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Aviation Ground Support

U.S. Marine Corps

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FOREWORD

Marine Corps Tactical Publication (MCTP) 3-20B, *Aviation Ground Support*, applies the philosophies in Marine Corps Doctrinal Publication (MCDP) 4, *Logistics*, and MCDP 3, *Expeditionary Operations*, to Marine Corps Aviation Ground Support (AGS). It is the link between Marine Corps Warfighting Publication (MCWP) 3-20, *Aviation Operations*, and the tactics, techniques, and procedures contained in other Marine Corps aviation and logistic publications. In establishing the doctrinal basis for the planning and execution of AGS, this publication provides the basis for employment of AGS by the aviation combat element of the Marine air-ground task force (MAGTF) during the prosecution of war and other operations that support the Marine Corps' mission.

Marine Corps AGS is an integral part of the MAGTF because it extends its tactical reach and flexibility for the aviation combat element. This publication provides a common basis for understanding Marine Corps AGS and the manner in which the MAGTF can tactically exploit those capabilities. Therefore, this publication is intended for commanders and staff officers who are responsible for the planning and execution of aviation operations and for personnel 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 that require an understanding of Marine Corps AGS.

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

This publication supersedes MCTP 3-20B, *Aviation Ground Support*, dated 24 April 2019.

Reviewed and approved this date.

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CHAPTER 1
FUNDAMENTALS

As the Nation's force in readiness, the Marine Corps provides great versatility and flexibility to deal with situations across the spectrum of warfare. Fighting as an integrated multi-domain team, the Marine air-ground task force (MAGTF) is a task-organized force comprised of four elements: the command element (CE), the ground combat element (GCE), the aviation combat element (ACE), and the logistics combat element (LCE).

The MAGTF's ability to project power is enhanced by the ACE's ability to deploy and operate across the battlespace. Potential operating sites range from urban areas containing established aviation facilities to areas with the crudest and most austere facilities. The MAGTF requires responsive aviation support for all types of operational areas.

AVIATION SUPPORT TO THE MARINE AIR-GROUND TASK FORCE

Marine aviation provides the MAGTF commander with a unique force. The ACE is ready for deployment and capable of fulfilling the MAGTF's fire support and maneuver requirements. This ranges from military engagement, security cooperation, and deterrence activities to crisis response and limited contingency operations, and, if necessary, major operations and campaigns.

Marine aviation performs six functions in support of the MAGTF: antiair 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 MAGTF to impose its will upon the enemy. Through Marine aviation's function of offensive air support, accurate and destructive firepower is brought to bear upon the enemy. Used at the right time and place, Marine aviation can capitalize and exploit fleeting opportunities created throughout the battlespace.

Marine aviation is expeditionary in nature and organizes, trains, and equips for operations in an austere environment. Marine aviation can operate from aircraft carriers, amphibious ships, or shore-based airfields. A shore-based airfield supports tactical operations without establishing full support facilities. Support by a forward operating base (FOB) or main operating base is required to provide backup support for a contingency airfield. The aviation combat element's unique organic equipment allows it to conduct sustained expeditionary operations wherever and whenever required. Airfields ashore can include design, construction, and operation of a new airfield or employment of expeditionary airfield (EAF) systems at an existing bare-base airfield. This operational flexibility sets the ACE apart from aviation organizations of other Services.

As an extension of sea-based aviation during the conduct of distributed maritime operation, airfields provide the ACE the capability to phase warfighting assets ashore in support of sustained operations. Deployment of ACE equipment, combined with EAF capabilities at airfields, can dramatically improve the responsiveness, endurance, and operational reach of the MAGTF. The ability to construct and operate from austere airfields is a critical requirement for enabling the expeditionary nature of the ACE.

AVIATION GROUND SUPPORT

Aviation ground support (AGS) is the critical component that gives Marine aviation its expeditionary capability. Aviation ground support is the ACE's primary aviation expeditionary maneuver enabler. Aviation ground support provides forward aviation combat engineering to include landing zone (LZ) survey and construction, contingency airfield support, airfield assessment and repair, aircraft salvage and recovery, and forward arming and refueling point (FARP). These AGS capabilities directly support the employment of the six functions of Marine aviation and consist of tailored engineering and logistics capabilities required for sustained air operations at airfields (except aircraft supply, maintenance, and aviation ordnance) in austere environments. Aviation ground support is unique within the naval service and it is ideally suited to answer the demands of expeditionary advanced base operations or distributed operations in support the naval campaign ashore at expeditionary advanced bases, and at advanced naval bases.

Aviation Ground Support Activities

Capabilities such as EAF services, expeditionary firefighting and rescue (EFR), and aircraft refueling are unique to the aviation community. Other capabilities such as limited general engineering and motor transport support services, while similar to these capabilities within the ground logistics communities, are tailored to enable expeditionary ACE operations. These capabilities harnessed together under a Marine wing support squadron (MWSS) allow the ACE to project its assets ashore and generate sorties at a rate beyond that capable of sea-based platforms. AGS equipment is compatible with United States (US) Department of Defense (DOD) aircraft and other naval centric aircraft, as well as North Atlantic Treaty Organization (NATO) aircraft. The MWSS provides the MAGTF, Marine aircraft wings (MAW), Marine aircraft groups (MAGs), or other naval forces with the following AGS activities:

- Forward aviation combat engineering operations.
- Airfield operations.
- Base recovery after attack (BRAAT).
- Airfield damage repair (ADR) operations.
- FARP operations.
- Aircraft salvage and recovery (ACSR) operations.

AVIATION GROUND SUPPORT ORGANIZATIONS

The principle AGS unit is the MWSS, which is an organic unit subordinate to a MAG. Not all MAGs within the Marine Corps have a subordinate MWSS. An AGS unit's core purpose is to enable a MAG, or composite MAG, as well as support a designated site commander in order to support expeditionary aviation operations that generate combat sorties for the MAGTF from airfields and other austere locations.

Marine Wing Support Squadron

Structured to provide task-organized or fully deployable elements in support of a deployed MAW at an airfield, the MAG exercises administrative, operational, and logistical control of the MWSS and ensures that the MAW receives the required AGS needed. When deployed, the MWSS may collocate with the MAG or MAW headquarters at an airfield and provide support to specified FARP locations.

The MWSS is capable of task organizing into Marine wing support detachments (MWSD) to meet specific mission requirements. A MWSD is a non-permanent, temporary task organized unit with an officer in charge (OIC) attached to a MAG, Special-Purpose MAGTF, or other unit. As a temporary unit, a MWSD's mission is to provide limited AGS to enable a MAG or a composite MAG, in order to conduct expeditionary aviation operations. Since the MWSD is very tailorable to mission requirements, there is no standard organization. See Marine Corps Reference Publication (MCRP) 1-10.1, *Organization of the United States Marine Corps*, for more information.

The MWSS provides, in a limited capacity, general and combat engineer capabilities as well as limited motor transport support to a MAG, ACE, MAGTF, or other Naval Force units. These capabilities include:

- Engineer reconnaissance and survey.
- Horizontal and vertical construction to include aircraft revetments and structures.
- Development, improvement, and maintenance of drainage systems, soil stabilization, and dust mitigation.
- Technical expertise in assessing and repair of airfield damage.
- Limited combat engineering capabilities.
- Construction, improvement, and maintenance of surfaced and unsurfaced LZ, EAFs, and airfield facilities.
    - Deliberate engineering design and maintenance of concrete or asphalt surfaced runways and taxiways require Naval Construction Force (NCF) support. See Marine Corps Tactical Publication (MCTP) 3-40D, *General Engineering* for additional details.

- Construction equipment and material handling equipment.

- Motor transport light, medium, heavy vehicle to include wrecker support.

  - The LCE provides the majority of inter- and intra-base support for the ACE and supplements the MWSS for motor transport support. Additional details related to transportation operations within the MAGTF are contained in MCTP 3-40F, *Distribution and Transportation Operations*.

- Motor transport vehicle maintenance (limited field level) and licensing services.

Additionally, the MWSS provides unique contingency airfield operations services to the ACE that directly enable Marine aviation to operate in austere expeditionary environments.

- EAF. The EAF capability is resident within the MWSS. It is an essential capability to support EAF installation and operations; EAF-specific surveys, liaison, and reconnaissance party tasks; and survey and airfield construction. EAF personnel and equipment require Naval Air Systems Command (NAVAIR) compliance and certification, naval funding, and Naval Aviation Maintenance Program (NAMP) adherence. EAF services possess the capability to conduct expedient tactical landing zone (TLZ) site surveys, selection, and marking. This capability is critical when conducting contingency airfield operations. A TLZ provides the flexibility to land a KC-130 resupply and rapidly refuel forward units, while providing the ACE the ability to project aviation power forward and sustain operations. An accurate LZ site survey provides the ACE commander with critical information such as the surface load bearing capability and dimensions of airfield surfaces, safety zone. It also advises on whether the terrain is favorable for expansion of the airfield. The MWSS maintains equipment that can determine the California bearing ratios of soils, subgrades, and soil analysis equipment, which can determine the gradation, compression, and classification of the soil. EAF Marines conduct EAF equipment certification, which include the following capabilities:

  - Airfield Surfacing. Airfield surfacing systems require formal training and familiarization with equipment characteristics and design requirements (e.g., aircraft spacing, airfield configurations, revetments, etc.). Airfield surfacing systems provide quick, responsive, and direct support to the ACE commander in order to augment an existing airfield or provide a standalone capability. Installation of airfield surfacing systems involves planning for aircraft parking, thus requiring firsthand knowledge of aviation intricacies (i.e., aircraft mix, fueling requirements, and ordnance).

  - Aircraft Arrestment. The Marine Corps operates aircraft recovery systems ashore for tailhook-equipped aircraft, and the systems found within the table of basic allowance. Applicable NAVAIR instructions and Naval Air Training and Operating Procedures Standardization (NATOPS) dictate arresting requirements for specific aircraft by type / model / series. Expeditionary arresting gear is essential to the operation of the EAF and enables the ACE to operate from host nation or captured airfields that lack sufficient operating length. Expeditionary aircraft arresting systems provide high-cycle operations and the capability to recover US and allied tailhook-equipped aircraft. Emergency arresting of aircraft is critical. Additionally, expeditionary aircraft arresting equipment provides overrun protection for aircraft during aborted takeoffs, inclement weather, and in situations where there are adverse runway surface conditions.

  - Visual Landing Aids. Expeditionary visual landing aids consist of airfield lighting, markings, and signage that provide illumination, depth perception cues, obstruction identification, and terminal guidance. Properly installed visual landing aids allow for safe flight operations under various mission requirements. With the assistance of lighting, marking, and supplemental equipment, the airfield has the capability to conduct safe night/low visibility operations for approach, landings, taxiing and parking of aircraft. Even if an airfield is a simple grass LZ that supports helicopter and tiltrotor operations, the installation and use of expeditionary visual landing aids can add versatility and durability to the site. Airfield lighting and marking systems include:

    - Marine-portable lighting. This system provides lighting during the initial phase of the airfield lighting operation and other operations that are short. It normally lights FARPs and TLZs. This capability provides visual flight rules and are night vision device capability.

    - Minimum operating strip (MOS) lighting. This system provides lighting during the intermediate phase of the airfield lighting operation. Minimum operating strip lighting is critical in marking a usable MOS on runways or taxiways after an airfield attack. This system provides a medium intensity non-precision instrument flight rules (IFR) and are night vision device capability.

    - Airfield lighting capability. This capability provides sustained lighting for airfields. Sustainment lighting for an EAF does not require phasing and only employed upon availability.

    - Aircraft terminal guidance. These systems provide approaching aviators a means to visually establish and maintain proper glide slope for landing aircraft.

    - Airfield marking. Marking includes the painting of airfield lines and designators, wind cone assemblies, and panel markers for TLZs. Airfield marking provides lateral guidance cues to aviators during landings and while taxiing throughout the airfield environment.

- EFR. EFR is a unique capability within the ACE that requires formal training and provides emergency services in support of airfields and support installations. The primary and secondary mission of EFR is to save lives and protect property. EFR provides services such as fire prevention, fire suppression and extinguishment, extrication and rescue, basic emergency medical services, ACSR operations, and response to hazardous material incidents. While supporting an airfield, EFR is also responsible for the effective implementation and management of fire protection and prevention programs. Refer to NAVAIR 00-80R-14, *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*; NAVAIR 00-80R-14-1, *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual*; NAVAIR 00-80R-20, *NATOPS U.S. Navy Aircraft Salvage Operations Manual (Ashore)*; Technical Manual (TM) 3-34.30, *Firefighting*; and MCRP, 3-40D.13, *Base Camps,* for additional information regarding EFR requirements and employment as well as other firefighting planning considerations.

  - In accordance with Homeland Security Presidential Directive-5, *Management of Domestic Incidents*, EFR personnel, as emergency responders, are certified by the Federal Emergency Management Agency based on the concepts of the National Incident Management System (NIMS). The NIMS provides a common, national approach to managing all threats and hazards. The NIMS enables Federal, state, tribal, and local governments; the private sector; and nongovernmental organizations to work together to prepare for, prevent, respond to, recover from, and mitigate the effects of incidents regardless of cause, size, location, or complexity. The NIMS provides a core set of doctrine, concepts, principles, terminology, and organizational processes that enables effective, efficient, and collaborative incident management.

  - Tactical and geographical considerations, dispersal of aircraft, and availability of finite assets within EFR units are some of the factors that affect EFR support capabilities. Ultimately, the MAGTF commander is responsible for establishing EFR requirements on a case-by-case basis.

- Aviation Fuel. The ACE is responsible for bulk fuel support and daily management of bulk fuel for airfields, FARPs, and other aviation locations. 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 receive, store, and dispense large quantities of bulk fuel for the ACE.

  - The MWSS has the capability to refuel fixed-wing, rotary-wing, tiltrotor, and unmanned aircraft systems and provides ground fueling to other ACE assets (e.g., mobile electric generators, tactical motor transport, field messing facilities, ground support equipment, and AGS equipment). The Marine air control group (MACG), Marine aviation logistics squadron (MALS), and vertical, Marine unmanned aerial squadron (VMU) possess tactical generators and motor transport assets, and require refueling support from the MWSS.

  - The MWSS can deliver fuel to aircraft while engines are shutdown or while they are running. NAVAIR 00-80T-109, *Aircraft Refueling NATOPS Manual*, covers aircraft refueling operations. Refueling operations occur at established airfields or at FARPs. This expeditionary fuel dispensing 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.

  - Close coordination with the command element (e.g., Marine expeditionary force) G-4 fuels section and the Marine logistics group (MLG)/LCE G/S-3 is necessary to ensure an effective fuel replenishment plan supports airfield operations.

- Explosive Ordnance Disposal (EOD). EOD provides the MAGTF with a critical enabling capability in the form of collection, reporting, and exploitation by providing access to terrain, installations, and facilities that would otherwise be denied to the force due to hazards associated with explosive ordnance. EOD personnel possess the capability to detect, locate, access, identify, triage, diagnose, stabilize, render safe/neutralize, recover, exploit, and dispose of weapons and explosive ordnance that threaten personnel, property, and lines of communications. This includes conventional munitions, chemical, biological, radiological, nuclear (CBRN) munitions, unexploded ordnance (UXO), weapons of mass destruction, homemade explosives, and improvised explosive devices. EOD provides the ACE the capability to respond to aircraft mishaps or weapons malfunctions on or off an established airfield or EAF, and at a FARP. This includes, but is not limited to, misfired ordnance, jettisoned ordnance, aircraft explosive hazards, and tactical recovery of aircraft and personnel missions. EOD also provides the ACE commander with the ability to promptly and safely clear area denial munitions during BRAAT. Refer to MCTP 10-10D, *MAGTF Explosive Ordnance Disposal*; Marine Corps Order (MCO) 3571.2H, *Explosive Ordnance Disposal (EOD) Program*, or Navy/Marine Corps Departmental Publication (NAVMC) 3500.66C, *Explosive Ordnance Disposal Training and Readiness Manual*; for further information regarding EOD employment, capabilities, and general information.

Aviation Ground Support Department

The AGS department is a staff section within the MAW. It plays an integral role in planning and managing of AGS tasks as well as provides detailed concepts of support to aviation operation plans. The AGS department coordinates with adjacent MAW staff sections, MAGs, and MWSSs to determine the priority of tasking for AGS requirements across the ACE.

The AGS department is the key to efficient and effective use of AGS within the ACE. It provides the MAW commanding general the ability to supervise, prioritize, and coordinate AGS employment for the entire MAW. Specifically, the AGS department:

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

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

- Conducts contingency airfield and AGS planning, as part of wing course of action development, pertaining to the deployment and employment of AGS assets in support of the wing mission for a MAGTF commander's or joint force commander's (JFC) operation plan or contingency.

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

OPERATIONS

The MWSS operates from an aviation ground support operations center (AGSOC) and responds to the MAG/ACE commanding officer or site commander that it supports. The AGSOC is the nucleus for the coordination and execution of AGS activities for the MAG/ACE. From the AGSOC, the MWSS commander commands and controls the MWSS companies and squadron activities in accordance with the priorities established by the supported MAG/ACE commanding officer or site commander.

The squadron S-3 runs the AGSOC, which includes representation from the squadron's other staff sections (i.e., S-1 through S-6) and subordinate companies. The S-3 must have the capability to receive, prioritize, assign, and track AGS activities. In an expeditionary environment, the AGSOC must employ flexibility to support changes in operations, tempo, and the environment. The AGSOC processes AGS requests from supported units and tasks subordinate elements to respond.

Note: The Marine wing communications squadron (MWCS) provides the necessary communications architecture for the ACE. The MWCS provides tactical communications services to the MWSS in order to allow the AGSOC to manage airfield operations, and support convoy and FARP operations outside of the airfield. Depending on the duration and complexity of operations, the Marine air traffic control detachment (MATCD), within the MACG, may support an air site with a small tower detachment to provide tower services, navigational assistance, or a Marine air traffic control mobile (MMT) for operations of a shorter duration. MATCD services include meteorological and oceanographic (METOC) support via mobile, tactical systems, which operate connected to shipboard, and shore-based networks to collect, fuse, analyze, and disseminate METOC information. At an airfield, the MATCD or MMT has the means to provide a command and control capability to aircraft and adjacent operating units via chat, satellite communications, ultrahigh frequency (UHF), very-high frequency (VHF), and high frequency assets. See MCRP 3-20F.7, *Marine Air Traffic Control Detachment Handbook* for additional planning details.

LOGISTICS SUPPORT

To conduct sustained operations ashore, the ACE relies on internal and external logistics support. Within the ACE, the MALS provides aviation peculiar logistics requirements. This includes aviation supply and maintenance support for aircraft, aviation support equipment, and aviation armament and ordnance equipment. Refer to MCWP 3-20, *Aviation Operations*, and MCTP 3-20A, *Aviation Logistics*, for additional information on the role of a MALS in support of Marine aviation.

The MLG or LCE provides combat service support (CSS) to the ACE. The degree of support provided can encompass the following functional areas: ground supply, health services, maintenance, services, general engineering, and transportation. MCTP 3-40B, *Tactical-Level Logistics*, contains a detailed discussion about the functions and sub-functions of CSS. The MLG or LCE provides the following CSS capabilities to the ACE:

- Disbursing, Postal, mortuary affairs, legal, exchange services, and operational contracting support.

- Dental and higher echelon medical capability.
- Bulk water / bulk fuel.
- Field messing.
- General engineering.
- Intermediate level maintenance for ground equipment.
- Arrival/departure airfield control group support.
- Air delivery and helicopter/tiltrotor support team.
- Port and terminal operations and other landing support services.

Note: The MWSS possesses an organic field-level maintenance capability for all engineer, motor transport, EFR, and weapons equipment assigned. It is also capable of performing intermediate-level maintenance on EAF systems equipment.

TRAINING

The MWSS consists of personnel from more than 60 military occupational specialties. These individuals must maintain occupational proficiency while integrating their abilities to perform AGS. The MWSS uses applicable training and readiness, and individual training standards to train personnel.

As a unit, the MWSS shall train to the standards established within the NAVMC 3500.117A, *Marine Wing Support Squadron Training and Readiness Manual*, MCO 1553.3B, *Unit Training Manual Program,* and various military occupational specialty-based training and readiness manuals. MCO 3500.109A, *Marine Corps Aviation Weapons and Tactics Training Program* (WTTP), identifies standardized aviation training for Marine aviation. The WTTP supports individual and unit combat readiness by tasking Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) to train officer and enlisted instructors to manage unit aviation training programs, develop aviation supplementary courses of instruction, standardize unit instruction certification programs, and develop and distribute academic courseware that supports the Marine Aviation Training and Readiness Program.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR DEFENSE CONSIDERATIONS

While CBRN defense is not an AGS activity, it is important to consider the effects CBRN defense has on AGS operations. The MAW possesses an organic CBRN defense capability, as well as the equipment necessary to support and conduct CBRN defense and decontamination operations for the ACE. The ACE normally consolidates its CBRN defense personnel and operations under the MAW or MAG for management and execution. The senior ranking CBRN defense officer/ specialist, normally from the MAG, supervises and coordinates CBRN defense activities through the MAG operations center. The MAG must coordinate CBRN defense activities with the MWSS.

A thorough and effective CBRN defense plan requires extensive coordination and participation by ACE units. Marines must continuously train for CBRN defense operations because of the potential negative impact of CBRN hazards. The ACE should schedule rehearsals and implement CBRN defense into daily operations to accomplish the mission without creating additional casualties. Rapid and proper reaction to a CBRN attack is critical for the ACE to remain effective. The MAG CBRN section assists in coordination of ACE CBRN defense activities. Refer to MCTP 10-10E *MAGTF Nuclear, Biological, and Chemical Defense Operations*, for additional information on the role of a CBRN.

- Detailed Troop Decontamination (DTD). ACE squadron augments form the DTD team. DTD team members and MAG CBRN defense personnel must maintain a close relationship to ensure proper training, supervision, and confidence. Personnel decontamination is the responsibility of the contaminated unit.

- Detailed Equipment Decontamination (DED). ACE squadron members and MAG CBRN defense personnel form the DED team. Team members must maintain a close relationship to ensure proper training, supervision, and confidence. Equipment decontamination (i.e., aircraft, vehicles, weapons, personal protective gear, etc.) is the responsibility of the contaminated unit. A MWSS can assist by providing engineer equipment and utilities support when setting up decontamination sites.

- CBRN Reconnaissance and Surveillance (R&S). R&S maintains continuous monitoring of the area of operations for CBRN hazards and is essential to CBRN defense. If contamination is a factor, team members reconnoiter alternate routes and potential areas to set up DTD and DED sites. R&S teams identify contaminated areas and send reports to the CBRN control center. The CBRN defense specialists at the CBRN control center calculate downwind hazards in order to alert and advise affected units.

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CHAPTER 2
CONTINGENCY AIRFIELD ESTABLISHMENT AND OPERATIONS

A contingency airfield is a non-enduring or semi-permanent location designed to support expeditionary aviation operations. It supports a designated naval aviation force from an austere location ashore in order to immediately respond to contingencies and meet a naval force's mission requirements. The location characteristics include flight line support from expedient infrastructure, limited airfield support services, and little or no routine external support except through naval capabilities.

The MWSS executes AGS for naval aviation, US Navy and US Marine Corps, as well as joint and coalition aircraft from austere locations that include expeditionary advance bases, advanced naval bases, and various expeditionary operating sites. As the critical component that gives Marine aviation its expeditionary capability, the MWSS provides forward aviation combat engineering operations and airfield operations at a contingency airfield to establish, develop, improve, maintain, and support the requirements of a contingency airfield.

An EAF is a shore-based aviation support system that permits landing force aircraft to operate from airfields within effective range of ground forces. An EAF is a construction concept used to develop or enhance airfields and should not be confused with a concept of employment for Marine aviation.

The EAF concept gives the ACE commander operational flexibility by providing a rapidly deployable, self-sustaining, and survivable forward air operating location designed to support the ACE during expeditionary operations. Prior to selecting an airfield site, ACE and AGS planners should consider the availability and use of host nation airfields and abandoned or captured airfields, highways, and parking lots before constructing an EAF with EAF equipment in order to reduce the necessary supporting resource requirements and to expedite airfield establishment.

The ACE has the capability to operate from naval vessels or shore-based airfields to provide timely aviation support. When conducting shore-based operations, the ACE should use existing facilities when available. The MWSS can employ organic, limited general engineering and EAF equipment to improve a facility's suitability or expand its capacity if an existing airfield is inadequate. Rapid establishment of an airfield ashore significantly improves the ACE's operational reach and responsiveness. When the tactical situation requires an airfield be established ashore, planners should consider the time and effort required for the establishment, logistical effort, and the duration that the airfield will need to be occupied. In most cases, improvement or expansion of an existing airfield or similar infrastructure is preferred over the construction of a new airfield.

AIRFIELD CONCEPTS

Planners have the following four ashore basing concepts when considering site selection of an airfield:

Host-Nation Airfields

Planners could choose to occupy host nation airfields, if available. Occupying host nation airfields requires coordination with the host country and may require special authorizations and agreements to be established in order to accommodate Marine Corps aircraft and sortie generation.

Captured or Abandoned Airfields

Using captured or abandoned airfields is another option that planners can consider. Using these airfields may require significant repairs to existing facilities in order to accommodate Marine Corps aircraft. Additional facilities not available may need to be constructed in order to ensure aviation operations.

Highways or Parking Lots

Using roads, highways, or parking lots is a third option that can be used in the site selection of an airfield. However, this method may not be applicable to all type, model, and series of aircraft. There may be limitations on the type or number of aircraft that can utilize these makeshift airfields.

Constructing an Expeditionary Airfield

The Marine Corps is unique as a Service in that it has the capability to establish/construct an airfield using organic EAF assets. Site planners should take into account that the construction of an EAF using EAF surfacing systems takes significant time, resources, labor, and engineering effort.

CLASSIFICATIONS

Expeditionary operating site classifications relate to their size, location, and characteristics in the form of airfield services, logistic supportability, and maintenance capability. A main air base, air facility, air site, and air point are the four ashore basing classifications that 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 aircraft. Task organization requirements determine support agencies and required facilities. At a minimum, the main air base includes an intermediate maintenance activity and full ground logistic and engineering functions required to support current and future needs. The US Air Force or US Army units operate these type of locations.

Air Facility

An air facility is a secure airfield capable of supporting squadron-sized elements and associated organizational maintenance activities. 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 and usually has rough, terrain-capable support equipment to move and maintain aircraft and load ordnance. An air facility can be an existing airfield or an EAF.

Air Site

An air site is typically austere in nature and is a secure location where aircraft pre-position 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 logistics support and contains minimal 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 and laager points.

- FARP. FARPs are 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 ACE's airfield. FARPs permit combat aircraft to rapidly and simultaneously refuel and rearm. The objective at the FARP is to minimize response time, decrease turnaround time, and increase aircraft loiter 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 as the tactical situation allows. The organizations providing support at the FARP may include, but is not limited to:
    - Air boss / plane captain.
    - FARP mission commander and FARP OIC.
    - Aviation fuels detachment.
    - Aviation ordnance detachment.
    - MMT detachment.
    - Communications detachment.

- Security detachment.
- Aviation maintenance detachment (restricted to minor repairs and adjustments).
- Motor transport / engineer equipment detachment (if required).
- EAF, EFR, and EOD detachments (if required).
- Low altitude air defense (LAAD) detachment based on the air threat.

- Laager Points. A laager point is a secure location at which aircraft rendezvous, marshal, or position between missions. These points are also used while awaiting completion or activation of an assigned mission. Laager points can be isolated and independent, or adjacent to airfields, air facilities, air sites, or FARPs. Lighting, marking, and communications should be the only support required.

AIRFIELD LAYOUT

The airfield layout is a graphical depiction of the airfield that consists of (not an all-inclusive list):

- Airfield dimension (shoulders, graded and maintained areas, clear and approach / departure zones).
- Airfield construction drawings and parking plans (taxiways, parking aprons, operating surface layers, etc.).
- Airfield lighting and marking.
- Aircraft maintenance areas, and ground maintenance locations for airfield ground support equipment.
- Aircraft ammunition supply points (ASP).
- Airfield survivability revetments and hardened existing facilities.
- Air traffic control (ATC) towers, location of the Marine tactical air command center (TACC), tactical air operations center (TAOC), METOC assets, and other aviation nodes as required.
- Aviation refueling pits, and ground refueling locations for airfield ground support equipment.
- EFR response plan.
- Foreign object damage (FOD) mitigation measures.
- Flight line aid station, medical evacuation and casualty evacuation LZs.

PLANNING CONSIDERATIONS

Planning and development requires extensive coordination with units that may be assigned to operate from the contingency airfield (e.g., ACE headquarters, flying squadrons, MACG, MALS, LCE, NCF, base defense operations center, other security organizations). Consider the following when developing an airfield layout:

- Contingency airfield phasing concept and classification.
- Type of operations the airfield must support (sustained or surge combat sortie rate).
- Length the airfield could be use.
- Number of type / model / series aircraft that need support.
- Time required before fully operations capable.
- Engineer support battalion (ESB) units available to provide life support services.
- Other special consideration.

Contingency Airfield Phasing Concept

Contingency airfield establishment can take a significant amount of time. The general planning phases for the construction of mission essential infrastructure include:

- Phase I: Initial. This phase encompasses the first three days of occupation. Establishment of minimal operating airfield requirements include:
    - Runway and taxiways.
    - Airfield lighting and marking.
    - Refuel points.
    - Airspace controls.
    - Support units for antiair and ground security.
- Phase II: Immediate. This phase encompasses the first 10 days of occupation. Minimal airfield enhancements include:
    - Aviation ASP.
    - Arresting gear for tail hook aircraft (if applicable).
    - EOD.

  - Hot refuel pits.
  - Aircraft parking.
  - Establish basic flight line aid station capabilities.
  - BRAAT and CBRN response measures.
  - Establish aircraft maintenance areas (as required).
  - Designate combat aircraft loading area (as required).
  - Airfield radar systems (as required).

- Phase III: Follow-On. This phase encompasses the first 30 days of occupation. At a minimum, the major tasks that should be accomplished within the first 30 days include:
  - Initial airfield expansion to accommodate specific type / model / series in the ACE or naval force.
  - Airfield survivability bunkers and hardening existing facilities.
  - EOD disposal / demolitions range.
  - ADR / Class IV material stockpile locations.
  - ATC functionality, airspace control measures, and their integration.

- Phase IV: Sustainment. This phase encompasses occupation greater than 30 days. After the first 30 days, major quality of life improvements could be added based on mission requirements:
  - Extensive airfield expansion to accommodate all type / model / series in the ACE or naval force.
  - Substantial force protection improvements.
  - Substantial infrastructure improvements.

- Transfer and Closure. The airfield may be transferred to another organization (e.g., Marine Corps, Joint Service, allied nation, or host nation military unit) or closed if the area is no longer needed.

Note: See MCRP 3-20B.1, *Multi-Service Tactics, Techniques, and Procedures for Airfield Opening,* and MCRP 3-40D.13 for additional planning details.

AIRFIELD OPERATIONS

The MWSS has the ability to support Marine aviation needs by building or occupying existing airfields. The effective operation of an airfield provides the timely execution of aviation operations in support of ground forces. An airfield design, maintenance, and operations are critical to the success of aviation operations. When developing an airfield, the following factors should be considered:

- ACE mission and the estimated duration of operations from the airfield.
- Aircraft mix by type / model / series.
- Aviation ordnance.
- Aviation fueling points.
- Revetment availability by type / model / series.
- Airfield surfacing, lighting and marking.
- Site maintenance and communications.
- Arresting gear (if required).
- Terminal guidance, ATC communications and associated facilities.
- Host-nation and/or joint support.

Airfield Design

There are four basic airfield designs. Each runway type, length, and configurations provide unique opportunities to generate combat sorties.

- Single Runway. A single runway is the least flexible and lowest capacity system. The capacity of a single runway airfield design will vary from approximately 40 to 50 operations per hour under IFR conditions, and up to 75 operations per hour under visual flight rules (VFR) conditions.

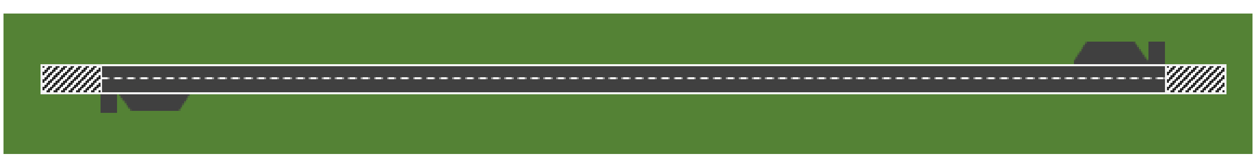

Figure 2-1. Example Single Runway.

- Parallel Runways. This airfield design consists of two landing surfaces that are parallel and can be of the same length or different lengths. For dual runways they can be classified as ‘close runways’ (less than 2,500 feet apart), ‘intermediate runways’ (between 2,500 feet and 4,300 feet), ‘far runway’ (greater than 4,300 feet apart), or ‘dual-line runways’ (same operating strip).

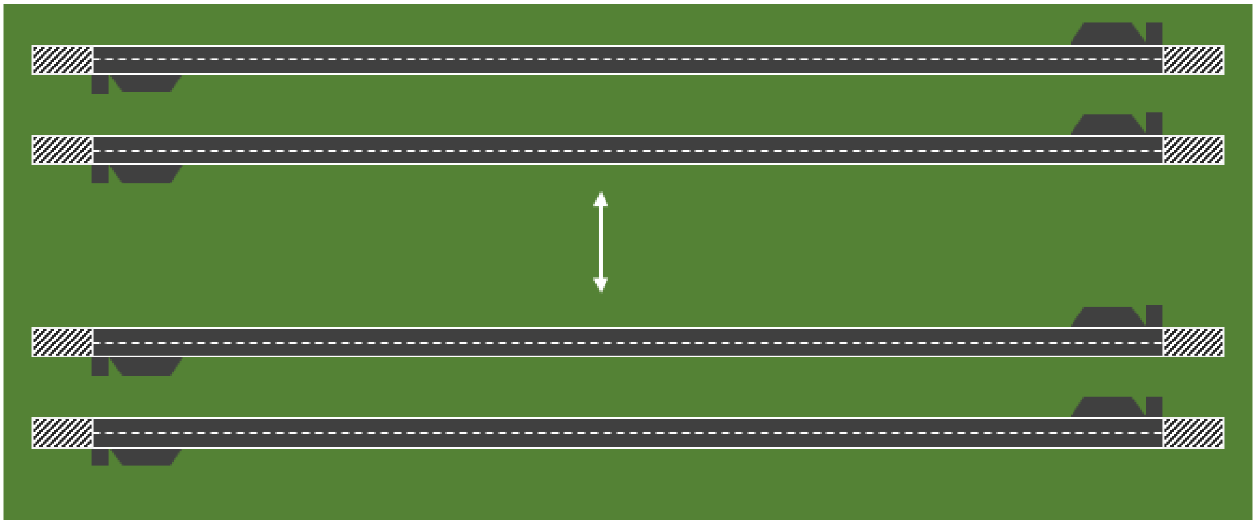

Figure 2-2. Example Parallel Runways.

- Intersecting Runways. This airfield design incorporates two landing surfaces that intersect at the far threshold, near threshold, or mid-point of the airfield’s direction of operations. Intersecting runways allow for greater sortie generation, depending on wind direction and aircraft.

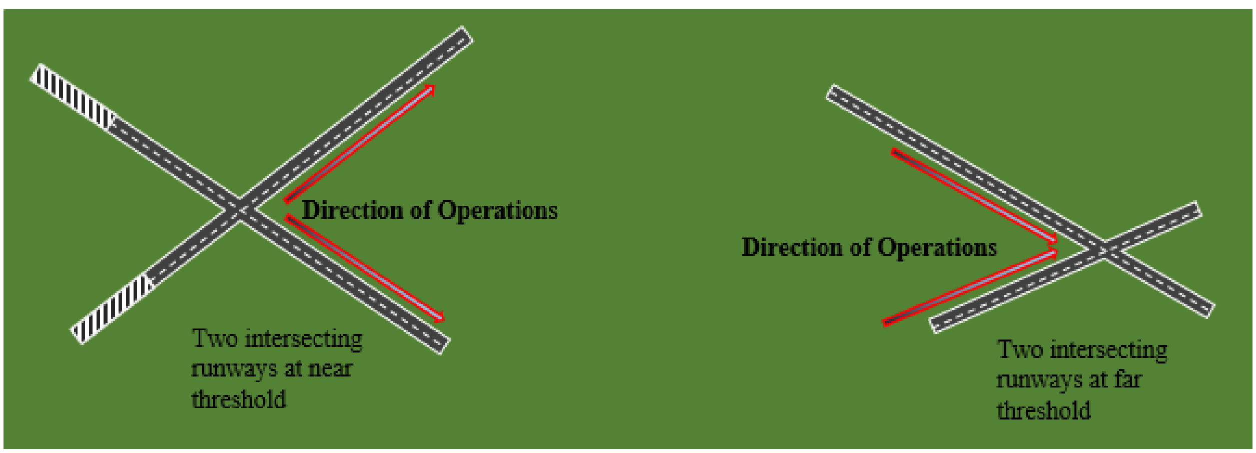

Figure 2-3. Example Intersecting Runways.

- Open "V" Runways. This airfield design consists of two landing surfaces that join.

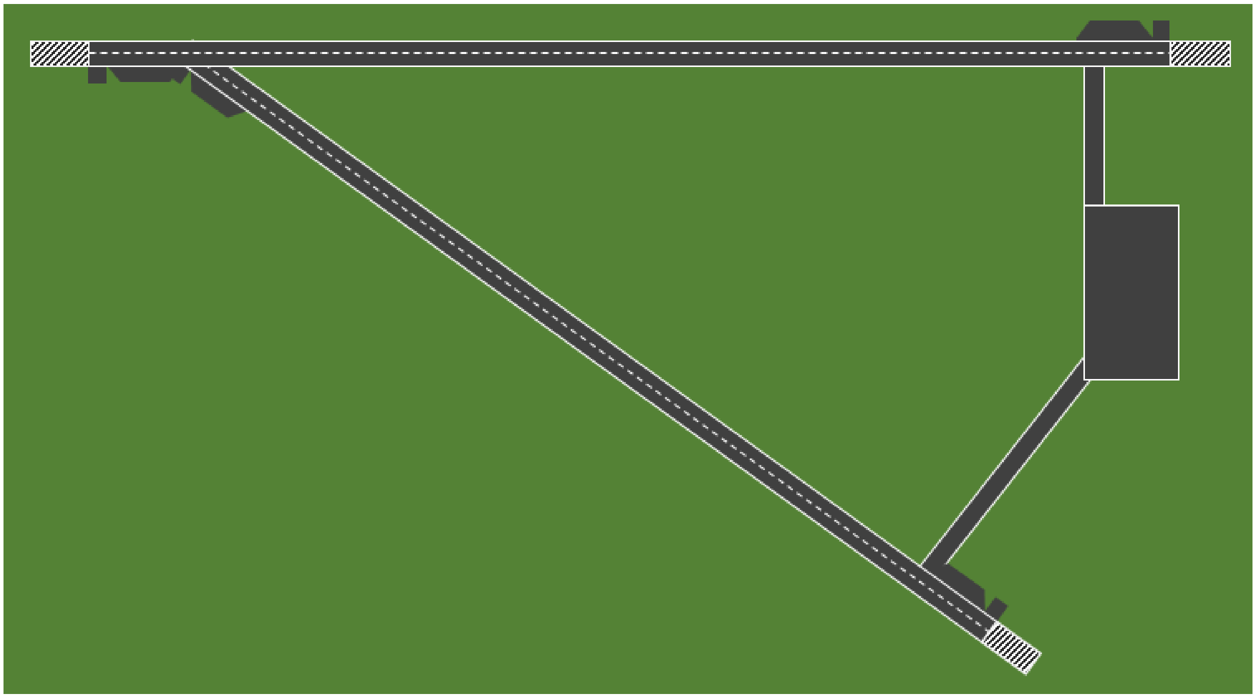

Figure 2-4. Example Open "V" Runways.

The greatest challenge for an AGS planner in the airfield planning process will be determining aircraft parking requirements. Taxiways and aircraft parking utilize 75 percent of the total airfield surface. The planner must determine the maximum (aircraft) on ground capacity for the airfield. Through aerial photography and simple math, the planner can determine the appropriate mix by type / model / series of aircraft the airfield can accommodate.

Parking areas are key concerns when occupying an existing airfield. It is likely that the captured airfield's original design does not support the type / model / series and amount of traffic needed to support MAGTF air operations. The clearance between aircraft, ordnance spacing requirements as well as forward firing ordnance are all critical considerations during the planning process. The possible need for airfield expansion should also be part of the original planning, and include:

- Maintain proper separation by type / model / series.

- Rotary-wing and tiltrotor aircraft parking separated from fixed wing jet engine aircraft.

- Required ordnance spacing based on net explosive weight of aviation ordnance.

- Strategic position of aircraft to achieve maximum (aircraft) on ground capacity.

In addition to aircraft parking considerations, the flow of aircraft throughout the airfield should be evaluated regardless of whether the airfield is to be constructed or already exists. This evaluation includes examination of how aircraft will move between the landing strip, taxiways, parking areas, refueling pits, and arm/dearm points. Taxiways should allow for a minimum number of changes in speed, the shortest distance from runway and parking, and multiple ingress and egress routes while aprons should permit safe and controlled movement of aircraft under their own power.

Planning example note: Supporting three squadrons of fixed-wing and three squadrons of rotary-wing requires an EAF system 4,000 feet by 96 feet with three vertical takeoff and landing pads on the runway, and 40 aircraft parking hides for tactical fixed-wing, 35 for rotary-wing, and three for KC-130s. The total area required is between 1,463,930 and 1,612,350 square feet.

Airfield Lighting and Marking

During airfield design planning, another key consideration is lighting and marking. Planners should consult with the MAG/ACE commander, air boss and MATCD to ensure the airfield lighting and marking design accommodates the operational nuances identified by these subject matter experts. A carefully designed and properly installed airfield lighting and marking system provides an invaluable visual reference to aviators during approach, landing, takeoff, and taxi.

Runway lighting consists of white lights, while taxiway lighting employs blue colored lights. The MWSS can illuminate an airfield by using either one of the two expeditionary lighting systems it possesses. The length of time the airfield used will influence the decision as to which lighting system is selected for installation. In some cases, a hardwired lighting system can be commercially procured or may already be installed at an existing airfield.

Airfield marking is another navigation aid that serves an important role in maintaining safety at the airfield. It is important to properly and consistently apply markings to suitable operating surfaces. Improperly installed or inconsistent markings should be promptly corrected to reduce the potential for an aircraft mishap. Table 2-1 depicts mandatory runway marking requirements for each flight rule (e.g., visual or instrument).

Runway Marking	VFR	IFR Non-Precision	IFR Precision
Threshold Bar	R	AR	AR
Runway Threshold	O	R	R
Runway Centerline	R	R	R
Runway Designation	O	R	R
Fixed Distance	O	AR	R
Touchdown Zone	NR	O	R
Runway Edge	R	R	R
Cross Deck Pendant	AR	AR	AR

Table 2-1. Runway Marking Requirements.

Legend

R	required	AR	as required	VFR	visual flight rules
O	optional	NR	not required		

Aircraft Arrestments

Aircraft arresting gear is a mechanical system used to rapidly decelerate an aircraft as it lands. It can be used to permit aircraft to operate from an airfield with a shorter landing distance or to safely arrest an aircraft experiencing trouble at aborted take-off or emergency landing. The MWSS possesses personnel qualified to install and maintain expeditionary arresting equipment so that tail-hook equipped aircraft can be arrested at an assigned airfield. Installation of expeditionary arresting equipment is both time and labor intensive. The following factors should be considered when planning for the installation of an expeditionary arresting system:

- Installation type, location, and use duration.
- Surface and subsurface soil composition, and hazards.
- Type and number of aircraft that may require arrestment.
- Logistics support facilities to support equipment.
- Large commercial aircraft traffic.

Aircraft Refueling

The establishment and operation of a tactical fuel system at an airfield directly supports the operational tempo (in terms of sortie rate) for aircraft that operate from that airfield. A tactical fuel system installed to refuel aircraft will include a central storage site, an aircraft refueler truck fill stand, a parking area for aircraft refueler trucks, fuel receiving stations, transfer lines, fuel testing laboratory and a facility (tent/building) for bulk fuel personnel to perform administrative duties. The MWSS possesses the equipment and personnel to install, operate and maintain this equipment. Key factors to consider prior to installation include:

- Spill prevention and HAZMAT control.
- Hot and cold refueling.
- Defueling.
- Product receipt.
- Sampling and testing.
- Additization.

Emergency Services Requirements

Flight operations at an airfield can occur 24 hours per day. To meet the desired sortie rate, a multitude of activities are performed to safely launch and recover each aircraft. This includes the inherently dangerous actions of refueling and rearming aircraft while their engines are running during daylight and reduced visibility conditions. The use of an airfield standing operating procedure (SOP) can reduce the chance for a mishap to occur or limit the severity of a mishap. An airfield SOP will contain information about how to handle a range of airfield emergencies and which organizations provide emergency service response for specific types of emergencies. The MWSS possesses equipment and personnel trained to respond to a wide range of airfield or aircraft emergencies. Necessary planning and training areas are:

- Incident Command. EFR personnel possess the requisite knowledge of aircraft and safety hazards associated with rescue procedures and are the first individuals to respond to aircraft mishaps on the airfield.

- Structural Responses. EFR personnel possess the requisite knowledge, training, and equipment to perform structural firefighting. Fires involving structures can include various types of residential, commercial and industrial buildings, temporary structures, along with different construction types (wood, metal, concrete, etc.). See 00-80R-14-1 *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual* for more information.

- Aircraft Response. Mishaps involving aircraft present unique safety circumstances including flammable liquids, hazardous cargo, ordnance, and ejection seats. Extrication of the aircrew involved in an aircraft mishap requires specialized training and equipment (e.g., hydraulic rescue tools). This equipment maintenance is through properly trained EFR Marines.

- Airfield Mishaps. These can include structural response to airfield infrastructure fires, vehicle and equipment accidents, or aircraft mishaps.

- Tactical Response Team. This security organization responds to threats to aircraft, vehicles, or other high dollar assets on the airfield. EFR personnel are capable of providing fire suppression / extinguishment as well as vehicle and equipment extrication in a tactical environment. The EFR tactical response team’s organization equips them to respond to any situation that threatens the survivability of crewmembers in aircraft or vehicles, or damage to high dollar and critical assets.

- Vehicle / Equipment Mishaps. EFR personnel receive training in the proper operation of extrication equipment and application techniques for automotive and tactical vehicles, as well as industrial equipment mishaps.

- Medical Emergencies/Mass Casualty Operations. Medical professionals that can respond to mass casualty events on the airfield and have the ability to conduct stabilization, first aid, triage, and medical transport. They are capable of providing initial treatment and simple triage of personnel based on the severity of their condition.

- EOD Responses. The EOD response element is responsible for the render-safe activities for military grade munitions and non-standard munitions on airfields and base camps. EOD teams need clearly defined disposal routes from the airfield to a disposal range for UXO reduction.

SUPPORT ORGANIZATIONS

The planning, design, construction, maintenance, and repair of an airfield directly affects the ACE's ability to support the MAGTF. Due to the operational importance and complexity involved in constructing a new airfield and improving or repairing an existing airfield, a MWSS may require augmentation by another engineer unit. Augmentation could come from within or outside the MAGTF. Reallocating units from within the MAGTF or requesting support from units located externally can accomplish augmentation. The MWSS constructs and provides sustained support to airfields.

Engineer Support Battalion Support to Airfield Operations

The ESB of the MLG has greater capacity to perform general engineering activities of a larger scope and scale than a MWSS. This includes the ability to perform horizontal and vertical construction projects at an airfield. The ESB can also perform ADR. See MCWP 3-34, *Engineering Operations*, for more information.

Navy Engineering Support to Airfield Operations

The NCF is the combined construction units of the Navy that are part of the operating forces and represent the Navy's capability for advanced base construction. It consists of naval construction groups/regiments that contain naval mobile construction battalions. Naval mobile construction battalions can construct runways, taxiways, aircraft maintenance hangars and base operations facilities. They can conduct ADR and are able to deploy an air detachment on short notice. See MCTP 3-34D/NTTP 3-10.1M, *Seabee Operations in the Marine Air-Ground Task Force (MAGTF)* for additional information.

Air Force Engineering Support to Airfield Operations

The primary mission of Air Force engineers is to provide mission-ready base systems, to include force bed-down and aircraft bed-down. Air Force engineer units, organized as prime base engineer emergency force (BEEF) or rapid engineer deployable heavy operational repair squadron engineer (also referred to as RED HORSE) squadrons/groups or teams are organized, trained, and equipped to provide the full range of support required to establish, operate, and maintain garrison and contingency air bases that support fixed-wing and rotary-wing aircraft. Due to their specialized expertise in airfield operations, Air Force engineers are usually deployed to open and operate airfields designated to serve as transportation hubs for strategic airlift, intra-theater airlift and commercial aircraft. Another Service may provide base operating support engineers.

Prime BEEF consists of total force personnel assigned to home-station civil engineer organizations. During contingencies, civil engineers transition to expeditionary mode as members of Prime BEEF teams. These teams are capable of rapidly responding worldwide to provide the full range of engineering expertise and emergency services needed to establish, sustain, and recover bases for employing Air Force weapon systems or supporting joint, interagency, or multinational operations. Prime BEEF teams can perform a variety of engineering activities such as: establish expeditionary bases, modify terrain, repair or construct force protection sites, operate and maintain mobile or fixed aircraft arresting systems, road repair and construction, implement environmental protection measures, construct, repair modify, maintain and operate facilities and utilities. They can also erect specialized structures such as aircraft shelters, dome shelters, and clamshells with augmentation. They provide pest management and environmental management and overall bare base conceptual planning, design, and contract support. They also perform emergency service activities including fire emergency services, explosive ordnance disposal, CBRN response, ADR and emergency management.

Normally, rapid engineer deployable heavy operational repair squadron engineer units are assigned operational control to the Air Force forces and are tasked through the commander, Air Force forces, to provide force bed-down, construction, heavy repair, or other general engineering and limited combat engineering capabilities as needed throughout the theater of operations. Other Service engineers may provide these and other services in support of airfield operations. See Air Force Instruction (AFI) 10-209, *Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer Program,* and AFI 10-210, *Prime Base Engineer Emergency Force Program*.

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CHAPTER 3
SECURITY

Security is an inherent consideration during any military activity. Security plans synchronize the application/implementation of protective measures at the local and area levels, based upon an estimated threat condition and the probability of an attack. Due to the critical nature of aviation activities conducted at an airfield, security planning is an essential component of the airfield design, construction and operation. Similar to the integration of defensive position sectors of fire with indirect fire and obstacle emplacement, airfield security integration begins at the perimeter of the airfield and focuses effort to defend/protect the most vital infrastructure or supplies (e.g., command center, ASP, fuel farm). Security is equally applicable during the establishment, operation and relocation of a FARP.

The table of organization for a MAG headquarters, flying squadron, and MWSS does not contain billets dedicated toward airfield security. As a result, the MAG/ACE headquarters will identify airfield security force requirements to the MAGTF headquarters and request augmentation. The request for augmentation may describe how the MAG/ACE commander intends to employ organic personnel to meet the estimated threat condition, as well as the operational risk to mission if augmentation is not provided.

REAR AREA SECURITY FUNDAMENTALS

Units are responsible for their own local security. When executing area security or unit defense, unit commanders should employ active and passive measures. Security measures are proportionate to the enemy threat. Security measures should be sufficient to handle the threat while diminishing the impact of support units in performing their primary missions.

Active Measures

- Organizing units for local defense.
- Conducting access control, security patrols, route sweeps, and aerial reconnaissance.
- Establishing defensive positions, obstacles, and observation / listening posts.
- Integrating antiair, close air support (CAS), and close fire support.

Passive Measures

- Hardening key infrastructure/mission-critical facilities.
- Camouflaging, dispersing, and using natural cover.
- Establishing redundancy in critical facilities.
- Using deception measures and establishing dummy installations / positions.

THREATS

It is logical for an enemy to attack an opponent's center of gravity and high-priority assets. This can be accomplished by attacking to prevent replenishment of key supply items (e.g., ammunition, fuel or water), attacking an airfield to disrupt sortie rate or destroy aircraft, and attacking command centers. A near-peer enemy can employ a variety of means to accomplish this goal; including long range weapons such as missiles, rockets, or aircraft, as well as attack by special operations forces. The enemy will attempt to:

- Disrupt MAGTF combat operations by forcing MAGTF commanders to use combat forces to stabilize their security 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.

Threat Levels

Commanders must consider the enemy's capabilities and potential impact on operations. During ACE operations, planners need to pay close attention to enemy threat organization, equipment, and potential damage to airfields and aviation operations. Joint Publication (JP) 3-10, *Joint Security Operations in Theater* 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 defend against enemy threats.
    - Enemy-controlled agents and sympathizers.
    - Terrorists.
    - Civil disturbances (e.g., demonstrations, riots).
- Level II. Level II 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.
    - Small tactical units (e.g., squad, section, platoon).
    - Irregular warfare forces.
    - Guerrillas.
- Level III. Level III threats exceed local security measures and a response force's capabilities and require timely commitment of the tactical combat force (TCF). The ACE cannot defeat against Level III threats, but will delay until TCF arrives.

- Airborne or air assault operations.
- Amphibious operations.
- Major air operations.

PLANNING CONSIDERATIONS

Area security planning starts at the theater combatant commander or JFC level. The combatant commander or JFC assigns responsibilities for joint security area (JSA) security to subordinate commanders, such as the MAGTF commander. Efficient JSA security planning and execution requires effective and timely command and control. To plan and execute efficient JSA security, the MAGTF commander must:

- Identify the area of operations.
- Define the roles and responsibilities of each subordinate element within the MAGTF's area security plan.
- Designate the MAGTF's rear area security coordinator (RASC).
- Ensure effective and timely command and control.
- Assign security responsibilities for:
  - CSS and ACE facilities along main supply routes (MSR) and remote sites.
  - 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 or site commander may be responsible for several independent bases, aviation areas, or base clusters comprised of smaller airfields.

Aircraft are most vulnerable while on the ground and in flight routes during approach and departure. Security plans must address aggressive random foot and mobile patrols by security force personnel in these areas to detect and prevent any threats to aircraft during takeoff and landing. Security force patrols should be task-organized with equipment that affords the mobility and firepower necessary to disrupt an enemy attack and destroy the enemy force conducting the attack. Additionally, operational tempo normally requires aircraft to stage with a full complement of support equipment; therefore, the aircraft and its fuel, ammunition, equipment, and supporting facilities are prime enemy targets and enemy indirect fires present a threat to these assets. To mitigate the enemy's ability to directly view these aircraft targets, berms can be constructed or other screening materials used. Defense in depth with echelon approaches provides a layered methodology, with overarching and complementing security measures. It allows for maintaining a security presence adjacent to air assets while supporting strong perimeter defensive positions.

Detailed planning and coordination by the MAG/ACE staff can ensure the airfields security force is able to prevent the enemy from disrupting the pace of air operations. The ultimate goal is to protect ACE assets at the airfield and allow for uninterrupted sortie generation. Refer to JP 3-10, MCRP 3-40D.13 for further security planning.

COMMAND AND CONTROL

At the JFC level, the joint security coordinator coordinates and maintains JSA security measures from the joint security coordination center (JSCC). The JSCC is the senior JSA command and control agency. Subordinate commanders must coordinate their security measures with the JSCC.

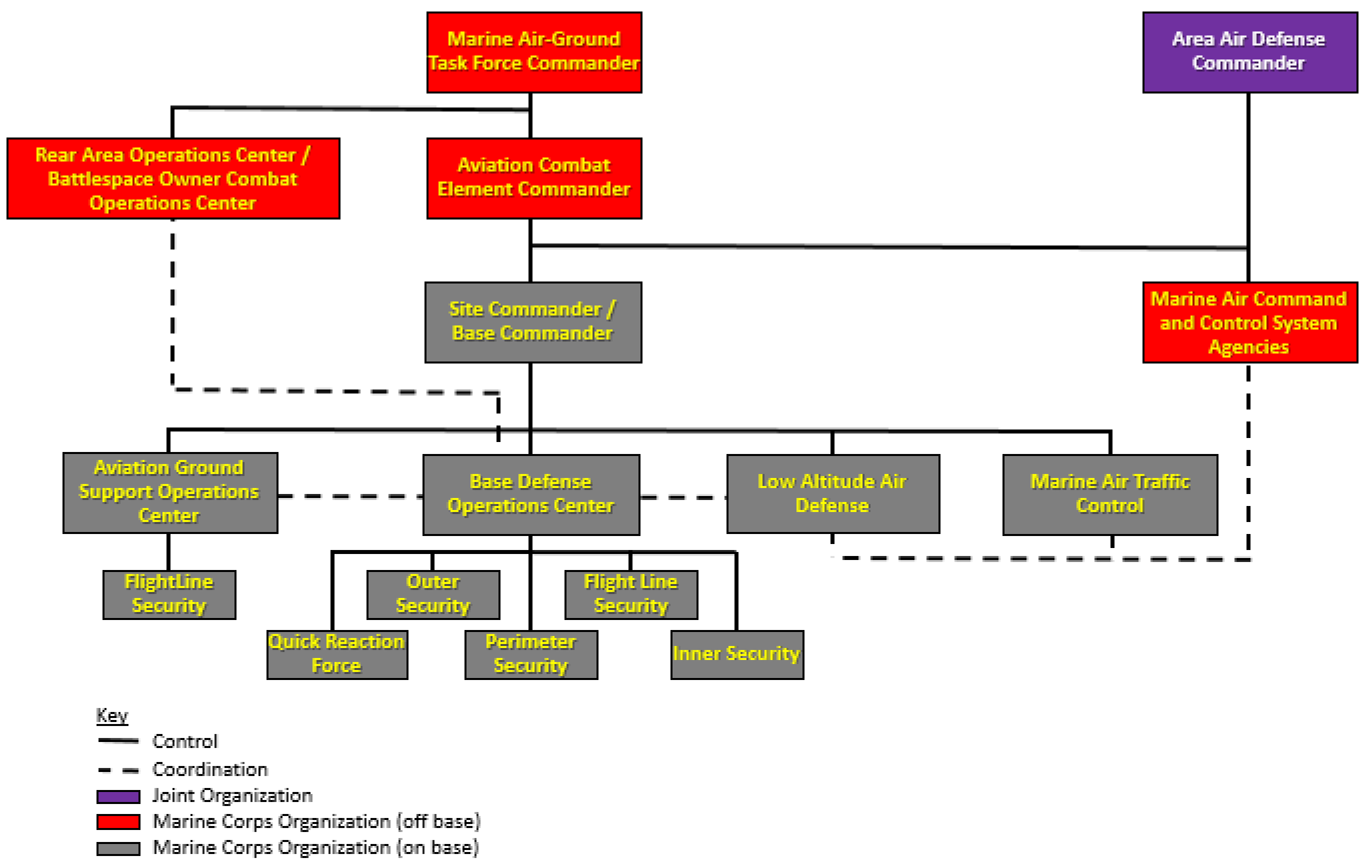

Figure 3-1. Security in Support of the Aviation Combat Element Commander.

Marine Air-Ground Task Force

At the MAGTF level, JSA security measure coordination runs through the rear area operations center (RAOC). The RASC, through the RAOC, has area security coordinating authority over subordinate elements of the MAGTF. The area security coordinator will assign a tactical security officer (TSO) to supervise security operations within the RAOC. Unit commanders assigned an area of operations or base within the MAGTF's area of operations will assign a TSO and establish a security operations center for their respective areas. The area security coordinator assists the RASC in managing security 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 a CBRN representative.

The MAGTF commander could assign the responsibility of area security to the GCE, LCE, or ACE commanders. In an LCE scenario, the area security coordinator will either establish the RAOC in or adjacent to the CSS operations center. The TSO and operations of the RAOC normally comes from the MLG G-2 and G-3. The MLG G-3 tactical readiness and training section has infantry officers within its structure who are well suited in providing advice and rendering assistance on rear area security tasks. In the event that the LCE and the ACE are collocated, the LCE will normally serve as the RASC. The LCE is usually best equipped and staffed to manage the area security mission.

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CHAPTER 4
AIRFIELD DAMAGE ASSESSMENT AND REPAIR

BRAAT and ADR operations are activities that center on restoring the mission capabilities of an airfield after an enemy attack. The MWSS will develop a BRAAT plan in conjunction with the site commander to address recovery following a variety of enemy methods of attack (e.g., air attack, mechanized force attack, indirect fire attack). The site commander will activate the BRAAT plan. During BRAAT and ADR operations, the MWSS AGSOC is responsible to the site commander for base recovery and support activities. The MWSS is required to operate emergency and other essential services to keep vital facilities in operation. Initial actions include the following:

- Firefighting response.
- Search and rescue.
- Medical response.
- CBRN monitoring and decontamination.
- Damage assessment of the airfield and facilities.
- MOS selection.
- EOD.
- Isolation of damaged facilities.
- Debris cleanup.

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 airfield recovery process is broken down into the following elements:

- BRAAT planning.
- BRAAT command and control.
- Airfield damage assessment.
- UXO mitigation.

- MOS selection and layout, to include marking and lighting.
- FOD mitigation.
- Aircraft arresting gear systems.
- ADR.

BASE RECOVERY AFTER ATTACK

BRAAT activities, as illustrated in figure 4-1, revolve around a three-phased continuum. The three phases of the continuum are pre-attack preparations, under attack actions, and post attack repairs.

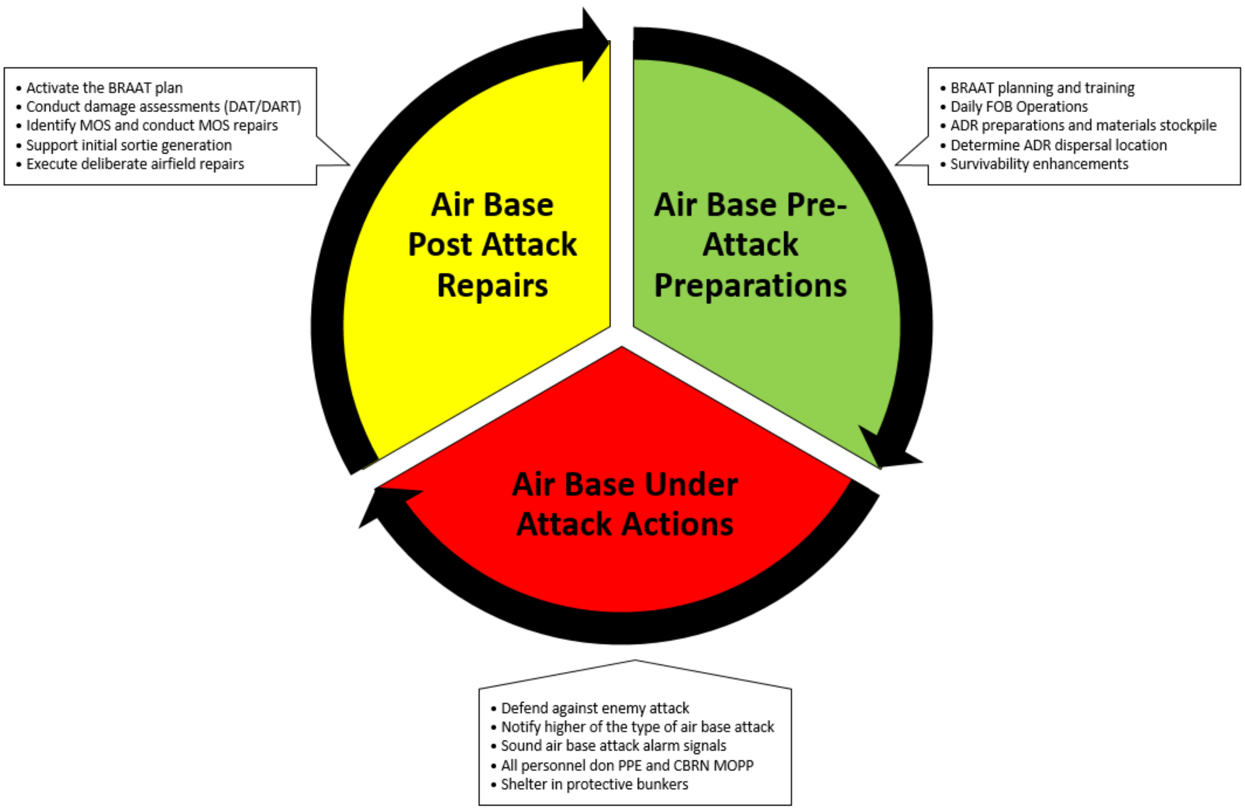

Figure 4-1. Base Recovery After Attack Execution Continuum.

Legend
DART damage assessment and response team
DAT damage assessment team
MOPP mission-oriented protective equipment
PPE personal protective equipment

- Phase I: Pre-attack preparations are those actions that prepare an airfield for an enemy attack based on evaluation of mission, enemy, terrain and weather, troops and support available-time available (METT-T) factors and BRAAT plan for that particular airfield. These actions are extensive and will include, but are not limited to, the following:
    - BRAAT planning and training.
    - Daily airfield operations.
    - ADR preparations and materials stockpile.
    - Determine ADR dispersal location.
    - Survivability enhancements.
- Phase II: Under attack actions are those actions taken when an airfield is actively under an enemy attack. The BRAAT plan will describe immediate actions that are to be executed by specific units while the airfields is still under attack. These actions are extensive and will include, but are not limited to, the following:
    - Defend against enemy attack.
    - Notify higher of the type of attack, enemy weapons used, and extent of damage.
    - Sound airfield attack alarm signals.
    - All personnel don personal protective equipment and CBRN mission-oriented protective posture (MOPP).
    - Shelter in survivability positions.
- Phase III: Post attack repairs are those actions required to recover an airfield from an enemy attack. It includes damage assessment of the entire airfield, initial opening of the airfield to support sortie generation, and concludes once the entire airfield is returned to fully operations capable. These actions are extensive and will include, but are not limited to, the following:
    - Activate the BRAAT plan.
    - Conduct damage assessments (damage assessment teams [DAT] and damage assessment and response teams [DART]).
    - Identify MOS and conduct repairs.
    - Support initial sortie generation.
    - Execute deliberate airfield repairs.

Returning an airfield to fully operations capable may take between several hours or several months based on the type of attack and extent of damage to the airfield or airfield-operating strip. It is important to note that initial MOS repairs require regular maintenance until there is time for permanent airfield repair of the damage surface.

BASE RECOVERY AFTER ATTACK ORGANIZATION

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

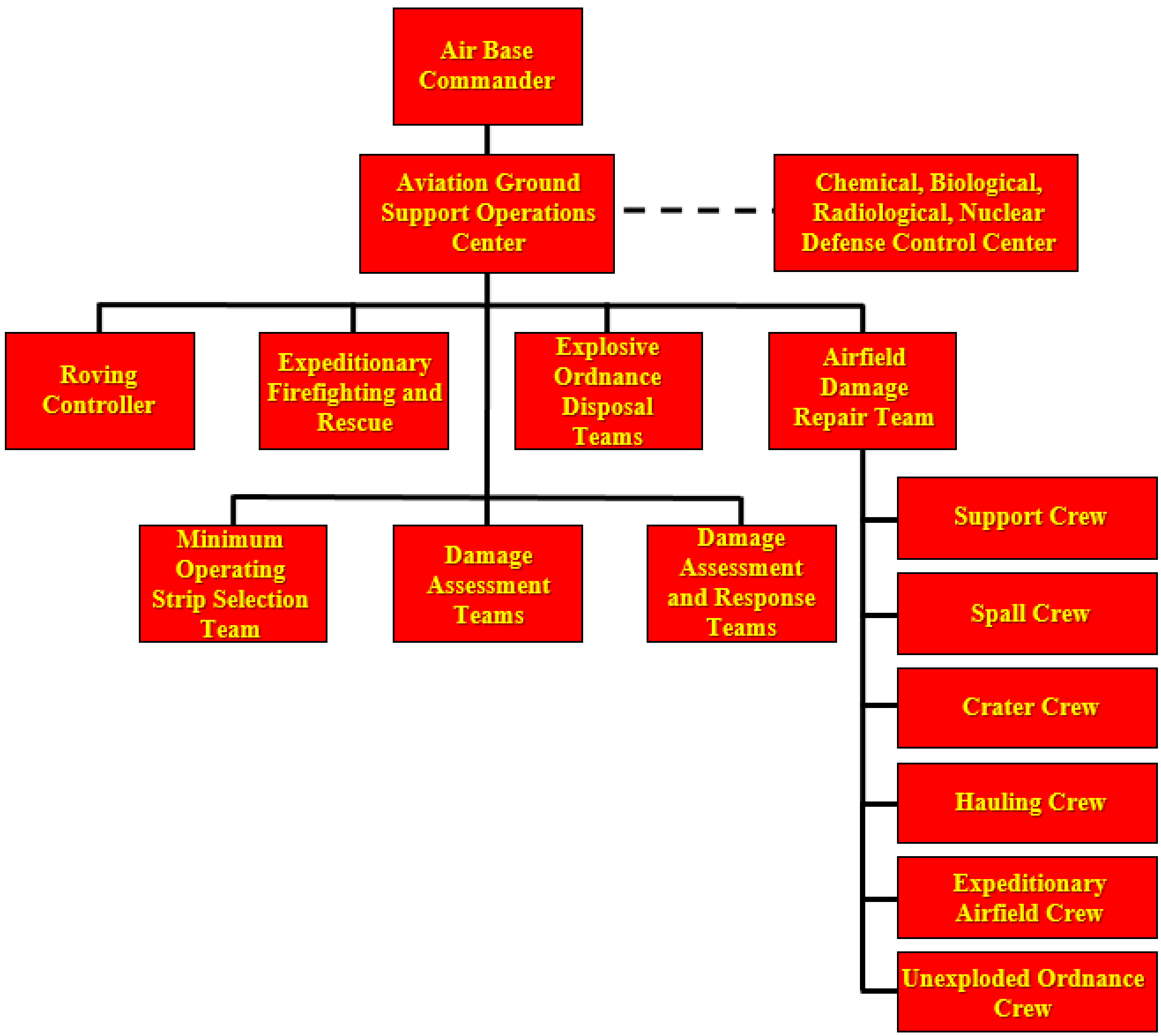

Figure 4-2. BRAAT Organization.

Aviation Ground Support Operations Center

As the center for BRAAT operations, the AGSOC is responsible for collecting, analyzing, prioritizing, and reporting information pertaining to the status of the airfield. The AGSOC must be able to communicate with its subordinate elements during BRAAT. Initially, DATs and DARTs have the highest priority for communications. Based on damage reports from the DAT and DART, the AGSOC develops the airfield recovery plan for the site commander. Once approved, the AGSOC directs subordinate companies to form and deploy teams (ADR, EFR, EOD) so as to implement the airfield recovery plan. During the airfield's recovery efforts, the AGSOC:

- Develops the site commander's recovery plan with repair priorities.
- Coordinates execution of the recovery plan, following the site commander's approval.
- Directs the activities of the DAT, DART, EFR team, EOD team, and ADR team.
- MOPP levels via the CBRN defense control center.

Chemical, Biological, Radiological, and Nuclear Defense Control Center

The CBRN defense control center is responsible for employing CBRN survey teams across the airfield, plotting CBRN contamination, advising the AGSOC on CBRN hazards, and recommending the appropriate MOPP level for the conditions. The CBRN defense teams receive direction from the CBRN defense control center and provide vital information of MOPP levels and current CBRN threats.

Roving Controller

The roving controller reports the status of recovery activities to the AGSOC. During BRAAT operations, the roving controller is the mobile eyes and ears for the AGSOC. The roving controller reports on the progress of repairs and alerts the AGSOC of developing problems. In addition, the roving controller reports material shortfalls and equipment problems to the AGSOC.

Expeditionary Firefighting and Rescue Team

The EFR team is responsible for critical airfield firefighting requirements, including, extinguishing fires on parked aircraft, hangars, mission-critical structures/facilities and conducting search and rescue. EFR teams use organic equipment, kits, litters and tools to render first aid when directed by the AGSOC. These personnel conduct first aid and are equipped with first aid kits, litters, blankets, and tools. The EFR team receives airfield recovery directions from the AGSOC. EFR directs its firefighting and rescue teams to extinguish fires on parked aircraft, hangars, and other airfield structures.

Explosive Ordnance Disposal Section

The EOD section is responsible for accurately identifying, classifying, removing and disposing of UXO. It oversees the activities of other BRAAT teams to advice on how to safely operate in an area containing UXO. From within the AGSOC, the senior EOD technician will prioritize deployment of EOD teams based upon DAT/DART reporting and dissemination of the airfield recovery plan. It 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 EOD teams to the priority areas requiring UXO mitigation.

Damage Assessment Teams

The DATs are responsible for reconnoitering and surveying the airfield for damage such as craters, spalls, and UXO on the runway, taxiway, and parking areas and for damage to EAF equipment that is required to conduct flight operations from the MOS. The DATs report airfield damage directly to the AGSOC. The number of runways and airfield operating surfaces determines the number of teams required to maintain the operating surfaces. Often, more fielded DATs leads to quicker battle damage assessment and the airfield recovered. Conduct of simultaneous runway damage and UXO assessment shortens airfield restoration time.

The DAT organization provide ground assessment of UXO locations and bomb damage. Damage assessment team assessments occur through foot mobile team, hardened vehicles, or via existing structures. The 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 C for a more detailed discussion of BRAAT forms and procedures. A DAT normally consists of the following:

- Team leader who performs the DAT reporting quality control to the AGSOC and directs the team per the BRAAT plan.
- Radio operator / driver to support the DAT's movement around the airfield as well as their communications to the AGSOC.
- Two EOD technicians for the identification, classification, and removal of UXO.
- Spall damage assessor for the identification, classification, marking, and reporting of spall and bomblet fields.
- Two crater damage assessors for the identification, classification, marking, and reporting of craters.

Damage Assessment and Response Teams

The DARTs assess damage to designated critical facilities and infrastructure, report the presence of UXO, and isolate utility disruptions. Two teams are normally sufficient for an air site or air facility (the US Air Force and US Army operate and repair main air bases). The size and composition of the DART may vary, depending upon the type of airfield systems that need to be assessed and the level of response needed. Personnel should have technical expertise appropriate to the type of damage requiring assessment (electrical, mechanical, or structural). A prioritized list of facilities and infrastructure critical to sortie generation is usually established during

BRAAT planning and should be approved by the ACE / site commander. An example of DART organization is a:

- Team leader who performs the DART reporting quality control to the AGSOC and directs the team per the BRAAT plan.
- Radio operator / driver to support the DART's movement around the airfield as well as their communications to the AGSOC.
- Utilities assessor for the identification, marking, and reporting of damaged, serviceable, or non-function power distribution and generation systems on the airfield.
- Structural assessor for the identification, marking, and reporting of damaged airfield infrastructure that support sortie generation.
- Engineer equipment representative for the identification, marking, and reporting of damaged engineer and motor transport equipment, ADR tools, and Class IV material stockpiles.
- Medical support for immediate causality response as the DART conducts assessments.

The following is a recommended priority list for damage inspection by the DART:

- Command posts and control facilities directly related to combat flying squadrons.
- Communications facilities.
- Petroleum, oils, and lubricants (POL) and munitions facilities.
- Fire stations.
- Medical facilities.
- Power generation and distribution facilities.

The AGSOC receives the information from the DART and tasks the appropriate companies with the appropriate repair and damage mitigation responsibilities. See Appendix C for a DART 8-Line report example.

Minimum Operating Strip Team

After an airfield attack, the MOS selection team assembles 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 the following:

- A team leader who performs the quality control of the MOS selection process, recommends the MOS location to higher authorities, and prepares an estimate of the time required to repair the runway and access routes.

- A data recorder who receives coordinates of airfield damage and UXO from the DAT and records this information on an MOS selection team record sheet.

- A data plotter who takes the information from the data recorder and plots the airfield damage and UXO locations on the airfield map (to scale) in the AGSOC.

- A 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 UXO located on the MOS. The ACE / site commander selects and approves the MOS. After MOS selection, the ADR OIC begins repair actions on the airfield.

Airfield Damage Repair Officer in Charge

The AGSOC forwards the airfield recovery plan, depicting the MOS requiring immediate repair, to the ADR OIC. The ADR OIC, typically the engineer company commander, directs the ADR effort. The ADR OIC must have the ability to communicate with the AGSOC, roving controller, and the ADR crews. Communication with the AGSOC enables the ADR OIC to receive the airfield recovery plan, which will show the selected MOS that requires immediate repair. Communication with the roving controller permits the ADR OIC to receive supplemental information regarding the damaged area. The ability to communicate with ADR crews allows the ADR OIC to synchronize activities during the repair. The ADR OIC is a combat engineer officer.

Communications

The ability to communicate is the most vital part of an efficient BRAAT operation. Radio, telephone, messenger, and a combination of those methods are the communications options for BRAAT.

Table 4-1. Recommended Base Recovery After Attack Communications Architecture.

BRAAT Unit Networks	MWSS Cmd	BRAAT Cmd	ADR Cmd	ADR Coord
AGSOC	P	P		
Roving controller		P	Monitor	
EFR Team 1	Monitor	P		
EFR Team 2	Monitor	P		
EFR Team 3	Monitor	P		
EOD Team 1	Monitor	P		
EOD Team 2	Monitor	P		
DAT 1		P		
DAT 2		P		
DART 1		P		
DART 2		P		

BRAAT Unit Networks	MWSS Cmd	BRAAT Cmd	ADR Cmd	ADR Coord
DART 3		P		
Minimum Operating Strip		P	Monitor	
CBRN Team	Monitor	Monitor	Monitor	
Airfield Damage Repair OIC		Monitor	P	Monitor
Support Crew Chief			P	
Utilities DET				Support Network
Medical DET				Support Network
Food Service DET				Support Network
CBRN Tm				Support Network
Spall Crew Chief			P	
Spall Crew 1				CC Network
Spall Crew 2				CC Network
Crater Crew Chief			P	
Crater Crew 1				CC Network
Crater Crew 2				CC Network
Hauling Crew Chief			P	
Motor Transport DET				Hauling Network
Maintenance DET				Hauling Network
Fuels DET			P	
EAF Crew Chief				Support Network
Lighting and Marking Crew				Support Network
Arresting Gear Crew				Support Network
Surfacing Crew				Support Network
UXO Crew Chief			P	
EOD Team				CC Network
EOR Team				CC Network

Legend

Cmd	command	EOR	explosive ordnance removal
Coord	coordinator	OIC	officer in charge
CC	Crater Crew	P	Primary coordination
Det	detachment	UXO	unexploded ordnance

AIRFIELD DAMAGE REPAIR OPERATIONS

Airfield damage repair operations are an integral part of airfield recovery process. ADR operations are a type of large-scale, horizontal construction engineering operation conducted on short notice but without the aid of construction drawings or standardized plans. After an enemy attack, the ACE must repair the damage quickly to support aircraft launch and recovery operations. The ACE can expect to repair the following:

- Airfield surfaces (i.e., runways, taxiways, parking areas).
- Airfield support areas (e.g., ordnance, fuels, maintenance).
- Communications facilities (i.e., ATC towers, radar facilities, Marine TACC).
- Facility infrastructure (i.e., aircraft maintenance hangers, support buildings, fire station).

Planning

During the development of an airfield's BRAAT plan, ADR considerations must address a wide range of potential damage from an enemy attack. The ACE G-2/S-2 provides ADR planners with insight relative to enemy weapons capabilities in terms of the most dangerous and the most likely enemy weapon employment methods. These usually include air or indirect fire weapons capable of penetrating, cratering the airfield's operating surfaces, taxiways, and parking areas or dispersing explosive ordnance (scatterable mines, cluster munitions) that either impedes flight operations or destroys EAF, navigational aid equipment. Planning should also consider the probability that an enemy attack will introduce UXOs onto the airfield. When time and resources are available, ADR planners procure and maintain a sufficient quantity of construction materials on hand to use during ADR missions.

Categories of Damage

Enemy munitions used to attack an airfield can create various forms of damage. There are four categories of airfield damage. Appendix C discusses crater damage and repair procedures in detail.

- Spalls. Less than five feet in diameter, does not penetrate through the pavement surface to the underlying soil layers. This type of damage is generally caused by:
  - Small rocket fire.
  - Small-caliber artillery fire.
  - Small bombs with air burst fuzes.
  - Other small-caliber, contact-fuzed munitions.

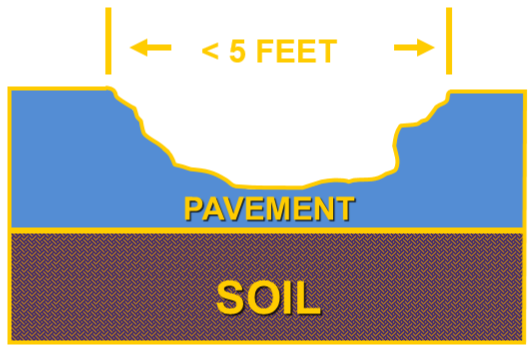

Figure 4-3. Spall Diagram.

- Small Craters. Less than 20 feet in diameter, penetrates the pavement layer in the base course and possibly into the subgrade course of a runway, and may or may not cause pavement upheaval. This type of damage is generally caused by:
  - Large rocket fire.
  - Small concrete penetrators.
  - Small bombs weighing less than 500 pounds.
  - High-angle, medium-caliber naval gunfire with time-delay fuzes.

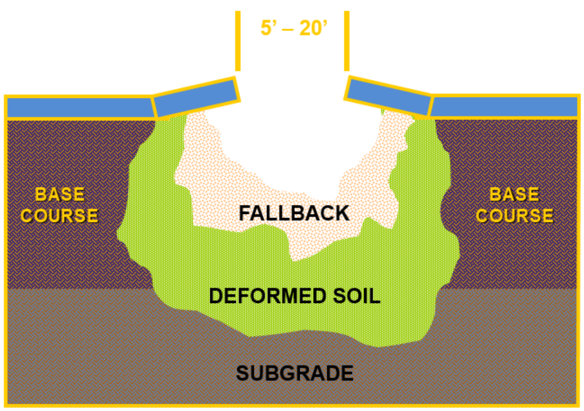

Figure 4-4. Small Crater Diagram.

- Large Craters. Greater than 20 feet in diameter, penetrates the layers of a runway (i.e., pavement, base, and subgrade courses), and causes pavement upheaval. This type of damage is generally caused by:
  - Large ballistics or cruise missiles.
  - Large concrete penetrators.
  - Large and medium bombs weighing more than 500 pounds.

- High-angle, large-caliber naval gunfire with time-delay fuzes.

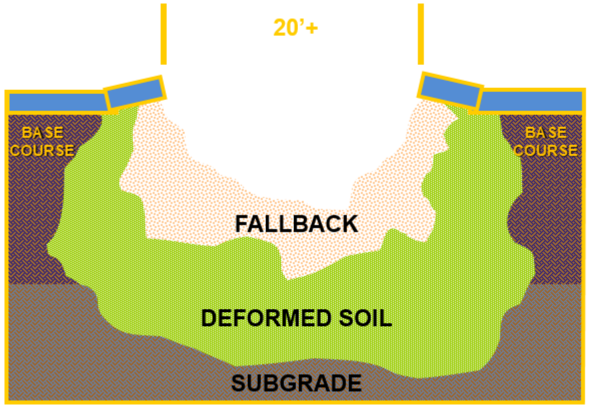

Figure 4-5. Large Crater Diagram.

- Camouflets. Camouflets are deep, small diameter craters, normally created by large penetration-type projectiles with hardened warheads and time-delay fuzes.

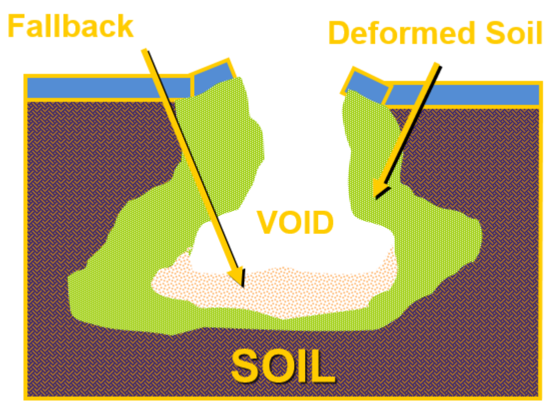

Figure 4-6. Camouflet Diagram.

Considerations

An increase in the diversity and lethality of the enemy's air- and surface-launched weapons requires planning for ADR materials, procedures, and techniques to repair bomb-damaged runways and taxiways. Early in the BRAAT planning cycle, identification of ADR requirements ensure personnel receive training and familiarization with their duties following an attack. See the ADR personnel and equipment requirements in Appendix C. Planners must consider the requirements for and availability of personnel, equipment, and repair materials when developing an ADR organization plan.

Personnel and Equipment

Personnel within the MWSS fill specific billets within the ADR organization. Under ideal situations, there should be one repair crew and one FOD cover crew for every crater that requires repair. The MWSS supplies the ADR labor as their table of organization allows. Other supported units on the airfield are required to augment the ADR organization. After personnel requirements and availability have been determined, the MWSS determines equipment availability for ADR by using the equipment availability matrix in Appendix C.

Repair Materials

ADR 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 the FOD cover being used, ADR planners 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 C, assists in tracking and recording necessary quantities. Refer to US Army Training Circular (TC) 5-340, *Air Base Damage Repair (Pavement Repair)*, Air Force Pamphlet (AFPAM) 10-219, Volume 4, *Airfield Damage Repair Operations*, and Whole Building Design Guide (WBDG) 3-270-01.3-270-07, *O&M: Airfield Damage Repair*, which detail the procedures used for crater and spall repair and for FOD cover applications.

AIRFIELD DAMAGE REPAIR ORGANIZATION

The ADR OIC is responsible for coordinating the actions of the crater crews, support crews, spall repair crews, aircraft recovery crews, and hauling crews. The AGSOC forwards the airfield recovery plan, depicting the MOS requiring immediate repair, to the ADR OIC. The ADR OIC is responsible for directing the ADR effort.

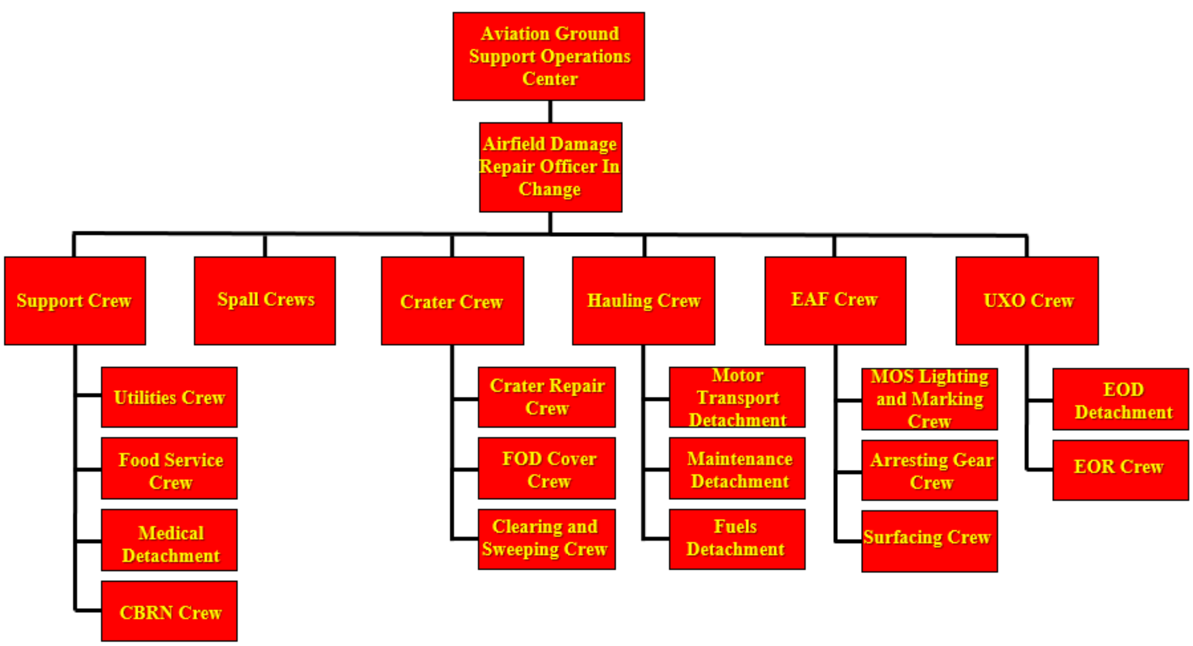

Figure 4-7. Airfield Damage Repair Organization.

Legend
EOR explosive ordnance removal

Support Crew

The support crew is responsible for additional motor transport support, water delivery, field maintenance, lighting and power generation, and refueling of equipment supporting the ADR effort.

Spall Repair Crews

Spall repair crews are responsible for repairing spalls located on the MOS. The number of spall repair crews depends on the amount of damage and the availability of personnel and equipment.

Crater Crew

Each crater crew excavates, repairs, places FOD covers, and cleans away debris for each assigned crater. Crater crews can work as a team or in a series depending on the number of craters, number of crews, and the MWSSs' SOP for the unit.

- 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 a FOD cover. The number of crater repair crews depends on the availability of personnel / equipment and the scope of damage inflicted on the airfield.

- FOD Cover Crews. The 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.

- Cleaning and Sweeping Crew. This crew is responsible for the removal of debris from the MOS.

Hauling Crew

The hauling crew ensures adequate crater repair materials, including fill and FOD cover material, arrive at each crater. The number of hauling crews depends on the availability of personnel and equipment at the airfield.

- Motor transport and Maintenance Crew. The motor transport and maintenance crew provides tactical vehicle support and maintenance required to keep the crater repair crews on schedule.

- Fuels Detachment. The fuels detachment directly supports the ADR effort by ensuring that operations have the fuel necessary for uninterrupted operation.

Expeditionary Airfield Crew

The EAF crew consists of the MOS lighting and marking crew, the arresting gear crew, and, when necessary, the surfacing crew.

- MOS Lighting and Marking Crew. The MOS lighting and marking crew is responsible for the placement of the runway markings, painting, edge markers, and lighting on the MOS.

- Arresting Gear Crew. The arresting gear crew is responsible for the placement, installation, operation, and repair of the aircraft arresting gear system.

- Surfacing Crew. If an expeditionary surface other than concrete, asphalt, or fiberglass reinforced polyester (FRP) is required, the surfacing crew maintains or repairs the surface.

Unexploded Ordnance Crew

The UXO crew consists of an EOD detachment and, if required, an explosive ordnance removal (EOR) crew.

- EOD Crew. The EOD crew is responsible for the render-safe activities of military grade and non-standard munitions on the airfield.

- EOR Crew. The EOR crew is responsible for the movement of military grade and non-standard munitions off the airfield for designated disposal ranges.

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CHAPTER 5
FORWARD ARMING AND REFUELING POINT OPERATIONS

The FARP mission is to provide fuel and ordnance necessary for a highly mobile and versatile rotary-wing, tiltrotor, fixed-wing, and unmanned aircraft operations, which enables increased sortie generation for the naval campaign ashore. The size of the FARP varies with the mission and the number of aircraft. Normally, FARPs (sub-classifications of air points) are temporary, transitory facilities established for a specific duration and mission. The objective of a FARP is to minimize response time and decrease turnaround time in support of sustained operations.

The establishment and operation of a FARP is an aviation operation. Planning and coordination of execution details involve the requesting unit as well as elements from the supporting AGS, aviation command and control, and aviation ordnance units. Figure 5-1 illustrates the composition of a notional FARP organization and the relationship between the FARP detachment and the supported unit headquarters. Because of the extensive aviation involvement in FARP operations—as well as focus on sortie generation—an aviator from the requesting unit is typically selected to fill the air boss position. The knowledge and experience in AGS, ACE integration, and security resident in the MWSS make it the ideal source for providing the FARP leadership.

FORWARD ARMING AND REFUELING POINT ORGANIZATION

Air Boss

The air boss is an aviator from the MAG/ACE headquarters that has the same type / model / series aircraft qualifications that the FARP is supporting. While not every FARP will have, or need, an air boss, if an air boss is required; they are responsible for the de-confliction and interaction with the various agencies outside of the FARP (e.g., Marine TACC, direct air support center [DASC], LAAD, pilots, etc.) and focus on communications directly with the aircraft and FARP Mission Commander.

Forward Arming and Refueling Point Mission Commander

Planning and execution of FARP operations are led by the MWSS supporting the MAG, or other flying unit, and includes a FARP mission commander as the designated individual responsible for the overall planning, aviation integration, and conduct of FARP operations. The FARP mission commander focuses on external FARP operations, movement to the next FARP site, local air point security, logistics forecasting and resupply, and future FARP mission planning.

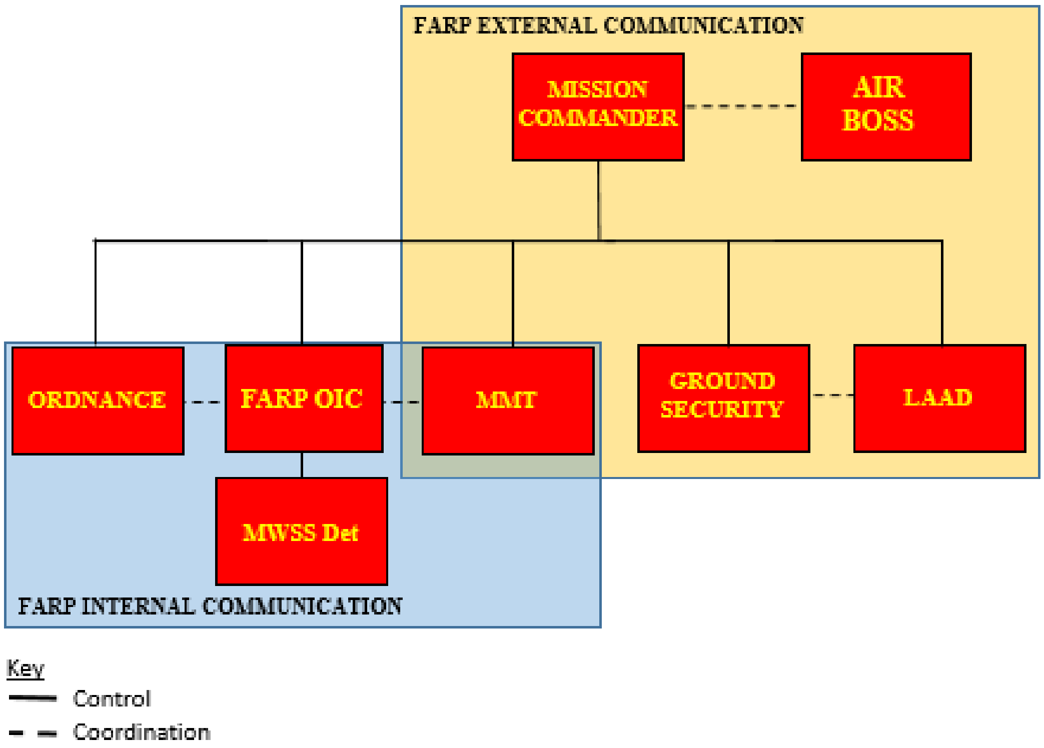

Figure 5-1. Forward Arming and Refueling Point Organization.

Legend
Det Detachment

Forward Arming and Refueling Point Officer in Charge

The FARP OIC is the senior designated military occupational specialty 1390 Bulk Fuels Officer or 1391 Bulk Fuel Specialist on the FARP team. The FARP OIC is responsible for the internal coordination of the FARP including coordination with the fuels detachment, ordnance detachment (if applicable), MMT detachment (if applicable), and any other detachments assigned. In the event the FARP Mission Commander is not located at the FARP, the FARP OIC is required to conduct external communications and coordination.

Ground Security

Organic personnel, augmented security forces, and host nation or coalition partnered units provide the principal FARP ground defense. Reconnaissance personnel and ground combat force personnel passing through the FARP could integrate into the FARP's defense for limited periods if required. Reconnaissance personnel have the ability 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 to the aircraft commander (airborne). Because aircraft must off-load nonessential personnel during refueling operations, disembarked assault forces could augment the FARP defense while they are within the FARP and waiting to load the aircraft.

A tactical air control party inserted into the FARP to provide a link with most supporting arms also provides additional FARP security. Close air support for the FARP may consist of organic and nonorganic rotary- and fixed-wing aircraft. 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.

Low Altitude Air Defense

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 GCE, or accompany the FARP team. The LAAD OIC or section leader must be involved in the FARP planning to ensure LAAD personnel properly integrate into the FARP defensive plan.

To plan the FARP's air defense, the LAAD OIC or section leader require a thorough briefing on the FARP's operation (e.g., types and number of aircraft, aircraft approach and departure direction, etc.). The LAAD OIC or section leader is normally located in close proximity with the FARP mission commander or FARP OIC to receive current aircraft information. In most cases, the LAAD OIC or section leader receives current situational awareness from the FARP communications links.

Ordnance and Maintenance

The size and composition of the aviation ordnance detachment is contingent upon the quantity and type of aircraft that are to be supported. Flying squadron ordnance personnel are required to conduct an arming / de-arming or a loading / downloading sequence. Intermediate maintenance activity personnel may be required to build and assemble ordnance at the FARP.

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. Additional ACE maintenance personnel and equipment are necessary if a problem exists beyond the FARP maintenance crew's capabilities. See *NAVAIR 00-80T-103 NATOPS Conventional Weapons Handling Procedures Manual (Ashore)* for additional guidance.

Marine Wing Support Squadron Detachment

Similar to the aviation ordnance and maintenance detachments, the size and composition of the MWSS detachment in the FARP team is contingent upon the quantity and type of aircraft that are to be supported, the threat condition and the length of time the FARP is to be operational. The FARP OIC supervises and directs the activities of the members of the MWSS detachment. Motor transport and engineer equipment requirements are dependent on the size and scope of the FARP. METOC and MMT support on an as required basis. The air boss is the overall authority at a FARP and is the representative of the Marine air command and control system on site who takes direction from the Marine TACC. However, the FARP mission commander may have to assume this role if an air boss is not present. Normally, a MWSS detachment consists of the following:

- Bulk Fuel Section. The minimum personnel required for a FARP varies based on the type of FARP and the aviation refueling system used. While situationally dependent and for general planning purposes, a FARP should have a line non-commissioned officer, a pump operator for every pump, a nozzle operator (e.g., crew chief, air boss / plane captain, qualified person), and a refueling point operator at each refueling point. Additionally, taxi directors may be required based on the type of FARP layout. See *NAVAIR 00-80T-109 Aircraft Refueling NATOPS Manual* for additional personnel guidance.

- EFR Section. The EFR section provides vital lifesaving support at FARPs that are operated during training, exercises and contingencies. NAVAIR 00-80R-14, *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*, is the primary reference for training and exercises. It also is used during contingencies but some procedures may be temporarily waived or suspended by the MAGTF commander due to unique, combat conditions.

- EAF Section. The size and composition of the EAF section is contingent on the quantity and type of aircraft to be supported and the characteristics of the location selected for establishing a FARP. The section can install aviation-specific lighting and marking equipment. It may also assist during LZ surveys. NAVAIR 00-80T-115, U.S. *Marine Corps Expeditionary Airfield and Aircraft Recovery Operations NATOPS Manual*, is the primary reference for the section.

- EOD Section. An AGS unit has limited EOD technicians; therefore, the situational and operational requirements determine EOD participation during FARP operations. See *MCTP 10-10D* for additional guidance.

- MMT. The requirement for a MMT is based on the type / model / series of aircraft that the FARP is supporting, the volume of aircraft expected at the FARP, and if the LZ requires an expedient survey. See *MAWTS-1 MMT TACSOP* and MCRP 3-20F.7 for additional guidance.

PLANNING CONSIDERATIONS

A FARP extends the combat radius of aircraft and reduces turnaround time to the objective. The combat radius is the distance and flight time per type / model / series. If there is any doubt that the fuel and ordnance available for a mission is insufficient, plan for a FARP. The FARP planners should consider location, employment techniques, refueling methods, equipment, and personnel requirements. In addition, planners should consider the following:

- Distance to the forward line of own troops or objective area.

- Number and type of aircraft to be serviced.

- Required time on station.

- Security requirements for the FARP.
- Enemy, weather, and terrain.
- Availability of adequate road networks and proximity to the MSR.
- Distance between the FARP, the nearest bulk fuel, and aviation ordnance supply points.
- Command and control requirements.
- Coordination with the LCE.
- FOD mitigation.

Location

Evaluation of mission variables (e.g., METT-T) will guide site selection for a FARP. The tactical dispersion within the FARP depends upon terrain and threat condition. The location must allow sufficient area for ground vehicles, aircraft operations, and material movement, and it should provide terrain masking for cover and concealment.

Assume enemy radar and forces occupy any prominent terrain in the vicinity of the FARP site. To determine the available radar mask, an ACE/MAW G-2 line-of-sight analysis is made of the FARP location. Three or four points leading to the FARP that have masked routes from radar detection are ideal for aircraft entering and exiting the FARP. By using such passive security measures, aircraft can avoid having the FARP directly detected by enemy radar and observation.

FARP establishment is outside of an enemy's missile engagement zone (MEZ) because the Doppler radar returns from a large number of tiltrotor and helicopter rotor systems that are close in makes it difficult to track other targets in the MEZ. Therefore, FARP placement is critical and typically placed outside of an enemy's MEZ or out of line-of-sight with LAAD units.

Aircraft return routes require thoroughly planning with the Marine TACC's air defense staff. Windows of time and / or specific routes should be planned so that air defense units are expecting friendly aircraft in their vicinity, 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.

The location of the FARP is determined by mission analysis, to include the type / model / series of aircraft the FARP is being employed to support. The site selected for establishment of a FARP should not be within range of enemy artillery systems. The site should allow rapid turnaround of aircraft and accommodate cross-country movement by the vehicles transporting the FARP's personnel, fuel, and aviation ordnance. Depending upon the tactical situation, a FARP placement could be on the inbound, return, or outbound route in relation to a tactical objective.

- 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 pre-position closer to the objective area.
  - Provides the assault force 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 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. Aircraft leaving the objective area to receive fuel and ordnance resupply before returning to the objective uses a FARP established on the return route. To confuse enemy antiair defenses, the return route is not on either the inbound or the outbound route. A FARP established on a return route:

  - Allows the assault force 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.

- 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 or return 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 may not easily augment security for the FARP because prior briefing with ground forces or ordnance may be limited.

Communications

FARPs may be required to operate within a communications command and control denied or degraded environment for prolonged periods. To counteract the degradation, FARP teams must have prearranged communications plans that provide daily burst of information to headquarters or a supported unit. Regardless of the denied communications mitigation plan, FARP operations require external and internal communications on both UHF and VHF nets. The FARP requires external communications to higher headquarters and aviators in the aircraft. The FARP also requires internal communications to command and control the organizations within the FARP. The FARP MMT provides external communications for the FARP, while the MWCS provides additional communication support. Agencies within the FARP monitor the FARP control net.

Each organization may have its own internal frequency to coordinate its specific functions. Fuels, EFR, and EOD use the air operations net, and maintenance and ordnance detachments use the maintenance control net for internal control. The number and types of frequencies within the FARP is mission dependent. If there is no MMT at the FARP, aircraft switch to FARP control net on approach to receive terminal guidance.

Brief the FARP frequencies, call signs, and radio procedures during the aviator's mission brief. To control frequency emissions once the aircraft are within the FARP, limit radio transmissions during refueling and arming procedures to essential communications only. Aircraft and ground personnel should make initial contact with one another before aircraft enter the FARP.

Table 5-1. Example Forward Arming and Refueling Point ARP Communications.

FARP Unit/Nets	**DASC (UHF)**	**FARP (VHF)**	**FARP Control (VHF)**	**Airfield Operations (VHF)**	**Maintenance Control (VHF)**
DASC	P				
Air Boss/ FARP MC	M	P	P		
FARP OIC	M*	M(P*)	P	P	
Fuels				P	
EFR			M	P	
EAF				P	
EOD				P	
Maintenance					P
Ordnance			M		P
LAAD			PM		
MMT	M	P			
Ground Security			P		

Legend

M	monitor	NET	network
P	primary	MC	mission commander

*When the air moss or FARP mission commander are not present

Employment Techniques

FARPs are required to operate in small, highly mobile units that have the ability to rapidly-deploy and maintain a high degree of signature management. In a moderate or high threat environment, a FARP team may be required to move frequently to avoid detection by the enemy. In a low threat environment with a static front and little enemy air activity, the requirement for FARP team displacement reduces. Depending on the situation, multiple FARP employment, or a single FARP, may relocate to different sites. The mobility of a single FARP team or multiple FARP teams provides the ACE commander with increased responsiveness and flexibility.

During establishment of multiple FARP sites or relocation of a single FARP team, the new FARP should be operational before the initial FARP is shutdown. Speed of movement to establish the FARP site is of prime importance and adequate time to set-up equipment is a large planning factor.

The mode of transportation used by a FARP team should depend on the urgency of the mission. Personnel, equipment, and supplies necessary to establish and operate a FARP can be transported by ground, air, sea, or a combination of all three.

- Ground. Establishing a FARP using ground vehicles is the most common means of employment. These FARPs require more coordination to establish and could have a larger logistical requirement to sustain. These FARPs may be preferred when an air delivered or sea transported FARP is restricted by the tactical situation, terrain, or time. Because resupply of the FARP may be necessary, planners must consider the following:
    - Availability of adequate road networks.
    - Location of CSS areas.
    - MSRs.
    - Distance to the FARP.
    - Timing.
    - Threat conditions and security requirements.
- Air. The use of assault support assets is an alternate means of establishing a FARP. Use air delivered FARPs for tactical operations that require rapid emplacement, or when ground transportation is not achievable due to time, distance, inadequate road networks, or enemy activity. Air resupply of the FARP should be limited due to the large quantities of fuel and ammunition required the limited availability of aircraft, and the increased probability of detection by the enemy. Because resupply of the FARP may be necessary, planners must consider the following.
    - Availability and type of aircraft.
    - Time and distance to the FARP via air.

- Landing location and obstructions.
- Aerial resupply.
- Air and anti-air threats.
- Increased probability of detection by the enemy.

- Combination of Air and Ground. A combination of air- and ground-delivered 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 bulk fuel and aviation ordnance supplies for one turnaround per helicopter. Continued operation could then rely on ground transportation for sustainment. Inversely, a FARP may be established using ground transportation, but due to the extended distance to the original fuel source, assault support aircraft could provide resupply of aviation fuel and aviation ammunition.
- Sea. Establishing a FARP using surface connectors may be required. Once ashore, the FARP operates in the same way as a ground transported FARP would operate. These FARPs are easy to coordinate, logistically flexible, and do not require the use of aviation assets to set up or resupply the FARP. These FARPs are preferred when the tactical situation, terrain, and time allow for the movement of ground assets into the desired location. These FARPs are established, execute the mission, and return to the origination site. Because resupply of the FARP may be necessary, planners must consider the following:
    - Availability and type of surface connectors.
    - Landing locations.
    - Availability of adequate road networks off the beach.
    - Surface resupply.
    - Distance to the FARP from the beach.
    - Underwater and surface threats.

SAFETY

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

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CHAPTER 6
AIRCRAFT SALVAGE AND RECOVERY OPERATIONS

One of the most difficult and demanding tasks within AGS is ACSR operations. The urgency of moving a crashed/damaged aircraft from areas that interfere with flight operations dictates a rapid and intelligent response to the salvage-handling problem. Each person must fully understand the capabilities and limitations of the equipment, be able to safely perform all salvage/recovery actions with minimum direction and supervision, and be able to rely on the performance of other team members.

Despite their importance, it is difficult for the MWSS to maintain proficiency in the critical skills required to perform aircraft salvage and aircraft recovery due to the infrequency of actual aircraft mishaps. Regardless of this fact, the MWSS plans and conducts rehearsals and drills at their home station using simulated aircraft mishaps to sustain proficiency.

ACSR operations have two distinct parts, aircraft salvage and aircraft recovery. While similar in general scope, they require different planning aspects, equipment sets, personnel requirements, and individual training. For the purposes of this manual, the terms "*Salvage*" and "*Recovery*" are defined as:

- Salvage. Those actions required, after an aircraft mishap, which do not require future use of the aircraft. Typically, an aircraft salvage is conducted when the aircraft mishap results in significant damage to the airframe. A salvage is also characterized by the retrieval of aircraft pieces that were separated from the main aircraft frame due to the resulting mishap.

- Recovery. Those actions required, after an aircraft mishap, which require the future use of the aircraft. Typically, an aircraft recovery is conducted when the aircraft mishap results in minimal or no damage to the aircraft frame. A recovery is also characterized by the extensive subject matter expertise from the owning flying squadron's, or MAG's, aviation maintenance officer (AMO), as well as the careful handling of the aircraft and its parts. Aircraft recovery operations require a significantly higher planning fidelity and organizational training.

AIRCRAFT SALVAGE AND RECOVERY ORGANIZATION

The pre-mishap plan developed and maintained by aviation activities clearly identify the department/organization responsible for ACSR operations and shall include a pre-salvage plan. It has been demonstrated that ACSR operations can be successfully conducted under several different organizational structures. The billet guidelines listed below are general in nature and may differ with individual stations/activities. It is the responsibility of the commanding officer to determine billet organization within the structure of the command. The salvage officer must be designated in writing by the MWSS commanding officer.

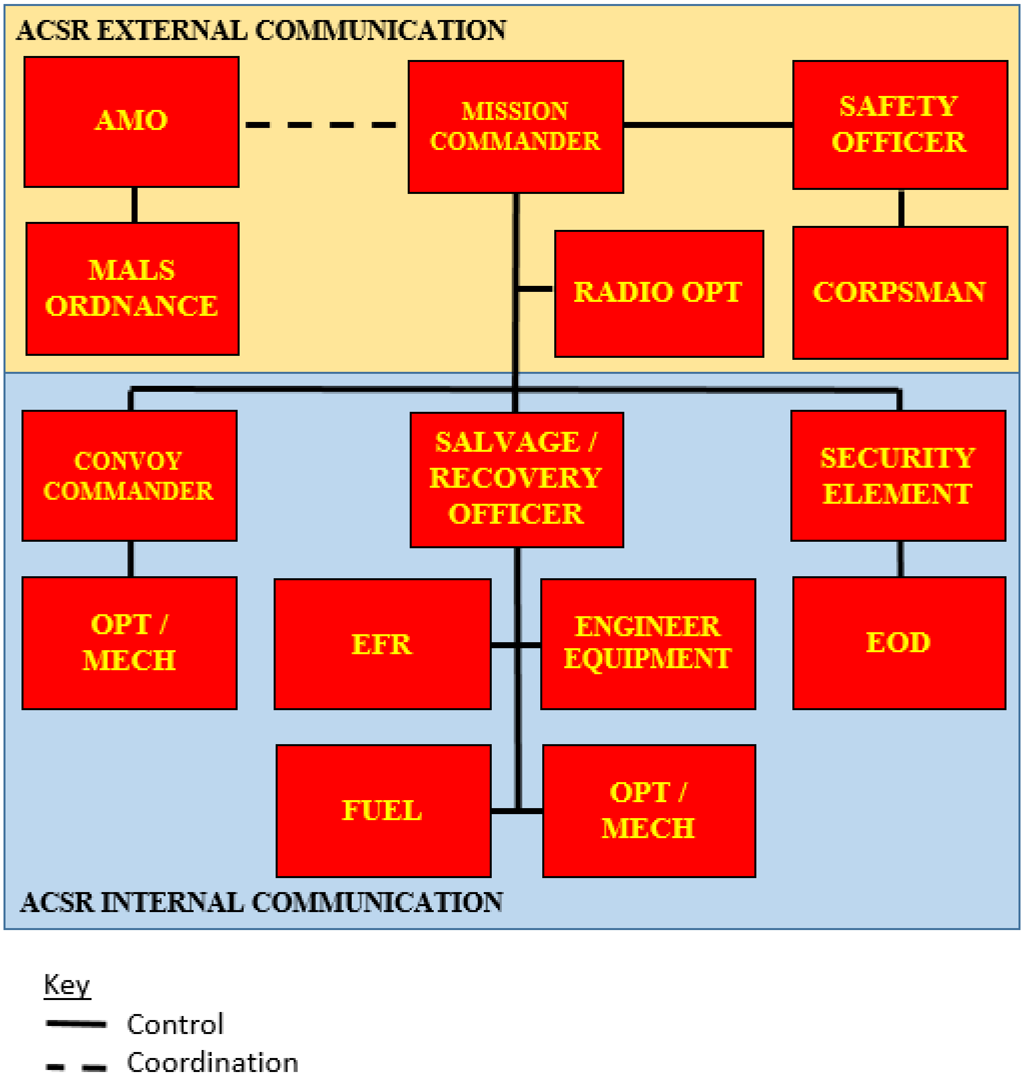

Figure 6-1. Aircraft Salvage and Recovery Organization.

Legend

AMO	aviation maintenance officer	SVC	services
MECH	mechanics	UT	utilities
OPT	operators		

Aircraft Salvage and Recovery Mission Commander

Planning and execution of ACSR operations are led by the MWSS directly subordinate to the MAG that suffered the aircraft mishap. The ACSR mission commander (designated by the

MWSS commander) is responsible for the overall planning, aviation integration, and conduct of ACSR operations. The ACSR Mission commander focuses on external ACSR operations, the movement to and from the aircraft mishap site, local security, and future mission planning.

Salvage and Recovery Officer

The MWSS commander typically designates the Expeditionary Airfield and Fire and Emergency Services Officer (military occupational specify 7002) as the salvage and recovery officer. In this capacity, the salvage and recovery officer is responsible for controlling the activities, personnel and equipment involved in an aircraft salvage or aircraft recovery. The actions of the salvage and recovery officer include defueling and downloading cargo from the damaged aircraft, as well as directing the lifting, shoring and movement of the same aircraft. The salvage and recovery officer uses NAVAIR 00-80T-20, *U.S. Navy Aircraft Crash and Salvage Operations Manual (Ashore)*, as the primary reference during the salvage or recovery. The MWSS provides the following task-organized sections based on mission planning:

- EFR Section. The EFR section provides fire protection / suppression capabilities and HAZMAT response, in accordance with NAVAIR 00-80R-14 *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*. Hazardous material cleanup and fire protection may be required prior to, during, and following an aircraft salvage or recovery.

- Engineer Equipment Section. The engineer equipment section provides material handling equipment to include frontend loaders, multi-ton cranes, and other specialty equipment as required.

- Fuels Section. The fuels section provides a host of POL activities but primarily serves to defuel aircraft for the safe lifting and movement of the airframe. The section also handles initial POL HAZMAT containment and cleanup. Follow-on cleanup is the responsibility of the flying squadron.

- Motor Transport Section. The motor transport section provides heavy motor transport support to include super low multi-ton trailers, heavy haul trucks, vehicle cranes, and other specialty equipment as required.

Convoy Commander

The convoy commander is responsible to the ACSR mission commander and works closely with the salvage and recovery officer to support the movement to and from the mishap site. The convoy commander positions transportation assets appropriately for aircraft salvage or recovery (e.g., trailers, vehicle cranes). Additionally, the convoy commander works closely with the security element at the crash site to provide a security cordon around the mishap site.

Security Element

The size and composition of the security element is based on the METT-T considerations and threat conditions. These forces provide security for convoys to and from the mishap site and for on-site security. Besides focusing on ground-related threats, the security element may include antiair assets to combat air threats. Based on the threat level, additional capabilities may require:

- Combat engineers for limited route sweeps around the mishap site.
- EOD for render safe and reduction of aviation ordnance or improvised explosive devices.
- LAAD for antiair and anti-unmanned aircraft system capabilities.

Aviation Maintenance Officer

ACSR operations normally require the squadron aircraft maintenance department personnel that are knowledgeable in damage assessment, airframes, power plants, hydraulics, avionics, aircraft reclamation and ordnance. The requirements should quickly be identified and personnel made available to the salvage and recovery officer as soon as possible. The MAG or MALS AMO, or a qualified Marine, is a primary subject matter expert that should be on-site to provide the salvage and recovery officer technical airframe advice.

Safety Officer

During salvage and recovery operations, pre-designated safety and medical personnel are available for immediate response to the mishap site based on mission requirements. The safety officer should have understanding of all aspects of the ASCR operation and aircraft specific hazards.

PLANNING CONSIDERATIONS

The potential for a mishap and the subsequent ACSR operation exists and dictates that a state of preparedness be established and maintained. A detailed ACSR operations plan should account for:

- Mishaps on and off of the contingency airfield and / or EAF.
- Transportation to / from the mishap location, including route considerations such as overhead clearance.
- Available personnel support in a ready status.
- Crew and maintenance shelters if the off-station mishap requires a lengthy recovery or salvage.
- Specialty personnel protective equipment.
- Corpsman and first aid support.
- Rations (food and water) for personnel.
- Internal and external communication plans.

- Special equipment required for each type / model / series aircraft.

Training

The ACSR organization requires a minimum of one simulated salvage exercise annually. Team crewmembers should perform non-simulated salvage and recovery operations up to and including a full aircraft lift (if available) every three years for qualification retention. The actual removal of damaged / disabled aircraft may be used to fulfill the training requirement. Whenever mass casualty or disaster drills involving aircraft are conducted, the final phase of the exercise should include salvage and recovery. The ACSR operation phase of the exercise includes all salvage and recovery organization members. A comprehensive check to verify the pre-salvage plan is conducted quarterly to maintain proficiency and accuracy of points of contact. Training incorporates the procedures required to salvage or recover the different aircraft models normally operated at the airfield. Exercises should be structured to provide the necessary training in the use of equipment for various crash situations. Because of the potential for damage during lifting, hoisting, and transporting, exercise objectives should be limited to making the equipment available to the scene, positioning it to satisfy the simulated requirements, and ensuring operational readiness of the team personnel and equipment. The lifting, hoisting, and transporting of an aircraft during a training exercise may be simulated, or where available, performed by using a strike aircraft fuselage. See NAVAIR 00-80T-20 *U.S. Navy Aircraft Crash and Salvage Operations Manual (Ashore)* for additional guidance.

Pre-Salvage Planning

Notification of a mishap sets in motion the firefighting and rescue effort, aviation mishap board (AMB), and ACSR organization. A logically thought-out pre-salvage plan provides the salvage and recovery officer with sufficient data to determine the type of equipment required and skills of the personnel to be assigned to the mishap site. Basic information is necessary in making preliminary plans and decisions. Ideally, the pre-salvage plan should be an integral part of and used in conjunction with the aircraft pre-mishap plan. Essential information includes, but not limited to:

- The location of the mishap.
- Routes to and from the mishap site.
- Aircraft type, and ordnance (if applicable).
- Description of the terrain and weather conditions.
- Identify of obstacles which would make access to or from the site difficult.
- Support unit available.
- Security planning that account for enemy situation, disposition, and composition.

Salvage Methods

Each aircraft mishap presents its own unique requirements, which necessitates adapting general methods to the case at hand. Maintenance manuals for individual aircraft are helpful for locating structural bulkheads and jack points, identifying special tools, and providing specific salvage data. There are two general salvage methods: fixed-wing and helicopter/tiltrotor salvage and recovery.

- Fixed-Wing. Some mishaps may cause damage so severe that recovery of the complete aircraft may be impractical. In these cases, salvage or recovery would consist of the removal of reusable sections and disposal of the remainder. Operational necessity, on rare occasions, may require the airfield or runway to reopen immediately. The urgency of the situation may require dragging an aircraft to a clear area without regard to the secondary damage that may occur. When an aircraft has run one or more landing gear off the paved surface with no damage, the situation is substantially the same as if the landing gear had been damaged. In most cases, the aircraft must be lifted to free the landing gear and an egress route prepared. For detailed fixed-wing salvage procedures, refer to NAVAIR 00-80R-20 *U.S. Navy Aircraft Crash and Salvage Operations Manual (Ashore)*.

- Helicopter/Tiltrotor. The preferred method to recover a helicopter/tiltrotor is to hoist the entire helicopter using the manufacturer's sling. This method minimizes additional damage, but is frequently not usable because of restrictions on pitch and roll attitudes for each model helicopter/tiltrotor. Use of the universal aircraft fabric-hoisting sling (bellyband) presents other difficulties. Helicopters/tiltrotor have a very high center of gravity and relatively narrow beam. They may tend to upset before they can be raised high enough to place a damaged landing gear on padded cribbing or they may tend to rotate within the slings if all wheels are lifted off the ground. On some helicopter/tiltrotor aircraft, the structural bulkheads or jack points are located so the bellyband cannot be positioned without causing additional damage. For detailed helicopter salvage procedures, refer to NAVAIR 00-80R-20 *U.S. Navy Aircraft Crash and Salvage Operations Manual (Ashore)*.

Site Security and Traffic Control

A secure and controlled site is essential to preserve evidence for the AMB, protect classified material, protect government property, and ensure the safety of personnel. Responsibility for establishing security normally lies with the senior member of the AMB. The firefighting / rescue team normally provides initial security and internal site control while the security personnel provide external security. This dedicated force, under the command of the security officer, maintains site security through the completion of the ACSR effort.

SAFETY

The mishap site presents many hazards, not all of which are associated with the aircraft itself. All hazards that could endanger personnel, the aircraft, its cargo, the environment, the site, and the ACSR operation must be identified and protective measures taken. Prevention of additional damage to the aircraft and airfield is important to the ACSR operation. However, it is secondary to the safety of personnel. When planning and conducting ACSR operations, the following hazards should be accounted for:

- Fire Hazards. ACSR operations may create serious fire hazards, and dictate that an appropriate level of fire protection be available. Extreme caution must be exercised if the site is contaminated by POLs. Most aircraft contain either gaseous or liquid oxygen, which vigorously supports combustion. Cutting tools and other heat-generating equipment must be used with caution. Aircraft battery switches are turned off and batteries are disconnected as soon as possible to minimize the possibility of an electric arc. Smoking and open flames are not permitted inside the perimeter of the mishap site.

- Explosive Hazards. EOD personnel are required to render safe all explosives and explosive-actuated devices. Ensure all ejection seats and canopy safety pins are properly installed. Prior to commencing ACSR operations, all explosive devices are rendered safe and / or removed by qualified personnel. Hydraulic pressure accumulators, aircraft engine fire bottles, and emergency nitrogen blow-down bottles should be considered as explosive hazards.

- Electrical Hazards. Keep clear of all power lines. Treat all wires as if they are live. Contact the facilities maintenance officer / public works officer or the local electric utility authorities to render the area safe.

- Lifting Hazards. Keep clear of wreckage as it is being lifted. Avoid unequal distribution of weight. Ensure aircraft pitch and roll attitudes are within maximum limits and take all precautions to prevent secondary damage to the airframe. Ensure guideline / safety personnel are well clear of the aircraft.

- Electronic Radiation Hazards. Precautions are taken when handling equipment capable of causing radiation. Some avionics equipment and components may have retained a charge, or may be capable of emitting radiation if a power source is available.

- Composite Material Hazards. Individual squadron / aircraft reclamation teams as identified by the aircraft pre-mishap plan shall be responsible for cleanup of composite material. ACSR operations should not commence until exposed composite material is contained. If additional composite material is identified during the ACSR operation, the operation should stop until additional cleanup is complete.

- Miscellaneous Hazards. Some additional hazards which could be encountered are battery acid, compressed gases (accumulators, shock struts, tires, pneumatic systems, fire bottles), and torn metal. Industrial areas can present additional hazards involving exotic materials, which can be flammable, toxic, corrosive, or explosive in any combination.

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APPENDIX A
SECURITY PLANNING CHECKLIST

The security planning checklist is a tool to assist planners in effectively assessing threat conditions at a proposed contingency airfield location. While defense of the entire airfield is not the responsibility of the MWSS, it is the responsibility of the MWSS to support expeditionary airfield survivability infrastructure. This requires the MWSS to integrate with security and airfield tenant units assigned MAGTF to address security concerns.

Tasks

1) Determine Threat Level.
    - Level I. A small enemy force that can be defeated by a unit's organic resources.
    - Level II. An enemy activity that requires the commitment of a reaction force to defeat it.
    - Level III. A threat that requires a commitment of a TCF to defeat it.
2) 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 AGS.
    - Provide unimpeded movement of friendly units through the area.
    - Find, fix, and destroy enemy incursion areas.
    - Provide quick and responsive area damage control.
3) Principles.
    - Establish unity of effort.
    - Consider economy of force.
    - Security force must establish airfield security / perimeter security and defense.

- Augment with GCE, if required.
- Employ LAAD, if required.
- Establish responsiveness criteria.

4) Security Tasks.

- 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).

5) Intelligence Preparation of Rear Area.

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

6) Operations.

- Include 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 with local augmentation.
    - Defend against Level II threats with use of ACE or other MAGTF response forces.
    - Defend against Level III threats with TCF 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 internal infrastructure and road networks).
- Identify external accessibility.
- Identify proximity to supporting units and facilities.
- Determine security and defense capabilities (adequate against Level I threats).
- Establish communications (base defense operations center has own network, thorough connectivity, and redundancy).
- Plan fire support and CAS.

7) Base Defense System.

- Secure the base (based on METT-T and space and logistics).
- 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.

8) Determine Force Protection Conditions.

- Force Protection Condition (FPCON) Normal. Applies when a general global threat of possible terrorist activity exists and warrants a security posture.
- FPCON Alpha. Applies when there is an increased general threat of possible terrorist activity against personnel or facilities, the nature and extent of which are unpredictable. FPCON Alpha measures must be capable of being maintained indefinitely.
- FPCON Bravo. Applies when an increased or more predictable threat of terrorist activity exists. Sustaining FPCON Bravo measures for a prolonged period may affect operational capability and impact relations with local authorities.
- FPCON Charlie. Applies when an incident occurs or intelligence is received indicating that some form of terrorist action or targeting against personnel or facilities is likely. Implementation of FPCON Charlie measures creates hardship and affects the activities of the unit and its personnel.

- FPCON Delta. Applies in the immediate area where a terrorist attack has occurred or when intelligence has been received that terrorist action against a specific location or person is imminent. Normally, this force protection is declared as a localized condition. FPCON Delta measures are not intended to be sustained for substantial periods.

9) 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-served weapons.
- Provide redundancy in communications.
- Use rally points and staging areas.
- Use security enhancing equipment.
- 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 the enemy before the enemy can disrupt operations).
- Solidify reporting procedures and signals.
- Establish vehicle search procedures.
- Rehearse immediate actions and upgrade threat response posture.
- Conduct random (unpredictable) patrols.

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APPENDIX B
AIRFIELD SITE SURVEY WORKSHEET

The airfield site survey worksheet is designed to provide information concerning airfield facilities and airfield equipment that is required by the ACE to function at an airfield. Those AGS items not available at the airfield and considered mission essential will have to be embarked with the ACE. The worksheet should be completed in as much detail as possible.

The worksheet is divided into seven sections.

- Section I. Basic Survey Information.
- Section II. Airfield Suitability.
- Section III. Airfield Operations.
- Section IV. Motor Transport.
- Section V. Engineering.
- Section VI. General Airfield Characteristics.
- Section VII. Summary.

AIRFIELD WORKSHEET

Section I. Basic Survey Information

Airfield Surveyor Name(s): ____________________

Airfield Location: ____________________

- **MGRS Location (Center):** ____________________

- **LAT/LONG Location (Center):** ____________________

Date Survey Completed: ____________________

Personnel Conducted Survey

Name/Rank	Position	Organization	Phone/Email	Military Personnel/ Host Nation Personnel

Section II. Airfield Suitability

Airfield Lighting

Is power commercial (shore) or generator? Yes / No Notes: ___________________

Are power lines buried or above ground? Yes / No Notes: ___________________

Identify type of wire used (single/double/triple conductor).

____

____

____

Identify voltage, amp, and phase.

____

____

____

Soil Type

Assess general soil conduction (e.g., rock, clay, sand, etc.), particularly in areas of possible arresting gear placement.

____

____

____

Runways, Taxiways, and Parking Areas

Runway Data							
Designation							
Length							
Width							
Surface							
Condition (Note 1)							
Slope							
Published Strength							
Weight Limits (Note 2)							
Centerline Markers							
Distance Markers							
Edge Markers							
Approach Lighting							
Threshold Lighting							
Visual Slope Indicator Lighting							
Shoulder Surface							
Shoulder Width							
Shoulder Conduction							
Overrun Length							
Overrun Surface							
Overrun Condition							

Notes:

1. Excellent, good, fair, poor. If fair or poor, give details
2. Imposed by host nation airport manager or official

Description, location, and height of obstruction along runways.
Example: Radar reflector 72 inches high, 300 feet left of centerline Runway 04, 550 feet from the approach end (include lighting data).

Description, location, and height of obstructions in the approach and departure zones.
Example: Trees, 322 feet mean sea level, 1,000 feet prior to threshold Runway 22, 70 feet left of the runway's centerline (include lighting data).

Describe approach illusions, if any.

Taxiway Data							
Taxiway Letter							
Designation							
Width							
Surface							
Condition							
Published Strength							
Weight Limits (Note 2)							
Centerline Markers							
Edge Limits							
Shoulder Stabilized							
Stabilized Surface							
Stabilized Width							
Notes: 1. Excellent, good, fair, poor. If fair or poor, give details 2. Imposed by host nation airport manager or official							

Description, location, and height of obstructions along taxiways (include lighting area).

____

____

____

Parking Area Data							
Parking Area Number							
Designation							
Dimensions (Note 3)							
Surface							
Condition							
Published Strength							
Weight Limits (Note 2)							
Taxi Strips							
Tie-down Rings							
Ground Points							
Shoulder Stabilized							
Stabilized Surface							
Stabilized Width							
Flood Lighting							

Notes:

1. Excellent, good, fair, poor. If fair or poor, give details
2. Imposed by host nation airport manager or official
3. If irregular size, indicate dimensions on attached drawing

Description, location, and height of obstructions adjacent to parking area that will restrict aircraft movement while compiling with taxi obstacle clearance requirements (include lighting data).

____

____

____

Are parking spaces made available for aircraft with explosives?
Yes ____ No ____ If yes, identify number and explosive limits for each (indicate location on a drawing).

Are parking spots marked (e.g., C-5/17/130, instrument landing system, Civil Reserve Air Fleet B-747)?
Yes ____ No ____ If yes, identify.

Identify how much of the total parking space available can be allocated.

Is load classification number waiver required?
Yes ____ No ____ If yes, will local officials grant waivers?

Does the slope of the parking area aggravate the breakaway and taxi power requirements?
Yes ____ No ____ If yes, identify problem areas.

Provide remarks on any aspect of parking aircraft not covered.

____

____

____

Is space adequate for emergency vehicles to maneuver around aircraft?
Yes ____ No ____ If no, identify problem areas.

____

____

____

Section II Instructions:

- Identify and complete data blocks on all runways, taxiways, and parking areas whether they are active or inactive.
- Include an airfield diagram or sketch labeling each of the runways, taxiways, and parking areas.
- Identify specific taxi routes and parking areas on the airfield diagram/sketch.
- List the published runway, taxiway, or apron strength by at least one of the following designations:

Runway, Taxiway, Apron Strength Designations	
Designator	Description
T	twin gear rating
ST	single tandem gear rating
TT	twin tandem gear rating
TDT	twin delta tandem gear rating
ESWL (include associated tire pressure, if available)	equivalent single wheel loading
LCN	load classification number

- If listing T, ST, TT, or TDT, include the other rating, if available (e.g., if a T is given, attempt to obtain the ST, TT, and TDT rating). If a data source is the current Flight Information Publication (FLIP), confirm with the appropriate airport officials / civil engineers. If other ratings are not available, do not convert. Every effort should be made to furnish the LCN at airports, which support civil aircraft.
- Identify and locate all obstructions adjacent to all runways, taxiways, and parking areas. For example: Runway distance markers 4 feet high every 1,000 feet along runway 04/22, 8 feet from runway edge. If obstacle data are listed in the current FLIP, confirm its accuracy.
- Identify and include all obstructions in the approach and departure zones that violate the standards of UFC 3-260-01. Identify all obstructions and associated heights and locate them from a known reference point adjacent or near to the obstruction.
- Record distances between adjacent runways, taxiways, and parking areas (e.g., 1,000 feet between runway 20 and the parallel taxiway).
- Record the condition of area surfaces in regard to possible repair, FOD, and engine blast damage.
- List and locate AGS equipment, building, and barriers, subject to possible blast damage.
- Designate tie-down rings, which qualify as aircraft grounding points.
- Include any gross weight or other limitations imposed by airport operator / manager.

Engine Blast

Can engines be run up to maximum power in parking positions without damage to ground surfaces or structures? Yes ____ No ____

Is an engine trim pad available for maximum power run up? Yes____ No ____

Is a blast fence installed or planned for the engine trim pads? Yes ____ No ____

Are other aircraft, structures, or surfaces likely to be damaged by engine blast from application of breakaway power when moving from parking spot or from taxi power application as the aircraft follows designated taxi routes to and from parking area? Yes____ No____ If yes, explain.

____

____

____

Is any damage to structures, surfaces, or vehicular traffic likely to occur while the aircraft is in the takeoff position when maximum engine power is applied? Yes ____No ____ If yes, explain.

____

____

____

Provide remarks on any aspect of jet blast not covered.

____

____

____

Aircraft Movement On The Ground

Identify any area not accessible to the aircraft because of surface strength, obstacles, or probable engine blast damage.

____

____

____

Identify any specified taxi route that aircraft would have to follow from landing to the parking areas and from the parking areas to the runways for take-off.

____

____

____

Can the aircraft taxi in and out of the following areas. Refueling area?
Yes ____ No ____ If no, explain in detail.

____

____

____

Loading / unloading area? Yes ____ No ____ If no, explain in detail.

____

____

____

Maintenance area? Yes ____ No ____ If no, explain in detail.

____

____

____

Attach, to the completed survey, an airfield drawing (8 inches by 10 inches) showing designated taxiways and the proposed parking plan that the aircraft will have to comply with while observing limitations imposed by obstacles, weight bearing capacity, probable blast damage, and width. Provide remarks on any aspect of ground movement difficulties not covered.

____

____

____

Expeditionary Airfield Development Or Extension Of Existing Facilities

Sketch the proposed airfield showing all dimensions, to include all existing structures, of the following:

General description of the area

- Natural grade / slope
- Type and condition of vegetation
- Soil classification (e.g., clay, sand, gravel, other)
- Roads that cross the area or are adjacent to area
- Potholes, depressions, or other items necessitating surface preparation
- Obstacles, manmade or natural

Utilities in unpaved area

- Overhead
- Underground
- Storm drains or any other large underground conduits and underpasses
- Water source

Determine use of unpaved areas for EAF development based on soil strength, testing, and identifying soils. Personnel qualified in soil mechanics and the data made a supplement to this survey will subsequently test areas identified in the previous paragraphs that show potential for off-pavement aircraft operations. This data will include the following:

- Soil classification in accordance with the Unified Soil Classification System
- Measures California bearing ratio (CBR) and moisture content at the time of CBR measurements. Record CBRs at depths of 36 inches
- Airfield index measured at the same time and location as the CBRs and listed at same depth

Billeting

Identify the following billeting information:

On base:

- Number. ________
- Type. ________
- Total capacity. ______
    - Officer. ________
    - Enlisted. ________

Off base:

- Number. ________
- Type. ________
- Total capacity. ______
    - Officer. ________
    - Enlisted. ________

Messing

Identify the following messing capabilities:

On base:

- Capacity. ________
- Hours of Operation. ________
- Total capacity. ______
    - Officer. ________
    - Enlisted. ________

Off base:

- Capacity. ________
- Hours of Operation. ________
- Total capacity. ______
    - Officer. ________
    - Enlisted. ________

General remarks (e.g., quality, health standards).

____

____

____

Section III. Airfield Operations

Flight line Security

Type guards: Military / civilian, US / indigenous

____

____

____

Are guards armed? Yes ____ No ____ If yes, identify weapons type (e.g., rifle, machine gun).

____

____

____

Number of guards on each shift. ____

Do guards patrol on foot or in vehicles? ________________________________

Are patrol dogs used? Yes ____ No ____
Do guards speak English? Yes ____ No ____
Does the transient aircraft parking area appear secure? Yes ____ No ____
Is the transient parking area well lit? Yes ____ No ____
Were portable lights furnished for the transient parking area? Yes ____ No ____
Does the flight line have restricted access? Yes ____ No ____
Is the flight line fenced? Yes ____ No ____ If fenced, identify type (e.g., wood, chain link).

____

____

____

Did the security force appear to have inter-base radios? Yes ____ No ____

Does the security force use a restricted area badge or some other type of personal identification? Yes ____ No ____ If yes, identify type.

____

____

____

Did local forces provide a security check of passengers? Yes ____ No ____
Are weapons storage facilities available? Yes ____ No ____ If yes, identify type.

____

____

____

Communications

Telephones
- Is there a base telephone exchange? Yes ____ No ____
- Are commercial telephone lines available? Yes ____ No ____

Direct circuit:

- To ________, ________, ________.

- Type of termination:
    - Is a private branch exchange switchboard available? Yes ____ No ____
    - Is a console available? Yes ____ No ____
    - Is there a patching capability? Yes ____ No ____

Defense Switch Network:

- Quantity (number of incoming, outgoing, 2-way lines): Private branch exchange.

____

____

____

- 4-wire (where is it located).

____

____

____

- Precedence capability (flash, priority): Private branch exchange and 4-wire

____

____

____

- Maximum call area (e.g., worldwide, continental United States, Pacific): Private branch exchange and 4-wire.

____

____

____

- Number (area code, operator assist).

____

____

____

Local commercial numbers (area code, operator assist):

- Are local, commercial numbers available? Yes ____ No ____

- Type. ____

- Number/listing. ______________________________________

Communications Assets: Local area network/wide-area network services:

- Connectivity type.

____

____

____

- Is there a communications infrastructure? Yes ____ No ____

- Messaging:
- Is automated message handling system available? Yes ____ No ____

- Is defense message system available? Yes ____ No ____

- Is Defense Switch Network terminal available? Yes ____ No ____

- Identify digital subscriber terminal equipment type (automated exchange, automated branch).

____

____

____

- Identify any other communications assets (e.g., Mode V, II).

____

____

____

- Determine highest security classification that the available circuit can process.

____

____

____

-Identify distance and travel time between operating locations and communications center.

____

____

____

-Identify hours of operation (e.g., 24 hours/day, 7 days/week; 8 hours/day, 5 days/week).

____

____

____

-Identify routing indicator.

Radio

UHF/VHF: Type (US Army/US Navy nomenclature).

- Quantity.

- Frequencies available.

Identify intra-base radio (by net) and frequency.

Auxiliary power for communications equipment

Determine volts ________ hertz ________

Type of communications support to be augmented

Identify buildings and room numbers where services are required.

Contacts for additional communications requirements

Identify people to contact and telephone numbers for coordination of additional communications required.

Communications-electronics facilities/capabilities program change

Identify any major communications-electronic facilities/capabilities program changes.

Communications support at airfield

Identify any resident communications support at the airfield.

General remarks

Provide any other general, relevant information (e.g., reliability of communications equipment and long-haul circuits and other pertinent comments).

____

____

____

Provide the following information on the nearest Federal Aviation Administration center or flight service station facility: Identify location, type, distance, and phone number

____

____

____

Structural Firefighting And Aircraft Rescue And Firefighting

Provide the following information for rescue crews:

- Are rescue crews housed and messed on the flight line? Yes ____ No ____

- Is a full suit of protective clothing available for each on-duty fire fighter (i.e., hood, coat, trousers, boots, and gloves)? Yes ____ No ____

- Is a water supply available on the airfield for refilling ARFF vehicles? Yes ____ No ____

Is each firefighting vehicle radio equipped? Yes ____ No ____

Can vehicles communicate with the tower? Yes ____ No ____

Equipment (provide the following for all non-Marine Corps fire protection vehicles):

- Make. ____

- Number. ____

- Water capacity. ____________________________________

- Foam type/capacity. ________________________________

- Number of turrets. _________________________________

- Water rate (gallons per minute) of turrets. ______________________

Identify the following information for the nearest hospital:

- Name. ______________________________
- Location. ______________________________
- Role designation. ______________________________
- Distance from base. ______________________________
- Ground travel time from base. ______________________________
- Air Travel time from base. ______________________________
- Air MEDEVAC / CASEVAC pad on site? Yes ____ No ____

During a contingency, identify how many medical personnel will reside at the base medical facility:

- Flight surgeons, physicians, medical technicians, dentists, dental technicians, nurses

____

____

____

Identify the following information to determine ambulance availability:

- Number of ambulances. ______________________________
- Ambulances with radios. ______________________________
- Other ambulances:
  - Military. ______________________________
  - Civilian. ______________________________
- Does an ambulance normally respond to all in-flight emergencies? Yes ____ No ____
- During an emergency, how many ambulances will remain at the base medical facility? ____
- Civilian ambulances. ______________________________
- Military ambulances. ______________________________

General comments/remarks.

____

____

____

Fuel

Identify the following storage capacities:

- Bulk storage capability. ____

- Average inventory in bulk storage. ____________________________________

Identify how the bulk storage of fuel (tank truck; tank car; pipeline; tanker/barge) is handled.

____

____

____

Identify jet fuels dispensing capabilities.

____

____

____

Identify fueling hydrant storage capabilities.

____

____

____

Determine number of hydrant refueling positions. ____________________________

Determine total gallons per minutes that can be pumped through hydrant systems. __________

Determine the number of aircraft that can be refueled by hydrants simultaneously. _________

Determine the number/capacity (gallons) and pumping rates (gallons per minute) of refueling vehicles (trucks).

Determine turnaround time from flight line to fuel point, fill, and return to the flight line.

Determine number of fuel points and pumping capacity of each.

Determine distance between fuel points.

Determine compatibility of host support equipment to Marine Corps airfield.

Identify the following off base facilities:

- Where is the off base supply point? ______________________________

- Identify the storage capacity and average fill.

____

____

____

- Trace POL supply back to port or refinery. If the refinery is the source, determine production capability for jet fuels.

____

____

____

Identify the following POL test laboratory information:

- Is one in operation? Yes ____ No ____

- Would military personnel be allowed to work in the laboratories? Yes ____ No ____

Food Services

Identify the following food services capabilities:

On base	Off base
- Capacity. ________	- Capacity. ________
- Hours of operation. ________	- Hours of operation. ________

Do the off base eating facilities practice good standards of food preparation? Yes ____ No ____ If yes, identify the off base eating facilities that should be avoided.

____

____

____

Are there foods/drinks that should be avoided by Marine Corps personnel? Yes ____ No ____
If yes, identify foods/drinks that should be avoided.

What is the source of local water?

Is the local water supply disinfected? Yes ____ No ____
Is the base located in a malaria risk area? Yes ____ No ____ If yes, identify the months of the year that the base is as risk.

Is the surrounding countryside in the risk area? Yes ____ No ____ If yes, identify the months of the year that the country is at risk.

Medical

General information

Identify topography (mountains, desert, etc.).

Identify climate (tropical, arctic, etc.).

____

____

____

Identify the following temperature ranges:

- Summer. ________ to ________
- Spring. ________ to ________
- Winter. ________ to ________
- Fall. ________ to ________

Water Availability			
Source	**Quality**	**Quantity**	**Contaminate**

Epidemiology	
Disease	**Occurrence**

Insects, plants, and animals of medical importance

Identify the insects, plants, and animals of medical importance.

____

____

____

Civilian health services

Identify the organization and administration of civilian health services agencies.

____

____

____

Identify public health laws.

Provide comments on overall quality of civilian health care (include blood bank and blood testing).

Identify significant civilian health services personnel (e.g., coroner or equivalent).

Significant Civilian Health Services Personnel	
Name	**Title**

Military medical services

Identify the organization and administration of the military medical services.

Identify required and available medical logistics (civilian and military patient transport [ground or air available], blood supplies, etc.).

Provide comments on overall quality of military health care.

____

____

____

Identify significant military medical personnel.

Significant Military Medical Personnel	
Name	**Title**

Production Capabilities of Medical Material			Stockpile of Medical Material			Local Medical Facilities		Significant Personnel at Local Medical Facilities	
Name	**Location**	**Production**	**Name**	**Civilian/Military**	**Material**	**Name**	**Location**	**Name**	**Title**

Outpatient care available

Is on base outpatient care available? Yes ____ No ____

Is off base outpatient care available? Yes ____ No ____

Identify the number of flight physicians available (overseas bases only):
US. _____ / Foreign nationals. _____

Identify the number of other physicians available (overseas bases only):
US. _____ / Foreign nationals. _____

Identify the number of medical technicians available:
US. _____ / Foreign nationals. _____

Identify the number of dentists available:
US. _____ / Foreign nationals. _____

Identify the number of dental technicians available:
US. _____ / Foreign nationals. _____

Identify the number of nurses available:
US. _____ / Foreign nationals. _____

Identify the number of in-patient beds available:
US. _____ / Foreign nationals. _____

General impression of health and sanitation of local area

Identify any organic material (wastes) present.

Identify industrial pollutants in local water.

Determine if there is evidence of atmospheric pollution.

General impression of local city conditions

Determine garbage and trash accumulation.

Determine fly / insect vector population.

Determine stray animals (is rabies present) risk.

Determine sanitary compliance in restaurants, bars, and street vendors.

Determine illicit drug availability (what types and where).

Determine the following in regards to prostitution:

- Is solicitation legal? Yes ____ No ____ If yes, where does solicitation/prostitution occur (e.g., streets, bars).

- Are health cards carried? Yes ____ No ____

Section IV. Motor Transport

Identify support provided by the following host nation/activity:

Light vehicles available: Type (e.g., car, van, taxi service) and hours of operation.

___

___

___

Medium vehicles available: Type (e.g., bus, truck wrecker) and hours of operation.

___

___

___

Heavy vehicles available: Type (e.g., tractor-trailer, long bed) and hours of operation.

___

___

___

Indicate if vehicle support is organic or host supported.

___

___

___

Indicate how costs on fuel and repairs are handled.

___

___

___

Section V. Engineering

This section identifies support provided by the host nation/activity. Obtain or produce a layout of the entire airfield and include all major construction efforts (e.g., roads, containment areas, fuels site, equipment lot, ASP). Ensure adequate area is available for each proposed site and pay particular attention to drainage and trafficability.

Engineer Equipment

Identify type of engineer equipment.

____

____

____

Identify capacity of available engineer equipment.

____

____

____

Identify hours of operation.

____

____

____

Materials Handling Equipment

Identify available cranes and forklifts by the following:

- Type. ____
- Capacity. ____
- Hours of operation. ____________________________________

Utilities

Identify available power by the following:

- Alternating current / direct current. ______________________________

- Source. ______________________________

- Voltage. ______________________________

- Wattage capacity. ______________________________

- Reliability. ______________________________

Identify available water (water points) by the following:

- Location. ______________________________

- Quantity. ______________________________

- Quality. ______________________________

- Laundry (capacity). ______________________________

- Bath. ______________________________

- Sewage treatment/human waste removal. ______________________________

Identify garbage dump locations.

____

____

____

Identify any restrictions.

____

____

____

Identify any hazardous materials removal requirements.

____

____

____

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

Identify quantity of available construction materials.

Identify type of available construction materials.

Determine procurement requirements.

Determine locations of available construction materials.

Construction Requirements

Is site preparation required? Yes ____ No ____ If yes, identify requirement.

Is earth work is required? Yes ____ No ____ If yes, identify requirement.

Is road work required? Yes ____ No ____ If yes, identify requirement.

Is drainage work required? Yes ____ No ____ If yes, identify requirement.

Are berms (Class V) required? Yes ____ No ____ If yes, identify requirement.

Are survivability positions required? Yes ____ No ____ If yes, identify requirement.

Is concertina required? Yes ____ No ____ If yes, identify requirement.

Are ditches required? Yes ____ No ____ If yes, identify requirement.

____

____

____

Are guard towers required? Yes ____ No ____ If yes, identify requirement.

____

____

____

Are revetments required? Yes ____ No ____ If yes, identify requirement.

____

____

____

Are aircraft recovery systems (type and measurements) required? Yes ____ No ____
If yes, identify requirement.

____

____

____

Is aircraft lighting required? Yes ____ No ____ If yes, identify requirement.

____

____

____

Is an airfield parking lamp required? Yes ____ No ____ If yes, identify requirement.

____

____

____

Is a high power run up required? Yes ____ No ____ If yes, identify requirement.

___

___

___

Section VI. General Airfield Characteristics

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

Aerial Port Facilities

Cargo terminal

Identify available covered space at cargo terminal.

____

____

____

Identify available outside storage space at cargo terminal.

____

____

____

Determine building number and/or space. ______________________________________

Determine if aircraft loaders are available and quantity available:

- 40K Yes ____ No ____
- 25K Yes ____ No ____
- 10K forklift Yes ____ No ____
- 5K forklift Yes ____ No ____
- Wide-body material handling equipment (type and capacity).

____

____

____

- Upper lobe Yes ______ No ______
- Lower lobe Yes ______ No ______
- Other (explain type and rate capacity).

____

____

____

Are pallet/container trailers available? Yes ____ No ____ If yes, identify.

Are pallet / cargo scales available? Yes ____ No ____ If yes, identify type, make, and weight capability.

Are flatbed trucks available? Yes ____ No ____ If yes, identify type, if rollerized, and length.

Are truck offloading / onloading ramps available? Yes ____ No ____ If yes, identify.

Is material handling equipment repair location available? Yes ____ No ____ If yes, identify location.

Is space available? Yes ____ No ____ If yes, identify where.

Is there a vehicle cleaning capability/wash rack? Yes ____ No ____ If yes, identify where.

Passenger facilities

Identify location of passenger facilities.

Determine maximum capacity of passenger facilities.

Identify available eating facilities.

Identify passenger stairs (type, height capacity).

Fleet service

Identify location of fleet services.

Identify available space.

Is in-flight kitchen established? Yes ____ No ____ If yes, identify location of established kitchen.
If no, determine location of kitchen.

Is lavatory servicing truck available? Yes ____ No ____ If yes, document type / capacity. If no, establish lavatory servicing truck.

Identify disposal facility (distance/availability).

Cargo storage area

Determine inside storage: Identify type of flooring (e.g., concrete, dirt, gravel, asphalt) and Square feet.

____

____

____

Determine outside storage: Identify type of flooring (e.g., concrete, dirt, gravel, asphalt) and Square feet.

____

____

____

- Is area fenced? Yes ____ No ____
- Are outside lights available? Yes ____ No ____
- Identify any other cargo storage vehicle parking capacity other than the designated storage area is available for (give dimensions):

  - Vehicles / Wheels / Tracked / Cargo. ______________________________

  - Identify hazardous cargo build-up areas. ______________________________

  - Distance to remote parking. ______________________________

  - Size. ______________________________

  - Type surface. ______________________________

  - Revetment type. ______________________________

  - Maximum net explosive weight allowed in holding area. ______________________________

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 all types of cargo and passengers at an airport, and it is constrained by airfield reception, aircraft parking and unload, and clearance capabilities. In this regard, it is necessary to determine tonnage estimates for each airfield in terms of both the amount of work that could be accomplished each date over a sustained period of 30 days.

Considering the above factors, specify the tonnage that could be moved completely through the airfield during each 24-hour period:

Current average daily throughput: ________________short tons.

Estimated maximum daily throughput capability (with current manpower and equipment) ______________________________short tons.

Estimated maximum throughput capability (unconstrained by current manpower requirements) ______________________________short tons.

Arriving personnel, vehicles, and cargo will be moved to their final destination by rail, road, or a combination of both. The following information is required:

Identify and indicate the distance to the nearest railheads with the capacity to load wheeled and tracked vehicles. Also, include the capabilities of loading ramps and marshalling areas.

____

____

____

Identify the number and type (dual land) of major roads serving the airfield and any movement restrictions that exist in the vicinity of the airfield and / or between the airport and railheads that could prevent movement of large wheeled or tracked vehicles.

____

____

____

Air Mobility Command Operation Facilities

Is there a room or a building for operations (briefings, flight planning)? Yes _____ No _____ If yes, provide building number ______________. If no, establish a location. Identify limitations of room/building.

____

____

____

Is there a method for control of classified material available? Yes ____ No ____ If yes, identify. If no, establish control methods. Identify limitations.

____

____

____

Base Operations

Building number. ____

Telephone. ____

Were notices sent to pilots and aircrew? Yes ____ No ____
Are flight publications available? Yes ____ No ____
Are there customs requirements? Yes ____ No ____
Is there runway condition reading measuring equipment? Yes ____ No ____

Identify the following for the control tower:
- Does position and construction of control tower afford the operators unrestricted visibility of all approaches, runways, and taxi strips? Yes ____ No ____
- Identify the equipment limitations for guarding and transmitting on 802.11a/g [wireless standards] frequencies.

____

____

____

- Is emergency power available for the tower? Yes ____ No ____

- Are up-to-date charts and diagrams, including crash grid maps, maintained in the tower? Yes ____ No ____

- Who operates the tower facility? ____

Provide any required remarks.

____

____

____

Aids to Navigation

Facility	**Yes**	**No**
VOR		
TACAN		
RBN		
ILS		
Radar: PAR		
Radar: ASR		
Instrument Approved Procedures	**Yes**	**No**
Marine Corps		
Air Force		
Other (FLIP, Host Nation Only)		
Standard Instrument Departure	**Yes**	**No**
Marine Corps		
Air Force		
Other (FLIP, Host Nation Only)		

Legend

ASR	airport surveillance radar
FLIP	flight information publication
PAR	precision approach radar
RBN	radio beacon
TACAN	tactical air navigation
VOR	very high frequency omnidirectional range

Are replacements or additions to existing facilities needed and/or expected? If yes, identify replacements or additions.

____

____

____

Can published, standard instrument departures be used in lieu of radar vectors? Yes ____ No ____. Attach a copy of current standard instrument departures to survey.

Aircraft Support

Identify deicing equipment, fluid, and status.

Identify the following transient alert data:

- Are follow-me vehicles available? Yes ____ No ____
- Identify the operating hours. ____
- Are aircraft marshallers available? Yes ____ No ____
- Are fire guards available? Yes ____ No ____

Note: If aircraft jacking must be accomplished outdoors, designate an area where the ramp has sufficient strength and where jet blasts/prep blasts of taxiing aircraft will not affect jacked aircraft.

Equipment

Identify power by type available:

- Is MD-3 available? Yes ____ No ____
- Is M32A-60 available? Yes ____ No ____
- Is other power available? Yes ____ No ____ If yes, identify.

Identify any additional, required power supplies.

Are air carts available (include MA-1A and M32A-60)? Yes ____ No ____ If yes, identify available air carts and any additional, required air carts.

Identify, by type, the available hydraulic test stands.

Identify available air compressors: High pressure and Low pressure.

Identify available heaters available and if any additional heaters are needed.

Identify available light carts available and if any additional light carts are needed.

Identify any other powered ground support equipment and if any additional equipment is needed.

Identify any available jacks available and if any additional jacks are needed.

Type	Purpose	Available	Needed

Identify any available maintenance stands and if any additional stands are needed.

Type	Purpose	Available	Needed

Miscellaneous

Are liquid oxygen / gaseous oxygen, oils, and tires/wheels (build-up) available or procurable?

Yes _____ No _____ If yes, identify.

Identify runway clearance vehicles (i.e., snow removal and runway sweepers).

Identify if US air carriers operate through airfield.

Identify North Atlantic Treaty Organization air carriers that operate through the airfield?

Section VII. Summary

Summarize the airfield's capability to support C-130/C-17/C-5 and Civil Reserve Air Fleet B-747, ILS, DC-10, and DC-8 aircraft. Include whether the airfield is capable of supporting an on-load / offload, in route stop, or emergency/alternate capability. Include also any limiting factors not covered by this worksheet and measures necessary to correct all limiting factors. Include working on the ground for normal operations and for contingencies by aircraft type.

LANDING ZONE SURVEY	1A. LZ NAME	1B. ZAR INDEX NO.	2A. COUNTRY	2B. STATE
	3. MAP SERIES/SHEET NUMBER/EDITION/DATE OF MAP			

4. SURVEY APPROVAL/DISAPPROVAL DATA			
4A. DATE SURVEYED	TYPED NAME AND GRADE OF SURVEYOR	PHONE NUMBER *(DSN)*	UNIT
4B. DATE REVIEWED	TYPED NAME AND GRADE OF REVIEWER	PHONE NUMBER *(DSN)*	SIGNATURE
	UNIT AND LOCATION		
4C. DATE	TYPED NAME AND GRADE OF APPROVING AUTHORITY	PHONE NUMBER *(DSN)*	SIGNATURE
APPROVED ☐ DISAPPROVED ☐	UNIT AND LOCATION		

5. COORDINATING ACTIVITIES	
LZ CONTROLLING AGENCY OR UNIT	PHONE NUMBER *(DSN)*
RANGE CONTROL	PHONE NUMBER *(DSN)*

6. LZ DIMENSIONS *(FEET)*			
LENGTH	WIDTH	APPROACH END OVERRUN LENGTH	DEPARTURE END OVERRUN LENGTH
LEFT CLEAR ZONE	LEFT SHOULDER	RIGHT CLEAR ZONE	RIGHT SHOULDER

7. LZ AXIS DATA			
A. MAGNETIC	B. GRID *(UTM)*	C. TRUE	D. SOURCE/DATE OF VARIATION DATA
8. GROUND POINT ELEVATION FORRUNWAY	A. APPROACH END	B. DEPARTURE END	C. HIGHEST

9. LZ COORDINATES				
A. SPHEROID/DATUM	B. GPS DERIVED ☐ YES ☐ NO	C. GRID ZONE	D. EASTING	E. NORTHING

F. LZ CENTER POINT	MGRS COORDINATES	WGS84 LATITUDE *(D-M.MM)*	WGS84 LONGITUDE *(D-M.MM)*
G. APPROACH END	MGRS COORDINATES	WGS84 LATITUDE *(D-M.MM)*	WGS84 LONGITUDE *(D-M.MM)*
H. DEPARTURE END	MGRS COORDINATES	WGS84 LATITUDE *(D-M.MM)*	WGS84 LONGITUDE *(D-M.MM)*

10. LZ SURFACE DATA	
A. SURFACE	B. SOIL STRENGTH PROFILE

11. LZ LONGITUDINAL PROFILE	
A. GLIDE SLOPE RATIO	B. LONGITUDINAL RUNWAY GRADIENT

12. TRANSVERSE SECTION GRADIENTS			
A. LEFT TRANSITION AREA	B. LEFT GRADED AREA	C. LEFT SHOULDER	D. LEFT HALF RUNWAY
E. RIGHT TRANSITION AREA	F. RIGHT GRADED AREA	G. RIGHT SHOULDER	H. RIGHT HALF RUNWAY
I. PENETRATIONS			

AF IMT 3822, 20021001, V1 PREVIOUS EDITIONS ARE OBSOLETE.

Figure B-1. Landing Zone Survey Form (Front).

LZ NAME
13. LZ DIAGRAM
14. REMARKS

15. PHOTOGRAPHY AVAILABLE	LOW LEVEL ROUTES
☐ YES ☐ NO	☐ NONE AVAILABLE ☐ ROUTE NAME/DESIGNATOR

AF IMT 3822, 20020903, V1 *(REVERSE)*

Figure B-1. Landing Zone Survey Form (Back).

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APPENDIX C
BASE RECOVERY AFTER ATTACK FORMS AND PROCESURTES

The BRAAT forms, procedures, and references in this appendix are provided to assist planners in the development and execution of a BRAAT plan. This Appendix include the NATO Pavement Reference Marking System, MOS selection steps, ADR actions, materials calculations and engineer estimations, as well as DAT and DART actions.

MINIMUM OPERATING STRIP SELECTION

The following steps are provided as a guide to identify AGSOC responsibilities and required documents to be used during MOS selection:

1. Determine MOS dimensions by type/model/series aircraft.
2. Determine minimum airfield operating surface (MAOS).
3. Determine repair quality criteria.
4. Record and plot damage information from the DATs.
5. Identify candidate MOSs by type/model/series aircraft.
6. Determine crater diameter.
7. Estimate EOD response time per candidate MOS.
8. Estimate and record ADR times per candidate MOS.
9. Tabulate comparative candidate MOS recovery times per candidate MOS.
10. Brief the airfield commander or senior airfield authority (SAA) on candidate MOSs.
11. Airfield commander or SAA select the MOS.

Note 1: Steps 1–3 can be accomplished prior to any damage being received.
Note 2: Steps 4–11 are completed after an attack on the airfield has occurred.

Step 1. Determine Minimum Operating Strip Dimensions.

The SAA determines the required MOS based on type, model, and/or series of aircraft, operating conditions, and environmental factors at the airfield. Once the SAA has determined a MOS length and width, the appropriate MOS template can be made for the MOS selection process.

These MOS templates will be used to identify primary and secondary MOSs during the MOS selection process.

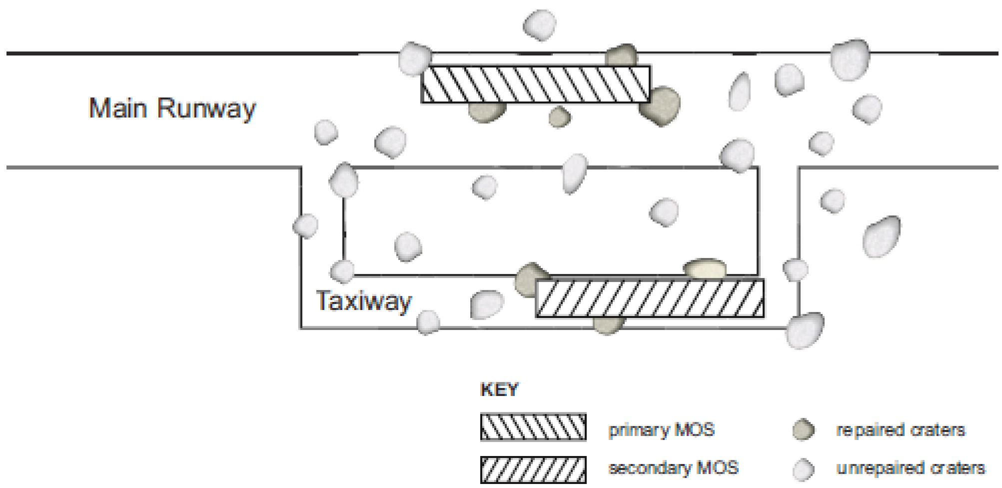


Figure C-1. Minimum Operating Strip Templates Overlaid on an Airfield.

Step 2. Determine Minimum Airfield Operating Surface

The MOS selection team must also take into consideration the damage to the entire airfield operating surface, which could possibly impact sortie generation. This entire airfield area is commonly referred to as the MAOS. Simply put, the MAOS consists of a MOS and supporting taxiways or access routes. Table C-1 provides minimally acceptable taxiway widths for common aircraft. In addition, the MOS selection team or team leader requests data from the SAA regarding aircraft turning radius requirements and cleared area widths.

Aircraft	Required Width (Feet)
F-15/16/18/22/35	25
KC-130	30
C-17	50
C5, KC-10, B-747	60
KC-135	75

Table C-1. Minimally Accepted Repair Taxiway Width Criteria.

Step 3. Determine Repair Quality Criteria

Repair quality criteria is generally assigned by the AGSOC. It gives the maximum upheaval that can remain above the undisturbed pavement and is expressed in table C-2. The objective is to get flush repairs; however, timelines and repair techniques may necessitate the use of lesser quality of repairs. Refer to AFPAM 10-219 Volume 4 *Airfield Damage Repair Operations* for further information on repair quality criteria. For planning purposes the MOS selection team will utilize “C” criteria, which equates to 1.5 inches of upheaval above the undisturbed surface as the maximum surface roughness on a MOS with an objective of flush repairs.

Quality	Criteria
A	Repair must be flush with undisturbed pavement level
B	Repair can extend above undisturbed pavement 1 inch
C	Repair can extend above undisturbed pavement 1.5 inches
D	Repair can extend above undisturbed pavement 3 inches
E	Repair can extend above undisturbed pavement 4 inches

Table C-2. Repair Quality Criteria.

Step 4. Record and Plot Damage Information

Using the NATO Pavement Reference Marking System (see example in figure C-2), the DAT reports surface damage to the AGSOC. For examples and more detailed description of the plotting steps, refer to AFPAM 10-219 Volume 4 *Airfield Damage Repair Operations*. The MOS selection team records damage on the DAT Record Sheet (see table C-3) and, using the crater damage template (see figure C-5), plots damage on the airfield map (see figure C-3) and operating surface grid map (see figure C-4).

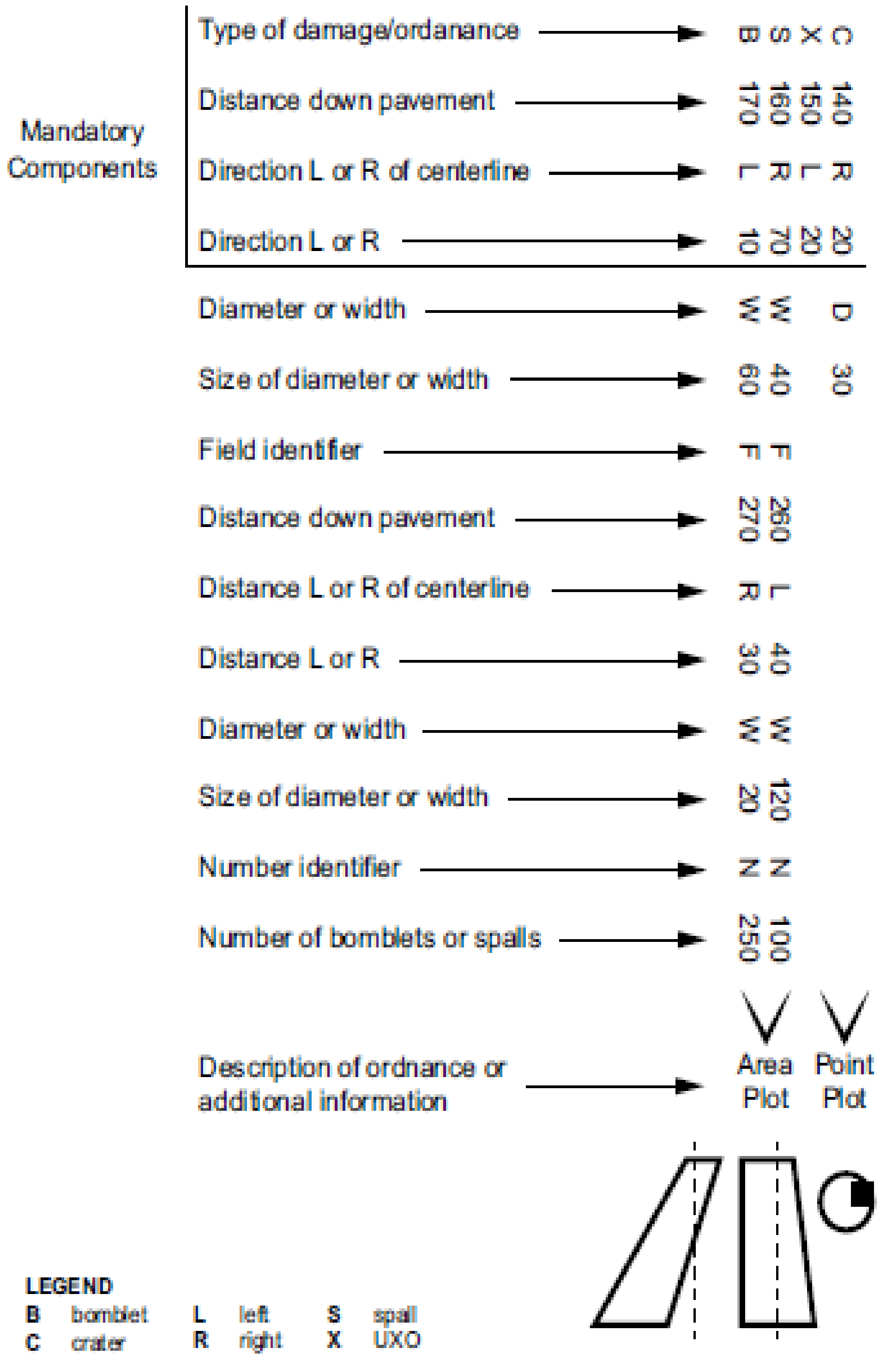


Figure C-2. NATO Pavement Reference Marking System.

DAT Number / Route														
Mandatory Components	Crater number or slap field number													
	Type of damage/ordnance													
	Distance down pavement													
	Direction left/right of centerline													
	Distance left/right													
Spall and Bomblet Fields	Diameter or width													
	Size of crater diameter or width of spall/bomblet field													
	Field Identifier													
	Distance down pavement													
	Direction left/right of centerline													
	Distance left/right													
	Diameter or width													
	Size or width													
	Number identifier													
	Number of bomblets or spalls													

Table C-3. Damage Assessment Team Recording Sheet.

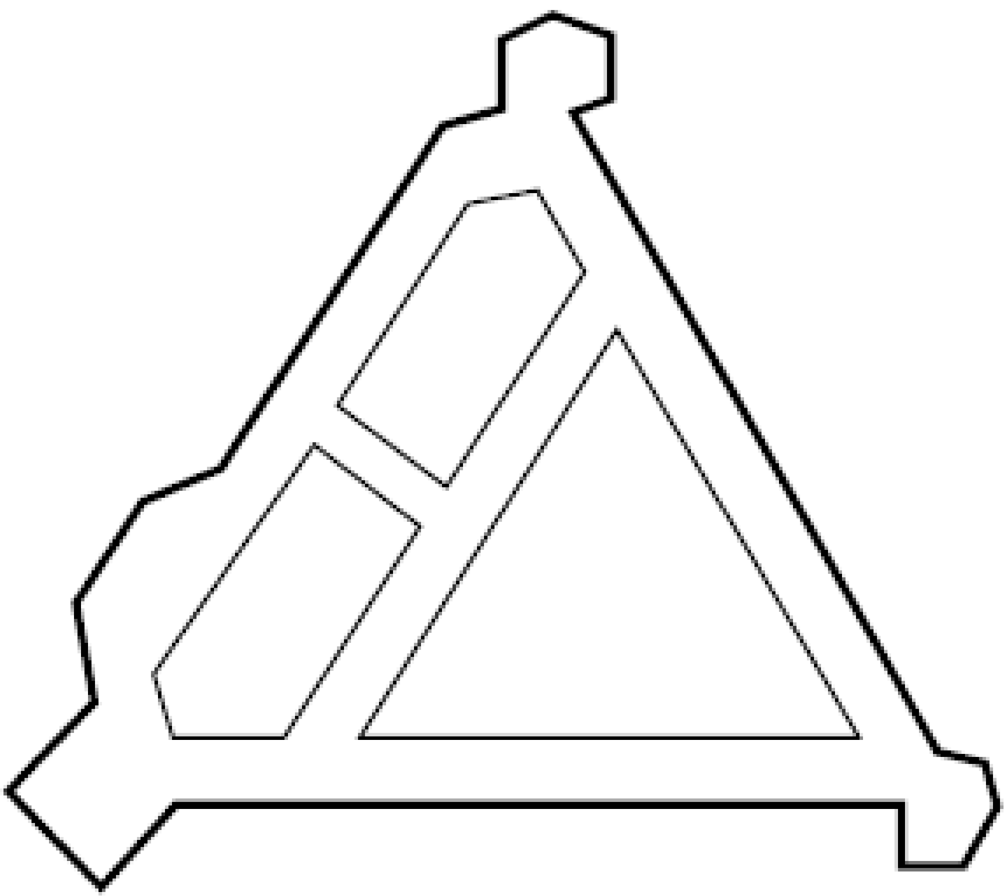
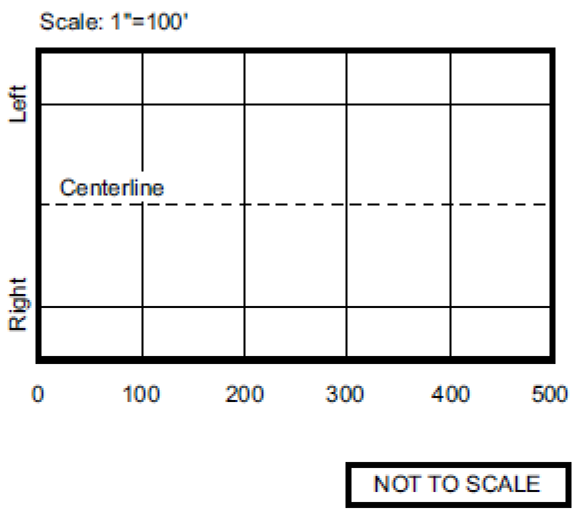


Figure C-3. Airfield Map.



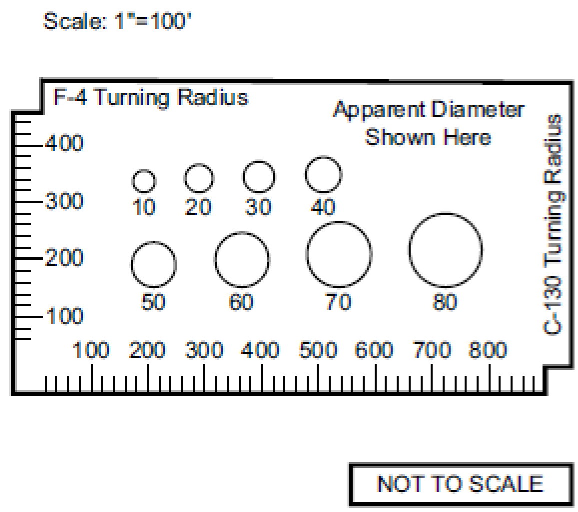


Figure C-4. Operating Surface Grid Map Example. Figure C-5. Crater Damage Template.

Step 5. Identify Candidate Minimum Operating Strip

The MOS selection team uses the MOS template (see figure C-6) to identify candidate MOSs and associated taxiway on the airfield map. MOS candidate selection is based on time to repair and accessibility.

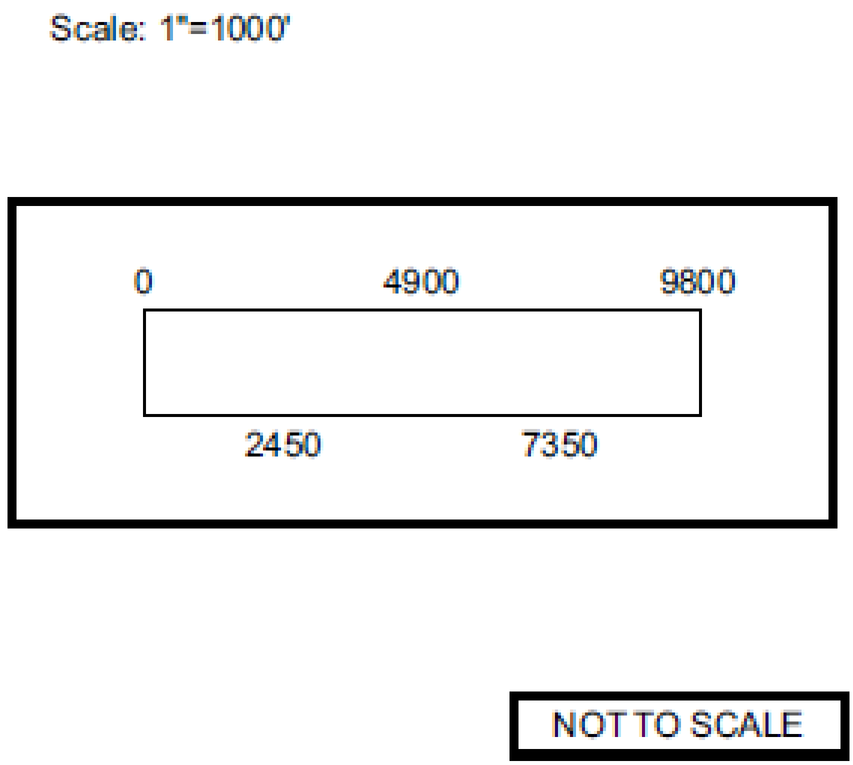


Figure C-6. Minimum Operating Strip Template.

Step 6. Determine Crater Diameter

The MOS selection team transfers damage information from the DAT Record Sheet to the MOS selection team worksheet (see table C-4) and fills in remaining information on the worksheet. To convert apparent crater diameter to actual crater diameter, use the crater diameter conversion chart (see figure C-7). Record information on MOS selection team worksheet.

MOS Identification							
Crater Number / Spall Field Number	Distance Down MOS	Crater Diameter / Dimensions of Spall Field	Distance to Next Crater	Repair Quality Criteria	Crater Diameter / Number of Spalls	Repair Crew Number	Crater / Spall Repair Time (minutes)
Total Crater/Spall Repair Time (minutes/hours) (based off greatest cumulative crew hours of one team)							
Total EOD Time (minutes/hours)							
MOS Repair Time (minutes/hours)							

Table C-4. Minimum Operating Strip Selection Team Worksheet.

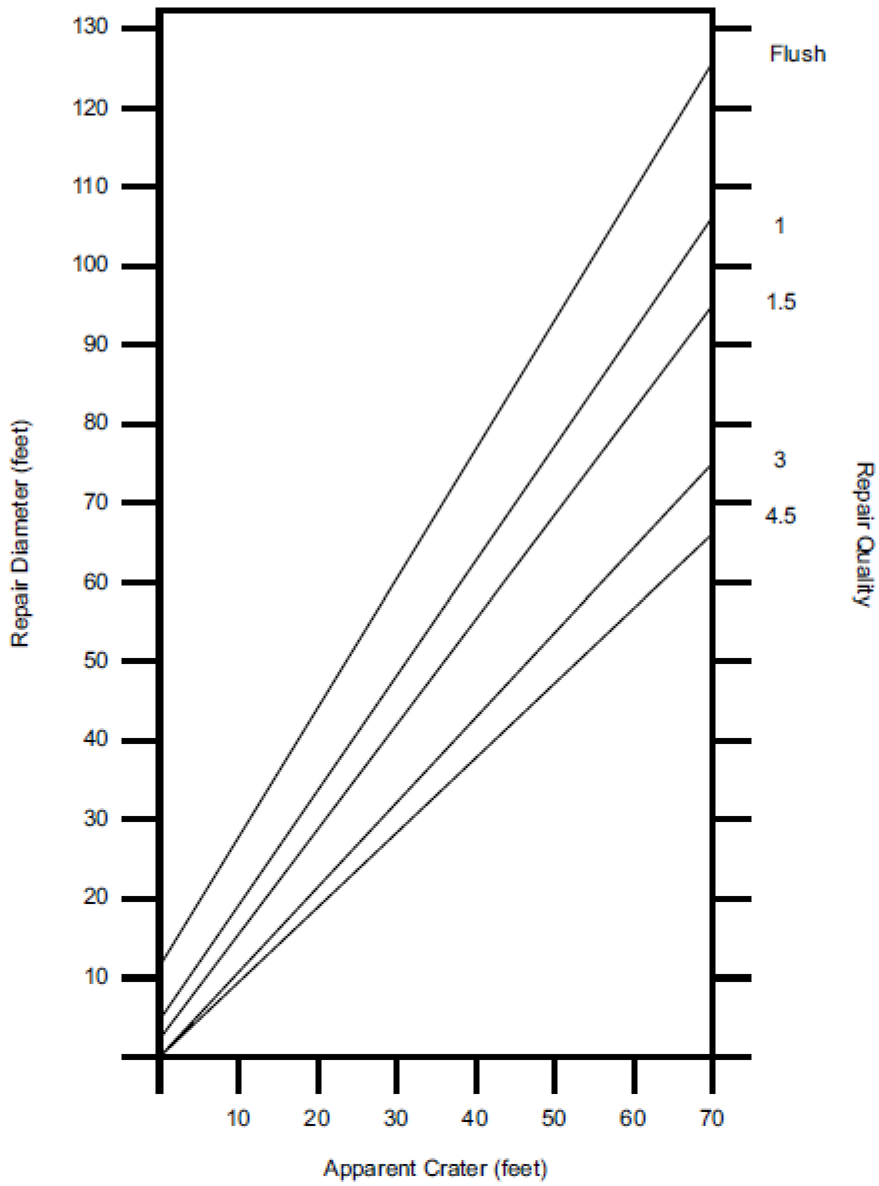


Figure C-7. Crater Diameter Conversion Chart.

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

Step 7. Estimate Explosive Ordnance Disposal Time

The EOD team leader will give the MOS team leader estimates of UXO safe / clearing time.

Step 8. Estimate and Record Airfield Damage Repair Times

The MOS team leader estimates ADR time and records estimated repairs times on the MOS selection team worksheet by:

- Determining repair times for each crater, using the actual crater repair time worksheets for chemical and nonchemical environments (see tables C-5 and C-6).

- Assigning crater repairs to crater repair crews and determining total repair time using the MOS selection team worksheet.

Quality Repairs		Crater Diameter									
		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	388	548	670	703	930
	Crater Number										
B 1.0 inches	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										

Table C-5. Actual Crater Repair Time Worksheet for a Chemical Environment, 5-50 Feet.

Quality Repairs		Crater Diameter									
		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 inches	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										

Table C-6. Actual Crater Repair Time Worksheet for a Chemical Environment, 55-100 Feet.

Quality Repairs		Crater Diameter 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 inches	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										

Table C-7. Actual Crater Repair Time Worksheet for a Nonchemical Environment, 5-50 Feet.

Quality Repairs		Crater Diameter 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 inches	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										

Table C-8. Actual Crater Repair Time Worksheet for a Nonchemical Environment, 55-100 Feet.

Note: Assigning spall repairs to spall repair crews and determining total repair time using the spall repair time formula (see figure C-8). The time equation for repairing spall damage is determined by number of spalls, time to prepare each spall, time to mix and place rapid setting material for each spall, number of spall repair crews, and a human efficiency factor. The spall repair time formula assumes that a two-Marine crew is required to prepare the spalls, but only one Marine is required to repair the spalls by mixing and placing rapid setting material. It is assumed that two minutes are required to prepare one spall and 6.5 minutes are required to mix and place the rapid setting material into the spall. Human efficiency can deteriorate with fatigue, weather, and in a chemical environment.

$$time = \left[\frac{(2\ min) \times (\#\ of\ spalls)}{(\#\ of\ crews) \times (human\ efficiency)}\right] + \left[\frac{(6.5\ min) \times (\#\ of\ spalls)}{2 \times (\#\ of\ crews) \times (human\ efficiency)}\right]$$

Figure C-8. Spall Repair Time Formula.

Step 9. Tabulate Comparative Candidate Minimum Operating Strip Recovery Times

Tabulate comparative recovery times for candidate MOSs. The MOS team leader calculates total estimated recovery times for each MOS based on EOD, crater repair times, and spall repair times.

Step 10. Brief Airfield Commander or Senior Airfield Authority on Candidate Minimum Operating Strip

Airfield Authority on candidate MOS. The MOS team leader briefs the candidate MOSs to the airfield commander.

Step 11. Select Minimum Operating Strip

The airfield commander selects the MOS. Once the MOS is selected, more surface roughness tests must be conducted to ensure repair quality criteria are met for each crater. Surface roughness test should be conducted along three parallel lines to the MOS centerline using a repair quality criteria gauge and string as shown in figures C-9 and C-10 on page C-14. In addition, the maximum slope at the edge of a crater that is acceptable for a MOS can be measured using a change of slope straight edge as shown in figure C-10.

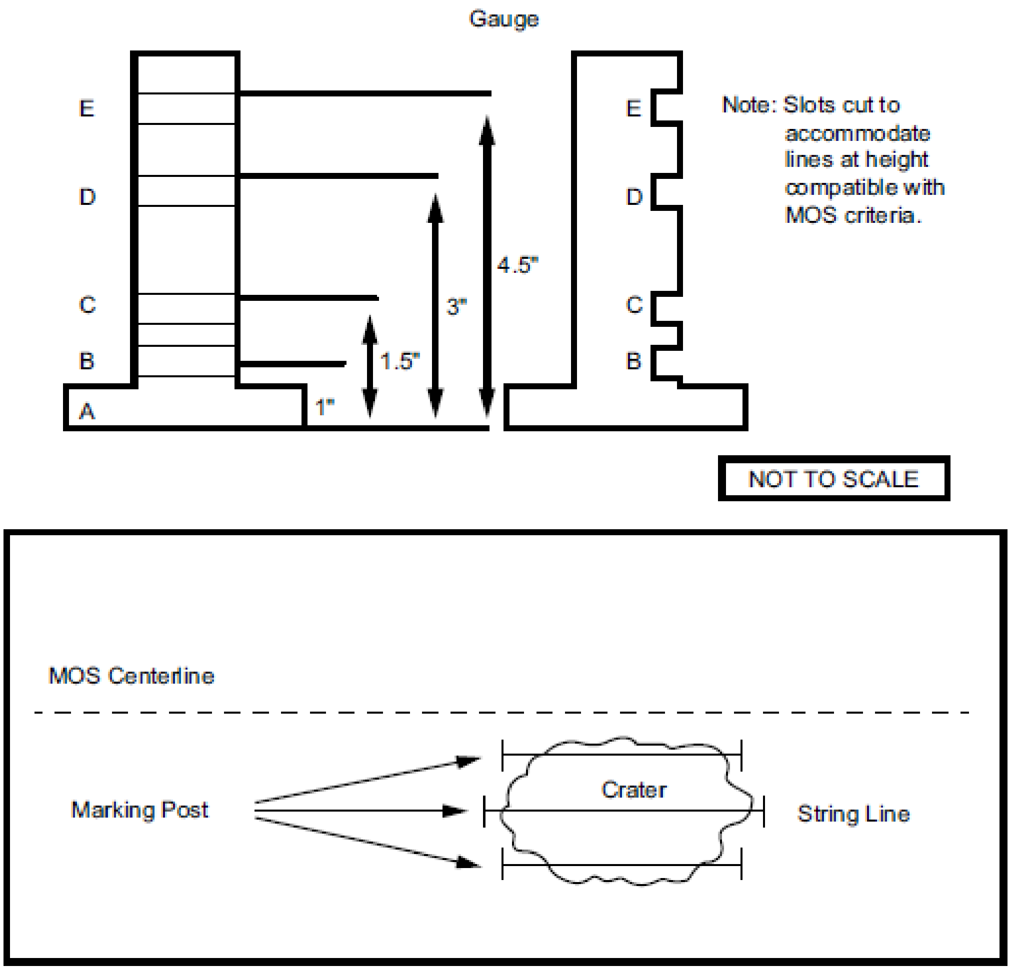


Figure C-9. Surface Roughness Testing.

Note: Surface roughness test should be conducted along three lines parallel to the MOS centerline.

Change Slope Straight Edge **Measuring Surface Roughness**

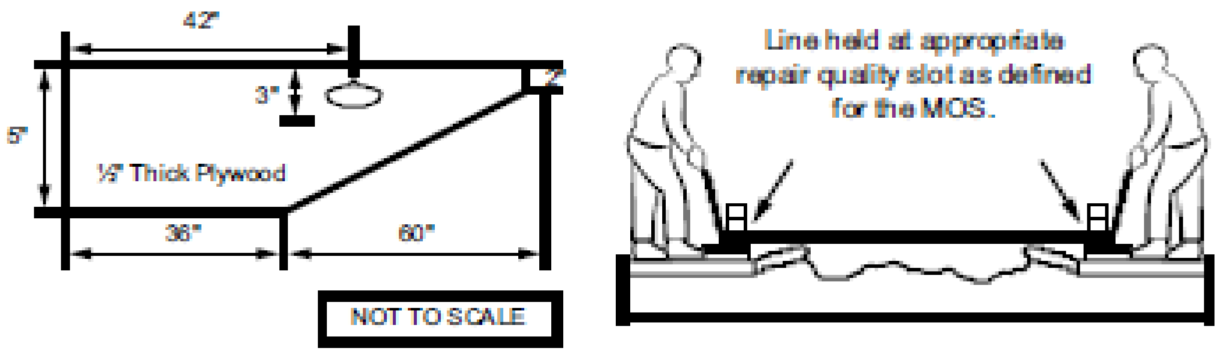


Figure C-10. Measuring Roughness Testing.

Note 1: The change slope straight edge can be made of ¼" plywood; place template on the good pavement with the sloped edge against the upheaved crater lip. Sloped edge represents 5 degree / 33.3% maximum slope allowed for upheaval.

Note 2: Measuring surface roughness maximum upheaval is within allowable limits as defined by the MOS.

AIRFIELD DAMAGE REPAIR

There are 10 steps for proper crater repair during ADR. These steps can be followed for the repair of any type of crater.

1. Remove debris.

    - Clear / remove debris from around crater lip.

    - Ensure up heaved pavement is visible.

2. Conduct surface roughness test.

    - Measure upheaval around crater to determine how much to remove.

    - Make checks along lines parallel to MOS centerline.

    Note: The Line-of-Sight technique, Sight Rod, Change of Slope Straight Edge, and Surface Roughness Height Measuring Gauge are all acceptable means of testing.

3. Break, remove pavement upheaval.

    - Remove upheaved pavement.

    - Equipment required: dozer, excavator, TRAM (tractor, rubber-tried articulating steering, multi-purpose), backhoe loader, concrete saw, jackhammer, hand tools.

4. Remove water.

    - Remove water from crater before back filling and compacting ejecta.

    - Divert surface water from draining into crater.

5. Backfill.

    - Backfill crater with ejecta and fill material to within 18-24” of surface (Ballast rock to within 6” of surface).

    - Use no ejecta greater than 12” for backfill.

    - Debris can be used if not wet, crater is dry.

- Ballast rock is best choice for wet crater.

6. Level, compact backfill.

- Use vibratory compactor or tamping device of excavator. This will require hand tamping or small compacting device around edge of crater.

7. Place impervious membrane.

- Impervious membrane (geotextile) over sub-grade backfill.
- Cut geotextile to fit crater with edges extending up sides of crater 6-12”.
- Membrane prevents water inflow into sub-grade and higher quality stone / select fill from settling into sub-grade.

8. Repair sub-base, base course: there are four methods of crater repair.

- Crushed stone normal method.
  - o Only for dry craters.
  - o Crater sub-grade backfilled with debris (ejecta) to within 18-24” (Steps 1-6).
  - o Sub-grade covered with impervious membrane (Step 7).
  - o Crater filled with crushed stone approximately 4” above surface.
  - o Crushed stone compacted with roller, excess removed with grader to level repair.
  - o Apply FOD cover.

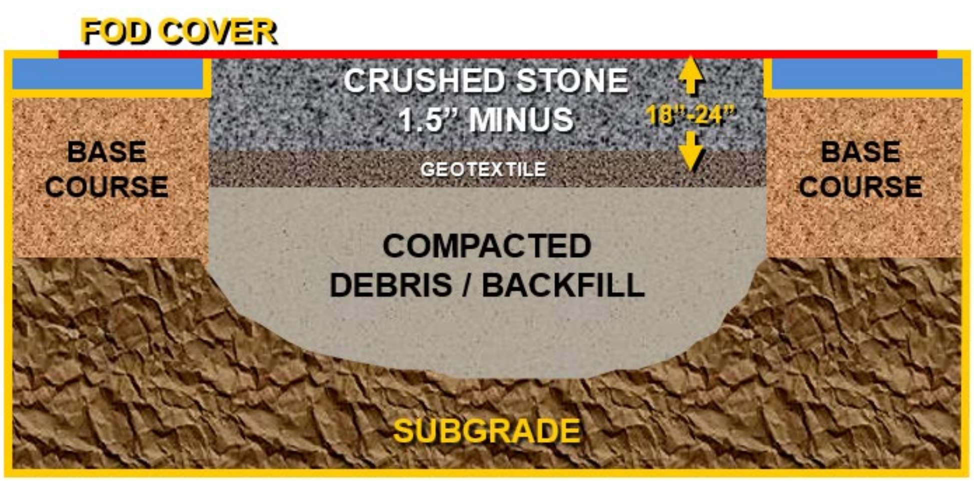


Figure C-11. Normal Method Layers.

- Choked-ballast normal method.
  - Used when crater contains water or when debris unsuitable for backfill.
  - Crater sub-grade backfilled to within 4-6” of surface with ballast rock (Steps 1-6).
  - Sub-grade covered with impervious membrane (Step 7).
  - Crater filled with crushed stone approximately 4” above surface.
  - Crushed stone compacted, scraped level by grader to level of repair criteria.
  - Apply FOD cover.

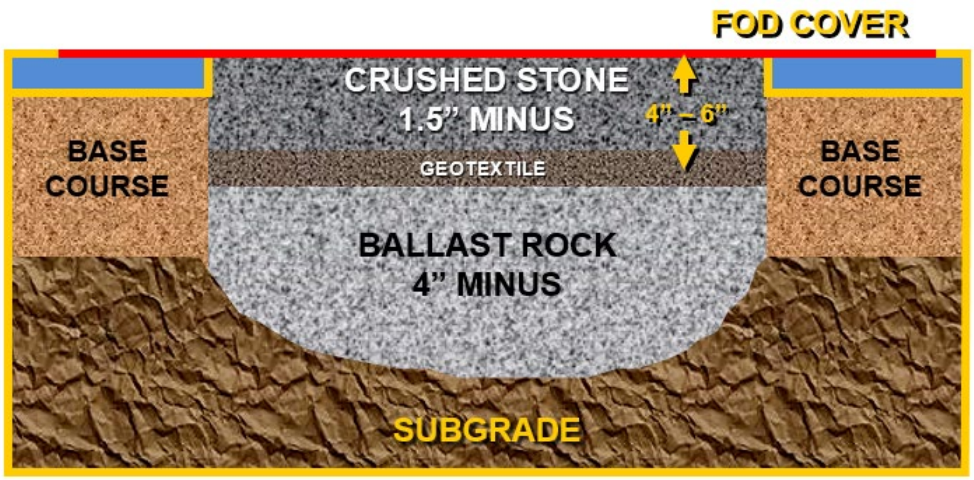


Figure C-12. Choked-ballast Method Layers.

- Cheap-ballast normal method.
  - Suitable for dry crater.
  - Maximum use of cheaper fill material.
  - Crater sub-grade backfilled to within 14-18” of surface with ejecta.
  - Sub-grade covered with impervious membrane.
  - Crater backfilled to within 4 – 6” of surface with ballast rock.
  - Ballast rock covered with membrane.
  - Crater filled with crushed stone approximately 4” above surface.
  - Crushed stone compacted, scraped level by grader to level of repair criteria.
  - Apply FOD cover.

Figure C-13. Cheap-ballast Method Layers.

- Sand grid method.
  - Used when the terrain is very sandy or in desert environments.
  - Expand to 8' x 20' x 8" forming 561 cells and made from high density polyethylene plastic.
  - Crater preparation, sub-grade construction same as for crushed stone.
  - Important to have sub-grade as close to 20" below surface as possible (tolerance of 1").

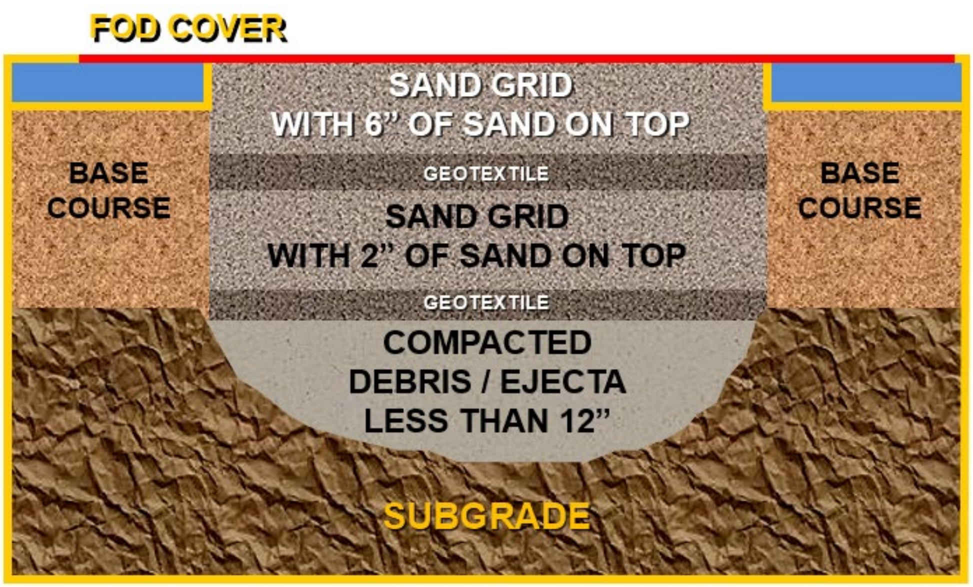


Figure C-14. Choked-Ballast Method Layers.

9. Measure repair sag.
   - Performed after crater repaired.
   - All numbered repair heights can allow a maximum sag of 2".

- No sag is allowed with flush repairs beyond the +/- ¾” normally accepted as part of flush repair criteria.

10. Place FOD cover.

- Finishing touch dependents on the type of repair, the repair quality requirement, and availability of resources.
- Ready mix cement, precast concrete slabs, FRP, and AM-2 matting are all methods of FOD cover.
- Crushed stone without FOD cover.

Tables C-7 through C-11, on pages C-16 through C-20, are provided as guides to the ADR organization and the airfield recovery process. The ADR personnel requirements chart is used to assist in determining unit ADR personnel.

Table C-9. Airfield Damage Repair Personnel Requirements Chart.

ADR Personnel Requirements	Crater	Precast Concrete FOD Cover	Concrete FOD Cover	AM2 FOD Cover	FRP FOD Cover	Hauling	MT Det	Maint Det	Fuels Det	Spall Repair	Clearing and Sweeping	MOS Lighting	Support	M-31 Gear	UXO
HE Opr	5	2	2	1	2	6					2			3	
MT Opr	1		1	1	1	3	4		1				1	1	
UT Opr			2												
EAF Specialist				2								6		10	
Refueler															
Combat Engineer	1	1	1		1				1	2	2				
General Laborer	8	17	17	21	12					3					
HE Mech															
MT Mech								2							
UT Mech								2							
Surveyor								2						2	
FD Svc													1		
Medical													1		
CBRN													2		
EOD															3
Total	15	20	23	25	16	9	4	6	2	5	4	6	5	16	3

Legend

Det	detachment	OPR	operator
Maint	maintenance	SVC	services
Mech	mechanic	FD	food
HE	heavy equipment	CBRN	chemical, biological, radiological, nuclear
EAF	expeditionary airfield	UT	utilities
EOD	explosive ordnance disposal		
MT	motor transport		

The ADR equipment requirements chart is used to assist in determining unit ADR equipment.

Table C-10. Airfield Damage Repair Equipment Requirements Chart.

ADR Personnel Requirements	Crater	Precast Concrete	Concrete FOD Cover	AM2 FOD Cover	FRP FOD Cover	Hauling	MT Det	Maint Det	Fuels Det	Spall Repair	Clearing and Sweeping	MOS	Support	M-31 Gear	UXO
Front-end Loader	2		1			3					1				
Dozer	1														
Grader	1										1				
Roller/ Compactor	1	1													
Excavator	1													1	
Concrete Mixer			1								1				
Tractor-trailer						1									
7-Ton			1	1	1	1	2								
Dump Truck						2	2								
UT vehicle	2					2	1			2	1	1	1	1	
Water Truck										1					
Sweeper											2				
Fuel Truck									1						
Floodlights	1									1					
Compressor	1	1	1	1	1					1	1				
Forklift		1	1	1	1	3								1	
Concrete Saw	1	1													
Crane		1												1	
Lifting Beam		1													
RTCH					1										
M-31														1	
Maint Truck								2							

Legend

Det	detachment	UT	utilities
Maint	maintenance	RTCH	kalmar

Table C-11. Airfield Damage Repair Equipment Availability Matrix.

Types of Equipment	Organic Assets	Station	Augmented Assets	ADR Requirements	Shortfalls
Front-end Loader					
Dozer					
Grader					
Roller/ Compactor					
Excavator					
Concrete Mixer					
Tractor-trailer					
7-Ton					
LVSR					
Dump Truck					
UT vehicle					
Water Truck					
Sweeper					
Fuel Truck					
Floodlights					
Compressor					
Forklift					
Concrete Saw					
Crane					
Lifting Beam					
RTCH					
ADR Kits					
Maint Truck					
Totals					

Legend

MAINT maintenance

RTCH kalmar

UT utilities

LVSR logistics vehicle system replacement

The material availability matrix is used in identifying equipment and material resources and shortfalls.

Table C-12. Airfield Damage Repair Material Availability Matrix.

Date:					
Type of Materials			**Onsite Inventory**	**Materials Required**	**Shortfalls**
Fill Materials	Ballast Rock				
	Crushed Rock				
	Sand				
FOD Cover	FRP				
	AM-2				
	Precast Concrete				
	Preheated asphalt				
	Crushed Stone				
Spall Repair	Silica	Mix			
		Pea Gravel			
	Magnesium phosphate	Mix			
		Pea Gravel			
	Penatron	Mix			
		Pea Gravel			
Spall and FOD Cover	Rapid Set Conrete	Portland Cement			
		3/4” Aggregate			
		Sand			
		Water			
Optional Materials	Sand Grid				
	Geotextial Seals				

Material estimate planning formulas help determine the material requirements.

Table C-13. Material Estimate Planning Formulas.

Formulas for Estimating Fill Materials (crushed stone, ballast rock, and sand) in Feet	
Area of a square/rectangle	L × W = ft^2
Area of a cylinder	3.1416 × R^2 = ft^2 [or] 0.7854 × D^2 = ft^2
Volume of a square/rectangle	L × W × H = cu ft
Volume of a cylinder	3.1416 × R^2 × H = cu ft [or] 0.7854 × D^2 × H = cu ft
Conversion: cu ft to cu yd	Cu ft ÷ 27 = cu yds
Formulas for Estimating Foreign Object Damage Cover Requirements in Feet	
AM-2	(L + 4) (W + 4) = ft^2 matting
FRP	Kit = (4) 34 2/3 ft × 32 ft or (1) 69 1/3 ft × 62 ft-panels Craters <20 ft diameter require 5 ft overhang Craters >20 ft diameter require 10 ft overhang
Precast concrete slabs	Slab = 2 × 2 meters (meter = 3.2808 ft) Y = L ÷ 6.5616 (round up to whole number) Z = W ÷ 6.5616 (round up to whole number) Y × Z = number of 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

Legend

<	less than	ft	feet
>	greater than	H	height/depth
cu ft	cubic feet	L	length
cu yd	cubic yard	R	radium
D	diameter	W	width

DART 8-LINE REPORT FORM

Following an attack on a FOB, a DART is dispatched in order to identify, report, and fix damage to facilities on the base other than the airfield. Figure C-15 illustrates the 8-line report is used by the DART to report damage to the AGSOC. Further guidance will then be provided by the AGSOC on repair priorities.

1. Building number and grid:

____

2. Is the building on fire or is other emergency medical response required?

____

____

3. Structural damage:

____

____

4. Electrical damage:

____

____

5. Water damage:

____

____

6. Casualties

____

____

7. UXO

____

____

8. Overall assessment of facility:

____

____

Figure C-15. Damage Assessment Response Team 8-Line Report.

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APPENDIX D
FORWARD ARMING AND REFUELING POINT OPERATIONS DOCUMENTS

The FARP documents and references in this appendix are provided to assist planners in the development and execution of FARP operations. This Appendix includes FARP refueling methods, types, equipment, and diagrams. For additional FARP planning details, lighting and marking, refueling methods, FARP procedures, or FARP ordnance, refer to NAVAIR 00-80T-103 *Aircraft Refueling NATOPS Manual*, NAVAIR 00-80T-109 *NATOPS Conventional Weapons Handling Procedures Manual (Ashore)*, and NAVAIR 00-80T-115 *U.S. Marine Corps Expeditionary Airfield and Aircraft Recovery Operations Manual*.

FORWARD ARMING AND REFUELING POINT TYPES

The MWSS possess a robust aviation refueling capability that consists of various refueling assets. In addition, Marine aviation is experimenting with various light tactical refueling systems. While the equipment and FARP layouts may change, the refueling methods do not.

Refueling Methods

Aircraft use either the hot or the cold refueling methods.

- 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 incorporates an automatic fuel shutoff capability.

- Cold Refueling. The cold refueling method is accomplished by shutting down the engines and waiting until the rotor blades have stopped turning. Pressure and open-port methods are used in cold refueling.

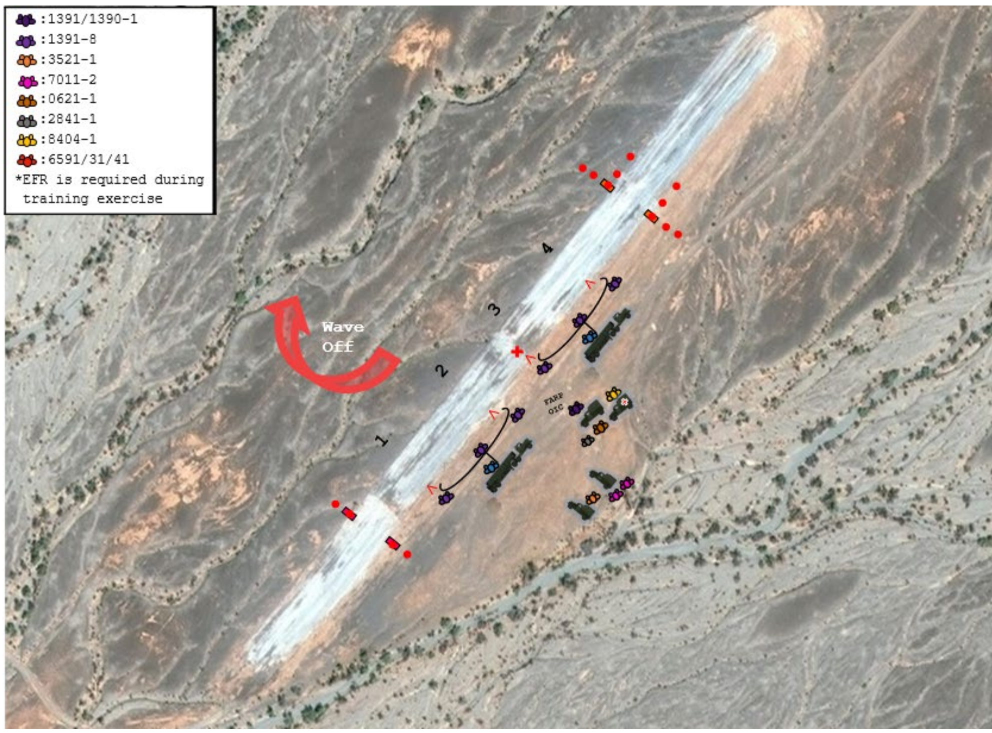
FARP planning note: Simultaneous refueling and ordnance operations on a single aircraft is authorized. For specific procedures and safety measures see NAVAIR 00-80T-103 *NATOPS Conventional Weapons Handling Procedures Manual (Ashore)* and NAVAIR 00-80T-109 *Aircraft Refueling NATOPS Manual*.

Contact MAWTS-1, Aviation Ground Support Department for experimental refueling equipment, new FARP layout designs, and FARP diagram examples.

Assault Forward Arming and Refueling Point

An assault FARP is one in which assault support aircraft or fixed-wing aircraft land at a designated area and taxi through refuel points. Ordnance operations can take place in an assault FARP based on the type / model / series. The aircrew or qualified ordnance personnel are responsible for de-arming / arming procedures in the pre-stage and post-stage areas. Aircraft are refueled using the hot refueling method from stationary fuels equipment. Assault FARPs normally require a large amount of area to conduct operations due to the required safety distances. It should also be noted that assault FARPs usually require much more fuel on hand to support aircraft than attack FARPs. The primary purpose of an assault FARP is to extend the range of aircraft without the requirement for air-to-air refueling.

- Assault (Rotary-Wing and Tiltrotor Aircraft) FARP. While not optimal, an assault FARP can accommodate attack style aircraft without forward firing ordnance. Forward firing aviation ordnance is not allowed in an integrated assault FARP with attack aircraft.



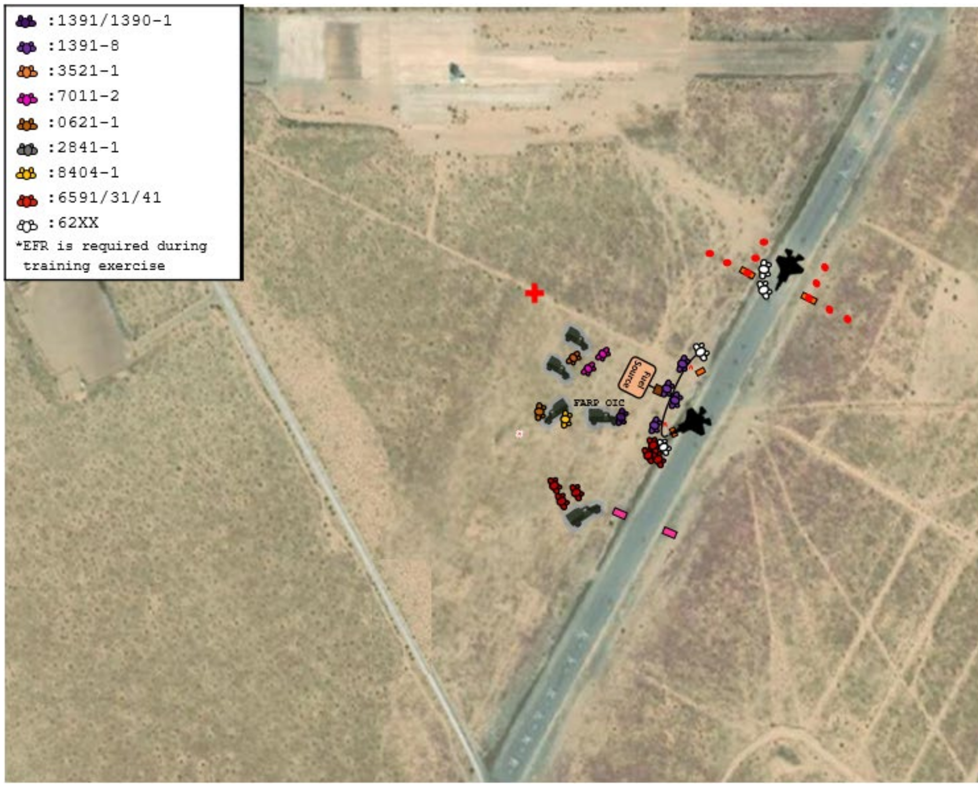
Date/ Time Operational	YYYYMMDD 1800-2200
Imagery Date	MrSID AUG 2018
Grid ✚	11S PS 12345 56789
MMT Call Sign/Net	HERMES / YELLOW
FARP Call Sign/Net	JACK / PURPLE
Type A/C and Call Sign	MV-22 / GRAY BRID
FARP Type/ # of Points	ASSAULT 4pt (Rotor/ Tiltrotor
Fuel Qty	Lbs 24,000 Gal 3,582
Obstacles	3' Grounding Stake left of the spot
NORDO Day	Land: Orange Air Panel Circle: Cerise side
NORDO Night	Land: IR/RED buzzsaw Circle: No Signal

Figure D-1. Notional Assault Forward Arming and Refueling Point Diagram for Rotary-Wing and Tiltrotor Aircraft.

Legend

A/C	aircraft	NET	network
Gal	gallons	NORDO	no radio
IR	infrared	Qtr	quantity
Lbs	pounds		

- Assault (Fixed Wing Aircraft) FARP. An Assault FARP supporting fixed-wing aircraft is unique and requires a suitable landing surface, FOD mitigation measures, and qualified aviation ordnance and aviation maintenance personnel for the de-arming and arming procedures.



Date/ Time Operational	YYYYMMDD 1800-2200
Imagery Date ✚	MrSID JAN 2020
Grid	11S QS 33700 03900
MMT Call Sign/Net	HERMES / YELLOW
FARP Call Sign/Net	JACK / PURPLE
Type A/C and Call Sign	F-35B/C LIGHTNING
FARP Type/ # of Points	ASSAULT 2pt
Fuel Qty	Lbs 21,000 Gal 3,134
Obstacles	N/A
NORDO Day	Land: Orange Air Panel Circle: Cerise side
NORDO Night	Land: IR/RED buzzsaw Circle: No Signal

Figure D-2. Notional Assault Forward Arming and Refueling Point Diagram for Fix-Wing and Tiltrotor Aircraft.

Legend

A/C	aircraft	NET	network
Gal	gallons	NORDO	no radio
IR	infrared	Qtr	quantity
Lbs	pounds		

Attack Forward Arming and Refueling Point

An Attack FARP, sometimes referred to as a Static FARP, is a FARP type that is designed to service attack helicopters with forward firing ordnance (AH-1, UH-1, and similar type aircraft). These aircraft types require a special FARP design so they can land and depart from a designated refuel point that is aligned with an arm / de-arm heading. Once the aircraft is at the designated landing point and are de-armed, the aircraft can be refueled via two different refueling methods:

- Hot Refueling. The aircraft remains running and is refueled with pre-established fuels equipment. The primary purpose of an Attack (HOT) FARP is to rapidly refuel and re-arm attack helicopters to provide consistent CAS to troops on the ground. Therefore, speed of operations at the FARP site is critical to minimize the time the aircraft spends in the FARP.

Date/ Time Operational	YYYYMMDD 1800-2200
Imagery Date	MrSID AUG 2018
Grid	11S PS 12345 56789
MMT Call Sign/Net	HERMES / YELLOW
FARP Call Sign/Net	JACK / PURPLE
Type A/C and Call Sign	AH-1 / COBRA COMMANDER
FARP Type/ # of Points	ATTACK 4pt
Fuel Qty	Lbs 24,000 Gal 3,582
Obstacles	3' Grounding Stake left of the spot
NORDO Day	Land: Orange Air Panel Circle: Cerise side
NORDO Night	Land: IR/RED buzzsaw Circle: No Signal

Figure D-3. Notional Attack (HOT) Forward Arming and Refueling Point Diagram.

Legend

A/C	aircraft	NET	network
Gal	gallons	NORDO	no radio
IR	infrared	Qtr	quantity
Lbs	pounds		

- Cold Refueling. The aircraft's engines are shut down and mobile refueling assets are then driven to each aircraft landing point. Stationary fuel systems, like the helicopter expeditionary refueling system, could also be employed. The primary purpose of an Attack (COLD) FARP is to refuel and re-arm a large number of attack helicopters, need time to conduct further planning, or wait a designated amount of time before the next mission. While Attack (COLD) FARPs can accommodate a large number of aircraft, no more than six to eight spots is recommended due to the high signature of multiple aircraft in one location.

Figure D-4. Notional Attack (COLD) Forward Arming and Refueling Point Diagram.

Legend

A/C	aircraft	NET	network
Gal	gallons	NORDO	no radio
IR	infrared	Qtr	quantity
Lbs	pounds		

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GLOSSARY

Section I. Abbreviations and Acronyms

AAW ..... antiair warfare
ACE ..... aviation combat element
ACSR ..... aircraft salvage and recovery
A/DACG ..... arrival/departure airfield control group
ADR ..... airfield damage repair
AFI ..... Air Force instruction
AFPAM ..... Air Force pamphlet
AGS ..... aviation ground support
AGSOC ..... aviation ground support operations center
AMB ..... aviation mishap board
BRAAT ..... base recovery after attack
CAS ..... close air support
CBR ..... California bearing ratio
CBRN ..... chemical, biological, radiological, and nuclear
CSS ..... combat service support
DASC ..... direct air support center
DART ..... damage assessment and response team
DAT ..... damage assessment team
DED ..... detailed equipment decontamination
DOD ..... Department of Defense
DTD ..... detailed troop decontamination
EAF ..... expeditionary airfield
EFR ..... expeditionary firefighting and rescue
EOD ..... explosive ordnance disposal
EOR ..... explosive ordnance removal
ESB ..... engineer support battalion
FARP ..... forward arming and refueling point
FLIP ..... flight information publication
FOB ..... forward operating base
FOD ..... foreign object damage
FPCON ..... force protection condition
FRP ..... fiberglass reinforced panel
G-2 ..... assistant chief of staff, intelligence/intelligence staff section
G-3 ..... assistant chief of staff, operations and training/operations and training staff section
G-4 ..... assistant chief of staff, logistics/logistics staff section
GCE ..... ground combat element
IFR ..... instrument flight rules
ILS ..... instrument landing system
JFC ..... joint force commander
JP ..... joint publication
JSA ..... joint security area
JSCC ..... joint security coordination center
LAAD ..... low altitude air defense

LCE .... logistics combat element
LCN .... load classification number
LZ .... landing zone
MACG .... Marine air control group
MAG. .... Marine aircraft group
MAGTF .... Marine air-ground task force
MALS .... Marine aviation logistics squadron
MAOS .... minimum airfield operating surface
MATCD .... Marine air traffic control detachment
MAW .... Marine aircraft wing
MAWTS-1 .... Marine Aviation Weapons and Tactics Squadron One
MCDP .... Marine Corps doctrinal publication
MCO .... Marine Corps order
MCRP .... Marine Corps reference publication
MCTP .... Marine Corps tactical publication
MCWP .... Marine Corps warfighting publication
METOC .... meteorological and oceanographic
METT-T .... mission, enemy, terrain and weather, troops and support available—time available
MEZ .... missile engagement zone
MLG .... Marine logistics group
MMT .... Marine air traffic control mobile team
MOPP .... mission-oriented protective posture
MOS .... minimum operating strip
MSR .... main supply route
MT .... motor transport
MWCS .... Marine wing communications squadron
MWSD .... Marine wing support detachment
MWSS .... Marine wing support squadron
NATO .... North Atlantic Treaty organization
NATOPS .... naval air training and operating procedures standardization
NAVAIR. .... Naval Air Systems Command
NAVMC .... Navy and Marine Corps department publication
NCF .... naval construction force
NIMS .... national incident management system
OIC .... officer in charge
POL .... petroleum, oils, and lubricants
Prime BEEF .... prime base engineer emergency force
RAOC .... rear area operations center
RASC .... rear area security coordinator
RED HORSE .... rapid engineer deployable heavy operations repair squadron engineer
R&S .... reconnaissance and surveillance
S-2 .... intelligence officer/intelligence office
S-3 .... operations and training officer/operations and training office
S-6 .... communications staff office
SAA .... senior airfield authority
TACC .... tactical air command center

TACP .... tactical air control party
TC .... training circular
TCF .... tactical combat force
TLZ .... tactical landing zone
TSO .... tactical security officer
UFC .... unified facilities criteria
UHF .... ultrahigh frequency
US .... United States
UXO .... unexploded ordnance
VFR .... visual flight rules
VHF .... very high frequency
VMU .... vertical, Marine unmanned aerial squadron
WTTP .... weapons and tactics training program

Section II. Terms and Definitions

actual crater diameter—Opening in the airfield surface after all the debris and upheaved surface have been removed. Also measured from lip-to-lip, and in most cases is significantly larger than the apparent diameter. Also called "crater-actual diameter." (AFPAM 10-219, vol 4)

air boss—The single point of contact at an air facility, responsible to the aviation combat element G-3, who coordinates all activities at an air facility and is the primary interface with the tactical air command center. The air boss is responsible for synchronizing the operations of fuel, ordnance, maintenance, and ground support activities to execute the missions tasked in the daily ATO. Additionally, the air boss is responsible for recommending changes to the air tasking order based on changes in the status of operations at the air facility and adjusting the operations at the air facility to meet changes in the ATO. (USMC Dictionary)

air facility—A secure airfield that provides organizational maintenance activity, stages aviation ordnance, and supports staging and replenishment of forward sites to sustain operations at a combat sortie rate. (Upon promulgation of this publication, this term and definition are approved for use and will be included in the next edition of the USMC Dictionary.)

air point—A geographic location designed to support specific tactical aviation missions. (Upon promulgation of this publication, this term and definition are approved for use and will be included in the next edition of the USMC Dictionary.)

air site— A secure, typically austere, location where fully loaded and armed prepositioned aircraft await preplanned or immediate missions. (Upon promulgation of this publication, this term and definition are approved for use and will be included in the next edition of the USMC Dictionary.)

apparent crater diameter—Opening in the airfield surface that can be seen before work is accomplished on the crater; measured from upheaval lip-to-lip. (AFPAM 10-219, vol 4)

apron — A defined area on an airfield intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. (DOD Dictionary)

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

base defense—The local military measures, both normal and emergency, required to nullify or reduce the effectiveness of enemy attacks on, or sabotage of, a base to ensure the maximum capacity of its facilities is available to United States forces. (JP 3-10)

base defense operations center—A command and control facility established by the base commander to serve as the focal point for base security and defense. Also called BDOC. (JP 3-10)

base recovery after attack—A theater concept of recovering a base after a conventional attack where resumption of flying operations is the first priority. Other recovery activities may be conducted concurrently; however, these activities must not impede the resumption of flying operations. Also called BRAAT. (AFPAM 10-219, vol 4)

camouflet—The resulting cavity in a deep underground burst when there is no rupture of the surface. (AFPAM 10-219, vol 4)

closed-circuit refueling—Nozzle and receptacle system used on United States Army helicopters. (NAVAIR 00-80T-109)

combat engineering—Engineering capabilities and activities that directly support the maneuver of land combat forces that require close and integrated support. (JP 3-34)

combat operations center—The primary operational agency required to control the tactical operations of a command that employs ground and aviation combat, combat support, and logistics combat elements or portions thereof. The combat operations center continually monitors, records, and supervises operations in the name of the commander and includes the necessary personnel and communications to do the same. Also called COC. (USMC Dictionary)

combat service support area—(See DOD Dictionary for core definition. Marine Corps amplification follows.) The primary combat service support installation established to support Marine air-ground task force operations ashore. Normally located near a beach, port, and/or an airfield, it usually contains the command post of the logistics combat element commander and supports other combat service support installations. Also called CSSA. (USMC Dictionary)

contingency—A situation requiring military operations in response to natural disasters, terrorists, subversives, or as otherwise directed by appropriate authority to protect United States interests. (JP 5-0)

crater—The pit, depression, or cavity formed in the surface of the earth by an explosion. It may range from saucer shaped to conical, depending largely on the depth of burst. In the case of a deep underground burst, no rupture of the surface may occur. The resulting cavity is termed a "camouflet." (AFPAM 10-219, vol 4)

closed-circuit refueling—Nozzle and receptacle system used on United States Army helicopters. (NAVAIR 00-80T-109)

ejecta—The debris and other material ejected from a crater during detonation of a bomb. (AFPAM 10-219, vol 4)

expedient airfield repair—Provides an accessible and functional MAOS that will sustain 100 C-17 passes with a gross weight of 227,707 kilograms (502 kips), or 100 C- 130 passes with a gross weight of 79,380 kilograms (175 kips), or 100 passes of a particular aircraft at its projected mission weight if other than the C-17 or C-130, or the number of passes required to support the initial surge mission aircraft. (AFPAM 10-219, vol 4)

expeditionary airfield—A prefabricated and fully portable airfield. The effort and assets (e.g., materiel, engineer support, operational guidance, security) required for the installation/operation of an expeditionary airfield can require the participation / support of all elements of the Marine air-ground task force. Also called EAF. (USMC Dictionary)

explosive ordnance—All munitions and improvised or clandestine explosive devices, containing explosives, propellants, nuclear fission or fusion materials, and biological and chemical agents. (Upon promulgation of this publication, this term and definition are approved for use and will be included in the next edition of the USMC Dictionary)

explosive ordnance disposal—1. The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance. 2. The organizations engaged in such activities. Also called EOD. (DoD Dictionary)

foreign object damage—Rags, pieces of paper, line, articles of clothing, nuts, bolts, or tools that, when misplaced or caught by air currents normally found around aircraft operations (jet blast, rotor or prop wash, engine intake), cause damage to aircraft systems or weapons or injury to personnel. Also called FOD. (DoD Dictionary)

forward arming and refueling point—A temporary facility, organized, equipped, and deployed to provide fuel and ammunition necessary for the employment of aviation maneuver units in combat. Also called FARP. (DoD Dictionary)

forward aviation combat engineering—A mobility operation in which engineers perform tasks in support of forward aviation ground facilities. (DOD Dictionary)

forward operating base—An airfield used to support tactical operations without establishing full support facilities. Also called FOB. (DOD Dictionary)

forward operating site—A scalable location outside the United States and its territories intended for rotational use by operating forces. Also called FOS. (DOD Dictionary)

Fresnel Lens Optical Landing System—An electro-optical aviator landing aid. (NAVAIR 00-80T-104)

ground combat element—The core element of a Marine air-ground task force (MAGTF) that is task-organized to conduct ground operations. It is usually constructed around an infantry organization but can vary in size from a small ground unit of any type to one or more Marine divisions that can be independently maneuvered under the direction of the MAGTF commander. It includes appropriate ground combat and combat support forces, and in a joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the MAGTF. The ground combat element itself is not a formal command. All so called GCE. (USMC Dictionary)

helicopter/tiltrotor support team—A task organization formed and equipped for employment in a landing zone to facilitate the landing and movement of troops, equipment, and supplies, and to evacuate selected casualties and enemy prisoners of war. The team is sourced from the Marine logistics group, specifically from the landing support company of the support battalion. Also called HST. (USMC Dictionary)

laager point—A secure location on the ground designated by aviation units utilized for the rendezvous, marshalling, or positioning of flights of aircraft between missions or awaiting completion or activation of an assigned mission. Other than communications, no other support should be required. The site may be isolated and independent or it may be adjacent to an airfield, a facility, or a forward arming and refueling point. (USMC Dictionary)

landing area—1. That part of the operational area within which are conducted the landing operations of an amphibious force. 2. In airborne operations, the general area used for landing troops and materiel either by airdrop or air landing. 3. Any specially prepared or selected surface of land, water, or deck designated or used for takeoff and landing of aircraft. (DOD Dictionary)

landing site—A site within a landing zone containing one or more landing points. See also airfield. 2. In amphibious operations, a continuous segment of coastline over which troops, equipment, and supplies can be landed by surface means. (DoD Dictionary)

landing zone—A specified ground area for landing assault support aircraft to embark or disembark troops and/or cargo and it may contain one or more landing sites. Also called LZ. (This modified definition is approved for use and will be included in the next edition of the USMC Dictionary.)

large crater—Pavement damage from conventional weapons that penetrate or disturb the sub grade, resulting in a pavement damage area in excess of 20 feet in diameter. Also called crater-large. (AFPAM 10-219, vol 4)

logistics combat element— The core element of a Marine air-ground task force (MAGTF) that is task-organized to provide the combat service support necessary to accomplish the MAGTF's mission. The logistics combat element varies in size from a small detachment to one or more Marine logistics groups. It provides supply, maintenance, transportation, general engineering, health services, and a variety of other services to the MAGTF. In a joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the MAGTF. The logistics combat element itself is not a formal command. Also called LCE. (USMC Dictionary)

main air base—A secure airfield that provides the required intermediate maintenance activity support and full ground, logistic, and engineering functions to support sustained operations ashore. (Upon promulgation of this publication, this term and definition are approved for use and will be included in the next edition of the USMC Dictionary.)

minimum airfield operating surface—The combined requirement for airfield surfaces for both runway and access routes. For example, the MOS is part of the MAOS. Also called MAOS. (AFPAM 10-219, vol 4)

minimum operating strip—1. A runway which meets the minimum requirements for operating assigned and/or allocated aircraft types on a particular airfield at maximum or combat gross weight. 2. The MOS is the smallest amount of area that must be repaired to launch and recover aircraft after an attack. Selection of this MOS will depend upon mission requirements, taxi access, resources available, and estimated time to repair. For fighter aircraft, the typically accepted dimensions are 5,000 feet long by 50 feet wide. Also called MOS. (AFPAM 10-219, vol 4)

minimum operating strip selection—The process of plotting damage and UXO locations on an airbase runway map and using this information to select a portion of the damaged runway which can be repaired most quickly to support aircraft operations. (AFPAM 10-219, vol 4)

pavement upheaval—The vertical displacement of the airfield pavement around the edge of an explosion-produced crater. The pavement upheaval is within the crater damage diameter, but is outside the apparent crater diameter. In other words, it is the part of the pavement out of "flush" tolerance, which is elevated above the adjusted undamaged surface. (AFPAM 10-219, vol 4)

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. Also called RAS. (USMC Dictionary)

senior airfield authority—An individual designated by the JFC to be responsible for the control, operation, and maintenance of an airfield to include the runways, associated taxiways, parking ramps, land, and facilities whose proximity directly affects airfield operations. Also called SAA. (DoD Dictionary)

small crater—Damage that penetrates into the base course from the airfield surface. Small craters have an apparent diameter of 6 meters (20 feet) or less. Also called "crater-small." (AFPAM 10-219, vol 4)

site commander—A group or squadron commanding officer or detachment officer in charge designated by and directly accountable to the aviation combat element commander for everything that takes place within the air base. The site commander's authority and responsibilities are not restricted to rear area operations but include all operational functions supporting the base including force closure and deployment to and from the site and must be intimately involved in the detailed planning of all units to ensure the aviation combat element commander's assigned mission timelines are met. (USMC Dictionary)

spalls or scabs—Pavement surface damage that does not penetrate the pavement base course and results in a pavement damage area that could typically be up to 5 feet in diameter. (AFPAM 10-219, vol 4)

tactical air control party—(See DOD Dictionary for core definition. Marine Corps amplification follows.) A subordinate operational component of a tactical air control system organic to infantry divisions, regiments, and battalions. Tactical air control parties establish and maintain facilities for liaison and communications between parent units and airspace control agencies, inform and advise the ground unit commander on the employment of supporting aircraft, and request and control air support. Also called TACP. (USMC Dictionary)

tactical airfield fuel dispensing system— A tactical aircraft refueling system deployed by a Marine air-ground task force in support of air operations at an expeditionary airfield or a forward arming and refueling point. This expeditionary system provides bulk fuel storage and dispensing facilities at airfields not having permanently installed fuel systems and supports fuel dispensing at established airfields. Also called TAFDS. (USMC Dictionary)

Section III. Nomenclature

AH-1W .... attack helicopter (SuperCobra)
AH-1Z .... attack helicopter (Viper; SuperCobra replacement)
AM-2 .... aluminum airfield matting
B-747 .... jet airliner and cargo aircraft
C-130 .... military transport aircraft (Hercules)
C-17 .... long-haul military transport aircraft (Globemaster III)
C-5 .... military transport aircraft (Galaxy) *other variants include C-5A/B/C/M Super Galaxy*
DC-8 .... narrow-body, long-range jet airliner
F-15 .... tactical fighter aircraft
F-16 .... supersonic, multirole fighter aircraft
F-18 .... all-weather, multirole, fighter attack aircraft (Hornet)
F-22 .... all-weather tactical fighter aircraft (Raptor) (USAF)
F-35B .... short takeoff/vertical-landing, supersonic stealth aircraft (Lightning II)
KC-10 .... aerial refueling tanker aircraft *(USAF)*
KC-130 .... multirole, multimission tactical tanker/transport (Hercules)
KC-135 .... military aerial refueling aircraft (Stratotanker)
M-31 .... arresting gear
M32A-60 .... aircraft ground power unit
MA-1A .... high velocity air start cart for jet engines
MD-3 .... aircraft ground power unit
MK-970 .... 5,000-gallon aircraft refueler
MV-22B .... multimission tiltrotor aircraft (Osprey)
UH-1Y .... utility helicopter (Venom, Super Huey)

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REFERENCES AND RELATED PUBLICATIONS

Presidential Directives

Homeland Security Presidential Directives-5, Management of Domestic Incidents

Department of Defense Publications

Unified Facilities Criteria (UFC)
3-250-01 Pavement Design for Roads and Parking Areas
3-250-03 Standard Practice Manual for Flexible Pavements
3-250-11 Soil Stabilization for Pavements
3-260-01 Airfield and Heliport Planning and Design
3-260-02 Pavement Design for Airfields
3-260-03 Airfield Pavement Evaluation
3-260-04 Airfield and Heliport Marking
3-260-17 Dust Control for Roads, Airfields, and Adjacent Areas
3-270-07 Operations and Maintenance (O&M): Airfield Damage Repair

Joint Publication (JP)
3-10 Joint Security Operations in Theater
3-34 Joint Engineer Operations
4-0 Joint Logistics
4-02 Joint Health Services
4-03 Joint Bulk Petroleum and Water Doctrine
4-04 Contingency Basing

Miscellaneous
DoD Dictionary of Military and Associated Terms

United States Army Publications

Graphic Training Aid (GTA)
90-01-011 Deployed Forces Protection Handbook, 7th Edition (JFOB Handbook)

Training Circular (TC)
3-04.16 Airfield Operations
5-340 Air Base Damage Repair (Pavement Repair)

Training Manual (TM)
3-34.30 Firefighting

United States Navy Publications

Naval Air Systems Command (NAVAIR)

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 Salvage Operations Manual (Ashore)
00-80T-103	NATOPS Conventional Weapons Handling Procedures Manual (Ashore)
00-80T-104	NATOPS Landing Signal Officer Manual
00-80T-109	Aircraft Refueling NATOPS Manual
00-80T-113	Aircraft Signals NATOPS Manual
00-80T-115	U.S. Marine Corps Expeditionary Airfield and Aircraft Recovery Operations NATOP Manual
51-60A-1	Technical Manual, Handbook, AM-2 Airfield Landing Mats and Accessories; Installation, Maintenance, Repackaging, & Illustrated Parts Breakdown

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

Naval Air Systems Command Manual (NAVAIRMAN)

48J200-00-21	Subgrade Requirements for Expeditionary Airfields

Naval Medical Command Publication (NAVMED-P)

5010-9	Manual of Naval Medicine: Chapter 9, Preventive Medicine for Ground Forces

United States Marine Corps Publications

Marine Corps Orders (MCO)

1553.3B	Unit Training Management Program
3500.109A	Marine Corps Aviation Weapons and Tactics Training Program
3571.2H	Explosive Ordnance Disposal (EOD) Program
5530.15	U.S. Marine Corps Interior Guard Manual

Navy and Marine Corps Departmental Publications (NAVMC)

3500.117A	Marine Wing Support Squadron Training and Readiness Manual
3500.66C	Explosive Ordnance Disposal Training and Readiness Manual (w/ Ch 1)

Marine Corps Warfighting Publications (MCWP)

3-20	Aviation Operations
3-34	Engineering Operations
3-40	Logistic Operations
5-10	Marine Corps Planning Process

Marine Corps Tactical Publications (MCTP)

3-20A	Aviation Logistics
3-20B	Aviation Ground Support
3-20C	Antiair Warfare
3-20D	Offensive Air Support
3-20E	Assault Support

3-20G Air Reconnaissance
3-34D Seabee Operations in the Marine Air-Ground Task Force (MAGTF)
3-40A Health Service Support Operations
3-40B Tactical-Level Logistics
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10-10D MAGTF Explosive Ordnance Disposal
10-10E MAGTF Nuclear, Biological, and Chemical Defense Operations

Marine Corps Reference Publications (MCRP)
1-10.1 Organization of the United States Marine Corps
1-10.2 Marine Corps Supplement to the DoD Dictionary of Military and Associated Terms
2-10B.6 MAGTF Meteorological and Oceanographic Operations
3-20A.1 Coalition Forward Arming and Refueling Point (FARP) Interoperability Pamphlet
3-20B.1 Multi-Service Tactics, Techniques, and Procedures for Airfield Opening
3-20F.2 Marine Tactical Air Command Center Handbook
3-20F.3 MAGTF Aviation Site Command Handbook
3-20F.5 Direct Air Support Center Handbook
3-20F.7 Marine Air Traffic Control Detachment Handbook
3-32D.1 Electronic Warfare
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3-40A.1 Multi-Service Tactics, Techniques, and Procedures for Treatment of Chemical Warfare Agent Casualties and Conventional Military Chemical Injuries
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3-40G.1	Marine Corps Field Feeding Program
10-10E.1	Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, Nuclear Planning
10-10E.3	Multi-Service Doctrine for Chemical, Biological, Radiological, Nuclear Operations
10-10E.4	Chemical, Biological, Radiological, and Nuclear Threats and Hazards (w/ Ch 1)
10-10E.6	Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Consequence Management Operations
10-10E.7	Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Reconnaissance and Surveillance
10-10E.8	Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense (w/ Ch 1)

Marine Corps Interim Publications (MCIP)

3-40G.2i	Waste Management for Deployed Forces

Miscellaneous

Marine Corps Functional Concept for Fleet Marine Force Engineering

United States Air Force Publications

Air Force Instruction (AFI)

10-209	Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers Program
2-10	Prime Base Engineer Emergency Force Program
13-217	Drop Zone and Landing Zone Operations
13-1041	Airfield Pavement Evaluation Program

Air Force Pamphlet (AFPAM)

10-219 vol 1	Contingency and Disaster Planning
10-219 vol 2	Civil Engineer Contingency Response and Preparations
10-219 vol 3	Civil Engineer Contingency Response and Recovery Procedures
10-219 vol 4	ADR Operations
10-219 vol 5	Bare Base Conceptual Planning
10-219 vol 6	Planning and Design of Expeditionary Airbases
10-219 vol 7	Expedient Methods

Engineering Technical Letter (ETL)

02-19	Airfield Pavement Evaluation Standards and Procedures
09-6 (Ch 1)	C-130 and C-17 Landing Zone Dimensions, Marking, and Lighting Criteria

Technical Order (T.O.)

35E2-5-1	Crushed-Stone Crater Repair and Line-Of-Sight Profile Measurement for Rapid Runway Repair

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