depressions and hollows.

- Equipment must be positioned in a location that provides adequate drainage away from the equipment and refueling points in the event of fuel spills or sudden rainfall.

ROUTING AND AIRCRAFT CONTROL PROCEDURES

Aircraft going to the FARP should enter from a designated initial point. If there is no MATC detachment at the FARP, individual flight leaders will provide separation and control of aircraft into the FARP. The FARP OIC will maintain VHF and UHF radio communication.

The pre-briefed landing pattern shall be the same for all aircraft operating at the FARP. Procedures for wave-offs at the FARP and the staging areas should be pre-briefed and conform to the pattern established in that area. The heading for final approach to the FARP should be determined during the planning phase and may be terrain dependent. The final approach should be marked with LZ panels, markers, or airfield lighting assets (e.g., IR lights, chemical lights).

Aircraft should avoid over-flying the FARP while other aircraft are in the site. If other aircraft are waiting at the primary staging area, incoming aircraft will be directed to land at the alternate staging area. A right-hand landing pattern is desired. Pattern altitudes shall be specified and selected in accordance with METT-T considerations. Orbiting of the FARP should be avoided to prevent the enemy from detecting and targeting the FARP.

FARP aircraft directors can provide terminal guidance with hand and arm signals and night vision goggles (NVG) compatible wands. Depending on the number of aircraft and complexity of the operation, an MMT may be used to provide procedural control to incoming aircraft and airspace deconfliction. If emission control conditions allow, the flight leader will call the FARP for clearance to land at the fuel point, the staging area or an alternate staging area, depending on traffic and refueling priority.

COLD REFUELING PROCEDURES

Cold refueling procedures are used for but are not limited to attack aircraft requiring ordnance uploads. Although inherently more time consuming, cold refueling operations are simplistic in design and require minimal aircraft movement. Refer to NAVAIR 00-80T-109 for procedural information.

HOT REFUELING PROCEDURES

Hot refueling operations are generally more complex and dangerous than cold refueling, because hot refueling FARPs consist of more moving parts and fueling occurs while aircraft engines are running. Aircraft enter the FARP via predetermined routing procedures, land in the pre-staging area to dearm, and taxi to a designated fueling point. When fueling is complete and it is safe, the aircraft taxi to the post-staging area where it will either arm or shut down to receive ordnance uploads. Pre-refueling and post-refueling staging area locations should be thoroughly briefed and understood by aircrews that will use the FARP.

In the pre-stage landing area, aircraft position to dearm their ordnance and to wait when FARP refueling points are full. Aircrew can dearm assault support aircraft; however, only a qualified ordnance team can dearm attack aircraft in the pre-stage area. This landing area should be within visual range of the FARP and be large enough to contain at least a division of aircraft. The use of the pre-staging area will preclude flights of aircraft orbiting the FARP. Aircraft director support normally will not be available at the pre-staging area. The pre-staging area will be marked for assault and attack aircraft (see appendix A diagrams). Procedures for hot refueling aircraft carrying explosive ordnance on board can be found in NAVAIR 00-80T-109.

PRE-OPERATIONAL PROCEDURES

Before aircraft arrive in the FARP, FARP operators should—

- Verify that a minimum of one fire extinguisher is in the immediate vicinity of the fuel source and the refueling point.
- Clear areas that may be susceptible to rotor downwash.
- Ensure that visual landing aids (e.g., panel markers, NVG-compatible lighting) are securely anchored/attached to the ground at the fuel points and pre- and post-staging areas.
- Ensure the site is clear of loose debris or FOD-producing material.
- Ensure there are no depressions or protrusions in the landing areas that exceed 10 inches.
- Ensure the slope of the FARP area (landing points) do not exceed 5 degrees.
- Use locations that minimize soil disturbance from heavy FARP equipment and aircraft.
- Verify availability of access roads.

EMERGENCY FIRE AND RESCUE PROCEDURES

FARP personnel must follow procedural steps in a fire or crash emergency. Ground and air crewmembers should follow the basic emergency fire and rescue reaction steps outlined in NAVAIR 00-80T-109; specific steps depend on the emergency. Either a ground or air crewmember can man the fire extinguisher nozzle during a fire emergency.

ADDITIONAL PROCEDURES

A FARP may be established to provide fuel and ordnance for several days in support of sustained operations, or it may be required to provide fuel for a period of hours in support of a raid. Depending on the mission, FARP personnel may employ procedures for emergency breakdown and evacuation, night operations, ordnance, or crew-served weapons.

Emergency Breakdown and Evacuation

In the event the FARP comes under attack, participants must be familiar with the load plan and the sequence of extract. The hard rules are that security forces will be the last out, refueling equipment is considered expendable, and supporting arms must be preplanned and used. Standardized procedures are not established for this evolution; therefore, each mission will develop its own procedure according to METT-T and the availability of supporting units.

Night Operations

Because of the sophisticated threat anticipated during future operations, using the hours of darkness for helicopter operations will enhance survival. This increased requirement for a night operation capability dictates that detailed planning take place at all levels, because night activities inherently take longer to complete. FARP night activities will normally be set up for NVG operations. Taxi directors should use wands with cones or IR chemical lights.

Ordnance

Loading and downloading of ordnance and fueling of aircraft must be conducted as separate activities. The aircrew preflight briefing will include the arming/dearming location and loading/downloading locations of the FARP. Ordnance personnel should use the appropriate NATOPS checklists during ordnance activities. Refer to NAVAIR 00-80T-103, *NATOPS Conventional Weapons Handling Procedures Manual (Ashore)*.

Crew-Served Weapons

After refueling, an aircraft in the post-refueling staging area that requires ammunition for crew-served weapons will signal the ordnance personnel using prearranged signals. Arming and dearming of crew-served weapons shall be accomplished in accordance with applicable weapon procedures.

SAFETY

Safety is the responsibility of all personnel and shall be the determining factor before, during, and after activities involving Class V (A) munitions and refueling operations. Unsafe situations, practices, or procedures observed by any person should immediately be brought to the attention of all hands, and ordnance and refueling activities must immediately stop until the unsafe condition can be eliminated.

Chapter 8. Deployment Planning

An effective AGS deployment capability enables the MAGTF ACE to establish and maintain a viable expeditionary force. The MWSS must be capable of deploying under a variety of conditions and configurations. This chapter is an overview of MWSS deployment, employment, and redeployment planning considerations and organization.

PREDEPLOYMENT

The organization and employment of AGS are accomplished by task-organizing elements of an MWSS to fit the particular support requirement of the MAGTF ACE. A task-organized MWSS will normally deploy in three phases:

- Advance party.
- Main body.
- Rear party.

Each phase encompasses specific tasks. Normally, considerable base preparation is required before the arrival of the ACE main body and is accomplished by a task-organized advance party. Once the main body arrives, the advance party reverts to the control of the parent organization. The main body is responsible for sustained operations and air base development and improvement. A task-organized rear party remains behind to provide coordination for redeployment operations.

Requirements

The following steps provide a systematic approach in determining support requirements and in task-organizing the MWSS to fulfill AGS requirements.

Step 1

The MWSG reviews the ACE operations order, identifies AGS requirements, and assigns an MWSS to support the deploying ACE. If possible and time permitting, the MWSG/MWSS should participate in SLRP operations to assess potential FOB sites and determine site capabilities and limitations from an AGS standpoint. If conducting an SLRP is unfeasible, previous SLRP data can be used to help MWSG/MWSS planners in determining site potential and AGS requirements.

Step 2

The MWSS analyzes the mission to determine specific and implied AGS tasks and begins developing the concept of AGS for the ACE commander's approval. During the development of the AGS concept, the MWSS begins constructing the ABMP, the base camp layout, the ABGD plan, and the BRAAT plan.

Step 3

Once the concept of AGS is approved, the MWSS develops the T/O and T/E for each of their advance party, main body, and rear body elements. Additionally, the MWSS identifies personnel, equipment, and material requirements needed to support the concept of the AGS plan based on the availability of airlift, sealift and the employment of maritime pre-positioning ships (MPS).

Step 4

MWSG and MWSS, through the MAW G-4 and ACE S-4, coordinate with other ACE and MAGTF support agencies (e.g., MALS, CSSE) to provide for logistical requirements beyond the MWSS's capability.

Step 5

The MWSS provides the ACE with AGS input for the ACE operations order and the finished ABMP, base camp layout, ABGD plan, and

BRAAT plan products. The MWSS also publishes an internal operations order/letter of instruction, which includes the—

- Mission, tasks, T/O, and T/E for each of its elements.
- Command relationship between the ACE, MWSS, and CSSE.
- Procedures for obtaining support from the MWSS and CSSE.

Task Organization

Task organization ensures an effective support element that is tailored to meet the specific requirements of a given contingency with the appropriate number of personnel and amount of equipment required to effectively perform the mission. To enhance the MWSS for deployment and employment and to provide the ACE commander with the greatest flexibility in employment options, the MWSS organizes for deployment using a system of capability packages. By using these capability packages, the MWSS commander can tailor equipment and personnel densities of the deploying unit to fit the assigned mission.

Generally, an entire MWSS should deploy to provide appropriate AGS to support one main air base. As an element of the MAW or ACE and not the FSSG or CSSE, the MWSS possesses no deployable stand-alone CSS capabilities. An MWSS's AGS capabilities are interdependent (i.e., EAF requires drafting and survey as well as heavy equipment support; EOD requires MT support and directly supports ARFF). Therefore, MWSS task organization is driven more by AGS requirements to support an airfield or FOB than by the size of a supported ACE. Each capability package represents an initial core capability that can be modified to respond to specific circumstances.

Basic Capability Package

The basic capability package is comprised of those items of equipment and associated personnel required to achieve initial operational capability at a selected main base or air facility FOB.

Full Capability Package

The full capability package is comprised of equipment and personnel assets not already assigned to another capability package but required to achieve full operational capability at a main base or air facility FOB.

Site/Point Package

The site/point package is comprised of the minimal quantities of personnel and equipment required to operate an air site or air point FOB.

Expeditionary Airfield Package

The expeditionary airfield package is comprised of EAF components used to augment or enhance airfield capabilities.

Logistical Preparation

After identifying mission, tasks, T/O, T/E, requirements, and concept of employment, the MWSS must report lift and movement requirements to the ACE. The MWSS's lift requirements are based on its personnel, equipment, and concept of deployment. The MWSS reports its requirements to the ACE using the data link known as MAGTF Deployment Support System II (MDSS II). By using predetermined capability packages, the MWSS can speed up this reporting process.

The MDSS II program is a part of a larger operational and logistic planning system managed by the MAGTF. Operational planning, deployment, and execution of MAGTF operations are supported by a series of coordinated, mutually supporting automated systems known as the MAGTF Logistics Automated Information System (MAGTF II/LOG AIS).

To understand how the movement of the ACE is scheduled, coordinated, and controlled, an understanding of this series of automated systems and their purposes is necessary. Refer to MCWP 4-1, *Logistics Operations*, for further description of the following planning systems.

MAGTF II

An automated operational planning and deployment execution system, the MAGTF II allows planners to select and tailor force structures and estimate sustainment and lift requirements for plan flexibility. MAGTF II also provides the interface between the MAGTF II/LOG AIS series of systems and the Joint Operation Planning and Execution System (JOPES). This interface allows for transmission of time-phased force and deployment data (TPFDD) to JOPES.

MDSS II

A user level system, the MDSS II is used by MAGTF elements to build and maintain a data base that contains force and equipment data reflecting the deployment configuration of the MAGTF. The data is uploaded to MAGTF II where it becomes part of the TPFDD provided to JOPES.

Transportation Coordinator's Automated Information for Movement System (TC-AIMS)

The TC-AIMS provides the capability to plan and execute movement from point of origin to air and/or sea point of entry (POE), and from the point of debarkation (POD) to final destination. This system updates MDSS II, MAGTF II, and the defense transportation system with movement requirements and status. TC-AIMS and MAGTF II provide in-transit visibility to JOPES.

Computer-Aided Embarkation Management System (CAEMS)

Used to produce shipload plans and associated reports, the CAEMS provides the capability to reorganize ship and cargo characteristics, conduct cargo on-load and off-load flow path analysis, allocate cargo to stowage spaces, and ensure stowage compatibility. CAEMS updates MDSS II.

Computer-Assisted Load Manifest (CALM)

CALM is used to produce AMC-approved aircraft load plans and reports. It is capable of updating MDSS II, MAGTF II, and JOPES with actual aircraft load plans.

DEPLOYMENT

The ACE deployment is executed by forming the unit into movement groups according to speed and characteristics of the lift available and the time the forces are required in the operational objective area. Although movement echelons and methods are situation dependent (i.e., maritime pre-positioning force [MPF], amphibious, air-landed), the ACE and MWSS may deploy its elements using one or more of these methods. To move ACE logistic support to the objective area, both air and sealift will be required. ACE elements may be organized and moved in fly-in echelon (FIE), follow-on echelon (FOE), aviation logistics support ship (TAVB), and MPS.

Fly-In Echelon

FIE assets arrive by air transportation to support deployment to the theater of operation. Offload preparation party (OPP), SLRP, advance party, main body, and flight ferry (F/F) may use FIE deployment.

Offload Preparation Party

The OPP is used exclusively in MPF operations. The OPP consists of equipment operators and maintenance and embarkation personnel who embark aboard MPF ships in transit to the amphibious objective area and prepare equipment for off-load. The MWSS provides cooks, mechanics, and heavy equipment, utility, and MT operators to support OPP operations.

Survey, Liaison, and Reconnaissance Party

Primarily used in MPF operations, the SLRP consists of personnel from MAGTF elements. The mission of the SLRP is to—

- Assess areas with potential to support the arrival and assembly phase.
- Evaluate HN support capabilities.
- Determine engineering requirements.

The SLRP precedes MAGTF deployment and provides vital information to operational and logistic planners. The MWSS normally supplies an engineer officer, EAF officer, MP officer, and a communications operator to support SLRP activities. The actual makeup of the SLRP is determined by MAGTF and ACE requirements. The SLRP uses the site survey checklist in appendix E to provide the ACE with information concerning airfield facilities and equipment requirements.

Advance Party

The advance party is a task-organized element that will provide logistical capability for off-load, arrival, and assembly operations. When the advance party arrives in the arrival and assembly area, it will absorb the OPP and SLRP. The MWSS should strive to deploy a robust AGS capability within the advance party to prepare for and receive the ACE's equipment.

Main Body

The main body consists of the remaining MAGTF forces less the ACE personnel involved in F/F. The remainder of the MWSS, not deployed with the advance party, and the preponderance of the ACE will normally arrive with the main body. Rotary-wing aircraft not capable of self-deployment will be loaded aboard appropriate transport aircraft and flown in the operating area with the main body.

Flight Ferry

The F/F will consist of fixed- and rotary-wing aircraft capable of self-deployment. It will involve inflight refueling, en route maintenance and supply support, and coordination of en route support bases.

Follow-on Echelon

FOE will consist of personnel and equipment not planned for deployment or required for FIE but identified later as being required.

Aviation Logistics Support Ship

The TAVB will provide dedicated sealift for the movement of the MALS IMA and other aviation support assets. The IMA may operate aboard the TAVB, or it may be phased ashore in the objective area.

Maritime Prepositioning Ships

In an MPF operation, the MPS delivers the preponderance of MWSS equipment, especially the larger engineer, MT, EAF, ARFF, and fuel assets. Use of the MPS to fill T/E requirements drastically reduces the ACE airlift and sealift requirements.

OPERATIONS

The MWSS provides the 14 functions of AGS to the ACE. To support the ACE, the MWSS employment, organization, and operations will depend largely on the following:

- Planned operating site for the ACE.
- Size of the ACE.
- Availability and capability of existing airfields within the area of responsibility.

- Requirement to provide airfield improvements or expansion.
- Projected duration of ACE operations.
- Availability of Class IV material and airfield matting.

While a single MWSS can support more than one location, the desired level of support and the distance between sites can directly influence the level of AGS provided. Primarily, the number of airfields or FOBs requiring support affects MWSS employment in MAGTF operations. Operation of an airfield, whether for a composite squadron or an air wing, requires ARFF, RRR, weather services, engineer support, fuel support, and other air base and ground services. These core requirements are relatively consistent and are planned for accordingly within the FIE. As support requirements increase because of expanding operational tempo and heavier airfield service demands, FOE components will augment initial MWSS assets with the appropriate support.

When preparing for operations, the MWSS should use all available information assets. The threat and HN logistic capabilities information drastically affects the MWSS's ability to provide the 14 functions of AGS to the ACE. When developing the AGS concept, planners and executors should pay close attention to the considerations and requirements listed in previous chapters.

The MWSS needs a close working relationship with the ACE staff to execute its AGS mission. The support requirements and operations of the ACE always drive the operations of the MWSS. The ACE S-3 will provide information on sortie rates and desired airfield operational requirements. The ACE will collect, prioritize, and deconflict ACE logistical requirements for the ACE commander and provide vital information to assist AGS planners with—

- Personnel and aircraft.
- Billeting.

- Messing.
- Electrical power.
- Radio and telephone.
- Other air base logistical requirements.

RECONSTITUTION AND REDEPLOYMENT

The logistical support capabilities resident within the MWSS play a large role in the preparation, movement, reconstitution, and redeployment of the ACE. While the ACE S-4 develops the reconstitution and redeployment plan for the ACE, the MWSS provides the majority of the equipment and personnel to execute the plan. Reconstitution and redeployment operations are managed and supervised from the AGSOC. The MWSS redeploys in the reverse order it arrived in the operating area. The MWSS is usually one of the first ACE elements into theater and one of the last to leave.

Appendix A. Forward Arming and Refueling Point Survey

This survey provides FARP personnel with a list of items that should be identified when planning, establishing, and operating a FARP.

FARP Location (Primary/Alternate)	
Grid coordinate (8 digit)	
Area description	
Obstacles	
Elevation	
FARP Requirements	
Aircraft (number and type)	
Ordnance (quantity and type)	
Type of refueling (hot/cold)	
Number of refueling points	
Quantity of fuel required	
External communications requirements	
Internal communications requirements	
Aircraft arrival time(s)	
Aircraft departure time(s)	
FARP operation time	
FARP setup time	
Movement time	
Convoy departure time	
Retrograde time	

Personnel Requirements	
FARP Control	
FARP OIC/air boss	
S-2 intelligence representatives	
MWSS Detachment	
Fuels	
ARFF	
MT/MHE operators	
EOD	
Security	
MALS Detachment	
IMA Ordnance	
OMA Ordnance	
OMA Maintenance	
MACG Detachment	
Communications	
MMT	
LAAD	
Total number of personnel	
Equipment Requirements	
MWSS Detachment	
Fuels	
ARFF	
MT/MHE	
EOD	
Security	
MALS Detachment	
IMA ordnance	
OMA ordnance	
OMA maintenance	

MACG Detachment	
Communications	
MMT	
LAAD	
FARP Setup and Layout	
FARP marking	
FARP heading	
Inbound initial point and heading	
Outbound initial point and heading	
Aircraft heading in FARP	
Location of FARP control	
Location of fuel assets	
Location of refueling points	
Location of ordnance personnel	
Location of ordnance assembly	
Location of ARFF	
Location of communications	
Location of LAAD	
Location of security	
Location of others	
Pre-Stage Area	
Location	
Spacing	
Marking (attack/assault)	
Heading	
Movement in/out	
Fueling Points	
Location	
Spacing	
Marking	
Heading	
Movement in/out	

Arming/Dearming and Uploading/Downloading	
Type ordnance required	
Quantity ordnance required	
Tools required	
K-4 trailers	
SATS loaders	
Trucks	
MHE	
Other	
Security	
Threat condition	
Likely threat	
Convoy requirements	
Site requirements	
Air defense requirements	
Reconnaissance of FARP	
Setup in/out of MEZ	
Ground security requirement	
Air defense	
CAS/supporting arms	
Other available assets	
Communications	
Frequencies/Call signs	
Primary	
Alternate	
Signals (day/night)	
Aircraft lighting	
Hand signals	
Signals for NVD operations	

Emergency and Immediate Actions	
Nonfire	
Wave-off	
Aircraft emergency	
Aircraft Fire	
While arming	
While staging	
While fueling	
Refueling Point Fire	
Emergency procedures	Stop fueling, free aircraft, sound alarm, attempt rescue, and contain fire.
Administration and Logistics	
Maximum fuel per aircraft	
Fuel disposal	
Replenishment/resupply	
Logistical support	
FARP diagram published	
Fuel Planning Guide	
Fuel estimate	JP-5/8 in gallons x 6.8=pounds
CH-46	capacity=4,400 pounds burn rate=1,400 per hour time=3+30
CH-53D	capacity=13,400 pounds burn rate=2,200 per hour time=5+54
CH-53E	capacity=15,545 pounds burn rate=3,300 per hour time=4+42
UH-1N	capacity=1,300 pounds burn rate=750 per hour time=1+44
AH-1W	capacity=2,000 pounds burn rate=800 per hour time=2+30

Weather Information	
Sunrise	
Sunset	
End of evening nautical twilight	
Moonrise	
Moonset	
Lunar III	
Forecasted maximum temperature	
Forecasted minimum temperature	
Thunderstorms	
Precipitation	
Cloud cover	

Appendix B. Base Camp Fire Protection and Prevention

Providing adequate fire protection and prevention in a base camp and cantonment environment is necessary to preserve the lives and equipment of Marines. Without adequate planning for fire safety, lives and equipment could be lost or destroyed. This appendix provides guidance and fire protection and prevention procedures governing tent camp and cantonment sites.

COMMANDER'S RESPONSIBILITIES

The ACE commander, through the air base commandant, is responsible for establishing effective fire protection and prevention programs. Commanders must also ensure that adequate training is provided and conducted so Marines can carry out fire protection and prevention duties. Tenant commanders should support fire protection and prevention efforts by disseminating regulations and procedures (tent camp fire bill) established by the air base commandant. In addition, tenant commanders should ensure maximum participation during fire protection and prevention training.

FUNDAMENTALS OF FIRE

A basic understanding of fire behavior and classification is necessary to provide adequate fire protection and prevention.

Behavior

Fire burns in surface combustion and flaming modes. Surface combustion is represented by the fire triangle, which consists of fuel, oxygen, and heat. Flaming is represented by the fire tetrahedron that includes a chemical reaction as a component of burning. This converts the fire triangle into a four-sided figure.

Classification

The type of fuel that is burning determines the classification of fire. The four classifications of fire are as follows:

- Class A fires are fueled by solids (e.g., paper, wood, cloth).
- Class B fires involve flammable liquids (e.g., gasoline, oils, greases).
- Class C fires involve energized or live electrical equipment. Once the electrical source is removed, the fire reverts to one of the other fire classifications.
- Class D fires involve combustible metals (e.g., titanium, zirconium, sodium, potassium, magnesium, lithium batteries).

BASIC FIRE EXTINGUISHING METHODS

Cooling or Quenching

Fires fueled by solids are extinguished by reducing the temperature of the fuel below its ignition temperature.

Smothering or Blanketing

This process simply removes oxygen from the fire (e.g., covering a burning pan, throwing dirt on a flame).

Removing Fuel

Turning off the fuel supply source (e.g., natural gas, kerosene, oil) or removing solid fuel can effectively control and extinguish fires.

Chemical Fire Inhibition

Agents such as dry chemicals or gases (halon) react with the burning fuel and interrupt the flame producing the chemical reaction, resulting in rapid extinguishment.

PORTABLE FIRE EXTINGUISHER

The following are considerations for portable fire extinguisher use:

- The extinguisher must be visible, easily accessible, and maintained in good working order.
- The extinguisher must correspond to the type of fire expected (Class A, B, C or D).
- Personnel must be trained in the proper use of extinguishers.

SAFETY

The following are fire safety requirements and considerations:

- Personnel who have not been formally trained in firefighting tactics must be cautioned to exercise good judgment while combating a fire and cautioned not to endanger themselves in the process.
- Warning signs, indicating escape routes, should be posted at the entry points to confined spaces.
- Exits and entrances to structures must remain free of objects and obstructions.
- Emergency vehicle access lanes shall remain clear of obstructions (e.g., vehicles, structures).

CAMP LAYOUT

Camps must be laid out in such a way as to prevent fire from jumping from tent to tent. Tents should be placed so that the adjoining tent could not collapse on another tent.

To prevent flames from using ropes as a vehicle, tent support ropes should not crisscross each other between tents. Grass, underbrush, fallen leaves, and pine needles should be cleared from around the tents to prevent fire from spreading. Special considerations should be given to the placement of supply areas, ammunition dumps, petroleum, oils, and lubricants areas, and other areas containing combustible materials.

Tents should be configured into blocks of six tents (two rows of three tents). See figure B-1. Tents within the blocks should be spaced at least 10 feet apart side-to-side and 8 feet apart end-to-end. A 20-foot fire lane should separate each tent block. This allows the firefighters to attack the fire from any angle and reach every tent within the block.

Tent blocks and individual tents should also be marked using an alpha-numeric identification system to speed fire report and respond times. The unit responsible for the tent and/or workspace is responsible for placing a fire extinguisher in each tent.

FIRE PREVENTION REGULATION

The air base commandant will establish fire regulations in the form of a tent camp fire bill, which will be distributed to tenant organizations within the camp area. The fire bill and evacuation directions should be posted in a visible place on each tent or structure. A class on the following regulations, other fire protections measures, and use of available fire extinguisher should be given to camp inhabitants as soon as possible after their arrival:

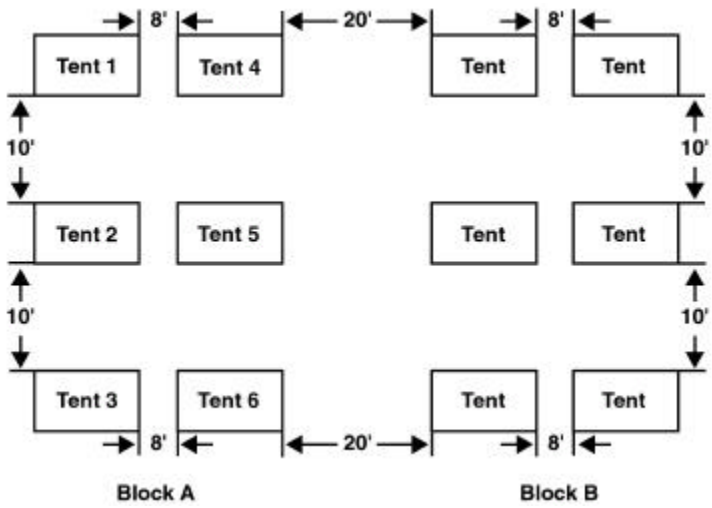


Figure B-1. Tent Blocks.

- A high state of cleanliness in and around tents must be maintained. Trash must be removed each day or whenever a large amount accumulates.

- Combustible waste should be collected and disposed of on a regular basis. Avoiding buildup of combustibles will prevent spread of an ongoing fire.

- Lockers and cabinets containing combustibles or hazardous supplies must be properly ventilated, located at least 50 feet away from structures, and clearly marked flammable.

- In the event of fuel or hazardous material spills, local fire departments should be contacted and all personnel kept clear and upwind.

- Hazardous waste shall be placed in approved containers marked with the name of the substance and placed in a hazardous material staging area.

- Explosives, flares, grenades, detonating cord, and training devices will be stored in the magazine areas. If any of these items are found, explosive ordnance disposal or ordnance personnel shall be contacted for proper recovery and disposal.

- Butt cans for cigarettes will be provided in bivouac areas. Butt cans shall be drenched with water prior to disposal.

- Tent stoves, heaters, cooking ranges, and other heat producing equipment will be placed no closer that 18 inches to a tent wall or other flammable objects (e.g., cots, tables, chairs).

- Stovepipes will have tight-fitting joints and will terminate in a standard roof jack containing a spark suppressor. Stovepipe sections extending above the apex of the tent will be supported by nonflammable guide wires.

- Open flame burning (e.g., trash, classified material, barbecue) will not be conducted without the prior approval of the fire department or air base commandant. Burn permits (see page B-9) should be used to document requests/approval. No open flame burning will be permitted within 200 feet of a combustible building. A fire extinguisher or bucket of water will be available until fire is completely out. Burning must be contained in a 55-gallon drum/barrel with a grill on top. No burning shall be conducted if excessive wind conditions exist.

- Barrel latrines are to be burned according to regulations. Extreme caution must be used when lighting the drum. Only diesel fuel is to be used. Detailed instructions can be found in NAVMED P5010, *Manual of Naval Preventive Medicine*, and Field Manual 21-10, *Field Hygiene and Sanitation*.

- Tampering with electrical wiring or circuits is strictly prohibited. Only utility personnel should conduct repairs and modifications. To avoid overloading circuits, multiple plugs and light sockets will not be used. All personnel should be familiar with the power breakers.

If an incident involving electricity occurs, the source should be secured immediately.

- Messhall stoves and immersion heaters must be cool to the touch prior to release of pressure and refueling. Refueling will be done outside with a minimum of 50-feet clearance of all combustibles. A safetyman will stand by with an extinguisher to observe the process. Equipment leaking liquid or vapor fuel will be removed from service until repaired.

FIRE SAFETY WARDEN

A fire safety warden shall be designated for each unit to assist the fire department in fire prevention for the unit's shop and billeting areas. Fire safety wardens are responsible for—

- Posting the fire bill in their unit's billeting areas and workspaces.
- Ensuring personnel in their units are familiar with the nearest fire alarm and fire extinguisher location in their vicinity.
- Coordinating with the fire department personnel to obtain necessary training in the operation and maintenance of fire extinguishers.
- Designating smoking areas that are away from combustible structures with a minimum of two butt cans half full of sand.
- Designating a predetermined muster area to be used during a fire by unit personnel to conduct roll call.

FIRE PROTECTION MEASURES

The following measures are necessary to maintain an effective fire protection program:

- Billeting tents must have a minimum of one multipurpose fire extinguisher.

- Working spaces should have appropriate extinguishers.
- Fire points, consisting of two 55-gallon drum barrels full of water, should be established no further than 100 feet from any tent. Barrels for fire points should be painted and clearly marked for fire protection. During the winter, the barrels will be full of water treated with calcium chloride to prevent freezing.
- Fire watches will be established for each bivouac and storage area.
- A fire alarm should be installed at each fire point. The alarm must be loud and distinct.
- The communications officer shall maintain channels of communication to the base/air station fire department.

FIRE DEPARTMENT/AIRCRAFT RESCUE AND FIRE FIGHTING (ARFF)

The ARFF section is tasked with providing structural fire protection for tent camp areas where no permanent fire department is available. The ARFF officer shall be responsible for the organization and operation of the ARFF section and its structural component. The ARFF officer will provide assistance to the tent air base commandant in the preparation of the fire bill. The ARFF section will maintain fire extinguishers in good working order per current Naval Air System Command and National Fire Protection Agency standards.

SAMPLE OPEN FLAME BURNING PERMIT

From: Air Base Commandant/Fire Department
To: (Person in charge of open burning)

Subj: OPEN FLAME BURNING PERMIT

Date Issued:_____Date Expires:_____

Permit Number:_____Location:_____

Name and Signature of Responsible Person:_____

Fire Inspector/Fire Warden's Signature and Date:_____

1. Permission for open burning is hereby approved provided the conditions listed below are adhered to.

a. The fire will be at least 50 feet from any combustible structure.

b. The fire will be at least 200 feet from flight line, explosive or fuel storage areas.

c. Fire extinguisher/bucket of water will be on hand until the fire is completely out.

d. Personnel will monitor the fire until completely out.

e. Ashes must be drenched with water prior to disposal in trash container.

f. Burning must not be conducted during excessive wind conditions (surface winds greater than 5 miles per hour or 4.3 knots).

g. Burning will be conducted in a designated area approved by the air base commandant/fire department.

h. Document burning will be contained in a drum barrel (55-gallon) with a grill top.

2. Any violation of the above listed conditions will result in fire extinguishment and permit revocation.

_____

(Name and Signature)
Air Base Commandant/Fire Department Personnel

Appendix C. Air Base Ground Defense Planning Checklist

This checklist is a tool to assist air base ground defense (ABGD) planners and base defense operations center (BDOC) supervisors in effectively assessing threat conditions (THREATCONs), establishing a sound ABGD plan, and operating a BDOC.

THREAT LEVELS

- LEVEL I—enemy controlled agents, sabotage, terrorism.
- LEVEL II—unconventional warfare, raids, ambushes, reconnaissance operations.
- LEVEL III—airborne, amphibious, ground deliberate, infiltration operations.

OBJECTIVES

- Secure rear area, local areas, and facilities.
- Prevent or minimize enemy interference with command, control, and communications operations.
- Prevent or minimize disruption of aviation operations.
- Prevent or minimize disruption of aviation ground support (AGS).
- Provide unimpeded movement of friendly units through the area.
- Find, fix, and destroy enemy incursion areas.
- Provide quick and responsive area damage control.

PRINCIPLES

- Establish unity of effort.
- Consider economy of force:
  - Establish air base defense forces/perimeter security and defense.
  - Use military police as initial reaction force and security screen.
  - Augment with ground combat element (GCE), if required.
  - Employ military police and engineers in ABGD planning and operations.
  - Establish a BDOC for ABGD coordination and control.
- Establish responsiveness criteria.

SECURITY TASKS

- Secure necessary support to sustain AGS/combat service support.
- Emphasize local security (every Marine's responsibility).
- Detect the enemy by using observation, patrols, and electronic sensors.
- Delay the enemy by using firing positions, sectors, obstacles, etc.
- Destroy the enemy (immediate reaction requires thorough planning, coordination, and rehearsal).

BDOC RESPONSIBILITIES

- Ensure units are responsible for their living and workspace defense.
- Man BDOC 24 hours a day.
- Develop a defensive plan that includes reaction forces.
- Establish a reaction force for internal security and reinforcement of the air base.

INTELLIGENCE PREPARATION OF REAR AREA/AIR BASE

- Consider area of operation, area of influence, area of interest, and battlespace.
- Convert terrain analysis into graphic information.
- Analyze weather.

OPERATIONS

- Include military police patrols, reconnaissance, cover and concealment, deception, immediate reaction to attack, reinforcing obstacles, natural obstacles, observation post, listening post, and sentry post.
- Consider base configuration and positioning:
  - Define perimeter and establish access controls.
  - Defend against Level I and Level II threats without augmentation.

- Defend against a Level II threat with use of MAGTF response forces.
- Defend against a Level III threat with GCE augmentation.
- Identify natural and manmade obstacles for defense.

- Disperse personnel, equipment, and facilities against enemy air/ground attack.
- Locate units to mutually support one another.
- Identify need for both cover and concealment.
- Establish internal accessibility (airfield and base camp internal infrastructure and road networks).
- Establish external accessibility (close to main supply route [MSR]/alternate MSRs).
- Identify proximity (close enough to support facilities).
- Determine security and defense capabilities (adequate against Level I threat).
- Establish communications (BDOC has own net, thorough conductivity and redundancy).
- Plan fire support.
- Plan close air support.

AIR BASE DEFENSE SYSTEM

- Secure the base (based on mission, enemy, terrain and weather, troops and support available, time available).
- Use early warning systems and procedures.
- Phase defense posture against increasing threat levels.
- Use base alarm to signal alert posture.
- Use available resources to augment defense.
- Rehearse air base defense plans, increased readiness postures, and reaction forces.

THREATCON POSTURES

- THREATCON Normal—general threat exists, warrants routine security posture.
- THREATCON Alpha—low/general threat, no attack probable within 96 hours, unpredictable natural/extent, measures can be maintained indefinitely.
- THREATCON Bravo—medium threat, probable attack within 96 hours, increased predictable threat exists, measures can be maintained for weeks.
- THREATCON Charlie—high threat, attack expected within 24 hours, incident has occurred elsewhere, intelligence received indicates action imminent, measures can be sustained for days.
- THREATCON Delta—imminent threat, attack expected within 24 hours, attack has occurred in immediate area, intelligence shows action against specific location/person, localized warning.

SECURITY AND CONTROL PROCEDURES

- Subject individuals entering base to identification check.
- Specify points of entry and exit.
- Reinforce high-speed avenues of approach and entry points with crew-serve weapons.
- Provide redundancy in communications (telephone and radio).
- Use rally points and staging areas.
- Use night vision devices and other security enhancing equipment (e.g., flood lights).
- Develop range cards and a fire support plan.
- Harden critical facilities and defensive/security positions.
- Position listening post/observation post/sentry post based on threat (locate enemy before he can disrupt operations).
- Solidify reporting procedures and signals.
- Establish vehicle search procedures.
- Rehearse immediate actions and upgrade threat response posture.
- Conduct random patrols (unpredictable).

Appendix D. Base Recovery After Attack Worksheets

The base recovery after attack (BRAAT) worksheets, forms, and references in this appendix are provided to assist planners in the development and execution of BRAAT minimum operating strip (MOS) selection and rapid runway repair (RRR). (Underlined worksheets and references are included in this appendix.)

Section I. MOS Selection Worksheets and Procedures

The following procedures are provided as a guide to identify aviation ground support operations center (AGSOC) responsibilities and worksheets used during MOS selection.

Step 1. Determine forward operating base (FOB) operating conditions.

The MOS selection team records information obtained from the aviation combat element on the MOS Selection Form, page D-4.

Step 2. Determine surface roughness chart requirements.

The MOS selection team determines chart selection tables and surface roughness charts (SRCs) (found in USAF Technical Order [TO] 35E2-4-1, *Repair Quality Criteria system for Rapid Runway Repair*) based on aircraft type and operating conditions. The team records this information on the MOS Selection Form.

Step 3. Determine MOS and taxiway requirements.

The MOS selection team uses SRCs to identify MOS length and width requirements and the Taxiway Criteria Chart, page D-4, to identify taxiway requirements. The team records these requirements on the MOS Selection Form.

Step 4. Record and plot damage information.

Using the NATO Pavement Reference Marking System, page D-5, the damage assessment team (DAT) reports surface damage to the AGSOC. (See pages D-6 and D-7 for examples of plotting airfield damage.) The MOS selection team records damage on the DAT Record Sheet, page D-8, and plots damage on the Airfield Map and Operating Surface Grid Map, page D-9, using the Crater Damage Template, page D-10.

Step 5. Identify candidate MOSs.

The MOS selection team uses the MOS Template, page D-10, the Spall Criteria Chart, and the MOS Launch or Recovery Capability Chart, page D-11, to identify candidate MOSs. MOS candidate selection is based on rapid repair and sortie capabilities, location, low probability of aircraft damage, and expandability.

Step 6. Determine repair quality requirements on candidate MOSs.

To determine MOS repair quality requirements, the MOS selection team—

- Transfers damage information from the DAT Record Sheet to the MOS Selection Team Worksheet, page D-12, and fills in remaining information on the worksheet.

- Plots crater damage on the SRC and determines tentative repair quality.

- Converts apparent diameter of crater damage to actual crater diameter, using the Crater Diameter Conversion Chart, page D-13.

- Validates the repair quality for craters exceeding 40 feet in diameter using the SRC repair length key in USAF TO 35E2-4-1.

- Records information on MOS Selection Team Worksheet.

Step 7. Estimate explosive ordnance disposal (EOD) and RRR repair times. The MOS team leader—

- Estimates unexploded ordnance safe/clearing time using the EOD Time Worksheet, page D-14.

- Estimates RRR time by—

  - Determining repair times for each crater, using the RRR Time Worksheets for Chemical and Nonchemical Environments, pages D-15 through D-18.

  - Assigning crater repairs to crater repair crews and determining total repair time, using the Crater Repair Worksheet, page D-19.

  - Using Spall Repair Tables for Chemical and Nonchemical Environments, pages D-20 and D-21, to determine time adjustments necessary if crater crews are repairing spalls in addition to repairing craters.

- Records estimated times on the MOS Selection Team Worksheet.

Step 8. Tabulate comparative recovery times for candidate MOSs. The MOS team leader calculates total estimated recovery times based on EOD and RRR times.

Step 9. Brief airfield commander on candidate MOSs.

The operations officer or MOS team leader briefs the candidate MOSs to the airfield commander.

Step 10. Select MOS.

The airfield commander selects the MOS.

MOS Selection Form

Circle conditions that apply and fill in applicable blanks.

Aircraft	Operational Mode				
F-4C/D (F-18*)	takeoff	landing	evacuation	barrier	
F-4 E	takeoff	landing	evacuation	barrier	
F-15 (F-14*)	takeoff	landing	evacuation	barrier	aerodynamic
F-16(F-5*)	takeoff	landing			
A-10	takeoff	landing			
C-130	takeoff	landing	no braking	weight=	
C-141	takeoff	landing	no braking	weight=	

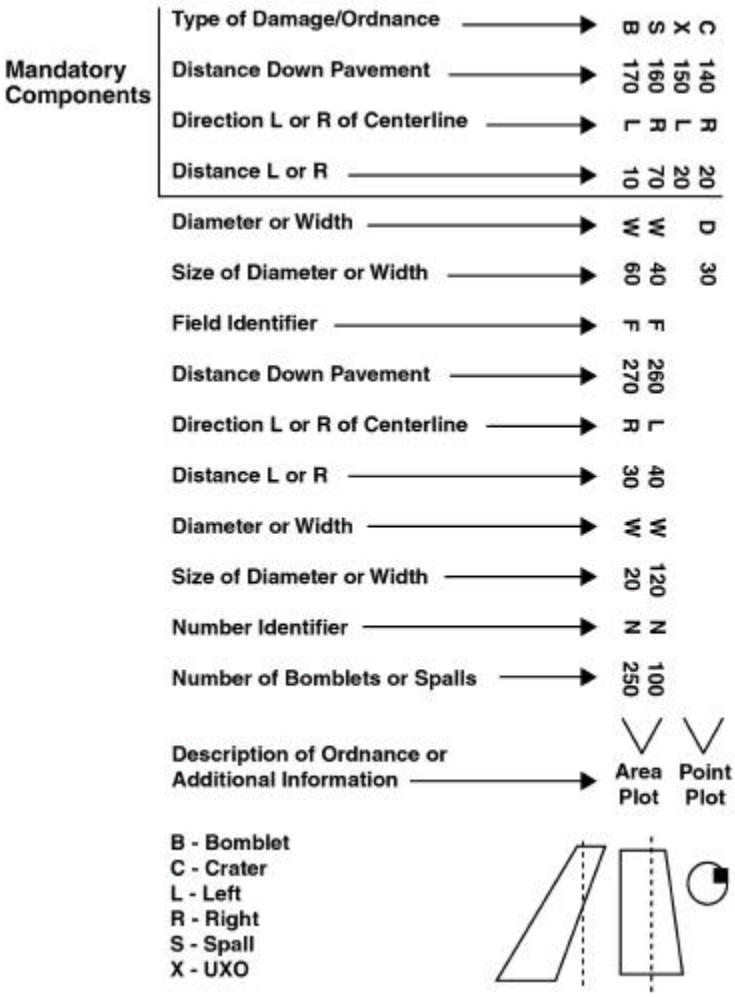
Runway Condition Reading:	wet dry icy	**Runway Surface Conditions:**	Good (no slush/standing water) Poor (slush/standing water)		
Temperature: **Pressure Altitude**:		**Direction**:	unidirectional bidirectional	**Density Altitude**:	0.9 1.0 1.1
Surface Roughness Chart Numbers:					
MOS Length:	**MOS Width**:	**Taxiway width**:			

* Aircraft that have not been have-bouce tested.

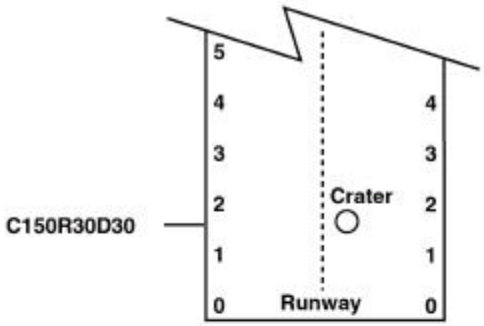
Taxiway Criteria Chart

Aircraft	Repaired Width (feet)	Cleared Width (feet)	Swept Width (feet)	90° Turn Width (feet)	180° Turn Width (feet)	Minimum Crater Spacing (feet)[1]
F-4	25	35	35	30	50	50
C-130	30	135	100	50	100	66
C-141	50	170	85	75	140	none
F-15	25					
F-16	25					
A-10	25					
A-7	25					
F-111	25					
C-5A	60					
DC-10	60	[1] For minimum spacing indicated, 4.5-inch repair quality with maximum taxi speed of 10 knots is allowed. When spacing is less, upgrade repair quality to 3 inches or reduce maximum taxi speed to 5 knots.				
DC-747	60					

NATO Pavement Reference Marking System

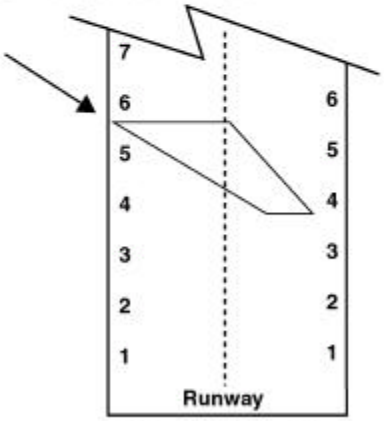


Examples of Plotting Airfield Damage



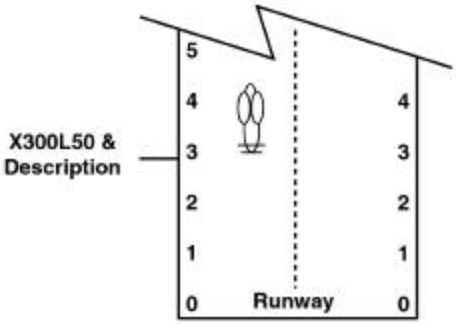
30' diameter crater located
150' down runway
30' right of centerline

S350R60W40F550L50W100N150



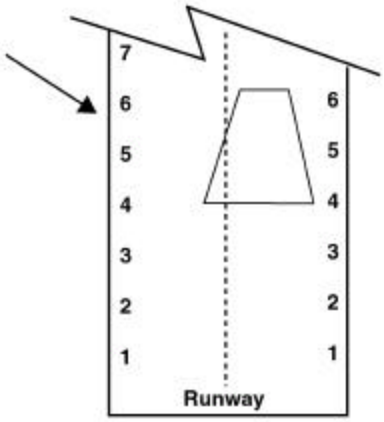
150 spalls located in a
field 350' down runway
with 200' depth

Examples of Plotting Airfield Damage (continued)



UXO located
300' down runway
50' left of centerline

B400L30W140F600R25W40N250-BLU-24/S

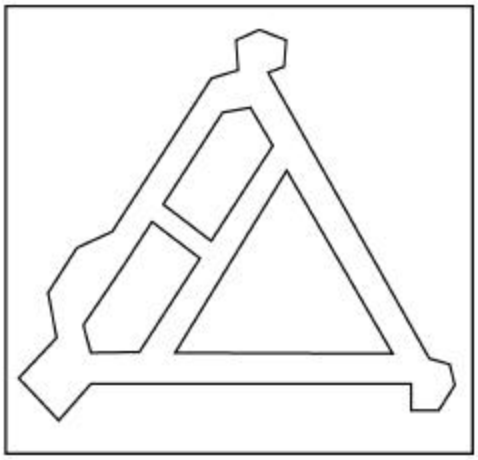


250 bomblets located in a
field 400' down runway
with 200' depth

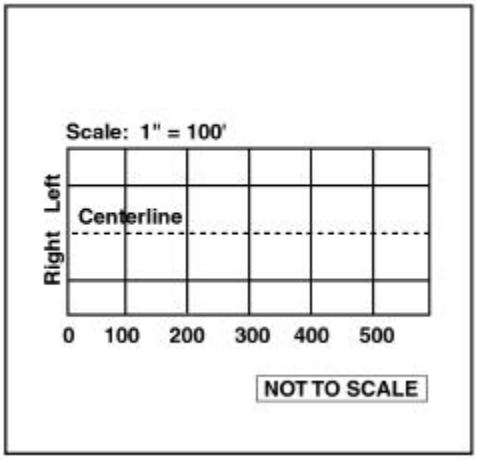
DAT Record Sheet

DAT Number/Route:				Date:		
Crater Number	Type of Damage	Distance from Zero	Left/Right of Centerline	Crater Diameter (apparent)	Number of Spalls	Comments

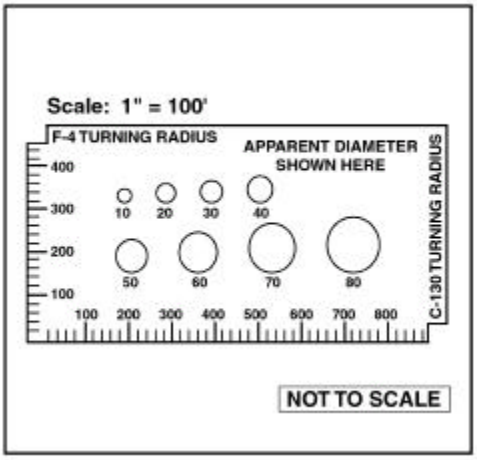
Airfield Map



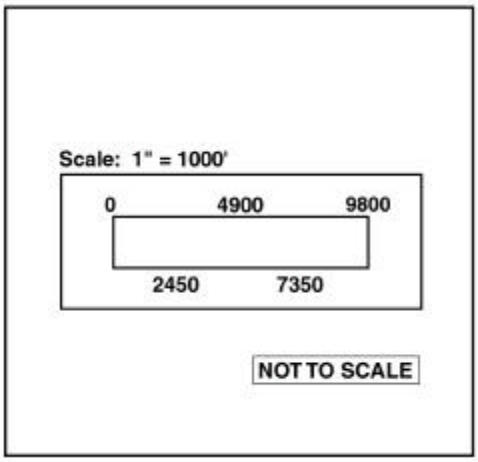
Operating Surface Grid Map



Crater Damage Template



MOS Template



Spall Criteria Chart

Aircraft	Maximum Depth (inches)	Maximum Length in Direction of Travel (feet)	Maximum Slopes of Side (percent)	Maximum Number of Personnel	
				40-Foot Span	100-Foot Span
F-4	1.5	2.0	25	2	2
C-130	3.0	5.0	25	3[1]	3
C-141	2.5	5.0	25	2[2]	2

[1] Taxi speed less than 10 knots.
[2] Taxi speed less than 15 knots.

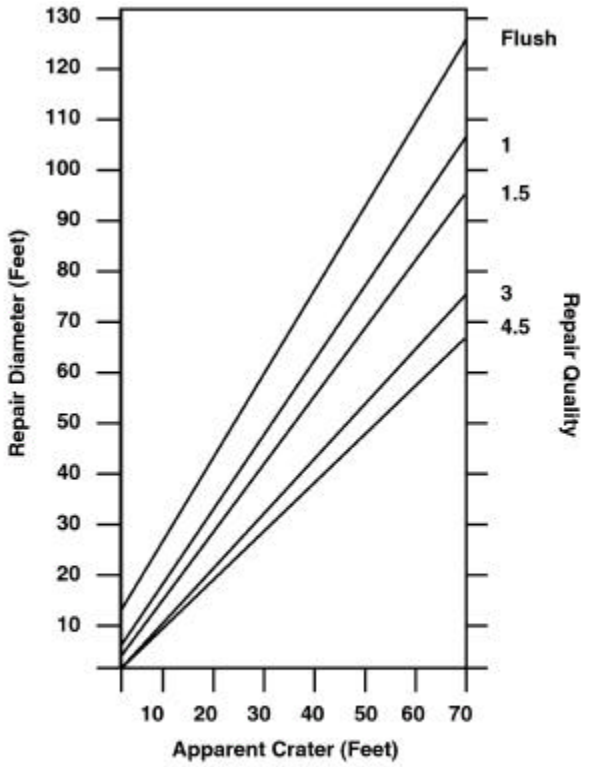
MOS Launch or Recovery Capability Chart

Two-Access Taxiway	One-Access Taxiway	Taxi Backtrack Greater Than 1,000 Feet	Taxi Backtrack Greater Than 2,000 Feet	Barrier in Use	Air Traffic Control Equipment Not Functional	Relative Launch or Recovery Capability (percent)
X						100
X				X		34
X				X	X	25
X		X				60
X			X			50
	X					40
	X			X		27
	X			X	X	19

MOS Selection Team Worksheet

MOS Identification:					**Date:**		
Crater Number	**Distance Down MOS**	**Crater Diameter** (apparent)	**Number of Spalls**	**Distance to Next Crater**	**Quality Repair**	**Crater Diameter** (actual)	**Time** (minutes)
Total Crater Repair Time (minutes/hours)							
Time from Spall Table (minutes)							
Spall Table Time/Repair Teams (minutes/hours)							
Total Time for Repairs (minutes/hours)							

Crater Diameter Conversion Chart



The effects of surface roughness on repair diameter chart converts apparent crater diameter obtained during damage assessment to actual diameter for crater repair estimates and purposes.

EOD Time Worksheet

MOS Identification:		
Line 1	Enter total safe time (minutes).	
Line 2	Enter estimated safing team travel time (minutes).	
Line 3	Sum lines 1 and 2.	
Line 4	Divide line 3 by the number of safing teams.	
Line 5	Enter total area to machine clear (square feet).	
Line 6	Divide line 5 by the machine clearance rate.	
Line 7	Enter total tow distance (feet).	
Line 8	Divide line 7 by machine tow rate.	
Line 9	Enter the number of bomblets to hand clear.	
Line 10	Divide line 9 by the hand clearance rate.	
Line 11	Enter the number of bomblets to be blown in place[1].	
Line 12	Divide line 11 by the blown-in-place rate.	
Line 13	Add line 6, line 8, line 10, and line 12.	
Line 14	Divide line 13 by the number of removal teams.	
EOD Removal Time (minutes): Greatest amount of time between line 4 and line 14.		

[1]If unexploded ordnance must be blown in place, add additional damage repair time to the MOS Selection Team Worksheet.

RRR Time Worksheet for a Chemical Environment

MOS Identification:											
		Crater Diameter									
Quality Repair		**5 feet**	**10 feet**	**15 feet**	**20 feet**	**25 feet**	**30 feet**	**35 feet**	**40 feet**	**45 feet**	**50 feet**
A 0.0 inches	Fresh crew repair time (minutes)	48	95	143	225	238	340	368	415	463	550
	Old crew repair time (minutes)	78	155	233	315	388	460	548	670	703	930
	crater number										
B 1.0 inch	Fresh crew repair time (minutes)	40	80	120	160	200	240	280	365	380	445
	Old crew repair time (minutes)	(65)	130	195	225	325	390	420	620	680	885
	Crater number										
C 1.5 inches	Fresh crew repair time (minutes)	40	80	120	130	190	220	250	290	320	405
	Old crew repair time (minutes)	63	125	170	185	295	330	355	495	630	765
	Crater number										
D 3.0 inches	Fresh crew repair time (minutes)	33	65	80	95	145	210	240	290	310	330
	Old crew repair time (minutes)	53	105	123	140	228	325	345	475	550	625
	Crater number										
E 4.5 inches	Fresh crew repair time (minutes)	13	26	39	80	142	205	230	255	290	325
	Old crew repair time (minutes)	52	105	113	120	218	305	335	410	460	510
	Crater number										

RRR Time Worksheet for a Chemical Environment (continued)

MOS Identification:											
		Crater Diameter									
Quality Repair		**55 feet**	**60 feet**	**65 feet**	**70 feet**	**75 feet**	**80 feet**	**85 feet**	**90 feet**	**95 feet**	**100 feet**
A 0.0 inches	Fresh crew repair time (minutes)	578	680	708	736	783	830	878	926	1013	1100
	Old crew repair time (minutes)	940	950	1008	1096	1218	1340	1373	1406	1633	1860
	Crater number										
B 1.0 inch	Fresh crew repair time (minutes)	511	577	605	633	660	730	745	760	825	890
	Old crew repair time (minutes)	898	910	968	1056	1178	1240	1300	1440	1535	1710
	Crater number										
C 1.5 inches	Fresh crew repair time (minutes)	420	440	470	500	540	580	610	640	725	810
	Old crew repair time (minutes)	780	800	830	860	900	990	1125	1260	1395	1530
	Crater number										
D 3.0 inches	Fresh crew repair time (minutes)	355	420	450	480	530	580	600	620	640	660
	Old crew repair time (minutes)	637	650	670	690	820	950	1025	1100	1175	1250
	Crater number										
E 4.5 inches	Fresh crew repair time (minutes)	347	410	435	460	485	510	545	580	615	650
	Old crew repair time (minutes)	523	610	640	670	745	820	870	920	970	1020
	Crater number										

Rapid Runway Repair Time Worksheet for a Nonchemical Environment

MOS Identification:											
		Crater Diameter									
Quality Repair		**5 feet**	**10 feet**	**15 feet**	**20 feet**	**25 feet**	**30 feet**	**35 feet**	**40 feet**	**45 feet**	**50 feet**
A 0.0 inches	Fresh crew repair time (minutes)	15	29	49	70	100	130	151	172	193	214
	Old crew repair time (minutes)	43	85	136	186	234	282	314	387	438	488
	Crater number										
B 1.0 inch	Fresh crew repair time (minutes)	14	28	41	53	82	110	130	150	171	191
	Old crew repair time (minutes)	41	82	121	160	215	269	310	351	393	435
	Crater number										
C 1.5 inches	Fresh crew repair time (minutes)	14	27	36	44	69	94	106	118	130	142
	Old crew repair time (minutes)	40	80	113	146	192	237	276	315	353	391
	Crater number										
D 3.0 inches	Fresh crew repair time (minutes)	14	27	33	39	58	77	89	102	114	126
	Old crew repair time (minutes)	40	79	108	137	179	221	253	285	318	350
	Crater number										
E 4.5 inches	Fresh crew repair time (minutes)	13	26	30	34	47	59	62	64	66	68
	Old crew repair time (minutes)	38	76	102	128	151	174	197	219	241	263
	Crater number										

Rapid Runway Repair Time Worksheet for a Nonchemical Environment (continued)

MOS Identification:											
		Crater Diameter									
Quality Repair		**55 feet**	**60 feet**	**65 feet**	**70 feet**	**75 feet**	**80 feet**	**85 feet**	**90 feet**	**95 feet**	**100 feet**
A 0.0 inches	Fresh crew repair time (minutes)	230	260	281	302	323	344	365	386	407	428
	Old crew repair time (minutes)	495	564	596	628	701	774	825	876	926	976
	Crater number										
B 1.0 inch	Fresh crew repair time (minutes)	206	220	240	260	280	300	321	342	362	382
	Old crew repair time (minutes)	484	538	579	620	661	702	744	786	828	870
	Crater number										
C 1.5 inches	Fresh crew repair time (minutes)	162	188	200	212	224	236	248	260	272	284
	Old crew repair time (minutes)	437	474	513	552	591	630	668	706	744	782
	Crater number										
D 3.0 inches	Fresh crew repair time (minutes)	147	154	166	178	191	204	216	228	240	252
	Old crew repair time (minutes)	411	442	474	506	538	570	603	636	668	700
	Crater number										
E 4.5 inches	Fresh crew repair time (minutes)	93	118	122	125	126	128	130	132	134	136
	Old crew repair time (minutes)	306	348	378	408	423	438	460	482	504	526
	Crater number										

Crater Repair Worksheet

Repair Crew Number:		
Crater Number	**Crater Repair Time** (minutes)	**Cumulative Repair Time**
Total Crater Repair Time (minutes)		
Total Crater Repair Time (hours)		

Spall Repair Table for a Chemical Environment

Spall Repair Time

Crater Repair Time in Minutes												
3800	4100	4398	4697	4995	5294	5592	5891	6189	6488	6786	7085	7383
	4000	4298	4597	4895	5194	5492	5791	6089	6388	6686	6985	7283
3600	3900	4198	4497	4795	5094	5392	5691	5989	6288	6586	6885	7183
	3800	4098	4397	4695	4994	5292	5591	5889	6188	6486	6785	7083
3400	3700	3998	4297	4595	4894	5192	5491	5789	6088	6386	6685	6983
	3600	3898	4197	4495	4794	5092	5391	5689	5988	6286	6585	6883
3200	3500	3798	4097	4395	4694	4992	5291	5589	5888	6186	6485	6783
	3400	3698	3997	4295	4594	4892	5191	5489	5788	6086	6385	6683
3000	3300	3598	3897	4195	4494	4792	5091	5389	5688	5986	6285	6583
	3200	3498	3797	4095	4394	4692	4991	5289	5588	5886	6185	6483
2800	3100	3398	3697	3995	4294	4592	4891	5189	5488	5786	6085	6383
	3000	3298	3597	3895	4194	4492	4791	5089	5388	5686	5985	6283
2600	2900	3198	3497	3795	4094	4392	4691	4989	5288	5586	5885	6183
	2800	3098	3397	3695	3994	4292	4591	4889	5188	5486	5785	6083
2400	2700	2998	3297	3595	3894	4192	4491	4789	5088	5386	5685	5983
	2600	2898	3197	3495	3794	4092	4391	4689	4988	5286	5585	5883
2200	2500	2798	3097	3395	3694	3992	4291	4589	4888	5186	5485	5783
	2400	2698	2997	3295	3594	3892	4191	4489	4788	5086	5385	5683
2000	2300	2598	2897	3195	3494	3792	4091	4389	4688	4986	5285	5583
	2200	2498	2797	3095	3394	3692	3991	4289	4588	4886	5185	5483
1800	2100	2398	2697	2995	3294	3592	3891	4189	4488	4786	5085	5383
	2000	2298	2597	2895	3194	3492	3791	4089	4388	4686	4985	5283
1600	1900	2198	2497	2795	3094	3392	3691	3989	4288	4586	4885	5183
	1800	2098	2397	2695	2994	3292	3591	3889	4188	4486	4785	5083
1400	1700	1998	2297	2595	2894	3192	3491	3789	4088	4386	4685	4983
	1600	1898	2197	2495	2794	3092	3391	3689	3988	4286	4585	4883
1200	1500	1798	2097	2395	2694	2992	3291	3589	3888	4186	4485	4783
	1400	1698	1997	2295	2594	2892	3191	3489	3788	4086	4385	4683
1000	1300	1598	1897	2195	2494	2792	3091	3389	3688	3986	4285	4583
	1200	1498	1797	2095	2394	2692	2991	3289	3588	3886	4185	4483
800	1100	1398	1697	1995	2294	2592	2891	3189	3488	3786	4085	4383
	1000	1298	1597	1895	2194	2492	2791	3089	3388	3686	3985	4283
600	900	1198	1497	1795	2094	2392	2691	2989	3288	3586	3885	4183
	800	1098	1397	1695	1994	2292	2591	2889	3188	3486	3785	4083
400	700	998	1297	1595	1894	2192	2491	2789	3088	3386	3685	3983
	600	898	1197	1495	1794	2092	2391	2689	2988	3286	3585	3883
200	500	798	1097	1395	1694	1992	2291	2589	2888	3186	3485	3783
	400	698	997	1295	1594	1892	2191	2489	2788	3086	3385	3683
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**

Total Number of Spall

Spall Repair Table for a Nonchemical Environment

Spall Repair Time

Crater Repair Time in Minutes												
3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3071	3176	3281
	2900	2900	2900	2900	2900	2900	2900	2900	2900	3004	3109	3214
2800	2800	2800	2800	2800	2800	2800	2800	2800	2832	2937	3042	3147
	2700	2700	2700	2700	2700	2700	2700	2700	2765	2870	2975	3080
2600	2600	2600	2600	2600	2600	2600	2600	2600	2698	2803	2908	3013
	2500	2500	2500	2500	2500	2500	2500	2627	2632	2737	2842	2942
2400	2400	2400	2400	2400	2400	2400	2400	2460	2666	2670	2775	2880
	2300	2300	2300	2300	2300	2300	2300	2393	3498	2603	2708	2813
2200	2200	2200	2200	2200	2200	2200	2221	2326	2431	2638	2641	2746
	2100	2100	2100	2100	2100	2100	2154	2259	2364	2469	2574	2679
2000	2000	2000	2000	2000	2000	2000	2087	2192	2297	2402	2507	2612
	1900	1900	1900	1900	1900	1916	2021	2126	2231	2336	2441	2546
1800	1800	1800	1800	1800	1800	1849	1964	2059	2164	2269	2374	2479
	1700	1700	1700	1700	1700	1782	1887	1992	2097	2202	2307	2412
1600	1600	1600	1600	1600	1610	1715	1820	1925	2030	2136	2240	2345
	1500	1500	1500	1500	1543	1648	1753	1858	1963	2068	2173	2278
1400	1400	1400	1400	1400	1476	1581	1586	1791	1896	2001	2106	2211
	1300	1300	1300	1305	1410	1515	1620	1725	1830	1936	2040	2145
1200	1200	1200	1200	1238	1343	1448	1553	1658	1763	1868	1973	2078
	1100	1100	1100	1171	1276	1381	1486	1591	1696	1801	1906	2011
1000	1000	1000	1000	1104	1209	1314	1419	1524	1629	1734	1839	1944
	900	900	932	1037	1142	1247	1352	1457	1562	1667	1772	1877
800	800	800	866	971	1076	1181	1286	1391	1496	1601	1706	1811
	700	700	799	904	1009	1114	1219	1324	1429	1534	1639	1744
600	600	627	732	837	942	1047	1152	1257	1362	1467	1572	1677
	500	560	665	770	875	980	1085	1190	1295	1400	1505	1610
400	400	493	598	703	808	913	1018	1123	1228	1333	1438	1543
	321	426	531	636	741	846	951	1056	1161	1266	1371	1476
200	265	360	465	570	675	780	885	990	1095	1200	1305	1410
	188	293	398	503	608	713	818	923	1028	1133	1238	1343
	50	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**

Total Number of Spalls

Section II. RRR Worksheets

The following worksheets and references are provided as a guide to the RRR organization and the airfield recovery process:

- RRR Personnel and Equipment Requirements charts, pages D-23 and D-24, are used to assist in determining unit RRR personnel and equipment requirements.

- Equipment Availability Matrix, page D-25, and Material Availability Matrix, page D-26, are used in identifying equipment and material resources and shortfalls.

- Tools for Measuring Crater Upheaval and Slope Damage, page D-27 and D-28, and the Surface Roughness Criteria for Crater Repair, page D-28, are used to determine acceptable tolerances when conducting crater repair.

- Types of Crater and Spall Damage, page D-29 through D-32, are used to identify possible damage to a forward operating base.

- Methods of Crater and Spall Repair, page D-33, and the Types of FOD Cover for Crater Repair, D-34, help determine the crater repair method and foreign object damage (FOD) cover material.

- Material Estimate Planning Formulas, page D-35, help determine the material requirements.

RRR Personnel Requirements

RRR Crew Personnel Requirements	Crater	Precast Concrete FOD Cover	Concrete FOD Cover	AM2 FOD Cover	FRP FOD Cover	MT Det	Maint Det	Fuels Det	Spall Repair	Clearing and Sweeping	MOS Lighting and Marking	M21 Gear	Hauling
HE Operator	5	2	2	1	2					2		3	6
MT Operator			1	1	1	4				as required		1	as required
Utility Operator			2							1			
EAF Specialist				1[1]	1[1]					1[1]	6	10[1]	
Refueler								2					
Combat Engineer	1[1]	1[1]	1[1]						1[1]	1			
General Laborer	7	16	16	20	11				4				
MT Mechanic							2						
HE Mechanic							2						
Utility Mechanic							2						
Surveyor												2	
Total	13	19	22	23	15	4	6	2	5	?	6	16	?

[1]NCOIC for the crew.

RRR Equipment Requirements

RRR Crew Personnel Requirements	Crater	Precast Concrete FOD Cover	Concrete FOD Cover	AM2 FOD Cover	FRP FOD Cover	MT Det	Maint Det	Fuels Det	Spall Repair	Clearing and Sweeping	MOS Lighting and Marking	M21 Gear	Hauling
Front End Loader	1		1							1			3
Dozer	1												
Grader	1									1			
Roller/ Compactor	1	1											
Excavator	1											1	
Concrete Mixer			1										
Tractor Trailer													as required
5-Ton Truck			1	1	1	2							as required
Dump Truck						2				2			2 per crew
Utility Vehicle	2[1]					1[1]			2[1]	1[1]	1	1	2[1]
Water Truck			1										
Sweeper										2			
Fuel Truck								1					
Flood Lights													
Compressor										1			
Forklift		1	1	1	1							1	3
Concrete Saw	1+	1+											
Crane		1										1	1
Lifting Beam		1											
RTCH					1								
M21 Arresting Gear												as required	
Field Maint Trucks							2						

[1] Vehicle for the crater crew, support crew, aircraft recovery, and hauling crew chiefs.

RTCH=rough terrain container/cargo handler

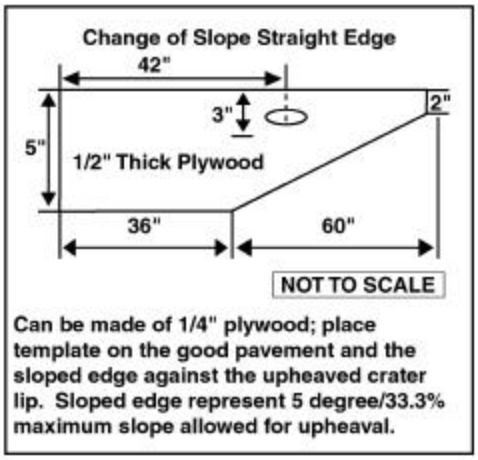
Equipment Availability Matrix

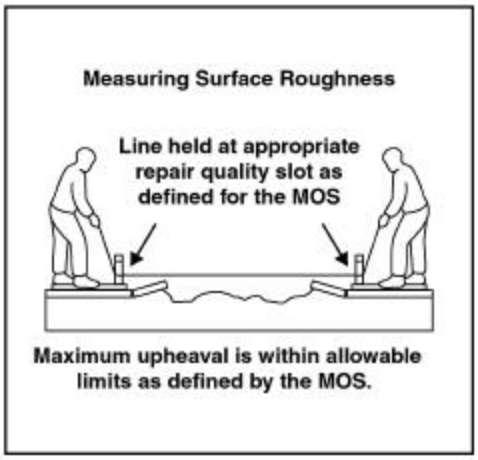
Types of Equipment	Organic Assets	Station	Augmented Assets	RRR Requirements	Shortfall
Front-end loader					
Dozers					
Graders					
Rollers					
Excavator (multipurpose)					
Concrete mixer					
Dump trucks					
Tractor trailers					
LVS					
5-ton trucks					
Water trucks					
Sweepers					
Fuel truck					
Flood lights					
Compressors					
Forklifts					
Pumps					
Concrete saws					
Cranes					
1 1/4-ton tow vehicles					
Totals					

Material Availability Matrix

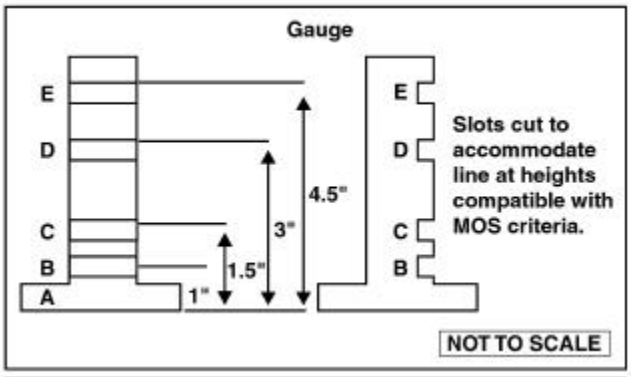
Date:					
Type of Material			**Onsite Inventory**	**Material Required**	**Shortfall**
Fill Material	ballast rock				
	crushed rock				
	sand				
FOD Cover	FRP panels				
	AM-2 matting				
	precast concrete				
	preheated asphalt				
	crushed stone				
Spall Repair	silica	mix			
		pea gravel			
	magnesium phosphate	mix			
		pea gravel			
	penatron (polymer)	mix			
		pea gravel			
	cold mix asphalt				
Spall and FOD Cover	rapid set concrete	Portland cement			
		3/4-inch aggregate			
		sand			
		water			
Optional Materials	sand grids				
	geotextile seals				

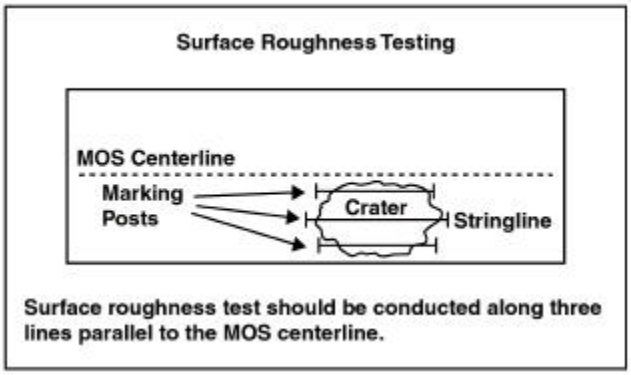
Tools for Measuring Crater Upheaval and Slope of Damage





Tools for Measuring Crater Upheaval and Slope of Damage (continued)

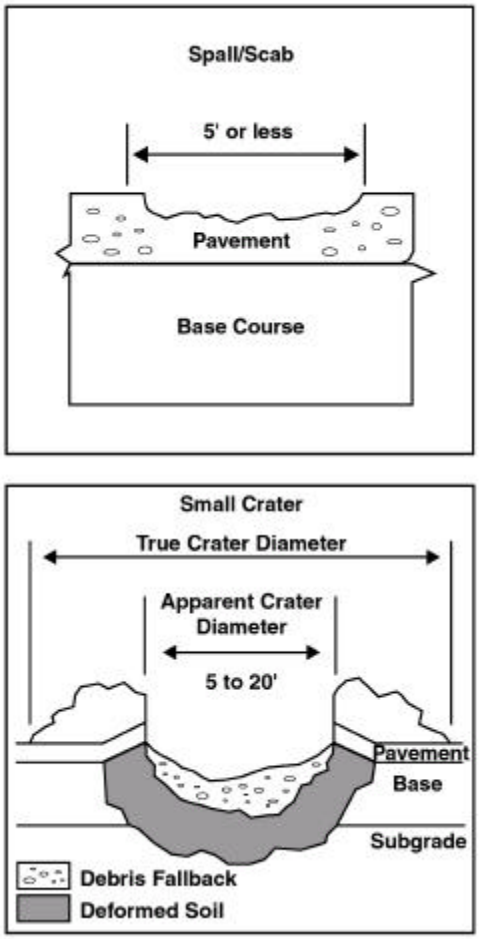




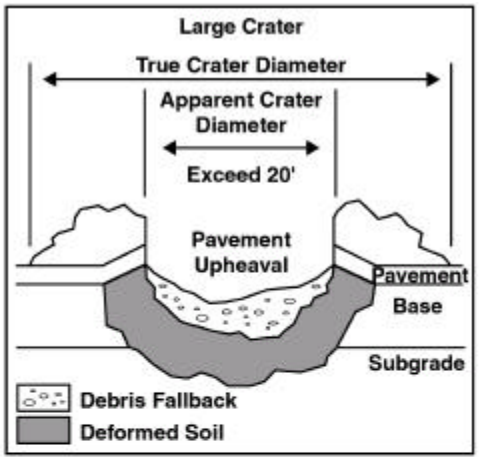
SURFACE ROUGHNESS CRITERIA FOR CRATER REPAIR

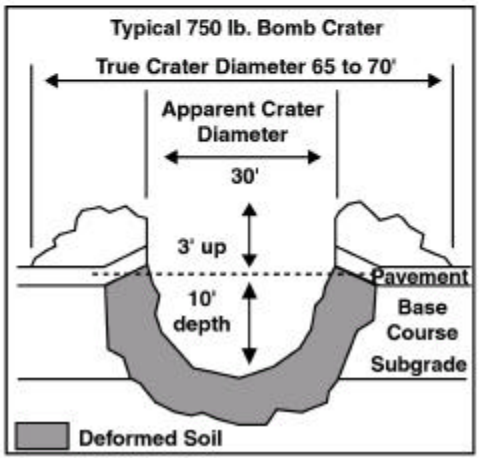
Quality	Criteria
A	Repair must be flush with undisturbed pavement level. (longest repair time)
B	Repair can extend above undisturbed pavement one inch.
C	Repair can extend above undisturbed pavement one and a half inches.
D	Repair can extend above undisturbed pavement three inches
E	Repair can extend above undisturbed pavement four and a half inches.

Types of Crater and Spall Damage

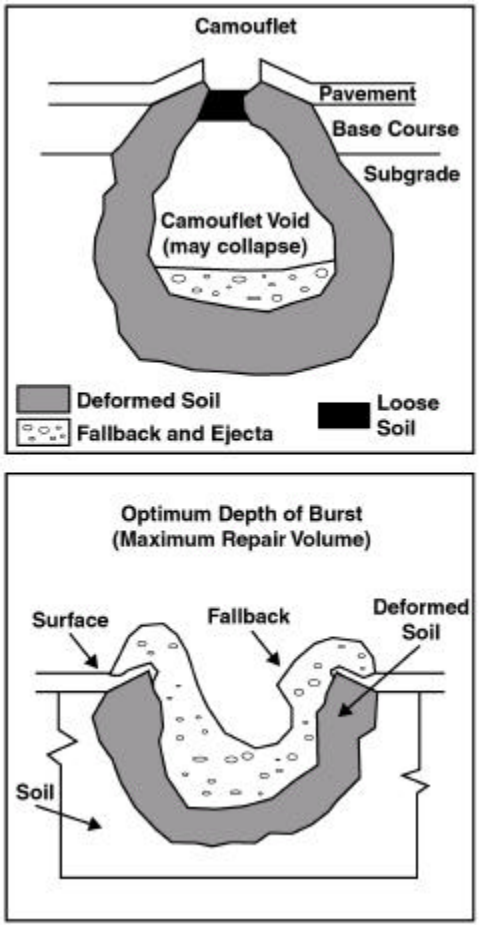


Types of Crater and Spall Damage (continued)

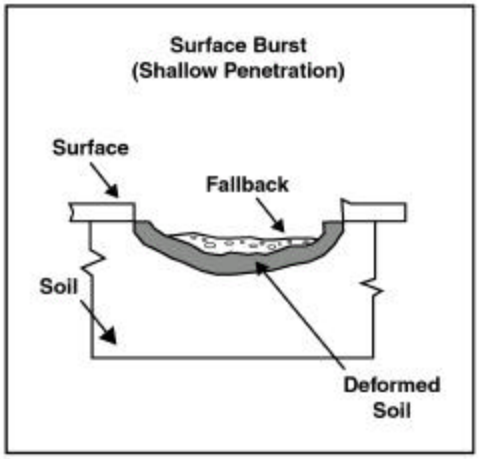


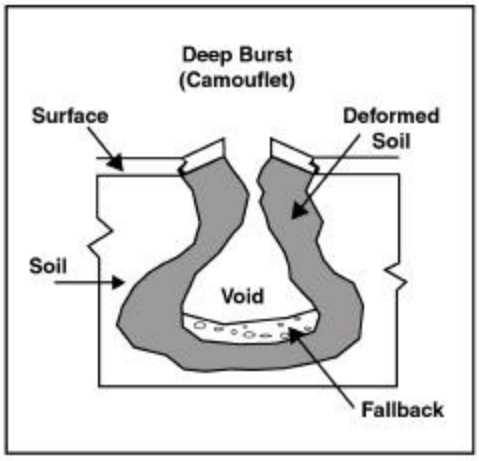


Types of Crater and Spall Damage (continued)

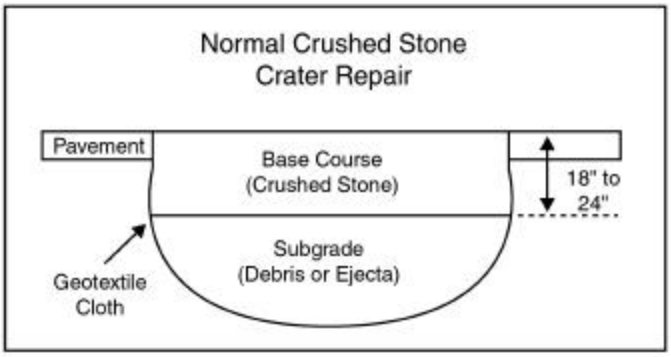


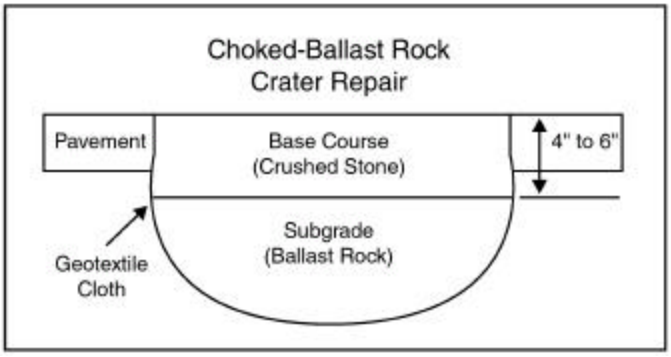
Types of Crater and Spall Damage (continued)



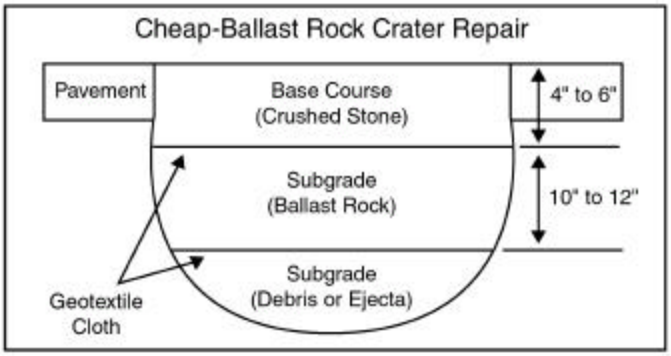


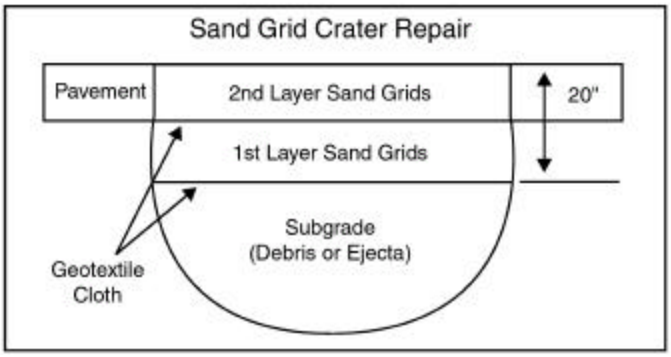
Methods of Crater and Spall Repair





Methods of Crater and Spall Repair (continued)





FOD Cover for Crater Repair

Crater Repair	Foreign Object Damage Cover				
	Rapid Set Concrete	Precast Concrete	AM-2 Matting	Fiberglass Reinforced Polyester	Asphalt
Crushed stone	X	X	X	X	X
Sand			X	X	

Material Estimate Planning Formulas

Determining the quantity of material for repairs is based on the shape and type of repair being conducted (i.e., normal crushed stone, cheap ballast, choked ballast, or sand).

Formulas for Estimating Fill Material (Crushed Stone, Ballast Rock, and Sand) in Feet		
Area of square/rectangle	L x W = ft^2	
Area of cylinder	3.1416 x R^2 = ft^2 [or] 0.7854 x D^2 = ft^2	
Volume of square/rectangle	L x W x H = cu ft	
Volume of cylinder	3.1416 x R^2 x H = cu ft [or] 0.7854 x D^2 x H = cu ft	
Conversion: cu ft to cu yd	cu ft divided by 27 = cu yds	
Formulas for Estimating Foreign Object Damage Cover Requirements in Feet		
AM-2 Matting	(L+4)(W+4) = ft^2 matting	
Fiberglass reinforced polyester	kit = (4) 34 $^2/_3$ ft x 32 ft or (1) 69 $^1/_3$ ft x 62 ft-panels craters <20 ft diameter require 5 ft overhang craters >20 ft diameter require 10 ft overhang	
Precast concrete slabs	slab = 2 x 2 meters (meter = 3.2808 ft) Y = L divided by 6.5616 (round up to whole #) Z = W divided by 6.5616 (round up to whole #) Y x Z = # slabs required	
Rapid set concrete Portland cement ¾-inch aggregate Sand Water	volume of repair (square/rectangle/cylinder) 8 bags per cu yd concrete 1 cu yd per cu yd concrete 1 cu yd per cu yd concrete to be determined by sump required	
cu ft = cubic feet cu yd - cubic yards D = diameter ft^2 = feet squared	H = height/depth L = length R = radium	W = width < = less than > = greater than

Appendix E. Airfield Site Survey

The airfield site survey is designed for use by the survey, liaison, and reconnaissance party (SLRP) to provide information concerning airfield facilities and equipment required by the aviation combat element (ACE) to function at an airfield. Aviation ground support (AGS) items not available at the airfield and considered mission essential will be embarked with the ACE.

The survey on the following pages should be completed in as much detail as possible. The airfield site survey is updated annually by the staff of Marine Aviation Weapons and Tactics Squadron One (MAWTS-1). Updates to this survey can be obtained from the MAWTS-1 home page.

Contents

	Page
AIRFIELD SITE SURVEY	E-3
Section I. Airfield Suitability	E-4
Airfield Lighting	E-4
Soil	E-4
Runway Data	E-6
Taxiway Data	E-8
Parking Apron Data	E-9
Engine Blast	E-11
Aircraft Movement on the Ground	E-12
EAF Development or Extension of Existing Facilities	E-13
Billeting	E-15
Messing	E-15
Section II. Airfield Operations	E-16
Military Police/Flight Line Security	E-16
Communications	E-17
Weather Services	E-21
Structural Fire Fighting and ARFF	E-24
Fuel	E-26

Food Services E-28
Medical E-29
Section III. Motor Transport E-36
Light Vehicles E-36
Medium Vehicles E-36
Heavy Vehicles E-36
Section IV. Engineer E-37
Heavy Equipment E-37
Materials Handling Equipment E-37
Utilities E-37
Construction Material Availability E-39
Construction Requirements E-39
Section V. General Airfield Characteristics E-41
Aerial Port Facilities E-41
Airfield Throughput Capacity E-43
Air Mobility Command Operation Facilities E-44
Base Operations E-45
Aids to Navigation E-46
Aircraft Support E-46
Equipment E-47
Miscellaneous E-48
Summary E-49

AIRFIELD SITE SURVEY

Airfield Name:_____

Airfield Location:_____

Date Survey Completed:_____

Personnel Conducting Survey:

Name/Rank	Position	Organization	Phone

Host Airfield Representatives:

Name/Rank	Position	Organization	Phone

Section I. Airfield Suitability

1. Airfield Lighting

   a. Is lighting powered commercially or by generator? _____

   b. Are power lines buried or above ground? _____

   c. Type wire used (c, 2/c, 3/c): _____

   d. Voltage, amp, and phase: _____

2. Soil. What are general soil conditions (e.g., rock, clay, sand), particularly in areas of possible arresting gear placement? _____

(Use the instructions below to complete the runway, taxiway, and parking apron data on the following pages.)

- Identify and complete data blocks on active or inactive runways, taxiways, and parking aprons.
- Include an airfield diagram/sketch and label runways, taxiways, and parking aprons.
- List the published runway, taxiway or apron strength by at least one of the following designations:
  - T twin gear rating.
  - ST single tandem gear rating.
  - TT twin tandem gear rating.
  - TDT twin delta-tandem gear rating.
  - ESWL equivalent single-wheel loading (include associated tire pressure if available).
  - LCN load classification number.

- List applicable surface strength designations (e.g., if a T is given, attempt to obtain the ST, TT, and TDT rating). If the data is not from a current flight information publication (FLIP), confirm the designation with appropriate airport officials/civil engineers. Every effort should be made to furnish the LCN at airports that will support civil aircraft.

- Identify and locate obstructions adjacent to runways, taxiways, and parking aprons. (Example: Runway distance markers 4 feet high every 1,000 feet along runway 04/22, 8 feet from runway edge.) Confirm the accuracy of obstacle data if it is listed in the current FLIP.

- Identify and include obstructions in the approach and departure zones that violate standards of Air Force Instruction 32-1026, *Planning and Design of Airfields*. Identify obstructions, their heights, and location from a known reference point.

- Record distances between adjacent runways, taxiways, and parking aprons. (Example: 1,000 feet between runway 20 and parallel taxiway.)

- Record condition of area surfaces, regarding possible repair, foreign object damage, and engine blast damage.

- Locate and list ground support equipment, building, and barriers that are subject to possible blast damage.

- Designate tie-down rings that qualify as aircraft grounding points.

- Include gross weight or other limitations imposed by the airport operator/manager.

3. Runway Data

Runway number						
Designation						
Length						
Width						
Surface						
Condition[1]						
Slope						
Published strength						
Imposed weight limits[2]						
Centerline marked						
Distance markers						
Edge markers						
Approach lights						
Threshold lights						
VASI lights						
Shoulders (surface)						
Shoulders (width)						
Shoulders (condition)						
Overrun (length)						
Overrun (surface)						
Overrun (condition)						

[1] Excellent, good, fair, poor (if fair or poor, give details).
[2] Imposed by host airport manager or officials.

a. Describe obstructions along runway, including location, height, and lighting data. (Example: Radar reflector 72 inches high, 300 feet left of centerline runway 04; 550 feet from the approach end):

_____
_____
_____
_____
_____
_____
_____
_____
_____

b. Describe obstructions in approach and departure zones, including location, height, and lighting data. (Example: Trees; 322 feet mean sea level; 1,000 feet prior to threshold runway 22; 70 feet left of runway centerline):_____

_____
_____
_____
_____
_____
_____
_____
_____
_____

c. Describe approach illusions, if any:_____

_____
_____
_____
_____
_____
_____
_____
_____

4. Taxiway Data

Taxiway number						
Designation						
Width						
Surface						
Condition						
Published strength						
Imposed weight limit[1]						
Centerline						
Edge limits						
Shoulder stabilized						
Stabilizing surface						
Stabilizing width						
[1]Imposed by host airport manager or officials.						

Describe obstructions along taxiways, including location, height, and lighting area: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. Parking Apron Data

Parking apron number						
Designation						
Dimensions[1]						
Surface						
Conditions						
Published strength						
Imposed weight limit[2]						
Taxi stripes						
Tie-down rings						
Grounding points						
Shoulder stabilized						
Stabilizing surface						
Stabilizing width						
Flood lighting						

[1]If irregular size, indicate dimensions on attached drawing.
[2]Imposed by host airport manager or officials.

a. Describe obstructions adjacent to a parking apron that will restrict aircraft movement but will comply with taxi obstacle clearance requirements; include location, height, and lighting data:

_____
_____
_____
_____
_____
_____

b. Are remote parking spaces available for explosives handling? Yes__/No__. Designate number of spaces and explosive limits for each parking area (indicate location on attached drawing):_____

_____
_____
_____
_____
_____
_____

c. Are parking spots marked (e.g., C-5, C-141, C-130, CRAF B 747)? Yes__/No__. Explain: _____

_____
_____
_____
_____

d. How much of the total parking area can be allocated for U.S. ground support? Is an LCN waiver required; if so, will local officials grant waivers? _____

_____
_____
_____
_____

e. Does the slope of the parking apron aggravate the breakaway and taxi power requirements? Yes__/No__. Explain: _____

_____
_____
_____
_____

f. Remarks on any aspect of parking aircraft not covered: _____

_____
_____
_____
_____

g. Is space adequate for emergency vehicles to maneuver around aircraft? Yes__/No__. Explain:_____
_____
_____
_____
_____

6. Engine Blast

a. Can engines be run-up to maximum power in parking positions without damage to ground surfaces or structures? Yes__/No__. Explain: _____
_____
_____
_____

b. Is an engine trim pad available for maximum power run-up? Yes__/No__. Explain: _____
_____
_____
_____

c. Is a blast fence installed or planned for engine trim pads? Yes__/No__. Explain: _____
_____
_____
_____

d. Will other aircraft, structures or surfaces be damaged by engine blast from application of breakaway power when aircraft move from parking spot or from taxi power application while following designated taxi routes to and from the parking apron? Yes__/No__. If yes, explain: _____
_____
_____
_____

e. Will damage occur to structures, surfaces or vehicular traffic while the aircraft is in the takeoff position and maximum engine power is applied? Yes__/No__. If yes, explain: _____
_____
_____
_____
_____

f. Include additional engine blast remarks: _____
_____
_____
_____
_____

g. Define disposition requirements for damaged aircraft and/or location for hazardous material:_____
_____
_____
_____
_____

7. Aircraft Movement on the Ground

a. Designate any area not accessible to the aircraft because of surface strength, obstacles or probable engine jet blast damage: _____
_____
_____
_____
_____

b. Specify taxi routes that aircraft would have to follow from landing to the parking aprons and from the parking aprons to runways for takeoff. _____
_____
_____
_____
_____

c. Can the aircraft taxi in and out of the following (if no, give reason):

(1) Refueling area? Yes__/No__

_____

(2) Load/Unload area? Yes__/No__

_____

(3) Maintenance area? Yes__/No__

_____

d. Attach an airfield drawing (8 x 10 inches) showing designated taxiways and proposed parking plan that the aircraft will have to comply with while observing limitations imposed by obstacles, weight bearing capacity, probable blast damage, and aircraft width.

e. Include additional ground movement difficulties: _____

_____

_____

_____

_____

8. EAF Development or Extension of Existing Facilities

a. Sketch proposed airfield showing dimensions, to include existing structures.

b. Provide a general description of the area.

(1) Natural grade/slope:_____

(2) Type and condition of vegetation: _____

(3) Soil classification (e.g., clay, sand, gravel): _____

(4) Roads that cross the area or are adjacent to the area:_____
_____

(5) Potholes, depressions or other items necessitating surface preparation: _____

(6) Manmade or natural obstacles:_____

c. Describe utilities in the unpaved area.

(1) Overhead: _____

(2) Underground: _____

(3) Storm drains or other large underground conduits and underpasses: _____

(4) Water source: _____

d. Provide soil data for unpaved areas. (The utilization of unpaved areas for EAF development is based on predetermination of the soil strength by personnel experienced in testing and identifying soil. Areas identified for potential off-pavement aircraft operations will be tested by qualified soil mechanics.) The data should be made available as a supplement to this survey.

(1) Soil classification in accordance with the Unified Soil Classification System: _____

(2) California bearing ratio (CBR) and moisture content measurements recorded at depths of 3, 6, 9, and 12 inches:_____
_____

(3) Airfield index measurements gathered at the same time, location, and depth as CBRs: _____
_____

9. Billeting

   a. On base

      (1) Number: _____ Type: _____

      (2) Capacity: Officer: _____ Enlisted: _____

   b. Off base

      (1) Number:_____ Type: _____

      (2) Capacity: Officer: _____ Enlisted: _____

10. Messing

   a. On base:_____ Capacity:_____ Hours of operation:_____

   b. Off base:_____ Capacity:_____ Hours of operation:_____

   c. General remarks (e.g., quality, health standards): _____

_____
_____
_____
_____
_____
_____
_____
_____

Section II. Airfield Operations

1. Military Police/Flight Line Security

a. Type guards (e.g., military/civilian, U.S./indigenous): _____
_____
_____
_____
_____

b. Are guards armed? Yes__/No__
If yes, what type of weapon (e.g., handgun, rifle, machine gun)? _____

c. Number of guards on each shift:_____

d. Do guards patrol on foot or in vehicles?_____

e. Are patrol dogs used? Yes__/No__

f. Do guards speak English? Yes__/No__

g. Does the transient aircraft parking apron appear secure? Yes__/No__. Explain: _____
_____
_____
_____
_____

h. Is the transient parking apron well lit? Yes__/No__
Were portable lights furnished? Yes__/No__

i. Does the flight line have restricted access? Yes__/No__

j. Is the flight line fenced? Yes__/No__
If so, what type (e.g., wood, chain link)? _____

k. Does the security force appear to have interbase radios? Yes__/No__

l. Do guards appear to use a restricted area badge or some other type of personal identification? Yes__/No__

m. Do local forces provide a security check of passengers? Yes__/No__

n. Are weapons storage facilities available? Yes__/No__

o. Estimate security requirements: _____
_____
_____
_____
_____

2. Communications

a. Telephones

(1) Is a base telephone exchange available? Yes__/No__

(2) Are commercial lines available? Yes__/No__

(3) Direct Circuit

(a) To _____, _____, _____.

(b) Type Termination

1 Switchboard (PBX): Yes__/No__

2 Console: Yes__/No__

3 Patching capability: Yes__/No__

(4) Defense Switched Network (DSN)

(a) Number of incoming, outgoing, and two-way lines.

1 PBX: _____, _____, _____

2 Four-wire (where is it located):_____, _____

(b) Precedence capability (flash, priority)

1 PBX: _____

2 Four-wire: _____

(c) Maximum calling area (e.g., worldwide, CONUS, Pacific)

1 PBX: _____

2 Four-wire: _____

(d) Number (area code, operator assist): _____

(5) Local Commercial Number (area code, operator assist)

(a) Available: Yes__/No__

(b) Type: _____

(c) Number/listing: _____

b. Record Communications

(1) Telegraph

(a) Speed (words per minute):_____

(b) Type (point-to-point, TELEX, TWX): _____

(c) Highest security classification circuit can process (TS, S, SPECAT): _____

(2) DSN terminal: Yes__/No__

(a) DSTE type (AE, AB): _____

(b) Other (mode V, II): _____

(c) Highest security classification the circuit can process: _____

(3) Distance and travel time between operating locations and communications center:_____

(4) Hours of Operations

(a) 24 hours a day, 7 days a week: _____

(b) 8 hours a day, 5 days a week: _____

(c) Other (specify): _____

(5) Routing indicator: _____

c. Radio

(1) UHF/VHF

(a) Type (AN nomenclature): _____

(b) Quantity: _____

(c) Frequencies available:_____

(2) Intrabase radio net frequency: _____

d. Nearest Federal Aviation Administration center or flight service station facility: _____

(1) Location:_____

(2) Type:_____

(3) Phone number: _____

(4) Distance:_____

e. Auxiliary power for communications equipment:

Volts _____ Hertz _____

f. Type of communications support to be augmented, building and room number where service is required:_____
_____

g. Person to contact and telephone number for coordination of additional communications required:_____
_____

h. General remarks (reliability of communications equipment and long-haul circuits and other pertinent comments): _____
_____
_____
_____
_____

i. Major communications-electronics facilities/capabilities program change: _____
_____

j. Aeronautical Radio Incorporated, Society International of Telecommunication Aeronautics facilities at the airfield: _____
_____
_____
_____

3. Weather Services

a. Observations

(1) Agency responsible for observations: _____
Phone number:_____

(2) Observing hours (Zulu): _____

(3) Location of observing site (with respect to runway): ____
_____
_____
_____

(4) Frequency of observations: _____

(5) Upper air observations:
Rawinsonde:_____Scheduled times:_____
PIBAL:_____Scheduled times:_____

(6) Radar observation: Yes__/No__

b. Forecasts

(1) Agency responsible for forecasts: _____
Phone number:_____

(2) Forecasting hours (Zulu): _____

c. Are weather briefings available to support—
Local flying only? Yes__/No__
International flights? Yes__/No__

d. Weather Communications

(1) Is teletype available? Yes__/No__
Kind:_____
Number of machines: _____
Speed:_____
Intercept capability: _____

(2) Is facsimile available? Yes__/No__
Kind:_____
Number of machines: _____
Speed:_____
Intercept capability: _____

(3) Is telephone service available? Yes__/No__
Local: _____
Long line capability:_____

(4) Where does the weather station transmit its weather data?
Locally:_____
Long line: _____

(5) Weather data received in the weather station comes from whom/where?_____

(6) Pilot to forecaster (metro): Yes__/No__
Frequency: _____

e. Weather equipment to measure:

(1) Wind
Sock: Yes__/No__
Anemometer: Yes__/No__ Type: _____

(2) Temperature/Humidity: Yes__/No__ Type: _____

(3) Visibility
Runway visual range: Yes__/No__ Type:_____
Transmissometer: Yes__/No__ Type:_____

(4) Ceiling: Yes__/No__ Type:_____

(5) Other:_____
_____
_____

f. Miscellaneous Weather Station Information

(1) Where is the physical location (building and phone)?
_____

(2) How close is the weather station to the primary location where aircrews file flight plans (e.g., base operations, flight service station)? _____

(3) Do weather people speak English? Yes__/No__
How well? _____

(4) Where is the nearest U.S. Embassy/consulate?_____
_____
What is the distance from the weather station?_____

(5) What is the Embassy's/Consulate's address? _____
_____
Message address:_____
Telephone number: _____

(6) What are plans for increasing/improving service? _____
_____
_____
_____

(7) Other remarks: _____
_____
_____
_____
_____
_____
_____
_____
_____

4. Structural Fire Fighting and ARFF

a. Rescue Crews

(1) Are rescue crews housed and messed on the flight line? Yes__/No__

(2) Is a full suit of protective clothing available for each on-duty firefighter (i.e., hood, coat, trousers, boots, gloves)? Yes__/No__

(3) Is aluminized protective clothing available? Yes__/No__

(4) Is a water supply available on the airfield for refilling crash trucks? Yes__/No__

b. Operations

(1) Is each firefighting vehicle radio equipped? Yes__/No__

(2) Can vehicles communicate with the tower? Yes__/No__

c. Equipment. (Provide the following information for non-USMC fire protection vehicles.)

Make: _____
Number: _____
Water Capacity: _____

Foam Capacity: _____
Number of Turrets: _____
Water rate (gallons per minute) of turrets:_____

d. Nearest Hospital

(1) Name:_____

(2) Location: _____

(3) Distance from base: _____

e. During a contingency, how many medical personnel will reside at the base medical facility?

(1) Flight surgeons: _____

(2) Other physicians:_____

(3) Medical technicians: _____

(4) Dentists:_____

(5) Dental technicians: _____

(6) Nurses:_____

f. Number of Ambulances

(1) Crash ambulances with radios: _____

(2) Other Ambulances
Military:_____
Civilian: _____

g. Does a crash ambulance normally respond to all inflight emergencies? Yes__/No__

h. During an emergency, how many ambulances will remain at the base medical facility?

(1) Crash ambulances: _____

(2) Military ambulances: _____

i. General comments/remarks: _____
_____
_____
_____
_____
_____
_____

5. Fuel

a. Storage

(1) Bulk storage capability: _____

(2) Average inventory in bulk storage: _____

(3) How does bulk storage receive the jet fuel (tank truck [TT]; tank car [TC]; pipeline [PL]; tanker/barge [TB])? _____
_____
_____

(4) Receiving rate (simultaneously by TT, TC, PL, and TB):
_____

(5) Transfer rate (gallons per minute) from bulk storage to the hydrant storage tanks: _____

b. Jet Fuel Dispensing Capabilities

(1) Hydrant storage capability: _____

(2) Number of hydrant refueling positions:_____

(3) Gallons per minute that can be pumped through the hydrant systems: _____

(4) Number of aircraft that can be refueled simultaneously by hydrants: _____

(5) Number/capacity (gallons) and pumping rates (gallons per minute) of refueling vehicles (trucks): _____

(6) Turnaround time from flight line to fuel point, fill, and return to the flight line: _____

(7) Number of fuel points and pumping capacity of each:

_____
_____
_____
_____

(8) Distance between fuel points: _____

(9) Compatibility of host support equipment to USMC airfield:_____
_____
_____

c. Off-Base Facilities

(1) Location of off-base supply point:_____
_____

(2) Storage capacity and average fill: _____
_____

(3) Trace POL supply back to port or refinery; if refinery is source, determine production capability for jet fuels: _____
_____

(4) Resupply rate from off-base facility using organic and HN assets: _____

(5) Vulnerability of off-base fuel storage: _____
_____

(6) Location of alternate off-base facilities:_____
_____

(7) Redundancy of refuel supply methods from off-base source (e.g., roads, rail, pipeline): _____

d. POL Test Lab

(1) Is a POL test lab in operation? Yes__/No__

(2) Would military personnel be allowed to work in the labs? Yes__/No__

6. Food Services

a. On-base location: _____
Hours of operation: _____

b. Off-base location: _____
Hours of operation: _____

(1) Do the off-base eating facilities practice good standards of food preparation? Yes__/No__

(2) Are there foods/drinks that should be avoided by USMC personnel? Yes__/No__

(3) What is the source of local water?_____

(4) Is the local water supply disinfected? Yes__/No__

7. Medical

a. General Information

(1) Topography (e.g., mountains, desert):_____

(2) Climate (e.g., tropical, arctic):_____

(3) Temperature Ranges
Summer: _____ to _____
Winter: _____ to _____

(4) Distance to water source:_____

(5) Availability of Water

Source	Quality	Quantity	Contaminants

(6) Epidemiology

(a) Is the base located in a malaria risk area? Yes__/No__
Is the surrounding countryside in the risk area?
Yes__/No__
Months of the year that the base is at risk: _____
Months of the year that the country is at risk:_____

(b) Other Diseases

Disease	Occurrence

(7) Insects, plants, and animals of medical importance: _____
_____
_____
_____
_____

(8) HN vector control services: _____

b. Civilian Health Services

(1) Organization and administration: _____
_____
_____
_____
_____

(2) Public health laws: _____
_____
_____
_____
_____

(3) Comments on overall quality of civilian health care (include blood bank and blood testing): _____
_____
_____
_____
_____

(4) Significant Personnel (coroner or equivalent)

Name	Title

c. Military Medical Services

(1) Organization and Administration: _____

_____
_____
_____
_____
_____
_____

(2) Medical logistics (e.g., patient transport, blood supplies):

_____
_____
_____
_____
_____
_____

(3) Comments on overall quality of military health care:

_____
_____
_____
_____
_____
_____

(4) Significant Personnel

Name	Title

d. Medical Material

(1) Production Capabilities

Name	Location	Production

(2) Stockpiles

Name	Civilian/Military	Material

e. Local Medical Institutes

(1) Facilities

Name	Location

(2) Significant Personnel

Name	Title

f. Outpatient Care Available

(1) On base: Yes__/No__

(2) Off base: Yes__/No__

g. Number of Physicians Available (overseas bases only)

(1) Flight surgeons: U.S. _____ foreign nationals _____

(2) Other physicians: U.S. _____ foreign nationals _____

h. Number of Medical Technicians Available
U.S. _____ Foreign nationals _____

i. Number of Dentists Available
U.S. _____ Foreign nationals _____

j. Number of Dental Technicians Available
U.S. _____ Foreign nationals _____

k. Number of Nurses Available
U.S. _____ Foreign nationals _____

l. Number of In-Patient Beds Available
On base: _____
Off base: _____

m. Health and Sanitation of Local Area

(1) Give general impression of local area.

(a) Organic material (wastes) present: _____
_____

(b) Industrial pollutants in local water: _____
_____

(c) Evidence of atmospheric pollution: _____
_____

(2) Give general impression of local city conditions.

(a) Garbage and trash accumulation (degree of): _____
_____

(b) Fly/insect vector population: _____
_____

(c) Stray animals (is rabies present): _____
_____

(d) Sanitary compliance in restaurants, bars, and street vendors: _____
_____

(e) Illicit drug availability (what types and where): ____
_____
_____

(f) Prostitution (is solicitation legal; and where does it occur, streets, bars, etc.; are health cards carried): _____
_____
_____

Section III. Motor Transport

(Support provided by host nation/activity)

1. Light Vehicles[1]

   a. Type (e.g., car, van, taxi service):_____
   _____
   _____

   b. Hours of operation: _____

2. Medium Vehicles[1]

   a. Type (e.g., bus, truck, wrecker): _____
   _____
   _____

   b. Hours of operation: _____

3. Heavy Vehicles[1]

   a. Type (e.g., tractor-trailer, long bed): _____
   _____
   _____

   b. Hours of operation: _____

_____

[1] Does the HN provide drivers? How are fuel and repair costs handled?

Section IV. Engineer

(Support provided by host nation/activity)

1. Heavy Equipment

   a. Type: _____

   b. Capacity: _____

   c. Hours of operation: _____ _

2. Materials Handling Equipment

   a. Crane

      (1) Type: _____

      (2) Capacity: _____

      (3) Hours of operation: _____

   b. Forklift

      (1) Type: _____

      (2) Capacity: _____

      (3) Hours of operation: _____

3. Utilities

   a. Power

      (1) AC/DC: _____

(2) Source: _____

(3) Voltage: _____

(4) Wattage capacity: _____

(5) Reliability: _____

(6) Phases: _____

b. Water Points

(1) Location: _____

(2) Quantity: _____

(3) Quality: _____

c. Laundry capacity: _____

d. Bathing facilities: _____

e. Sewage treatment/human waste removal: _____

_____

f. Garbage Dump

(1) Location: _____

(2) Restrictions: _____

g. Hazardous materials removal: _____

_____

_____

_____

4. Construction Material Availability (e.g., lumber, fill, sand, gravel, concrete)

   a. Quantity:_____

   b. Type: _____

   c. Procurement requirement: _____

   d. Location: _____

5. Construction Requirements

   a. Site preparation: _____
_____

   b. Earth work:_____
_____

   c. Road work:_____
_____

   d. Drainage: _____
_____

   e. Berms (Class V TAFDS): _____
_____

   f. Bunkers: _____
_____

   g. Minefields: _____
_____

   h. Obstacles/barriers: _____
_____

i. Ditches: _____
_____

j. Guard towers: _____
_____

k. Aircraft Revetments: _____
_____

l. Aircraft recovery system: _____
_____

m. Airfield lighting: _____
_____

n. Airfield parking ramp: _____
_____

o. Obtain or produce a layout of the entire airfield and include major construction efforts (e.g., roads, containment areas, TAFDS site, equipment lot, Class V site). Ensure adequate area is available for each proposed site and pay particular attention to drainage and trafficability.

Section V. General Airfield Characteristics

(This section is ACE related and should be filled out by the ACE representative.)

1. Aerial Port Facilities

   a. Cargo Terminal

      (1) Covered space available: _____
      _____

      (2) Outside storage space available: _____
      _____

      (3) Building number: _____ Space: _____

      (4) Aircraft Loaders (quantity)
      40K:_____ 25K: _____
      10K forklift: _____ 4K forklift:_____
      Wide-body MHE (type and capacity):_____
      _____
      Upper lobe: _____ lower lobe: _____
      Other (explain type and rate capacity): _____
      _____

      (5) Pallet/container trailers:_____
      _____

      (6) Pallet/cargo scales (type, make/weight capability): _____
      _____

      (7) Flat-bed trucks (type/rollerized/length): _____
      _____

(8) Truck off/on loading ramp(s): _____
_____

(9) MHE repair location: _____
_____
Space: _____
Vehicle cleaning capability/wash rack: _____
_____

b. Passenger Facilities

(1) Location: _____ Maximum capacity: _____

(2) Eating facilities available: _____

(3) Passenger stairs (type, height capability): _____
_____

c. Fleet Service

(1) Location: _____ Space: _____

(2) Inflight kitchen: _____

(3) Latrine servicing truck (type/capacity): _____
_____

(4) Disposal facility (distance/availability): _____

d. Cargo Storage Area

(1) Inside storage (in square feet): _____
Type flooring (e.g., concrete, dirt, gravel, asphalt): _____
_____

(2) Outside storage (in square feet): _____
Type surface: _____

Is area fenced? Yes__/No__
Are outside lights available? Yes__/No__

(3) Available Cargo Storage Vehicle Parking Capacity (other than the designated storage area)

(a) Vehicles (area dimensions): _____
Wheeled (area dimensions): _____
Tracked (area dimensions):_____

(b) Cargo: _____

e. Hazardous Cargo Buildup Areas

(1) Distance to remote parking: _____

(2) Size: _____

(3) Type surface: _____

(4) Revetment type: _____

(5) Maximum net explosive weight allowed in holding area:
_____

2. Airfield Throughput Capacity

(Throughput capacity is comprised of the personnel, equipment, and facilities required to perform the functions necessary for receiving, parking, unloading, processing, and clearing of cargo and passengers at an airport.)

a. Specify the tonnage that could be moved through the airfield during each 24-hour period.

(1) Current average daily throughput in short tons: _____

(2) Estimated maximum daily throughput capability (with current manpower and equipment) in short tons: _____

(3) Estimated maximum throughput capability (unconstrained by current manpower requirements) in short tons: _____

b. Provide information required to move arriving personnel, vehicles, and cargo to their final destination.

(1) Identify and indicate the distance to the nearest railhead(s) with the capacity to load wheeled and tracked vehicles. Include capabilities for loading ramps and marshaling areas: _____
_____
_____
_____
_____

(2) Identify the number and type of major roads serving the airfield and movement restrictions in the vicinity of the airfield and/or between the airport and railhead(s) that could prevent movement of large wheeled or tracked vehicles. _____
_____
_____
_____
_____

3. Air Mobility Command Operation Facilities

a. Is a room or building available for operations (briefings, flight planning)? Yes__/No__
Building number: _____
Limitations:_____

b. Is a method for control of classified material available?
Yes__/No__
Limitations:_____

4. Base Operations

a. Building number: _____Telephone number: _____

b. Are notices to airmen (NOTAMs) available? Yes__/No__

c. Are flight publications available? Yes__/No__

d. Customs required? Yes__/No__

e. Is runway condition reading measuring equipment available? Yes__/No__

f. Control Tower

(1) Does position and construction of control tower afford operators unrestricted visibility of approaches, runways, and taxi strips? Yes__/No__

(2) What are the equipment limitations for guarding and transmitting on air/ground frequencies? _____
_____
_____

(3) Is emergency power available for the tower? Yes__/No__

(4) Are up-to-date charts and diagrams, including crash grid maps, maintained in the tower? Yes__/No__

(5) Who operates the tower facility?_____
_____

g. Remarks: _____
_____
_____
_____
_____

5. Aids to Navigation

a. Are the following navigational aids available?

	Yes	No
VOR	___	___
TACAN	___	___
RBN	___	___
ILS	___	___
PAR	___	___
ASR	___	___
Instrument approach procedures		
USMC	___	___
USAF	___	___
Other type (FLIP, Jeppesen, HN only)	___	___
Standard instrument departure (SID) procedures		
USMC	___	___
USAF	___	___
Other type (FLIP, Jeppesen, HN only)	___	___

b. Determine which replacements or additions to existing facilities are expected: _____
_____
_____
_____

c. Can published SID procedures be used in lieu of radar vectors? Yes__/No__ (Attach a copy of current SIDs.)

6. Aircraft Support

a. Is de-icing equipment available? Yes__/No__
Type fluid:_____
Status of equipment: _____

b. Transient Alert Procedures

(1) Is a follow-me vehicle available? Yes__/No__
Operating hours of the vehicle: _____

(2) Are aircraft marshaling personnel available? Yes__/No__

(3) Are fire guards available? Yes__/No__

7. Equipment

a. List available two tractors (e.g., MD-3, M32A-60): _____
_____
Additional requirements: _____
_____

b. List available air carts (e.g., MA-1A, M32A-60): _____
_____
Additional requirements: _____
_____

c. List available generators (e.g., 90G20P):_____
_____
Additional requirements: _____
_____

d. List types of hydraulic test stands available: _____
_____

e. Identify number of air compressors available.
High pressure: _____
Low pressure:_____

f. Identify type and number of heaters available: _____
_____
Additional requirements: _____
_____

g. Identify type and number of light carts available: _____
_____

Additional requirements: _____
_____

h. List other powered ground support equipment: _____
_____

Additional requirements: _____
_____

i. Jacks. (If aircraft jacking must be accomplished outdoors, designate an area where ramp has sufficient strength and where jet/prep blast of taxiing aircraft will not affect jacked aircraft.)

Type	Purpose	Available	Required

j. Maintenance Stands

Type	Purpose	Available	Required

8. Miscellaneous

a. Are liquid/gaseous oxygen, oils, and tires/wheels (buildup) available or procurable? Yes__/No__. Explain: _____
_____
_____
_____
_____
_____

b. Which runway clearance vehicles are available (i.e., snow removal, runway sweepers)? _____

_____

_____

c. Which U.S. air carriers operate through the airfield?

_____

_____

d. Which NATO air carriers operate through the airfield?

_____

_____

9. Summary. (Summarize the airfield's capability to support C-130/C-141/C-5 and CRAF B-747, DC-10, and DC-8 aircraft. Include the airfield's capabilities to support an on/off load, en route stop or emergency/alternate capability. Include limiting factors not covered by this survey and measures necessary to correct limiting factors.)_____

_____

_____

_____

_____

_____

_____

Appendix F. Glossary

Section I. Acronyms and Abbreviations

AB . . . . . automated branch
ABGD . . . . . air base ground defense
ABMP . . . . . air base master plan
AC . . . . . alternating current
ACE . . . . . aviation combat element
AE . . . . . automated exchange
AFDD . . . . . Air Force doctrine document
AFI . . . . . Air Force instruction
AGS . . . . . aviation ground support
AGSOC . . . . . aviation ground support operations center
AMC . . . . . Air Mobility Command
AN . . . . . Army/Navy (radio designation)
AO . . . . . area of operations
AOR . . . . . area of responsibility
ARFF . . . . . aircraft rescue and fire fighting
ASP . . . . . ammunition supply point
ASR . . . . . airport surveillance radar
ATC . . . . . air traffic control
ATCF . . . . . air traffic control facility
BDOC . . . . . base defense operations center
BRAAT . . . . . base recovery after attack (team)
CA . . . . . California
CAD . . . . . computer-aided design
CAEMS . . . . . computer-aided embarkation management system
CALM . . . . . computer-assisted load manifest
CAS . . . . . close air support
CBR . . . . . California bearing ratio
CC NET . . . . . crater crew network
CINC . . . . . commander in chief
CONUS . . . . . continental United States
CSS . . . . . combat service support
CSSE . . . . . combat service support element

CSSOC . . . . . combat service support operations center
DART. . . . . damage assessment and response team
DASC. . . . . direct air support center
DAT . . . . . damage assessment team
DC . . . . . .direct current
DED . . . . . detailed equipment decontamination
det. . . . . detachment
DSN . . . . . Defense Switched Network
DSTE . . . . . digital subscriber terminal equipment
DTD . . . . . detailed troop decontamination
EAF . . . . . expeditionary airfield
engr . . . . . engineer
EOD . . . . . .explosive ordnance disposal
EOR . . . . . explosive ordnance reconnaissance (agent)
ESBn . . . . . engineer support battalion
ESWL. . . . . equivalent single wheel loading
F/F . . . . . .flight ferry
FARP . . . . . forward arming and refueling point
FEBA . . . . . .forward edge of the battle area
FIE . . . . . fly-in echelon
FLIP . . . . . flight information publication
FLOLS . . . . . .fresnel lens optical landing system
FLOT . . . . . .forward line of own troops
FMFM . . . . . .Fleet Marine Force manual
FML . . . . . field marker lights
FOB . . . . . .forward operating base
FOD . . . . . foreign object damage
FOE . . . . . .follow-on echelon
FRP . . . . . fiberglass reinforced polyester
FSSG . . . . . force service support group
ft . . . . . feet
FW . . . . . fixed-wing
GCE . . . . . ground combat element
GSE . . . . . ground support equipment
HAUL NET . . . . . .hauling crew network
HE . . . . . .heavy equipment
HD-1 . . . . . helicopter direction-1

HERS. . . . . helicopter expeditionary refueling system
HF . . . . . .high frequency
H&HS . . . . . headquarters and headquarters squadron
HN. . . . . .host nation
HQMC. . . . . Headquarters Marine Corps
IED . . . . . .improvised explosive device
ILS. . . . . .instrument landing system
IMA. . . . . .intermediate maintenance activity
IPB. . . . . intelligence preparation of the battlespace
IR. . . . . infrared
JFC . . . . . joint force commander
JOPES . . . . . Joint Operation Planning and Execution System
JP. . . . . .joint publication; jet petroleum
JRA . . . . . .joint rear area
JRTOC. . . . . .joint rear tactical operations center
JTTP . . . . . .joint tactics, techniques, and procedures
Kt. . . . . knot (nautical miles per hour)
LAAD . . . . . low altitude air defense
LAN. . . . . local area network
LCN. . . . . .load classification number
LOC. . . . . lines of communications
LOS . . . . . line of sight
LVS . . . . . Logistics Vehicle System
LZ . . . . . landing zone
MACG. . . . . Marine air control group
MACS . . . . . Marine air control squadron
MAG . . . . . Marine aircraft group
MAGTF. . . . . .Marine air-ground task force
MAGTF II/LOG AIS . . . . . MAGTF Logistics Automated Information System
maint . . . . . .maintenance
MALS . . . . . Marine aviation logistics squadron
MATC . . . . . .Marine air traffic control
MAW. . . . . Marine aircraft wing
MAWTS-1. . . . .Marine Aviation Weapons and Tactics Squadron One
MCCRES. . . . . .Marine Corps Combat Readiness Evaluation System
MCDP . . . . . Marine Corps doctrinal publication

MCO . . . . . Marine Corps order
MCRP . . . . . Marine Corps reference publication
MCWP . . . . . Marine Corps warfighting publication
MDSS II . . . . . MAGTF Deployment Support System II
MEF . . . . . Marine expeditionary force
MetMF (R) . . . . . meteorological mobile facility (replacement)
METOC . . . . . meteorological and oceanographic
METT-T . . . . . mission, enemy, terrain and weather, troops and support available-time available
MEZ . . . . . missile engagement zone
MHE . . . . . materials handling equipment
MMT . . . . . Marine air traffic control mobile team
MOOTW . . . . . military operations other than war
MOS . . . . . minimum operating strip
MOSLS . . . . . minimum operating strip lighting system
MP . . . . . military police
MPF . . . . . maritime pre-positioning force
MPS . . . . . maritime pre-positioning ships
M/S . . . . . monitor/survey
MSR . . . . . main supply route
MST . . . . . MEF weather support team
MT . . . . . motor transport
MWCS . . . . . Marine wing communications squadron
MWSG . . . . . Marine wing support group
MWSS . . . . . Marine wing support squadron
MWSS (FW) . . . . . Marine wing support squadron (fixed-wing)
MWSS (RW) . . . . . Marine wing support squadron (rotary-wing)
NATO . . . . . North Atlantic Treaty Organization
NATOPS . . . . . Naval Air Training and Operating Procedures Standardization
NAVAIR . . . . . Naval Air Systems Command
NAVAIRINST . . . . . Naval Air Systems Command instruction
NBC . . . . . nuclear, biological, and chemical
NC . . . . . North Carolina
NCF . . . . . naval construction forces
NCO . . . . . noncommissioned officer
NCOIC . . . . . noncommissioned officer in charge

NIPRNET . . . . . nonsecure internet protocol router network
NOTAM . . . . . .notice to airmen
NVD . . . . . night vision device
NVG . . . . . night vision goggles
NWP . . . . . naval warfare publication
OIC . . . . . officer in charge
OMA . . . . . organizational maintenance activity
OPNAVINST . . . . . Chief of Naval Operations Instruction
OPP . . . . . off-load preparation party
PAR . . . . . precision approach radar
PBX . . . . . private branch exchange
PIBAL . . . . . pilot balloon
POL . . . . . petroleum, oils, and lubricants
RAOC . . . . . rear area operations center
RAS . . . . . rear area security
RASC . . . . . rear area security coordinator
RASP . . . . . .rear area security platoons
RBN. . . . . radio beacon
RRR. . . . . rapid runway repair
RW . . . . . .rotary-wing (aircraft)
S. . . . . secret
S-1 . . . . . .manpower staff officer/organization
S-2 . . . . . .intelligence staff officer/organization
S-3 . . . . . .operations staff officer/organization
S-4 . . . . . .logistics staff officer/organization
S-6 . . . . . communications and information systems officer/organization
SATS . . . . . small aircraft transportation system
Seabees . . . . . naval construction force
SID . . . . . .standard instrument departure
SIPRNET. . . . . SECRET internet protocol router network
SIXCON . . . . . six containers together (modular system)
SLRP . . . . . .survey, liaison, and reconnaissance party
SPECAT . . . . . .special category
SPT NET . . . . . support crew network
SRC . . . . . .surface roughness chart
ST . . . . . single tandem gear rating

T . . . . . twin gear
TACAN . . . . . tactical air navigation aid
TACC. . . . . tactical air command center
TACP . . . . . tactical air control party
TAFDS. . . . . tactical airfield fuel dispensing system
TBA . . . . . table of basic allowance
TC-AIMS . . . . . Transportation Coordinator's Automated Information for Movement System
TDT . . . . . twin delta tandem gear rating
T/E . . . . . table of equipment
TELEX. . . . . teletype
THREATCON . . . . . threat condition
TLZ . . . . . tactical landing zone
TO . . . . . technical order
T/O . . . . . table of organization
TPFDD. . . . . time-phased force and deployment data
TS. . . . . top secret
TSO . . . . . tactical security officer
TT. . . . . twin tandem gear rating
TWX . . . . . teletypewriter exchange
UAV. . . . . unmanned aerial vehicle
UHF . . . . . ultra high frequency
U.S. . . . . United States
USA . . . . . United States Army
USAF . . . . . United States Air Force
USMC . . . . . United States Marine Corps
USN . . . . . United States Navy
UXO. . . . . unexploded ordnance
VASI . . . . . visual, approach, slope indicator
VHF . . . . . very high frequency
VOR. . . . . very high frequency omnidirectional range
V/STOL . . . . . vertical/short takeoff and landing
VTOL. . . . . vertical takeoff and landing
WAN . . . . . wide-area network

Section II. Definitions

closed-circuit refueling—Nozzle and receptacle system used on U.S. Army helicopters. (NAVAIR 00-80T-109)

fresnel lens optical landing system—An electro-optical pilot landing aid. (NAVAIR 00-80T-104)

k-span—A steel building constructed on site over a concrete foundation using a machine to seam the metal together. It can be de-seamed for repacking. (MCWP 3-25.4)

meso-scale—Scale size referring to weather systems smaller than synoptic-scale systems but larger than storm-scale systems. (*Introduction to Meteorology*)

open-port refueling—Over-wing refueling aircraft with mobile refuelers. (NAVAIR 00-80T-109)

rapid runway repair—The process of using construction equipment, tools, portable equipment, expendable supplies, and temporary surfacing materials to provide a minimum operating surface through expedient repair methods.

rawinsonde—An upper air observation that evaluates the winds, temperature, relative humidity, and pressure aloft by means of a balloon-attached radiosonde that is tracked by a radar or radio-direction finder.

rear area security—The measures taken before, during and/or after an enemy airborne attack, sabotage action, infiltration, guerrilla action, and/or initiation of psychological or propaganda warfare to minimize the effects thereof. (MCRP 5-12C)

single-point pressure refueling—Pressure refueling an aircraft through a single connection. (NAVAIR 00-80T-109)

spall—A crater less than 5 feet in diameter that does not penetrate the runway base course and subgrade.

terminal aerodrome forecast—A forecast of weather elements for aviation operations for an area within a 5-nautical mile radius from the center of an aerodrome for a period of up to 24 hours. (AFDD 100).

Appendix G. References and Associated Publications

JOINT

Joint Publications (JPs)

3-07.2	Joint Tactics, Techniques, and Procedures for Antiterrorism
3-10	Joint Doctrine for Rear Area Operations
3-10.1	Joint Tactics, Techniques, and Procedures for Base Defense

NAVY

Naval Warfare Publication (NWP)

55-3-AH1	AH-1 Tactical Manual, Volume 1 (REV. D) (NAVAIR 01-110HC-IT)

Chief of Naval Operations Instructions (OPNAVINSTs)

3710.7	NATOPS General Flight and Operating Instructions
4790.2	The Naval Aviation Maintenance Program (NAMP)

Naval Air Systems Command Instruction (NAVAIRINST)

13800.12B	Certification of Expeditionary Airfield AM-2 Mat Installation, Aircraft Recovery Equipment, Visual/Optical Landing Aids, and Marking/Lighting Systems
13800.13B	Certification of Shore-Based Aircraft Recovery Equipment and Visual/Optical Landing Aids Systems

Naval Air Systems Command (NAVAIR) Technical Manuals

00-80R-14	NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual
00-80R-14-1	NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual
00-80R-20	NATOPS U.S. Navy Aircraft Crash and Salvage Operations Manual (Ashore)
00-80T-103	NATOPS Conventional Weapons Handling Procedures Manual (Ashore)
00-80T-109	Aircraft Refueling NATOPS Manual
00-80T-115	Expeditionary Airfields Forward Operating Bases NATOPS Manual
51-40ABA-7	Lighting and Marking Systems for Expeditionary Airfields
51-40ABA-14	Fresnel Lens Optical Landing System (FLOLS) MK 8
51-40ABA-18	Lighting and Marking for EAF Bare-Base Airfields
51-40ACB-1	Airfield Emergency Portable Marker Light Battery Powered Type 1
51-40ACB-2	Portable Lighting Set Heliport
51-5EAA-2	M21 Expeditionary Aircraft Recovery System
51-60A-1	Airfield Mat and Accessories

NAVMED

P5010	Manual of Naval Preventive Medicine

Navy and Marine Corps Handbook

Navy/Marine Corps Runway Crater Repair Handbook

MARINE CORPS

Marine Corps Doctrinal Publications (MCDPs)

1	Warfighting
3	Expeditionary Operations
4	Logistics

Marine Corps Warfighting Publications (MCWPs)

3-2	Aviation Operations
3-17	Engineering Operations
3-25.8	Marine Air Traffic Control Detachment Handbook
3-34.1	Military Police in Support of the MAGTF
3-35.7	MAGTF Meteorological and Oceanographic Support
3-41.1	Rear Area Operations
4-1	Logistics Operations
4-11	Tactical Level Logistics
4-11.5	Seabee Operations in the MAGTF
4-11.6	Bulk Liquids Operations

Marine Corps Reference Publications (MCRPs)

5-12C	Marine Corps Supplement to DOD Dictionary of Military and Associated Terms
5-12D	Organization of Marine Corps Forces

Fleet Marine Force Manual (FMFM)

13-8	MAGTF Explosive Ordnance Disposal

Marine Corps Order (MCO)

3507.1	Marine Corps Combat Readiness Evaluation System (Short title: MCRES);Volume VI, Combat Service Support Units

ARMY

Field Manual (FM)

21-10/MCRP 4-11D Field Hygiene and Sanitation

Army Regulation (AR)

AR 415-30/AFR 93-10 Troop Construction and Engineering Support of the Air Force Overseas

Training Circular (TC)

5-340 Air Base Damage Repair (Pavement Repair)

AIR FORCE

Air Force Instruction (AFI)

32-1026 Planning and Design of Airfields

Technical Order (TO)

35E2-4-1 Repair Quality Criteria System for Rapid Runway Repair

ELECTRONIC SOURCE

Marine Aviation Weapons and Tactics Squadron One web page (www.tecom.usmc.mil/mawts1) contains supporting materials regarding aviation ground support functions and course outlines.