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Engineering Operations

U.S. Marine Corps

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UNITED STATES MARINE CORPS

20 December 2023

FOREWORD

Marine Corps Warfighting Publication (MCWP) 3-34, *Engineering Operations,* addresses the fundamental principles required for planning, executing, and assessing Marine air-ground task force engineering operations. It provides a broad overview for commanders and their staffs on engineer support tasks and functions related to expeditionary advanced base and distributed maritime operations. Additionally, it provides the reader with a conceptual understanding of engineer capabilities, planning considerations, command relationships, support requirements, and considerations for the successful execution of missions throughout the competition continuum. It is the pinnacle of engineer doctrine and links directly with all other Marine Corps engineer doctrinal publications and Joint Publication 3-34, *Joint Engineer Operations*.

This publication supersedes MCWP 3-17, *Engineering Operations*, dated 14 February 2000, erratum dated 2 May 2016, and change 1 dated 4 April 2018, and cancels MCRP 3-34.4, *Engineer Forms and Reports*.

Reviewed and approved this date.

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Chapter 1.
Fleet Marine Forces Engineering

Engineering has held a significant role in Marine Corps operations from the turn of the 20th century to today. From crisis response and foreign humanitarian assistance (FHA) to counterinsurgency and large-scale combat operations, Marine Corps engineering has evolved, enabling the Fleet Marine Forces (FMF) to continue to project combat power and accomplish assigned missions. As the Marine Corps adapts its force structure to new operating concepts for great power competition, the role of engineering grows in significance to meet the operational challenges of the FMF. Operating in smaller formations from expeditionary advanced bases (EABs) or advanced naval bases (ANBs), engineers enable distributed operations across key maritime terrain by providing mobility, countermobility, survivability, general engineering, and geospatial intelligence support.

Marine Corps Engineer Capabilities

The core engineer functions of mobility, countermobility, survivability, general engineering, and engineer reconnaissance enable force maneuver, enhance force protection, and create friction or disorder for the enemy. Marines in the engineer and utilities military occupational specialties (MOSs) perform these functions, delivering both constructive and destructive effects that enable supported unit commanders to modify the battlespace to their advantage and sustain operations. These combat-support actions can be decisive in sustaining the fluid momentum necessary during distributed maritime operations and operations from EABs. Throughout the competition continuum, engineer reconnaissance and general engineering support in security cooperation and FHA missions set conditions to enable mobility, countermobility, and survivability support in crisis and conflict. When integrated with the naval construction force (NCF), Marine Corps engineering activities provide a deliberate, single-focus, and purpose-built force multiplier that scales engineer support at the right time and place to enhance the tactical situation.

Engineers Across the Fleet Marine Forces

The Marine Corps organizes engineering units to provide organic engineering capabilities in each element of the Marine air-ground task force (MAGTF):

- A combat engineer battalion (CEB) in the ground combat element (GCE).
- An engineer company in the Marine wing support squadron (MWSS) of the aviation combat element (ACE).
- An engineer support battalion (ESB) in the logistics combat element (LCE).

Additionally, engineer staff personnel provide planning and coordination support within the command element (CE). In naval operations, FMF mission requirements might require augmenting engineering support from the NCF. The NCF provides civil engineering and contingency construction support for more complex general engineering activities to be a considerable force multiplier in the operational framework of FMF engineering.

The FMF engineer units can be task-organized to support the required combat, general, and geospatial engineering capabilities of each element in a MAGTF. Task organizing engineer units enables the FMF to maneuver and operate throughout the competition continuum in a variety of operational environments and threat conditions. Figure 1-1 illustrates the versatility of FMF engineering in an operational framework. The figure shows the joint force engineer functions alignment with FMF engineering activities applied against actions that occur under direct or indirect competition with near-peer competitors and opponents. Refer to Marine Corps Doctrinal Publication (MCDP) 1-4, *Competing*, for more information about near-peer competition.

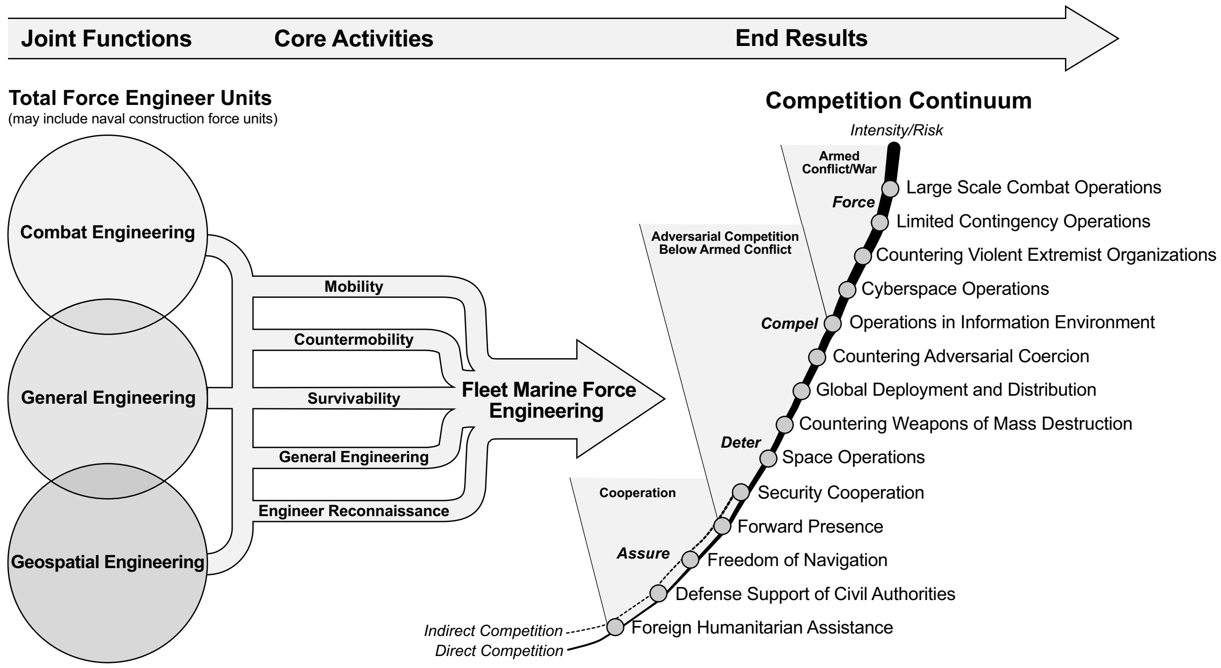


Figure 1-1. Operational Framework of Fleet Marine Forces Engineering.

Engineers Across the Service Headquarters, Service Component Command Headquarters, and the Supporting Establishment

Engineers in Headquarters, United States Marine Corps; Service component command headquarters; and the supporting establishment support the FMF engineers' warfighting needs by coordinating with engineers across the total force and advising senior leaders about organizing, training, equipping, and employing engineer units in the FMF. Engineers closely coordinate with Navy counterparts to develop the interoperability of engineering support in naval operations. Engineers also coordinate inter-Service, inter-agency, and foreign military information exchanges regarding common military engineering capabilities and interests.

Operational-Level Organizations

The supported and supporting Marine Corps Service component commands and joint force commands influence FMF engineering by conducting operational-level planning, coordination, and resource synchronization. Common engineering concerns that require coordination between the deploying force, component commands, and joint force command include—

- The priority of engineering effort in support of operations.
- Staff engineer participation in functional boards, centers, cells, and working groups.
- Theater standards for force protection, contingency construction, and environmental compliance.

Joint Publication (JP) 3-34, *Joint Engineer Operations*, provides more detail about the duties and responsibilities of the Service component command and joint force command staff engineer offices, particularly those pertaining to the coordination of operational-level engineer issues and the employment of theater-level engineer units. The remainder of this publication focuses on tactical-level employment of engineer units in the FMF.

CHAPTER 2. ENGINEER ORGANIZATIONS

Engineer and explosive ordnance disposal (EOD) units of the FMF are key enablers in supporting Marine Corps operations throughout the competition continuum. This chapter describes the current engineer units' organization and capabilities. Refer to Marine Corps Reference Publication (MCRP) 1-10.1, *Organization of the United States Marine Corps*, and *Total Force Structure Management System* for a more comprehensive description of the approved force structure and engineer unit mission statements.

Current Marine Corps Force Design plans require a realignment of FMF force structure, modernized equipment, and new tactics, techniques, and procedures (TTP) to successfully conduct expeditionary operations against a peer opponent. Operating from EABs or ANBs, FMF units support naval fleets during distributed maritime operations to accomplish sea control and sea denial missions. Deliberate experimentation will test new FMF organizational constructs, capabilities, and TTP to refine Marine Corps force design by 2030, enable operations from EABs, and support Naval Fleets during distributed maritime operations. See the current version of *Tentative Manual for Expeditionary Advanced Base Operations* for descriptions of new Marine Corps organizations.

ENGINEER ORGANIZATIONS IN THE FLEET MARINE FORCES

The MAGTF is the Marine Corps' principal organization for all missions throughout the competition continuum. It comprises task-organized forces under a single commander who can rapidly respond to a contingency anywhere in the world. The MAGTF functionally groups its forces into four core elements: a CE, ACE, GCE, and LCE. The MAGTF structure enables the commander to configure each element with the appropriate number, size, and type of Marine Corps unit, dependent on the assigned mission. The MAGTF can contain other Service component or multinational forces assigned or attached to it in a joint or multinational environment. As standing organizations, the Marine expeditionary force (MEF) and the Marine expeditionary unit (MEU) include engineer formations to provide the MAGTF with combat, general, and geospatial engineering support to accomplish the assigned mission. Similarly, MAGTFs formed and scaled to contingencies, such as the Marine expeditionary brigade (MEB), special purpose Marine air-ground task force (SPMAGTF), or crisis response force would include engineer formations that are organized and equipped to provide designated engineering support. See Appendix A for a list of engineer resources.

Marine Expeditionary Force

Each major subordinate command (MSC) within the MEF has an organic engineer unit. An NCF containing a naval construction regiment (NCR) headquarters, along with elements from naval mobile construction battalion(s) (NCMBs), naval construction battalions, or underwater construction teams (UCTs) can be assigned to augment the MEF. Although Figure 2-1 depicts the notional structure of organic engineer units within each MSC of a standard MEF, the individual engineer units across the MEF vary in terms of personnel and equipment.

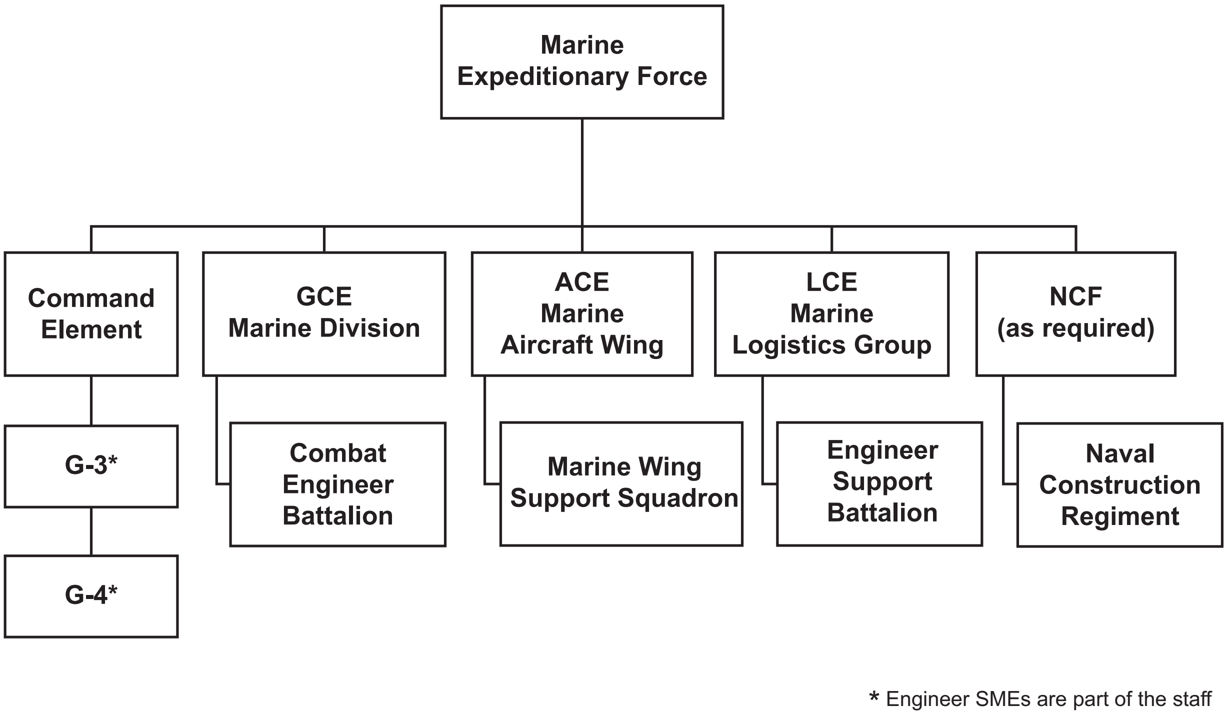


Figure 2-1. Engineer Units in a Notional Marine Expeditionary Force.

Marine Expeditionary Brigade

Marine expeditionary brigades consist of units sourced from within a MEF or across the entire FMF and typically organize around a regimental landing team The MEB can contain an NCF assigned or attached to it during a joint or maritime operation. Like the standard MEF formation, the MEB organization includes organic engineer units in each of its major subordinate elements (MSEs). Figure 2-2 depicts the organization of engineer units within a standard MEB.

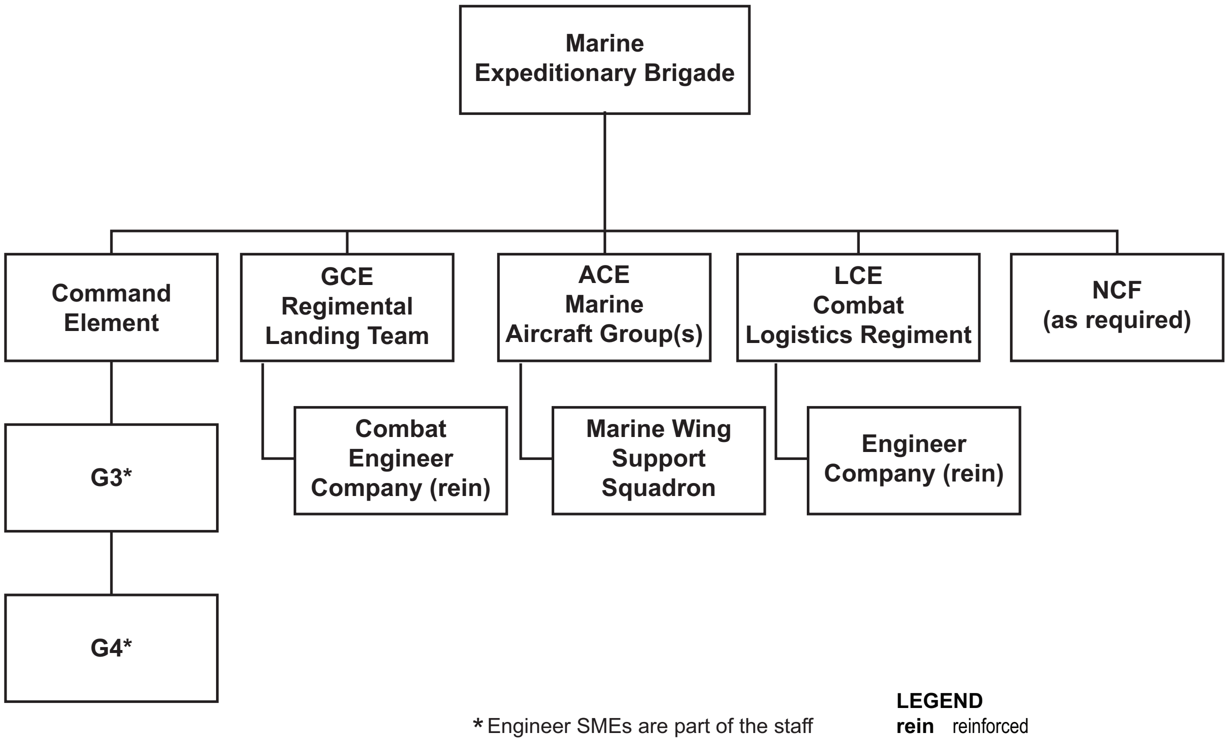


Figure 2-2. Engineer Units in a Notional Marine Expeditionary Brigade.

Marine Expeditionary Unit

Each MSE within the MEU has an organic engineer unit. Figure 2-3 depicts the organic engineer units within a standard MEU.

Special Purpose Marine Air-Ground Task Force

A SPMAGTF is a MAGTF organized, trained, and equipped to accomplish a specific mission or task. The SPMAGTF can contain other Service component or multinational forces assigned or attached to it in a joint or multinational environment. The SPMAGTF's assigned mission guides development of its composition. Subsequently, SPMAGTFs contain personnel and equipment in an engineer detachment tailored to perform a specific task or multiple tasks, as required.

Marine Air-Ground Task Force Command Element

The CE is composed of the commander; general or executive and special staff sections; headquarters section; and requisite communications support, intelligence, and reconnaissance forces, necessary to accomplish the MAGTF mission. The CE provides command and control (C2), intelligence, and other support essential for effective planning, execution, and assessment of operations. In a joint or multinational environment, the CE's size and composition can include other Services or multinational forces assigned or attached to the MAGTF.

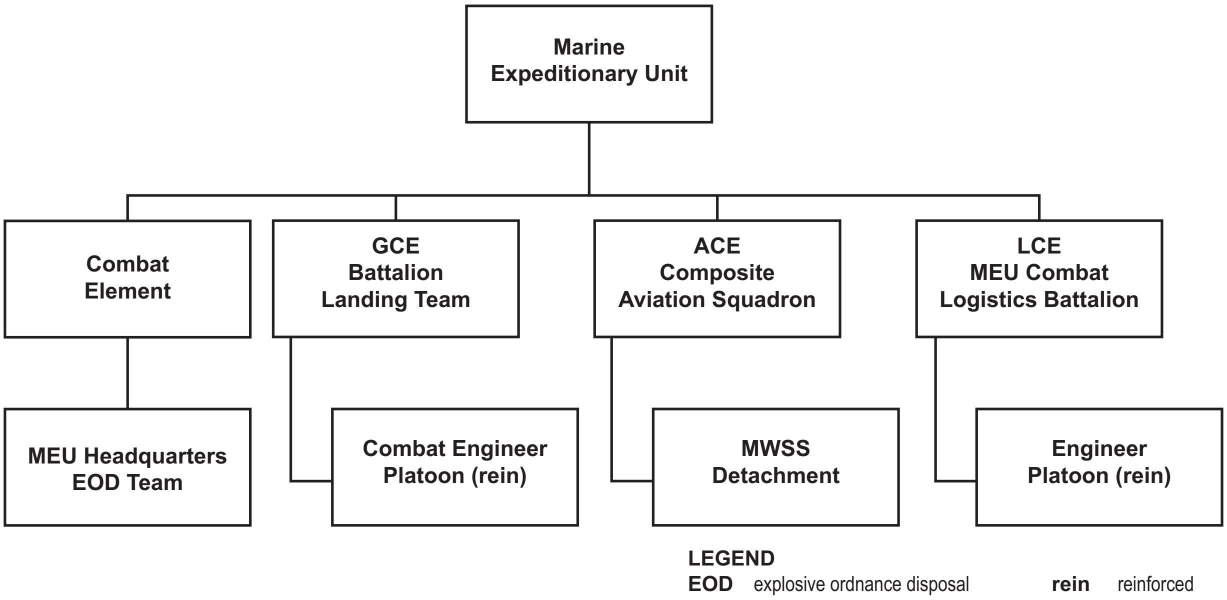


Figure 2-3. Engineer Units in a Notional Marine Expeditionary Unit.

Engineer subject matter experts (SMEs) advise the commander on the employment of engineer activities conducted within the MAGTF area of operations (AO). The staff develops estimates of supportability, determines material and equipment requirements, and coordinates and monitors the completion of MAGTF engineering activities.

Marine Expeditionary Force and Marine Expeditionary Brigade

The MEF and MEB CE table of organization includes an engineer section composed of a staff engineer officer, other officers, and staff noncommissioned officer SMEs. The engineer staff is vital to ensuring the appropriate planning and synchronization of combat, general, and geospatial engineering capabilities across the battlefield functions. The engineer section is heavily involved with the activities of other staff sections throughout all phases of operations. This collaboration includes participation in functional boards, centers, cells, and working groups within the headquarters and between the headquarters and the staff of the supported component command. These boards, centers, cells, and working groups can include the following engineering aspects:

- Engineer reconnaissance and information about the physical terrain of the battlespace.
- Gap crossing.
- Route and area clearance.
- Explosive hazard and mine countermeasures.
- Barrier and obstacle emplacement.
- Force protection and survivability.
- General engineering construction.
- Materials handling equipment (MHE) and cargo-handling equipment.
- Bulk fuel distribution, water purification, and hygiene services.
- Power generation and distribution.
- Engineering resources and commodities.

Other related aspects that can include FMF engineers include the following:

- Civil affairs.
- Environmental management.
- Facility utilization.
- Base camp development and master planning.
- Real estate acquisition and management.
- Waste management.

The following subparagraphs provide examples of engineering aspects that require coordination throughout the CE staff.

G-1, Personnel Staff Section. The engineer section and EOD cell collaborate with the G-1 on personnel readiness of engineer and EOD units, management of critical low-density engineer and EOD MOS billets, timely replacement for combat casualties in engineer and EOD units, and requests for external augmentation (individual or teams of engineer specialists and EOD technicians).

G-2, Intelligence Staff Section. The engineer section assists the G-2 in coordinating intelligence requirements throughout all phases of the intelligence cycle. It provides technical assistance to identify, prioritize, and validate engineer intelligence requirements and coordinate collection of engineer-related geospatial information. Additionally, it provides technical analysis of information regarding infrastructure such as determining the capacity and capabilities of available facilities, bridges, tunnels, lines of communications (LOCs), water and fuel sources, construction materials and assets. The engineer section evaluates options and advises the commander on the most effective tactical methods to either bypass or breach enemy obstacles. It uses the identity and location of enemy mine stocks and engineer units or assets to make recommendations regarding the priority for their destruction during the targeting board. Additionally, it assists in managing and prioritizing engineer-related requests for information and developing and analyzing the modified combined obstacle overlay.

G-3, Operations and Training Staff Section. The engineer section and EOD cell collaborate with the G-3 on operational factors including the readiness and availability of forces, phased force deployment, and recommended assignment of engineer or EOD forces to support operations. Subject matter experts are located in both current and future operations sections to coordinate the planning, production, and execution of operation orders, deployment orders, and fragmentary orders. Additionally, SMEs support the counter-improvised explosive device cell and the targeting board. Engineer SMEs attending the targeting board conduct target and risk analysis to minimize the destruction of critical infrastructure and facilities. The SMEs within the G-3 advise the staff on—

- Using reinforcing obstacles to achieve countermobility effects in harmony with planned targeting actions and defensive plans.
- Integrating engineer units conducting reconnaissance, breaching, clearance, and gap crossing in support of maneuver.
- Engineering techniques, materials, and designs that increase survivability and comply with established construction standards.
- Engineering support to civil affairs construction projects.

G-4, Logistics Staff Section. Engineer SMEs located within the G-4 coordinate with other staff planners on factors required to support engineer operations. This can include maintenance and supply readiness of critical low-density engineer equipment; coordination of heavy-lift ground transportation for engineer equipment; timely delivery of construction materials to construction sites; replacement for equipment combat losses; and prioritization for distribution of supply Class IV, construction materials (e.g., barrier, force protection, and construction materials) and Class V, ammunition (e.g., breaching items and military explosives). The engineer SMEs also monitor the bulk fuel status and the potable water production to ensure there are sufficient quantities to meet the forecasted consumption demand. They monitor the condition of transportation and distribution network infrastructure (e.g., roads, airfields, seaports, bridges, tunnels, landing beaches, landing zones [LZs]) and ensures the G-3 engineer staff coordinates engineer efforts to repair or maintain these vital transportation and distribution nodes.

G-5, Plans Staff Section. During deliberate and crisis action planning, the engineer section supports the G-5 by providing engineer input to time-sensitive planning or development of future plans. When conducting deliberate planning, the engineer section personnel prepare engineer estimates of supportability, provide input on courses of action, and prepare respective engineer-related annexes, appendices, and tabs within the operation plan or order. During crisis action planning, it provides SMEs to support the operational planning team. Engineer SMEs identify potential engineer requirements in the functional areas of combat, general and geospatial engineering. Additionally, they provide advice regarding command relationships in the employment of engineer units. The SMEs advise the operational planning team on the size and composition of the engineer forces needed to address the forecasted requirements. They also provide the recommended deployment sequencing for the engineer forces and engineer materials.

Marine Expeditionary Force Support Battalion

The MEF support battalion is task-organized to provide general engineering support for the establishment and sustainment of expeditionary C2 facilities for a MEF CE. The general engineering capabilities of the MEF support battalion include:

- Materials handling.
- Designing and establishing an electrical power distribution plan.
- Mobile electric power generation.
- Environmental control for the installation, operation, and maintenance of organic communications equipment.

Marine Expeditionary Unit

The MEU CE table of organization does not include a staff engineer officer or engineer section. Instead, the battalion commanders and staff of the battalion landing team and the MEU combat logistics battalion advise the MEU commander on engineering capabilities within their respective battalions.

GROUND COMBAT ELEMENT

The GCE is task-organized to conduct ground operations in support of MAGTF missions. These missions can include seizing and defending key maritime terrain, conducting land operations essential to naval operations, and sustaining operations ashore that support joint or combined force land or maritime operations. Although a GCE typically forms around infantry organizations, its size can vary from a squad level to one or more Marine divisions that can independently maneuver under the direction of the MAGTF commander. The GCE also includes applicable ground combat and combat support forces. The GCE might contain other Service or multinational forces assigned or attached to the MAGTF in a joint or multinational environment.

Engineer units support the GCE’s mission by providing task-organized elements to execute combat engineering activities that improve its mobility, countermobility, and survivability. These elements also perform engineer reconnaissance to support GCE intelligence collection requirements and provide limited general engineer support, such as mobile electric power and water support.

Combat Engineer Battalion

The mission of the CEB is to provide the Marine division with engineer reconnaissance, mobility, countermobility, survivability, limited general engineering, command and control of assigned forces, and be prepared to conduct provisional infantry operations to support ground combat operations. The CEB is a separate battalion located within the 1st, 2d, and 4th Marine Divisions. The CEB commander reports to the division commander and fulfills additional duties as the division commander’s advisor on engineering operations. The CEB is the division commander’s organic combat engineering force. The CEB headquarters plans, coordinates, and executes engineering tasks in support of the division and GCE schemes of maneuver. The CEB provides command and control of subordinate companies and coordinates their sustainment when the battalion headquarters is ashore. The battalion commander allocates combat engineer forces across the division, based on mission requirements. Navy/Marine Corps Departmental Publication (NAVMC) 3500.12B, *Engineer and Utilities Training and Readiness Manual* contains the CEB mission-essential task listing. Figure 2-4 provides an organizational chart for a standard CEB. (See MCRP 1-10.1 for current force structure of Active and Reserve Component CEBs.)

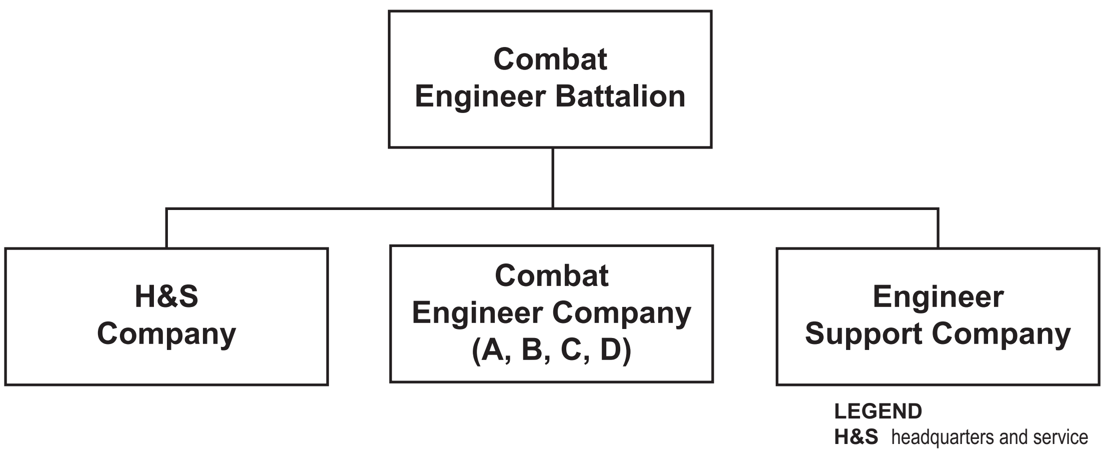


Figure 2-4. Baseline Combat Engineer Battalion.

Marine Littoral Regiment

The Marine littoral regiment is a 3d Marine Division organic task-organized unit for conducting ground operations. It has a littoral combat team consisting of an infantry battalion with an organic combat engineer platoon. The combat engineer platoon provides the battalion with limited capabilities to conduct reconnaissance, mobility, countermobility, survivability, and general engineering tasks. Figure 2-5 provides an organizational chart for a standard Marine littoral regiment.

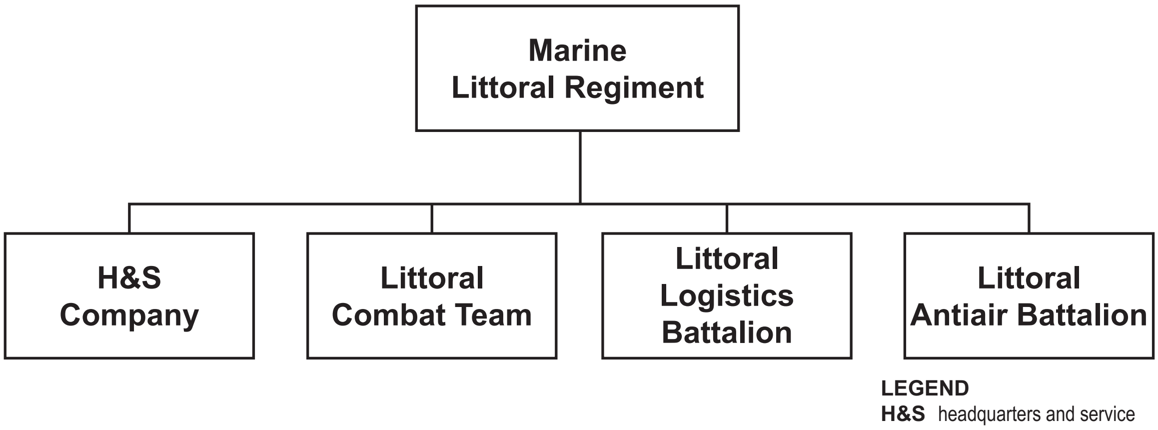


Figure 2-5. Notional Marine Littoral Regiment.

Artillery Regiment

The artillery regiment of the Marine division has organic engineer equipment and utilities capabilities in the engineer platoon of the headquarters battery. The platoon's table of equipment includes power generation and distribution, water purification, environmental control, MHE, and earthmoving equipment. The regimental commander distributes organic engineer assets to support cannon and rocket artillery operations.

Assault Amphibian Battalion

The assault amphibian battalion possesses assault amphibious vehicles and amphibious combat vehicles for transporting engineer personnel and equipment ashore and on land. Combat engineers riding in amphibious vehicles can dismount to conduct engineer reconnaissance, as well as perform mobility, countermobility or survivability tasks to support land operations essential to naval operations.

Light Armored Reconnaissance Battalion

Combat engineers can be task organized to support the light armored reconnaissance battalion with engineer reconnaissance, along with providing mobility, countermobility, and survivability capabilities to shape the battlespace.

Reconnaissance Battalion

Combat engineers can be task organized to support reconnaissance battalion with engineer reconnaissance teams (ERTs) to answer priority intelligence requirements.

AVIATION COMBAT ELEMENT

The ACE is task-organized to conduct aviation operations. The ACE provides all or a portion of the six functions of Marine aviation necessary to accomplish the assigned mission. The ACE is composed of an aviation unit headquarters and aviation units or their detachments. It can vary in size from an aviation detachment of specifically required aircraft to one or more Marine aircraft wings. The ACE could contain other Service or multinational forces assigned or attached to the MAGTF in a joint or multinational environment.

During expeditionary operations, the MAGTF requires responsive aviation support. The ACE's ability to sustain operations from amphibious warships, EABs, and ANBs ashore requires the full range of aviation ground support (AGS) capabilities provided by the MWSSs of each Marine aircraft wing. The organic personnel and equipment in the MEU ACE can support limited refueling and airfield operations ashore. (See Marine Corps Tactical Publication [MCTP] 3-20B, *Aviation Ground Support*, for a more expansive description of AGS capabilities and functions.)

Marine Wing Support Squadron

The mission of the MWSS is to conduct task organized AGS for a Marine aircraft group of other designated aviation forces by establishing and supporting contingency airfields through forward aviation combat engineering, flight line operations, forward arming and refueling points (FARPs), airfield damage repair, and aircraft salvage and recovery to enable expeditionary aviation operations.

From the AGS operations center, the MWSS plans, coordinates, and provides command and control of AGS operations in a defined area of operations. The MWSS commander uses centralized command and control and decentralized execution to employ task-organized elements. The mission-essential task listing for the MWSS is included in NAVMC 3500.14E, *Aviation Training and Readiness Program Manual*. Figure 2-6 depicts the location of engineer units in a standard MWSS. (See MCRP 1-10.1, for current force structure of the Active and Reserve Component MWSSs.)

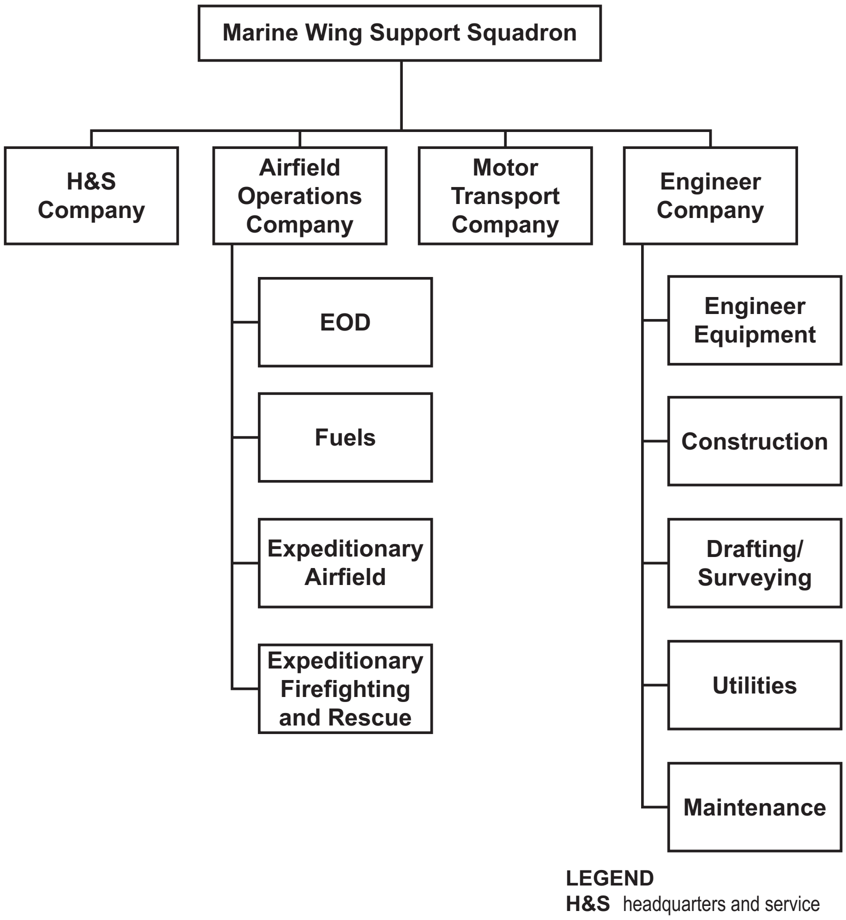


Figure 2-6. Engineer Elements in a Baseline Marine Wing Support Squadron.

LOGISTICS COMBAT ELEMENT

The LCE is task-organized to provide the combat service support (CSS) necessary to accomplish the assigned mission. The LCE varies in size from a detachment to one or more Marine logistics groups (MLGs). In a joint or multinational environment, it could also contain other Service or multinational forces assigned or attached. It provides supply, maintenance, transportation, general engineering, health services, and other services to supported Marine units.

Engineers in the LCE enable the tactical-level logistics effort by creating and maintaining the LOCs and facilities sufficient to support the distribution of supplies and equipment and by providing general engineering support to the LCE units, thereby assisting LCE units in accomplishing their mission. Additionally, engineers in the LCE provide support to the entire MAGTF. Although the size and composition of each Active Component MLG varies, it always contains one ESB.

Engineer Support Battalion

The engineer support battalion provides general engineering to the MEF to assist the tactical agility and mobility of the MAGTF maneuver elements by enhancing survivability, mobility, and countermobility as well as tactical utilities support, and handling, storage and dispensing bulk water and bulk fuel. Additionally, the ESB provides EOD support to the MEF to mitigate hazards associated with unexploded explosive ordnance, improvised explosive devices, and weapons of mass destruction. As an independent battalion within the MLG, the ESB employs as a complete organization in general support of a MEF. It provides C2 support functions for subordinate elements of the battalion. The commander and staff of the ESB plan, direct, and supervise the activities conducted by subordinate companies. The ESB commander allocates forces across the MAGTF to support mission requirements. The mission-essential task listing for the ESB is included in NAVMC 3500.12B. Figure 2-7 depicts a standard ESB. (See MCRP 1-10.1 for current force structure of the Active and Reserve Component ESBs.)

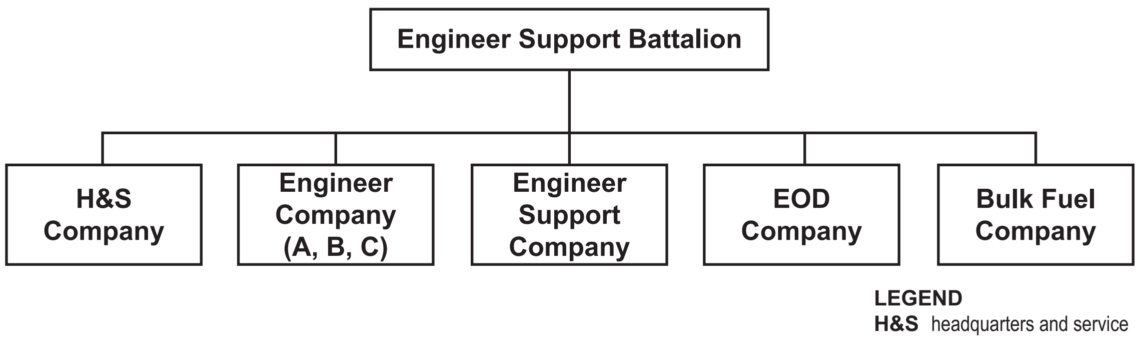


Figure 2-7. Baseline Engineer Support Battalion.

Combat Logistics Battalion

The combat logistics battalion provides direct support and tactical logistics to units beyond their organic capabilities in the areas of transportation, engineering, health services, and maintenance. Combat logistic battalion engineers provide limited general engineering capabilities (e.g., water purification, horizontal and vertical construction, and hygiene services) to the designated units within the MAGTF. The also conduct engineer reconnaissance.

Other Marine Corps Units

A Marine Corps Service component commander can task a MAGTF to provide engineering support to Marine Forces Special Operations Command (MARFORSOC) units. Within the MARFORSOC headquarters is an engineer staff section that contains a combat engineer officer and staff noncommissioned officer. The engineer staff section provides subject matter expertise and planning support to missions assigned by the commander or the combatant commander employing special operations forces. Additionally, they provide recommendations for support beyond organic capabilities based on mission analysis and the nature of support required. Within MARFORSOC, the Marine Raider Support Group provides engineering support including power generation and distribution and MHE. Explosive ordnance disposal support is organic to the Marine Raider Battalion, and it supports operations across MARFORSOC. The MARFPORSOC staff submits external requests for support to the theater special operations command of the respective combatant command when engineering requirements exceed the organic capabilities of MARFORSOC. The theater special operations command coordinates with the combatant command J-4 and the respective theater Marine Corps forces for engineer support it cannot internally source. For more information related to interoperability between MARFORSOC units and conventional force units, see MCRP 3-30.4, *Multi-Service Tactics, Techniques, and Procedures for Conventional Forces and Special Operations Forces Integration, Interoperability, and Interdependence*.

NAVAL CONSTRUCTION FORCE

The primary mission of the NCF is to conduct general engineering operations for distributed maritime operations lethality and maritime sustainment (e.g., refuel, rearm, reload, resupply, repair, rebuild, recover, revive, and reman). The NCF conducts contingency construction, engineering and provides CSS as required by operational, campaign and engineer support plans across the spectrum of competition, crisis, and conflict in all climatic environments. The NCF provides multi-disciplined, general engineering units to the Fleet, MEF and Joint Task Force commanders. Naval construction force units are capable of tactical-level command and control, construction, improvement, maintenance, repair, and recovery of airfields, ports, and other logistic LOCs, expeditionary and advanced naval bases, expeditionary medical facilities, and associated infrastructure; geospatial engineering reconnaissance, battle damage repair, contingency base maintenance support; and specialized construction (including underwater construction operations). The NCF can perform defense support of civil authorities (DSCA), humanitarian aid and disaster relief operations and humanitarian and civic assistance (HCA) as required by higher headquarters (HHQ) tasking.

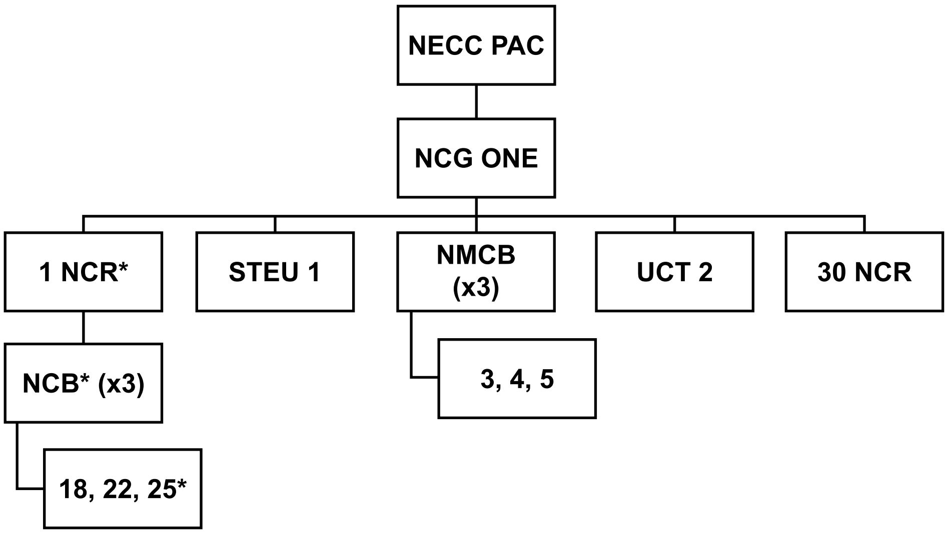
When assigned to a MAGTF, the NCF operates as a separate MSC or MSE, or as a functional regiment or battalion within the LCE. The NCF provides task-organized units to create a single-mission or flexible multi-mission, task-organized force for each operational requirement. A supporting command element (e.g., NCR) is established and deployed if mission, scope, and complexity require it. The NCF commander can also serve as a functional staff advisor in a MEF headquarters. For further information on planning and coordination considerations specific to NCF employment, refer to Navy Warfare Publication (NWP) 5-01, *Navy Planning.* See MCTP 3-34D, *Seabee Operations in the Marine Air-Ground Task Force (MAGTF)*, for information about the unique capabilities and requirements inherent to the NCF. Refer to Tactical Memorandum 4-04.2.1-22, *Naval Construction Force Operations*, for information about the latest force structure changes for the Active and Reserve Component of the NCF. See Navy Warfare Publication 4-04, *Naval Civil Engineering Operations*, for additional information on Naval Facilities Engineering Systems Command engineering and contingency contract services.

Naval Construction Group

The NCF consists of two naval construction groups (NCGs), which serve as the immediate superiors in command for their NCRs, naval mobile construction battalions (NMCBs), naval construction battalions (NCBs), and underwater construction teams (UCTs). Operational NCF units are assigned under the administrative control of Navy Expeditionary Combat Command or Navy Expeditionary Combat Command Pacific through their respective NCGs.

The NCG's mission is to serve as the immediate superior in command for their assigned forces; to lead and manage the overall capability and readiness of NCRs, NMCBs, NCBs, and UCTs through the Fleet Response Training Plan cycle; and to man, train, equip, and deploy units to support combatant command and naval component command tasking. The NCGs also provide program management and oversight in support of subordinate units and force development efforts.

Naval Construction Group One. Naval Construction Group ONE is under administrative command of Navy Expeditionary Combat Command Pacific and is the administrative immediate superior in command for all Active and Reserve Component NCF units assigned to U.S. Pacific Fleet. Active Component units of NCG ONE include an NCR, three NMCBs, and a UCT. Reserve Component units of NCG ONE include an NCR and three NCBs. Figure 2-8 illustrates the organizational chart of NCG ONE.



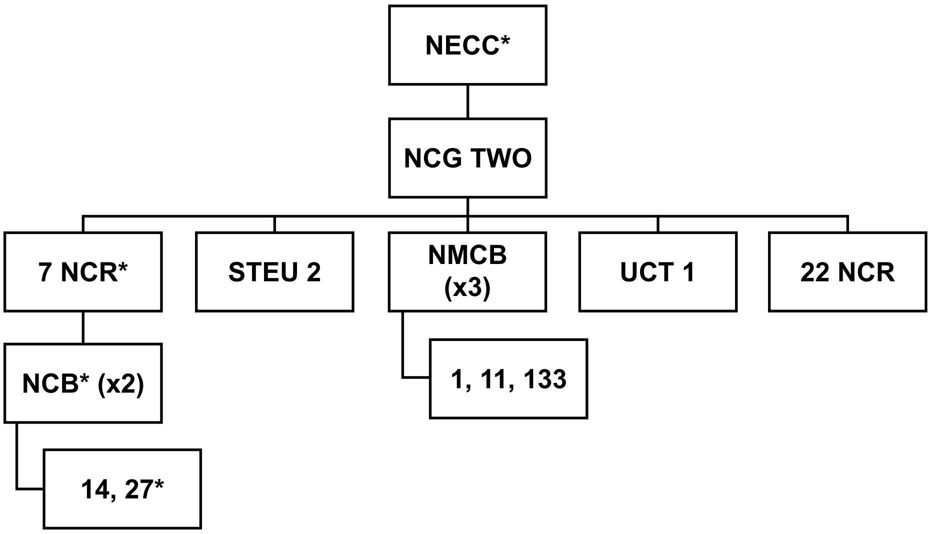
* Reserve component

LEGEND

NCB	naval construction battalion	NMCB	naval mobile construction battalion
NCG	naval construction group	SCB	specialized construction battalion
NCR	naval construction regiment	STEU	seabee training and evaluation unit
NECC PAC	Naval Expeditionary Combat Command Pacific	UCT	underwater construction team

Figure 2-8. Naval Construction Group One.

Naval Construction Group Two. Naval Construction Group TWO is under administrative command of Navy Expeditionary Combat Command and is the administrative immediate superior in command for all Active and Reserve Component NCF units assigned to United States Fleet Forces Command. Active Component units of NCG TWO include an NCR, three NMCBs, and a UCT. Reserve Component units of NCG TWO include an NCR and two NCBs. Figure 2-9 illustrates the organizational chart of NCG TWO.



* Reserve component

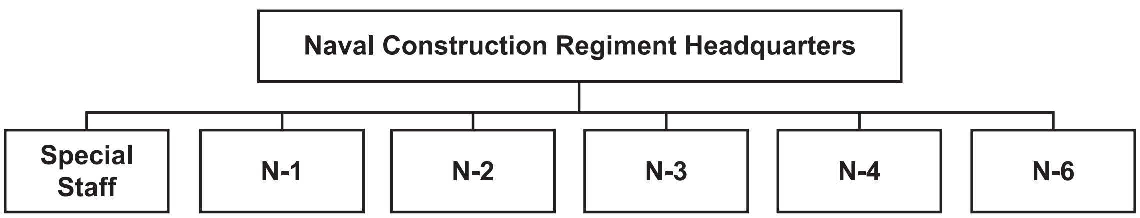
LEGEND

NCB naval construction battalion
NCG naval construction group
NCR naval construction regiment
NECC Naval Expeditionary Combat Command
NMCB naval mobile construction battalion
STEU seabee training and evaluation unit
UCT underwater construction team

Figure 2-9. Naval Construction Group Two.

Naval Construction Regiment

The NCR is a permanently structured CE that provides command and control over assigned engineer and other expeditionary units while assigned to a geographical area of responsibility (AOR). The NCR implements general engineering policy, guidance, and standards, and conducts limited construction contracting capability when augmented by the Naval Facilities Engineering Systems Command. The NCR does not have dedicated direct-labor assets; these reside in its subordinate units. There are two Active Component NCRs: 22 NCR and 30 NCR and two Reserve Component NCRs: 7 NCR and 1 NCR. The NCRs provide an 0-6-level battle staff, purpose-built to shape the engineer battlespace for decisive operations, inform the operational commander's engineer support plan, and execute tactical command and control over two or more NCF, naval expeditionary combat forces, or joint force engineer units operating in a geographic area or operating to support a military operation. During multinational operations, the NCR can also provide command and control over assigned partner nation engineer or expeditionary forces. Figure 2-10 illustrates the organization of the standard NCR headquarters.



LEGEND

N-1 Navy staff manpower and personnel directorate
N-2 Navy staff intelligence directorate/Navy intelligence staff officer
N-3 Navy staff operations directorate/Navy operations staff officer
N-4 Navy staff logistics directorate
N-6 Navy staff communications directorate/communications officer

Figure 2-10. Standard Naval Construction Regiment Headquarters.

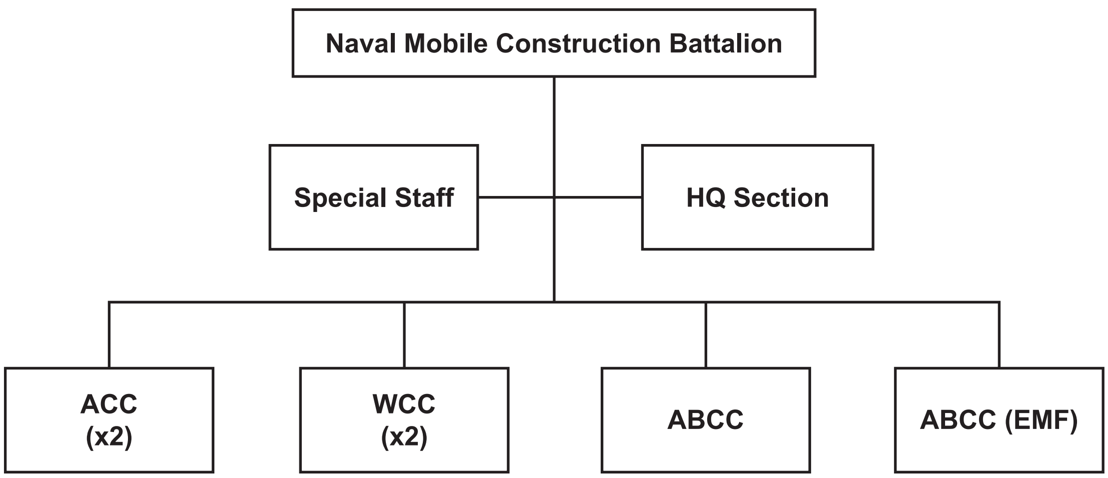
The NCR's mission is to execute naval construction activities to support naval forces conducting maritime operations throughout the competition continuum. This can include building, expanding, and repairing ANBs, airfields, seaports or EABs. It can operate in all domains, all threat conditions, and under environmental extremes (e.g., desert, mountain, jungle, cold region, urban).

Naval Mobile Construction Battalion

There are six Active Component NMCBs: NMCB-1, NMCB-3, NMCB-4, NMCB-5, NMCB-11, and NMCB-133. The NMCB builds and repairs physical infrastructure, ports, and logistics nodes to enable maritime operations. The NMCB is the basic operating organization and primary unit for conducting engineer and construction operations. Its personnel and equipment are a modular task organization of air-transportable, ground, and sea logistics elements.

The mission of the NMCB is to provide task-organized, multi-disciplined general engineering and construction forces that deploy to support naval objectives globally and enable logistics for distributed Fleet operations. Focus areas for the NMCB are waterfront construction and port damage repair; airfield construction and damage repair; and advanced base construction including ANBs, EABs, and expeditionary medical facilities. In peacetime, NMCBs can support emergency response (such as FHA and DSCA) or can perform deliberate construction to support fleet readiness, theater security cooperation, and civic action missions. The NMCB can execute construction across the spectrum of construction endurance by providing organic, initial, temporary, semi-permanent, and permanent facilities.

The NMCB is a permanently structured, deployable unit. It consists of a battalion headquarters, and six companies. The companies (also referred to as tactical units of action) include two airfield construction companies, two waterfront construction companies, one advanced base construction company and one advanced base construction company (expeditionary medical facility). The NMCB is capable of task organizing into detachments, details, or elements to support the tasking mission. Figure 2-11 is an organizational chart for the standard NMCB.



LEGEND
ABCC advaced base construction company
ABCC (EMF) advaced base construction company (expeditionary medical facility)
ACC airfield construction company
HQ headquarters
WCC waterfront construction company

Figure 2-11. Standard Naval Mobile Construction Battalion.

Naval Construction Battalion

There are five Reserve Component NCBs: NCB-14, NCB-18, NCB-22, NCB-25, and NCB-27. The NCB oversees mineral production, ground lines of communication (GLOCs) construction, bridging, temporary base construction (including intermediate staging bases, forward operating bases and sites, and main operating bases), water well drilling, construction quarries, and infrastructure repair and maintenance to support Navy, MAGTF, and joint task force commanders engaged in military operations throughout the competition continuum. Naval construction battalions focus on wood frame and relocatable structures; water-well drilling; bulk water production; utilities; bridging and gap crossing; and pit and quarry operations.

Each NCB is a permanently commissioned, fully deployable unit. The NCB consists of a battalion headquarters and four companies. The companies (also referred to as tactical units of action) include two general construction companies, a ground lines of communication construction company and a mineral products company. The NCB is capable of task organizing into detachments, details, or elements to support the mission. Figure 2-12 is an organizational chart for the standard NCB.

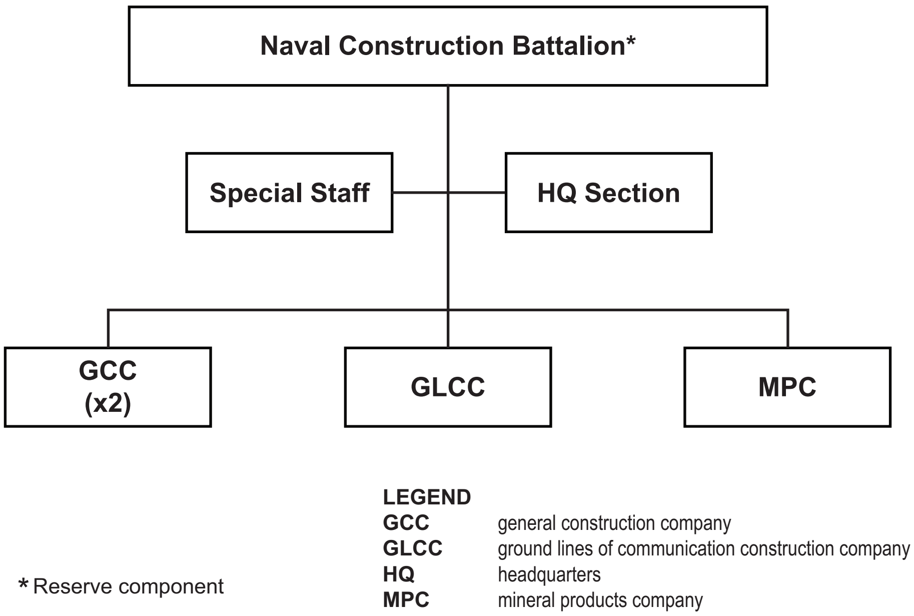


Figure 2-12. Standard Naval Construction Battalion.

Underwater Construction Team

There are two UCTs: UCT ONE and UCT TWO. Underwater construction teams are specialized units that provide a wide range of underwater survey, engineering, inspection, repair, demolition, and construction expertise. Underwater construction teams are amphibious in nature; therefore, the UCT personnel are qualified divers with Seabee ratings who accomplish inshore and deep-ocean engineering tasks. The UCTs facilitate port-opening with underwater surveys, damage repair, and obstacle removal using precision demolitions, as well as detailed beach and port hydrographic and side-scan surveys for maritime prepositioning force or amphibious operations. The UTCs conduct battle damage repair and assessments to ocean and waterfront and port facilities and can perform light salvage operations. Ports, docks, piers, wharfs, fleet moorings, beachheads, submarine cables, aids to navigation, and underwater utilities are built, repaired, and maintained within threat areas by UCTs.

The UCTs have two primary missions. First, they conduct expeditionary, temporary, or permanent pier damage inspection and repair and underwater deep ocean facility construction, inspection, repair, and maintenance. Second, they conduct amphibious landing support of joint logistics-over-the-shore operations, including FHA and DSCA, consequence management, and underwater recovery operations.

Additionally, UCTs perform complex inshore and deep ocean underwater construction tasks in any climate, including extreme cold weather environments. The provide ocean bottom surveys for site selection of underwater facilities. Personnel of the UTCs can dive to and work at 190 feet of seawater, relying on scuba and surface-supplied diving systems. Typical projects include underwater repair of wharves, piers, pipeline, moorings, boat ramps, underwater utility systems, and the installation of sub-sea cables. The unit also supports offshore petroleum discharge system operations by sinking, installing, connecting, and maintaining the single anchor leg moorings, as well as the associated flexible pipelines. See Figure 2-13 for the organizational chart of the standard UCT.

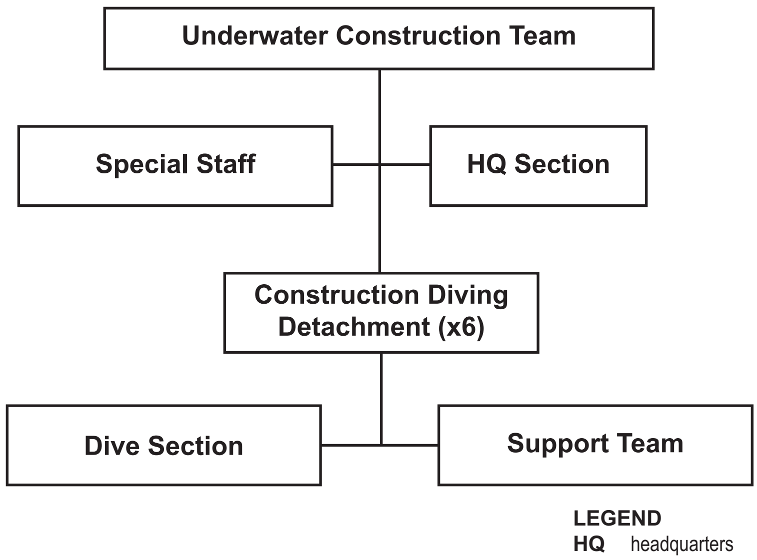


Figure 2-13. Standard Underwater Construction Team.

CHAPTER 3.
COMMAND AND CONTROL OF ENGINEER UNITS IN THE MARINE AIR-GROUND TASK FORCE

As one of the seven Marine Corps warfighting functions, command and control is important to the success of all operations. Command and control comprise the interrelated responsibilities between commanders and the operational authorities exercised by commanders in the chain of command. Relationships are combatant command (command authority), operational control, tactical control, support and attached. Refer to the *DoD Dictionary of Military and Associated Terms* (hereafter referred to as the *DoD Dictionary*) for definitions of these command relationships.

COMMAND RELATIONSHIPS

Command relationships allow a commander to exercise authority over subordinate units within the organization. This relationship originates at the MAGTF commander and spans the organization to the smallest units of action. Command relationships further allow information to elevate from the lowest echelons to the MAGTF commander to enable situational awareness and support the decision-making cycle. The distributed nature of engineer tasks and forces requires planners in the FMF to understand how command relationships can affect engineer operations.

Operational Control

A commander with operational control (also referred to as OPCON) of engineer forces maintains the authority to give direction over all aspects of engineer operations and training, employ engineer forces within the command to carry out missions assigned to the command, and task organize the engineer force as required to complete the assigned mission.

Tactical Control

A commander with tactical control (also referred to as TACON) of an engineer unit has sufficient authority for controlling and directing the unit within the assigned mission or task. A commander with tactical control does not have the authority to change the structure of the supporting engineer unit.

Support

A common commander establishes a support relationship between subordinate commanders when one organization should aid, protect, complement, or sustain another force. Within the MAGTF, a supported and supporting command relationship is the most common form between an engineer unit (supporting) and another unit (supported). Four types of support relationships can be established:

- *Direct*. Engineer support provided at the direction of the supported unit to accomplish a specific mission. For example, the Marine division normally tasks the CEB to provide direct support to other elements of the division.
- *General*. Engineer support provided to a supported force rather than a particular element of that force. For example, the MLG typically tasks the ESB to provide general support to the MEF.
- *Mutual*. Support that units render to each other, because of their assigned tasks, their position relative to each other and to the enemy, and their inherent capabilities. For example, the CEB and ESB can each provide a platoon to conduct a combined arms breach in support of a maneuver force.
- *Close*. Actions of a supporting engineer unit against targets or objectives near the supported force that require detailed coordination with the fire, movement, or other actions of the supported force. For example, during a deliberate breach, close support coordination is critical to synchronize breach force activities while reducing the enemy's complex obstacle system.

Transfer of Forces (Attached)

Depending on mission requirements, an engineer element might transfer (also referred to as attach) to a command. When transfer of forces is used, the command relationship exercised over the transferred forces requires an agreement established between the gaining and relinquishing commander. For example, a gaining commander has tasking authority and is responsible for sustainment and administrative support beyond the attached unit’s organic capability. The Marine division typically attaches a combat engineer platoon to the battalion landing team (or GCE) of a MEU for the entire deployment cycle.

Liaison

Liaison is not a specific element of the C2 structure, but it provides advantages that support command relationships internal and external to the MAGTF. Commanders employ liaison officers or teams to maintain close, continuous contact between subordinate, adjacent, and higher commands. Liaison ensures mutual understanding and unity of purpose and action. Liaison between maneuver forces and supporting engineer units ensures timely identification of operational requirements and aids in resource management.

COMMAND ELEMENT

The engineer staff in the MAGTF CE has the functional expertise to integrate engineer-specific planning considerations into operations. For more information on the commander’s decision-making cycle, refer to JP 3-33, *Joint Task Force Headquarters*.

The Role of the MAGTF Engineer in Planning

Planning synchronizes the activities within each phase or stage of a larger operation. Planning comprises future operations and future plans. Future operations planning focuses on activities occurring within the near term, while future plans focus on activities occurring at longer intervals from when the planning begins. Future operations can include engineering tasks, such as emplacing obstacles and barriers, clearing and repairing roads, conducting engineer reconnaissance to assess civilian infrastructure or displacing fuel sites to enable the maneuver or movement of a supported force. Future plans can include the planning for more complex engineering activities, such as establishing FARPs or constructing nonstandard bridges, clearing an area to construct an EAB, or synchronizing the closure or deconstruction of multiple base camps. The MAGTF engineer supports internal and external planning actions to ensure the integration of organic engineer support. Internally oriented engineer planning actions include the following:

- Identifying and coordinating engineer reconnaissance support required to facilitate the scheme of maneuver in each phase and stage of an operation.
- Identifying engineering essential tasks for mobility, countermobility, survivability, and general engineering to support each phase and stage of an operation.
- Coordinating the integration of NCF, other Service, or multinational engineer forces into the MAGTF.
- Developing the task organization and command relationships for engineer formations.
- Developing engineering estimates of supportability.
- Identifying initial Class I (subsistence/water), Class III (petroleum, oils, and lubricants), IV (construction), V (ammunition), VII (major end items), and IX (repair parts) supply support estimates to conduct planned engineering tasks.
- Supporting the development of a modified combined obstacle overlay.
- Identifying critical engineering capability and capacity shortfalls in units, personnel, equipment, supplies, or funding and possible methods to resolve or mitigate shortfalls.
- Tracking the flow of mission critical Class IV and V supplies and monitoring on-hand inventory and distribution to designated engineering activity sites.
- Validating long-haul transportation asset priorities (including host nation) for movement of engineering equipment and materials with transportation coordinators of the MAGTF deployment and distribution operations center.
- Planning for engineer support to mitigate the environmental impact of MAGTF operations.
- Developing or providing the engineering elements to annexes, appendices, and tabs of the operations order, such as:
  - Annex C (Operations) and Appendix 21 (Barriers and Obstacle Plan), Appendix 22 (Mobility and Breaching), and Tab D (Counter-Improvised Explosive Device Plan) of Appendix 14 (Force Protection).
  - Annex D (Logistics) and Appendix 1 (Petroleum, Oils, and Lubricants Supply), Appendix 2 (Joint Subsistence, Food Service Support and Water Management), Appendix 4 (Logistics Supportability Analysis), Appendix 5 (Mobility and Transportation), and Appendix 6 (Engineer Support Plan).

- Annex G (Civil-Military Operations).
- Annex L (Environmental Considerations). Refer to Appendix C of this publication for more information on environmental considerations.
- Annex W (Operational Contract Support).

Externally oriented engineer planning actions include the following:

- Planning and supervising engineer activities in support of joint task force contingencies.
- Coordinating essential logistics and administrative support details with the headquarters of the engineer force(s) assigned to augment the MAGTF.
- Coordinating essential logistics and administrative support details with the gaining force headquarters when MAGTF engineer units augment another external organization, such as the NCF.
- Supporting HHQ staff during deliberate planning, particularly during development of the engineer portions of national and theater operation plans and theater security cooperation plans.
- Advising Marine Corps component command staff on the general engineering, real estate, facilities, and potential civil engineer requirements of the MAGTF.
- Representing the MAGTF during Marine Corps forces or joint force boards, cells, centers, and working groups.

Based on the planning conducted by the command element, subordinate engineer units conduct similar planning on receipt of the mission. Automated tools assist engineer planners in developing estimates of supportability and calculating accurate material, labor, and cost estimates. Appendix A contains detailed information about these resources. For further information on the planning process, see Marine Corps Warfighting Publication (MCWP) 5-10, *Marine Corps Planning Process*. See CJCSM 3130.03A, *Planning and Execution Formats and Guidance*, for examples of joint operations order annexes, appendices, tabs, and exhibits.

The Role of the MAGTF Engineer in Directing

The MAGTF engineer advises the MAGTF commander on how to best use the available engineer assets. The commander is the only one who directs actions, but the staff provides the information the commander uses to make decisions. The MAGTF engineer influences the direct process by—

- Developing the engineer scheme of maneuver and recommending engineer forces in certain time and space throughout the battle.
- Describing engineer unit capabilities and methods of employment so that engineer forces can have the greatest effect on mission accomplishment.
- Recommending changes to engineer command relationships or the specific task organization of engineer forces based on the execution of the current plan.
- Determining the priority of contingency construction projects across the MAGTF AO.

The Role of the MAGTF Engineer in Monitoring

The MAGTF engineer supports monitoring by reviewing intelligence assessments and keeping abreast of all engineer operations in the assigned AO. Actual events (such as the impact of enemy activity) compared against planned events in the engineer scheme of maneuver help determine the appropriate allocation of MAGTF assets. The MAGTF engineer maintains situational awareness (e.g., readiness, quantity of engineer supplies, personnel status of engineer units) of engineer formations throughout the MAGTF AO to ensure they continue to be best situated to support the engineer scheme of maneuver. Symbols depicted on the MAGTF's common operational picture, along with tactical reporting by engineer units provide situational awareness across the MAGTF. Refer to Appendix E for information about engineer unit symbols.

Boards, Centers, Cells, and Working Groups. Collectively, the *direct* and *monitor* steps of the commander's decision cycle correlate to the execution phase of an operation. Throughout the execution phase of operations, the MAGTF engineer, and staff attend and chair functionally oriented boards, centers, cells, and working groups. MAGTF representation is required at those events conducted by the MAGTF HHQ or that involve the Service component command headquarters. The specific features of boards, centers, cells, and working groups are the following:

- *Boards*. Boards serve as the forum to address issues outside of daily operations and to ensure coordination at the leadership level and across the staff. An important distinction between a board and a working group is that a board is usually a decision-making body.
- *Centers*. Centers are standing organizations typically operating 24 hours.
- *Cells*. Cells are functionally oriented groups attended by personnel with specific skills, accomplish key functions, and meet on a regular basis.
- *Working groups*. Working groups conduct staff coordination at the action-officer level and prepare materials for board decision making.

To prepare for HHQ boards, cells, or working group sessions, the MAGTF engineer, and staff chair similar internal MAGTF sessions to allow collaboration among the MAGTF MSEs and their engineer units. Collaborative tools allow subordinate elements to participate in boards, working groups, and cells without being physically present. The timing of MAGTF sessions is directly associated with the battle rhythm for those that are conducted by the MAGTF HHQ. The MAGTF engineer is most likely to participate in the following boards and cells:

- *MAGTF Engineering Board*. This board reviews all MAGTF engineering requirements, including (but not limited to) the concept of engineer support, engineer mission priorities, critical engineer events, and engineer task organization. Additionally, it validates the justification, scope of work, and cost estimate for all engineer project submissions and presents a recommended prioritization of validated projects to the MAGTF commander for approval. It monitors projects underway and project packages submitted to HHQ. For more information about contingency construction, see Appendix C.
- *Explosive Hazards Coordination Cell*. This cell predicts, tracks, and distributes information to mitigate explosive hazards within a theater that affect maneuver and movement, logistics, force protection, and situational awareness. It establishes, maintains, and employs collaborative tools, such as a database and predictive analysis software to conduct pattern

analysis, assess attacks involving mines and improvised explosive devices, and track unexploded ordnance hazard areas.

- *Joint Targeting Coordination Board*. This board evaluates and coordinates joint targeting actions. As a result, engineer personnel attend to ensure that targeting is coordinated with barrier and obstacle plans and that critical infrastructure is preserved.
- *Joint Facilities Utilization Board*. This board assists in managing the use of real estate and existing facilities. It evaluates and reconciles requests for real estate, use of existing facilities, inter-Service support, and construction, to ensure compliance with joint force commander (JFC) priorities. It is the primary coordination body for approving construction projects within base camps and expeditionary installations to support troop encampment and mission requirements. During sustained operations in one region, it might issue master planning guidance and develop the JFC's program to support enduring base operations.
- *Joint Civil-Military Engineer Board*. This board provides overall direction for civil-military construction and engineering requirements within a theater or joint operations area. It recommends policies, procedures, priorities, and overall direction for civil-military construction and engineering requirements. It also evaluates and prioritizes engineer resource utilization to ensure it can support operational civil-military requirements.
- *Joint Environmental Management Board*. This board assists in managing environmental requirements. It establishes policies, procedures, priorities, and the overall direction for environmental management in a joint operations area. Refer to Appendix B for more information about environmental considerations.

Historically, engineers have chaired the MAGTF engineering board and explosive hazards coordination cell. This list is not all-inclusive, but engineers support other boards and cells depending on mission requirements. The MAGTF engineer needs to rely heavily on the NCF engineer to represent the MAGTF in the joint facilities utilization board and the joint civil-military engineer board because NCF engineers have the training and education required to manage real estate, facilities, and civil engineering projects.

The Role of the MAGTF Engineer in Assessments

Initially, the MAGTF engineer must determine what has happened and clearly identify the current situation within the engineer scheme of maneuver. Once there is a good understanding of the current situation, the engineer needs to understand the significance of the unfolding events, determine why they matter, and how they relate to the overall mission. After evaluating the situation, the engineer can determine new courses of action and make recommendations to the commander on how to proceed. For additional information on conducting assessments, refer to MCRP 5-10.1, *Multi-Service Tactics, Techniques, and Procedures for Operation Assessment*.

CHAPTER 4. SUPPORT TO THE MARINE AIR-GROUND TASK FORCE

Engineer units in the MAGTF can support maneuver and movement and contribute to the distribution of CSS through the application of combat, general, and geospatial engineering. The phrase “engineer units in the MAGTF” refers to all engineer formations that support the MAGTF, including the CEB, ESB, MWSS, and NCF. This chapter contains three parts. The first discusses maneuver, movement, countermobility, and survivability in the execution of ground and aviation operations. The second part discusses engineer activities that contribute to the distribution of CSS. The third part discusses engineer reconnaissance. Refer to Appendix F for details pertaining to specific operational environments. Refer to Appendix G for description of how MAGTFs conduct shaping activities throughout the competition continuum.

MANEUVER AND MOVEMENT

As a key component of the Nation’s naval expeditionary force-in-readiness, the MAGTF must be able to conduct operations wherever and whenever required. To achieve this objective, it must be capable of tactically maneuvering under adverse weather conditions, across difficult terrain, and while combating the actions of a determined enemy. Likewise, it must be capable of modifying the terrain to support tactical ground maneuver by the GCE and wheeled vehicle movement required to distribute CSS across the assigned AO. The MAGTF command element conducts centralized planning and supervises the synchronized execution of engineer activities conducted across the assigned AO so that freedom of maneuver is established, and tactical movement preserved. Since tactical maneuver is generally required for all GCE actions, the CEB is the engineer unit most likely to execute engineer activities that establish or preserve ground combat vehicle maneuver. To afford greater flexibility to the ACE, the MWSS can establish air facilities to bolster aviation responsiveness and directly support the employment of the six functions of Marine aviation. Nevertheless, the combat engineer activities performed during the initial phase of an operation can link to general engineering activities conducted during a later phase of the operation by the ESB or an MWSS. For example, the CEB can create a combat road or trail to expedite vehicle maneuver for a deliberate attack. Afterwards, the ESB could improve the road or trail so it can become a main supply route (MSR) or an alternate supply route (ASR) for the delivery of CSS. Additionally, elements of the CEB might support an infantry unit during an air assault and employ expedient combat engineer methods to clear and prepare an LZ to support the arrival of additional waves of an air-landed force or replenishment of the ACE’s tactical aircraft.

Maneuver

The DoD Dictionary contains four definitions for the term maneuver. The two most applicable for distributed maritime operations are "the employment of forces in the operational area through movement in combination with fires and information to achieve a position of advantage in respect to the enemy," and "a movement to place ships, aircraft, or land forces in a position of advantage over the enemy." Maneuver is one of the seven Marine Corps warfighting functions. During the execution of all GCE operations, the CEB provides a vital contribution to support tactical maneuver by performing multiple combat engineer activities. Collectively, these allow the GCE to mass the effects of combined-arms combat power at the optimum time and location to achieve surprise, shock, and momentum that limits the enemy's reaction time and degrades its ability to effectively resist or fight.

The combat engineer tasks executed to ensure maneuver include five basic activities:

- Breaching.
- Gap crossing.
- Performing route and area reconnaissance and clearance.
- Forward aviation combat engineering.
- Constructing combat roads and trails.

Two additional combat engineer activities that also support maneuver are the emplacement of obstacles and barriers and the expedient construction of survivability positions for key ground weapon systems.

Breaching. Breaching is a synchronized, combined-arms activity under the control of the maneuver commander conducted to allow maneuver despite the presence of obstacles. The two types of breaches conducted by MAGTF engineer units in support of GCE maneuver are deliberate and hasty. A deliberate breach involves detailed prior planning, preparation, and buildup of combat power on the nearside of an obstacle; a hasty breach is an adaptation to the deliberate breach, used when less time is available. The CEB uses specialized equipment to conduct breaching to support maneuver. Refer to MCTP 3-34A, *Combined Arms Mobility*, for more information.

Gap Crossing. Gap crossing in support of maneuver is like breaching in that the maneuver force is vulnerable while it is moving through a breached lane or across a tactical bridge. When the GCE encounters a complex obstacle system, breaching activities can incorporate gap crossing as a mutually supportive reduction method. Under these tactical conditions, however, the primary focus of planning and preparation are directed toward the breach, while gap crossing considerations are typically discussed as a subordinate part of the larger combined arms, complex obstacle reduction effort.

Route and Area Reconnaissance and Clearance. Combat engineers conduct route and area reconnaissance and clearance to support maneuver by collecting information about a route's key terrain features, obstacles, enemy activity, and the mechanical condition. Combat engineers can detect, mark, reduce, and clear explosive hazards (EHs) (including landmines) and improvised explosive devices that exist along the route or within the area selected for reconnaissance. When attached, EOD personnel provide the capability to render safe, neutralize and exploit EHs and explosive ordnance. Refer to MCRP 10-10.1, *Countering Explosive Hazards*, for detailed information about the engineering techniques to clear EHs. Refer to MCRP 10-10D.1, *Multi-Service Tactics, Techniques and Procedures for Explosive Ordnance*, for information about EOD techniques for explosive ordnance.

Forward Aviation Combat Engineering. Forward aviation combat engineering encompasses engineer activities undertaken to support forward aviation ground facilities, such as landing strips, LZs, and FARPs. It can consist of hasty repair of existing aviation facilities or expedient construction of a tactical LZ to support aviation operations, including reconnaissance, defensive air support and anti-surface warfare. Refer to MCTP 3- 34A, *Combined Arms Mobility*, and MCRP 3-20B, *Aviation Ground Support*, for additional details pertaining to forward aviation combat engineering.

Constructing Combat Roads and Trails. Constructing combat roads and trails provides an expedient means of hasty bypass to an existing road that has man-made or natural obstacles, or a path for ground maneuver. (Constructing a combat trail to expedite the maneuver of armored vehicles is an example.) Site selection can be determined after conducting engineer reconnaissance.

Movement

Movement is the act of changing one’s physical location or position, not necessarily to gain an advantage over the enemy. Engineer activities conducted to support movement complement those applied to enhance maneuver but could occur at a separate time, by another unit, and could involve complex activities. For example, a combat road that was constructed by the CEB to support maneuver during one phase of an operation might evolve or be developed by the LCE so that it can be used as an MSR or ASR for vehicles that distribute CSS to widely dispersed elements of the supported force.

In most cases, engineers directly supporting movement are not under direct fire, though the threat of enemy observation and indirect fire is always a factor during major combat operations. The MAGTF’s ability to travel freely across its AO depends on four engineer activities that must be coordinated and synchronized to avoid interrupting the operational tempo of the combined arms force:

- Route and area reconnaissance and clearance.
- Improving and expanding air facilities.
- Improving and expanding the capacity of the GLOC.
- Countering EHs.

Route and Area Reconnaissance and Clearance. Route and area reconnaissance and clearance helps maintain open GLOC to support operations. It confirms MSRs and ASRs are safe for vehicles to travel, and an area is safe for occupation. These missions can collect information about key terrain features, obstacles, and man-made features along a specific route or within a selected area. Mission requirements determine the frequency of route reconnaissance and clearance operations.

Improving and Expanding Air Facilities. The MAGTF engineer units can design, construct, and operate a new airfield, improve a recovered airfield, or employ expeditionary airfield systems at an existing bare-base airfield to enable the functions of Marine aviation. Additionally, MAGTF engineer units can perform airfield damage repair to restore the operational capability of an air facility after an enemy attack.

Improving and Expanding the Capacity of the GLOC. The MAGTF engineer units can construct, improve, or expand existing roads and bridges that are part of the GLOC to increase the volume of traffic within the MAGTF AO. MAGTF engineer units could construct nonstandard bridges to replace damaged existing bridges or to provide an additional means to cross a natural obstacle. These engineer activities improve movement within the MAGTF AO and facilitate the delivery of CSS.

Countering Explosive Hazards. Countering EHs is the application of the engineer disciplines and functions of combat engineering according to the commander's guidance regarding types of EHs, to enable freedom of action for friendly forces. Combat engineers can counter EHs by conducting engineer tasks as part of combined arms teams to provide maneuver commanders the ability to accomplish missions more effectively and safely.

COUNTERMOBILITY

The MAGTF engineer units are often required to emplace or construct obstacles in direct support of maneuver. These countermobility activities provide security and prevent the enemy from using the existing natural terrain (e.g., high-speed maneuver corridor) for an attack. Man-made obstacles are designed and constructed to block, turn, fix, or disrupt enemy forces and the original purpose for constructing obstacles could change over time. For example, as operations progress from an offensive to a defensive phase, previously emplaced obstacles can be improved or expanded to integrate with the MAGTF's ground defensive positions and fire support plan. Refer to MCTP 3-34B, *Combined Arms Countermobility*, for additional information regarding engineer activities in direct support of countermobility and maneuver.

SURVIVABILITY

In addition to engineer activities conducted for mobility and countermobility purposes, MAGTF engineer units can deploy task-organized elements to improve the survivability of the MAGTF. During maneuver, expediently constructed earthen berms offer additional protection to key weapon systems (e.g., amphibious combat vehicles, assault amphibious vehicles, anti-air and anti-ship missile launchers) and their crews. Activities conducted at contingency bases to protect combat power, such as construction of aircraft revetments and berms around aviation fuel and ordnance, permit the ACE to maintain sufficient sorties to support combat operations. Camouflage, decoys, dispersion, and redundancy improve survivability and lower the detectable signature of friendly forces. Refer to MCTP 3-34C, *Survivability Operations*, for additional information on engineer activities related to survivability.

Hardening Infrastructure

Engineer activities to harden infrastructure prevent the destruction of C2 facilities and protect key assets (e.g., storage areas for bulk fuel, bulk water, or ordnance) against the effects of enemy weapons. Force protection and engineer planners can identify vulnerabilities and recommend mitigation measures, to include constructing vehicle barriers to achieve standoff distance, and installation of sandbags, pre-detonation screening, or rapid-assembly protective wall bastions to improve the protective qualities of an existing facility.

Protecting Supplies

Engineer activities conducted to protect critical supplies can include constructing berms to contain bulk fuel and ammunition storage or constructing decoys to confuse enemy targeting. Berms limit the possibility of a catastrophic chain reaction from occurring (particularly when the enemy could potentially use scatterable munitions or unmanned aerial vehicles to attack bulk fuel or ammunition storage sites). Realistic decoys make target selection more difficult for the enemy and can cause the enemy to expend munitions against "false" targets.

ENABLING COMBAT SERVICE SUPPORT

The MAGTF can deploy alone or as part of a larger, aggregated force to conduct missions throughout the competition continuum under permissive, uncertain, or hostile threat conditions. While deployed, sustainment for the MAGTF arrives by a global network of transportation modes matched with distribution methods and infrastructure to provide expedited delivery of the essential supplies and equipment to the area in need. The MAGTF conducts self-sustained operations, logistically supported from a sea base containing amphibious, maritime prepositioning, and commercial vessels, or support obtained from local logistic resources (e.g., contingency contracting). Expeditionary logistics supports MAGTF operations by creating a temporary support apparatus necessary to sustain operations to their conclusion. The ESB and NCF possess the engineering capability and capacity to accomplish general support activities that can improve the distribution of CSS.

General Support Engineering Activities

To achieve the uninterrupted distribution of CSS across the MAGTF AO, it is vital that the engineer and logistics stakeholders coordinate early and throughout the planning process. This close coordination ensures the synchronization of MAGTF engineering activities with the pace of operations and the CSS distribution apparatus established by the LCE. It also permits development of accurate material estimates and matches them with the means to sustain forecasted engineering activities throughout all phases of an operation. General support engineering activities that improve the distribution of CSS include establishing bulk water production and storage sites; emplacing bulk fuel storage and dispensing facilities; constructing, improving, and maintaining base camps; maintaining and improving the distribution infrastructure; and providing engineer services.

Establishing Bulk Water Production and Storage Sites. Establishing and operating bulk water production and storage sites is critical to the success of all operations. Potable water provides the sustenance needed for Marines to fight under all environmental conditions. It is also necessary for medical treatment, mortuary affairs, and field messing. Non-potable water, at times, is acceptable for laundry, engineer construction, aircraft maintenance (when water meets quality standards outlined in aircraft technical manual), vehicle and equipment washing and maintenance, decontamination following attack by chemical, biological, radiological, and nuclear (CBRN) weapons (see Technical Bulletin Medical 577 for water quality standards), firefighting, pest control and dust control. Because of water's importance for warfighting and human survival, planners establish and displace bulk water production and storage sites to correspond with the movement of forces as described in the concept of operations. In addition to displacement concerns, engineer planners should consider redundancy to address the possibility of an enemy attack against a bulk water production and storage site. Refer to MCRP 3-40D.14, *Water Support Operations*, for additional information about planning, establishing, and operating water purification sites.

Emplacing Bulk Fuel Storage and Dispensing Facilities. Fuel is another essential commodity for conducting sustained military operations; it affords the MAGTF operational reach and sustain operational tempo. To maximize these effects, the design for emplacement of bulk fuel storage and dispensing facilities includes the flexibility to reposition, in response to the progress of combat actions. During the emplacement or displacement of bulk fuel storage and dispensing facilities, engineer activities focus primarily on horizontal construction to prepare the site for installation of bulk fuel equipment and to construct berms for protecting the fuel. Refer to MCRP 3-40B.5, *Petroleum Operations*, for information on bulk fuel operations.

Constructing, Maintaining, and Improving Base Camps. Some base camps are necessary to provide the support, facilities, and infrastructure systems necessary to receive and stage supplies and equipment essential to operations. Through the construction, maintenance, and improvement of bases, MAGTF engineer unit actions enhance personnel readiness, efficiency of operation, safety, durability, morale, and health standards for tenant and transient units. For additional information, refer to JP 4-04, *Contingency Basing*, and MCRP 3-40D.13, *Base Camps*.

Maintaining and Improving the Distribution Infrastructure. The MAGTF engineer units maintain and improve the distribution infrastructure to increase the responsiveness of CSS distribution across the MAGTF AO. Austere locations containing substandard roads, bridges, airports, seaports, warehouses, or storage areas, can affect the delivery of CSS. Refer to MCTP 3-40F, *Distribution and Transportation Operations*, for more information on distribution.

Providing Engineer Services

Engineer units support CSS distribution by providing engineer services (such as power generation and distribution, climate control, water production and storage, laundry, and field showers) at contingency bases, air facilities, and remote locations. These services can be oriented toward medical aid stations, command and control, unit readiness and other mission-related functions. Refer to MCRP 3-40D.14, *Water Support Operations*; MCRP 3-40D.17, *Electric Power Generation and Distribution*; MCTP 3-40D, *General Engineering*; and MCTP 3-40B, T*actical-Level Logistics*, for additional information.

ENGINEER RECONNAISSANCE

Reconnaissance is a mission undertaken to obtain information about the activities and resources of an enemy or adversary, or to secure data concerning the meteorological, hydrographic, geographic, or other characteristics of a particular area, by visual observation or other detection means. Engineer reconnaissance teams in the MAGTF conduct reconnaissance to support planning for mobility, countermobility, survivability, and general engineering activities. To support the reconnaissance mission, ERTs focus on collecting tactical and technical information using engineer reconnaissance tools. Information collected by ERTs can satisfy intelligence collection requirements (particularly those related to accurate geospatial information) or to support distribution of CSS.

Examples of information related to geospatial features include beach and LZ surveys. Examples of information related to the distribution of CSS include identifying sources of raw water for bulk water production, classifying and quantifying available natural construction materials (e.g., gravel, timber, sand), and identifying civilian sources of bulk petroleum products. The ERTs can also concentrate on the collection and evaluation of technical information related to host nation infrastructure and resources. Host nation infrastructure collection requirements can include air and seaports, roads, bridges, tunnels, railroads, fuel storage and distribution sites, water purification and potable water supply systems, power generation and distribution network and waste management facilities.

Engineer reconnaissance tools permit accurate measurement and reporting of the information collected by ERTs. Sometimes, reports created by ERTs need to be forwarded to civil engineer reachback centers in the United States via the MAGTF chain of command, to receive a more technical assessment of the information collected. Appendix A discusses civil engineer reachback centers. Appendix D of this publication contains standard reconnaissance forms and reports used by ERTs. Refer to MCRP 3-34.3, *Engineer Reconnaissance*, for information about how to use these forms and reports.

APPENDIX A.
ENGINEER RESOURCES

This appendix presents information related to allied, multinational, joint, and Service-specific resources that are available to assist engineer unit commanders and planners during the planning, execution, and assessment phases of operations. The same resources can also be helpful to formal school instructors, curriculum developers, and combat developers.

ALLIED AND MULTINATIONAL RESOURCES

The United States actively participates in multinational military organizations and security establishments. The largest of these are North Atlantic Treaty Organization (NATO) and the American, British, Canadian, Australian, New Zealand (ABCANZ) Armies' Program, which use an extensive collection of doctrinal and technical publications to enhance interoperability and standardization. To obtain access to these and other interoperability products, contact the Allied Military Standardization Coordinator at Training and Education Command headquarters via an email sent to doctrine@usmc.mil.

North Atlantic Treaty Organization

The NATO Standardization Office maintains a protected website that provides access to NATO standardization agreements (also referred to as STANAGs), which are used to establish processes, procedures, terms, and conditions for common military or technical procedures or equipment between countries of the alliance. Additionally, standardization agreements record each nation's agreement to use all or part of a particular allied doctrinal publication. To reach the NATO Standardization Office website, use the link https://nso.nato.int/protected/home. The website also allows access to the NATO terminology database (NATO*Term*). The NATO*Term* database is now the sole authority for terminology, eliminating Allied Administrative Pub-6, *NATO Glossary of Terms and Definitions*.

The Military Engineering (MILENG) Center of Excellence (COE), in Ingolstadt, Germany, is one of several COEs established by NATO member nations to focus attention onto key areas within the allied joint warfighting functions. Seventeen sponsoring NATO member nations, including the United States, contribute personnel and funding to operate the MILENG COE. The MILENG COE supports its sponsoring nations, NATO, and other customers. The organization of the MILENG COE includes concepts and doctrine, training and education, and lessons learned branches. The concepts and doctrine branch serves as the custodian (author) for several allied MILENG publications and collaborates with the custodians of other allied publications to ensure complementary publications contain accurate descriptions of MILENG capabilities and TTP. It also supports the annual meeting of NATO senior joint engineer commanders and provides functional advice during each cycle of the NATO defense planning process. The training and education branch is responsible for curriculum development and delivery of several resident officer and staff noncommissioned officer courses. These courses prepare allied students to participate as staff officers at the NATO strategic, operational, or tactical levels.

The MILENG COE lessons learned branch collects and analyzes lessons learned. The MILENG COE's public website gives an overview of course schedules, significant events, and lessons learned. To reach the website, use the link http://www.milengcoe.org.

American, British, Canadian, Australian, and New Zealand Armies' Program

The ABCANZ Armies program produces and uses standards, reports, and databases to support greater interoperability among the land forces of participating nations. The program describes these interoperability items as products. To view ABCANZ products, use the link https://wss.apan.org/cda/abcanz-armies/productslibrary. An account must be established before users can view products on the ABCANZ website.

DEPARTMENT OF DEFENSE RESOURCES

Joint Doctrine

The Joint Staff, J-7 (Joint Force Development) directorate of the joint staff manages the joint doctrine library. The three JPs that are most useful to engineer planners in the FMF are JP 3-02, *Amphibious Operations*; JP 3-15, *Barriers, Obstacles, and Mines in Joint Operations*; and JP 3-34, *Joint Engineer Operations*. Equally useful is the *DoD Dictionary*. The Joint Electronic Library contains all joint publications. The library is available to personnel with common access cards (CACs) at https://jdeis.js.mil/.

The joint staff also manages the Joint Lessons Learned Information System, a CAC-enabled website located at https://www.jllis.mil/, and the Joint Engineer Common Operating Picture (JECOP). The JECOP is a web application that allows joint engineers the capability to better visualize engineer activity, link tactical and operational activities to strategic effects, and assess engineer operations throughout each respective combatant commander's area of responsibility to inform recommendations about current and future plans. The JECOP is CAC-enabled and is located at https://jecop.usace.army.mil. The JECOP also provides the Reachback Engineer Data Integration (also referred to as REDi) link to request technical assistance from the civil engineer staff of either the U.S. Army Corps of Engineers or Naval Facilities Engineering Systems Command.

National Institute of Building Sciences

To coordinate the standardization of civil engineer military construction projects, the Department of Defense (DoD) uses a website sponsored by the National Institute of Building Sciences. It offers access to the current editions of all Unified Facilities Criteria (UFC) documents, which provide planning, design, construction, sustainment, and modernization criteria. These UFC documents apply to the Military Departments (MILDEPs), the defense agencies, and DoD field activities. The website also serves as a gateway to up-to-date information on integrated "whole building" design techniques and technologies. The goal of whole building design is to create a successful high- performance building by applying an integrated design and team approach to the project during the planning and programming phases. Although it is more applicable to civil engineer military construction than expedient temporary construction, the site supports direct collaboration among the Services and the civil engineer construction industry. The website is located at https://www.wbdg.org.

UNITED STATES MARINE CORPS RESOURCES

Marine Corps Engineer School

The Marine Corps Engineer School (MCES) provides subject matter expertise in support of HQMC and FMF engineers for allied and multinational matters concerning engineer force interoperability, standardization, and doctrine. This includes participation in military engineer-related meetings, working groups, doctrinal projects, capabilities development, training and readiness, explosive hazard and improvised threat training, and other studies.

Engineer units or personnel in the FMF who have questions related to allied or multinational doctrine or the NATO MILENG COE can contact the MCES S-3 or the allied military standardization coordinator at Training and Education Command headquarters for assistance. The MCES website offers a view of MCES offered courses and provides information related to current MCES managed activities. The public website is located at https://www.trngcmd.marines.mil/Units/Marine-Corps-Engineer School/.

Other Web-Based Resources

Additional Marine Corps websites that provide information related to doctrine, training, education, and weapon system and equipment resourcing activities include—

- *Marine Corps Doctrine Library*. Contains all unclassified publications and links to other doctrinal resources. It is a CAC-required site located at https://usmc.sharepoint-mil.us/sites/MCEN_Support_MCDoctrine.
- *Technical Data Management*. Publications. Contains all unclassified technical manuals. It is a CAC-required site located at https://app.mcboss.usmc.mil/suite/sites/support/page/home.
- *Marine Corps Systems Command*. Provides information regarding weapon system and equipment acquisition and total life cycle management. It is located at https://www.marcorsyscom.marines.mil/.
- *MarineNet eLearning Ecosystem*. Provides CAC-enabled users with online training resources to improve individual and collective MOS-related skills. It is located at https://www.marinenet.usmc.mil/.
- *Marine Corps Training and Information Management System*. Provides MOS-specific TPP on how to conduct both individual and unit training, as well as training management. It is located at https://mctims.usmc.mil/.

UNITED STATES NAVY RESOURCES

The Navy Warfare Library consists of two, CAC-enabled websites that contain unclassified and classified Navy doctrine publications. It includes publications related to the NCF, naval mine warfare, and mine countermeasure activities conducted in support of amphibious and distributed maritime operations. The unclassified publication website is located at https://doctrine.navy.mil. The classified publication website is located at https://doctrine.navy.smil.mil.

UNITED STATES ARMY RESOURCES

Army websites that provide information related to doctrine, technical publications, lessons learned, and technical engineering support include—

- *Army Publishing Directorate*. Affords access to view or download Army doctrinal and technical publications. It is located at https://armypubs.army.mil/.
- *The Center for Army Lessons Learned*. Allows a review of current and emerging trends, as well as best practices used by the Army engineer regiment. It is located at https://www.army.mil/call.
- *The United States Army Corps of Engineers*. Affords a more comprehensive understanding of how the United States Army Corps of Engineers provides contingency support, field force engineering, installation support, interagency and international support, and real estate management support via a network consisting of 44 different technical centers of expertise. It is located at https://www.usace.army.mil.
- *The United States Army Corps of Engineers Reachback Operations Center*. This center allows deployed units to reach back to professionally licensed civil engineers at the U.S. Army Corps of Engineers or Naval Facilities Engineering Systems Command, who can provide technical expertise in support of contingencies. The Reachback Engineer Data Integration portal of the JECOP allows access to the reachback center. The staff engineer office of the MAGTF headquarters reviews MAGTF requests for technical support prior to submission to the reachback center to ensure the request is accurate, valid and complies with the MAGTF commander's priorities. Submit unclassified matter requests for technical assistance to https://uroc-redi.usace.army.mil/sites/uroc/default.aspx. Submit classified matter requests for technical assistance via email to uroc@mail.smil.mil.

UNITED STATES AIR FORCE RESOURCES

Air Force websites that provide information about technical publications, civil engineer units, equipment, training, and technical support include an electronic publications library and the Air Force Civil Engineer Center (AFCEC).

Air Force E-Publishing

The Air Force's e-publishing website, located at https://www.e-publishing.af.mil, contains the Air Force's digital publication library. It includes civil engineer-related publications in the form of Air Force pamphlets (AFPAMs) and Air Force Tactics, Techniques, and Procedures (AFTTP) publications. Civil engineering AFPAMs contain 10-219 series numbering, while civil engineering AFTTP publications contain 3-32 numbering. These publications address topics such as the planning and design of expeditionary air bases and Air Force airfield damage repair operations. Pertinent civil engineering AFPAMs and AFTTP publications that may be of interest to MAGTF engineers include—

- AFPAM 10-219V4, *Airfield Damage Repair Operations*.
- AFPAM 10-219V5, *Bare Base Conceptual Planning*.
- AFPAM 10-219V6, *Planning and Design of Expeditionary Air Bases*.
- AFPAM 10-219V7, *Expedient Methods*.
- AFTTP 3-32.11, *Airfield Damage Assessment After Major Attack*.
- AFTTP 3-32.12, *Minimum Airfield Operating Surface (MAOS) Selection and Repair Quality Criteria (RQC)*.
- AFTTP 3-32.13, *Airfield Marking and Striping After Major Attack*.
- AFTTP 3-32.16, *Sustaining Airfield Pavement at Enduring Contingency Locations.*
- AFTTP 3-34V3, *Civil Engineer Expeditionary Force Protection*.

Air Force Civil Engineer Center

The AFCEC is responsible for providing responsive, flexible installation engineering services across the Air Force. The AFCEC's missions include facility investment planning, design and construction, operations support, real property management, readiness, energy support, environmental compliance and restoration, audit assertions, acquisition, and program management. The AFCEC website, located at https://www.afcec.af.mil/, describes the AFCEC organization and offers current information related to civil engineering in the Air Force. This information may be beneficial to MAGTF planners that are responsible for incorporating Air Force civil engineering capabilities (such as rapid engineer deployable heavy operational repair squadron engineer detachments, also referred to as REDHORSE detachments) to reinforce or augment the MAGTF. The AFCEC operates a technical engineering reachback center to assist deployed Air Force civil engineers during contingencies worldwide. Email requests for AFCEC Reachback Center support to AFCEC.RBC@us.af.mil. Similar to other external support requests, the MAGTF headquarters staff engineer office reviews requests prior to submission to the reachback center.

APPENDIX B. ENVIRONMENTAL CONSIDERATIONS

Environmental considerations can have an impact on engineer activities executed across the functions of mobility, countermobility, survivability, and general engineering. As a result, planning activities integrate environmental considerations within the operations process. Integrating environmental considerations into the operational planning process helps to identify, prevent, and mitigate potential threats to the environment (including those affecting historical and cultural resources) and potential environmental threats to friendly force and indigenous population. Environmental compliance is not a means to an end. Instead, it provides a synopsis of significant environmental findings and recommendations based on the analysis of environmental data, with the ultimate outcome of supporting a commander's decision to use or not use a particular site or to restrict or prohibit activities conducted at (within) that site.

Environmental policy and guidance in the DoD include Department of Defense Instruction (DoDI) 4715.05, *Environmental Compliance at Installations Outside the United States*; DoDI 4715.08, *Remediation of Environmental Contamination Outside the United States*; and DoD 4715.05-G, *Overseas Environmental Baseline Guidance Document*. Doctrinal publications, such as MCRP 3-40B.2, *Environmental Considerations* and MCRP 3-40B.7, *Waste Management for Deployed Forces*, provide best practices, techniques, and procedures for deployed forces. Deployed force commanders are obligated to judiciously apply combat power and limit negative environmental impacts to the extent that mission accomplishment and rules of engagement allow.

PLANNING

Within any joint force, the joint force engineer is responsible for devising the JFC's plan to mitigate negative impacts to the environment during joint operations. The JFC establishes policy and procedures for environmental compliance and reporting based on national law, international agreements, or host nation laws. The MAGTF commander and staff disseminates the JFC's guidance across the MAGTF and monitors compliance via environmental baseline surveys (EBSs) and incident reporting. Within the MAGTF headquarters, the staff engineer officer is responsible for preparing an environmental staff estimate and estimate of supportability. Since engineer projects are often extremely labor and construction-material intensive, they have the potential to produce a significant environmental impact. The engineer staff officer works with the logistics officer in performing site assessments for base camps and facilities. If necessary, the engineer staff officer and the staff judge advocate advise the commander on the necessity for an environmental assessment. The environmental staff estimate ensures that the activities of MAGTF engineer units comply with the JFC's environmental policies and procedures and host nation laws.

The MAGTF commander relies on engineer planners to ensure construction design and plans consider the environmental effects. This includes construction estimation for all material requirements (especially when use of local materials is considered) and designs that propose to modify the natural drainage of the terrain. Consequently, MAGTF engineer operations require the integration of environmental considerations throughout the planning, execution, and assessment cycle. In practice, environmental considerations are included into the coordinating instructions of standing operating orders, if not placed in Annex L (Environmental Considerations) of the operation order. When specific command guidance warrants, MAGTF staff officers might include environmental considerations content in the logistics and medical annexes. All operations must comply with federal law, status of forces agreements, or host nation law to the maximum extent possible. For a more detailed discussion on the range of requirements needed to complete and track all environmental management obligations, refer to DoDI 4715.05, DoDI 4715.08, MCRP 3-40B.2, and MCRP 3-40B.7. Refer to Appendix D of this publication for Department of Defense forms applicable to environmental matters.

MOBILITY

From a mobility standpoint, the assigned mission and survivability of the force supersedes environmental compliance during combat operations. When the tactical situation becomes more permissive, however, the MAGTF commander can commit more attention and resources to environmental compliance objectives. Engineer activities that support mobility can include expedient construction of combat roads, trails, and LZs; using local timber to construct nonstandard bridges and bunkers; and filling wet or dry gaps with soil to permit maneuver. All of these activities can have environmental effects because they modify natural drainage and remove existing vegetation.

COUNTERMOBILITY

During the defensive phase of operations, the MAGTF takes actions to defend itself and environmental compliance objectives are suspended. Since defensive tactics usually involve an offensive counterattack that requires mobility support, environmental compliance objectives might be suspended for an extended length of time. Engineer activities that support countermobility consist of constructing and emplacing non-explosive obstacles and barriers integrated with engagement areas and camouflaged ground defensive positions. Engineer units use bulldozers and excavators to create berms and anti-vehicle ditches, employ demolitions to crater roads and damage bridges, emplace wire obstacles, construct abatis, and use local timber to fabricate log cribs or similar anti-vehicle obstacles. All these activities can have environmental effects because they modify natural drainage and remove existing vegetation.

SURVIVABILITY

Marine air-ground task force engineer units conduct actions to improve the survivability of the force during offensive, defensive, and stabilization phases of operations. During the offensive phase, activities center on hasty construction of berms to protect combat vehicles and critical weapon systems. Vegetation removal and ground preparation occur during construction of expedient LZs.

During the defensive phase, activities focus on constructing and improving bunkers and emplacing obstacles and barriers at defensive positions and bases. Sandbags and force protection barriers are filled using local soil. Local timber and vegetation are used to construct overhead cover and for camouflage. To protect critical supplies (primarily fuel and ammunition) and contain damage that could result from enemy indirect fire berms are constructed. The application of dust abatement materials at air facilities, FARPs, and LZs helps to minimize their signature to avoid detection by the enemy and improve flight safety.

During the stabilization phase, actions might shift to address health concerns, such as waste management, hygiene, habitability, safety, and physical security at bases. If the enemy employs a CBRN weapon during any of these phases, engineer activities immediately focus on minimizing damage, conducting decontamination as directed by CBRN personnel, and restoring the fighting power of the force.

GENERAL ENGINEERING

In light of the nature of the tasks performed throughout all general engineering projects, planners incorporate environmental considerations into their project estimation. These factors apply to projects conducted both in the United States and overseas. During project estimation, planners become familiar with local conditions by studying geospatial intelligence, reviewing engineer reconnaissance reports, and conducting detailed site surveys. Activities such as bulk fuel operations, horizontal and vertical construction, field showers and laundry, water production, construction and operation of expeditionary base camps, and waste management may might require an engineer unit to conduct an EBS. The EBS assesses the potential impact of proposed projects and records the actual level of environmental impact produced by each general engineering activity. The EBS, along with occupational health monitoring by field medical teams helps to minimize hazardous effects to friendly and indigenous population. Based on the urgency of the tactical situation, the EBS requirement is suspended. An environmental site closure survey could be required when expeditionary bases or air facilities constructed by the MAGTF are either closed or deconstructed. This survey reports the environmental state for areas used by the MAGTF. See MCRP 3-40B.2 for additional information pertaining to environmental surveys.

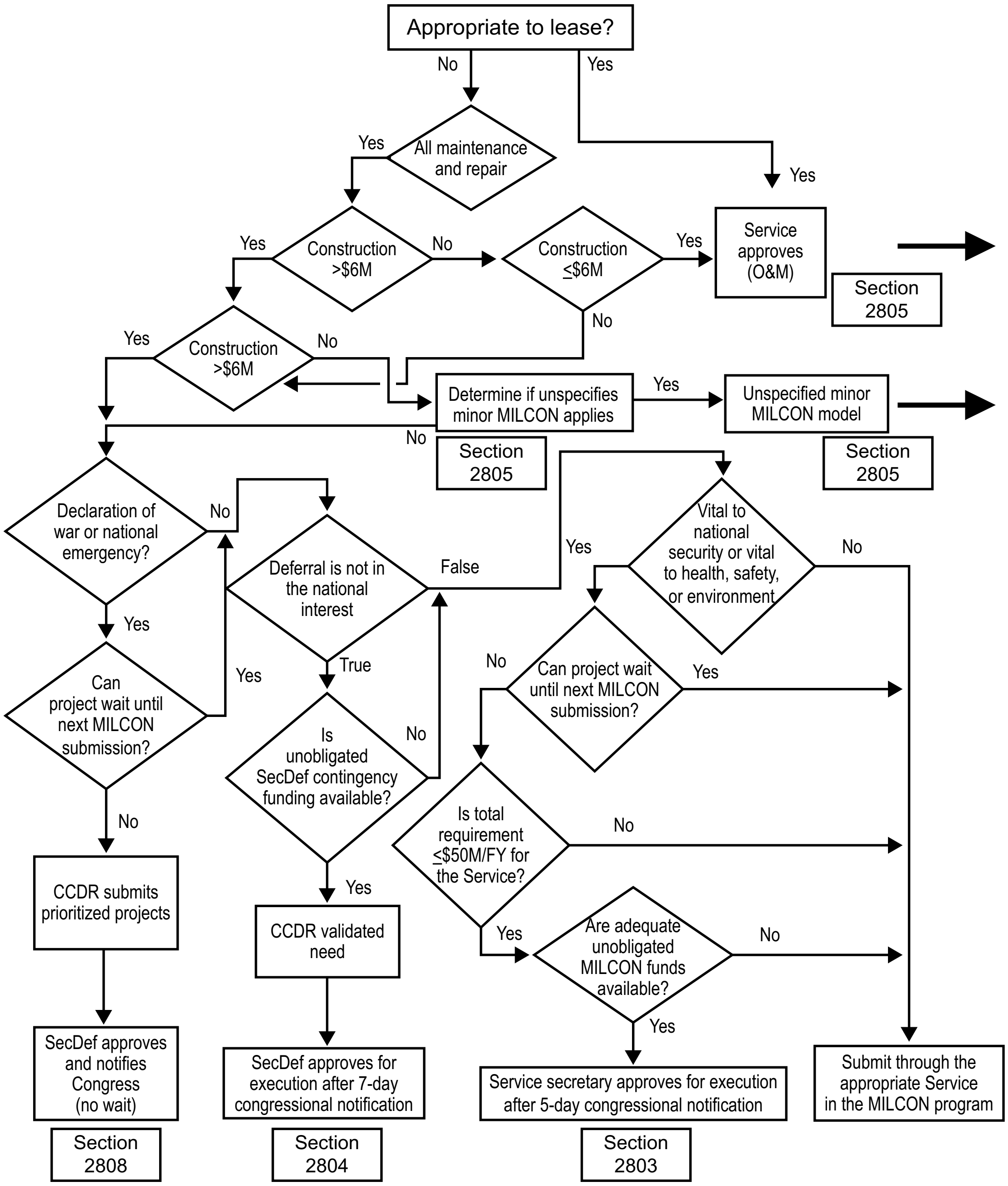
APPENDIX C.
CONTINGENCY CONSTRUCTION

This appendix divides the topic of contingency construction into two sections. The first is an overview of the process used to identify and adjudicate military construction (MILCON) requirements encountered during the execution of joint operations. Joint Publication 3-34 provides a more detailed description of the joint process and the construction continuum, which includes defining MILCON as any construction, alteration, development, conversion, or extension of any kind carried out with respect to a military installation. This appendix focuses on how the process applies to contingency construction. The second part reviews best practices collected from combat operations conducted in the US Central Command area of responsibility (AOR). It provides a narrative explanation of how personnel managed the contingency construction program during a particular period of Operation Iraqi Freedom to manage MAGTF engineering projects accomplished within and outside contingency bases and installations (e.g., base camps, forward operating bases). It does not discuss Marine Corps Force Design or tentative concepts for operating throughout the competition continuum. Appendix G contains information about funding for construction activities that occur during non-contingency situations (e.g., exercise related construction, security cooperation, humanitarian mine action, etc.). For additional information related to MAGTF engineer operation relationships, see *U.S. Marine Corps Forces (MARFOR) Logistics for Deployed Forces Handbook*.

JOINT OVERVIEW

Joint force commanders are required to comply with DoD guidance related to MILCON requirements and those public laws applicable to the funding provided to satisfy authorized MILCON requirements. Explicit guidance is contained in DoD 7000.14-R, *Department of Defense Financial Management Regulation*, and Department of Defense Directive 4270.5, *Military Construction*. Both documents are relevant to routine MILCON requirements submitted under the annual Future Years Defense Program and unforeseen requirements that arise during contingencies. Specific sections of USC Title 10 provide statutory guidance related to funding for MILCON during unique circumstances in Subtitle A; part IV; chapter 169; sections 2803, *Emergency construction*; 2804, *Contingency construction*; 2805, *Unspecified minor construction*; and 2808, *Construction authority in the event of a declaration of war or national emergency*. The dollar amounts established for each category of MILCON funding in USC Title 10 can be changed by legislative actions (such as a national defense authorization act).

Subsequent paragraphs provide short descriptions of each funding category, complemented by Figures C-1 and C-2. Figure C-1 depicts the contingency construction-funding model, which illustrates a process and decision flow chart for each of the MILCON funding categories described in sections 2803, 2804, 2805, and 2808 of USC Title 10. Figure C-2 depicts how the funding model applies to unspecified minor MILCON projects (e.g., section 2805 funding).

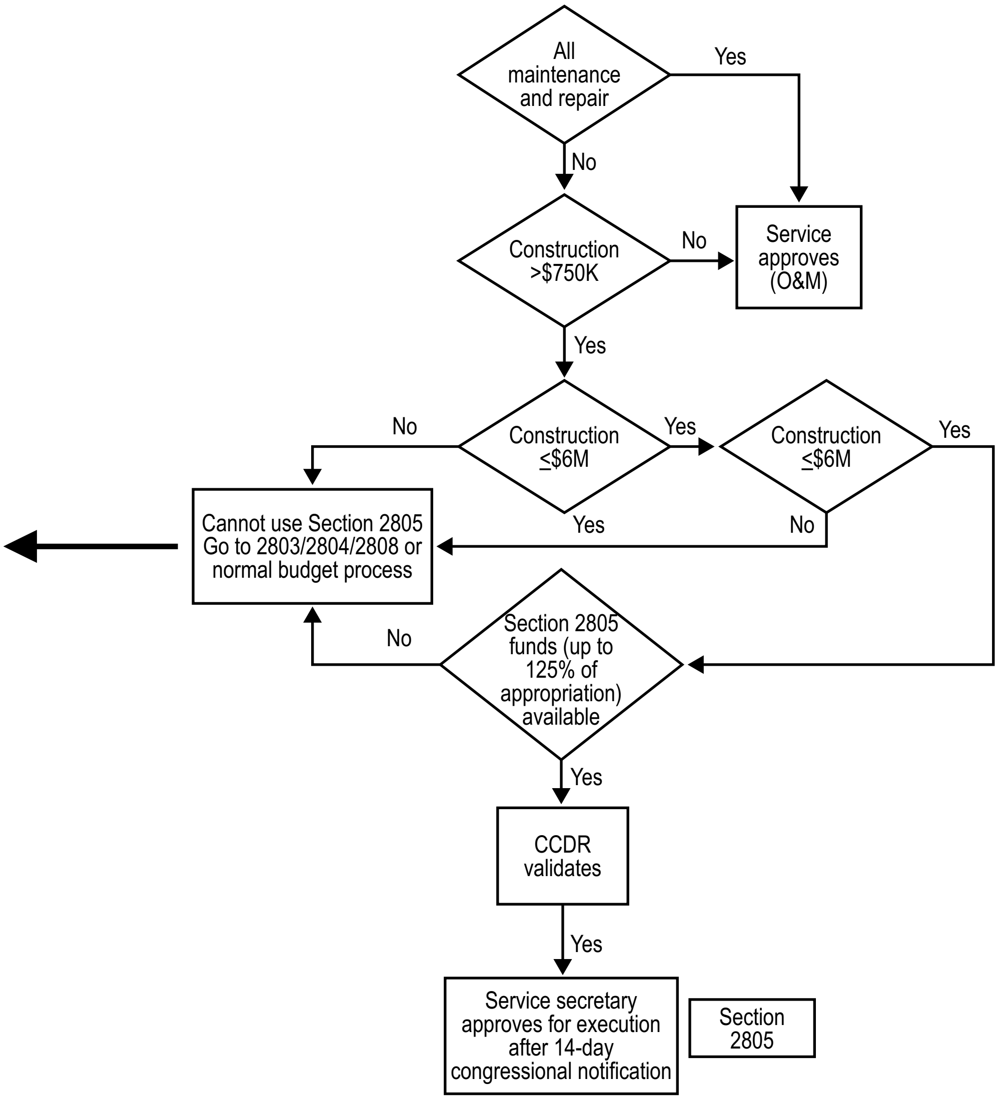


Note: Dollar amounts[1] depicted are subject to legislative change.

LEGEND

1	accurate per FY23 NDAA	**MILCON**	military construction
CCDR	combatant commander	**NDAA**	national defense authorization act
FY	fiscal year	**O&M**	operation and maintenance
M	million	**SecDef**	Secretary of Defense

Figure C-1. Contingency Construction Funding Model.



Note: Dollar amounts[1] depicted are subject to legislative change.

LEGEND

1	accurate per FY23 NDAA	**M**	million
CCDR	combatant commander	**NDAA**	national defense authorization act
FY	fiscal year	**O&M**	operation and maintenance
K	thousand		

Figure C-2. Contingency Construction Funding Model (Unspecified Minor).

Section 2803 authorizes the Secretary of Defense (SecDef) to obligate funding (currently $50 million across the DoD) per year of nonobligated appropriated funds for MILCON projects that are vital to national security or the protection of health, safety, or environmental quality and cannot wait for inclusion in the next Military Construction Authorization Act because of the level of urgency in protecting those interests. Access to these funds requires congressional notification, a 5-day waiting period after electronic notification, and availability of funds from the reprogramming of previously congressionally approved project funds.

Section 2804 provides that within the amount appropriated for such purpose, the SecDef can carry out a MILCON project not otherwise authorized by law or authorize the Secretary of a MILDEP to carry out such a project, if the SecDef determines that deferral of the project for inclusion in the next Military Construction Authorization Act would be inconsistent with national security or national interest. The SecDef can authorize a Service Secretary to carry out such a project. Congressional notification and a 7-day wait period after electronic notification is required before proceeding.

Subsection 2805 authorizes the SecDef or each Service Secretary to carry out unspecified minor MILCON projects not otherwise authorized by law. An unspecified minor MILCON project is a MILCON project that has an approved cost equal to or less than $6 million. Projects costing more than $750,000 require Secretary approval. Projects over $2 million require Secretarial notice and justification to congressional committees as well as a 14-day waiting period after electronic notification to Congress before proceeding. Unspecified minor MILCON projects costing less than $2 million can be funded with operation and maintenance (O&M) funds.

Section 2808 authorizes the SecDef, in the event of a declaration of war or a Presidential declaration of a national emergency (under 50 USC 1601), to undertake (or authorize the Service Secretaries to undertake) MILCON projects that are necessary to support the use of the Armed Forces for the war or national emergency. The funds for these projects must be nonobligated, MILCON-appropriated funds. The appropriate congressional committees must be notified of each project, but there is no waiting period before the project can begin.

Because of legislated limits and procedures associated with the use of DoD funding, there is considerable scrutiny applied to all requests for MILCON. The DoD and MILDEPs receive funding via authorized appropriations, which are contained in the NDAA approved each fiscal year by the President. An NDAA is a federal law specifying the budget and expenditures of the DoD. An appropriation is a provision of law conferring authority to incur obligations for a specific purpose. Military construction appropriations within the NDAA directly link to specific construction projects at authorized military installations or a named operation (e.g., Operation Iraqi Freedom). Requests for emergent funding for MILCON during a contingency are examined to ensure they are mission-essential and possess sufficient justification to warrant committing the finite resources of the DoD or MILDEPs or redirecting resources appropriated for another purpose (e.g., O&M).

To ensure compliance with regulations and harmonize oversight of contingency construction funding activities within their respective AOR, several combatant commanders have published additional AOR-specific guidance. Examples from United States Central Command, United States Pacific Command, and United States European Command AORs include *The Sand Book*;

Contingency Basing & Construction Standards, (also referred to as *The Blue Book*); and Pamphlet 420-100, *Standards for Forward Operating Sites*, (also referred to as *The Red Book*), respectively. In addition to tailoring the process to manage contingency construction requirements, prioritization, and funding based on conditions within the AOR, these books establish common standards for contingency construction and quality of life.

Operations conducted in response to contingencies often necessitate construction of new (or improvement of) existing facilities to meet minimum military needs. The DoD uses UFC to unify all technical criteria and standards pertaining to planning, design, construction, and operation and maintenance of real property facilities. Newly constructed facilities must meet criteria defined in UFC 1-201-01, *Non-Permanent DoD Facilities in Support of Military Operations*. Existing facilities must be assessed and meet the criteria defined in UFC 1-201-02, *Assessment of Existing Facilities for Use in Military Operations*. It is a preferred best practice to maximize use or improvement of existing facilities over construction of new facilities. Another best practice consideration is expedient construction (e.g., prefabricated buildings, clamshell structures), because its employment involves minimum time, cost, and risk.

Some contingencies require executing major combat operations. As the intensity of combat declines within the AOR, military activities begin to transition toward the stabilization and enable civil authority phases of operations. Because of the unstable nature of security within the combat area, military forces already located in the AOR deliver assistance, conduct hasty repairs to infrastructure, and support the restoration of civil services. To address costs associated with meeting emergent humanitarian needs, restoring civil services, and establishing civilian authority, the US Government can allocate specific funding be expended within the AOR. This funding can be provided by the Department of State, the United States Agency for International Development, or by the DoD and can be expended for construction projects or non-construction endeavors.

Marine Air-Ground Task Force Best Practices

Contingency basing and MILCON requirements for a deploying or deployed MAGTF are coordinated by the supported Marine Corps Service component command headquarters of each respective geographic combatant command, using the fiscal framework presented earlier in this chapter. This responsibility includes oversight of construction requirements, master planning, and base operating support service functions that originate from a MAGTF assignment as the base operating support integrator for a contingency base camp containing joint force and other agency tenants. It also includes coordination of construction projects accomplished within the MAGTF's assigned AO, but physically located outside the perimeter of a base camp or forward operating base.

A MAGTF construction requirement might be satisfied using the MAGTF's organic resources (i.e., O&M funding, supplies, equipment, and personnel) if several criteria are met. This can include ensuring the urgency of need and mission-essential justification is valid; the statement of work is accurate; the project is consistent with priorities established by the MAGTF commander, Marine Corps component commander, and combatant commander; and the project's estimated cost is within the prescribed cost range that can be approved by the MAGTF commander.

Delineate the project's statement of work on Department of Defense (DD) Form 1391, *Fiscal Year MILCON Project Data*, when the estimated cost exceeds the MAGTF commander's funding approval authority, or the statement of work involves civil engineer capabilities not inherent to the MAGTF. Submit the DD Form 1391, along with the MAGTF commander's endorsement of the project's justification and priority, for approval via the Marine Corps Service component commander. The DD Form 1391 permits several key organizations in the funding approval chain of command to review the request for construction funding. Depending on the estimated total cost of the project, the following organizations may review the DD Form 1391: Marine Corps Service component command, geographic combatant command, HQMC, Secretary of the Navy, SecDef, and Congress. The contract construction agent for the respective AOR in which the MAGTF operates manages funds approved for civil engineering projects. Appendix D of JP 3-34 provides additional information related to this topic, along with a list of organizations assigned as contract construction agents for geographic combatant command AORs.

Because it is not always possible to predict exactly how much a single structure will cost during the early stages of a contingency or know which source of funding will be available for construction, some MAGTFs have made the use of the DD Form 1391 compulsory for all contingency construction support requests. Use of the DD Form 1391 in this fashion enables the MAGTF headquarters to quickly review, prioritize, endorse, and forward the request to the appropriate funding approval authority. The MAGTF headquarters staff engineer officer can also use the DD Form 1391 to synchronize technical and logistical details related to each project. This can include details associated with prioritizing and scheduling the assignment of construction missions to MAGTF engineer units, justifying requests for engineer augmentation from another Service or for commercial civil engineers, forecasting consumption and prioritizing distribution of construction materials, coordinating performance of EBSs prior to construction, and acquisition or lease of real estate. See Appendix D of this publication for a blank DD Form 1391.

In addition to using organic engineer resources to accomplish construction projects to meet the MAGTF's internal requirements, MAGTF engineer units may perform general engineering tasks to meet JFC contingency construction requirements. Funding for procurement of bill of material for JFC-directed construction are provided by the JFC prior to construction, or the MAGTF can commit on-hand supplies and then seek reimbursement or replacement-in-kind from the JFC after the general engineering project has been completed.

To improve coordination of the construction project process during lengthy contingency operations, many MEF- or MEB-sized MAGTFs have established and operated a headquarters-level working group. These functionally oriented working groups have been specifically devoted to MAGTF engineering matters related to the management of MAGTF engineering projects, oversight of facility utilization, and the employment of MAGTF resources. Each working group employs a collaborative staffing process to manage contingency construction (inclusive of general and civil engineering projects), while using the contingency construction-funding model. In all cases, the collaborative process begins with submission of a construction project request. It involves technical review, prioritization, approval (or disapproval), work assignment (by an engineer tasking order, a fragmentary order, or awarding of a contingency construction contract), acquisition of construction materials, and execution of construction. It concludes with final inspection, acceptance of the completed structure or structures, and occupancy.

To improve the efficiency of the collaborative process, most working groups have used a spreadsheet (also referred to as the prioritized engineer project list or PEPL) to consolidate key details related to all engineer projects. Ad hoc titles, such as prioritized engineer project list working group and engineer synchronization working group have been used by MAGTFs to identify each respective working group. The selection of the title MAGTF Engineering Board has resolved this standardization issue.

Appendix D.
ENGINEER FORMS AND REPORTS

This appendix incorporates relevant content from MCRP 3-34.4, *Engineer Forms and Reports*, (canceled by this publication) and current MAGTF engineer publications into a single location to make MCWP 3-34 more useful for engineer planners, engineer units, and formal school instructors. These forms and reports are applicable to engineer activities conducted across the competition continuum and under any threat condition. Engineer communities in the Army and Marine Corps share use of most of these forms and reports. To gain access or download fillable forms and reports, visit the DoD Forms Management website at http://www.esd.whs.mil/Directives/forms/. Below is a consolidated list of forms and reports that appear in this appendix, organized according to the respective engineer functions of mobility, countermobility, and general engineering. These forms were current as of the date of publication; it is incumbent on the user to check the website above to ensure updates have not been made before using them.

> *NOTE:* The forms visible below are "shells" of the actual documents. Readers can open the forms by double-clicking on the image. Any forms that have been made fillable will require the user to click "Enable All Features" upon opening the form.

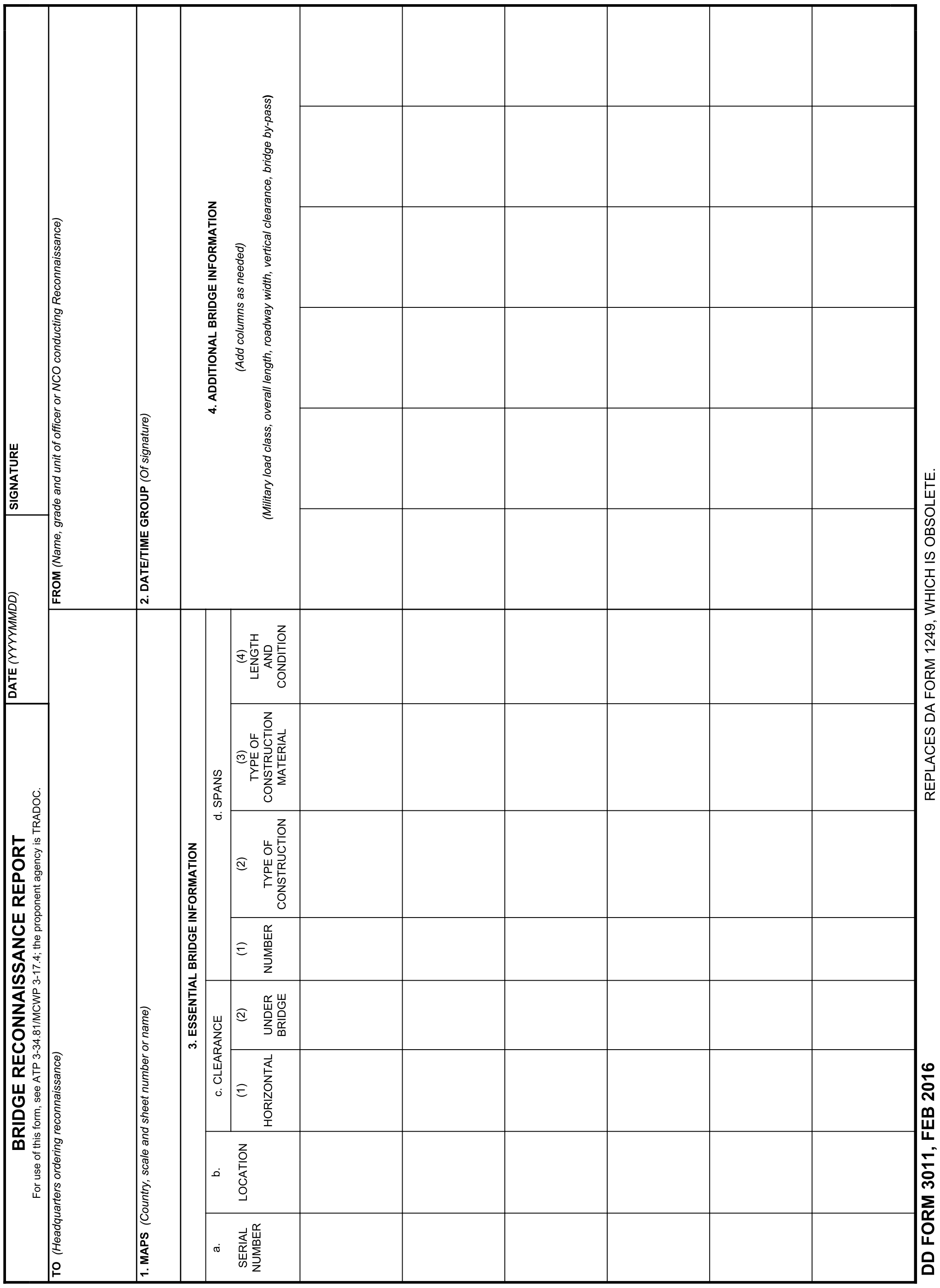
LIST OF FORMS

Mobility Forms and Reports

Countermobility Form

General Engineering Forms and Reports

Mobility Forms and Reports



BRIDGE RECONNAISSANCE REPORT

For use of this form, see ATP 3-34.81/MCWP 3-17.4; the proponent agency is TRADOC.

BRIDGE RECONNAISSANCE REPORT	DATE *(YYYYMMDD)*	SIGNATURE
TO *(Headquarters ordering reconnaissance)*	FROM *(Name, grade and unit of officer or NCO conducting Reconnaissance)*	
1. MAPS *(Country, scale and sheet number or name)*	2. DATE/TIME GROUP *(Of signature)*	

3. ESSENTIAL BRIDGE INFORMATION								4. ADDITIONAL BRIDGE INFORMATION *(Add columns as needed)* *(Military load class, overall length, roadway width, vertical clearance, bridge by-pass)*					
a. SERIAL NUMBER	b. LOCATION	c. CLEARANCE		d. SPANS									
		(1) HORIZONTAL	(2) UNDER BRIDGE	(1) NUMBER	(2) TYPE OF CONSTRUCTION	(3) TYPE OF CONSTRUCTION MATERIAL	(4) LENGTH AND CONDITION						

DD FORM 3011, FEB 2016 REPLACES DA FORM 1249, WHICH IS OBSOLETE.

Figure D-1. Bridge Reconnaissance Report (Click Image to Open Entire Form).

FERRY RECONNAISSANCE REPORT

For use of this form, see ATP 3-34.81/MCWP 3-17.4; proponent agency is TRADOC.

DATE *(YYYYMMDD)*

TO: *(Headquarters ordering the reconnaissance)*

FROM: *(Name, grade, and unit of reconnaissance officer)*

1. ROUTE OR LINE		2. FROM *(Initial point)*	3. TO *(Terminal point)*	4. DATE/TIME *(Of signature)*
a. HIGHWAY	b. RAILROAD			

5. MAP SERIES	6. SHEET NUMBER	7. GRID REFERENCE		8. FERRY	9. CLASS
		a. TYPE	b. COORDINATES		

10. LOCATION FROM NEAREST TOWN			11. CROSSING *(Name of stream or body of water)*
a. DISTANCE	b. DIRECTION	c. NAME OF NEAREST TOWN	

12. LIMITING FEATURE *(Condition of vessels, terminals, floods, low water, freezing, tides, and so forth.)(Seasons and dates)*

13. WATER LEVELS *(Depths)*			14. CROSSING TIME	15. LENGTH
a. LOW	b. MEAN	c. HIGH		

16. VESSEL FEATURES *(Attach photographs)*

a. UNITS	b. CONSTRUCTION TYPE	c. PROPULSION METHOD			d. LENGTH	e. BEAM	f. DRAFT	g. TONNAGE		h. CAPACITY		
		(1) TYPE	(2) UNITS	(3) HP				(1) GROSS	(2) NET	(1) PASS	(2) VEHICLE	(3) RAILROAD CARS

17. TERMINAL FEATURES

a. DIRECTION OF BANK	b. NAME	c. SLIP			d. DOCKING FACILITIES	e. APPROACHES				
						(1) HIGHWAY			(2) RAILROAD	
		(1) WIDTH	(2) DEPTH	(3) CAPACITY		(a) SURFACE	(b) LANES	(c) CLASS	(a) TRACKS	(b) SIDING
N E S W N										
N E S W N										

18. REMARKS *(Amplify above details. Note obstructions, navigational, and other pertinent data.)*

DD FORM 3014, FEB 2016 REPLACES DA FORM 1252, WHICH IS OBSOLETE.

Figure D-2. Ferry Reconnaissance Report (Click Image to Open Entire Form).

FORD RECONNAISSANCE REPORT

For use of this form, see ATP 3-34.81/MCWP 3-17.4; the proponent agency is TRADOC.

DATE *(YYYYMMDD)*

TO: *(Headquarters ordering reconnaissance)*	**FROM:** *(Name, grade and unit of reconnaissance officer)*

1. ROUTE NUMBER	**2. FROM** *(Initial point)*	**3. TO** *(Terminal point)*	**4. DATE/TIME** *(Of signature)*

5. MAP SERIES NUMBER	**6. SHEET NUMBER**	**7. GRID REFERENCE**		**8. FORD NUMBER**
		a. TYPE	b. COORDINATES	

9. LOCATION FROM NEAREST TOWN			**10. CROSSING** *(Name of stream or other body of water)*
a. DISTANCE	b. DIRECTION	c. NAME OF NEAREST TOWN	

11. CHARACTERISTICS OF CROSSING

WATER LEVELS	a. WIDTH	b. DEPTH	c. VELOCITY	d. DATE	e. SEASON OR MONTH(S)
(1) TODAY					
(2) LOW					
(3) MEAN					
(4) HIGH					

12. BOTTOM ☐ SAND ☐ GRAVEL ☐ STONE ☐ OTHER *(Specify)*:	**13. APPROACHES** ☐ FIRM ☐ SOFT ☐ PAVED	**14. SLOPE RATIO**

15. TYPE OF PAVEMENT	**16. USABLE WIDTH**	**17. HAZARDS** *(Flash floods, quicksand and so forth)*

18. REMARKS *(Description of approach roads, guide markers, depth gauges and so forth)*

DD FORM 3013, FEB 2016 REPLACES DA FORM 251, WHICH IS OBSOLETE.

Figure D-3. Ford Reconnaissance Report (Click Image to Open Entire Form).

RIVER RECONNAISSANCE REPORT For use of this form, see ATP 3-34.81/MCWP 3-17.4; the proponent agency is TRADOC.			**DATE ORDERED** *(YYYYMMDD)*
RECONNAISSANCE OFFICER/NCO *(Name, Rank, Unit)*		**ORGANIZATION ORDERING RECONNAISSANCE**	
1. ROUTE NUMBER OR NAME	**2. FROM** *(Initial point)*	**3. TO** *(Terminal point)*	**4. DATE/TIME OF COMPLETION**
5. MAP SERIES NUMBER	**6. SHEET NUMBER**	**7. GRID COORDINATES**	**8. OPORD NUMBER/NAME**

9. LOCATION FROM NEAREST TOWN			**10. CROSSING** *(Name of river or other body of water)*
a. DISTANCE	b. DIRECTION	c. NAME OF NEAREST TOWN	

11. CHARACTERISTICS OF NEARSHORE					
a. BANK HEIGHT	b. BANK SLOPE	c. BANK STABILITY	d. BANK SOIL TYPE	e. MINES	f. OBSTACLES *(Type)*
g. SLOPE TO DEPTH OF 2M	h. SOIL TYPE TO DEPTH OF 2M	i. MINES TO DEPTH OF 2M	j. OBSTACLES TO DEPTH OF 2M		

12. CHARACTERISTICS OF RIVER			
a. GAP WIDTH	b. VELOCITY *(m/sec)*	c. FLOW DIRECTION	d. BOTTOM COMPOSITION *(Mud, sand, gravel; hard-packed or* soft*)* 1/4 GAP ______ 1/2 GAP ______ 3/4 GAP ______
e. MAXIMUM DEPTH 1/4 GAP ______ 1/2 GAP ______ 3/4 GAP ______	f. ANCHORAGE SUITABILITY *(Describe)*	g. OBSTACLES	

13. CHARACTERISTICS OF FARSHORE					
a. BANK HEIGHT	b. BANK SLOPE	c. BANK STABILITY	d. BANK SOIL TYPE	e. MINES	f. OBSTACLES *(Type)*
g. SLOPE TO DEPTH OF 2M	h. SOIL TYPE TO DEPTH OF 2M	i. MINES TO DEPTH OF 2M	j. OBSTACLES TO DEPTH OF 2M		

14. REMARKS *(Describe the farshore and nearshore approaches, assembly areas, available cover and concealment, and overall assessment of crossing-site potential for freezing over or flooding.)*

DD FORM 3016, FEB 2016 REPLACES DA FORM 7398, WHICH IS OBSOLETE.

Figure D-4. River Reconnaissance Report (Click Image to Open Entire Form).

ROAD RECONNAISSANCE REPORT

For use of this form, see ATP 3-34.81/MCWP 3-17.4; proponent agency is TRADOC.

DATE *(YYYYMMDD)*

TO *(Headquarters ordering reconnaissance)*	**FROM** *(Name, grade and unit of officer or NCO making reconnaissance)*

1. MAPS	a. COUNTRY	b. SCALE	c. SHEET NUMBER OF MAPS	**2. DATE/TIME GROUP** *(Of signature)*

SECTION I - GENERAL ROAD INFORMATION

3. ROAD GRID REFERENCE

a. FROM

b. TO

4. ROAD MARKING *(Civilian or Military number of road)*

5. LENGTH OF ROAD *(Miles or kilometers, specify)*

6. WIDTH OF ROADWAY *(Feet or meters, specify)*

7. RECONNAISSANCE

a. DATE *(YYYYMMDD)*

b. TIME

8. WEATHER DURING RECONNAISSANCE *(Include last rainfall,if known)*

SECTION II - DETAILED ROAD INFORMATION

When circumstances permit more detailed information will be shown in an overlay or on the mileage chart on the reverse side of this form. Use standard symbols.

9. ALIGNMENT *(Check one ONLY)*

- ☐ (1) FLAT GRADIENTS AND EASY CURVES
- ☐ (2) STEEP GRADIENTS *(Excess of 7 in 100)*
- ☐ (3) SHARP CURVES *(Radius less than 100 ft (30m))*
- ☐ (4) STEEP GRADIENTS AND SHARP CURVES

10. DRAINAGE *(Check one ONLY)*

- ☐ (1) ADEQUATE DITCHES, CROWN/CAMBER WITH ADEQUATE CULVERTS IN GOOD CONDITION
- ☐ (2) INADEQUATE DITCHES, CROWN/CAMBER OR CULVERTS, ITS CULVERTS OR DITCHES ARE BLOCKED OR OTHER-WISE IN POOR CONDITION

11. FOUNDATION *(Check one ONLY)*

- ☐ (1) STABILIZED COMPACT MATERIAL OF GOOD QUALITY
- ☐ (2) UNSTABLE, LOOSE OR EASILY DISPLACED MATERIAL

12. SURFACE DESCRIPTION *(Complete Items 12a and b)*

a. THE SURFACE IS *(Check one ONLY)*

- ☐ (1) FREE OF POTHOLES, BUMPS, OR RUTS LIKELY TO REDUCE CONVOY SPEED
- ☐ (2) BUMPY, RUTTED OR POTHOLED TO AN EXTENT LIKELY TO REDUCE CONVOY SPEED

b. TYPE OF SURFACE *(Check one ONLY)*

- ☐ (1) CONCRETE
- ☐ (2) BITUMINOUS *(Specify type where known):*
- ☐ (3) BRICK *(Pave)*
- ☐ (4) STONE *(Pave)*
- ☐ (5) CRUSHED ROCK OR CORAL
- ☐ (6) WATERBOUND MACADAM
- ☐ (7) GRAVEL
- ☐ (8) LIGHTLY METALLED
- ☐ (9) NATURAL OR STABILIZED SOIL, SAND CLAY, SHELL, CINDERS, DISINTEGRATED GRANITE, OR OTHER SELECTED MATERIAL
- ☐ (10) OTHER *(Describe):*

SECTION III - OBSTRUCTIONS

List in the columns below particulars of the following obstructions which affect the traffic capacity of a road. If information of any factor cannot be ascertained, insert "NOT KNOWN".
(a) Overhead obstructions, less than 14 feet or 4.25 meters, such as tunnels, bridges, overhead wires and overhanging buildings.
(b) Reductions in road widths which limit the traffic capacity, such as craters, narrow bridges, archways, and buildings.
(c) Excessive gradients (Above 7 in 100)
(d) Curves less than 100 feet (30 meters) in radius
(e) Fords

13.a. SERIAL NUMBER	b. PARTICULARS	c. GRID REFERENCE	**d**. REMARKS

DD FORM 3010, FEB 2016 REPLACES A FORM 248, WHICH IS OBSOLETE.

Figure D-5. Road Reconnaissance Report (Click Image to Open Entire Form).

ROUTE CLASSIFICATION

For use of this form, see ATP 3-34.81/MCWP 3-17.4; the proponent agency is TRADOC.

SECTION I

1. SERIAL NUMBER	2. TO
3. FOR INFORMATION	4. DATE/TIME GROUP
5. NUMBER OF SHEETS OR ENCLOSURES	6. RECONNAISSANCE OFFICER/NCO
7. UNIT	8. FORMATION
9. SIGNATURE	

10. UNITS USED IN THE FORM *(Please check)*

☐ CENTIMETERS ☐ INCHES ☐ FEET ☐ MILES ☐ METERS ☐ KILOMETERS ☐ CENTIGRADE ☐ FAHRENHEIT

11. MAPS

12. COUNTRY	13. NAME
14. EDITION	15. SHEET NUMBER
16. SERIAL	17. SCALE

SECTION II

1. ROUTE CLASSIFICATION *(See Section VII, Block 7.1.)*

/ / / ( ) ( ) ( )

1 2 3 4 5 6 7

2. LIMITED BY SECTIONS

SECTION III

1. ROAD CLASSIFICATION *(See Section VII, Block 7.2.)*	2. WEATHER *(Include last rainfall, if known, plus the temperature)*	3. GRID REFERENCE - START

4. ROAD

SECTION A		5. PREFIX	6. LIMITED FACTORS	7. WIDTH	8. CONSTRUCTION	9. LENGTH	10. OBSTRUCTIONS
11. START GRID	12. FORMULA						
	13. SHOULDERS						
SECTION B							
11. START GRID	12. FORMULA						
	13. SHOULDERS						
SECTION C							
11. START GRID	12. FORMULA						
	13. SHOULDERS						
SECTION D							
11. START GRID	12. FORMULA						
	13. SHOULDERS						
14. GRID REFERENCE - END:							

SECTION IV

1. ENCLOSURES

SERIAL	TITLE	ATTACHED	SERIAL	TITLE	ATTACHED
1	OVERLAY(S)	☐	6	RAPID BRIDGE ASSESSMENT(S)	☐
2	MAP(S)	☐	7	DETAILED BRIDGE ASSESSMENT(S)	☐
3	DETAILED SKETCH(ES)	☐	8	PHOTOGRAPH(S)	☐
4	CALCULATION(S)	☐	9	OTHER *(Describe):*	☐
5	WORK ESTIMATE(S)	☐	10	OTHER *(Describe):*	☐

DD FORM 3009, FEB 2016 REPLACES DA FORM 1247, WHICH IS OBSOLETE. **Page 1 of 6**

Figure D-6. Route Classification Form (Click Image to Open Entire Form).

TUNNEL RECONNAISSANCE REPORT

For use of this form, see ATP 3-34.81/MCWP 3-17.4; proponent agency is TRADOC.

DATE *(YYYYMMDD)*

TO: *(Headquarters ordering reconnaissance)*

FROM: *(Name, grade and unit of reconnaissance officer)*

1. ROUTE OR LINE
a. HIGHWAY
b. RAILROAD

2. FROM *(Initial point)*

3. TO *(Terminal point)*

4. DATE/TIME *(Of signature)*

5. MAP SERIES

6. SHEET NUMBER

7. GRID REFERENCE
a. TYPE
b. COORDINATES

8. TUNNEL NUMBER

9. LOCATION FROM NEAREST TOWN
a. DISTANCE
b. DIRECTION
c. NAME OF NEAREST TOWN

10. TYPE *(Subaqueous, rock, soil)*

11. NAME *(Mountain or water feature)*

1 . LENGTH

13. NUMBER OF TRACKS

14. ROADWAY WIDTH

15. CLEARANCE
a. VERTICAL
b. HORIZONTAL

16. GRADE *(Percent)*

17. ALIGNMENT *(Straight or radius of curve)*

18. LINING *(Material)*

19. PORTALS *(Material)*

20. VENTILATION *(Type)*

21. DRAINAGE

22. CHAMBERED FOR DEMOLITION
☐ YES ☐ NO

23. COMPLETED *(Year)*

24. CONDITION *(Check appropriate box)*
☐ EXCELLENT ☐ GOOD ☐ FAIR ☐ POOR

25. BYPASSABILITY

26. ALTERNATE CROSSING

27. APPROACHES

28. IN-TUNNEL RESTRICTIONS

29. GEOLOGIC DATA

DD FORM 3012, FEB 2016 EPLACES DA FORM 250, WHICH IS OBSOLETE.

Figure D-7. Tunnel Reconnaissance Report (Click Image to Open Entire Form on Desktop).

EXPLOSIVE HAZARDS CLEARANCE REPORT

SECTION I - GENERAL INFORMATION

1. EXPLOSIVE HAZARDS AREA IDENTIFICATION		. TASK ORDER NUMBER
3. APPROVING AUTHORITY		4. UNIT
5. OFFICER IN CHARGE		6. REPORTED BY
7. MAP NAME		8. MAP SERIES NUMBER
9. MAP SHEET NUMBER	10. MAP SCALE	11. MAP EDITION
12. START DATE *(YYYYMMDD)*		3. COMPLETION DATE *(YYYYMMDD)*
14. AREA TO BE CLEARED *(m^2)*	15. REQUIRED DEPTH *(cm)*	16. TOTAL WORK HOURS

SECTION II - CLEARANCE INFORMATION *(Check more than one, if appropriate.)*

17. TYPE OF TASK

☐ CLEARING
☐ BREACHING

18. TECHNOLOGIES/METHODS USED

☐ MANUAL ☐ ROLLER ☐ EXPLOSIVE LINE CHARGE
☐ FLAIL ☐ MINIFLAIL ☐ DOZER
☐ DOGS ☐ OTHER

19. TERRAIN

☐ RURAL ☐ URBAN
☐ INDUSTRIAL ☐ GRICULTURAL
☐ WOODED ☐ OPEN
☐ SWAMP

20a. ACCIDENT/INCIDENT DURING CLEARING *(Attach additional sheets, if needed.)*
☐ YES ☐ NO

b. ACCIDENT IDENTIFICATION | c. DATE *(YYYYMMDD)*

d. DESCRIPTION

21. UNCLEARED AREA LEFT

☐ YES ☐ NO

20a. ACCIDENT/INCIDENT DURING CLEARING *(Attach additional sheets, if needed.)*
☐ LOCAL SIGNS ☐ OFFICIAL SIGNS
☐ FENCED ☐ NONE

23. UNCLEARED AREA DESCRIPTION

SECTION III - UNCLEARED AREA

24. TURNING POINT NUMBER	25. 10-DIGIT GRID COORDINATE
TP 1	
TP 2	
TP 3	
TP 4	
TP 5	
TP 6	
TP 7	
TP 8	
TP 9	
TP 10	
TP 11	
TP 12	
ADDITIONAL INFORMATION	

FORM 3008, DEC 2015 EPLACES DA FORM 7601, WHICH IS OBSOLETE. **Page 1 of 4**

Figure D-8. Explosives Hazards Clearance Report (Click Image to Open Entire Form).

Sample EOD 9-Line Report		
Line	**Description**	**Example**
Line 1	Date-Time Group (DTG): DTG of item discovery.	131200ZAUG23
Line 2	Reporting Activity Identification and Location: Unit identification code and location (8-digit grid of explosive ordnance).	2/5, D CO, 2 PLT, BS13221433
Line 3	Contact Information: Radio frequency, call sign, POC, and telephone number, email, or chat.	F400, SHOCKWAVE3, Lieutenant Radcliffe
Line 4	Type of Explosive Ordnance: 1. Method of emplacement: Dropped, projected, placed, possible IED, unknown, or thrown. If possible, provide the total number of items. 2. Description: Without touching, disturbing, or approaching the item, include details about size, shape, color, and condition (intact or leaking). 3. Method of discovery.	Possible 155MM, wrapped in wires and tape, 1 visual confirmed, multiple suspected.
Line 5	CBRN Contamination: Be as specific as possible (i.e., include visible and physiological effects). If CBRN contamination or hazard is suspected, follow up this report with an NBC spot report.	No
Line 6	Resources Threatened: Report any units, equipment, facilities, or other threatened assets.	Items located 1 meter off MSR SLEEPY
Line 7	Impact on Mission: Provide a short description of the current tactical situation and how the presence of the explosive ordnance affects that status.	Vehicle traffic restricted/stopped
Line 8	Protective Measures: Describe any measures taken to protect personnel and equipment.	Perimeter established, traffic halted
Line 9	Recommended Priority: Recommend a priority for response by EOD technicians.	Immediate

Figure D-9. Sample EOD 9-Line Report.

EXPLOSIVE HAZARDS SURVEY REPORT

SECTION I - GENERAL INFORMATION	
1. EXPLOSIVE HAZARDS AREA IDENTIFICATION	. TASK ORDER NUMBER
3. APPROVING AUTHORITY	4. UNIT
5. OFFICER IN CHARGE	6. REPORTED BY
7. MAP NAME	8. MAP SERIES NUMBER

9. MAP SHEET NUMBER	10. MAP SCALE	11. MAP EDITION
12. START DATE *(YYYYMMDD)*	13. COMPLETION DATE *(YYYYMMDD)*	14. AREA TO BE CLEARED *(m^2)*
15. EQUIPMENT USED	16. SPECIFIED DEPTH OF CLEARANCE *(cm)*	17. ADJUSTED DEPTH OF CLEARANCE *(cm)*
18. REASON FOR NEW DEPTH		

SECTION II - COORDINATES OF SURVEY *(Explosive hazards area reference)*	
19. REFERENCE POINT 1 DESCRIPTION/GRID	20. MEASUREMENT/AZIMUTH TO BENCHMARK
21. REFERENCE POINT 2 DESCRIPTION/GRID	22. MEASUREMENT/AZIMUTH TO BENCHMARK
23. BENCHMARK DESCRIPTION	24. MEASUREMENT/AZIMUTH TO START POINT
25. START POINT	26. MEASUREMENT/AZIMUTH TO TURNING POINT 1

27. TURNING POINTS	28. GRID OF FIRST TURNING POINT	29. DISTANCE *(m)*	30. AZIMUTH *(°)*
TP 1 to TP 2			
TP 2 to TP 3			
TP 3 to TP 4			
TP 4 to TP 5			
TP 5 to TP 6			
TP 6 to TP 7			
TP 7 to TP 8			
TP 8 to TP 9			
TP 9 to TP 10			
TP 10 to TP 1			
BOUNDARY LANE			

31. PERIMETER FENCE DESCRIPTION

DD FORM 3017, DEC 2015 REPLACES DA FORM 7602, WHICH IS OBSOLETE. **Page 1 of 4**

Figure D-10. Explosive Hazards Survey Report (Click Image to Open Entire Form).

BREACHING RECONNAISSANCE RECORD

SECTION I - GENERAL

1. FILE NUMBER	2. DEMOLITION RECON REPORT NUMBER	3. DATE *(YYYYMMDD)*	4. TIME

5. RECON ORDERED BY	5. RECON ORDERED BY
a. NAME AND RANK	a. NAME AND RANK
b. ORGANIZATION	b. ORGANIZATION

7. MAP INFORMATION			8. TARGET DATA	
a. NAME			a. COMPOUND NUMBER	b. BUILDING NUMBER
b. SCALE	c. SHEET	d. SERIES	c. TARGET NUMBER	d. BLUEPRINTS ON FILE *(X one)* ○ Yes ○ No *(If yes, attach)*

9. ENTRY LOCATIONS

a. DOOR TYPE *(X all that apply)*
- ☐ Wood
- ☐ Metal
- ☐ Security
- ☐ Barriers/Obstructions

b. WINDOW TYPE *(X all that apply)*
- ☐ Residential
- ☐ Casement
- ☐ Store Front
- ☐ Barriers/Obstructions

10. UTILITIES *(X all that apply)*
- ☐ Gas
- ☐ Water
- ☐ Electric
- ☐ Unknown

11. GENERAL STRUCTURE DESCRIPTION *(Use Block 14 for sketches)*

a. BUILDING FUNCTION *(X all that apply)*
- ☐ Residential
- ☐ Commercial
- ☐ Public and Civic
- ☐ Mixed Use

c. CONDITION *(X one)*
- ☐ Damaged
- ☐ Undamaged

b. CONSTRUCTION METHOD *(X all that apply)*
- ☐ Framed
- ☐ Mass (Frameless)

12. CONSTRUCTION COMPOSITION

a. TYPE OF STRUCTURE *(X all that apply)*
- ☐ Unit Masonry Unknown
- ☐ Concrete Unknown
- ☐ Stone
- ☐ Mud Brick
- ☐ Brick
- ☐ CMU
- ☐ Tilt Up
- ☐ Insitu
- ☐ Box Wall
- ☐ Framed Unknown
- ☐ Steel or Concrete Framed Unknown
- ☐ Half Timbered
- ☐ Light Wood Framed
- ☐ Light Cladding
- ☐ Heavy Cladding
- ☐ Infill CMU, Terra Cotta
- ☐ Other *(Specify)* ____________

b. EXTERIOR WALLS *(X all that apply)*
- ☐ Metal Curtain Wall
- ☐ Infill Brick (Stucco, painted, etc.)
- ☐ Infill Concrete Block (Stucco, painted, etc.)
- ☐ Precast Concrete Panel
- ☐ Insitu Concrete
- ☐ Stone
- ☐ Concrete Block
- ☐ Brick
- ☐ Wood
- ☐ Sandwich Panel
- ☐ Metal Panels
- ☐ Decorative Light Weight Concrete Panel
- ☐ Veneer Marble, Granite, etc.
- ☐ Window Wall
- ☐ Hollow Clay Tile
- ☐ Other *(Specify)* ____________

c. INTERIOR WALLS/PARTITIONS *(X all that apply)*
- ☐ Metal Partitions
- ☐ Concrete Block
- ☐ Brick
- ☐ Load Bearing Masonry (Brick or Block)
- ☐ Concrete
- ☐ Wood
- ☐ Gypsum Wallboard/Steel Studs
- ☐ Gypsum Block
- ☐ Gypsum Panels
- ☐ Gypsum Wallboard/Wood Studs
- ☐ Hollow Clay Tile (Plastered)
- ☐ Gypsum Chipboard
- ☐ Closet System
- ☐ Other *(Specify)* ____________

d. FLOORS *(X all that apply)*
- ☐ Precast Concrete
- ☐ Concrete
- ☐ Timber
- ☐ Small Floor Components
- ☐ Other *(Specify)* ____________

e. ROOF *(X all that apply)*
- ☐ Wood Trusses with Clay/Concrete Tile
- ☐ Steel Deck
- ☐ Precast Concrete
- ☐ Pseudo Concrete
- ☐ Insitu Concrete
- ☐ Asbestos Cement
- ☐ Other *(Specify)* ____________

SECTION II - BREACHING REQUIREMENTS

13. ADDITIONAL BREACHING CONSIDERATIONS

a. EQUIPMENT REQUIREMENTS

(1) *(X if applicable)*	(2) Quantity
☐ Ram	
☐ Pry/Lever	
☐ Break and Rake Tool	
☐ Assault Ladder	
☐ Thermal Breach Asset	
☐ Saw	
☐ Bolt Cutter	
☐ Blast Blanket	
☐ Other *(Specify)*	

b. EXPLOSIVE REQUIREMENTS

(1) *(X if applicable)*	(2) Quantity
☐ M456 (Det cord)	
☐ M023 (M112)	
☐ MN86 (M19)	
☐ ML47 (M11)	
☐ MN08 (M81)	
☐ MN88 (M21)	
☐ MN90 (M23)	
☐ Other *(Specify)*	

c. OTHER REQUIRED ASSETS

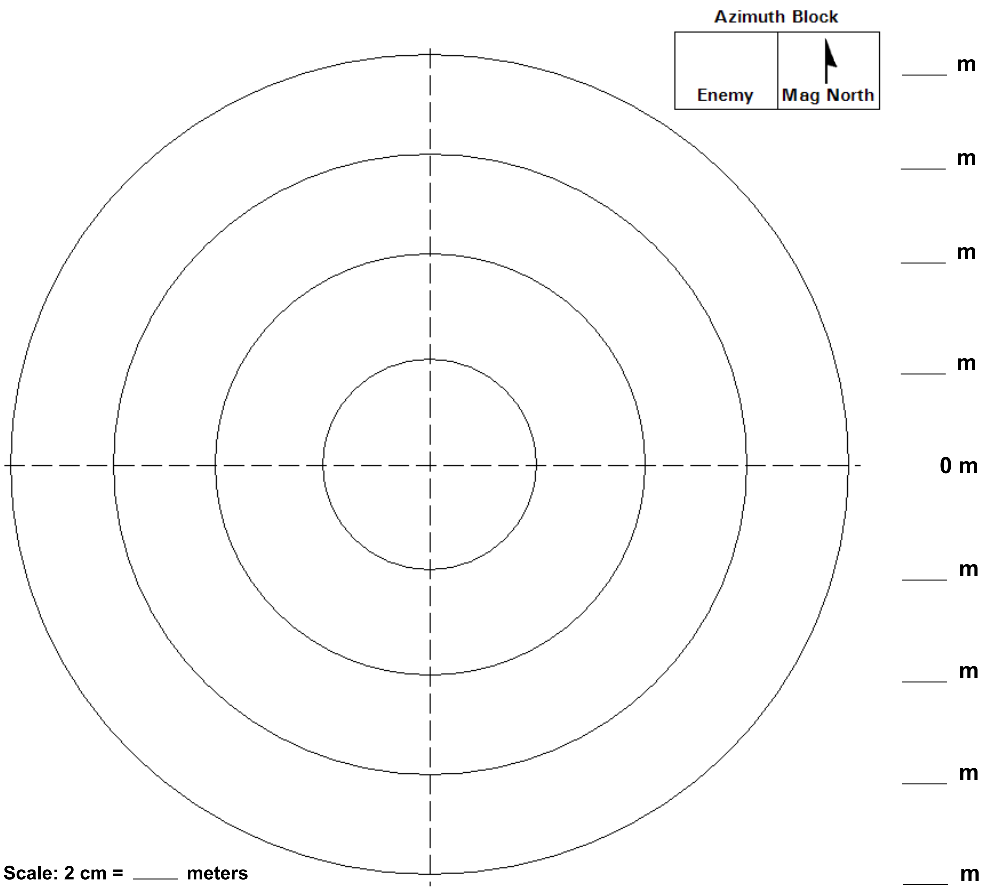
DD FORM 3020, FEB 2016

REPLACES DA FORM 2203, WHICH IS OBSOLETE.

Figure D-11. Breaching Reconnaissance Report (Click Image to Open Entire Form).

COUNTERMOBILITY FORM

HASTY PROTECTIVE ROW MINEFIELD RECORD



Tabular Block

Row	Type	Actuation	Mine Number
Remarks			

Identification Block

Unit	
Reference Point	
Remarks	
Map and Sheet No.	
Name of OIC	
Signature	Time and Date
Mines Removed	
Mines Transferred	

DD FORM 3007, DEC 2015 REPLACES DA FORM 1355-1, WHICH IS OBSOLETE.

Figure D-12. Hasty Protective Row Minefield Record (Click Image to Open Entire Form on Desktop; NOTE: User Must Click “Enable all Features” Upon Opening Form to View It).

GENERAL ENGINEERING FORMS AND REPORTS

Priority of Engineer Project List (Requesting Unit: Part A)						
Priority #	Project/Support Required	Requesting Unit	Date Requested	Location	Unit Assigned	Remarks

Figure D-13. Priority of Engineer Project List Example (Click Image to Open Entire Form and Instructions).

1. COMPONENT	FY ______ MILITARY CONSTRUCTION PROJECT DATA		2. DATE *(YYYYMMDD)*
3. INSTALLATION AND LOCATION		4. PROJECT TITLE	
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST *($000)*

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST *($000)*

10. DESCRIPTION OF PROPOSED CONSTRUCTION

DD FORM 1391, JUL 1999 PREVIOUS EDITION IS OBSOLETE. Reset PAGE NO. ______

Figure D-14. Military Construction Project Data Form (Click Image to Open Form).

Fragmentary Engineer Situation Report	
Alpha	Subject of the fragmentary SITREP, such as enemy minefield.
Bravo	Location of the subject.
Charlie	Time germane to the subject, not the time message is sent
Delta	Action desired or support requested.
Echo	Action taken by the reporting unit.
Foxtrot	Any other additional pertinent information.
Engineer Equipment Report (To cover static and mobile mechanical equipment).	
Alpha	Map sheets.
Bravo	Date and time of collection of information
Charlie	Location (grid reference or trace).
Delta	Type of equipment.
Echo	Number on hand.
Foxtrot	Condition of equipment.
Golf	Any other information which could be given.

Figure D-15. Fragmentary Engineer Situation Report and Engineer Equipment Report.

Engineer Reconnaissance Report Instructions

From: NO.___

(Organization)

To: _________________________________Effective___________________________(Date-time group)

Maps:____

Completed report to __________________________ at____
(Organization) (Place, time, and date)

1. **ROADS**: Classify using symbols.
2. **BRIDGES, FORD AND FERRIES**: Classify using symbols. Possible bypass for existing crossings.
3. **OBSTACLES TO OUR MOVEMENT**: Natural and artificial including demolitions, mines, and boobytraps.
4. **TERRAIN**: General nature, ridge system, drainage system including fordability, forest, swamps, areas suitable for mechanized operations.
5. **ENGINEER MATERIALS**: Particularly road material, bridge timbers, lumber, steel, and explosives
6. **ENGINEER EQUIPMENT**: Rock crushers, sawmills, garages, machine shops, blacksmith shops, etc.
7. **ERRORS AND OMISSIONS ON MAPS USED**.
8. **BARRIERS TO ENEMY MOVEMENT**: Natural, artificial, and sites for construction of improvement (work estimates).
9. **WATER POINTS**: Recommended locations.
10. **STREAMS**: General description, width, depth, banks, approaches, character of bottom, means to be used at possible crossing sites, and navigability.
11. **DEFENSIVE POSITIONS**.
12. **BIVOUAC AREAS**: Entrance, soil, drainage, sanitation, and concealment.
13. **PETROLEUM STORAGE AND EQUIPMENT**.
14. **UTILITIES**: Water, sewage, electricity, and gas.
15. **PORTS**: Warves, sunken obstacles, cargo handling facilities, storage facilities, and transportation routes.
16. **CONSTRUCTION SITES**: Drainage, water supply, power sources, earthwork, access, acreage, and soil.
17. **OTHER**:

Figure D-16. Engineer Reconnaissance Report Instructions.

ENGINEER RECONNAISSANCE REPORT

For use of this form, see ATP 3-34.81/MCWP 3-17.4; proponent agency is TRADOC.

1. OPORD NUMBER AND NAME	2. RECONNAISSANCE LEADER *(Name, grade, unit)*	3. LOCATION / DTG OF RECONNAISSANCE

4. MAPS / COUNTRY / SHEET NUMBER / NAME / SERIAL NUMBER / EDITION	5. SCALE

6. HEADQUARTERS ORDERING RECONNAISSANCE

a. KEY	b. OBJECT	c. TIME OBSERVED	d. WORK ESTIMATE	e. ADDITIONAL REMARKS AND SKETCH

Engineer work estimate on reverse side.

7. TYPED NAME, GRADE, ORGANIZATION	8. SIGNATURE

DD FORM 3015, FEB 2016

REPLACES DA FORM 1711, WHICH IS OBSOLETE.

Figure D-17. Engineer Reconnaissance Report (Click Image to Open Form).

Bulk Petroleum Contingency Report
(Insert date here)

A	B	C	D	E
PART I Location				
Insert town or city and grid				
Product	Issued Last 24 Hours	Receipts Last 24 Hours	On-Hand Inventory	Storage Capacity
JP-8	X	X	X	X
AVGAS	X	X	X	X
MOGAS	X	X	X	X
PART II Forecast				
	24 Hours	48 Hours	72 Hours	96 Hours
JP-8	X	X	X	X
AVGAS	X	X	X	X
MOGAS	X	X	X	X
PART III Equipment				
TYPE SYSTEM (capacity)	On Hand	In-Service	Notes	Storage Per
AAFS (1.2 million)	X	X		1,200,000
TAFDS (320K)	X	X		320,000
TAFDS (120K)	X	X		120,000
HERS (9K/18K)	X	X		9,000/18,000
ARC (5K)	X	X		5,000
MK970	X	X		5,000
PART IV Personnel				
	On Hand			
Enlisted Petroleum Supply Spec	X			
MK970 Driver/mechanic	X			
Petroleum Officer	X			
PART V Remarks				
Prepared by: Rank and name	XXXXXXXXX			
Telephone #: Valid/accurate telephone#	XXXXXXXX			

Legend:
JP-8 jet propulsion fuel, type 8
AVGAS aviation gasoline
MOGAS motor gasoline
AAFS amphibious assault fuel system
TAFDS tactical airfield fuel dispensing system
HERS helicopter expedient refueling system
ARC aviation refueling capability
MK mark
K thousand

Note: Report becomes SECRET when filled out with factual information.

Figure D-18. Bulk Petroleum Contingency Report.

WATER RECONNAISSANCE REPORT For use of this form, see ATP 4-44; the proponent agency is TRADOC		DATE	TIME OF RECONNAISSANCE
REPORTED BY *(Name , Grade, Organization)*			
FORWARDED TO *(Name and Organization)*			
MAP COORDINATES OF WATER SOURCE			
1. Quality-Quantity			
TYPE OF SOURCE	TDS		TEMPERATURE
TURBIDITY *(Estimate)*	pH TEST		QUANTITY
2. Site Conditions			
SECURITY			
DRAINAGE-SOIL TYPE			
TERRAIN			
BIVOUAC			
DISTANCE TO CONSUMERS		ROADS	
3. SKETCH OF AREA ***(Show road net and traffic circulation.) (Use reverse side for additional sketches, if necessary.)***			

DA FORM 1712, SEP 2015 PREVIOUS EDITIONS ARE OBSOLETE APD LC v1.00

Figure D-19. Water Reconnaissance Report. Click Image to Open.

DAILY WATER PRODUCTION LOG - 3,000 GPH ROWPU
For use of this form, see ATP 4-44; the proponent agency is TRADOC

SHIFT NO.

PART I. HOURLY CHEMICAL DOSAGE LOG

WATER POINT NO./ROWPU NO.	NCO IN CHARGE	DATE

TIME		SEQUESTRANT		POLYELECTROLYTE / SODIUM BISULFITE		CHLORINE		RAW TDS	PRODUCT TDS	TURBIDITY	pH		CHLORINE RESIDUAL *(ppm)*	REMARKS
ON	OFF	SPEED	STROKE	SPEED	STROKE	SPEED	STROKE	MG/L	MG/L	NTU	RAW	PRODUCT		

Chemicals Used						SIGNATURE OF NCO IN CHARGE WHEN COMPLETED
Chemicals On Hand						

DA FORM 1713, SEP 2015 EDITION OF MAY 91 IS OBSOLETE APD LC v1.00ES

Figure D-20. Daily Water Production Log; 3,000 Gallons Per Hour, Reverse Osmosis Water Purification Unit (Click Image to Open Entire Form).

DAILY WATER PRODUCTION LOG - 1,500 GPH TWPS
For use of this form, see ATP 4-44; the proponent agency is TRADOC

SHIFT NO.

PART I. HOURLY CHEMICAL DOSAGE LOG

WATER POINT NO./TWPS NO.	NCO IN CHARGE	DATE

TIME		ANTISCALANT		SODIUM BISULFITE		CHLORINE		RAW TDS	PRODUCT TDS	TURBIDITY	pH		CHLORINE RESIDUAL *(ppm)*	REMARKS
ON	OFF	SPEED	STROKE	SPEED	STROKE	SPEED	STROKE	MG/L	MG/L	NTU	RAW	PRODUCT		
Chemicals Used											SIGNATURE OF NCO IN CHARGE WHEN COMPLETED			
Chemicals On Hand														

DA FORM 1713-2, SEP 2015 APD LC v1.00ES

Figure D-21. Daily Water Production Log; 1,500 Gallons Per Hour, Tactical Water Purification System. (Click Image to Open Entire Form).

DAILY WATER PRODUCTION LOG - 125 GPH LWP

For use of this form, see ATP 4-44; the proponent agency is TRADOC

SHIFT NO.

PART I. HOURLY CHEMICAL DOSAGE LOG

WATER POINT NO./LWP NO.	NCO IN CHARGE	DATE

TIME		ANTISCALANT		SODIUM BISULFITE / COAGULANT		CHLORINE		RAW WATER TDS	TURBIDITY	PRODUCT WATER TDS	pH		CHLORINE RESIDUAL *(ppm)*	REMARKS
ON	OFF	SPEED	STROKE	SPEED	STROKE	SPEED	STROKE	PPM	NTU	PPM	RAW	PRODUCT		

Chemicals Used						SIGNATURE OF NCO IN CHARGE WHEN COMPLETED
Chemicals On Hand						

DA FORM 1713-3, SEP 2015 APD LC v1.00ES

Figure D-22. Daily Water Production Log; 125 GPH, Lightweight Water Purifiers. (Click Image to Open Entire Form).

DAILY WATER ISSUE LOG

For use of this form, see ATP 4-44; the proponent agency is TRADOC

WATER POINT NO.	NCO IN CHARGE	DATE

TIME	AMOUNT *(Gallons)*	CHLORINE RESIDUAL	PICKED UP BY *(Using Unit)*
	TOTAL		

REMARKS

DA FORM 1714, SEP 2015 EDITION OF MAY 91 IS OBSOLETE APD LC v1.00

Figure D-23. Daily Water Issue Log.

DAILY WATER DISTRIBUTION LOG

For use of this form, see ATP 4-44; the proponent agency is TRADOC

WATER POINT NO.	NCO IN CHARGE	DATE

TIME	RECEIVED		DISPATCHED	
	AMOUNT	UNIT	AMOUNT	UNIT
	TOTAL		TOTAL	

Total Amount On Hand

REMARKS

DA FORM 1714-1, SEP 2015 PREVIOUS EDITION ARE OBSOLETE APD LC v1.00

Figure D-24. Daily Water Distribution Log.

WATER POINT DAILY PRODUCTION SUMMARY

For use of this form, see ATP 4-44; the proponent agency is TRADOC

DATE

TO

FROM *(Organization)*

WATER POINT NO.	HOURS OPERATION	PRODUCTION *(Gallons)*	JP8 *(Gallons)*	OIL *(Quarts)*	CHEMICALS USED			
					POLYMER *(Ml)*	CITRIC ACID *(Grams)*	SODIUM HEX *(Grams)*	CALCIUM HYPOCHLORITE *(Pounds)*
DAILY TOTAL								

TYPED OR PRINTED NAME AND GRADE

SIGNATURE

DA FORM 1716, SEP 2015 PREVIOUS EDITION ARE OBSOLETE APD LC v1.00ES

Figure D-25. Water Point Daily Production Summary.

CLASSIFICATION: ______________________________

ENVIRONMENTAL BASELINE SURVEY (EBS) CHECKLIST

See ATP 3-34.5/MCRP 3-40B.2, Environmental Considerations; the proponent agency is TRADOC.

An EBS Checklist becomes a classified document once location coordinates or classified information is added. The document classification must be added as a header and footer to each page. All classified information must be labeled as classified. Classified material may be sent only through a SECRET Internet Protocol Router Network (SIPRNet).

DIRECTIONS: Completion of this form requires information research, records reviews, and a site visit. Do not leave a block empty. If a block does not apply to the site, enter not applicable (NA) or nothing significant to report (NSTR) to show the block was investigated. The blocks expand, and many sections allow blocks to be added to allow for separate entries, as indicated by a plus (+) button. Attach enough site maps and sketches to achieve comprehensive coverage of the checklist contents. Number the maps and sketches, and reference them in the survey, where applicable. Mark locations of features and areas that correspond with location coordinates in the survey, and include a north arrow, scale, and legend. All location coordinates requested on the form are mandatory. Consultation with a Geospatial Engineer (12Y or 125D) is recommended because they can provide helpful survey information from the geospatial database; consult your S3 to find the appropriate point of contact. Note all sources of information (Section 22), and include contact information for individuals and copies of documentation. Describe samples and test results (Section 23); for coordination of samples and lab analyses, contact the Force Health Protection Officer at your Army Service component command or combatant command (command authority). Include enough photographs of the features and areas to accomplish comprehensive coverage of environmental conditions, and log all photographs (Section 24). Reachback support and help for completing this form are available by contacting the United States Army Engineer School, Directorate of Environmental Integration, at usarmy.leonardwood.engineer-schl.mbx.dei@mail.mil. Section titles on the EBS Checklist correspond to those on DD Form 2994, EBS Report. Once completed, send the EBS Checklist and the EBS Report through SIPRNet to the designated authority in the mission order.

1. SITE IDENTIFICATION

a. SURVEY START DATE		**b. SURVEY END DATE**	
c. LOCATION NAME			

(Provide the official place names and postal codes at the site being surveyed. Include names of administrative divisions for the location, such as township, city, county, district, region, state, province, territory, and country.)

d. LOCATION ALIASES

(List other names the site is currently or was previously known as.)

e. GEOGRAPHIC LOCATION

GEODETIC DATUM	

(Identify the datum [World Geodetic System 84 is recommended] of the device or source used to capture all coordinates throughout the form. The datum is the reference system used to identify a location with coordinates. It is critical information because locations can have substantially different coordinates, depending on the datum, or reference system, used to make the measurements. The source [such as a Global Positioning System or a map] used to capture coordinates will identify the datum.)

LOCATION COORDINATES

(List enough coordinates around the perimeter to provide an accurate site boundary. Coordinates should be in standard Military Grid Reference System coordinate format, which includes a 3-character zone designator, 2-character grid square identifier, and the 8-digit coordinates [for example, 18S UH 1482 8407]. NOTE: This form is a classified document once coordinates are added.)

2. PURPOSE

JUMP TO ITEM:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

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PREVIOUS EDITION IS OBSOLETE. CLASSIFICATION: ______________________________

Figure D-26. Environmental Baseline Survey Checklist (Click Image to Open Entire Form).

CLASSIFICATION: ______________________________

ENVIRONMENTAL BASELINE SURVEY (EBS) REPORT
See ATP 3-34.5/MCRP 3-40B.2, Environmental Considerations; the proponent agency is TRADOC.

An EBS Report becomes a classified document once location coordinates or classified information is added.
The document classification must be added as a header and footer to each page. All classified information must be labeled as classified.
Classified material may be sent only through a SECRET Internet Protocol Router Network (SIPRNet).

DIRECTIONS: Completion of this form includes analysis and summarization of the environmental baseline conditions (conditions prior to site occupation by the United States) at a site, especially conditions that potentially impact site use, selection, and planning. DD Form 2993, EBS Checklist, is the form for completing the full site survey of baseline conditions, and it provides comprehensive guidance and examples. The (detailed) Checklist should be completed first, followed by the (summarized) Report. If necessary, the EBS Report form can be used to conduct a hasty survey of conditions prior to completing the full site survey. When collecting information and documenting conditions during a survey, it is important to always include location coordinates, maps or sketches, photographs, points of contact, and sources of information. When summarizing the conditions in a report, always reference applicable maps or sketches, photographs, and test results to accurately report the conditions in an area. The blocks in the form expand to provide more space as needed for reporting. Do not leave a block empty. If a block does not apply to the site, enter not applicable (NA) or nothing significant to report (NSTR) to show the block was investigated. Reachback support and help for completing this form are available by contacting the United States Army Engineer School, Directorate of Environmental Integration, at usarmy.leonardwood.engineer-schl.mbx.dei@mail.mil. Section titles on this form correspond to those on DD Form 2993. Once completed, send the EBS Checklist and the EBS Report through SIPRNet to the designated authority in the mission order.

1. SITE IDENTIFICATION

a. SURVEY START DATE		**b. SURVEY END DATE**	
c. LOCATION NAME	*(Provide official place names and postal codes at the survey site.)*		
d. LOCATION ALIASES	*(List other names the site is currently or was previously known as.)*		

e. GEOGRAPHIC LOCATION

GEODETIC DATUM	*(Identify the datum of the source used to capture coordinates. World Geodetic System 84 is recommended.)*
LOCATION COORDINATES	*(List enough coordinates around the perimeter to provide an accurate site boundary.)*

2. PURPOSE

a. MISSION	*(Summarize the scope of the mission, purpose of the survey, and reasons for selecting the site.)*
b. LIMITATIONS	*(Summarize physical obstructions, conditions, lack of equipment, delayed test results, and other reasons that limit the report.)*

EXECUTIVE SUMMARY (Note: This block does not correspond to a block on DD Form 2993; it is a summary of critical findings from the checklist.)

(Summarize the critical findings from the environmental baseline survey. Identify and explain those conditions that could impact site selection or use. Highlight potential hazards to health, safety, and the mission, as well as historical and cultural resources, natural resources, and species of concern. Note areas that are off-limits and areas with sensitive populations and habitats. Recommend courses of action for reducing, mitigating, or eliminating hazards or impacts. Recommend further investigation and additional assessments required to fully address identified concerns. List and describe any assumptions used with supporting rationale. This is a synopsis of significant findings, conclusions, and recommendations based on the data analysis, with the ultimate recommendation being to use or not use the site. If the recommendation is to use the site, list the conditions that need to be addressed before using the site. The remainder of this report form should be used to expand on the information provided in the executive summary.)

JUMP TO ITEM:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

DD FORM 2994, SEPT 2022 Page of
PREVIOUS EDITION IS OBSOLETE.
CLASSIFICATION: ______________________________

Figure D-27. Environmental Baseline Survey Report (Click Image to Open Entire Form).

CLASSIFICATION: ______________________________

ENVIRONMENTAL SITE CLOSURE SURVEY (ESCS)

See ATP 3-34.5/MCRP 3-40B.2, Environmental Considerations; the proponent agency is TRADOC.

An ESCS becomes a classified document once location coordinates or other classified information is added.
The document classification must be added as a header and footer to each page. All classified information must be labeled as classified.
Classified material may be sent only through a SECRET Internet Protocol Router Network (SIPRNet).

DIRECTIONS: Throughout the site closure process, completion of this form is required three times, known as the Initial, Preliminary, and Final surveys.

- Initial (I): Survey is completed upon site closure notification.
- Preliminary (P): Survey is completed approximately 30 days prior to closure.
- Final (F): Survey is completed within approximately 24 hours prior to closing the site.

Do not leave a block empty. If a block does not apply to the site, enter not applicable (NA) or nothing significant to report (NSTR) to show the block was investigated. The blocks expand to accommodate more text, and many sections allow blocks to be added for separate entries, as indicated by a plus (+) button.

Attach enough site maps and sketches to achieve comprehensive coverage of the checklist contents. Number the maps and sketches, and reference them in the survey, where applicable. Mark locations of features and areas that correspond with location coordinates in the survey, and include a north arrow, scale, and legend. All location coordinates requested on the form are mandatory.

Note all sources of information (Section 22). Describe samples and test results (Section 23); for coordination of samples and lab analyses, contact the Force Health Protection Officer. Log enough photographs of the features and areas to accomplish comprehensive coverage of environmental conditions (Section 24).

If needed, seek guidance from environmental program managers with the geographic combatant command. Damaged resources may result in adverse relations with foreign populations and hinder site closure. Therefore, early in the closure process, it is important to refer to the closure plan and the real estate agreement made with the host nation, and to determine the closure standards and agreements that must be met. The S3 can provide points of contact and is responsible for coordinating completion of the ESCS before leaving the site. Reachback support and help with completing this form are available by contacting the United States Army Engineer School at usarmy.leonardwood.engineer-schl.mbx.dei@army.mil.

Section titles on the ESCS correspond to those on both the Environmental Baseline Survey (EBS) Checklist and the EBS Report (DD Forms 2993 & 2994, respectively). Upon completing the final ESCS, summarize the closure actions and final site conditions in a separate report entitled Environmental Site Closure Report (ESCR), and send the documents through SIPRNet to the designated authority in the mission order as well as the appropriate combatant commander for review and submission (for archiving) in the Military Exposure Surveillance Library.

Throughout this form, there are checklists to help track closure tasks and conditions. During each survey (I, P, and F), mark the checklist items as Red, Amber, or Green based on the following guidance.

- Red (R): Checklist items are not ready for site closure and may pose a concern or require special attention.
- Amber (A): Checklist items are not yet ready but are on track for site closure.
- Green (G): Checklist items are ready for site closure (tasks have been completed, and conditions meet closure standards and agreements). This includes checklist items that are marked as NA or NSTR.

1. SITE IDENTIFICATION

a. SURVEY START DATE	*(Initial)* *(Preliminary)* *(Final)*	**b. SURVEY END DATE**	*(Initial)* *(Preliminary)* *(Final)*
c. LOCATION NAME	*(Provide the official place names and postal codes at the site.)*		
d. LOCATION ALIASES	*(List other names that the site is currently known as or has been referred to during occupation.)*		

e. GEOGRAPHIC LOCATION

GEODETIC DATUM	
(Identify the datum [World Geodetic System 84 is recommended] of the device or source used to capture all coordinates throughout this form. The datum is the reference system used to identify a location with coordinates. It is critical information because locations can have substantially different coordinates, depending on the datum, or reference system, used to make the measurements. The source [such as a Global Positioning System or a map] used to capture coordinates will identify the datum. For consistency, the same datum should be used for the closure surveys that was used for the EBS.)	LOCATION COORDINATES

JUMP TO ITEM:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

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PREVIOUS EDITION IS OBSOLETE.

CLASSIFICATION: ______________________________

Figure D-28. Environmental Site Closure Survey (Click Image to Open Entire Form).

APPENDIX E.
MARINE AIR-GROUND TASK FORCE ENGINEERING SYMBOLOGY

This appendix provides a general overview of DoD symbology and a consolidated view of engineer unit and resource symbols.

DEPARTMENT OF DEFENSE SYMBOLOGY

To preserve interoperability and clear understanding across the Services, the DoD employs centralized management over the standardization of military symbology. The DoD publishes Military Standard (MIL-STD)-2525, *Department of Defense Interface Standard: Joint Military Symbology*, which contains illustrations and relevant codes for all DoD-approved military symbols and the methodology for their use. This ensures a common language for symbols used for reporting the location of friendly and enemy units, tactical control measures, geospatial features, and other militarily significant information in C2 systems. Ultimately, this improves the ability of military leaders to maintain visual awareness of the tactical situation (i.e., common operational picture) and exercise command and control over their organization. Readers are encouraged to consult the current edition of MIL-STD-2525 for unit symbols, equipment, and tactical control measures used throughout the DoD. Submit requests for changes to existing symbols or creation of new symbols to the DoD Standardization Symbology Management Committee via the Marine Corps' Symbologist.

MARINE AIR-GROUND TASK FORCE ENGINEERING SYMBOLOGY

Figure E-1 depicts symbols for specific units related to MAGTF engineering. The symbols illustrated are currently available in DoD C2 systems or built using the tools feature. An asterisk delineates symbols created using the tools feature. Although the symbols presented in Figure E-1 portray a specific-sized unit, such as a battalion, or company, they can also identify smaller sized units (i.e., section, squad, or team).

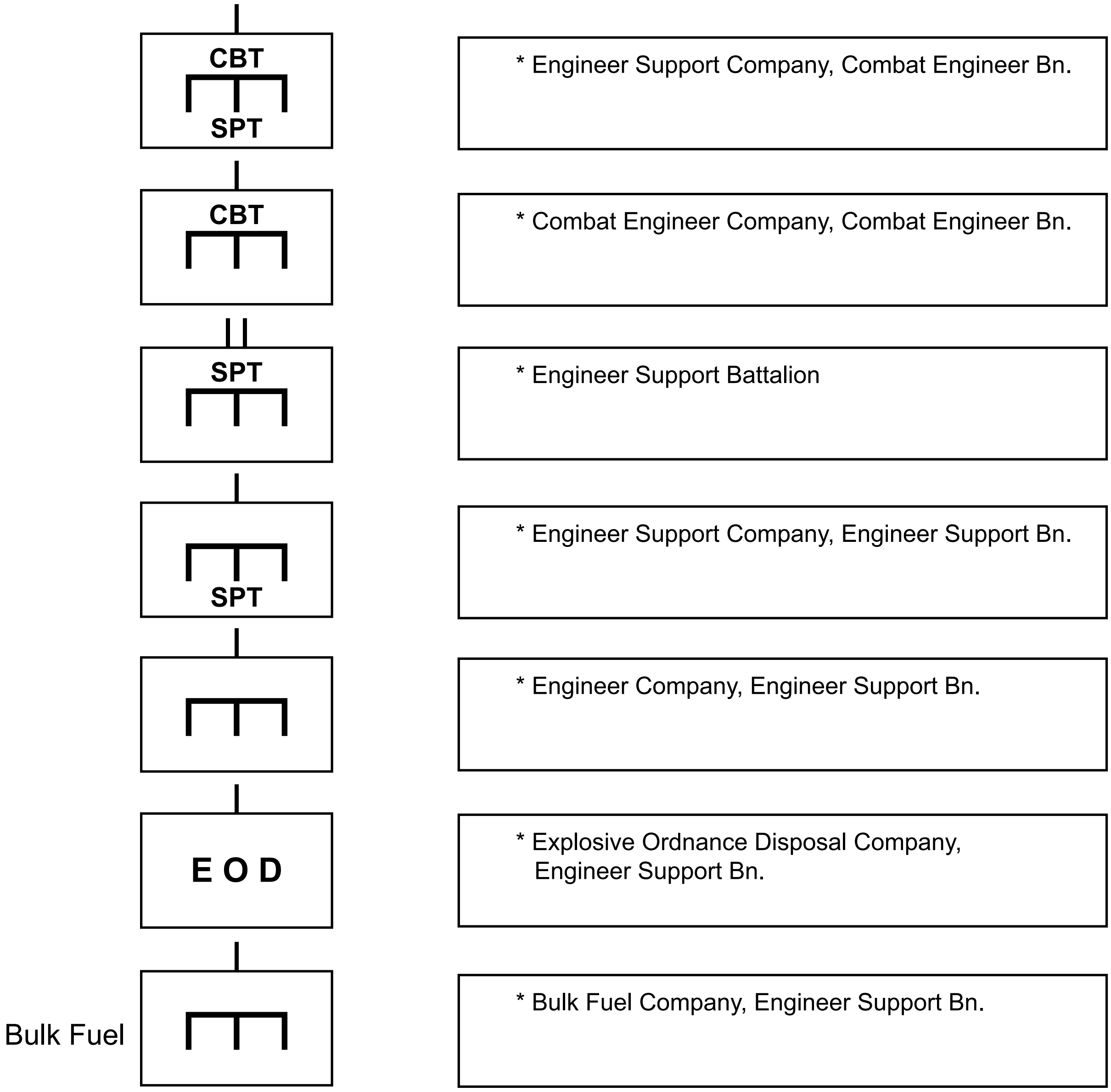

Figure E-1. Unit Symbols Related to Marine Air-Ground Task Force Engineering.

Figures E-2 and E-3 depict engineer resource symbols manually drawn onto paper or can be depicted onto a digital map by the ENFIRE engineer reconnaissance tool. Department of Defense C2 systems do not currently provide the ability for users to create digital versions of these engineer resource symbols.

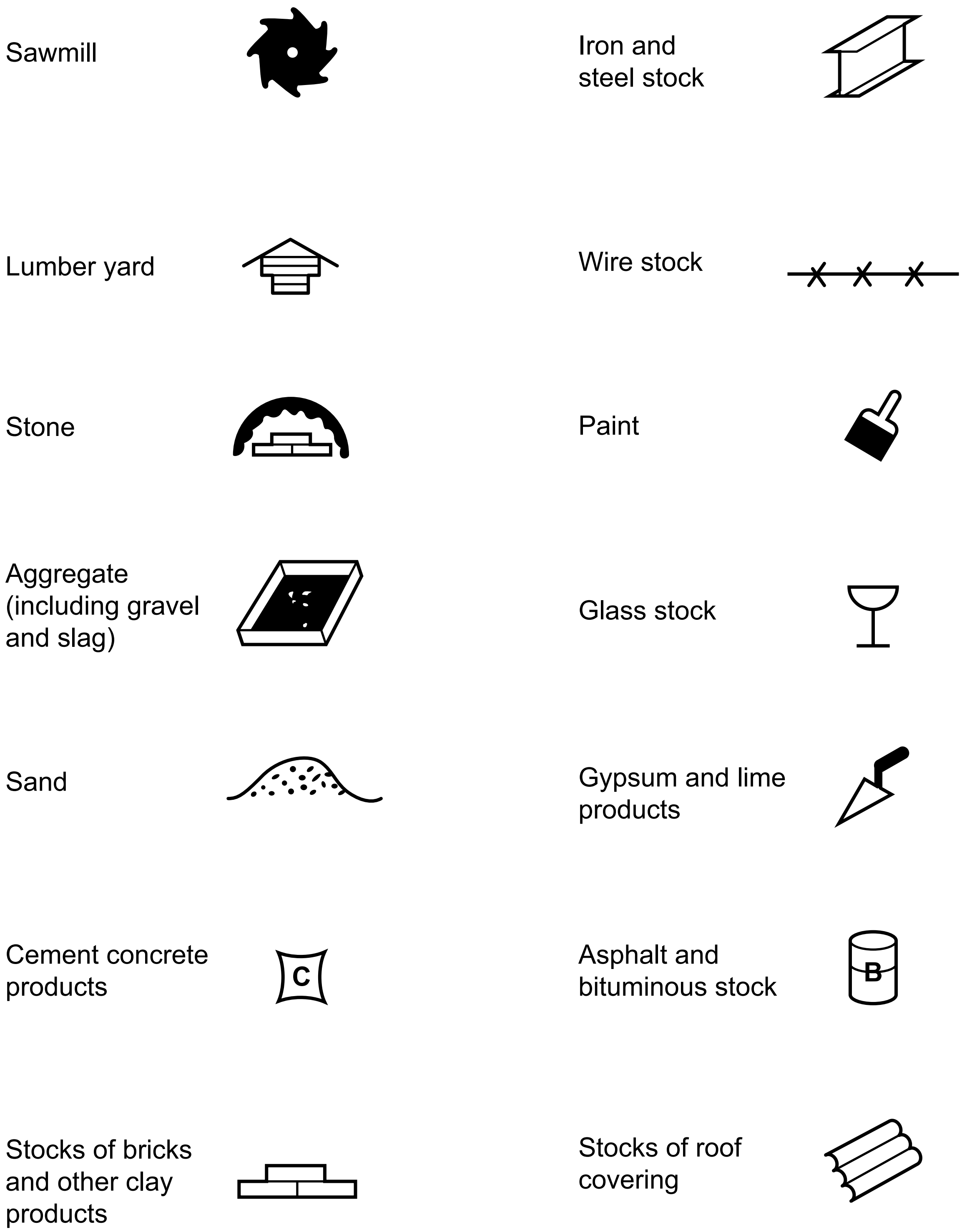

Figure E-2. Engineer Resource Symbols.

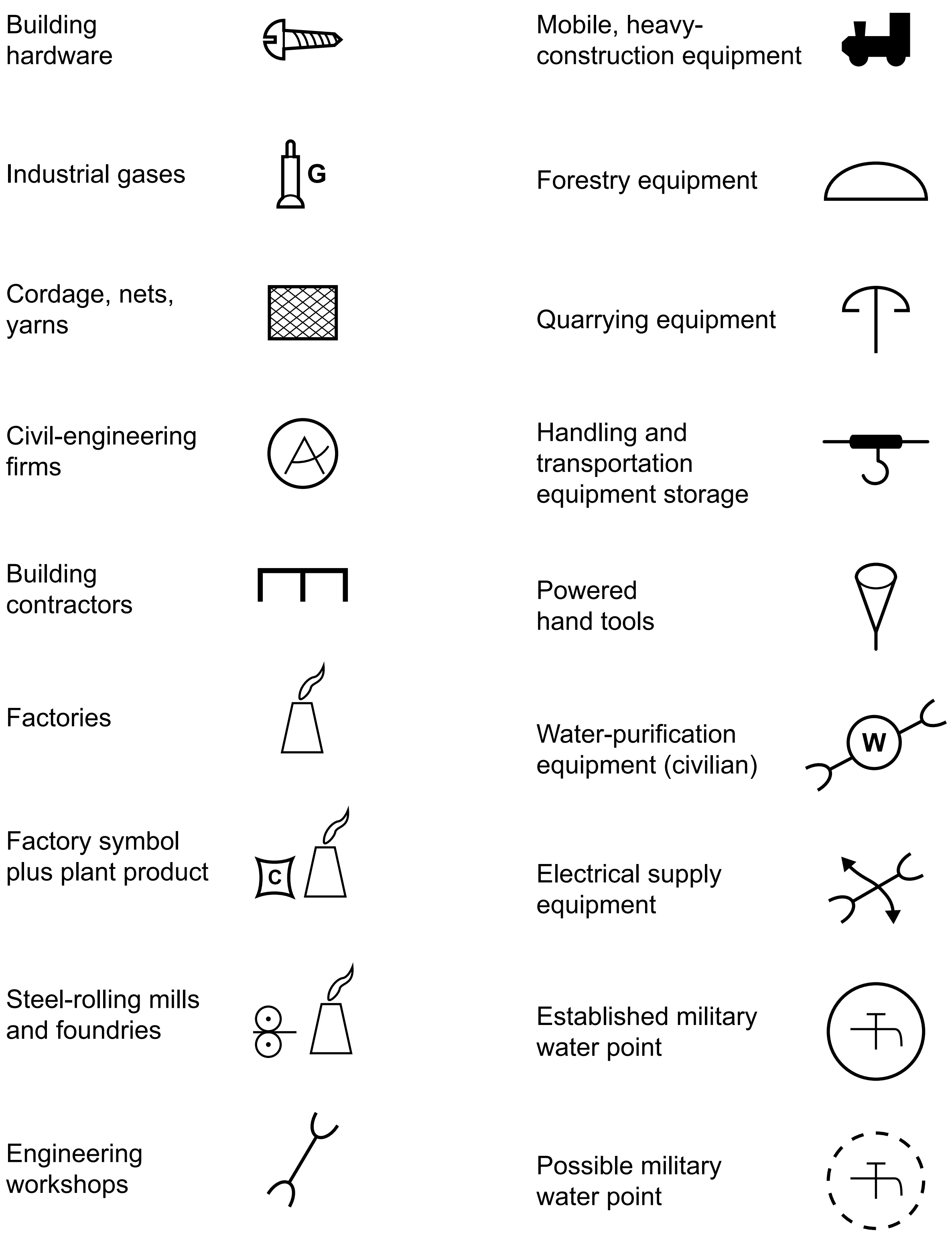

Figure E-3. Engineer Resource Symbols (continued).

APPENDIX F.
SPECIFIC OPERATIONAL ENVIRONMENTS

The MAGTF must be capable of conducting operations regardless of the environmental conditions that exist in the regions where employed. Whether these regions include the heat of the jungles and deserts, the chill of the mountains, or the closeness of urbanized terrain, each special environment presents its own unique set of challenges. The engineer planners' flexibility, agility, and foresight throughout the MAGTF will allow engineer units to support the mission despite these challenges. Engineer planners analyze geospatial intelligence and employ engineer reconnaissance assets to collect updated information to guide detailed, adaptive planning. The remainder of this appendix reviews special environmental factors that are applicable to planning, executing, and assessing MAGTF engineer operations in jungle, desert, mountain, cold region, CBRN, and urban terrain environments, presented from the mobility, countermobility, survivability, and general engineering functional points of view.

JUNGLE OPERATIONS

Jungle operations, as defined in MCTP 12-10C, *Jungle Operations*, include those offensive and defensive actions conducted in densely forested areas, grasslands, cultivated areas, and heavily vegetated swamps. The characteristics of jungle terrain require engineer units to modify standard mobility, countermobility, survivability, and general engineering TTP to address local conditions.

Mobility

The jungle environment contains lush vegetation, swamps, soil that may not drain well, seasonally heavy rainfall, and excessive humidity. Terrain, therefore, naturally canalizes or restricts motorized and mechanized movement to limited, poor quality roads or trails, naturally bisected by rivers and streams. Deforestation by the indigenous population can exacerbate these conditions. The limited number of roads and trails present the tactical opportunity for the enemy to emplace explosive obstacles or damage or destroy existing bridges to prevent tactical maneuver and enhance the effectiveness of permanent, natural obstacles. Additionally, the enemy can exploit natural camouflage to avoid detection and targeting by friendly force intelligence, surveillance, and reconnaissance (ISR) assets.

Engineer units operating in jungles construct and maintain expedient roads, trails, FARPs and LZs to support the scheme of maneuver. Drainage is a primary concern during the design phase for these vital LOCs. Engineer reconnaissance teams evaluate the battlespace to locate sites that are suitable for fording, bridging, or ferry operations. Planners evaluate the information obtained from engineer reconnaissance to determine whether standard bridging is required to overbridge existing structures or if nonstandard bridges constructed. Damage or deterioration of the condition of roads and trails may cause more reliance on air or boat transport of personnel, supplies, and equipment.

Countermobility

As described in the mobility section, MAGTF engineer units can integrate man-made obstacles and barriers that reinforce permanent, natural obstacles to restrict enemy maneuver and canalize massed formations into friendly force engagement areas. Vegetation may need to be removed to allow observation and direct fire support of emplaced obstacles. Wire obstacles integrated with existing vegetation can present a formidable obstacle to enemy dismounted maneuver. During maritime operations, mines incorporated with wire and other non-explosive obstacles deny enemy use of favorable amphibious landing sites or access to key maritime terrain. Abatis can be equally effective when employed against the potential axis of advance for enemy mounted and mechanized formations. Other methods to restrict the enemy's ability to maneuver by vehicles can include damaging or destroying bridges (when authorized), modifying natural drainage to increase flooding, or expanding the size of swamps and marshes.

Survivability

To support survivability and signature management efforts during the offensive phase of operations, engineer units use local materials and vegetation to provide cover, concealment, and camouflage. Planners must be innovative in their design of protective shelters because of the potential scarcity of available quarries and borrow pits for rock or soil. Since jungles typically contain an abundant supply of timber, planners use designs that incorporate field timber and camouflage.

During the defensive phase of operations, engineer units conduct expedient construction of bunkers and protective positions using chain saws and axes to harvest timber and small earthmoving equipment to reposition existing soil for fill material into rapid assembly protective wall bastions. Special attention is required during the design and construction of bunkers to compensate for seasonal flooding and drainage. Constructing berms protects critical supplies (e.g., ammunition, bulk fuel) and critical assets. Integrating camouflage with force protection mitigates enemy IRS detection. Construction teams also harden existing infrastructure with sandbags, blast walls that use rapid-assembly protective-wall bastions, and pre-detonation screening. Finally, they clear additional ground to support dispersion of the force and improve fields of fire and sight lines for direct-fire weapons, missile launchers and observation purposes.

General Engineering

Engineer units performing general engineering tasks, such as constructing and maintaining expeditionary bases and airfields and repairing and improving distribution hubs and ground LOCs, encounter the same problems as their CEB counterparts in a jungle environment. Engineer reconnaissance, surveying, land clearing, drainage, power generation, bridging, and waste management can be extremely difficult tasks, particularly during the rainy season. The warm temperature and high humidity in jungle environments increases the need for individual water use. When using local water sources, it is critical to conduct proper water treatment and field hygiene to protect personnel against waterborne organisms and diseases. Health services support and engineer planners develop contingency plans to address drainage, waste management, and personal hygiene to prevent illnesses and control insects, rodents, and infectious animals. With respect to mapping, because of the inaccessible and rapidly changing features in the jungle environment, maps may reflect only major terrain features. Swamps, streams, inlets, and lagoons seldom appear, and contours shown are rarely accurate. Engineers must conduct reconnaissance to supplement existing data. Engineer reconnaissance teams can also identify sources of local construction materials (e.g., aggregate, soil, lumber) and assess the capacity of ground LOCs.

DESERT OPERATIONS

Although all desert areas are not usually the same, they contain common physical characteristics, such as a lack of water and vegetation, extreme temperatures, bright sunshine and moonlight, dust storms, mirages, and dry river channels and washes. Desert operations significantly tax engineer resources because of the need to supply bulk water and bulk fuel, increased requirements for camouflage assistance and deception, and special problems in field fortifications. Their flat topography and open terrain of desert environments generally reduces requirements for road, airfield, and bridge construction as compared to other special environments; however, since desert terrain can be rugged, MAGTF engineer reconnaissance and terrain analysis efforts are crucial. See MCTP 12-10D, *Desert Operations*, for additional details regarding military aspects of desert operations.

Mobility

Despite the relative openness of the desert environment, soil conditions, weather, and topography (e.g., wadis, washes) can have an adverse effect on friendly force mobility. The MAGTF employs ground or aviation assets to transport personnel, supplies, and equipment over the vastness of open spaces. Tracked vehicles may encounter less difficulty than wheeled variants during cross-country movement. Some desert regions can contain mountains and rocks, however, which restrict vehicle movement. Due to the complexities of the desert environment, the enemy is more likely to employ surface-laid or scatterable mines and munitions. Early detection of explosive obstacles permits in-stride breaching, hasty construction of bypasses, and route and area clearance. Likewise, armored bulldozers and expedient gap crossing methods (e.g., fascines) reduce, bypass, or span man-made, anti-vehicle obstacles (such as ditches or berms). Speed over ground is essential to avoid providing the enemy with sufficient time to observe and coordinate fire against friendly-force ground formations. Establishing FARPs along the route-of-march to refuel air and ground vehicles increases operational reach and maintains tempo. Dust and brownouts temporarily reduce visibility. As a result, dust abatement is a primary consideration when designing and constructing FARPs and expeditionary airfields and during ground vehicular movement.

Countermobility

Desert terrain presents several countermobility challenges. Engineer planners must carefully consider where to employ reinforcing obstacles so they can exploit the countermobility effects natural obstacles provide while also conserving available resources (e.g., time, labor, barrier materials). Integrating man-made barriers and obstacles with long-range surveillance at fixed locations, such as expeditionary bases and airfields, can significantly improve the defensive posture of the installation. The expedient construction of an earthen berm or rapid emplacement of force protection and concrete barriers can create anti-vehicle barricades. Long-range detection of enemy movement and ISR is critical because it maximizes time available to coordinate massed fires and friendly-force maneuvers against enemy formations. When authorized, destroying bridges and cratering roads can be an effective technique to limit enemy freedom of maneuver. Destroying enemy mobility assets (i.e., breaching, gap crossing, or motor transport) and fuel supplies can also limit enemy movement and operational reach.

Survivability

The lack of natural vegetation in desert terrain means camouflage measures are limited to terrain masking or visual screening. Since moving vehicles create large dust signatures, moving at night can reduce the enemy's ability to observe and target such movements. To decrease the enemy's ability to target FARPs or air facilities, MWSSs can employ dust abatement materials or other techniques to mitigate the dust signature created by operational aircraft. To protect critical weapon systems, hasty survivability positions are constructed. To improve survivability of C2 centers, construct earth berms, sandbags, soil-filled rapid assembly protective wall bastions, or force protection barriers around them, or locate them underground. Overhead cover and pre-detonation panels can reduce the effectiveness of enemy indirect fire and protect vital C2 centers. At expeditionary bases and airfields, critical supplies and C2 infrastructure are hardened, positioned below ground, or deliberately dispersed. Entry control points are constructed using anti-vehicle and antipersonnel obstacles, reinforced defensive positions, and blast walls to offset potential vehicle-borne improvised explosive devices and enemy direct fire weapons. Engineer actions to improve survivability and force protection integrate with long-range surveillance and a mobile reaction force.

General Engineering

Desert operations place a greater demand on bulk fuel support because long-range foot mobility across desert terrain is neither fast nor practical. Instead, organic ground and aviation assets are essential to move the MAGTF rapidly throughout the battlespace. Combat road construction requirements are less complex than in other environments because the relatively unrestricted mobility of vehicles (particularly tracked vehicles) can eliminate the need for extensive road networks. Tractor-drawn drags usually suffice, except in loose sand or stony ground, and matting usually provides satisfactory traction for wheeled-vehicle movement across short distances containing loose sand. If seasonal rains are typical in the AO, then flash flooding and mud can prove particularly problematic for maintenance of road networks, air facilities, bridging sites, and base camps.

Bulk water support is arguably the most important and problematic engineer operation in the desert environment, where water is scarce, and transporting it across long distances is logistically challenging. It is essential to identify and control water sources to preserve the lives and sustain the endurance of personnel and equipment. Planners must ensure that MAGTF water consumption does not deplete available resources, particularly if the indigenous population shares the water resource. To lessen the possibility of depletion, engineers conduct continuous water reconnaissance and relocate water production as needed so that it remains responsive to the needs of the force throughout all phases of the operation. Water supply points require sufficient protection from a host of threat actions to include indirect- and direct-fire weapon systems, chemical and biological agents, and sabotage. Compounding the water supply point security problem is the general lack of concealment available in the desert and the required troop dispersion. In areas that do not contain readily available surface water sources, special well-drilling and pumping equipment is required to supply water for purification and storage. Since the Marine Corps does not possess an organic well-drilling capability, the MAGTF must seek well-drilling support from another Service (e.g., NCF, Army engineer units).

The extreme temperatures associated with desert conditions during the summer and winter seasons increase demand for mobile electric power. Heating, ventilation, and air conditioning (HVAC) support is typically greater in the desert than in other environments. Utility planners match estimated power and HVAC requirements with the commander's priority for utility support, available power and HVAC equipment and utility personnel. Detailed planning will enable them to deploy equipment to meet forecasted demand and implement redundancy at the most critical locations specified by the commander. Depending on the tactical situation, load management helps alleviate some of the power and HVAC demand. Other methods used to manage demand include using light-emitting diode lighting, employing vertical construction designs that incorporate insulation, and installing thermal shielding to reduce the interior temperature of tents used for workspaces, command centers or billeting.

MOUNTAIN OPERATIONS

Mountainous environments contain exaggerated terrain features, heavy woods, rocky crags, glacial peaks, extreme weather, high altitudes, and few ground LOCs. Mountains challenge engineer units to provide the mobility, countermobility, survivability, and general engineering support required to permit the MAGTF to operate in this terrain. See MCTP 12-10A, *Mountain Warfare Operations*, for additional details regarding military aspects of mountain operations.

Mobility

The mountainous environment presents natural maneuver and mobility difficulties that engineer units must overcome. Mountainous terrain challenges all vehicular movement. Cross-country movement is slow and involves transporting everything needed to conduct operations using either personnel, animal, or air assets. Existing routes for maneuver and LOCs may contain severe slope, narrow widths, unimproved surface conditions, poor drainage, or undersized tunnels and bridges. Enemy forces can employ demolitions and man-made obstacles to block or restrict friendly forces' vehicle movement. To counter both natural factors and enemy actions, combat engineer units detect and breach enemy obstacles, construct bypasses or combat roads and trails, emplace gap-crossing equipment, and construct expedient LZs.

During construction and improvement of combat roads and trails, drainage for rainwater and snow is a primary design consideration. Expedient LZ and air site construction provides an alternate means for transportation (should roads become damaged or interdicted); however, site selection and horizontal techniques must address the fact that aircraft require relatively flat, level operating surfaces.

Countermobility

To generate countermobility effects, the MAGTF can capitalize on the above-listed mobility challenges by directing them against the enemy. Reinforcing obstacles limits the enemy's ability to use high-speed avenues of approach (particularly roads) or fix its force for supporting arms attack. Obstacles can be constructed using locally available materials, such as boulders and timber. Planners should consider that covering obstacles by direct-fire weapons is problematic due to limited line of sight and the reduced range of longitudinal motion for crew-served weapon systems. When authorized, destroying bridges and tunnels or employing demolitions to cause rockslides can be effective techniques to limit enemy freedom of maneuver. Destroying enemy mobility assets (particularly gap crossing and breaching) can also limit enemy movement, tempo, and operational reach.

Survivability

To avoid detection and manage the signature of individual positions, exploit the availability of natural camouflage. Constructing bunkers to protect C2 and critical weapon systems involves building above ground unless natural caves or tunnels exist. Depending on the location of available materials (e.g., rock, timber, soil), ground transportation might be needed to deliver the materials to bunker construction sites.

Removing some foliage can improve fields of fire. Positions used to overwatch and defend key terrain (e.g., bridges, tunnels) might need strengthening. Certain survivability equipment (e.g., largest-sized, rapid-assembly protective wall bastions) may not be suitable for use because of the difficulty in obtaining, transporting, and packing fill materials into these products, particularly at higher elevations of terrain. In those locations, lighter materials, such as sandbags, may be more suitable.

General Engineering

Operations conducted in mountainous terrain place unique demands on general engineering activities, particularly horizontal and vertical construction, hygiene services, bridging, bulk fuel, power generation, and bulk water production. The horizontal construction effort focuses toward improving and maintaining GLOC, base camps, and air facilities. Road networks may require installing turn-around points, improving drainage systems and road surfaces, removing snow or rock and mud slide material, and replacing or maintaining standard bridges. The vertical construction effort focuses toward building structures to improve the capacity and habitability of base camps and air facilities. Access to water and adequate drainage are two key considerations that affect the establishment of hygiene services. As a result, units occupying very steep terrain may need to walk or use transportation to and from hygiene sites. Similarly, dedicated transportation may be required to deliver bulk fuel and bulk water to using units, particularly for storage sites positioned at lower altitudes, where there is flatter terrain and sources of surface water. The same considerations apply to the collection, removal, and disposal of waste. Utility planners must address the challenge of extreme terrain when developing plans for providing mobile electric power and HVAC support. To overcome the terrain, aircraft may reposition power generation equipment and resupply fuel to support units operating at high altitudes and on steep terrain.

COLD-REGION OPERATIONS

Cold-region operations can occur in both the northern and southern hemispheres. For military purposes, cold regions include any region where cold temperatures and snowfall have a significant effect on military operations for one month or more each year. The effects of cold on military operations in this region are generally short-term, but these effects can be catastrophic for unprepared units. See MCRP 12-10A.4, *Cold Region Operations*, for more information about military aspects of cold-region operations.

Mobility

The terrain in cold regions presents natural maneuver and mobility difficulties. Seasonal variances in the weather (particularly temperature and precipitation) can make the terrain more challenging or more favorable for vehicular movement. For example, frozen waterways might be able to support use as ice roads, depending on the temperature and thickness of the ice. At other times, vehicle cross-country movement might not be possible due to vegetation or extensive wet, permafrost areas. Existing routes and roads might be undeveloped and limit mobility. Enemy forces can employ demolitions and obstacles to block or restrict friendly forces' vehicle movement. Snow makes detection of man-made obstacles (particularly land mines) more difficult. To counter these natural factors and enemy actions, combat engineer units detect and breach enemy obstacles, construct bypasses or combat roads and trails, emplace gap-crossing equipment, and construct expedient LZs. When constructing and improving combat roads and trails, design considerations need to address drainage for rain and snow runoff and stabilization of permafrost. Expedient LZ or air site construction can provide an alternate method for transportation if roads become damaged or interdicted; however, site selection and horizontal construction techniques must acknowledge the fact that aircraft require solid, relatively level operating surfaces.

Countermobility

Engineer units can use demolitions and emplace obstacles to reinforce existing terrain features. Detailed reconnaissance is essential to guide the site selection for obstacle emplacement. Snow is employed in constructing anti-vehicle berms and to disguise the location of antipersonnel obstacles. Damaging or destroying bridges and ice roads (when authorized) provides countermobility effects against the enemy's freedom of maneuver and operational tempo.

Survivability

To avoid detection by enemy ISR assets and manage unit signature, exploit the use of available camouflage. Completely frozen soil (permafrost) can adversely affect the construction of bunkers used to protect C2 and critical weapon systems or berms to protect critical supplies. This also makes it difficult to place fill material in survivability systems (e.g., rapid-assembly protective-wall bastions or sandbags). Depending on several environmental factors, snow could reinforce berms to help withstand enemy direct-fire weapons.

General Engineering

During cold-region operations, general engineering tasks like horizontal and vertical construction activities become increasingly difficult to perform. Environmental characteristics that complicate engineer tasks are permafrost, extreme and rapid changes in temperature, wind, snow, ice storms, and flooding. Designing vertical construction projects to include insulation can protect against the harsh effects of the weather and reduce electricity and fuel demand. Enclosures can be constructed to provide thermal protection for water storage bags for hygiene services. Vehicles and aircraft operating in cold regions use jet propulsion fuel, type 8 (also referred to as JP-8) or commercial jet fuel with additives to enhance the long-term storage stability, improve cold weather vehicle operation, and reduce fuel-system corrosion. Enhanced quality surveillance is required to ensure temperature remains above the freezing points for specific fuels. Redundant power generation systems would be established at all C2 centers. With respect to water production, the major sources of water supply are (in order of efficiency and economy): drawing water from under rivers or lakes, melting ice or snow, and drilling wells. If water is not available under rivers or lakes, special or improvised ice melting equipment must melt ice in place. Collecting and melting ice or snow in quantities required for a unit is impractical and only done in an emergency. Shaped charges are far superior to hand tools for cutting holes through thick ice to prepare a water hole. Heated shelters are often necessary to operate water purification equipment. See MCRP 3-40D.14, *Water Support Operations*, for further information regarding water production and storage in cold regions.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR OPERATIONS

A CBRN attack can occur with minimal or no advanced warning. Friendly forces can encounter CBRN weapons in any operating environment. Thus, CBRN operations in the MAGTF consist of preventive and reactive measures. Tactical use of chemical and biological weapons focuses on attacking personnel, while radiological and nuclear weapons use focuses on personnel, facilities, terrain, and equipment. Since the enemy can use CBRN weapons against military and civilian targets, the DoD can employ military forces to assist civil authorities during recovery from a CBRN weapon attack against the civilian population. See JP 3-11, *Operations in Chemical, Biological, Radiological, and Nuclear Environments*, and JP 3-41, *Chemical, Biological, Radiological, and Nuclear Response*, for overarching joint doctrine for the military response to mitigate the effects of a CBRN event or incident. The remainder of this section, however, addresses only the MAGTF engineer actions taken to prevent and react to the enemy's tactical use of a CBRN weapon.

Mobility

Following a chemical or biological weapon attack, the MAGTF's ability to maneuver and move can be adversely affected by large numbers of dislocated civilians moving along GLOCs to request or seek immediate host nation or military medical treatment and decontamination. Abandoned civilian vehicles along with contaminated human and animal remains might also lie in the MAGTF's path. Engineer tasks can include conducting reconnaissance to develop options for bypassing affected areas or identify suitable areas to conduct friendly force decontamination, conducting expedient relocation, and possibly hasty burial of remains directly in the path of the force, removing or relocating abandoned vehicles, and assisting the host nation during any of the above activities.

As a result of a radiological or nuclear weapon attack, the MAGTF's ability to maneuver and move would be affected by catastrophic damage to infrastructure and military materiel; radiological contamination (fallout) of terrain, equipment, and personnel; and an enormous number of military and civilian casualties.

Engineer units would conduct hasty breaching through any obstacle created by the blast effects of the radiological or nuclear weapon, emplace expedient bridging to replace destroyed or damaged bridges, remove debris and damaged vehicles from MSRs and ASRs, and perform expedient construction of air sites to replace air facilities that have been damaged or destroyed.

Countermobility

Visualizing the enemy's capability to move and maneuver in a CBRN environment provides engineer planners with insights into how MAGTF engineering can support countermobility requirements. Initially, there would be less emphasis on emplacing new reinforcing obstacles to interdict the enemy's ability to exploit high-speed avenues of approach against friendly force positions because of contaminated terrain. Additionally, unlike US forces, most enemies do not have the capability to operate effectively in a CBRN environment for any extended period. Instead, enemy forces must reduce the pace of their attack to conduct hasty decontamination; otherwise, they risk excessive casualties and premature culmination of their attack. As the risk of contamination subsides, engineer units assist the MAGTF in defending itself by constructing additional obstacles to limit enemy movement into the MAGTF defensive zone or redirect them into known contaminated areas, destroying enemy mobility assets and potentially supporting the maneuver of the MAGTF counterattack force.

Survivability

The enemy can employ chemical weapons by using explosives or aviation assets (e.g., piloted aircraft, drones, or unmanned aerial vehicles) to disperse a gas, vapor, or liquid onto personnel, terrain, or equipment. Standard protective structure designs that incorporate overhead cover and camouflage can be effective in reducing the enemy's ability to target friendly positions. These measures can also lessen the level of chemical contamination applied to friendly force personnel, equipment, and weapon systems. The enemy can dispense biological weapons by various means, including contaminating water and food sources and releasing infected insects or animals. Engineer units operating water production and storage sites must conduct extensive testing of the water quality to ensure that it is not contaminated. Engineer units can support waste management needs at base camps and air facilities by burying waste material to eliminate conditions favorable for insect or animal infestations.

Engineer units can assist preventive efforts against radiological and nuclear weapons by constructing heavily reinforced bunkers, particularly below ground or in caves or tunnels, and by hardening critical infrastructure. These measures would offer some protection against the blast but might not reduce the level of radioactive or thermal exposure to personnel, equipment, and weapon systems. Engineer units' reactive efforts following a radiological or nuclear weapons attack involve debris and damaged equipment removal, containment of damage, firefighting, construction of decontamination sites, and offering support to medical treatment and mortuary affairs. All reactive efforts must consider the physical and environmental factors of the location, especially prevailing winds, precipitation, temperature range, and natural drainage.

General Engineering

The combat planning factors used for engineer units to perform general engineering tasks in other specific environments accommodate the unique aspects of the CBRN environment. Resources are prioritized to restore or maintain essential services (i.e., power generation or restoration, water production, and waste management) vice producing new horizontal or vertical construction because of the type and quantity of resources that decontamination efforts consume. Any contaminated units must be decontaminated; otherwise, their combat effectiveness will deteriorate to the point where they become operationally ineffective. The challenge becomes two-fold: MAGTF planners must plan for both the delivery of general engineering effects and support, as well as the force protection measures needed to protect personnel and equipment in a compromised environment. After the delivery of logistical supplies, the problem of potentially having to decontaminate the personnel and equipment moving those supplies to the end user and back persists. The resulting demand on potable water production and the need to contain decontamination run-off can have a staggering impact within any area that suffers a CBRN weapon attack.

URBAN TERRAIN OPERATIONS

The military considers urban areas to be maneuver obstacles because they cause the maneuver force to compress its formation and reduce its movement speed. The enemy can use a smaller force, entrenched in man-made structures, along with extensive reinforcing obstacles to block a much larger force. Urban terrain is often a complex and challenging environment because it possesses all the characteristics of the natural landscape, coupled with man-made construction, resulting in an incredibly complicated and fluid environment that affects the conduct of all military operations. Additional details concerning all aspects of military operations conducted in urban terrain can be found in MCRP 12-10B.1, *Military Operations on Urbanized Terrain (MOUT).*

Mobility

Within urban terrain, the enemy typically attempts to draw mechanized or motorized formations into ambush engagement areas, forcing their foes to dismount to deliberately clear man-made obstacles or fight in the streets. Fighting through urban terrain is unique in that attacks can come from fortified positions located in three different dimensions: above ground level, ground level, and beneath ground level. Combat engineer units deploy task-organized teams in direct support of ground maneuver against enemy positions located in all three dimensions. These teams employ specialized equipment and techniques to breach enemy obstacles; cross-gaps; clear rubble; and employ demolitions to destroy enemy positions or boobytraps or to create openings in walls, cellars, and subway systems for friendly-force maneuver.

Countermobility

Depending on rules of engagement, engineer units have an extensive array of techniques to support countermobility requirements in urban terrain. This includes reinforcing existing infrastructure to make buildings into field-expedient fortifications using locally procured material and positioning them to provide overwatch and direct fire toward designated engagement areas. Task-organized engineer units can use local materials such as overturned or derailed railroad cars, steel rails, rubble, automobiles, craters, demolished walls, and damaged bridges to canalize enemy vehicular movement. Antipersonnel obstacles can be emplaced in areas such as subway tunnels, sewers, cellars, thick masonry walls, reinforced concrete floors, and roofs because these areas afford excellent cover and concealment to enemy maneuver. The only limiting factors to emplacing complex obstacle systems are time, equipment, and ingenuity. See MCTP 3-34B *Combined Arms Countermobility* for additional information related to countermobility techniques and planning considerations in urban terrain.

Survivability

During operations conducted in urban terrain, survivability efforts include hasty and deliberate engineer actions. Combat engineer units can improve the survivability of battle positions by using expedient techniques and locally available materials. When infantry units displace forward and deeper into the terrain to seize new locations, engineers conduct hasty improvements to newly seized positions. Deliberate actions involve engineer units improving the survivability of command centers; critical supply or distribution sites containing ammunition, fuel, water, and medical supplies; and air facilities. Improving the survivability of air facilities is important to sustaining operations in urban terrain because friendly air power provides the unique ability to observe and conduct precision engagements against entrenched enemy positions from a standoff distance. In all cases, supported commanders should articulate their survivability positioning priorities to engineer units that are supporting them so that priorities of work for engineer tasks maximize engineer effects under constrained time limits.

General Engineering

General engineering considerations in urban areas can place a greater logistical burden on MAGTF engineer units and assets than other specific operational environments. Urban terrain usually contains a high concentration of an indigenous population within a relatively small area. Combat operations conducted in urban terrain disrupts or disables basic municipal services (e.g., water, sewer, sanitation, food, medical treatment, communications, animal control) and can destroy significant aspects of the infrastructure. These issues can displace large numbers of the population from their residences who might then seek basic life support from friendly forces, other municipalities, or host nation agencies. To meet their needs, engineer units can rapidly construct base camps for temporary housing and provide life-support services. See MCTP 3-40D for additional information related to the type of general engineer services that might be required to support displaced civilian populations.

APPENDIX G. SHAPING ACTIVITIES

A MAGTF conducts shaping activities to help set conditions for successful theater operations. Shaping activities include long-term persistent and preventive military engagement, security cooperation, and deterrence actions to assure friends, build partner capacity and capability, and promote regional stability. They help identify, deter, counter, and mitigate competitor and adversary actions that challenge country and regional stability. For example, should a crisis arise, the US military response would be smaller where the partner nation's military is highly trained, well equipped, and operationally proficient than in a nation that is not prepared. Additionally, building a partner nation's civil capacity can alleviate many of the transitional and procedural obstacles in the event a joint force must enter and operate within that nation during an emerging crisis. Shaping activities can involve forming a permissive attitude with the citizens of a partner nation through community outreach activities or working alongside partner-nation civil and military organizations to upgrade infrastructure. The role of engineer units in shaping activities can vary with mission requirements, equipment constraints, or other planning considerations.

MILITARY ENGAGEMENT, SECURITY COOPERATION, AND DETERRENCE

Marine air-ground task force engineer units possess unique equipment and technical training, which enable them to support military engagement, security cooperation, and deterrence actions. Engineers might be a part of any number of these missions; mission requirements and the operational environment will dictate the level of participation.

Humanitarian and Civic Assistance

Humanitarian and civic assistance (HCA) is assistance provided to the local populace that is specifically authorized by United States Code (USC), Title 10, Armed Forces, subtitle A, part I, chapter 20, section 401, "*Humanitarian and civic assistance provided in conjunction with military operations*." Programs authorized under HCA include the Medical Civic Action Program, Dental Civic Action Program, Veterinary Civic Action Program, Engineer Civic Action Program, and the Humanitarian Mine Action Program. The HCA projects are coordinated by or with the US country team in the host nation. They can include projects contracted by the embassy with host nation contractors with no participation of US military capabilities, or they can include projects conducted with troop labor deployed for other purposes (e.g., named operations, Chairman of the Joint Chiefs of Staff-funded exercises).

An example of this is a primary school constructed in Benin by a platoon from 6th ESB during exercise Shared Accord 2009. Costs associated with the platoon's deployment was provided by the Chairman of the Joint Chiefs of Staff exercise funding, however the HCA authority funded the purchase of construction materials and services, as well as wages for local residents employed as low-skilled laborers.

Security Cooperation

Security cooperation includes all DoD interactions with foreign defense establishments to build defense relationships that promote specific US security interests, develop allied and friendly military capabilities for self-defense and multinational operations, and provide US forces with peacetime and contingency access to a host nation. A security cooperation organization includes all DoD elements located in a foreign country with assigned responsibilities for carrying out security assistance and cooperation management functions, including all facets of coordination with the partner nation. Task-organized engineer units supporting a security cooperation or security assistance mission employ as an element of a SPMAGTF (security cooperation) or as a smaller, stand-alone force called a security cooperation team. In either case, they assist in developing a partner nation's military capability and capacity to provide self-defense or to participate in multinational operations. It is possible to accomplish these two objectives in the context of integrating combat and general engineer support with combined arms operations conducted by the partner nation's military forces or as independent, engineer-oriented capabilities and activities (e.g., power generation, road construction, nonstandard bridging, water production, carpentry, demolitions).

Security Assistance

Security assistance entails a group of programs authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act of 1976, as amended, or other related statutes by which the United States provides defense articles, military training, and other defense-related services by grant, loan, credit, or cash sales in furtherance of national policies and objectives. It is an element of security cooperation funded and authorized by the Department of State. The DoD and Defense Security Cooperation Agency administer the program.

Teams of MAGTF engineer SMEs can train partner-nation engineer personnel on how to operate and maintain engineer equipment purchased by the partner nation under the foreign military sales program, loaned by the US Government, or furnished by an engineer mobile training team. Engineer mobile training teams can also provide training on how to apply MAGTF engineer best practices and techniques for each item of equipment and how to employ that equipment item to directly support a specific engineer function (e.g., reconnaissance, mobility, countermobility, survivability, general engineering). They can also provide technical training on fundamental engineer activities such as how to perform construction estimates, calculate military demolitions, determine the military load bearing capacity of bridges, measure the slope of a road, or install electrical wiring in a facility.

Crisis Response and Limited Contingency Operations

Additional operations that could involve MAGTF engineers fall under crisis response and limited contingency operations. Again, engineers might take part in any number of these missions but will most often conduct those operations that fall under consequence management, FHA, and defense support of civil authorities (DSCA).

Consequence Management and Foreign Humanitarian Assistance

In addition to other contingency missions, MAGTF engineers can support consequence management and FHA. Consequence management consists of actions taken to maintain or restore essential services and manage or mitigate problems resulting from disasters and catastrophes, including natural, man-made, or terrorist incidents. When conducted overseas, consequence management most closely aligns with FHA. Foreign humanitarian assistance includes DoD activities conducted outside the United States and its territories to directly relieve or reduce human suffering, disease, hunger, or privation. Foreign disaster relief is assistance that used immediately to alleviate the suffering of foreign disaster victims. It includes services and commodities as well as the rescue and evacuation of victims; the provision and transportation of food, water, clothing, medicines, beds, bedding, and temporary shelter; the furnishing of medical equipment, medical and technical personnel; and making repairs to essential services.

During consequence management and FHA missions, a task-organized SPMAGTF (crisis response) or individual MAGTF engineer units can be committed to perform various tasks, including the following:

- Construct tent camps.
- Construct expedient shelters at distribution hubs for storage and protection of critical aid supplies.
- Build expedient LZs or bypasses for the delivery of relief supplies or the evacuation of indigenous population.
- Clear roads of debris.
- Emplace barriers to assist in controlling the flow of personnel into aid distribution and medical care centers.
- Employ water production or hygiene equipment.
- Provide mobile electric power.
- Operate temporary bulk fuel sites to refuel ground and aviation assets.
- Provide hasty burial of human and animal remains.

Further details regarding joint force and Marine Corps support to stability, humanitarian assistance, and civil-military operations is contained in the following publications: JP 3-07, *Joint Stabilization Activities*; JP 3-08, *Interorganizational Cooperatio*n; JP 3-29, *Foreign Humanitarian Assistance*; JP 3-57, *Civil-Military Operations*; and MCTP 3-03A, *Marine Air-Ground Task Force Civil-Military Operations*.

Defense Support of Civil Authorities

In addition to the missions described above, MAGTFs and MAGTF engineer units can provide DSCA, which are missions conducted only in the United States. The US Federal military forces, DoD civilians, DoD contract personnel, DoD component assets, and National Guard forces (when the SecDef, in coordination with the governors of the affected states, elects and requests to use those forces in USC, Title 32, *National Guard* status) provide DSCA support in response to requests for assistance from civil authorities for domestic emergencies, law enforcement support, and other domestic activities or from qualifying entities for special events. Defense support of civil authorities includes support to prepare, prevent, protect, respond, and recover from domestic incidents including terrorist attacks; major disasters, both natural and man-made; and planned domestic special events.

Frequent exercises or drills improve the interoperability and responsiveness of federal and state agencies to support domestic emergencies. These events provide numerous benefits. They help build the situational understanding of participants and strengthen the partnership between participating organizations, which enable these organizations to work more effectively during crisis action conditions. They also provide an opportunity for federal and state agencies to update or refine their operational procedures based on lessons learned. Historical examples of engineer-unit support to DSCA missions include the following:

- Post-storm recovery from Hurricanes Andrew, Katrina, Sandy, and Maria.
- Support provided to law enforcement for counter-drug and illegal immigration efforts conducted in the southwestern United States.
- Military support to the 1996 and 2002 Olympics.
- Support provided to the US Forestry Service (firefighting).

Typical engineer tasks during a natural disaster can encompass debris removal to restore trafficability of roads, construction of temporary billeting and delivery of basic services for people that displaced from their homes. Typical engineer tasks during a man-made disaster can include all the tasks performed during a natural disaster plus hardening of key facilities and emplacing barriers to improve standoff at designated critical facilities.

More details regarding joint force support during DSCA missions can be found in JP 3-08; JP 3-28, *Defense Support of Civil Authorities*; and MCRP 3-30.6, *Multi-Service Tactics, Techniques, and Procedures for Defense Support of Civil Authorities (DSCA)*.
For more information on the different types of Marine Corps operations, see MCDP 1-0, *Marine Corps Operations*.

Additional Considerations for Shaping Activities

Shaping activities involve several broad endeavors, including working with governments and institutions, providing aid to foreign partners and institutions, leveraging capacities and capabilities of security establishments, and strengthening the global defense posture. Similar functions occur on US soil to support civil authorities in times of emergency, unrest, or special circumstances.

Liaise

During exercises and operations, MAGTFs can exchange liaison groups with partner-nation equivalent organizations or can allow a partner nation to embed one of its engineer units into a larger MAGTF engineer unit. Liaison groups can contain engineer SMEs that train or advise their partner-nation counterparts on command and staff actions. This training can include how to prepare staff estimates of supportability and how to plan, execute, and assess combat and general engineer activities from the perspective of a combined arms land-force headquarters. These SMEs provide advice to commanders of partner-nation engineer units as required or requested. Engineer SMEs must be aware of any unique engineer considerations that are applicable to that partner nation (e.g., national power standards).

Embedding a partner nation engineer unit into a larger MAGTF engineer unit affords the partner nation's unit operational experience regarding how the MAGTF unit applies engineer TTP to various tactical situations. The partner-nation unit can observe how the MAGTF unit conducts detailed planning to support engineer activities, such as combined arms breaching or route reconnaissance and clearance, as well as how the MAGTF engineer unit commander exercises command and control of the unit. Lastly, an embedded partner-nation engineer unit can conduct engineer operations alongside its MAGTF counterparts during more complex or larger-scale tasks (e.g., horizontal and vertical construction, nonstandard bridging, rafting, and airfield damage repair or airfield expansion). This enables the partner-nation engineer unit to employ its nation's engineer equipment, personnel, and TTP to increase its technical proficiency and build small-unit cohesion. These types of operations also provide an excellent opportunity to strengthen small-unit leadership because the partner nation's unit is oriented toward a common objective, and the unit's personnel can see the immediate results of their technical proficiency, detailed planning, and teamwork. A partner-nation engineer unit receives similar benefits when it joins into a multinational force during multinational exercises or operations, as it can work alongside a larger group of more technically diverse militaries.

Participate in Deployments for Training

Marine air-ground task force engineer units can support building partner-nation capability and capacity through deployments for training. Deployments for training, used in conjunction with activities sponsored by international institutions or security establishments, can improve the proficiency of partner nation military personnel and strengthen interoperability. The most prevalent international institution supported by US military forces is the United Nations. The United States is a party to numerous security establishments worldwide, including NATO; the American, British, Canadian, Australian, and New Zealand (ABCANZ) Armies' program; Association of Southeast Asian Nations; the Southern Partnership Station; and the Africa Partnership Station program. Within each of the regions associated with the United Nations and these security establishments, MAGTF engineer units can perform a range of tasks including:

- Repair or improve host nation infrastructure to accommodate US force reception, staging, onward movement, and integration.
- Construct facilities to establish, operate, and maintain prepositioning programs.
- Construct, repair, or improve infrastructure to support host-nation military or internal security forces (e.g., logistic facilities, training ranges).
- Construct, repair, or improve host-nation civic and international institution charity facilities (e.g., medical clinics, schools, relief supply warehouses, water points).

Planning and Coordination Considerations

Due to the complexities involved with conducting deployment for training missions, detailed planning and coordination is required to synchronize the deployment, employment, redeployment, and support of MAGTF engineer personnel, equipment, and material. Factors to consider during planning can include the following:

- Limited resources or poor-quality materials at the mission site.
- Intercontinental distance between the mission site and the location of the deployments for training parent unit or Service component command headquarters.
- Cultural and weather elements.
- Antiquated infrastructure (e.g., roads, bridges, airports, and seaports).
- Intricacies associated with obtaining, using, and accounting for multiple categories of project funding.
- Availability of required construction materials, supplies, repair parts, and services (e.g., hazardous material disposal and resupply; petroleum, oils, and lubricants; compressed gasses for welding).
- Differences in international standards (e.g., nonequivalent metric versus US customary system measurements, fittings to refill gas and liquid containers manufactured in the United States).
- Differences in local construction standards compared to US standards when using contracted labor or construction services.
- Local pay standards, graft and corruption, and civil alliances (i.e., human networks and agendas that could influence contracts).
- Issues with contracted supplies and services that would present legal problems for the US Government, such as child labor, particularly when contracted through an intermediary or local husbanding agent.

GLOSSARY

Section I. Abbreviations and Acronyms

ABCANZ	American, British, Canadian, Australian, and New Zealand
ACE	aviation combat element
AFCEC	Air Force Civil Engineer Center
AFPAM	Air Force pamphlet
AFTTP	Air Force tactics, techniques, and procedures
AGS	aviation ground support
ANB	advanced naval base
AO	area of operations
AOR	area of responsibility
ASR	alternate supply route
C2	command and control
CAC	common access card
CBRN	chemical, biological, radiological, and nuclear
CE	command element
CEB	combat engineer battalion
COE	center of excellence
CSS	combat service support
DA	Department of the Army
DD	Department of Defense (form)
DoD	Department of Defense
DoDI	Department of Defense instruction
DSCA	defense support of civil authorities
EAB	expeditionary advanced base
EBS	environmental baseline survey
EOD	explosive ordnance disposal
ERT	engineer reconnaissance team
ESB	engineer support battalion

FARP	forward arming and refueling point
FHA	foreign humanitarian assistance
FMF	Fleet Marine Forces
G-1	assistant chief of staff, personnel/personnel staff section
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
G-5	assistant chief of staff, plans/plans staff section
GCE	ground combat element
GLOC	ground line of communications
HCA	humanitarian and civic assistance
HHQ	higher headquarters
HQMC	Headquarters, United States Marine Corps
HVAC	heating, ventilation, and air conditioning
ISR	intelligence, surveillance, and reconnaissance
J-4	logistics directorate of a joint staff
J-7	training and education directorate of a joint staff
JECOP	Joint Engineer Common Operating Picture
JFC	joint force commander
JP	joint publication
LCE	logistics combat element
LOC	line of communications
LZ	landing zone
MAGTF	Marine air-ground task force
MARFORSOC	Marine Forces Special Operations Command
MCES	Marine Corps Engineer School
MCRP	Marine Corps reference publication
MCTP	Marine Corps tactical publication
MCWP	Marine Corps warfighting publication
MEB	Marine expeditionary brigade
MEF	Marine expeditionary force
MEU	Marine expeditionary unit

MHE	materials handling equipment
MILCON	military construction
MILDEP	Military Department
MILENG	military engineering
MIL-STD	military standard
MLG	Marine logistics group
MOS	military occupational specialty
MSC	major subordinate command
MSE	major subordinate element
MSR	main supply route
MWSS	Marine wing support squadron
NATO	North Atlantic Treaty Organization
NAMVC	Navy/Marine Corps departmental publication
NCB	naval construction battalion
NCF	naval construction force
NCG	naval construction group
NCR	naval construction regiment
NDAA	national defense authorization act
NMCB	naval mobile construction battalion
O&M	operation and maintenance
S-1	personnel officer/office
S-2	intelligence officer/office
S-3	operations and training staff officer/office
S-4	logistics officer/office
S-6	communications system officer/communications staff office
S-7	information environment officer/office
SecDef	Secretary of Defense
SME	subject matter expert
SPMAGTF	special purpose Marine air-ground task force
TACMEMO	tactical memorandum
TTP	tactics, techniques, and procedures

UCT underwater construction team

UFC Unified Facilities Criteria

US United States

USC United States Code

Section II. Terms and Definitions

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, electromagnetic 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)

combat engineering

Engineering capabilities and activities that directly support the maneuver of land combat forces that require close and integrated support. (DoD Dictionary)

command and control

(See DoD Dictionary for core definition. Marine Corps amplification follows.) The means by which a commander recognizes what needs to be done and sees to it that appropriate actions are taken. Command and control is one of the seven warfighting functions. Also called **C2**. (USMC Dictionary)

command element

The core element of a Marine air-ground task force (MAGTF) that is the headquarters. The command element is composed of the commander, general or executive and special staff sections, headquarters section, and requisite communications support, intelligence, and reconnaissance forces, necessary to accomplish the MAGTF's mission. The command element provides command and control, intelligence, and other support essential for effective planning and execution of operations by the other elements of the MAGTF. The command element varies in size and composition; and, in a joint or multinational environment, it may contain other Service or multinational forces assigned or attached to the MAGTF. Also called **CE**. (USMC Dictionary)

engineer reconnaissance

The gathering of specific, detailed, technical information required by supporting engineer forces in order to prepare for and accomplish assigned missions. (USMC Dictionary)

environmental baseline survey

A multi-disciplinary site survey conducted prior to or in the initial stage of a joint deployment. Also called **EBS**. See also general engineering. (DoD Dictionary)

force protection

(See DoD Dictionary for core definition. Marine Corps amplification follows.) Actions or efforts used to safeguard own centers of gravity while protecting, concealing, reducing, or eliminating friendly critical vulnerabilities. Force protection is one of the seven warfighting functions. Also called **FP**. (USMC Dictionary)

foreign disaster relief

Assistance that can be used immediately to alleviate the suffering of foreign disaster victims that normally includes services and commodities as well as the rescue and evacuation of victims; the provision and transportation of food, water, clothing, medicines, beds, bedding, and temporary shelter; the furnishing of medical equipment and medical and technical personnel; and making repairs to essential services. Also called **FDR**. (DoD Dictionary)

foreign humanitarian assistance

Department of Defense activities conducted outside the United States and its territories to directly relieve or reduce human suffering, disease, hunger, or privation. Also called **FHA**. (DoD Dictionary)

general engineering
(See DoD Dictionary for core definition. Marine Corps amplification follows.) Intensive effort by engineer units that involves high standards of design and construction as well as detailed planning and preparation. It is that wide range of tasks in rear areas that serves to sustain forward combat operations. (USMC Dictionary)

geospatial engineering
Those engineering capabilities and activities that contribute to a clear understanding of the physical environment by providing geospatial information and services to commanders and staffs. (DoD Dictionary)

horizontal and vertical construction
Deliberate engineering projects that normally involve time, manpower, material, and equipment-intensive tasks. These tasks usually relate to survivability and sustainability efforts. (USMC Dictionary)

Marine air-ground task force
The Marine Corps' principal organization for all missions across the range of military operations, composed of forces task-organized under a single commander capable of responding rapidly to a contingency anywhere in the world. The types of forces in the Marine air-ground task force (MAGTF) are functionally grouped into four core elements: a command element, an aviation combat element, a ground combat element, and a logistics combat element. The four core elements are categories of forces, not formal commands. The basic structure of the MAGTF never varies, though the number, size, and type of Marine Corps units comprising each of its four elements will always be mission dependent. The flexibility of the organizational structure allows for one or more subordinate MAGTFs to be assigned. In a joint or multinational environment, other Service or multinational forces may be assigned or attached. Also called **MAGTF**. (USMC Dictionary)

Marine expeditionary brigade
A Marine air-ground task force that is constructed around an infantry regiment reinforced, a composite Marine aircraft group, and a combat logistics regiment. The Marine expeditionary brigade (MEB), commanded by a general officer, is task-organized to meet the requirements of a specific situation. It can function as part of a joint task force, as the lead echelon of the Marine expeditionary force, or alone. It varies in size and composition and is larger than a Marine expeditionary unit but smaller than a Marine expeditionary force. The MEB is capable of conducting missions across the range of military operations. In a joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the Marine air-ground task force. Also called **MEB**. (USMC Dictionary)

Marine expeditionary force
The largest Marine air-ground task force and the Marine Corps' principal warfighting organization, particularly for larger crises or contingencies. It is task-organized around a permanent command element and normally contains one or more Marine divisions, Marine aircraft wings, and Marine logistics groups. The Marine expeditionary force is capable of missions across a range of military operations, including amphibious assault and sustained operations ashore in any environment. It can operate from a sea base, a land base, or both. In a joint or multinational environment, it may also contain other Service or multinational forces assigned or attached to the Marine air-ground task force. Also called **MEF**. (USMC Dictionary)

Marine expeditionary unit
A Marine air-ground task force (MAGTF) that is constructed around an infantry battalion reinforced, a composite squadron reinforced, and a task-organized logistics combat element. It normally fulfills Marine Corps' forward sea-based deployment requirements. The Marine expeditionary unit provides an immediate reaction capability for crisis response and is capable of limited combat operations. In a joint or multinational environment, it may contain other Service or multinational forces assigned or attached to the MAGTF. Also called **MEU**. (USMC Dictionary)

naval construction force
Also known as the Seabees, the force is deployable naval military construction engineering units whose primary mission is to provide responsive contingency construction support for United States military forces in a given theater of operations. Also called **NCF**. (NTRP 1-02)

naval mobile construction battalion

An established naval construction unit, trained and equipped for general construction of an advanced base, including buildings, airfields, roads, waterfront structures, utilities, and fuel installations. It is an integral unit in personnel, housing, subsistence, administration, and equipment and is infantry-equipped for defensive warfare. Also called **NMCB**. (NTRP 1-02)

phase

(See DoD Dictionary for core definition. Marine Corps amplification follows.) A planning and execution tool that is used to divide an operation in duration or activity. A change in phase may involve a change in task or task organization. Phasing helps in planning and controlling and may be indicated by time, distance, terrain, or occurrence of an event. (USMC Dictionary)

Service component command

A command consisting of the Service component commander and all those Service forces, such as individuals, units, detachments, organizations, and installations under that command, including the support forces that have been assigned to a combatant command or further assigned to a subordinate unified command or joint task force. (DoD Dictionary)

special purpose Marine air-ground task force

A Marine air-ground task force organized, trained, and equipped with narrowly focused capabilities. It is designed to accomplish a specific mission, often of limited scope and duration. It may be any size, but normally it is a relatively small force the size of a Marine expeditionary unit or smaller. In a joint or multinational environment, it may contain other Service or multinational forces assigned or attached to the Marine air-ground task force. Also called **special purpose MAGTF**; **SPMAGTF**. (USMC Dictionary)

underwater construction team

A unit of the naval construction force that provides underwater construction, repair, and engineering capability. Also called **UCT**. (NTRP 1-02)

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4133	Electrical Power Supplies: Standard Types and Rotating Generating Sets (Alternating Current Current) (AEP-4133)
7011	Automated Fuel System Monitoring and Control Equipment (AFLP-7011)
7063	Methods of Detection and Treatment of Fuels Contaminated by Micro-Organisms (AFLP-7063)