FM 5-116

Engineer Operations: Echelons Above Corps

Headquarters,

Department of the Army

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Preface

Field Manual (FM) 5-116 provides doctrine to commanders and staffs concerning the employment of engineer units at echelons above corps (EAC). These units will be required to complement or expand the combat capabilities of divisional engineer assets as well as construct, maintain, and rehabilitate the logistics infrastructure needed for operational sustainment of the combat forces. Some EAC engineer units may operate as far forward as the brigade's rear area, but generally most will operate in the communications zone (COMMZ).

The EAC engineer structure varies depending on the size of the combat force being supported, the type of action undertaken (offense, defense, stability, and support), the maturity of the theater, the availability of host-nation support (HNS), and the intensity of the conflict. Engineer EAC missions change as the theater expands and must be accomplished in nuclear, biological, chemical (NBC) and electronic warfare environments.

This manual addresses specific actions EAC engineer units must plan and conduct. The doctrine presented is applicable to combined, joint, and contingency operations.

The proponent for this publication is HQ, TRADOC. Send comments and recommendations on Department of the Army (DA) Form 2028 directly to Commandant, United States Army Engineer School (USAES), ATTN: ATSE-TD-D, Fort Leonard Wood, Missouri, 65473-6650.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

Chapter 1

Operational Challenges to Army Engineers

Engineering in the theater of operations (TO) builds the foundation for decisive operations, reconstitution of the force, and development of conditions favorable for early withdrawal of United States (US) forces. When military forces of the US are called upon to support our national interests, we must have the capability to project elements of power from the continental United States (CONUS) or from overseas bases into the area of operations (AOs). Projecting and building up forces require such infrastructure as airfields, ports, roads and bridges, water sources, electrical power, and much more. The buildup of forces requires either adequate preexisting infrastructure, upgrading existing infrastructure, or construction of new facilities.

— *Mr. James Stewart*
Military Engineer Development Analyst

THE NATURE OF ENGINEER INVOLVEMENT

The Army faces a wide range of potential enemies; it is prepared to fight under diverse conditions, climate, and intensity levels with its sister services and its coalition partners. The range of military operations that are neither precise, clearly defined, nor exclusive of themselves includes the diverse environments of peacetime, conflict, and war. A distinct and/or unique point in time or geography does not exist to mark the separation of one category of conflict from the next. Recent challenges to national security interests showed that the Army employed engineers on the full range of military operations. *Figure 1-1, page 1-2,* shows the relationships of the range of military operations.

PATTERNS OF OPERATIONS

From initial mission receipt through deployment, operations, and transition to follow-on operations, engineers will execute their missions through a deliberate set of patterns of operations. These patterns are not phases, nor are they sequential. They serve to focus the many tasks that the armies have always performed in war and other military operations. The patterns of operations are—

- Project the force. Deploy tailored forces directly into operations.
- Protect the force. Incorporate organizational, material, and procedural solutions to protect soldiers, information, and equipment across the full spectrum of operating environments.

Precrisis	Crisis	Hostilities	Posthostilities
Offense Defense **STABILITY** **SUPPORT**	Offense **DEFENSE** Stability Support	**OFFENSE** Defense Stability Support	Offense Defense **STABILITY** **SUPPORT**
USACE SFO (Saudi Arabia) ERC 1991-present	Desert Shield 1990	Desert Storm 1991	Provide Comfort Intrinsic Action Southern Watch

Figure 1-1. Strategic spectrum of military operations

- Gain information dominance. Create a disparity between what the Army knows about its battlespace and the operations within it and what the enemy knows.
- Shape the battlespace. Create windows of advantage by setting conditions in terms of what the Army does to the enemy and how it postures its force and takes advantage of the operational environment (terrain, weather, and infrastructure).
- Conduct decisive operations. Execute military operations that force the enemy to give in to the Army's will by destroying its means and will to fight.
- Sustain the force. Maintain the dominant tempo of operations over time, and reinforce the existing infrastructure by integrating material and operational and organizational capabilities. This is an ongoing effort throughout the entire patterns of operations.

Regardless of the operational categories in which the Army becomes involved, the degree of engineer participation in the contingency response is likely to be high. In our modern force-projection Army, the insertion of US forces requires the reception, staging, onward movement, and integration (RSO&I) of the force. Engineers are key agents of this RSO&I mission. Operational challenges include support for intermediate staging bases (ISBs) and support for lodgments such as ports and airfields.

Beyond the RSO&I, engineers are integrated into the overall Army service component mission. *Figure 1-2* shows engineer activities that are integral to the patterns of operations. Each pattern serves to focus the many tasks that engineers have always performed.

In peacetime, the US Army and other engineers are strategically engaged worldwide in activities that promote national-security objectives by improving the host-nation's (HN's) infrastructure. Examples are products of the Exercise-Related Construction (ERC) Program, the Humanitarian and Civic

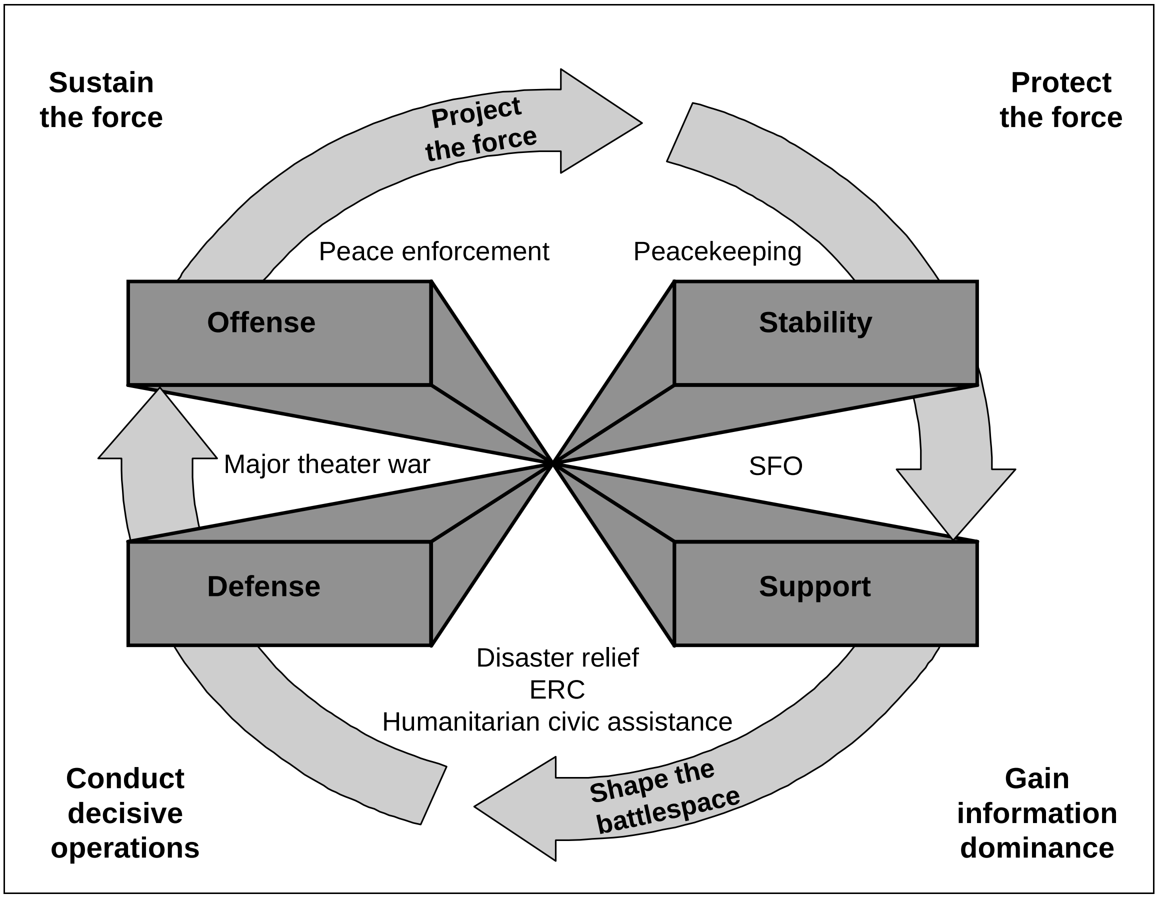

Figure 1-2. Engineer activities within the strategic spectrum

Assistance (HCA) Program, and the US Army Corps of Engineers (USACE) Support-for-Others (SFO) Program. These activities provide military training and support facilities and undertake civic projects such as—

- Building schoolhouses, farm-to-market roads, and health clinics.
- Drilling water wells.
- Building and maintaining infrastructure such as major bases, training areas, ports, and airfields.

These construction activities aid the geographic combatant Commander in Chief (CINC) in demonstrating his support within a particular region while maintaining presence within his area of responsibility (AOR). An aggressive exercise program within a particular AOR is also a fundamental tool the CINC uses to maintain presence and to foster strong military-to-military cooperation.

National and international disasters caused from hurricanes, floods, earthquakes, volcanic eruptions, and wildfires threaten the local populace and leave millions without necessities for life. The engineer response may include—

- Erecting temporary shelters and clinics.

- Removing debris.
- Performing temporary construction to bolster weakened superstructures.
- Reestablishing transportation right of ways.
- Constructing diversion or protective structures to counter lava flows.
- Constructing levees to contain rising floodwaters.
- Creating flood-prediction models for the mapping of disaster effects.
- Fighting fire.

Peace enforcement entails life support and force-protection facilities or may entail constructing physical barriers to ensure separation of combatant forces. During a major theater war (MTW), all of the above may be added to the engineer's combat operations in support of the combatant commander's mission.

ENGINEER OPERATIONS

The current trend of military operations has increased the US involvement in global responses. Operations Restore Hope and Continued Hope in Somalia, Operation Restore Democracy in Haiti, and Operation Joint Endeavor in Bosnia are all examples of the expanding role of the Army. Couple this trend with the global trend toward quantitatively smaller but technologically and qualitatively better military forces and the need for relevant doctrine becomes apparent. Engineer integration into staff planning, therefore, requires increased emphasis, since synchronizing the operation or battle is increasingly complex.

Engineer command and control (C^2) must function rapidly to be responsive to the dynamics of an ongoing operation. Terrain analysis and its products assist in faster planning and are unique perspectives of the AOs. Requirements for fortifications and protective shelters and the Army's standards for the quality of life (QOL) for its soldiers have gained importance. Obstacle systems retain their importance, while our aggressive doctrine within FM 100-5 places greater emphasis on operational mobility, obstacle breaching, and rapid gap crossing.

The five primary engineer functions in the TO are mobility, countermobility, and survivability (M/CM/S); general engineering; and topographic engineering. *Figure 1-3* shows the types of engineer missions by battlespace function.

MOBILITY

Mobility enables the force commander to maneuver units into advantageous positions. The Army commander relies on mobility to achieve surprise, mass at the critical time, and maintain momentum. Operation Desert Storm provides an excellent example of operational mobility. As it became apparent that Iraqi forces were content to occupy Kuwait and brace for the coming attack, CINC planners formulated the offensive plans for the sweep north that included two Army corps. The end run around Kuwait required displacing the XVIII Airborne Corps from their defensive positions in Central Saudi Arabia

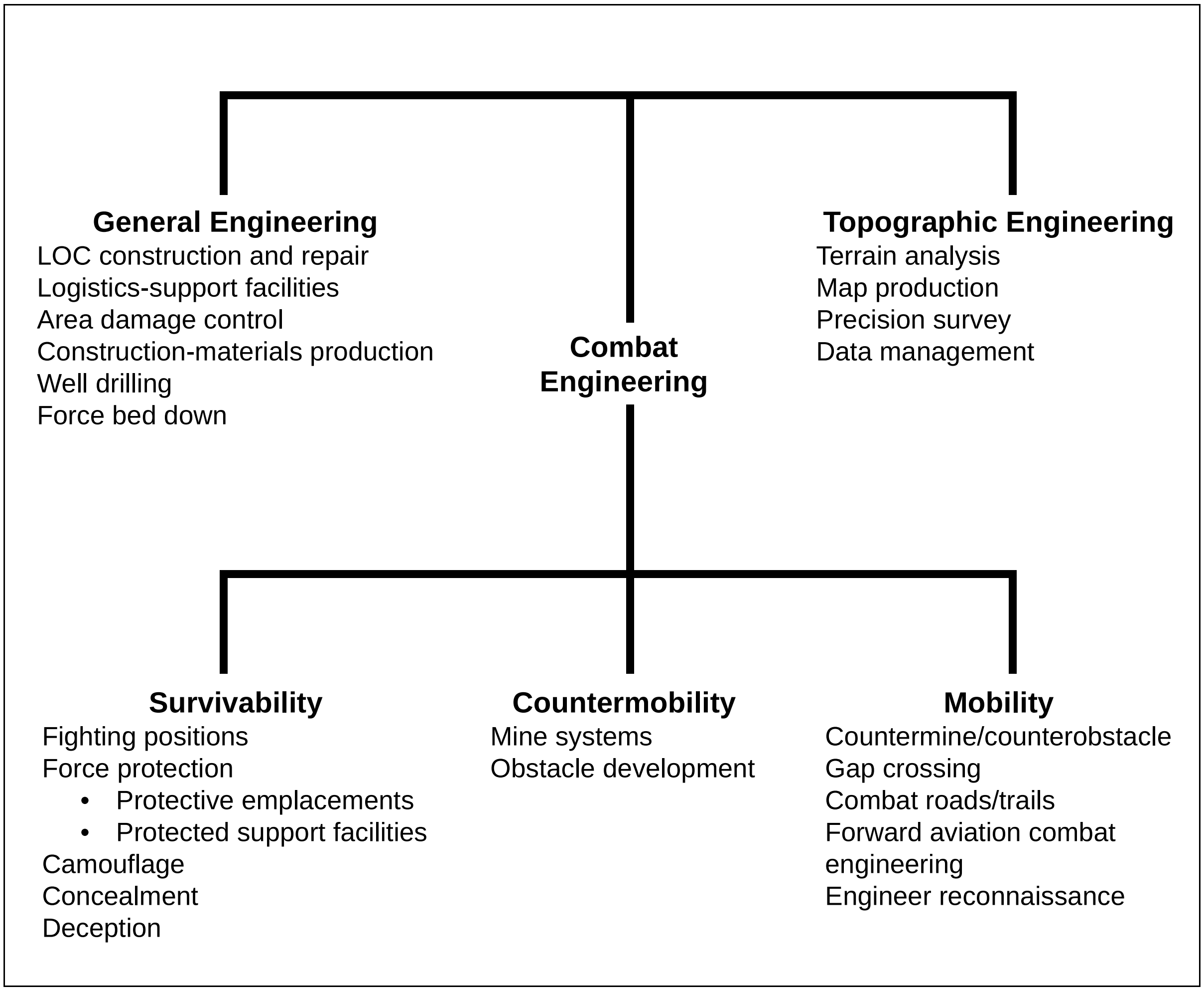

Figure 1-3. Engineer battlespace functions

to the northwest on the Iraqi border. Marshaling areas to upload tracks and road enhancements allowed for the rapid displacement of the corps into tactical assembly areas without providing the Iraqi force with even a hint of the Coalition's intentions. Army engineers aided in breaching the elaborate Iraqi defensive system, thereby allowing divisional engineers to remain integrated with the maneuver force.

In a similar vein, the bridge across the Sava River into Bosnia (and the accompanying crossing-site support areas) displayed the criticality of operational mobility during Operation Joint Endeavor.

The Army Service Component Commander (ASCC) designates the routes for ground forces, well in advance of their intended use, so that engineer units can upgrade the routes, as necessary, and keep them open or repaired. (See FMs 5-100, 5-430-00-1, 90-13, and 90-13-1 for more information on techniques and procedures for mobility.)

COUNTERMOBILITY

Countermobility augments natural terrain with obstacle systems according to the commander's concept of operations. This adds depth to the battle in space and time by attacking the enemy's ability to maneuver its forces. With its movement disrupted, turned, fixed, or blocked, the enemy is vulnerable to our forces. Engineers ensure obstacle integration through the proper exercise of obstacle C^2, focusing on obstacle-emplacement authority and obstacle control.

Obstacle-emplacement authority is the authority that a unit commander has to emplace reinforcing obstacles. The ASCC usually has the authority to emplace obstacles. Generally, he delegates the authority to corps commanders who may further delegate it to division commanders. Obstacle control ensures that obstacles support current and future operations. The ASCC's control mechanism to ensure that subordinate commanders do not emplace obstacles which will interfere with future operations is establishing obstacle zones and obstacle-free restrictive areas. The nature of obstacle integration from the ASCC level to company and/or team level leads to echelons in obstacle planning. At each lower level, engineers conduct more detailed planning. Operational planning consists of developing obstacle restrictions and granting obstacle-emplacement authority to subordinate elements. Obstacle planning requires engineers at each level to provide subordinate units with the right combination of positive control and flexibility. The engineer is also an important advisor/partner in deep-targeting discussions and the coordination focal point concerning obstacle barriers and mines for joint managers and coalition forces.

Timely, accurate reporting of obstacles from the emplacement unit all the way to the ASCC—

- Reduces the risk of fratricide.
- Allows for dissemination as boundaries change or units pass through areas occupied by others.
- Provides critical information in planning the forward passage of lines (FPOL).
- Enhances demining operations at the conclusion of contingency operations.

(FM 90-7 is the primary reference for countermobility planning; however, for more information on tactics and techniques for countermobility, see FMs 5-100 and 20-32.)

SURVIVABILITY

Survivability provides cover and mitigates the effects of enemy weapons. Engineers may be called on to mass their skills and equipment, augmenting combat units in developing defensive positions into fortifications or strongpoints and in improving defensive positions. More often, however, engineers participate in and provide staff advice on camouflage, concealment, and deception (CCD) measures and the hardening of facilities to resist the destruction of C^2 facilities (as part of integrated plans), air-defense weapons systems, and support structures within the COMMZ. Within a missile-threat environment, engineers provide field-fortification support to harden key assets against missile attacks. Force protection entails survivability engineering applications to HN facilities and US-operated facilities as protective measures against terrorist or extremists groups that threaten US forces or national interests. (See FMs 5-100, 5-103, and 5-114 for more information on techniques and procedures for survivability and force protection.)

GENERAL ENGINEERING

General engineering establishes and maintains the infrastructure that is required for conducting and sustaining military operations in the theater. General-engineering tasks include—

- Constructing and/or repairing the following:
  - Existing logistics-support facilities.
  - Supply routes, airfields, and heliports.
  - Railroads.
  - Ports.
  - Water wells.
  - Utilities (electric, heat, and water) and sanitation (sewage, hazardous waste, and solid waste).
  - Power plants.
  - Pipelines.
- Providing electrical distribution expertise.

General-engineering support—

- Begins with the supporting requirements for the initial reception of the force-projection Army (receiving equipment and soldiers).
- Is maintained throughout the operation, providing the infrastructure for the logisticians to sustain the force.
- Provides the support structure to redeploy the force.
- Ends with environmental restoration and the return of the facilities that were used by the deployed forces to HN control.

As the force advances forward on the battlefield, the corps's rear boundary will be continually drawn forward. General engineering also invokes force protection through operations such as clearing mines after the tactical breach and assisting explosive ordnance teams in clearing battlefield clutter within the expanded COMMZ to the extent necessary to conduct military operations safely.

At times, the military strategy may be to extend general-engineering support to restore facilities, power, and life-support systems within the infrastructure of the combatant countries. This effort aids in the recovery and the transition to preconflict conditions. Central to planning and executing these tasks are construction standards. The challenge is in establishing measures of success and conditions for transition to civil support. Within the modern framework of operations, all these efforts will likely be performed by a combination of joint engineer units, civilian contractors, and HN forces. These efforts require that large amounts of construction materials and specialized resources be planned and provided for in a timely manner. (See FMs 5-100 and 5-104 for more information on general-engineering techniques and procedures)

Army leadership in protecting the environment can only be achieved if environmental stewardship is integrated into the Army's decision-making process and their activities. Planning for all Army operations and strategies should include efforts to minimize releases of hazardous substances into the environment, protect cultural and natural resources, and prevent pollution. By maintaining environmental stewardship, relations with the HNs are enhanced and clean-up efforts in postconflict periods can be minimized. Guidelines on requirements for overseas operations are outlined in the Status of Forces Agreement (SOFA) with HNs or the Department of Defense (DOD) Overseas Environmental Baseline Document.

TOPOGRAPHIC ENGINEERING

Topographic engineering provides commanders with information about the terrain. Topographic information assists the commander in visualizing the battlespace environment better and aids in employing forces. All engineers are terrain experts and assist others to use the ground effectively. The division staff's terrain teams provide products for division-level planning. At the ASCC level, the topographic battalion and the planning and control detachment integrate echelons-above-division (EAD) support to Army forces, as well as to joint and multinational forces. Their use of digital terrain data to develop a detailed analysis aides the ASCC's visualization of the battlefield, thereby assisting in determining—

- Avenues and routes for Army forces (as well as likely enemy avenues of approach.)
- Terrain limitations to enemy capabilities.
- Obstacle-zone locations.
- Major engagement areas (EAs).
- Unit positions.
- Deep-operation targets and their impact on future operations.
- Rescue-operation parameters.
- Flood-prediction models.
- Water-resources information.
- Mission-planning and -rehearsal data.

(See FM 5-105 for more information on topographic support to Army systems.) Geospatial information and services (GI&S) support requirements, products, and capabilities are included in the GI&S annex to each contingency plan (CONPLAN), operation plan (OPLAN), or operation order (OPORD). Terrain aspects pertinent to operations will also be found in Appendix 2 to Annex B (Intelligence) of each plan or order.

THEATER OVERVIEW FROM THE ENGINEER PERSPECTIVE

The operational art employed within a theater is an orchestration of coherent movements and battles (real or threatened) that are distributed over time and space. These operations are characterized by using deep maneuvers and battles according to a common aim. The physical man-made infrastructure, coupled with natural terrain and the waterways of an AO, provides the framework of operational art, facilitating freedom of strategic and operational movement in a campaign. Clever planning and execution of engineer functions manipulate that framework to our advantage and are therefore imperatives of a successful operation.

Figure 1-4 portrays a conceptual theater. Regardless of the size of the projected force or the maturity of the theater, engineers impact within all zones. In the rear (the COMMZ), the first mission is the RSO&I. When soldiers, sailors, airmen, and Marines arrive at the aerial port of debarkation (APOD), they need a place to sleep, shower, and eat while receiving their equipment. Other soldiers, sailors, airmen, and marines are responsible for joining crews with weapons systems to repair the systems that are nonmission capable on arrival and generally process these units. This requires real estate; engineers acquire leases for real estate with the USACE contingency real estate support team (CREST).

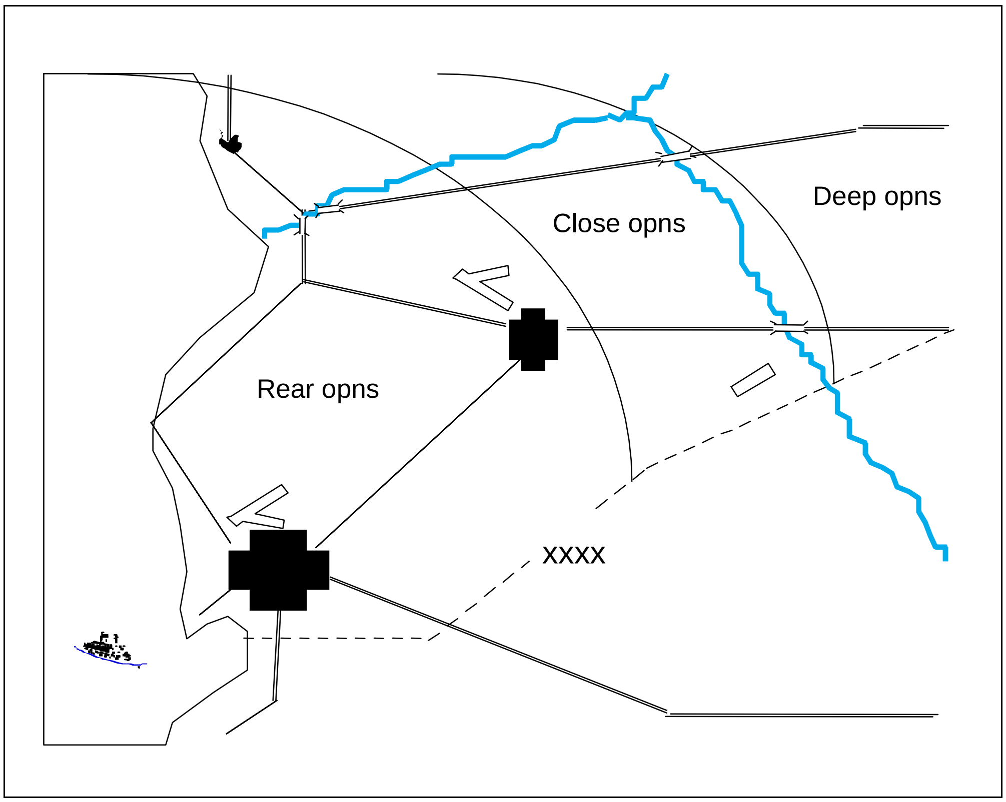

Figure 1-4. Conceptual theater structure

Depending on the distance/lines-of-communication (LOC) relationships, the use of an intermediate staging base and the engineer support of that critical operational node are imperative to extending the operational reach of Army forces.

Developing a seaport of debarkation (SPOD) to accept the equipment and the material deployed by the sea may require initial underwater port clearance and waterfront facility inspection and the expansion of the staging facilities. Similar inspection, upgrade, or expansion activities may also be required of the APOD. This construction effort accelerates equipment reception and the equipping and the organizing of the force for operations.

The Army's air dimension of early operations requires the immediate development and construction of rotary-wing aircraft bed-down/operations facilities. The theater C^2 structure and the protective systems (air-defense artillery [ADA] and military police [MP]) are employed in the rear and require protective shelters and bunkers.

The theater-sustainment base with stocks on the ground, coupled with a transportation network to get those stocks to the operator, resides within the rear. Training and rehearsals are concurrent activities during ongoing operations. These combatant-force actions, occurring in the rear, often require engineer construction of mock-ups, ranges, or similar facilities. Throughout the operation, many of these functions or the maintenance of these activities remain a focus of the Army's EAC engineers.

Engineers may also be called on to assist in repairing damage to SPODs, APODs, C^2 nodes, or other critical assets resulting from missile or bomber attacks. At the cessation of activities, the redeployment of forces, equipment, and unused materials steps up the pace of rear operations as the force prepares for the next contingency.

Constructing facilities and protective measures; establishing the sustainment base; and acquiring, maintaining, and disposing of real estate are all engineer missions that contribute to the overall operations within the confines of the rear. These missions are accomplished with a carefully orchestrated application of engineer units, construction contracting (perhaps managed by USACE assets), or HNS agreements.

In the combat zone (CZ), engineers employ tactical assets. In coordination and concert with division and corps engineers, the ASCC's staff engineer anticipates and plans for the combatant commander's engineer requirements, to include the forward reinforcement of division and corps units. Temporarily using EAC assets for specific missions or time frames allows the ASCC the flexibility to mass engineer assets within the close fight while exercising an economy of force elsewhere for a short duration.

On a more long-term basis, engineer work lines (EWLs) are negotiated far forward to facilitate the forward focus of the corps's engineer assets and to accomplish the myriad of tasks beyond the corps engineer's capabilities. Examples of such tasks are maintaining and/or constructing main supply routes (MSRs), forward landing strips, or forward-positioned medical facilities. Control measures (such as EWLs) delineate general responsibilities, facilitating the EAC engineers' work within the corps's area. Using control measures frees the corps's engineer assets to anticipate and support the close fight while posturing for the offensive momentum that Army doctrine embraces. EWLs are therefore independent of other boundary control measures, such as the corps's rear boundary.

The theater also augments the CZ, assuming responsibility for specific support on a task basis forward of the EWL. For example, in preparation for a counterattack and an exploitation of retreating enemy forces, the concept of operations may include major logistic bases well forward within the CZ to sustain the momentum of tactical units. Constructing these logistic bases will consume the corps's engineer assets and tie them to terrain around these bases. These tactical assets would better serve the combatant forces through integration into planning, rehearsals, and combat drills vice sustainment construction activities.

Deep operations within the CZ have Army-engineer concerns as well. The engineer focuses on future operations, which are shaped by deep operations, and on setting the conditions for tactical success. Future close operations of the land force will traverse and/or occupy this area. Therefore, an engineer analysis of the key terrain, the trafficability, the infrastructure, and the obstacles within the area are important considerations.

The obstacles that impact operations may be natural barriers, enemy-emplaced systems, friendly destroyed LOCs, or interdiction scatterable minefields emplaced deep to separate echelons or disrupt the sustainment flow to an enemy's forward elements. The divisional engineers are focused on close operations; therefore, these concerns are best addressed by the EAD/EAC engineers. They are also important advisors/partners in deep-targeting discussions. With the accuracy of smart munitions, careful selection of targets can render the desired effects on an enemy.

Engineer participation allows—

- The consideration and the comparison of candidate targets with the knowledge of repair capabilities.
- A greater perception of the impact of targeting on mobility (both friendly and enemy) or posthostility activity, regarding the restoration effort required.

CHARACTERISTICS OF OPERATIONS APPLIED TO ARMY ENGINEERS

Just as engineering manifests the *principles of war*, it also embraces the five essential characteristics of Army-operations doctrine:

- Initiative.
- Agility.
- Depth.
- Orchestration.
- Versatility.

Initiative sets or changes the terms of an operation by action and implies an offensive spirit in every endeavor. Theater engineers support the Army's goal of battlespace dominance in seizing the initiative. Initiative comes from understanding the commander's operational concept. This understanding allows the engineer to discern what is important, conduct mission analysis, and weight the efforts in support of the overall objective. Most engineering tasks take time to be accomplished. Initiative mandates gaining control of the situation rather than letting the situation control events.

Agility is the ability to act and react faster than an enemy. Digitization and automation increase agility by enabling engineers to exchange and analyze critical information quickly. Theater engineers anticipate the requirements for a mission and initiate preparatory action before their need is often perceived. Theater-engineer assets are neither quick nor totally self-mobile, so task organization is important to set the conditions for agility within the AOs. While theater engineers retain the flexibility to support operations forward in the CZ, they are postured to support all engineer requirements in the rear of the theater AOR. This allows the engineer commander to maintain the agility and meet unforeseen requirements that occur in the fast-paced operational tempo (OPTEMPO) of modern operations.

Depth is the extension of operations in time, space, resources, and purpose. Depth is served through simultaneous engineer operations by battlespace function. Theater engineers add visualization of the battlespace beyond the ground US forces occupy. They reinforce combat-engineer efforts at the forward edge of the battle, enhancing survivability, accelerating completion of countermobility systems, or providing operational mobility. Additionally, theater engineers support the rear lodgment, providing continued sustainment to all forces within the theater.

Orchestration means to arrange, develop, organize, or combine to achieve a desired or maximum effect. Theater engineers apply the right mix of forces using the right degree of control and operating at the right tempo and intensity level to accomplish the assigned missions. Each of the essential characteristics are valuable applications to engineer employment; however, without orchestration, they would only add value to current operations. The reality of our modern force structure and the competition for strategic lift capabilities in our force-projection Army limits the availability of engineers within the AOR. Orchestration of theater engineers as a limited resource sets the conditions for decisive victory.

Versatility denotes the ability to perform in many roles and environments while conducting the full range of operations. For example, the engineer battalion (combat) (heavy) may establish the sustainment base at the beginning of operations and a month later be engaged in constructing survivability positions to support a committed corps that is bracing for a counteroffensive. Stability operations and support operations require a versatile engineer force. Engineers must be able to transition from peacekeeping to peace-enforcement operations while simultaneously providing support operations with the same degree of success according to the CINC's priorities and strategies.

Chapter 2

Fundamentals of Theater-Engineer Operations

Great victories of military forces are often attributed to superior firepower, mobility, or logistics. In actuality, it often is the commander who makes good decisions and executes these decisions at a superior tempo who leads his forces to victory. Therefore, victory demands that commanders effectively link decision making to execution through the concept of C^2.

— Fleet Marine Force Manual (FMFM) 3

COMMAND AND CONTROL

Although the C^2 process begins and ends with the commander, the commanding, decision making, and problem solving that come with it are not done in isolation. The commander's staff and subordinates assist in developing, modifying, and improving courses of action (COAs) and in developing future COAs for events that are not totally clear.

Engineer commands (ENCOMs) and/or theater brigades will likely command and control the means by which forces execute the core-engineer functions for integrating systems. The theater backbone structure, absent in the first months of Desert Shield, now enters the theater early through the employment of an incremental deployment strategy. This provides continuity, the focus of operational issues by appropriately trained units, and allows corps and division engineers to remain focused on the conduct of operations.

TAILORING AND TASK ORGANIZATION

Commanders are challenged to generate a force that is tailored for current and anticipated missions, flexible to changing circumstances, and fits the constraints of lift capabilities in today's force-projection Army. The factors of mission, enemy, terrain, troops, time available, and civilian consideration (METT-TC) drive the initial tailoring of the force. Prioritizing and leveraging available assets for acceptable degrees of risk guide the commander in determining the timing, the amount, and the type of units to employ. Engineer units that make up the architecture of the theater-level engineer force are diverse, and many possess highly specialized capabilities. (See *Appendix A* for the types and missions of these units). Because the demands of any given operation vary, there is no set structure that comprises the engineer structure, and a building-block approach that is based on need is used to determine the ultimate force refinement.

Figure 2-1, page 2-2, is a useful depiction of the multiple engineer organizations that may comprise the theater-engineer task organization. This organization meets the needs of all the battlespace functions addressed in *Chapter 1*. This mature structure develops incrementally over time during a contingency response. This concept is addressed more thoroughly in *Chapter 3*. Examining the notional task organization, however, reveals the inclusion of Army assets other than traditional deployable units and units outside the sphere of habitually associated ENCOM units. *Appendix A* catalogs the deployable modification table of organization and equipment (MTOE) units within this structure. Discussed in the following paragraphs are organizations outside the military deployable units who also contribute to theater-engineer missions.

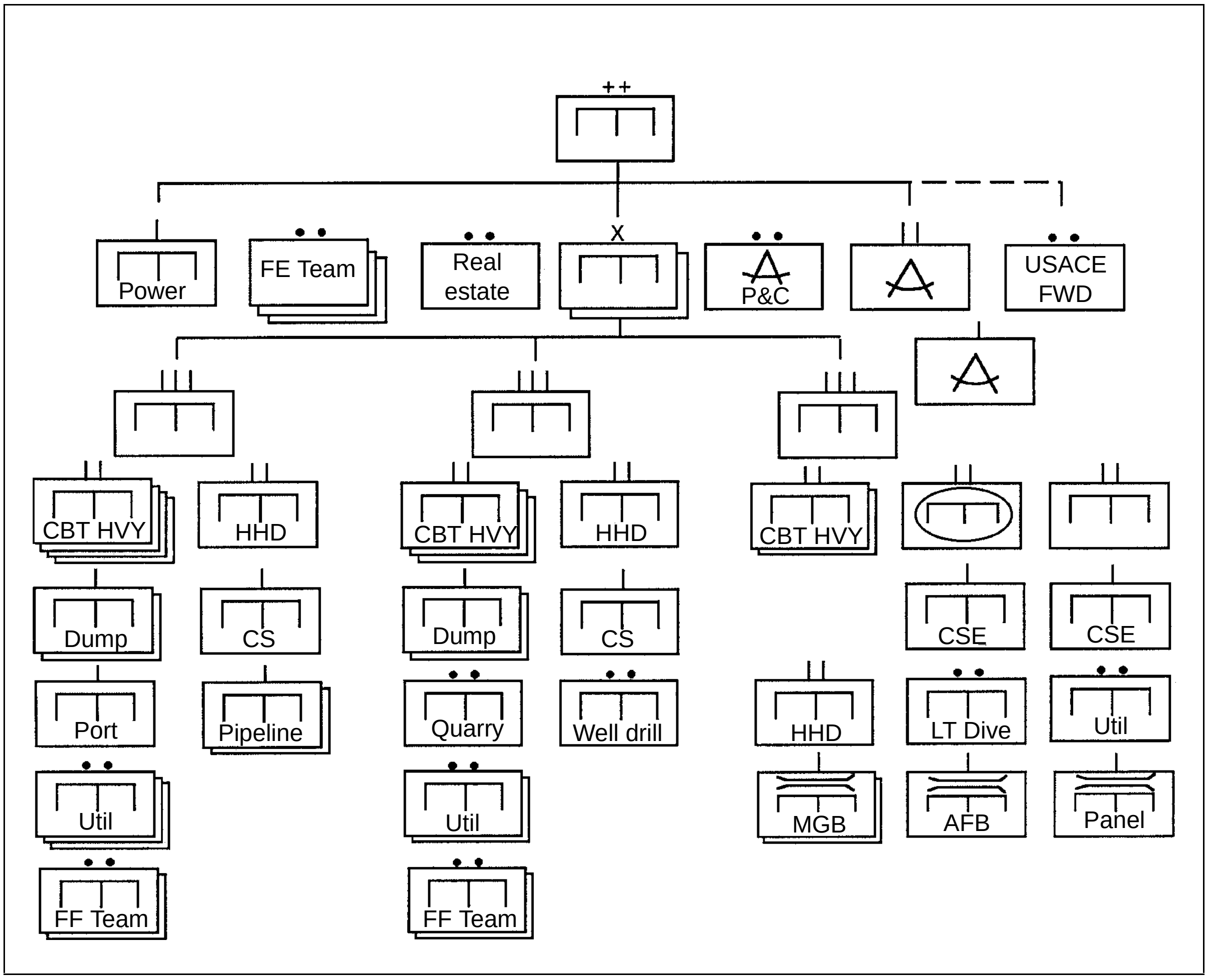

Figure 2-1. Notional theater-engineer structure

US ARMY CORPS OF ENGINEERS

A contract-construction agent (CCA) designated by the DOD manages and orchestrates defense-oriented construction activities overseas. This worldwide presence is divided between the USACE and the Naval Facilities Engineering Command (NAVFAC). The CCA is usually familiar with construction standards, materials, and contract providers within the AOR through their daily operation (before the events leading to a contingency response). Within the Army's AOR, the USACE provides the following support to the ASCC and engineer units with facilities-engineering responsibilities:

- Design and construction services.
- Construction and services contracts administration.

The theater's USACE (forward) commander may support the ENCOM, other commanders within the ASCC, and other service components. (See *Appendix B* for a more detailed description of USACE.) The USACE forward element's missions include—

- Planning and designing theater facilities for contract or troop construction.
- Providing engineer technical expertise (such as force protection, cold-weather effects, water detection, flood prediction, and topography) to support units in the field and providing engineer solutions for operational requirements.
- Managing the contract-construction program.
- Ensuring quality assurance (QA) for contract construction and troop construction, if requested.
- Planning for and acquiring real estate.
- Providing contract-construction management/oversight.
- Serving as the administrative contracting officer (ACO) for the Logistical Civil Augmentation Program (LOGCAP) construction and the contracting officer's representative (COR) for QA.
- Providing environmental technical support and managing contractor-executed hazardous and toxic-waste cleanup and environmental restoration missions.
- Ensuring that users of the Theater Construction Management System (TCMS) have technical support.
- Managing and accounting for all appropriated military-construction (MILCON) and international-construction support funds provided for construction execution in the theater.
- Providing a USACE liaison to the ENCOM staff and other supported or coordinating command staffs.

FACILITIES ENGINEER (FE) TEAM

An FE team is a reserve table of distribution and allowances (TDA) unit. In times of national emergency and contingency operations, it may mobilize and deploy to be attached to the senior engineer HQ, a group or higher engineer organization, or an area support group (ASG). As part of a large and diverse FE TDA unit, the team can be task-organized to fit a specific mission before deployment. The team has no organic communication, transportation, or defensive equipment.

The ASCC has overall responsibility for real-property maintenance activities (RPMA). A principal RPMA function in a TO is the operation, the repair, and the maintenance of facilities and utilities occupied by Army forces and other service-component units. The FE team is uniquely suited for this mission. It is a part of the FE TDA. The team is a nationwide reserve organization with the mission of assessing and managing the upkeep of the physical plant of our reserve facilities and mobilization base. The FE TDA is comprised of small highly skilled teams that can be easily task-organized to manage FE missions. Environmental considerations and mitigation have become increasingly relevant to US force-projection operations throughout the world in recent years. The team is particularly equipped to aid and advise the ASCC on Environmental Compliance and Assessment System (ECAS) issues as they relate to current and future operations. The team's skills, originally envisioned for use only within the US during partial or full mobilization, has been used repeatedly during contingency responses. The team was deployed to Saudi Arabia during Desert Shield, and others have been used in Somalia (Operation Continued Hope), Haiti (Operation Uphold Democracy), and Bosnia (Operation Joint Endeavor). The team is normally attached to ASGs and has a coordination relationship with the ENCOM.

COMBAT ENGINEERS WITHIN THE THEATER STRUCTURE

The use of combat-engineer units and bridge assets are depicted in the notional structure because of their utility and purpose beyond the needs of the maneuver elements, see *Figure 2-1*, page 2-2. These highly mobile, offensive US force-projection units will span great distances in an area from the entry points of the COMMZ to the forward edge of friendly forces.

The theater-engineer structure assumes responsibility for forward areas as the corps structure moves forward in the offense. The battlespace is expected to be an engineer challenge due to unexploded ordnance, mines, and damaged road networks. Combat-engineer units have immense utility within the theater-engineer task organization. Task organizing combat-engineer units with theater-engineer units increases the survivability of forward EAC engineer workforces and improves mobility throughout the theater AOR. The combat engineers' skill proficiency in demolitions and mine clearing reinforces the EAC engineers' military occupational specialties for construction. Likewise, the engineer bridge specialists' unique equipment and skills, organic to bridge units, are required to rapidly expand tactical bridging to a more permanent gap-crossing site that is capable of transiting sustained two-way traffic. When other services, such as the Marine Corps, require Army engineer augmentation, combat engineers may be assigned to the theater engineer for C^2 to provide engineer support in a joint operation. To perform M/CM/S and general engineering within the environment described above, bridging units and mechanized and wheeled combat battalions are task-organized within the theater-engineer structure.

All missions may not require the inclusion of these combat elements, bridge assets, or TDA units. The makeup of the task organization will vary based on the METT-TC. Task organization for the operational-engineer structure is situational dependent. The notional task organization depicted in *Figure 2-1* illustrates that the applicable "building blocks" are not limited to the customary EAC-type units.

ENGINEER COORDINATION

Engineer coordination in modern contingencies is as axiomatic as coordination between maneuver elements, whose coordination (left to right and higher to lower) enhances the probability of success, synchronization, and mass at the decisive moment and precludes fratricide. The earlier reference to an initial limited engineer-force structure within the AOR is overcome through the effectiveness of coordination. Just as the operator establishes maneuver graphics, boundaries, axes of advance, and fire-support coordination lines to control fires and maneuver, the engineer employs standards, prioritizes the effort, establishes EWLs, and employs obstacle-free zones. Some of these coordination measures are put forth by the CINC and the joint-force commander; others are established by the ASCC and the joint-force land-component commander.

The CINC's, joint-force commander's, and ASCC's ability to influence the battle with engineer assets may be managed through operating a theater contingency engineering management (TCEM) or a regional contingency engineering management (RCEM) cell. The composition and the procedures of the TCEM and the RCEM cells are governed by the respective geographic CINCs. These cells are augmented to the staffs they support and do not form an engineer-command stovepipe. The TCEM and the RCEM cells apply the commander's intent, merge engineer-support requirements, and orchestrate resources by—

- Establishing priorities and policy for theater Class IV (A and B) stockage levels.
- Establishing theater distribution protocols that are consistent with construction priorities.
- Monitoring and recommending the allocation and use of construction assets against priority operational requirements and recommending taskings for engineer assets.
- Developing construction standards and priorities.
- Providing input to the Joint Civil-Military Engineering Board (JCMEB).

STANDARDS

Established construction standards and policies guide engineer operations and are generally stated within the OPORD. These standards and policies provide for allocating limited resources to accomplish the most vital tasks and direct the priority and the level of effort to be expended. Engineer materials and services support the operator as well as the logistician. Mounting or conflicting demands on engineer resources must be resolved to ensure that the greatest use is gained. For example digging assets have multiple uses throughout the AOs. They can be used to—

- Enhance sustainment and the QOL in rear areas.
- Improve survivability of forward elements.
- Contribute to countermobility activities.

A principal tool that is available to the engineer is the Civil-Engineering Support Plan (CESP). For more information on the CESP, see *Chapter 5* and *Appendix C*. Generally, facility requirements within a contingency are needed for a short duration and, therefore, are satisfied (in priority) by—

- Obtaining maximum use of existing facilities (controlled by the US/HN).
- Modifying existing facilities rather than constructing new ones.
- Leasing facilities.
- Constructing new facilities.

Using an appropriate balance of US engineer troop units and contractors, Army forces that are deployed to developed areas capitalize on an established infrastructure and maximize the use of existing facilities. The construction effort is focused on facility modification and battle-damage repair, making maximum use of the HN's available manpower, equipment, and materials.

Army forces deployed to lesser-developed and undeveloped operational areas rely more on the construction of new austere facilities. The construction effort at first is focused on initial standard (up to 6 months expected use) or temporary standard (up to 24 months expected use) construction and battle-damage repair. As the operation extends over time, these standards may not be adequate for the level of QOL the commander deems appropriate for his soldiers. Whatever the standard, HNS is sought, but it may be less available than in developed areas. In all theaters, a prudent mix of troops, direct contracts, and LOGCAP contractors accomplish theater construction and/or repair requirements in the most efficient means available. Only through this mix can the engineer overcome shortfalls in resources while maintaining the support level required by all forces deployed in theater.

PRIORITIES

Engineer work requirements throughout the operational area normally exceed capabilities. The CINC routinely establishes a broad priority system within his OPORD (usually in *Appendix 5 of Annex D* in the OPORD). This priority system assists in applying resources across all services against only those tasks that are most critical to success. The following list provides a framework for assessing the priority of required engineer support in broad terms:

- High loss of life or combat defeat.
- Degraded combat effectiveness or increased vulnerability on the battlefield.
- Degraded critical then noncritical combat service support (CSS).

These broad priorities are often inadequate to address specific projects that compete for resources. Frequently, these instances impact on more than one service either through the consumption of limited Class IV materials or the allocation of a limited construction element. Adjudication occurs within the TCEM cell for cases of broad theater consequence or the RCEM cell for cases of a more local nature. These cells are augmented to the CINC's staff engineers and almost always have joint membership.

REPORTS

Accurate and timely engineer reports from subordinate units to the senior engineer and the ASCC are critical to the Army engineers' ability to inform and advise the ASCC on engineer status and issues. This routine feedback mechanism allows the commander and his staff the visibility of current operations as they monitor activities. This in turn gives the engineer and his staff a way to anticipate needs and validate current plans and future engineer efforts. A thorough awareness of the activity level, unit locations, equipment, material, and personnel status provide the basis for the commander's decisions on—

- Task organization.
- Mission allocation.
- Viability of future operational COAs.
- Time-phased force-deployment data adjustments.

The reporting times, the frequency, and the format will be specified within the OPORDs or the standing operating procedures (SOPs) for the units involved. Avoid generating reporting requirements that distract from the unit's mission capability or exceed their staffing capability. If the reports serve multiple purposes and HQ, duplicating information in varied formats would be minimized. The TCMS software fielded for all Army engineer battalions (combat) (heavy), groups, brigades, and ENCOMs has imbedded reports formats that could—

- Standardize reporting.
- Draw from management data assembled for mission execution.
- Benefit the reporting unit by decreasing the generation of reports for the higher HQ.

Obstacle and minefield reporting are engineer coordination measures with grave consequences if not recorded and communicated properly. The land-component commander by joint doctrine is the command repository for all minefield data. The need for a single clearing house for these reports is paramount to engineer units, maneuver elements, and logisticians operating within the theater. As units cross boundaries or push forward into enemy territory, friendly reinforcing obstacles must be known. Scatterable minefields, whether emplaced by the Air Force (Gator), Army aviation (air Volcano), artillery (area-denial artillery munition [ADAM], remote antiarmor mine [RAAM], and wide-area mine [WAM]), or combat engineers (Volcano or Modular Pack Mine System [MOPMS]), have variable self-destruct times and reliability that will affect operations.

At the time of publication, the US's use of antipersonnel land mines is being changed according to presidential guidance and the fiscal year (FY) 98 DOD Authorization Bill. As friendly elements report enemy or friendly emplaced systems, the ASCC's staff engineer is the clearing house for this information. This single repository becomes the authoritative source on obstacle status and is a principal guard against fratricide. The ASCC's staff engineer is assessable by all services that anticipate ground operations in affected areas. He possesses the visibility and/or connectivity to other services to ensure maintenance of the most complete, reliable database on obstacles.

ENGINEER SUPPORT CONCEPTS

Each committed corps will have an organic corps engineer brigade. The ASCC equips the corps brigade with sufficient combat and general-engineering assets to maintain operations for the requirements within the corps area. These requirements include—

- Integration into the combined-arms maneuver team.
- Survivability of assigned assets.
- General-engineering operations, such as construction support to the division support commands (DISCOMs) and the corps support commands (COSCOMs).

Some construction effort will be expended through expanding—

- Combat trails to divisional- and corps-level MSRs.
- Support to attack aviation bed down.
- Support to forward-area refueling points (FARPs).

Just as the ASCC desires the combatant corps's attention to be focused on matters oriented forward, engineers also maintain theater support and reinforce Army missions as far forward as practical to focus combat engineers on tactical support to combatant commanders.

THEATER SUPPORT BASE

The CSS units' ability to conduct RSO&I, sustain operations, and move and/or shelter combat and CS forces depends on adequate, responsive engineer support. The number and the type of engineer-support units depend on the—

- Size of the support base required.
- HN infrastructure and the support available.
- Mission.
- Availability of existing engineer support brought to the TO and other services.
- Perceived threat in the rear area.
- Duration of the operation.

Figure 2-2 displays the typical command and support relationships between the engineer elements and their supported Army sustainment providers. Although the theater support command (TSC) requires extensive general-engineering support, the operating systems that provide this support are shared by both the combat and support channels. The ASCC, through the engineer chain of command, orchestrates engineer support for all stakeholders. Depicted in *Figure 2-2* are the management/coordination cells within the theater that establish priorities and standards. The TCEM arranges theater-wide standards while the RCEM states the priorities relevant to a smaller geographic region.

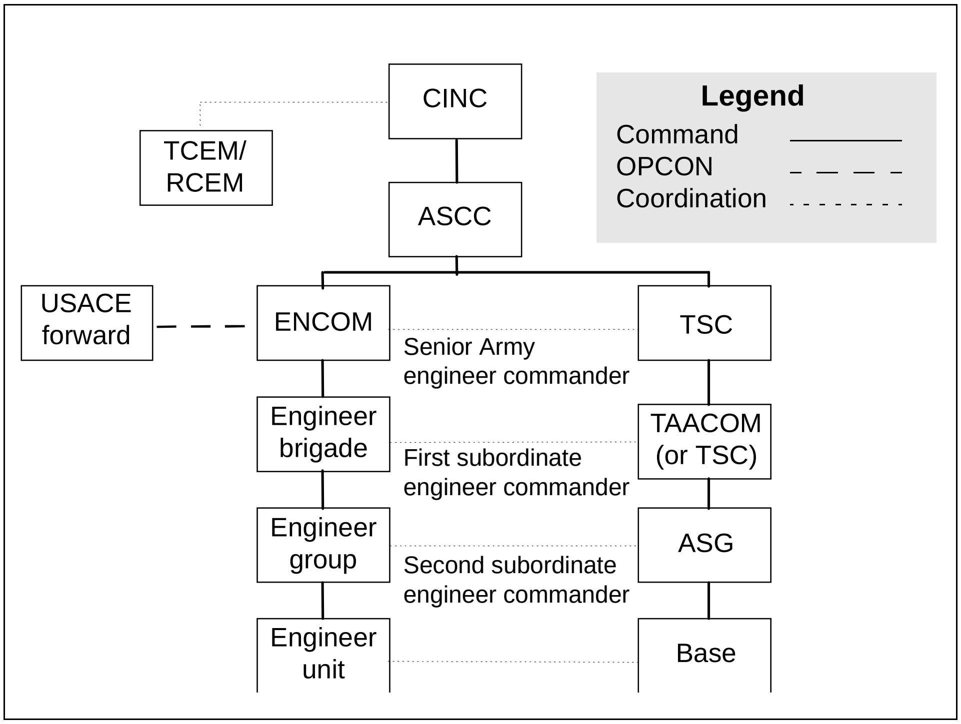

Figure 2-2. Theater-engineer support relationships (Army only)

Within the theater's rear area, Army engineer units provide—

- Topographic support to the theater at large.
- Real estate acquisition and management.
- RPMA support.
- Electric-power generation/distribution.
- Troop construction and repair.
- Contract-construction support.
- Environmental engineering support.
- Transportation engineering support.
- Underwater-port construction and repair.
- Underwater-port obstacle clearance or salvage.

TOPOGRAPHIC SUPPORT

The EAC's topographic-engineer battalion is the ASCC's topographic asset. The battalion commander is the theater's topographic engineer. The battalion can conduct topographic operations from the home station or a split-based or deployed environment. The battalion—

- Analyzes the terrain—
  - — To plan for the intelligence preparation of the battlespace (IPB), tactical-decision aids, and sustainment and rescue operations.

- — To plan and estimate for M/CM/S and general-engineering missions.
- Updates existing maps and digital topographic data.
- Establishes geodetic survey controls in the operational area.
- Manages, updates, and reproduces digital terrain information.

The topographic battalion is tailored to meet the requirements of the particular operational area. This unit supplements and enhances the National Imagery and Mapping Agency (NIMA) effort by compiling data from various sources into special-purpose topographic products such as—

- Digital topographic data for C^2 and mission planning and rehearsals.
- Image-based map substitutes.
- Terrain-analysis information (trafficability, line of sight, cover, concealment, route analysis, hydrological data, and obstacles).
- Geodetic survey data for precise positioning and targeting of weapons.
- Map overprints
- Map revisions.
- Model and simulation databases.

REAL ESTATE SUPPORT

The USACE forward element, through its real estate component, provides technical real estate guidance and advice to the ASCC. It recommends real estate policies and operational procedures. The element acquires, manages, disposes of, administers payment for rent and damages of, handles claims for, and prepares records and reports for the real estate used within the theater. The USACE, through the CREST, may also exercise staff supervision over the real estate operations of the Army's real estate detachments and routinely provides real estate support to other US services. Real estate planning must be initiated in the preparatory phases of a campaign by a planning group because of the significant role it plays in the initial RSO&I, particularly in less developed theaters. The ASCC's staff engineer participates in all planning activities. After hostilities cease, real estate requirements for the reconstruction period should also be considered.

Outside the active CZ, real estate is normally acquired by lease or HN agreements, and all transactions are documented thoroughly under the applicable provisions of theater directives. Large tracts of real estate are required for—

- Airfields and railheads.
- Port operations.
- Reception areas.
- Staging areas.
- Training and maneuver areas.

- Pipelines.
- In-theater recreation and reconstitution areas.
- Storage locations.
- Chemical decontamination sites.
- HQ installations.

Accommodations for displaced civilians and enemy prisoners of war (EPWs) are often suited to leased facilities within the COMMZ. Some of this property may be highly developed and may have considerable value to the HN corporate or civilian population. Procedures must be followed to provide the property required while ensuring that the legal rights of owners and the US government are protected. Environmental baseline surveys must be conducted before US personnel occupy any property.

RPMA REQUIREMENTS

The ASCC has the overall responsibility for the RPMA. The theater Army area command (TAACOM) (or TSC), through the FE teams (assigned to the ASGs), normally provides the needed RPMA support, using engineer units (attached to or in general support [GS] of the ASGs) to provide the engineer-specific services. These services include—

- Facilities and utilities repair and maintenance.
- Fire prevention and protection.
- Refuse disposal (landfill operations as opposed to refuse collection, which is an ASG responsibility).

Tailoring engineer units to support the ASGs is based on the expected RPMA workload. As logistics bases are established, the RPMA requirements are normally met with the assigned or attached assets of the ASG or other logistics organizations. As the bases mature and the RPMA requirements exceed these capabilities, the requirements are forwarded to the supporting engineer group for execution according to theater priorities. RPMA support is required for all Army facilities within the AOs, which includes leased facilities, unless HNS is available for them. The FE team is ideally suited as an RPMA manager within large HN-provided or -leased facilities equipped with heating, ventilation, and air conditioning (HVAC) and utility systems typical to commercial buildings and complexes. The FE team—

- Provides C^2 of a base directorate of public works (DPW) organization with augmented assets.
- Inspects facilities and systems.
- Prepares the scope of work and provides limited design services and contract administration for RPMA support.
- Provides staff support for a full spectrum of FE services to Army units requiring technical support.

- Coordinates engineer-support requirements and passes them on to supporting engineer teams, an engineer group in GS, a contracted RPMA engineering service, or HNS personnel.

Except for the specialized teams assigned to the ASG, the engineer group in GS to the ASG has control of all engineer units in its assigned area. The ENCOM can also administer real-property maintenance on a centralized basis as the need arises in task organizing engineer assets and weighting the main effort.

Once the capabilities of the ASG are exceeded, a DPW should be established. At this point, the base has under its control extensive facilities, possibly including HN-provided or -leased permanent buildings with complex utility, HVAC, solid-waste, housing-management, and other systems that provide life support and mission support.

The DPW organization must be tailored to the specific base RPMA needs from a variety of assets. The FE team should serve as the nucleus of the DPW organization. The team must be supplemented with HNS, USACE-contracted assets, and engineer units such as utility detachments, fire-fighting detachments, and others. The DPW can be assigned to the ASG or to a centralized RPMA organization under direct control of the theater commander.

ELECTRICAL POWER SOURCES

The technologically advanced systems employed within the TOs place demands on electrical power sources that existing facilities within the HN may not be able to accommodate. Many nations have electrical distribution systems that—

- May provide unreliable power with voltage fluctuations.
- May not be capable of meeting our power demands.
- Require step-down transformers.
- Are not compatible with normal US equipment.

To meet power needs, the prime-power battalion has the ability to generate and distribute utility-grade electrical power as well as provide expertise on all electrical and distribution systems. This is a superior alternative to multiple tactical generators that were designed for very different applications. Prime-power units meet the demands of large command, control, communications, computers, and intelligence (C4I) networks, such as the ASCC HQ and its multiple major subordinate commands (MSCs). These C4I nodes are typified by large power demands for extensive communications and automation systems. Remote base camps of significant density or those made up with force-provider packages use prime-power assets to reliably source electrical requirements.

TROOP CONSTRUCTION

For the greatest efficiency and increased responsiveness, the ENCOM operates on the principle of decentralized execution of the theater's construction program. Although progress is monitored within the ENCOM, decentralization requires that work requests enter the system at the lowest possible level. Within the theater-support base, alignment along area-support boundaries provides established conduits through the ASG. If the ASG cannot accomplish the work with its organic assets, it prioritizes the requests and provides them to the supporting engineer group. When the work cannot be done at this level, the engineer group enters the requests into a construction and repair backlog and passes them to the engineer brigade for resolution. Troop-construction tasks come as construction directives. *Appendixes D* and *E* show sample formats for a construction directive and a construction SOP.

The civil-affairs teams receive HN requests for US engineer support and pass them to the engineer group for execution. The engineer group enters these requests into its workload according to established theater priorities. Other component services submit work requests directly to the engineer brigade supporting the geographical area where the construction is required. The engineer brigade prioritizes these requests and provides them to the engineer group who supports the area requiring the work. When the work cannot be done, the ENCOM is advised through the reporting procedures so it can resolve the problem.

The ENCOM may receive work that is required in support of the theater's base-development plan (BDP) through coordination with the TAACOM or the TSC. The ENCOM also receives work generated at the CINC or the ASCC level based on plans for future operations. The ENCOM prioritizes the work and passes it to the appropriate engineer brigade for accomplishment. It may also redistribute backlog work to other engineer brigades that are not fully committed. This two-way flow of backlog work and taskings identifies the required workload to each level of the organization. The engineer group can do objective scheduling according to theater priorities. Only an exceptional case needs to be referred to the higher HQ; for example, to settle a question of priority. *Figure 2-3*, page 2-14, is a flow diagram that summarizes these procedures. The TCEM/RCEM cells will most likely be involved with prioritization during the early days of any operation.

CONTRACT-CONSTRUCTION AGENT

The CCA oversees construction and other contracting services that are available through the USACE, the NAVFAC, or the Air Force regional civil engineers' (AFRCE) CCAs, depending on the theater's location. CCAs will maintain control of the contractor's operations. Each service component has its own geographic AO; however, in any one area, only one CCA is designated. The DOD has assigned regional contract-construction capabilities as follows:

- The USACE has Northeast and Central Asia, Central and Northern Europe, North and South America, the Middle East, and Northeast Africa.
- The NAVFAC has the Iberian Peninsula, the South Pacific, the Caribbean, Antarctica, Southeast Asia, the Mediterranean Basin, and the Horn of Africa.
- The AFRCE has the United Kingdom (UK).

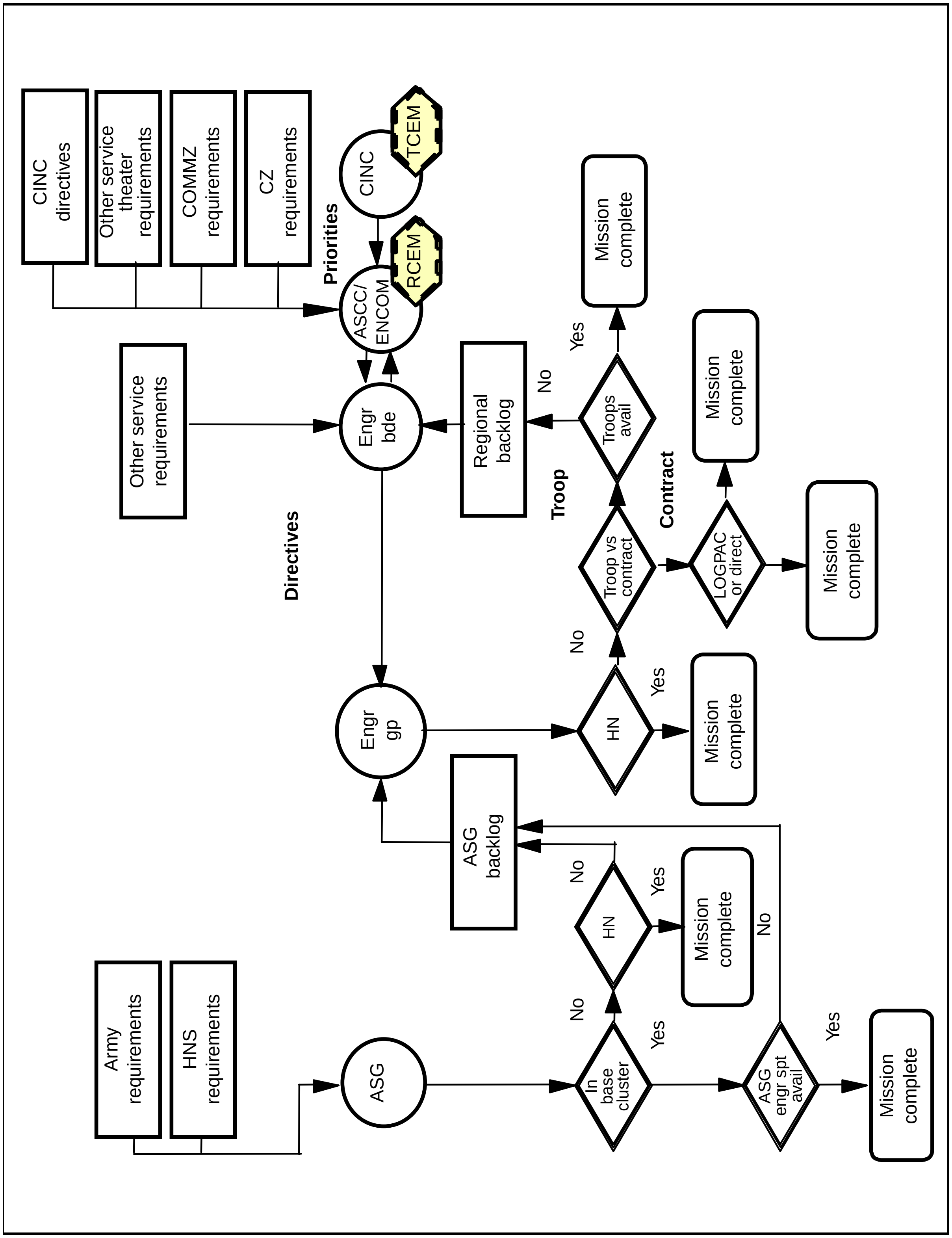

Figure 2-3. Flow of construction request

The CCAs will establish contract-management offices in support of force-projection operations. They will be deployed as early as possible to initiate the necessary contracting operations.

Army engineers routinely support other component services, HNs, and coalition partners as well. The Air Force, for example, plans on Army support for air-base damage repair to quickly generate sorties after an attack. The Marines have limited engineer-construction capabilities and rely on Army support if they will be engaged in an operation for any extended period of time. Joint engineer doctrine addresses these applications specifically; however, the fundamentals discussed within this manual apply to any engineer mission regardless of the supported unit.

SUPPORT TO COMBAT OPERATIONS

Army engineer support spans more than the theater-sustainment base. Maneuver elements receive limited organic engineer support. The theater support relationships are not traditionally direct support (DS) or GS roles because the senior engineer must maintain greater flexibility in assigning operational missions and redirecting assets while providing consistent C^2. Nevertheless, these Army engineers can and do support the combat engineers in accomplishing missions through activities within the CZ. Control measures, such as EWLs, delineate work zones and are positioned as far forward as practical for the respective level of engineer effort. This line between the combatant Army engineers is coordinated with the ASCC's staff engineer, the corps's engineer brigade, and the ENCOM to meet the operational and tactical needs. Coordinated EWLs ensure the most effective and efficient use of all engineer assets within the theater.

To facilitate the forward focus of the corps's engineer assets and to accomplish the myriad of tasks beyond the corps engineer's capabilities, Army-level engineers frequently work within the corps's area. All engineer missions behind the EWL delineating corps- and Army-level engineers are the responsibility of the Army engineer. Such missions include MSR maintenance and construction requirements for support facilities (hospitals and airfield matting for rotary aviation operations and bed down). This frees the corps's and the division's engineer assets from missions that draw their attention rearward.

Forward-placed EWLs posture the operational assets for continuing missions that would be otherwise handed off as the corps moves forward. Therefore, EWLs are independent of other boundary control measures (such as the corps's rear boundary), allowing division- and corps-level engineers to concentrate on forward efforts that are critical to the close fight. Finally, the theater augments all of its corps by assuming responsibility for specific support on a task basis forward to the specified EWL, again releasing the corps's construction units to engage in activities far forward and of immediate concern to the corps commander. Examples of such projects are constructing forward log bases and repairing war-damaged airfields or EPW/dislocated civilian camps in anticipation of the rapid advances of the forward elements.

Very specific operational support occurs at transition periods of current operations. Transitioning from the offense to the defense requires rapid employment of engineers in the following areas:

- Survivability emplacements for ADA.
- Primary and alternate positions for artillery.
- Survivability emplacements for C4I.
- Linear obstacle emplacements (tank ditches).

Transitioning from the defense to the offense has similar engineer requirements, such as—

- Expanding tactical breaches of obstacle systems.
- Positioning ammunition supply points (ASPs) forward.
- Establishing FARPs.
- Preparing areas for forward logistics bases.
- Assuming missions previously worked by divisional engineers.
- Upgrading combat trails to supply routes.
- Adjusting obstacle controls and allocations, as required.

After successful river-crossing operations, division and corps engineers are focused forward on the far-shore objectives that drove the river crossing. They need not be tied to the river at their rear—again handover to Army-level engineers to expand the bridgehead will proceed the shift of the corps's rear boundary.

Chapter 3

Theater Development

Initially, the Central Command (CENTCOM) CINC and staff determined that Operation Desert Shield was to be sustained in the theater by the premise of "minimum essential" support from troop units and maximum support from HN and contracting sources. The 20th Engineer Brigade's (Corps) (Airborne) commander initially served as the theater engineer, in addition to commanding engineer support to the forward fight. Fortunately, the Iraqi advance halted at the Saudi border, otherwise the XVIII Airborne Corps engineer commander would have been focused on the close fight vice the mission he assumed to provide theater troop bed down and logistic base-construction support.

The CINC made decisions not to deploy theater-engineer construction units, initially, because of their large strategic lift requirements and the prevailing attitude within the CENTCOM and Third US Army leadership (who believed that support facilities, and by inference engineers were not critical to Army operations). During the initial stages of Operation Desert Shield, it became quickly apparent that HNS and contracting would not be able to handle the massive amount of construction needed to logistically sustain and move forces in theater. The 20th Brigade, the USACE's Middle East Area Project Office (MEAPO), and the Third US Army's engineer staffs were not adequately staffed to control increasing theater-engineer requirements. The 416th ENCOM was mobilized and deployed to serve as the theater engineer.

— Major General (MG) Robert B. Flowers

BASIC THEATER PRINCIPLES

Today's force-projection Army creates challenges in all theaters (developed and underdeveloped). This includes those—

- With a permanent forward presence.
- With a limited presence (perhaps through training exercises).
- With no presence at all before the contingency.

The above perspective is not taken from obscure history; it is taken from recent experience that has shaped the way we approach contingency responses. Engineer doctrine as expressed in this manual, FM 5-100, and others is a reflection of lessons learned. Theater development occurs as appropriate organizations deploy to meet the needs of the mission without creating undue risk to the soldiers or the mission.

The foundations of basic theater development come from theory, history, and experience. The Army's requirement to project ground forces to anywhere in the world shaped current engineer concepts for the patterns of operations. From a strategic perspective, the patterns of conflict that we have experienced since about 1989 will likely continue into the 21st century. We expect to be involved—normally as part of a multinational force—in large-scale combat contingencies such as the Persian Gulf Conflict, 1990 to 1991; foreign humanitarian assistance efforts such as Operation Sea Angel in Bangladesh, 1991; peace operations such as those in Bosnia and Haiti; and various other types of operations requiring US military engineer capability.

The theater-development principles are incremental deployment, split-based operations, and mobilization of the Reserve Components (RC). Engineer units must be part of the initial or early deploying forces that enter the AOs and the last to leave the contingency area. Engineers will operate dispersed over the extended battlespace. They will be required to operate at all levels from tactical to strategic. Engineers rely on split-based operations to obtain current technical data or mission planning and execution from CONUS- and other COMMZ-based engineer organizations. Access to and involvement of the RC engineer units and soldiers will be essential whenever division formations deploy for extended periods. With about three-quarters of the engineer force in the RC, highly capable, rapidly deployable RC engineer units must be mobilized and inserted early in the time-phased force-deployment list.

INCREMENTAL DEPLOYMENT

The force-projection Army's first major challenge in a crisis response is mobilizing and deploying into the theater. This is particularly true for engineers whose force structure is largely made up from the RC forces. Also factored into the mobilization process is the availability of space on the military strategic sea lift and airlift and the Civil Reserve Air Fleet (CRAF).

Experience shows that the incremental deployment of individual engineer units meets the needs within the AOR with appropriate expertise and readiness from within the force-projection Army. This modular building of the theater support acknowledges the profound competition for available lift capabilities. The immediate needs within the AOR vary with each contingency operation. The functions that the theater HQ provides will be required in the early stages of any contingency operation. However, large C^2 organizations will not be needed entirely within the first 15 days of any contingency operation.

Deploying the well-trained, identifiable increments of the theater command early provides its expertise and oversight from the beginning of operations. Such a deployment strategy allows the tactical commander to plan and remain focused on his mission. Likewise, incremental deployment minimizes the footprint of theater command units when sea-lift and airlift capabilities are in great demand and troop-support capabilities within the AOR are limited. As the theater matures, follow-on lift capabilities will be allocated to larger increments of the theater's assets, increasing their capabilities in theater. This allows sea-lift and airlift capabilities to be appropriately allocated to the proper forces throughout theater development.

The two ENCOMs in the Army's force structure have early deploying cells. The cells' makeup differs between the two commands; however, there are common characteristics in nearly all early deploying incremental cells.

The cells—

- Have a well-defined structure versus an ad hoc organization. (Derivative unit-identification codes (UICs) aid in the time-phased force-deployment-data (TPFDD) development and access during contingencies.)
- Are made up of active, Active Guard Reserve (AGR), and M-day soldiers.
- Are represented by several (but not all) staff elements of the main command post (CP).
- Require significant communications assets to meet mission demands within the AOR in the absence of the main CP, yet leverage the resources of the main CP.
- Have a full-time forward element that is the nucleus (most familiar with the AOR, the agencies involved in the crisis action, and the circumstances and responses that led to the current crisis).
- Conduct specific collective team training during peacetime exercises with early deploying cells from other MSCs.

These common characteristics, regardless of the specific makeup of the derivative cell, equip it to meet the initial needs within the theater. Those initial needs are predominantly centered on the RSO&I of the projected force. As the theater increases both in physical terrain (which US forces occupy or operate within) and in the number and the makeup of forces, the demands for the theater functions also escalate. At some point, the theater requirements will surpass the capabilities of this initial cell. Consequently, among the implied tasks for these derivative elements is to assess the AOR needs and make recommendations on the makeup and timing of the follow-on flow to meet the engineer-function needs successfully. This includes recommendations for the subsequent modular building of the theater-engineer C^2 package.

The next package may be the entire ENCOM or, more likely, a significant element that provides—

- Greater in-theater capabilities.
- Additional services.
- Increased C^2 for the operational structure assembling within the AOR.
- More capability to operate at multiple locations within the AOR.

Lift constraints are still anticipated at the timing of this second increment; however, mission demands will exceed the capabilities of the first deployed package, and an increased theater presence will be required. The number and deployment sequencing of follow-on incremental "modules" is METT-TC driven. However, the governing principle is to achieve an adequate capability-based theater structure within the limits of lift capabilities and the theater footprint.

Before executing incremental deployment, the availability of materials within the AOR must be considered. Class IV is fundamental to construction missions. In general terms, construction materials are available everywhere. Developed theaters typically have more resources within the country from which to draw. Theaters with a permanent presence are also more likely to have at least some initial stocks pre-positioned within the theater to meet the initial needs. However, from a contingency perspective, the right Class IV or the needed quantities or quality of Class IV may not be locally available. In the crisis planning phase, the mission analysis should address the local and regional availability of the Class IV that is needed to meet mission requirements.

Local sources of gravel and sand need to be identified. The HN's known requirements for construction materials need to be considered (if US demands for construction materials exceed supply, the local economy may experience hyperinflation). Materials procured from other countries in the region may be delivered using regional transportation assets. Class IV procured in CONUS for overseas delivery will compete for space on US military sea lift, which may be scarce. Therefore, engineer planners must consider and plan for acquiring and delivering the necessary construction materials from sources within or as close to the AOR as possible. This will save on costs and assure delivery to meet project time tables.

SPLIT-BASED OPERATIONS

Split-based operations are associated with both inter- and intratheater operations from multiple locations. Deploying the derivative elements places theater assets into the AOR early to establish the theater backbone and initiate theater missions. Because the numbers are purposely held small, these derivative elements have moderate capabilities. Intertheater split-based operations overcome these shortfalls by leveraging the knowledge and the production base of the CONUS HQ, thereby magnifying the support within the AOR. For example, the Army engineer cell in theater defines engineer missions in concert with the commander's scheme of maneuver or support. By using tele-presence engineering (tele-engineering), the engineer on the ground can access detailed engineer expertise and technical advice from a variety of CONUS/outside continental US (OCONUS) sources to resolve engineering missions that are outside the scope of the in-theater engineers' capabilities. These sources can—

- Assist with construction design and drawings that exceed the in-theater staff's capabilities.
- Research alternate solutions and propose COAs to—
  - — Meet mission needs.
  - — Locate viable equipment and material sources outside the immediate AOR without the constraints or the limitations of in-theater communications networks.
  - — Access CONUS-based suppliers.

— Coordinate with deploying units before they depart CONUS.

- Assist in planning while the smaller in-county element is engaged in execution.

The essence of intertheater split-based operations is an increased value-added support with a relatively low cost in lift capabilities and the footprint within the AOR. If the crux of intertheater split-based operations is leveraged support, then the maxim for success is adequate communications with the CONUS support base to transmit voice and data. Communications is key to all split-based operations but particularly crucial when the theater cells are small.

The concept of intratheater split-based operations is age-old and rooted in our doctrinal approach regardless of the battlespace function. Maneuver elements, for example, have multiple CPs to control ongoing operations. The following are titles for the different C^2 nodes that have unique capabilities and focus:

- Jump tactical operations center (TOC).
- Tactical CP.
- Main CP.
- Rear CP.

The C^2 structure of the engineers mirrors a number of these control headquarters (HQ), enabling the engineer to best support the operation through collocation with the supported HQ elements. As the theater matures and the numbers of these separate command nodes expand, so do the requirements for the senior engineer HQ to operate multiple CPs. The ENCOM will operate intratheater split-based operations with the ASCC's rear, main, and forward HQ CPs to support rear, close, and deep operations.

MOBILIZATION OF THE RC

As stated previously, about three-quarters of the engineer-force structure is RC forces; some specialty units are only among the RC. For example, the ENCOMs and theater-engineer brigades participate only through accessing the RC. This is not unique to these HQ or engineers; mobilizing the RC is universally understood and a common practice for any operation. In the last decade, RC forces have participated in every contingency response, such as—

- Operations Desert Shield/Storm.
- Restore and Continued Hope.
- Uphold Democracy.
- Joint Endeavor.

As a result, a Presidential Selective Reserve Call-Up (PSRC) is included in standing OPLANs as a necessary assumption and condition for success.

Inherent to intertheater split-based operations is the requirement for partial or full mobilization of HQ commands for duty at the home station. The subtle distinction between mobilization and deployment is often missed. However, it is critical to mobilize a sufficient home-station force to support the deployed members of the HQ for split-based operations.

CONUS-based support requirements are substantial in support of the initial deploying cells. Without partial mobilization of the RC HQ at the home station, that support cannot be given. A significant portion of these RC units' full-time support staff (either active duty or AGR soldiers assigned in support of full-time, day-to-day unit operations) make up the initial deployment cell. The requirements to backfill their missions and to increase the stay-behind staff to provide responsive, thorough, and competent replies to AOR requests cannot be overstated. This multidisciplined HQ element (remaining at the home station)—

- Provides engineer expertise and design.
- Researches and solves problems.
- Increases the planning capability that directly supports the soldiers in the AOR.
- Prepares or assists engineer units preparing to deploy.
- Prepares to deploy itself.

An alternative to mobilizing units would be to authorize temporary tours of active duty (TTAD) for volunteers who would perform this crucial support to missions in the AOR from the home station. The drawback to this alternative is the availability of the right people in the right numbers to accomplish the mission. The RC soldiers may be willing to serve, however; without mobilization, they may be unable to disengage from civilian employment commitments.

Chapter 4

Joint, Multinational, and Interagency Engineering Operations

When a team takes to the field, individual specialists come together to achieve a team win. All players try to do their very best because every other player, the team, and the home town are counting on them to win. So it is when the Armed Forces of the US go to war. We must win every time. Every soldier must take the battlefield believing his or her unit is the best in the world. Every pilot must take off believing there is no better in the sky. Every sailor standing watch must believe their is no better ship at sea. Every marine must hit the beach believing there is no better infantrymen in the world. But they must all believe that they are a part of a team, a joint team, that fights together to win. This is our history, this is our tradition, this is our future.

— *General Colin L. Powell,*
Retired Chairman, Joint Chiefs of Staff

OVERVIEW

General Shalikashvili, former Chairman, Joint Chiefs of Staff, echoes these opening remarks in Joint Publication (JP) 1, "...the concepts and principles found in joint doctrine have been implemented and validated during major operations and deployments in Somalia, Rwanda, Haiti, and Kuwait, each skillfully executed by armed forces of our great nation. The enduring theme—joint warfare is team warfare." Beyond joint warfare, future operations will be multinational and include interagencies inside and outside the government structure. This is particularly true as our military force has been significantly drawn down in size and corresponding capability. The consequence of smaller components in the armed forces and the reduced overall total for the military structure is sharing the responsibility and the execution of war-fighting, stability, and support operations globally. Joint engineer capabilities are discussed in FM 5-100, Chapter 4. This chapter elaborates on those discussions and expounds on the fundamental actions that arise from the team effort of joint, multinational, and interagency engineer activities.

JOINT CAPABILITIES

Discussions of the joint units' capabilities and missions are relevant within Army doctrine because of the team approach to war fighting and the units' conduct within stability operations and support operations. Army units have and will continue to participate in joint response to crises around the world. For example, the Third US Army and each corps has been trained to act as a nucleus for a joint task force (JTF) HQ. The HQ is augmented with Marine, Navy, Air Force and interagency civilians who address component schemes unfamiliar to these Army staffs. Besides directing joint engineer operations in a small contingency as a JTF, Army engineers will be engaged in joint operations with missions and roles affected by other component activities. FM 5-100, Chapter 4, describes the missions and the organizations of component engineer forces such as the—

- Navy Seabees.
- Air Force Prime base engineer emergency force (BEEF); Prime readiness in base support (RIBS); and rapid, engineer-deployable, heavy, operational repair squadron (RED HORSE).
- Marine combat-engineer battalion.

Table 4-1 is a summary of the equipment that is available within these units. The table is arranged in a format that allows general comparison of the equipment.

TOPOGRAPHIC SUPPORT

Joint topographic operations include liaison with and support from the NIMA and operations with the US Marine Corps (USMC). These operations will come out of normal engineer channels as the USMC's topographic platoons are intelligence forces. The GI&S officer at the CINC or JTF level may work in the Intelligence Directorate (J2), Operations Directorate (J3), or even the Logistics Directorate (J4).

Multinational topographic operations may come out of normal engineer channels as topographic functions; however, in other countries, they are handled by the intelligence and field-artillery communities as well as the engineers'.

Interagency topographic operations in support of natural disasters and emergencies within the US will include coordination with the US Geological Survey (USGS) as well as the NIMA and the Federal Emergency Management Agency (FEMA). FM 5-105 describes topographic operations in more detail.

JOINT BOARDS

A joint staff often convenes boards to manage activities and ensure the visibility of all issues. These boards allow concerns to be raised and considered before policy implementation. The CINC's J4 or his engineer may convene these boards before deployment, if appropriate, to establish the standards and provide the guidance to components during their mission analysis and during deployment preparations. Often, this will not be possible as the joint staff, or the contingency JTF staff, will be assembled and deployed along with the component forces in a rapid fashion. Nevertheless, the nature of these boards dictates assembling at the earliest possible time. Based on the scope of the mission, the engineer may choose to convene the following boards to facilitate establishing policy and executing his responsibilities:

- Joint Facilities Utilization Board (JFUB).
- JCMEB.
- Joint Environmental Management Board (JEMB).

Table 4-1. Construction equipment summary

	Army					Air Force	Navy	USMC
Equipment	**Cbt Hvy**	**Cbt (W)**	**Abn**	**CSC**	**CSE**	**RED HORSE**	**Seabee**	**CEB**
Road grader, > size 5	9	9	9		6			
Road grader, < size 5						5	6	7
Dozer, > D7	21	12		3	6	2	6	20
Dozer, < D7			15			4	2	3
Front-end loader, > 2.5 cu yd	2			5	3			
Front-end loader, < 2.5 cu yd	6		9	4		6	10	8
Backhoe or SEE*	6	18	18		6	3	2	*
Trencher						1	2	*
Scraper	12		9		6	2	8	6
Dump truck, > 10 ton	9			8	20	12	16	
Dump truck, < 10 ton	30	54	32		9			34
Line maintenance truck						1	1	1
HEMMT/TPU fuel truck	9	3	3	1	3	3	4	
Tractor Truck	28	12	15	7	6	4	1	8
Low-bed semitrailer	22	12	15	6	6	8	13	8
Rock drill				2			1	*
Well driller						1	1	
10-K AT forklift	3		2	1		3	3	8
Concrete mixer truck						1	2	
8-cu-yd mobile concrete mixer	3					1	1	3
Asphalt paver				2		2	1	
Bituminous distribution truck	2			1				
Asphalt mix plant				1				
Water distributor truck	6	3	3	1	3	2	6	7
Crane	5	2	3	3	3	1	4	10
Vibratory roller	3	3	3		3	3	3	4
Pneumatic roller	5		3	2				
Steel-wheeled roller	1			4				
Sheepsfoot roller	3	3	3		3			
Towed sweeper	1			2				
Rock crusher/screen				1				

*Small emplacement excavator (SEE) tractor attachments.

NOTES:

1. Air Force Prime BEEF units are individually tailored to meet the needs of the assigned bases. Their equipment is not structured.

2. A metric conversion chart is included in *Appendix F*.

JOINT FACILITIES UTILIZATION BOARD

This board evaluates and reconciles component requirements for real estate, the use of existing facilities, interservice support, and construction when conflicting or competing requirements materialize. The board meets to resolve these issues and to coordinate with the JCMEB to achieve its priorities. The CINC's engineer-facilities section, with assistance from other selected JFUB members, handles most of the JFUB's work and issues as routine staff actions. The JFUB provides administrative support and functions as the executive agent for the tasking of the JCMEB.

The JFUB's composition varies depending on the nature of the contingency and the forces, the organizations, and the agencies involved. The board is activated on the order of the joint-force commander and chaired by the J4. Its members may consist of any required special staff (for example, legal and civil affairs).

JOINT CIVIL-MILITARY ENGINEERING BOARD

This temporary board provides joint input on establishing policies, procedures, priorities, and the overall direction of the civil-military construction and engineering requirements within the assigned joint operations area (JOA). The standards and the priorities derived from this board and approved by the CINC, or his designated representative, express to components the policy of the command, providing uniformity and conservation of limited resources. The JCMEB settles all issues referred to it by the JFUB.

The JCMEB's composition varies depending on the nature of the contingency and the forces, the organizations, and the agencies involved. The CINC/joint-force commander establishes the board with personnel from the component commands and the DOD agencies or activities that are in support of the CINC.

JOINT ENVIRONMENTAL MANAGEMENT BOARD

This is a temporary board that the joint-force commander or his designee may activate. The JEMB establishes policies, procedures, priorities, and the overall direction for the environmental-management requirements in the theater. This is done according to the overseas baseline environmental guidance and/or the final governing standards in effect for the countries within the JOA. If appropriate, the board may assume responsibility for preparing the environmental-management support plan.

The JEMB's composition varies depending on the nature of the contingency and the forces, the organizations, and the agencies involved. The board is established by the CINC/joint-force commander and is staffed by personnel from the component commands and the DOD agencies with real property and/or environmental responsibilities in the AOR.

Beyond chairing the previously mentioned boards, the CINC's staff engineer will likely seek representation on the following boards or organizations to express engineer concerns:

- Joint Transportation Board (JTB).
- Joint Material Management Office (JMMO).
- Joint Targeting Coordination Board (JTCB).

- Operations Planning Group (OPG).
- Joint Civil-Military Coordination Board (JCMB).
- Joint Intelligence Center (JIC).
- Joint Operations Center (JOC).

In addition to these standing boards, a contingency engineering-management organization may also be formed. The mission of these boards is to arbitrate and establish policy decisions for the joint HQ on matters with multicomponent interest. The CINC may form a TCEM cell that is structured and staffed to support his concept of operations. This cell augments the CINC's engineer staff by—

- Supporting engineer-plan development.
- Analyzing the commander's intent.
- Developing joint policy guidance for construction.
- Reviewing HNS agreements.
- Reviewing construction priorities and requirements.
- Monitoring the status of the theater's engineering forces.

Supporting a TCEM cell, or sometimes in lieu of a TCEM cell, the CINC may establish an RCEM cell and/or a JTF contingency engineering-management (JTFCEM) cell, depending on the conditions. Service components with operational forces in the theater will be expected to assign personnel to the TCEM cell as augmentees to the joint staff, adding service-specific expertise and facilitating coordination.

MULTINATIONAL UNITS AND ORGANIZATIONS

When military operations are considered, the US seeks to develop coalitions as preferable to unilateral operations. The operation in the Dominican Republic in 1965, for example, was under the aegis of the Organization of American States (OAS). More recently, Operations Provide Comfort (Northern Iraq) and Joint Endeavor (Bosnia) included a coalition of forces from other nations as well as the US, which was under the sponsorship of the United Nations (UN). The US may participate in a US-led coalition such as Operation Restore Hope (Somalia) or a non-US-led coalition such as Operation Able Sentry (former Yugoslav Republic of Macedonia). The agencies involved in each of these operations are both consumers and possible resources of engineer activity.

Army engineer units may be subordinate to, collocated and working alongside, or directing engineer activities and providing oversight or support for the missions assigned to these organizations. The engineer force's effectiveness to operate within the varied framework surrounding a collective international enterprise can be greatly enhanced by respecting the multinational partners; their construction and engineering techniques; and their ideas, culture, religion, and customs. Equally important and parallel to operating within a US-only joint environment is understanding the unit's or organization's capabilities and training. This understanding ensures the assignment of appropriate missions and avoids the risk of offending national honor or prestige by allocating unsuitable tasks to partners in the multinational endeavor.

UN Operations

UN-sponsored operations normally employ a force under a single commander. The force commander is appointed by the Secretary General of the UN with the consent of the UN Security Council. The force commander reports either to a special representative of the secretary-general (chief administrative officer [CAO]) or directly to the secretary-general. While the force commander conducts day-to-day operations with a fairly wide discretionary authority, he refers all policy matters to the special representative (CAO) or the secretary-general for resolution. The CAO not only establishes policy, but he can also control the resources and funding expenditures within a given operation.

The US commander retains command over all assigned US forces. The US chain of command runs from the national command authority (NCA), through the CINC, to the lowest commander in the field. This chain of command is national policy. The OPCON over US military forces by other agencies may be negotiated and exercised subject to prior approval by the NCA. The degree of OPCON exercised over US forces must be coordinated and agreed upon by the multinational-force commander and the CINC in accord with the NCA criterion. The US commander is therefore responsible for mission success to the UN-force commander as well as the theater CINC.

Non-UN Organizations

Although the US is more likely to undertake involvement in multinational operations with the UN, a number of regional organizations may perform this leadership function. The following are a few of those organizations:

- North Atlantic Treaty Organization (NATO).
- Organization of African Unity.
- OAS.
- Organization for Security and Cooperation in Europe (OSCE).

The UN may designate one of these regional organizations, with a greater vested interest and appreciation for the forces at work in a given region, as its operational agent to exercise control. Each of these organizations will have different operational concepts and organizational procedures. The US forces are familiar with some of these concepts and procedures, such as NATO's. However, there are others that they are not familiar with.

Multinational Troop Units

The engineer types that are available from deployed national armies are generally a mix of combat and/or construction engineers formed into company- and battalion-sized units. The training and experience levels and equipment fielding varies with these units. National engineers from Britain, Canada, and Australia have been involved in numerous missions outside their territorial boundaries. The political impact is important to understand. When the German engineers deployed into Somalia in 1992, it took a national legislative amendment to their constitution to allow them to participate in operations off

German soil. This was their first experience in multinational efforts outside of NATO. Smaller countries will have more regional bounds on their involvement, and their experience will be correspondingly narrow. However, they are also more likely to be attuned to the special circumstances that are relevant to the AO.

NONGOVERNMENTAL ORGANIZATIONS (NGOs) AND PRIVATE VOLUNTARY ORGANIZATIONS (PVOs)

Like operations with the UN or its operating agents, relationships with international and domestic NGOs and PVOs must be established through negotiation. Most agreements are made at the strategic level (unified command); however, the operational commander may have some latitude delegated to him. All agreements normally have serious legal restrictions on using military personnel and equipment. Some of these agencies may have unique and significant engineer capabilities and intelligence that could be used as a part of the overall operational concept. These capabilities may be a useful source of Class IV material, not only for the agency's own projects, but as a negotiated barter for services rendered in support of its mission. More often than not, however, these agencies and organizations may request extensive engineer support for their activities and programs. As these organizations play an important part in the CINC's achievement of strategic objectives, their demands should not be ignored but must be coordinated. Therefore, it is critical that an effective engineer liaison be established and maintained with the force HQ civil-military operations center (CMOC).

INTERAGENCY OPERATIONS

Interagency operations greatly expand the scope and capabilities of any given response team because of the wide variety of expertise and funding resources that can be tapped to perform functions during a crisis response. This is true whether the response is international or is within the territorial confines of the US and its protectorates and territories. Not only do interagency operations increase the resources engaged in any given operation, they also significantly increase and complicate the coordination necessary to achieve victory and generate mechanisms that reduce efficiency as organizations work at cross purposes. The SOPs, the report formats, the information requirements, and the intermediate goals and perceptions of each of these organizations vary greatly. Therefore, coordination and a clear understanding of the commander's intent are absolutely crucial when arranging operational efforts involving multiple interagency organizations. The following are some of the interagency organizations that could be involved:

- FEMA.
- Environmental Protection Agency (EPA).
- Drug Enforcement Administration (DEA).
- National Oceanic and Atmospheric Administration (NOAA).
- USGS.
- Public-health service.
- Civil air patrol.

- Department of Agriculture.
- Department of State.
- Office of Foreign Disaster Assistance (OFDA).
- Department of the Interior/Fish and Wildlife Agency.
- General Accounting Office (GAO).

USACE FORWARD ELEMENT

The USACE has worldwide operations, activities, and responsibilities that enable it to respond quickly and more effectively during the initial stages of a crisis because of its forward-deployed field offices. As a major Army command (MACOM), the USACE has trained rapidly deploying cells to meet mission requirements. The USACE forward element (may be a district command or a subdistrict organization) will be tailored to meet the anticipated needs (see *Appendix B* for a more detailed discussion). Within this element, there can be—

- A technical staff (with all the engineer disciplines).
- Contract constructing agents and project/program managers.
- Quality-assurance representatives (QARs) to monitor contract-construction progress and specification compliance.
- CREST elements.
- Specialized scientists and engineers from USACE laboratories and centers of expertise.

The element's makeup is situational dependent and not only varies from crisis to crisis, but also has the flexibility to vary with time in any given crisis. The deployed USACE organization may be assigned to the ASCC and in turn, placed under the control of the most senior ENCOM in theater. Regardless of the C^2 relationship, the USACE forward element retains technical and support channels to the division or the district with the responsibility for the crisis region. This split-based operation allows leveraged support from the CONUS outside the immediate crisis area and greatly increases the capabilities of the element. It may use liaison/action teams (forward corps, Air Force) that are collocated with customer activities. These teams have significant or special demands that require on-location USACE site representation, particularly in a geographically extended theater. Regardless of the mix or the employment strategy, this element of professional expertise is extremely valuable within the TO (particularly in the RSO&I) because of its long-standing association with area vendors and its accessibility in the theater before significant troop units arrive.

DEFENSE SECURITY ASSISTANCE AGENCY (DSAA)

The DSAA directs, administers, and supervises the execution of security assistance programs. This involves providing guidance to—

- Military services.
- Unified commands.

- In-country security-assistance officers in their efforts to assist foreign governments in obtaining US equipment, training, and other defense-related services authorized by the Foreign Assistance Act, as amended.

An operational-engineer application that may be coordinated through this agency is training foreign government personnel in demining operations. The US does not engage in demining operations as a matter of policy. The US does conduct clearing operations out of operational necessity for the safe operation of US activities within a region. In many foreign countries, mines litter the countryside from years of civil conflict. The US engineers, under the auspices of the DSAA, may provide technical training to assist a government in eliminating the mine threat to their population.

FEDERAL EMERGENCY MANAGEMENT AGENCY

The FEMA is the federal government's emergency coordinating agency within the US. Its major responsibilities include—

- Continuity of government and civil-defense activities.
- Prioritization of resources in a national emergency.
- Coordination of the federal government assistance to state and local governments under the Federal Response Plan (FRP) in presidentially declared disasters.
- Coordination of the federal component of consequence management in technological disasters or terrorist events.

The FEMA is the lead agency for coordinating federal emergency management activities for disasters. Under the FRP, the FEMA may request support from the DOD to provide assistance to state and local governments or assistance to other federal agencies that are providing assistance to state and local governments. The FEMA will coordinate activities for state and local governments but has no authority over them.

HN INTERFACE

In a forward-deployed theater, the ASCC (in conjunction with the other component commanders, the CINC, the allies, and the HNs) identifies wartime facility and construction requirements for the Army as part of the deliberate war-planning effort. Doctrinal construction requirements for the ASCC may be identified using the planning module in the TCMS. Subsequent analyses further refine construction requirements and provide a basis for—

- Force structuring.
- Procurement.
- Leasing provisions and establishing HN agreements.

The product of these analyses is the CESP. The goal is to reach HNS agreements in peacetime to provide as many as possible of the facilities that are needed within the theater. Advance planning and the commitment of resources by the HNs reduce the lift requirements that are needed early to support the RSO&I and allow force-projection assets to be concentrated on C^2

and engagement systems. Engineering support from the HN usually involves providing—

- Land.
- Facilities.
- Construction support.
- Manpower.
- Equipment.
- Materials.
- Services.
- Hazardous-waste disposal.

It is highly desirable to secure written agreements with the HNs on support items to foster an understanding of the assistance levels and increase the likelihood of fulfillment upon execution.

REAL ESTATE

Real estate authorities throughout the world have been assigned to components along similar lines corresponding to the designation of DOD construction agents (DOD Instruction [DODI] 4270.5). Within regions designated to the Army, the USACE establishes policies for the acquisition, the maintenance, and the disposal of real estate. This includes both leased and rent-free facilities. Real estate teams may be assigned to each ASG or centrally controlled at the senior engineer HQ. These teams coordinate with HN agencies and private owners for acquiring and disposing of real estate and the terms of lease agreements.

Real estate planning and surveys must be initiated as campaign plans are developed to ensure that timely and adequate facilities are provided to sustain the combat force. Local HN officials can help identify available facilities or land that meets military requirements. Thorough documentation of lease agreements, property conditions at the time of the lease (to include environmental baseline survey data) and expectations of property conditions at the termination of the lease are crucial to expedite a fair and amiable conclusion of lease activities. Civil-affairs and real estate personnel may be required to work through HN governments to settle agreements with property owners. Real estate acquisition is more difficult in contingency operations due to the lack of preparations to identify probable sources and confirm legal ownership. Real estate is required for—

- Air bases.
- Base camps.
- Medical and logistics complexes.
- Training sites.
- Quarry and borrow sites.
- Trailer transfer points.

- Traffic control points.

Property is generally acquired by requisition, with all transactions documented thoroughly under the provisions of the CINC's directives. Procedures will be used that provide the property required for missions while protecting the property owner's legal rights. Using facilities that are provided by the host government or a host agency rent free require the same legal responsibilities during use as the facilities leased from private owners. Real estate policies and procedures are discussed in more detail in FM 5-104.

SUPPORT

Wartime HNS agreements in forward-presence theaters (Europe and Korea) have been negotiated to provide HN construction support, such as facility modifications, LOC maintenance and repair, and utility services. In Southwest Asia, the agreements are less formal and lack the practiced application that accompanies the full-time presence of US forces in Europe and Korea. However, these agreements are no less critical to mission success in the event of an MTW in this region. Such HNS is used whenever possible to free US engineer units for critical missions where HNS alternatives are not viable. Support agreements are negotiated in peacetime on an asset basis. Assets may be facilities, contracts, or equipment. Again, this support is particularly critical during the initial stages of a contingency when RSO&I requirements are high and engineer assets are limited.

Pre-positioning equipment within the region reduces the US response time into a particular theater by allowing military forces to deploy by air and fall in on war stocks within the region. These pre-positioning locations are a critical element of our force-projection national strategy and represent a significant contribution of HNS. The HN's commitment for space, facilities, services, and utility support for these complexes are a demonstration of the HN's interface with US forces and the partnering the US and the UN share in the defense and stability within the region. Beyond direct HNS, other support may be available from allied nations directly or indirectly involved in the crisis. Other nations sympathetic to the cause may be limited in their direct participation because of constitutional limitations or political sensitivities. However, these nations may provide nonlethal equipment or monies much like the Japanese provided during the Gulf War.

During a conflict, the HN may provide construction organizations to repair or construct facilities, usually within the rear area. Construction materials such as portland cement, asphalt, aggregate, timber, steel, and contract labor may also be available. HN assets may be available for local security and for transporting construction materials and equipment. Third country nationals (TCNs) may also be available (either requested through the HN or through direct contact with the nationals) to support engineer activities within the rear areas. Engineer reconnaissance and assessment teams that are engaged in deliberate planning during peacetime or dispatched early in contingency operations are the key to identifying and accessing available HN assets.

Chapter 5

Operational Planning

To a conscientious commander, time is the most vital factor in planning. By proper foresight and correct preliminary action, he knows he can conserve the most precious elements he controls, the lives of his men. So he thinks ahead as far as he can. He keeps his tactical plan simple. He tries to eliminate as many variable factors as he is able. He has a first hand look at as much of the ground as circumstances render assessable to him. He checks each task in the plan with the man to whom he plans to assign it.

— *General Matthew B. Ridgeway*
(Korean War)

PLANNING CHALLENGES

The challenges of planning successful engineer missions within diverse theaters are vast and varied. Sound operational planning and execution are vital to the success of deployed forces.

As General Ridgeway pointed out, planning saves lives. It also—

- Shapes the forces that respond to a contingency.
- Drives the timing and the quantities of equipment and supplies that forces use to execute the missions.
- Forecasts the missions that engineer commanders will have to accomplish.

Understanding how the engineers effect each of the operating systems equips the planner with the background to form his plan of engineer actions. The significant role of the engineer within multiple elements of the Battlefield Operating System was discussed in previous chapters. This universal application of engineers within all operating systems is crucial at all levels.

OPERATIONAL MOVEMENT AND MANEUVER

Operational movement and maneuver is the disposition of forces to create a decisive impact on the conduct of a campaign or major operation. The commander achieves this decisive impact by securing the operational advantages of position before battle and/or by exploiting tactical success to achieve operational results. Engineers—

- Enhance the mobility of friendly forces while they degrade the mobility of enemy forces. This in turn allows friendly forces to achieve dominant maneuver and press the advantage and thereby dominate key terrain.

- Help friendly forces maneuver while delaying, turning, disrupting, or fixing enemy formations.
- Provide terrain-visualization products that enhance operational movement and maneuver. This allows commanders to determine what is operationally significant terrain at the earliest opportunity.

OPERATIONAL FIREPOWER

Operational firepower refers to a commander's application of nonlethal and lethal firepower to achieve a decisive impact on the conduct of a campaign or major operation. Operational fires are joint and potentially multinational activities and are a vital component of any operational plan. Engineers—

- Provide input concerning possible targets for engagement.
- Assess the effects of target execution by evaluating the level of disruption, delay, or neutralization to the enemy's operational mobility.
- Evaluate the surrounding terrain characteristics and the friendly force's capabilities to overcome the effects of an executed target during future operations.

To illustrate this concept, engineers might be advised to use complementary fires to destroy a critical enemy bridge through the synchronized employment of Gator scatterable mines and tactical air (TACAIR). Engineers could destroy a single bridge span that exceeds the enemy's rapid bridging capabilities knowing that US forces could still cross by emplacing a single Wolverine (heavy assault bridge [HAB]) during future operations. Targeting the span produces the desired result on the enemy's maneuver; however, it reduces friendly effort during future operations.

OPERATIONAL PROTECTION

Operational protection conserves the fighting potential of a force so that it can be applied at the decisive time and place. Operational protection includes actions taken to counter the enemy's firepower and maneuver by making soldiers, systems, and operational formations difficult to detect, strike, and destroy. Engineers—

- Provide advice and support in camouflage.
- Track minefields and unexploded ordnance concentrations.
- Incorporate force-protection considerations into current and future project designs.
- Perform geospatial analyses to assess the friendly force's vulnerabilities and the enemy's capabilities.

OPERATIONAL C^2

Operational C^2 is the exercise of authority and direction by a commander to accomplish operational objectives. Operational C^2 focuses efforts, establishes limits, and provides structure to operational functions. Commanders perform operational C^2 activities through planning, directing, coordinating, and controlling the forces that conduct campaigns and major operations to accomplish the mission. Engineers receive, analyze, and translate information into a usable form. Engineers—

- Retain, display, track, and disseminate the information to subordinates, lateral organizations, and higher HQ with an eye on how the execution contributes to major operations.
- Support the commander's planning process with the engineer estimate and the COA development.
- Continuously evaluate the information received through reports or personal observation and make adjustments to the tasks assigned (or planned) to forces engaged in the operations in support of long-range objectives.
- Directly control (through the ASCC) activities by issuing orders, establishing and coordinating control measures (such as EWLs), and allocating resources.

Engineer commanders establish the focus and the priorities for subordinate units as they execute their mission in support of the operational commander's scheme of maneuver.

OPERATIONAL INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

Operational intelligence, surveillance, and reconnaissance are required for planning and conducting major operations within a TO. Engineers, particularly through theater topographic assets, significantly aid in battlespace visualization, which leads to identifying and locating operational centers of gravity (both friendly and enemy) and war-fighting priority intelligence requirements (PIR). Analyzing topographic features, the nature and characteristics of the TO, and the creation/dissemination of special products allow operational planners to—

- Develop maneuver operations.
- Select high-payoff targets.
- Acquire precise information on deep targets.
- Facilitate the operational battle command.

OPERATIONAL SUPPORT

Operational support consists of logistics and other support activities that are required to support the force during campaigns and major operations within a TO. Engineers—

- Provide the physical plant for logistics sustainment operations, such as—
  - — Bed down of troops and equipment.
  - — Logistics bases to stockpile and distribute all classes of theater supplies.
  - — Transportation and distribution networks that link the strategic and operational sustainment base to the CSS elements.

- — Administrative facilities for operational planners to coordinate theater campaigns.
- Provide, in conjunction with MP and counterintelligence (CI)/human intelligence (HUMINT) teams, advice on rear-area force protection.
- Provide advice on how to distribute critical Class IV items.
- Recommend the necessary stock levels of critical Class IV items.
- Analyze local materials for suitability within the theater.
- Provide environmental security management.
- Develop terrain-visualization support tools that optimize stability operations and support operations. These include maps, simulations, digital data sets, and tactical decision aids.

From this operational battlespace blueprint, engineer planners use three tools to formulate and plan engineer responses in support of the operational war fighter. These tools are the Joint Engineer Planning and Execution System (JEPES), the CESP, and the engineer annex to an OPLAN (see *Figure 5-1)*. The systematic, deliberate approach to engineer planning is as follows:

- Collecting and sorting data.
- Analyzing data, prioritizing requirements, and making decisions.
- Assembling and disseminating the plan to the affected HQ at all echelons.

ENGINEER-SUPPORT PLANNING PROCESS

The engineer-support planning process consists of the following interrelated activities:

- Engineer facilities study. The study is derived from the JEPES computer model, which analyzes data. The study is used to develop a CESP and becomes part of Tab C of the engineer annex to an OPLAN.
- CESP. The CESP is a documented analysis of engineer capabilities in support of the OPLAN. The results of the CESP are used to prepare the engineer annex to the OPLAN.
- Engineer annex. The annex to the OPLAN is prepared using the results from the engineer facilities study and the CESP. The annex provides instructions for executing the engineer part of the OPLAN.

ENGINEER FACILITIES STUDY

According to JP 5-03.2, the CINC's engineer planners use the JEPES computer model to prepare estimates of theater-level wartime engineer requirements for the following items in support of an OPLAN:

- Facilities.
- Engineer man-hours.
- CESP.
- Engineer annex.

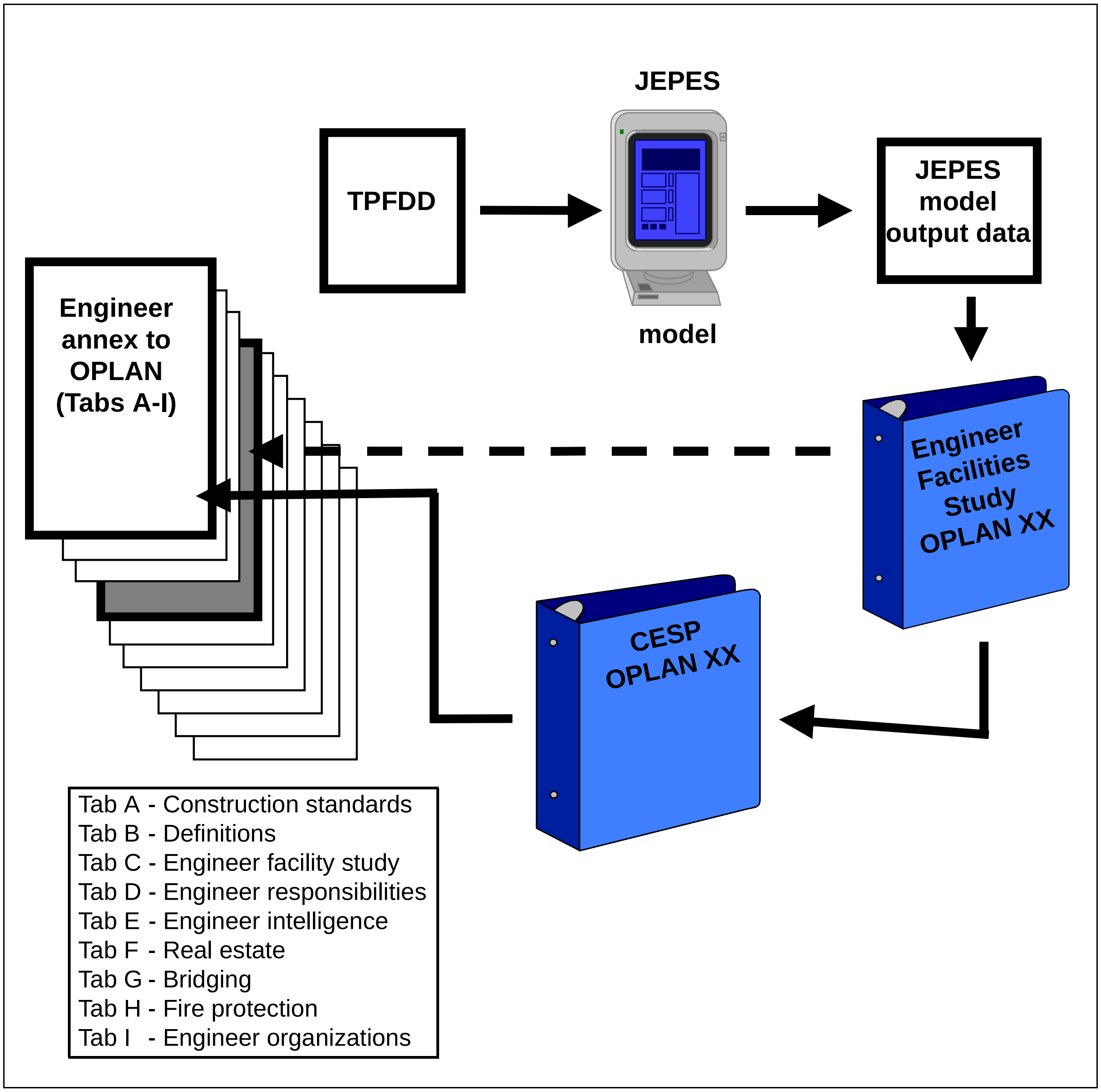

Figure 5-1. Engineer-support planning

The primary purpose of JEPES is to assist the CINC and service-component engineer planners in determining whether the OPLAN–

- Provides the correct amount of engineer capability at the right place.
- Is timed correctly to support deploying forces according to the theater's OPLAN.

The JEPES model is one of several tools the commander has at his disposal to assess the validity and the accuracy of an engineer plan. The JEPES data, along with the engineer analysis and command guidance, provides a commander with another means to check the supportability of the engineer plan for a specific OPLAN.

In deliberate planning, the CINC includes a CESP within the logistics annex of the OPLAN. Independent of the CINC's plan, the Army's service-component engineers routinely develop their service plan as a means of detailed, deliberate planning.

The TPFDD is the primary driver of the JEPES model. The JEPES model extracts information such as the unit type, the destination location, the arrival time, and the population from the TPFDD. Given this input, the JEPES model estimates construction man-hour and facility-type requirements to support the bed down of US forces deploying into a theater. The JEPES model also computes estimates on the US engineer assets (man-hours) that are available to meet the estimated requirements. The JEPES model provides Class IV output in the form of long- and short-ton totals. The results from the analyzed JEPES data are gross estimates that are used in the deliberate planning process for analyzing COAs for engineer support to the OPLAN. Because of the integral relationships between the JEPES model, the OPLAN, and the TPFDD for a theater, the JEPES does not readily lend itself to crisis planning in theaters where an existing OPLAN and the TPFDD have not been prepared.

The JEPES-model algorithms are based primarily on support facilities necessary for the RSO&I of all inbound forces. The JEPES model calculates facility requirements for a unit's final destination on the TPFDD but does not compute other engineer missions and support requirements within the theater. Aspects of the estimate that are not automatically calculated by the JEPES model are–

- Construction, maintenance, and repairs of MSRs.
- Construction of forward logistics bases and EPW and displaced persons camps.
- Survivability of command, control, and communications (C^3) nodes.
- Construction, expansion, or maintenance of port activities.
- Support of logistics over the shore (LOTS).
- Construction of attack aviation strips, theater ammunition storage points, and fuel pipelines.
- Support to tactical elements in M/CM/S.

The JEPES model has a capability for manually inputting specific requirements such as EPW camps, petroleum, oils, and lubricants (POL) pipelines, MSR construction, and other requirements specified or implied from the mission analysis and planning guidance. This data is entered into a users input file that the JEPES model combines with the other TPFDD requirements.

The output from the JEPES model is a gross estimate reflecting US engineer capabilities as depicted by the TPFDD. The accuracy and reliability of the information generated by the JEPES model is directly affected by the following:

- Accuracy of the unit data on the TPFDD.

- Level of accuracy of the assets in the JOA.
- Level of specificity on the TPFDD.
- Assumptions for HN-provided facilities.

The product of the JEPES output analysis is the engineer facilities study. Engineer planners at the CINC and component levels use this study to prepare their CESP and the engineer annex to the OPLAN. The study also becomes Tab C of the engineer annex. *Figure 5-2* illustrates the modeling process.

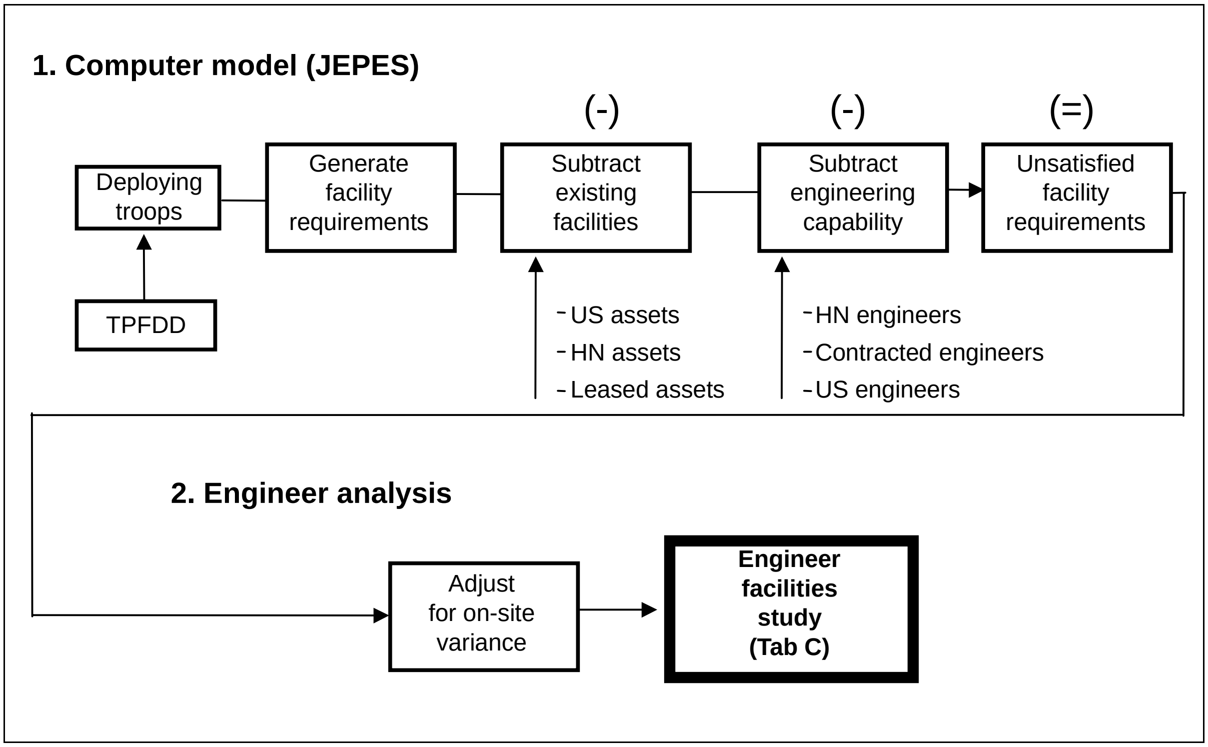

Figure 5-2. Methodology

CIVIL-ENGINEERING SUPPORT PLAN

The CESP is the primary planning document in which the engineer staff considers the minimum-essential facilities and the construction capabilities that are needed to support the commitment of military forces. When developing the CESP, the engineer staff should consider the following data:

- Engineer facilities study.
- Engineer intelligence of the theater.
- HN capabilities and HNS agreements.
- Construction contracting capabilities.
- Mission of other US and allied forces.
- War-damage estimates.

- Facility engineering responsibilities.
- Logistics support plans.
- Subordinate units.
- Any other aspect of the operation that impacts on general-engineering support.

In deliberate planning, the CINC includes the CESP within the logistics annex of the OPLAN. Independent of the CINC's plan, the Army's service-component engineers routinely develop their service plan as a means of detailed, deliberate planning. The CESP differs from the engineer facility study by taking into consideration other planning aspects that the JEPES model was not designed to estimate. The CESP usually addresses the following engineer aspects in addition to JEPES data:

- Information on available resources, facilities, and characteristics within the region relevant to the construction mission and construction capabilities.
- Restrictions imposed on the use of bases and installations.
- Major construction resources and their allocation.
- Future construction standards to be used as the theater matures.
- Responsibility for construction management among components.
- Responsibility for determining the facility's use in light of competing requirements from the components.
- Priorities at different phases during the conflict.
- Provisions for withdrawal, such as base denial and the movement of residual assets and stored critical Class IV supplies.
- CCA missions and responsibilities and their relationship to engineer assets.
- Engineer support guidance and agreements for support commands and the ASG.
- Class IV construction-materials availability.

Supported by the JEPES-data analysis or other studies, the CESP states the priorities, the programs, and the general policy when seeking general-engineering support. The format for the CESP is governed by the Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3122.03. A sample format is reproduced in *Appendix C*. The CESP is used in preparing the engineer annex to the OPLAN.

ENGINEER ANNEX

The engineer annex is the principal means for the engineer to state his intent; the concept of operations; and coordinating instructions to subordinate, supporting, and supported commanders.

The engineer annex is far more than an end product of planning; it is an integrated and incremental procedure that closes the planning process.

Producing the annex organizes thoughts and forces a careful review of the engineer tasks, the required coordination, and the allocation of resources to meet the commander's intent. As the task organization is developed, a review of the span of control ensures mission clarity and simplifies mission dissemination.

Unit resources, materials, and time are considered when assigning tasks. Unity of effort and continuity of support are considerations in determining what resources will be assigned to which missions. The suitability of logistics support for the plan is determined, and adjustments are made to best equip the forces with the means for mission success.

An integral component of the deliberate decision-making process is the production of the annex. The annex is a product that clarifies the plan and initiates the dialog between subordinate, supported, and supporting commands to orchestrate the effort. It includes the–

- Priorities of work to shape the theater/JOA.
- Operational project planning, preparation, and execution responsibilities.
- Engineer organization for combat.
- Engineer tasks for subordinate units.

As a result, the engineer community is better postured to support the operational commander.

Chapter 6

Logistics

I don't know what the hell this 'logistics' is that Marshall is always talking about, but I want some of it!

— Fleet Admiral E.J. King (to a staff officer in 1942)

LOGISTICS REQUIREMENTS

Field Marshal Rommel once remarked that battles are won or lost on the back of logistics before the first rounds are fired. Admiral King's statement and Field Marshal Rommel's belief place a significance on logistics that underscores the relevance of logistic matters in doctrinal discussions. JP 1 emphasizes logistics by stating "Logistics sets the campaign's operational limits. The lead time needed to arrange logistics support and resolve logistics concerns requires continuous integration of logistic considerations into the operational planning process."

Engineer-force sustainment maintains and multiplies combat power. Engineer commanders must understand the CSS system and know where to obtain logistic support. Many engineer needs are unique, one-of-a-kind requirements that stress the logistics system, such as massive requirements for Class IV barrier and construction materials.

Adequate Class IV supplies are central to the ability of engineer units to construct and maintain facilities in support of the ASCC's operations and the supporting sustainment base. For this reason, the senior Army engineer HQ (typically an ENCOM) plays a key role in establishing distribution protocols, stockage levels, and construction-material allocation in theater. The joint-force commanders, through the TCEM/RCEM cells, often control critical Class IV supplies across the theater. The ENCOM may send a liaison to support the packaging of critical engineer Class IV supplies.

CONSTRUCTION MATERIALS

In the TO, construction materials may be difficult to obtain. Required construction materials might be—

- Supplied by the CONUS through the supply system.
- Procured from neighboring countries within the region of operations.
- Obtained from local suppliers.
- Extracted from local natural sources.
- Produced by engineer units.

Ideally, construction materials should be procured from sources close to the construction site; however, this is often not possible. Because of the time and cost involved in moving construction materials, facility designs are often adapted to make maximum use of locally available materials.

Experienced planners will not neglect horizontal construction materials. Vertical materials, such as plywood and dimensional lumber, are Class IV items. Theater logisticians are very familiar with these items and, therefore, rarely overlook them. These materials are universal commodities that are used by logisticians for overhead protection, flooring in high traffic areas, and shelving. However, equally important to the engineer are the materials that are instrumental in the success of horizontal (earthwork) construction.

Aggregate (crushed rock or river run and sand) will be locally purchased or provided by engineer units. Other items, such as geotextiles or sand grid that is used to bolster poor soil conditions and improve trafficability, will have to be procured and shipped from CONUS. Soil stabilization and dust abatement require admixtures to the soil, such as lime, portland cement, asphalt emulsions, or resins. These products are bulky and may or may not be available within the region of current operations. Poor drainage can hinder operations. Therefore, ample supplies of culvert materials are a frequent concern of engineers.

Because of the multiple applications of many Class IV items, it is important that engineers remain involved in distribution decisions. This is particularly true regarding critical materials to ensure that they are not squandered on less critical missions. Engineers are not equipped to run Class IV yards, nor do they have the transportation assets to distribute Class IV supplies. However, the absence of engineer insight and critical assets management could lead to devastating theater shortages and mission impairment. Priority for transportation support is essential to supply operations as Class IV items and engineer equipment are large and bulky and may require convoy credits or special haul assets.

PLANNING CONSIDERATIONS

One of the primary responsibilities of the senior Army engineer is to forecast the types and the quantities of engineer materials required for the theater. *Chapter 5* described the CESP, which is generally used to establish the initial requirements during preconflict planning. Planning during the conflict requires good intelligence as to the damage caused by enemy action and a good forecasting of the additional facilities that are needed. The TCMS can be used as a guide in determining material requirements for facilities that are needed. In many cases, existing facilities can be modified to meet military requirements, thus conserving Class IV materials and expediting construction completion.

For horizontal construction and nonstandard projects, material requirements must be estimated manually because TCMS provides standard Army designs. The senior Army engineer must also aid the logisticians in determining the adequacy and the most expeditious source of materials, either from local sources, regional sources, or CONUS projection base. Materials from within the AOR may be from local manufacturers, commercial stockpiles, or HN government assets. Materials not locally available must either be procured out of theater (directly or through a service contract such as LOGCAP) or produced in theater by engineer units. Materials that fall in the latter category include aggregate, concrete, construction water, asphalt, and lumber. A local procurement system must be established to expedite the procurement of local materials. The procurement of local materials may be restricted or centrally controlled in some theaters to avoid—

- Inflating the cost of construction materials in the HN.
- Creating a bidding war between all participants vying for materials or services within a specific area.
- Depleting specific resources.
- Overspending of operational funds.

DESIGN CONSIDERATIONS

When designing projects for the TO, designers consider—

- Availability of construction materials.
- Local materials and properties and their suitability.
- Construction practices to accommodate HN maintenance and repair after US forces depart.
- HN environmental requirements.

During a recent study by the construction-engineering research laboratories to update Class IV supply planning factors, the findings indicated that the requirement for local material, especially sand and gravel, could be substantial. Even in the most developed countries, problems exist in finding and hauling locally procured construction materials. Engineer planners develop realistic estimates of the available quantities of local materials as early as possible and assess the feasibility of the plans they have developed.

Many designs may not be practical because of logistics considerations. For example, although the TCMS's designs are adjusted for various climates (desert, tropic, and arctic), they may be difficult to construct because of the unavailability of required construction materials in the region. Suitable materials could be brought from the CONUS; however, the level or the length of the US commitment may not support this action.

Military designers must be knowledgeable of local construction standards and materials commonly used in the particular region. Designs must include the use of local materials or provide flexibility within the design for use of substitute materials. The construction standard for the TO will likely be one of the following:

- Initial standard (up to 6 months expected use).
- Temporary standard (up to 24 months expected use).

Since the design life is short, only essential utilities, such as heating and cooling, will be provided. This will also reduce engineer material requirements. A heavy reliance on occupying existing facilities, either provided by the HN or leased, also minimizes construction-material requirements. There are design requirements associated with using existing facilities because modifications to structures are probable to meet the needs of the US-force mission. As a contingency is drawn out and soldiers are deployed for greater lengths of time, the engineer should expect to upgrade facilities to enhance the QOL as the mission, time, and materials allow.

CONSTRUCTION CONSIDERATIONS

In the material estimation process, 10 percent is usually added to the estimated quantity as an overage factor. The overage in the TCMS's bills of materials (BOMs) provides for material loss, damage, and waste and minor field modifications. Although this overage may seem minor, the combined effect of material overage will have a significant impact on the supply system. On the other hand, engineers should not succumb to pressures to eliminate this overage factor when ordering materials under the assumption that waste material can be eliminated through maximizing efficiency. Refuse material is unavoidable. However, all who are involved with actual construction can limit the construction-material waste by—

- Ordering and using optimum lengths.
- Providing clear designs (understandable to the construction unit).
- Inspecting the vendor's stocks to ensure satisfactory quality.
- Providing for the proper storage, security, and handling of construction materials.
- Providing proper worker training to limit waste.
- Reusing materials.
- Constructing the facility right the first time.

Another construction consideration more fundamental than ensuring adequate quantities are ordered is securing transportation to haul materials to the construction site. For some materials, transportation is available within engineer resources. Aggregate, for example, can be hauled by engineer dump-truck companies. Small quantities of dimensional lumber and plywood for small jobs can be hauled using organic assets within the combat heavy battalions. Larger quantities of Class IV supplies require coordination with the theater-level Movement Control Center (MCC) and the TAACOM to—

- Schedule convoys on MSRs.
- Allocate lift assets to move the material from the stockage points to the area of construction.
- Coordinate material drop-off requirements at engineer supply points (ESPs).

Beyond lumber and aggregate, other engineer items of bulk requiring coordinated lift assets include Inland Pipeline Distribution Systems (IPDSs), mines, and other special engineer Class IV barrier and Class V materials.

TRANSITION TO WAR

Unlike other supply classes, Class IV construction materials and Class II topographic items are not provided based on documented consumption rates;

there are no anticipated, preprogrammed surge rates for these items. With technological advances in material management, logistics planners can reduce the time required to get mission material to engineers. The management practices, however, cannot change the physical constants in execution—engineer-mission materials are normally bulky, heavy, and require dedicated transportation. Pre-positioning Class IV stocks reduces lift requirements during the initial stages of force projection.

Construction material is expensive and susceptible to weather damage; therefore, only limited quantities are on hand in the areas of major war plans. For this reason, the ASCC validates needs and initiates requisitions in advance of deployment or operations. Initial material forecasts are submitted by the senior Army engineer staff using data from the TCMS and the JEPES and the base-development plans in the theater-specific, mission-oriented CESP.

Successful execution of the theater's construction program depends on sufficient materials, logistics units to process the materials, and construction capability. Typically, during the early stages of a conflict, war-damage repair and construction of mission-essential facilities will dominate the engineer's construction activities. The RSO&I mission places heavy demands on the engineer as well as logisticians to receive and launch the combatant forces into forward operating areas. As the theater matures, more substantial facilities will be required and more construction forces will be available. The senior Army engineer forecasts adequate construction materials that are flexible enough to meet the varied construction requirements throughout all operation phases.

Special logistics-support considerations for topographic forces are equally important. Equipment such as the Multispectral Imagery Processor (MISP) System and the Combat Terrain Information System require specialized critical low-density supplies. For example, during the Dayton Peace Accord negotiations, November 1995, the Defense Mapping Agency (DMA) (currently known as NIMA) distributed some 30,000 paper copies of maps covering the revised inter entity boundary (IEB) on Bosnia-Herzegovina. As troops deployed to monitor the authoritative cease-fire line (the IEB and their respective buffer zones), thousands more copies of the 1:50,000 scale tactical line maps were needed. Engineer planners anticipated for demand surges on topographic products before operations and recognized that topographic forces were not equipped to run map warehouses, nor did they have the transportation assets to distribute topographic products.

MAINTENANCE SUPPORT

An effective maintenance program ensures that engineer units are capable of providing continuous, responsive support to combatant forces and the sustainment base. An effective supply system for repair parts and lubricants is also necessary. Engineer units consider the risks involved in mobility versus ample coverage for prescribed load list (PLL) repair parts. Logisticians anticipate and provide forward stockage of engineer-specific maintenance-supply support requirements. The Material Management Center (MMC) coordinates with tailored engineer forces in stockage selection and execution to maintain the dominant tempo of operations.

Military engineer units have the potential to use foreign commercial construction equipment. The source of this equipment is varied; for example, equipment may be—

- Provided by the HN.
- Leased from commercial venders.
- Obtained through a grant or loan.
- Bought by benefactor countries supporting the contingency operation.
- Purchased or leased through the LOGCAP.

Such was the case for the 34th Engineer Battalion (Combat) (Heavy) during the Gulf War. They deployed without their organic construction equipment and used the commercial equipment that the Government of Japan (GOJ) provided. Other battalions augmented their construction capabilities using additional leased equipment. These alternatives to increase construction capabilities pose challenges in maintenance to be considered, such as the—

- Lack of manuals and English labels on controls and switches.
- Lack of on-vehicle equipment (OVE), particularly safety equipment.
- Lack of service records or even a service schedule.
- Repair parts not being compatible or available within the Army's maintenance system.

The lack of manuals tends to make preventative maintenance haphazard. Nonstandard repair parts require mechanics to remove the part, take it to a vender to matchup with a suitable replacement, and then establish a PLL from scratch with no maintenance history. These challenges are not insurmountable; however, prior knowledge of the equipment's condition and preventative maintenance status helps the commander establish a reputable maintenance program when he assumes responsibility for foreign commercial construction equipment.

OTHER LOGISTICS SUPPORT

The ENCOM and its operational units assist in the management of critical Class IV and engineer Class V supplies, primarily in the establishment of theater policy or in an advisory capacity to the ASCC's logistics planner or the TAACOM. For other classes of supply and services, engineer units are consumers within the theater.

Engineer units obtain personnel service support (PSS), including finance services, from EAC PSS assets. Engineers need finance support to pay contractors and other local providers. The TAACOM's finance-support center provides finance support. The nearest medical facility provides medical support, to include medical supplies. The TAACOM's explosive-ordnance-disposal (EOD) detachments provide EOD support.

The ASG's supply and services battalion provides Class I supplies (rations). Rations are obtained based on the unit's strength reports that the battalion Adjutant (US Army) S1 prepares. When working on an air base, engineer units obtain Class I support from the Air Force.

The property book officer at the battalion or in the separate companies requisitions Class II supplies from the ASG's supply company. Requisitions for regulated or command-controlled items are processed through the command channels. Engineer units request Class VII items through the material readiness officer at the MMC.

The ASG's supply and services battalion provides Class III supplies (POL). This is true for both bulk and packaged products. Requisitions from the property book officer are required to obtain the needed supplies. When working on an air base, engineer units obtain Class III support from the Air Force.

Class V supplies (ammunition) are obtained from the nearest ammunition supply point that the TAACOM's ammunition battalion operates. Requisitions must be processed by the property book officer. The TAACOM requires input on recommended stockage levels for engineer-specific Class V supplies, such as mines and demolition items, based on plans and anticipated usage rates.

Transportation and material-transfer support are important when planning for Class IV and engineer Class V material. Supplies are often shipped by class. Transportation priorities for Class V supplies will often be higher than those for Class IV supplies. Synchronizing mission Class IV and engineer Class V transportation and material-transfer support is desirable to use mission loads effectively.

All the above logistics are an integral part of the engineer planning process. Engineer units that are not organic to a division are tailored for specific operations. Therefore, the staff engineer must articulate their CSS requirements from deployment planning through the engineer estimates for mission loads to the actual delivery of services and material. The coordination of units and resources facilitates the anticipation of engineer-unit sustainment requirements and the execution of CSS. The staff engineer ensures that CSS planners understand engineer-unit sustainment requirements and have a plan to meet those requirements.

Chapter 7

Stability Operations and Support Operations

Ably suited to help shape the international security environment, the total Army plays a central role in the conduct of our national military strategy. With over 100,000 soldiers stationed overseas, and on average 31,000 deployed in more than 70 countries on joint and combined exercises and operations in FY97, America's Army promoted regional stability through conduct of peace operations in Bosnia, Macedonia, Ecuador, Peru, the Mideast, and elsewhere; and contributed to arms control by its chemical weapons elimination program and active participation in demining efforts worldwide.

— *General Dennis J. Reimer*
Chief of Staff, US Army

GLOBAL RESPONSE

Stability operations and support operations are two distinct types of operations. Stability operations consist of those applications of military power or presence intended to influence the political environment, facilitate diplomacy, and interrupt specific illegal activities. These operations can include peace, combating terrorism, counterdrug, civil disturbance, noncombat evacuation, arms control, show of force, nation assistance, support to insurgencies, and support to counter insurgencies.

Support operations consist of providing essential supplies and services to assist designated groups. These operations are conducted mainly to relieve suffering and help civil authorities respond to crises that are man-made or natural disasters. Support operations can include humanitarian assistance and environmental assistance.

The following are some of the stability operations and support operations US forces have conducted:

- Peacekeeping in Bosnia.
- Humanitarian assistance in Somalia.
- Support to oppressed Kurds in Northern Iraq and to tribesmen in Rwanda.
- Civil restoration in Haiti.
- Refugee and migrant control in Guantanamo Bay.
- Earthquake response in Los Angeles.
- Wildfire fighting in the west.

- Flood fighting in the midwest.
- Hurricane relief on the East Coast and in Hawaii.

The NCA uses the Army and its engineers as a responsive tool to improve, stabilize, or bolster deteriorating conditions. Often, the number of engineers engaged in these operations is disproportionately high when compared to other forces. These forces are used either as a sole participant or as a component of a much larger activity that reacts to crises which threaten vital, important, and humanitarian interests of the US.

The NCA allows or directs the CINCs to respond to these crises in a manner uncharacteristic of their deliberate plans for the MTWs and the smaller scale contingencies. These quick-response actions occur without—

- The benefit of established TPFDDs.
- Prearranged international agreements for housing or other support.
- Pre-positioned sustainment supplies.
- A calculated analysis on COAs rehearsed in specific war-game exercises and computer-assisted simulations.

On the contrary, a plan is developed almost instantly using the crisis-action planning process, and forces are mobilized and sent to the crisis. An appointed JTF staff that is assembled specifically for the current crisis develops this process. As troops move to the location of action, the contingency is literally being defined and refined. A given crisis has multiple national-response alternatives. Military contingency operations pose an option that can be exercised independently, but more routinely, in concert with one or more of the following elements of national power: informational, diplomatic, and economic.

The NCA's reaction to the crisis is a measured response using appropriate agencies with the ability to meet their short- and long-range intents. The ultimate goal is to remove the crisis conditions and return the region to a stable economic and political environment able to prosper without further US intervention or support.

Figure 7-1 portrays the options under the stability and support operations umbrella. Typically, military operations are executed together with other ribs of the stability and support operations umbrella. Government organizations, such as the FEMA, state and local governments, or the State Department and/or country teams, may direct actions and set priorities within the region vice the military commander. NGOs and PVOs, such as the Red Cross and World Hunger, leverage donations and volunteers to reduce human suffering. The UN has become increasingly involved in peace enforcement and peacemaking operations, asserting greater authority than in the 1970s through the early 1990s.

JOINT AND MULTINATIONAL OPERATIONS

Recent activities, which the Army Chief of Staff recounted at the beginning of this chapter, reaffirm the likelihood of US forces becoming involved in future contingency operations. These same experiences demonstrate the role of the

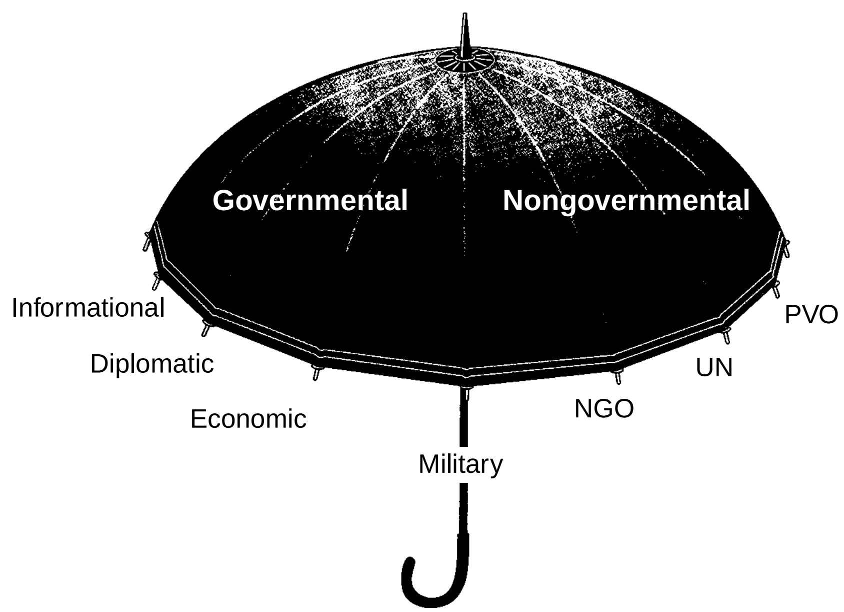

Figure 7-1. Stability and support operations umbrella

UN, international agencies, US governmental agencies, other components of the armed forces, allied forces, and nongovernmental agencies. This makes command and support relationships more complex and the responsibilities and capabilities of the assembled engineer force unclear. Army engineer commanders and staff must consider the possibility of commanding or directing other service-component engineers and other assets with unknown capabilities and limitations. Likewise, Army engineer assets may be subordinate to these other organizations; this is the nature of stability operations and support operations. Skillfully controlling this mixture of engineer assets is an enormous task and the key to victory for Army engineers.

ENGINEER OPERATIONS

Engineer activities in contingency operations may be prominent and, often, are the pivotal function that defines success for the JTF and/or component commanders. For example, in response to natural disasters (floods, earthquakes, hurricanes, and wildfires), engineers—

- Construct protective levees.
- Open thoroughfares for relief supplies and evacuation.
- Conduct rescue or recovery operations.
- Cut fire breaks to contain wildfires.
- Remove debris.

- Construct temporary camps to house military personnel engaged in relief actions.
- Reduce/remove damaged structures with demolitions or other means.
- Provide temporary repairs to public buildings such as schools and hospitals.

These activities are all engineer undertakings that are prominent within the overall military response. The engineers' clearing of sunken Russian gunships and marking of navigational channels in Somalia allowed for the off-loading of critical equipment and relief supplies. The engineers' construction or upgrade of roads and bridges and clearance of mines allowed forces to sustain the distribution of relief supplies in Somalia and maintain a stabilizing presence in outlying areas such as Baledogle, Oddur, and Bardera. The bridge crossing of the Sava River, which linked Hungary to war-torn Bosnia, received worldwide attention as a requisite activity to initiate the US efforts in Operation Joint Endeavor. Removing debris in South Florida after Hurricane Andrew was another highly visible engineer activity gaining praise from all observers.

These prominent examples of engineer effort however, do not fully illustrate the numerous missions that accompany stability operations and support operations. There are many other tasks that obligate engineers during these operations, such as force protection and bed down. Such tasks are critical to mission success; however, they are only indirectly tied to the conditions that precipitated the US response. The presence of US forces generates engineer tasks to support QOL requirements.

Typical missions that engineers conduct in response to stability operations and support operations are—

- Terrain visualization.
- Forced-entry support operations.
- Force protection.
- Force bed down.
- Force mobility.
- Infrastructure repair.
- Nation assistance.
- Redeployment.

DEFINED OBJECTIVE, END STATE, AND STANDARDS

Combat operations have a clearly defined objective, such as—

- Defeating the opposing forces.
- Gaining possession of or controlling key terrain.

Unfortunately, in contingency operations, the mission objective (which is translated into tasks) may not be as clearly defined. Earlier in this chapter, typical engineer missions were outlined. There is literally no end to the amount of work engineer resources can contribute to contingency operations. Engineer commanders and staffs ensure that the critical tasks are performed through a clear prioritization of personnel, material, and equipment. This prioritization serves to limit the costs of the US involvement by preventing—

- Increased material costs.
- Prolonged engineer deployment.
- Degradation of our ability to react to future contingencies because units are occupied in an effort above and beyond the stated mission requirements.

The end state and standards must be set by the force commander to be universally applied throughout the TO. In December 1992, the JTF engineer approached the JTF commander of Operation Restore Hope in Somalia to obtain the commander's intent and guidance on facility and road construction. He presented multiple options with varied construction standards. Each option had an associated resource requirement affixed to the level of work and an expected completion date.

Lieutenant General (LTG) Johnson, the JTF commander, established the standards for the theater and the end state for engineer activities. This end state became the benchmark for all US unilateral activities within the theater. The end state not only served as the initial negotiation point for the transfer of responsibilities from the US to the UN, but it also became the operational date for initiating the retrograde of US personnel and equipment from the region.

Choosing an end state is an art. Most governmental and nongovernmental elements will stay behind after the military achieves the end state; therefore, it is important for all elements to acknowledge when this should occur. Since LTG Johnson's end state did not coincide with the UN ability to accept the US missions, the US involvement was protracted beyond the end state.

An established end state motivates soldiers to accomplish the desired results. Equally important, it equips leaders with the rationale to evaluate the "good ideas," which will undoubtedly come, for merit and conformity with the commander's intent. This principle has been used in subsequent operations with equal success.

TOPOGRAPHIC ENGINEERING

With the advancements available in today's technologies to enhance topographic operations (and the promise of greater things tomorrow), the operational commander gains much in preparations for action before deploying to a contingency. Using 3D rendering tools and many types of imagery, the commander can graphically visualize the terrain in three dimension. Engineers must leverage every means available to commanders to support their fundamental knowledge of the terrain during planning.

Topographic engineering provides the framework whereby the commander and his staff can—

- Visualize the terrain.
- Appropriately employ his forces.

- Gain an understanding of the vulnerabilities or threats posed on his forces by opposing forces (natural or man-made).

For example, satellite imagery can map out the extent of flooding or the spread of wildfires. Using infrared spectral imagery, satellites can show the extent of earthquake damage and predict weaknesses within a slip plane of landslides.

Terrain analysts can provide critical information on base-camp sitings near functional roads and railway conduits and outside floodplanes subject to seasonal fluctuations. Digitized terrain products exploit numerous available data sources to equip ground commanders with—

- Special products in lieu of or supplemental to map products.
- Combined information from multiple sources for the most up-to-date intelligence.
- Existing maps and charts not readily available through traditional map depots and stockage.
- Near real-time terrain conditions of an area.

Terrain data empowers the commander to make informed decisions before soldiers deploy, reducing risk and increasing their efficiency when they arrive at the location requiring stability operations and support operations.

FORCED-ENTRY SUPPORT OPERATIONS

In some contingency operations, the US force-projection element may be opposed by belligerent forces who wish to deny the US an opportunity to stabilize an embattled situation. The same force may require LOTS operations for those areas with inadequate port facilities. Under either of these circumstances, engineers are required to establish and expand a lodgment area to receive US forces. This may be accomplished by—

- Building an expedient air strip.
- Enhancing a limiting port facility.
- Reducing obstacle systems at borders.
- Providing force-protection structures.

Sustained operations, beyond a few days, require supplies, equipment, and personnel support that must—

- Land on an improved runway.
- Off-load at a developed port facility.
- Transit on an established LOC network of roads or railways.

An engineer-support activity that is embedded in forced-entry support operations is establishing or enhancing C^2 facilities with electrical power to operate maneuver-control, computer, and communications systems.

FORCE PROTECTION

Force protection is a security program designed to protect soldiers, civilian employees, family members, facilities, and equipment in all locations and situations. As experienced in Operation Joint Endeavor, commanders considered the threat, natural elements, and safety when planning force protection. Engineers provide capabilities to combat terrorism and enhance physical security. In Army and joint/multinational operations, force protection is a principal concern of leadership at all command levels. Soldiers in Bosnia, Haiti, Somalia, Northern Iraq, and Panama faced a threat from armed and organized opposition groups. The rise in terrorist activities, such as the bombing of Khobar Towers in Saudi Arabia, is of increasing concern. However, the threat is not limited to operations involving strife.

In a disaster-relief response, forces may need protection from—

- Natural elements (heavy winds, freezing temperatures, fires, or floodwaters).
- Disorganized, yet armed, bands of looters or rioters.
- Deprived citizens and mobs anxious to obtain relief supplies.

Regardless, commanders equip soldiers with well-defined rules of engagement (ROE) and direct resources, typically engineers, to reduce the risks and mitigate the effects on the force. Those engineer resources, in concert with maneuver forces, build such items as protective bunkers, wire structures to control personnel, protective berms, and overhead cover to protect the force. Engineer resources also include technical assistance. The Army engineer’s force-protection center of expertise for planning and design is resident at the USACE Protective Design Center (PDC) in Omaha.

FORCE BED DOWN

Force bed down is a basic requirement that is applicable to all operations. Force bed down is the provision of expedient facilities for troop support to provide a platform for continued operations. These facilities may include modular or kit-type facility substitutes. Translated as facilities requirements, engineers choose facilities in the following order of precedence: HN assets provided at no cost, leased existing facilities, facilities constructed by the HN, and US-constructed facilities. Providing housing for the US projection force is an engineer function, whether it is building base camps or leasing facilities that will house soldiers. The housing requirements go beyond tent floors or strong-backed tents and include facilities for—

- Personal hygiene.
- Messing.
- Sanitation.
- Administrative functions.
- Morale, welfare, and recreation (MWR).
- Storage.
- Maintenance.
- Environmental protection.

Landfill operations and environmental support are also among force bed-down requirements. Power generation and distribution, well drilling, and fire fighting are also engineer requirements implied in force bed-down missions. Continual upkeep of camps in protracted deployments is also an engineer requirement that is defined as RPMA. The RPMA centers on the efforts to maintain the facilities that forces occupy and use to ensure that these facilities remain safe and sanitary. Finally, as soldiers remain in a deployed status, their QOL becomes an increasing concern to leaders. As time goes on in a deployed status, more and more engineer effort is spent on improving the units' QOL.

FORCE MOBILITY

Again, force mobility is a prevalent activity in most stability and support operations, regardless of the location. However, the activities are varied. In a disaster-relief operation, engineers may be—

- Clearing rubble.
- Repairing bridges that are flooded or damaged by an earthquake.
- Carving a bypass in an area obstructed by raging fires and mud slides or damaged by earthquake tremors.

In humanitarian relief, engineers enhance mobility to distant population centers whose access does not include serviceable roads. In peacekeeping operations, all the previous tasks may exist along with a probable requirement to clear the roadways of mines, particularly in countries like Cambodia, Somalia, Bosnia, Mozambique, Afghanistan, and Angola that have survived years or even decades of civil war.

INFRASTRUCTURE REPAIR

Infrastructure repair is another engineer-specific activity through which the commander can materially influence stability operations and support operations with tangible results. The infrastructure includes all fixed and permanent installations and facilities for the support and control of military forces. Repairs may be done to improve operational efficiency for the commander or as a stand-alone mission. The completed projects will directly contribute to the doctrinal stability and support imperatives.

Furthermore, infrastructure repair is a constant reminder to all of the US aid and commitment to the troubled region. Repairing or upgrading utilities, such as sewers, electrical systems, and water-distribution systems, directly impacts the populous by improving their QOL. Improving the transportation network of roads and bridges allows commerce to meet or exceed precrisis activity levels. Repairing airports and piers accelerates relief efforts by increasing throughput capabilities and allows international commerce to regain precrisis activities as well. In addition to the efforts that US forces directly impact, engineers assess and prioritize the repairs that the HN or others will perform to restore the infrastructure.

NATION ASSISTANCE

Much like infrastructure repair, nation assistance from the engineer's perspective normally encompasses construction activities. The main objective of nation assistance is to promote stability by helping a HN establish institutions and facilities that are responsive to its people's needs. Repairing or building municipal structures such as schools, clinics, hospitals, and orphanages is among the high-payoff projects. Repairing or building police stations, detention facilities, and marksmanship training ranges helps the HN reestablish law and order. This in turn enhances the HN's ability to "self-rule." Constructing dams and improving irrigation systems allow farming production to increase, while indirectly allowing population migration from densely populated areas to areas previously undeveloped. Again, these activities add legitimacy to the US activities within the region and reinforce the political circumstances of the host agencies responsible for the US presence.

REDEPLOYMENT

Often overlooked within planning and during execution, redeployment considerations can be a significant engineer challenge, particularly when terminating overseas contingencies. Restrictions aimed at guarding the US agriculture from inadvertent exposure to potentially devastating organisms require that equipment and vehicles be thoroughly cleaned before redeployment to meet the US Department of Agriculture's standards. Wash racks, substantial freshwater sources (both clean and desalinated), and drainage structures are among the redeployment considerations that involve engineer units. Engineers support the logisticians who collect and dispose of hazardous materials (HAZMATs) and waste. To reduce the effects of oil and fuel spills, engineer equipment is used to assist in clean-up by removing and containerizing contaminated soil or treating it through wind-rowing. For large-scale operations, redeployment facilities include—

- Troop housing.
- Staging areas for equipment awaiting washing.
- Inspection areas for the US Department of Agriculture's and Customs' inspectors.
- Sterile areas for equipment awaiting return to the US.
- Transportation networks.
- Hazardous waste accumulation sites.

OPERATIONAL CONSIDERATIONS

Stability operations and support operations possess many, if not all, the operational considerations found within the MTWs. At the execution level, the engineers perform the same tasks. Clearing rubble after a hurricane differs little from clearing rubble following military operations on urbanized terrain (MOUT). Constructing roads during stability operations and support operations differs little from constructing MSRs in an MTW. Yet, some of the force structure that automatically flows into a combat situation does not flow into a contingency operation because caps are emplaced on troop strength and the Army's response is tailored and limited by design. These limitations may be fiscally driven, politically motivated, or strategically oriented to retain the Army's flexibility and the deterrence capability that is associated with the MTWs. Some considerations that merit attention when planning and executing contingency operations follow.

COMMAND AND CONTROL

Engineers establish a sufficient operational staff to plan, perform engineer design, and control engineer actions. This allows the engineer force commanders to remain focused on mission execution. This principle is a reiteration of the concept discussed in *Chapter 3*. The expertise of theater assets, which are trained and equipped for theater missions, allows divisional units to remain focused on and responsive to mission execution. In May 1996, the 412th ENCOM, augmented with personnel from the 416th ENCOM, deployed a 28-man C^2 element to support Operation Joint Endeavor in Hungary, Bosnia, and Croatia. This element provided theater planning and control for engineers deployed in the AO. The ENCOM C^2 element was well equipped to—

- Monitor all LOC.
- Plan and oversee the maintenance of the LOC and coordinate and monitor all Title X construction.
- Plan future engineer operations.
- Provide vital engineer input to theater plans by the US Army, Europe (USAREUR) (forward).
- Provide real estate acquisition, management, and disposal.
- Oversee HAZMAT removal and environmental restoration.

Because of this in-country operational element, the CINC's staff was not entirely consumed with the operations in the Balkans and was able to manage the strategic elements throughout the entire region. Likewise, the supported commanders were free to focus on their mission.

RESERVE AND NATIONAL GUARD PARTICIPATION

These recent activities demonstrate the likelihood of US RC forces becoming involved in contingency operations. The following are a few of the units that can only be accessed through the reserve structure because there are none that are active duty:

- ENCOMs.
- FE teams.
- Port-construction companies.
- Dump-truck companies.

Similarly, the OPTEMPO for some active-duty low-density units, such as combat heavy battalions, light dive teams, or fire-fighting detachments, may preclude their participation in contingency operations. Therefore, a reserve or national guard battalion may be called on to meet mission requirements. These issues are not unique to engineers, therefore, a PSRC is a likely occurrence for contingency operations. A PSRC was initiated for both Haiti and Bosnia operations.

LOGISTICS AND RESOURCE MANAGEMENT

The availability of Class IV materials within a contingency region may be limited. Unlike regions of continued presence and the two MTWs where preparations for Class IV materials were established through pre-positioning or thorough site surveys, contingency operations may place US forces in regions where these supplies are not available or sources are unknown. Engineer assets are limited in effectiveness without Class IV materials. This axiom was the 36th Engineer Group commander's point in 1992 and remains relevant to all engineer commanders today.

In December 1992, the 36th Engineer Group commander prepared to deploy to Somalia as the Army force (ARFOR) engineer. His concern for Class IV materials was preeminent in his preparation planning. He believed that engineer victory hinged on the availability of Class IV materials and convinced his installation commander to use his operating-budget funds to purchase Class IV materials to be deployed with the group's equipment.

Contingency actions may occur with little notice and no funding. Contingency operations are unprogrammed activities, and resources typically come, at least initially, from another's command operating budget (COB) at the expense of programmed activities. Engineer and logistics planners work with resource managers to locate initial funding for Class IV materials and other engineer needs so that these items can be purchased, assembled, and shipped to the region. They capture such costs in reporting to support the replacement of funds shifted and expended for the operation.

Environmental compliance and conservation are considered in all aspects of operational planning and execution in stability operations and support operations. Hazardous wastes and POL are managed in a manner that minimizes the potential for releases to the environment which may expose personnel or impact valuable natural resources such as drinking water sources. Solid wastes are managed to control dumping that attracts vermin and disease causing vectors. Similarly, pesticides are managed and applied in a manner to minimize the possibility of impacts on natural resources, such as fish kills due to overapplications of pesticides. As with other operational considerations, environmental needs may be fiscally driven (controls hazardous-waste generation and minimizes the disposal cost), politically motivated (improves relations with HNs by ensuring the cleanup and the enhancement of the environment), and strategically oriented (minimizes cleanup efforts in postconflict periods). The FE team provides environmental management services to support military missions.

These operational considerations are not all that a deploying operational engineer will need to know; however, they are significant concepts that will help equip him with a more clearly defined scope and understanding of stability operations and support operations. For more information on stability operations and support operations, see FM 5-114 and other sources cited within this manual.

Appendix A

Engineer Troop Unit Organizations

Engineers operate as an integral member of the combined-arms team in peace and war to provide a full range of engineering capabilities. Engineers execute M/CM/S missions and provide general engineering throughout the theater from the CZ to the COMMZ. Engineers also provide terrain-analysis and special map products. See FMs 5-71-100 and 5-100-15 for the doctrinal organizations that provide engineer capabilities within the corps and the divisional structures. This appendix addresses engineer organizations that are not organic to divisions, separate brigades, or armored cavalry regiments.

Theater-engineer functions require a diversified and versatile engineer force that can provide the technical capabilities that are required to accomplish essential tasks. This appendix provides descriptions of the engineer units and elements that are normally not organic to division engineers. It also describes other units that are critical to theater operations, which may be assigned to the theater-engineer structure.

Engineer units may be engaged in operational art anywhere within the theater commander's battlespace framework. The traditional EAC engineers may find themselves pushed forward to reinforce corps efforts. Combat engineers may find themselves assigned at the EAC in support of the commander's concept of operations. The engineer architecture in operational art is the skillful design, organization, and integration of engineer units into an organization that is responsive to commanders for the attainment of strategic and/or operational objectives.

The following paragraphs identify the types of engineer units and describe them by their base table of organization and equipment (TOE) or TDA.

HQ, ENCOM

The ENCOM is normally assigned to an ASCC. It—

- Commands, controls, supervises, coordinates, and performs operational planning for the activities of assigned or attached engineer brigades, groups, and other units engaged in—
  - Operational M/CM/S.
  - Construction.
  - Topographic activities.

- — Production of military geographic intelligence.
- — Other related activities.

- Plans, coordinates, and supervises general troop and contractual construction support and support to the Army, other services, and allies throughout the theater.
- Allocates engineer troops, materials, and equipment to construction projects.
- Provides guidance and technical assistance to units engaged in construction projects.
- Coordinates topographic and military geographic intelligence support to the theater Army.
- Supervises contractual construction and labor, to include US, indigenous, and third-country personnel.

HQ, ENGINEER BRIGADE (THEATER ARMY)

This HQ is normally assigned to a theater Army and may be attached to an ENCOM. It—

- Commands, controls, conducts planning for, and supervises attached engineer units that are engaged in CS and constructing and rehabilitating facilities in support of a TO.
- Commands, controls, plans, and supervises the attached units' activities.
- Allocates resources in support of engineer operations.
- Supervises engineer units that are constructing and rehabilitating roads, structures, air-landing facilities, and petroleum-storage and -distribution facilities.
- Supervises HN personnel and administers contractual construction and labor.

Utility teams (TOE 05530LH00) normally augment the capabilities of this unit when facilities engineering support is required.

HQ, ENGINEER BRIGADE (CORPS)

This HQ is normally assigned to a corps or an airborne corps. It—

- Commands and controls assigned and attached units and coordinates engineer activities.
- Plans and coordinates the operations of the engineer units that are engaged in CS and constructing and rehabilitating facilities in support of the corps or the airborne corps.
- Plans and supervises the assigned and attached units' activities.
- Allocates units and resources in support of engineer operations.
- Plans and monitors the activities relating to river-crossing, barrier-placement, and counterobstacle and countermine operations.

- Supervises the engineer units constructing and rehabilitating roads, trails, structures, air-landing facilities, and petroleum-storage facilities.
- Supervises indigenous personnel and administers contractual construction and labor.
- Provides an engineer staff element to the corps or the airborne corps HQ.
- Plans and supervises terrain-intelligence and topographic operations.

HQ, ENGINEER GROUP (CONSTRUCTION)

This group HQ is normally assigned to a theater-engineer brigade and/or an ENCOM. It commands assigned and attached units and coordinates engineer activities. Because this HQ possesses a design/management section for specific engineering tasks at EAC, it can command, control, plan, and supervise the combat heavy engineer battalions' activities throughout the depth of the AO. It—

- Plans, supervises, and coordinates the activities of the assigned and attached engineer units engaged in M/CM/S and general-engineering functions.
- Supervises engineer units preparing and maintaining combat routes and MSR in the TO (to include the ingress and egress, battle positions, and river-crossing sites) and repairing bridges, fords, and culverts.
- Plans and supervises engineer reconnaissance.
- Conducts planning for and supervises assigned and attached engineer units performing general-engineering tasks, such as constructing and repairing landing strips, heliports, port facilities, and railroads.

HQ, ENGINEER GROUP (COMBAT)

This group HQ is normally assigned to a corps when the composition of the subordinate battalions is predominately combat-oriented and attached to an engineer brigade. At EAC, this group HQ may have a greater construction orientation; yet it brings valuable combat expertise to the EAC's reinforcing role in areas with forward-placed EWLs or special project zones. It—

- Commands assigned and attached units and coordinates engineer activities.
- Plans, supervises, and coordinates activities of assigned and attached engineer units engaged in M/CM/S and general-engineering functions.
- Supervises engineer units preparing and maintaining combat routes and MSRs in the TO (to include the ingress and egress, battle positions, and river-crossing sites) and repairing bridges, fords, and culverts.
- Plans and supervises engineer reconnaissance.

- Conducts planning for and supervises assigned and attached engineer units performing general-engineering tasks, such as constructing and repairing landing strips, heliports, port facilities, and railroads.
- Does not have a design management section.

ENGINEER BATTALION (COMBAT) (HEAVY)

The battalion is normally assigned to an engineer group, a brigade, a corps, or a joint or combined task force (TF). It—

- Increases the combat effectiveness of the division, corps, and theater Army's forces by accomplishing general-engineering and M/CM/S tasks.
- Constructs, repairs, and maintains the MSRs, landing strips, buildings, structures, and utilities.
- Performs rear-area security operations, when required.

At EAC, this unit may work forward of the traditional corps rear boundaries, as well as the operational engineer missions with EWLs throughout the theater. The battalion—

- Constructs, rehabilitates, repairs, maintains, and modifies landing strips, airfields, CPs, MSRs, supply installations, buildings, structures, and bridges.
- Repairs and reconstructs (on a limited basis) railroads and sewage and water facilities.
- Provides field-engineering assistance and support to divisional engineers preparing protective positions.
- Conducts engineer reconnaissance.
- Creates obstacles to degrade enemy mobility in rear areas.
- Clears obstacles as part of an area-clearance operation, not as part of an assault-breaching operation.
- Performs rear-area operations, to include infantry combat missions, within the limitations of organic weapons and equipment.
- Supervises contractual construction, skilled construction labor, and unskilled indigenous personnel.
- Conducts area-damage clearance/restoration operations.
- Provides religious support to assigned and attached units.

PLATOONS/COMPANIES, ENGINEER BATTALION (PRIME POWER)

Platoons/companies are normally in DS or operational control (OPCON) to a theater engineer HQ, such as the ENCOM, the engineer brigade, or the theater Army. The battalion—

- Generates electrical power and provides advice and technical assistance on all aspects of electrical power and distribution systems in support of military operations.

- Maintains the Army's power-generation equipment.
- Distributes the Army's power-generation equipment war reserves.

At EAC, this specialized unit provides specific essential services. It—

- Designs and constructs power plants and distribution systems to the panel box for base camps.
- Produces electrical power in support of C^2 sites, hospitals, weapons systems, logistics support areas, tactical generators at fixed sites needing relief, and critical facilities.
- Provides technical advice to commanders and senior engineers on all aspects of electrical-power systems.
- Repairs and maintains organic power-production and distribution equipment.
- Distributes power produced with organic systems.
- Operates, maintains, and performs minor repairs to other electrical-power-production equipment, including HN fixed plants.
- Provides electrical engineering support, such as limited design and analysis capabilities.
- Performs electrical surveys.
- Assists representatives from the electrical-related contracting office.
- Provides quality control (QC) for contractor designs and for constructing electrical-power plants and power-distribution systems.
- Manages and coordinates prime-power requirements worldwide.
- Supports RPMA and power reliability and enhancement programs.

ENGINEER TOPOGRAPHIC BATTALION (THEATER ARMY)

The battalion is normally assigned to an ENCOM or a theater Army. It—

- Provides C^2 and support for theater topographic units, including the engineer topographic company (EAC).
- Provides engineer topographic support to theater elements.
- Collects, analyzes, manages, and disseminates topographic information.
- Maintains topographic databases.
- Produces map updates, substitutes (such as image maps), and supplements; overlays; and digital topographic data.
- Provides terrain analyses and related products.
- Interprets and measures imagery.
- Performs topographic surveys and provides survey information to the theater elements.

- Stores and distributes special topographic products that the company under C^2 of the topographic battalion produces.
- Requisitions, stores, and distributes topographic technical supplies for theater units (theater's authorized stockage list [ASL]).
- Maintains liaison with allied topographic units, NIMA, and appropriate staff elements of support units.
- Depends on a quartermaster map-distribution platoon for the storage and the distribution of standard mapping products and the operation of map depots.

ENGINEER COMBAT BATTALION (CORPS) (WHEELED)

The battalion is normally assigned to a corps and attached to an engineer brigade or group. At EAC, the battalion adds combat skills and talents to the engineer structure much like the combat heavy battalion adds construction skills, expertise, and protection capability to the divisional structure. It—

- Increases the combat effectiveness of the corps by accomplishing M/CM/S and general-engineering tasks.
- Reinforces divisional engineer units, when required.
- Reorganizes into infantry units and fights as infantry, when required.
- Participates in joint military operations, when required.
- Commands, controls, and supervises assigned and attached units.
- Provides engineer support when constructing obstacles and defensive positions.
- Provides engineer support in assault river-crossing operations.
- Performs general-engineering tasks (such as constructing, repairing, and maintaining landing strips, heliports, CPs, LOC, tactical routes, culverts, fords, supply installations, buildings, and structures) and other related horizontal construction tasks, as required.
- Provides technical advice, assistance, and training in mine-warfare, field-fortification, camouflage, demolition, and engineer-reconnaissance techniques.
- Provides engineer information and develops engineer intelligence.
- Provides combat-engineer support for an independent TF or a joint military operation, when required.
- Participates in rear-area operations, when required.

ENGINEER COMBAT BATTALION (CORPS) (MECHANIZED)

The battalion is normally assigned to a corps and attached to a combat brigade or group. At EAC, the battalion adds survivability combat skills and talents to the engineer structure much like the combat heavy battalion adds construction skills, expertise, and protection capability to the divisional structure. The battalion consists of a headquarters and headquarters company (HHC) and three combat-engineer line companies. It—

- Increases the combat effectiveness of supported units by accomplishing M/CM/S and limited general-engineering tasks.
- Reinforces divisional engineer units, when required.
- Reorganizes into infantry units and fights as infantry, when required.
- Participates in joint military operations, when required.
- Commands, controls, and supervises assigned and attached units.
- Provides engineer support when constructing obstacles and defensive positions.
- Provides engineer support in assault river-crossing operations.
- Performs limited general-engineering tasks (such as constructing, repairing, and maintaining CPs and fords) and other related horizontal construction tasks, as required.
- Provides technical advice, assistance, and training in mine-warfare, field-fortification, camouflage, demolition, and engineer-reconnaissance techniques.
- Provides engineer information and develops engineer intelligence.
- Provides combat-engineering support for an independent TF or a joint military operation, when required.

ENGINEER COMPANY (TOPOGRAPHIC) (EAC)

The company is normally assigned to a theater Army. It—

- Provides topographic-engineering support to EAC.
- Compiles controlled, semicontrolled, and uncontrolled image maps and mosaics.
- Revises existing maps and other topographic data within its capabilities.
- Drafts special maps, overprints, overlays, and other topographic products.
- Reproduces monochrome and multicolor maps, map substitutes, overlays, overprints, and other topographic products by offset lithography and photocopy.
- Provides terrain-intelligence and terrain-analysis products.
- Performs topographic surveys and provides survey information to the EAC.
- Interprets and measures remote-sensed imagery.
- Extends horizontal and vertical controls into corps and division areas.
- Stores and distributes special topographic products that the company produces.

- Provides a survey information system and maintains digital point-positioning databases (DPPDB).

ENGINEER COMPANY (CONSTRUCTION SUPPORT)

The company is normally assigned to an ENCOM for further attachment to an engineer brigade or group. It augments a combat heavy battalion to give it additional horizontal construction capability. The company normally does not perform construction independently. It—

- Provides construction support, equipment, and personnel for rock crushing, bituminous mixing, paving, storage facilities, and airfields.
- Provides support to one engineer brigade or group engaged in construction projects that—
  - Require up to 75 tons per hour (tph) of crushed rock and sand from rock quarries and gravel pits for a two-shift operation.
  - Require up to 75 tph of washed and sized precrushed rock for a two-shift operation.
  - Require up to 150 tph of bituminous mixes and blends for paving projects for a one-shift operation.
  - Require equipment and operators to support selected construction for a two-shift operation and personnel with the capability of supervising contractual labor and indigenous personnel and assisting in the supervision of contractual construction.

ENGINEER DUMP-TRUCK COMPANY

The company is normally attached to an engineer brigade or group. It—

- Operates dump trucks for moving bulk materials in support of other engineer units.
- Provides a haul capacity of up to 600 tons of bulk material (such as gravel, earth fill, and crushed stone) per trip.

ENGINEER PIPELINE-CONSTRUCTION-SUPPORT COMPANY

The company is normally assigned to an ENCOM and attached to an engineer brigade or group. It augments a combat heavy battalion to give it the capability to perform pipeline operations. The company normally does not perform construction independently. It—

- Provides technical personnel and specialized equipment to assist military units or indigenous personnel in constructing, rehabilitating, and maintaining pipeline systems.
- Provides advisory personnel to support up to three engineer companies constructing a pipeline (stringing and coupling pipe), a pump station, and a dispensing facility and erecting a storage tank.
- Provides specialized tools, equipment, and personnel to operate on a two-shift basis.

- Is capable of transporting 21,000 linear feet of 6-inch pipe, 16,200 linear feet of 8-inch pipe, or 9,000 linear feet of 12-inch pipe over unimproved roads in two lifts.
- Constructs and rehabilitates pipeline systems, to include erecting storage tanks when construction units are available.

ENGINEER PORT-CONSTRUCTION COMPANY

The company is normally assigned to an ENCOM and may be further attached to an engineer brigade or group. It augments a combat heavy battalion to give it the specialized equipment required for port-construction and -repair operations. The company normally does not perform construction independently. It—

- Provides specialized engineer support in developing, rehabilitating, and maintaining port facilities, to include LOTS operations.
- Constructs, rehabilitates, and maintains offshore facilities, to include mooring systems, jetties, breakwaters, and other structures required to provide safe anchorage for ocean-going vessels.
- Constructs, rehabilitates, and maintains piers, wharves, ramps, and related structures required for cargo loading and off-loading.
- Constructs facilities for roll-on-roll-off, break bulk, and containerized cargo handling.
- Maintains tanker-discharge facilities, to include repairing or replacing existing POL jetties and submarine pipelines.
- Provides limited dredging and removes underwater obstructions.
- Installs the Off-Shore Petroleum Discharge System (OPDS) in support of Army LOTS operations where no naval units are assigned.
- Provides operators for selected items of equipment for a two-shift operation.
- Depends on the pipeline-construction engineer company for radiographic inspection of pipeline welds, when required, and the lightweight diving team for underwater construction, survey, reconnaissance, and recovery.

ENGINEER COMPANY, (MULTIROLE BRIDGE)

The company is normally task-organized to a corps or a divisional engineer battalion or a combat-engineer group to support bridging operations. It—

- Provides personnel and equipment to transport, assemble, disassemble, retrieve, and maintain all standard US Army bridging systems.
- Provides transportation for the palletized load system (PLS) configured cargo.

ENGINEER BRIDGE COMPANY (PANEL BRIDGE)

The company is normally assigned to a corps and attached to an engineer brigade or group. It—

- Provides personnel and equipment to transport, assemble, disassemble, and maintain engineer bridging.
- Provides dump trucks for earthmoving and engineer-mission cargo hauling in emergencies by downloading bridge loads.
- Provides one panel bridge set (bailey), with sufficient components, and a cable reinforcement set for erecting bridges of various spans and load classes. The set includes two 24.4-meter (80 feet) double-truss, single-story (Class 50 wheeled/Class 60 tracked) bridges without a cable reinforcement set and one 58.5-meter (180 feet) triple-truss, single-story (Class 50 wheeled/Class 60 tracked) bridge with a cable reinforcement set. Additional bridge components for spans over 100 feet are available.
- Provides technical supervision to assist other engineer units in bridge construction.
- Constructs bridges (in emergencies) using organic personnel, but with increased construction times.
- Provides 5-ton dump trucks for earthmoving and general-engineering-mission cargo hauling with a 150-ton capacity per trip when bridging is not loaded.

ENGINEER BRIDGE COMPANY, MEDIUM-GIRDER BRIDGE (MGB)

The company is normally assigned to a corps and attached to an engineer brigade or group. When task organized to the ENCOM, the bridge company is normally attached to an engineer group to provide upgrades to tactical bridging for an increased sustainment-flow capability. It—

- Provides personnel and equipment to transport, assemble, disassemble, and maintain engineer bridging.
- Provides dump trucks for earthmoving and engineer-mission cargo hauling in emergencies by downloading bridge loads.
- Provides four MGB sets with sufficient components to assemble various spans and load classes of single- and double-story bridges. Under normal conditions, the sets include four 31.5-meter (103 feet) Class 60 bridges or two 49.6-meter (163 feet) Class 60 bridges with reinforcement kits.
- Provides personnel and equipment to assemble two bridges simultaneously.
- Provides technical supervision to assist other engineer units in bridge assembly and disassembly.
- Provides 5-ton dump trucks for earthmoving and general-engineering-mission cargo hauling with a 150-ton capacity per trip when bridging is not loaded.

- Provides personnel and equipment to load, transport, and advise on the erection of panel-bridging equipment, when required.

ENGINEER COMPANY, ASSAULT FLOAT BRIDGE (AFB)

The company is normally assigned to a corps and attached to an engineer brigade or group. It—

- Provides personnel and equipment to transport, assemble, disassemble, retrieve, and maintain the engineer AFB at one or multiple bridge sites.
- Provides engineer-mission hauling of palletized cargo in emergencies by immobilizing bridge loads.
- Provides about 213 meters (700 feet) of a Class 96 wheeled/Class 75 tracked float bridge or six Class 96 wheeled/Class 75 tracked rafts based on a 0 to 3 feet per second water velocity.
- Conducts nontactical bridging and rafting missions, as required.
- Transports up to 560 tons of engineer-mission cargo in a single haul over highways and 280 tons of engineer-mission cargo in a single haul over unimproved roads and combat trails when the bridge load has been immobilized.

ENGINEER COMPANY (COMBAT-SUPPORT EQUIPMENT)

The company is normally assigned to a corps and attached to an engineer brigade or group. When assigned to the ENCOM, the company augments the horizontal-equipment capabilities of the combat heavy battalions that are engaged in theater projects such as airfields, logistics bases, or MSR maintenance. It—

- Supports engineer combat operations within corps and division areas by conducting M/CM/S and general-engineering tasks.
- Provides manned engineer construction equipment to construct, rehabilitate, repair, maintain, and modify landing strips, airfields, CPs, MSRs, and LOC.
- Provides construction equipment support for divisional engineer battalions, when required.
- Provides dump-truck support, when required.

ENGINEER COMPANY (LIGHT EQUIPMENT) (AIRBORNE)

The company is normally assigned to a corps or another major tactical command and attached to an engineer brigade, battalion, or group. It—

- Augments engineer operations and capabilities in support of light-force operations with engineer equipment.
- Provides earthmoving equipment support in an airborne, an air assault, an airmobile, or a light-force operation on a two-shift basis.
- Provides a cross-country dump-truck capability of about 50 cubic yards or 45 tons per lift.

- Can parachute or be air-delivered to work sites.

ENGINEER COMPANY (LIGHT EQUIPMENT) (AIR ASSAULT)

The company is normally assigned to a corps or another major tactical command and attached to an engineer brigade, battalion, or group. It—

- Augments engineer operations and capabilities in support of light-force operations with engineer equipment.
- Provides earthmoving equipment support in an airborne, an assault, or a light-force operation on a two-shift basis.
- Provides a cross-country dump-truck capability of about 50 cubic yards or 45 tons per lift.

ENGINEER COMPANY (TOPOGRAPHIC) (CORPS)

The company is normally assigned to a theater Army engineer battalion (topographic). It—

- Provides topographic-engineer support to the corps.
- Compiles controlled and uncontrolled photomaps and mosaics.
- Revises existing maps and other topographic data within its capabilities.
- Drafts special maps, overprints, overlays, and other topographic products.
- Reproduces monochrome and multicolor maps, map substitutes, overlays, overprints, and other topographic products by offset lithography and photocopy.
- Provides terrain-intelligence and terrain-analysis products.
- Performs topographic surveys and provides survey information.
- Interprets and measures remote-sensed imagery.
- Extends horizontal and vertical controls into corps and division areas.
- Stores and distributes special topographic products that the company produces.
- Provides a survey information system and maintains DPPDB.

HQ DETACHMENT, ENGINEER BATTALION

The detachment is normally assigned to an engineer group or a brigade HQ at the corps or the EAC level. It—

- Provides teams for the command, control, and administrative support of separate engineer companies and engineer teams organized under the 05-500 series.
- Can provide command, control, and planning for three to seven companies and teams performing engineering tasks.

ENGINEER TEAM, UTILITIES (4000)

The team is normally attached to an engineer brigade or group or may be organized into an engineer-composite service unit. It—

- Provides limited construction for specialized engineer support in the TO.
- Provides limited facility engineering support in the areas of carpentry, masonry, electrical, plumbing, and road maintenance and repair.

ENGINEER TEAM, FIRE-PROTECTION HQ (LA)

The team provides C^2/administrative support. One LA team can control three to seven fire-fighting teams (LB or LC). A team commander serves as the fire marshal of an installation/a facility or within his AOR. An LA team—

- Plans for fire defense on an installation.
- Conducts fire-prevention inspections.
- Conducts fire investigations.
- Establishes a fire-department communications network between the HQ, the MP, the airfield, and the fire-fighting teams.
- Commands the fire-fighting teams.
- Maintains and refills fire extinguishers.
- Makes minor repairs to fire hoses.
- Inspects and maintains fixed fire-protection systems on an installation/in an AO.
- Coordinates the resupply of fire-fighting assets, agents, self-contained breathing apparatus (SCBA) air, and fuel.
- Coordinates mutual aid with other services/HN fire-protection assets.

ENGINEER TEAM, FIRE TRUCK (LB)

The team provides fire protection, administers first aid, provides an initial response to HAZMAT incidents, and implements a fire-prevention program. A commander's primary task list determines the team's assignments. An LB team—

- Provides crash/rescue support for medical evacuation (MEDEVAC) and normal flight or maintenance standbys.
- Conducts fire-prevention inspections on an installation or airfield.
- Provides C^2 of the non-fire-fighting assets used to support natural-cover fire-fighting operations (such as heavy equipment and personnel).
- Conducts fire-fighting operations (such as structural, crash/rescue, and natural cover) on an installation/in an AO.
- Provides emergency medical assistance to victims.

- Conducts an initial response to HAZMAT incidents.
- Conducts the training of unit-level fire brigades.
- Assist with medical resources during mass casualty incidents.
- Assist in HNS, as a commander requires.

ENGINEER TEAM, WATER TRUCK (LC)

The team transports water to resupply fire-fighting teams when a fixed water supply is not in place. It also supplies manpower to fire-fighting teams. One LC team is assigned to each LB team. An LC team—

- Conducts water-resupply support to fire-fighting teams.
- Provides additional manpower support to fire-fighting teams.
- Conducts reconnaissance of water-resupply points.
- Maintains the emergency water-supply points.
- Assists in HNS, as a commander requires.

An aircraft crash/rescue team provides support to Army aviation and to Air Force, Navy, Marine, allied, and civil aviation assets in support of Army operations. The types of support include, search and rescue, emergency evacuation, FARP, and basic life support.

The standard requirement for crash/rescue operations will be a minimum of one LB team and one LC team. Aircraft that are over 10,000 pounds, have a normal fuel load over 400 gallons or have an average load of 12 or more persons, will require two LB teams and one LC, as a minimum. Additional LB teams can be assigned, if available.

ENGINEER TEAM, QUARRY (75 TPH)

The team is normally attached or assigned to a fixed-strength unit or may be organized into an engineer composite unit. It—

- Performs rock-crushing operations, which increases the capabilities of the construction group in major horizontal construction projects, such as roads, storage facilities, and airfields.
- Provides personnel and equipment for a 24-hour period to operate the 75-tph crushing plant and to issue its product to users.
- Provides personnel and equipment for drilling and blasting operations that are required to produce raw stone for operating the 75-tph crushing plant.
- Is capable of hauling 30 tons of rock per trip from the quarry to the processing plant.

ENGINEER TEAM, WELL DRILLING

The team is normally attached to an engineer battalion (combat) (heavy). It—

- Provides personnel and equipment for drilling and developing water wells.

- Is capable of drilling and casting two complete water-well holes of 5 7/8 inches in diameter to a depth of 2,500 feet.
- Installs casings, screens, and pumps and develops the well to provide water at the wellhead.

ENGINEER HEAVY DIVING TEAM

The team is normally assigned to a theater Army and attached to an ENCOM to support commanders in ports, harbors, and coastal zones. It—

- Assists in constructing port facilities, LOTS structures, and floating barriers.
- Repairs damaged piers, docks, wharves, seawalls, and breakwaters.
- Clears underwater obstructions and marks navigational waterways.
- Reduces and emplaces underwater obstacles and mines.
- Reduces structures with underwater demolitions.
- Recovers sunken material and vessels.
- Installs and maintains vessel moorings.
- Repairs Army lighters and vessels.
- Installs and maintains the underwater portion of off-shore petroleum and water-distribution systems.
- Protects land forces, vessels, and underwater structures from underwater threats, reducing the probability of underwater structural damage.

ENGINEER LIGHT DIVING TEAM

The team is normally assigned to a corps and attached to an engineer brigade or group. It—

- Provides nearshore and far-shore river-crossing-site reconnaissance and marks and prepares landing sites, riverbanks, and exit routes for crossing forces.
- Emplaces and reduces underwater obstacles and mines.
- Reduces structures with underwater demolitions.
- Collects underwater terrain data.
- Repairs damaged bridges, locks, dams, pipelines, canals, and levees.
- Constructs underwater bridge structures, obstacles, and floating barriers.
- Recovers submerged weapons systems.
- Protects land forces, river-crossing equipment, and underwater structures from underwater threats and deceives enemy forces of friendly underwater and waterborne intentions.
- Clears and marks inland navigational waterways.

The light team should be capable of supporting the heavy diving team in ports, harbors, and coastal zones. However, it will lack the heavy salvage and diving equipment required to perform salvage and continuous deep-sea diving operations.

ENGINEER TEAM, REAL ESTATE

The team is normally assigned or attached to an ENCOM or may be organized into an engineer composite service unit. It—

- Acquires, uses, and disposes of real property for military purposes.
- Inventories and records installed and personal property located on installations.

ENGINEER TEAM, TOPOGRAPHIC PLANNING AND CONTROL

The team is normally assigned to a theater Army. It—

- Coordinates the activities of and performs topographic operational planning for units and agencies engaged in producing and supplying military geographic information and topographic products to the theater Army.
- Determines the requirements and provides the programs for and the coordination of engineer topographic units assigned or attached to the theater.
- Coordinates with the NIMA, the host/allied nations' topographic support activities, and the higher HQ to accomplish the mission.

FE TEAM

The FE team is a reserve TDA unit with specific installation responsibilities. In times of national emergencies and contingency operations, it may be mobilized and attached to either an ASCC, a TAACOM, an ASG, a corps HQ, or a staff element of a TF HQ. When three or more FE teams are operating in a theater, an engineer support group is usually formed. It provides an additional depth of FE capability, and it has C^2 over its assigned teams. The engineer support group has the capability to perform the same missions as the FE teams. The group—

- Manages engineer resources in support of facility and civil engineering, performs master planning, and allocates resources, to include inspecting facilities; identifying, prioritizing, and conducting work; planning boards; and developing facility and civil-engineer projects.
- Manages real property and can control real estate engineer teams and coordinate their activities.
- Manages housing and space use.
- Manages the theater environmental-compliance and prevention programs, to include environmental-compliance assessments, recommendations for corrective actions, and proper reporting.

- Performs limited design, to include preparing drawings, specifications, and cost estimates in support of facility and civil-engineer projects.
- Reviews the designs of contract architects and engineers to ensure that they conform to the user's requirements, mission, and codes.
- Manages utilities services, maintenance, and repair efforts and can control engineer utility teams and coordinate their activities.
- Inspects and ensures that the quality standards of construction projects by contract or troop labor are met.
- Manages base operations, to include sanitation and landfill operations and can control fire-fighting and utility teams and coordinate their activities.
- Can perform limited supervision of troop labor and indigenous personnel.
- Manages facility-engineering supplies through assigned units.

Appendix B

US Army Corps of Engineers

The USACE is the MACOM that is responsible for executing the Army's and the DOD's military construction and real estate acquisition and the Army's civil-works programs. Combined, these programs have given the USACE a dual perspective. The civil-works program places the USACE in the role of developing national infrastructure and the associated planning, designing and executing of complex projects of regional and national significance. The military construction and real estate acquisition program provides the USACE with military expertise as a result of its worldwide responsibilities and presence in DS of US forces. The combined capabilities of these two major programs and the more specialized expertise in its laboratories has made the USACE one of the premier engineering and environmental organizations in the world. As a result, the USACE is constantly engaged in projects in support of other countries, through other agencies (for example, the Agency for International Development and the Office of Foreign Disaster Assistance), under the SFO program.

COMMAND AND CONTROL

The USACE subordinate commands are organized geographically and functionally. The HQ, USACE, is located in Washington, DC. There are four major organizational structures in the corps.

DIVISION COMMANDS

The division command is the C^2 organization for the USACE. The division commanders provide executive direction and management of the subordinate district commands. The division's orientation is regional and provides a broad interface with regional interests. The division manages division-wide programs.

DISTRICT COMMANDS

The district command is the operating arm of the division. All USACE districts in the US whose boundaries are delineated along major watershed basins have civil-works responsibilities. In addition, some of the districts whose work lines are set on state boundaries are responsible for executing military programs. The districts maintain in-house core capabilities in planning, engineering, construction, operations, and project management. OCONUS CINCs are supported as follows:

- US forces in Korea are supported by the Far East District (Seoul, Korea).
- US forces in Japan are supported by the Japan District (Camp Zama, Japan).

- Pacific command is supported by the Pacific Ocean Division (an operating division, Honolulu, Hawaii).
- Southern command is supported by the Mobile District (Mobile, Alabama).
- European command is supported by the Transatlantic Programs Center, Europe (Wiesbaden, Germany).
- Central command is supported by the Transatlantic Programs Center (an operating division, Winchester, Virginia).

LABORATORIES

USACE has the following laboratories:

- Waterways Experiment Station (WES).
- Topographic Engineering Center (TEC).
- Cold Regions Research and Engineering Laboratory (CRREL).
- Construction Engineering and Research Laboratory (CERL).

CENTERS

The centers provide support to the command in specialized or specific technical areas. They have no geographic boundaries.

SUPPORT FOR MILITARY OPERATIONS

The following are some of the support missions the USACE performs.

POWER PROJECTION

In support of power projection, the USACE has a two-fold mission. It provides engineering and construction support to Army power-projection platforms and supports platforms and strategic ports. It also leverages the commercial base to support operations in CONUS and OCONUS.

THEATER MISSION

The USACE wears two hats of operations. Support to the Army is its best known responsibility. This entails acquiring real estate and facilities through construction and leasing. Less visible is the Army's topographic engineering support that the TEC provides to divisional terrain teams and topographic engineering battalions and companies. In addition, the USACE provides technical assistance within the whole engineering spectrum to divisional through EAC engineers (including technical support for the TCMS). Not quite as broad as the support to the Army, but just as important is that the USACE is the Air Force's design and construction agent.

The USACE is also a DOD construction agent, often referred to as the CCA. In this role, the USACE provides engineering and construction-management services to the other services and DOD agencies in DOD-designated countries. The DOD designation is predicated on the predominance of continuing the Central Intelligence Agency's (CIA's) presence and mission. Thus, the USACE is the CCA in Germany (with its heavy Army and Air Force presence), and the NAVFAC is the CCA in Italy (with its heavy Navy presence). Those countries for which there is no DOD-designated CCA, the CINC will usually designate a CCA for contingency support.

CONUS CONTINGENCY MISSIONS

The USACE is the single most active DOD agency under the capstone military support to civil authorities (MSCA) program. Most USACE operations in CONUS are executed under the following authorities:

- Public Law 84-99. Through this law, the USACE has unique authorities for flood fighting and disaster preparedness. The USACE operates flood-control, or damage-reduction, structures (dams and levee systems) and provides technical assistance to state and local authorities. In addition to flood control and coastal emergencies (FC&CE), the USACE has authorities for navigation on US waterways and other authorities provided under project authorization acts.
- FRP. The USACE supports the FEMA as the responsible agency for emergency support function 3 (ESF 3) of public works and engineering. In this plan, the USACE is a coequal of the other federal departments and agencies. When activated, the USACE is responsible for such engineering missions as—
  - — Debris removal and disposal.
  - — Temporary repairs to and construction of facilities.
  - — Acquisition and distribution of emergency water supplies.
  - — Provision of electrical power.

At FEMA's request, the USACE also conducts damage surveys for public buildings. When DOD engineer units are activated to execute disaster-response missions under ESF 3, they are provided mission taskings from the USACE. Unlike OCONUS support, the prime-power battalion's assets remain under the C^2 of the USACE in a CONUS disaster response.

Therefore, in a given disaster, the USACE may operate under its own authorities; execute FRP missions with support from the Commander in Chief, Pacific (CINCPAC) Command or the Commander in Chief, Atlantic (CINCLANT) Command; and execute missions in support of the CINCPAC or the CINCLANT.

Appendix C

The Civil-Engineering Support Plan

Figure C-1, pages C-2 through C-9, and *Figure C-2*, page C-10, contain the information that is required for planning and executing a program to provide the facilities which are necessary for implementing individual OPLANs. This format is consistent with the references from CJCSM 3122.03.

The CESP identifies minimum-essential requirements in terms of HN provided, leased, and US provided (both contract and troops). After considering war-damage repair to facilities, then construction, material, and engineer-unit requirements are determined. Also, construction-support requirements such as beach preparation for LOTS operations, to include OPDS and IPDS operations, are considered.

CLASSIFICATION

HEADQUARTERS, _______________
APO __ XXXXX
DATE

APPENDIX 5 TO ANNEX D OF THE USCINC****OPLAN XXXX-YY (U)
CIVIL-ENGINEERING SUPPORT PLAN (CESP) (U)

REFERENCES. List references that provide guidance and applicable SOPs.

a. DODI 4165.3, Department of Defense Facility Classes and Construction Categories, 24 October 1978, Unclassified.

b. DODI 4270.5, Military Construction Responsibilities, 2 March 1982, as modified by the Deputy Assistant Secretary of Defense (DASD) (Instructions) Memorandum, DOD Construction Agent Responsibilities, 20 March 1986, Unclassified.

c. DOD Directive (DODD) 4270.36, DOD Emergency, Contingency, and Other Unprogrammed Construction, 16 May 1991, Unclassified.

d. DODD 6050.7, Environmental Effects Abroad of Major Federal Department of Defense Actions, 31 March 1979, Unclassified.

e. CJCSM 3122.03, Joint Operation Planning and Execution System, Volume II, Planning Formats and Guidance, 1 June 1996.

f. JP 4-0, Doctrine for Logistics Support of Joint Operations, 27 January 1995, Unclassified.

g. JP 4-04, Joint Doctrine for Civil Engineering Support, 26 September 1995, Unclassified.

h. JP 5-03.1, Joint Operation Planning and Execution System, Volume I, 4 August 1993, Unclassified.

i. DOD Overseas Environmental Baseline Guidance Document (OEBGD), October 1992, Unclassified.

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN**

j. United States Commander in Chief (USCINC)****Regulation XXX, Protection and Enhancement of Environmental Quality, dated (DTD), Unclassified.

k. USCINC****Regulation XXX, Real Estate Operations in the USCINC****AOR, DTD, Unclassified.

l. USCINC****Regulation XXX, Military Construction/Engineering in the USCINC****AOR, DTD, Unclassified.

m. USCINC****Regulation XXX, Operations SOP, DTD, Classified.

n. Army Regulation (AR) 415-30/Air Force Regulation (AFR) 93-10, Troop Construction and Engineering Support of the Air Force Overseas, 15 May 1979, Unclassified.

1. GENERAL.

a. Purpose, Scope, and Limitations. State in general terms what will and will not be addressed. State the character and the magnitude of the theater engineer effort. Include a gross estimate of expected enemy damage and any constraints affecting the engineering model.

(1) Describe the construction and contingency real estate policies for the USCINC****AOR in this OPLAN.

(2) Identify potential shortfalls, war-damage repair, and engineering support requirements in support of this OPLAN (Reference Tab C).

(3) Describe the environmental policy in support of this OPLAN.

(4) Provide financial guidance for the theater engineer support to this OPLAN.

(5) Describe what will not be addressed and what restraints will be imposed on the military forces (limitations). The CESP does not include the DS that is normally provided to ground combat forces in the CZ.

b. Engineering Intelligence.

(1) Refer to Annex B for significant engineering intelligence concerning climatology, terrain, natural/hydrographic features, and industrial resources in the AOR.

(2) List sources of engineering intelligence data; for example, see Appendix __ to Annex __ for information on mobility, transportation, seaport, and airport capabilities in the AOR.

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN (continued)**

c. Concept of Civil-Engineering Support. Describe the general concept for satisfying civil-engineering requirements. If the OPLAN involves multiple phases that differ significantly in types, quantities, or the construction quality of civil-engineering activity, divide this and subsequent paragraphs in specific guidance by phases.

(1) Describe the concept of theater engineer support for this OPLAN. Theater engineer support includes tasks that are associated with life support areas (LSAs) such as force bed down; base development; MSR improvement, maintenance and repair; logistics sustainment; and war-damage repair to critical facilities within the COMMZ.

(2) Describe the OPLAN engineer-management system, including responsibilities for implementation.

(3) Exploit the capabilities of subordinate units with organic engineer assets.

(4) Satisfy facility requirements, in the order of priority, by using existing facilities and field organic equipment, erecting pre-positioned portable or relocatable facilities, and using locally approved Class IV(A) materials for expedient construction. Expedient construction within the COMMZ will require the theater engineer's approval or his designated representative's.

(5) Satisfy facility requirements through new construction by using temporary standards; however, this will require special approval by the USCINC.

(6) Identify who is responsible for the RPMA. The TAACOM will be responsible for the RPMA until the facilities are returned to the HN. The TAACOM should address the RPMA in its support plan. Maximum use of indigenous personnel or contractors should be made.

d. Definitions. List the definitions that are necessary to understand this plan at Tab B.

e. International Agreements and Political Factors.

(1) General. Summarize agreements, other arrangements, and political factors affecting the CESP. If there are signed formal agreements with the HNs that are covered by this OPLAN for providing existing facilities, improving existing facilities, or constructing facilities to support the USCINC's force deployment, have subordinate units make reasonable assumptions regarding the HN-provided infrastructure and engineer support. Include these assumptions in the subordinate unit's support plan.

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN (continued)**

(2) Real Property. State local policies for real-property acquisition and use. Where facilities cannot be provided by the HN government, use of commercial property via real estate leasing is the quickest means of providing critical facilities. Subordinate units will include in their engineer support plan a prioritized list of anticipated leasing requirements. The USCINC****will review the leasing requirements for funding, and the DOD construction agent will review the list for lease planning. Acquiring and using HN real property are subject to the agreement between HN and US embassies, the federal acquisition regulation (FAR), and other applicable regulations and guidance.

(3) Host Nation Support. Discuss using the following, to include resources that may be available. Specify the quantity where possible.

(a) Indigenous and third-country labor. Discuss the use of local labor and funding.

(b) Local Supplies. Discuss the availability of local construction material, supplies, and equipment and indicate the level of planned usage.

(c) Local Contractor. Discuss the availability of local contractors and indicate the level of planned usage.

(d) Local Facilities. Discuss the availability of local facilities and indicate the level of planned usage.

(4) Limiting Factors. Identify rights, agreements, or other arrangements that are not in existence and are required to execute the plan. The absence of current agreements with HNs in the AOR may limit the detailed planning ability of subordinate units. Planning will be based on the maximum use of existing facilities in the AOR to reduce engineering requirements.

f. Construction Standards. Indicate the construction standards (as outlined in JP 4-04) to be used by all service components in the operational area, and explain the proposed deviations from these established standards. The provisions of Section III of references b and c will be followed when preparing the subordinate units' support plans. The initial standards generally apply until otherwise directed by the USCINC. When existing local facilities are used, the initial standard requirement is waived.

g. Planning factors. Explain the proposed deviations from the joint planning factors for military construction in contingency operations. The planning factors that are used when developing facility requirements are outlined in reference h.

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN (continued)**

h. General Priority of Development. Provide any general guidance for prioritizing engineer efforts. Include areas such as relative geographic, functional, and base priorities; theater-construction policy; and environmental-protection policy.

i. Protective-Construction Policy. Define the command policy for protective construction and damage repair.

(1) State the enemy's capability to inflict damage. (A quantitative evaluation is not required.)

(2) State the protection level that is required for weapons systems, personnel, and material.

(3) Discuss self-help versus engineer troop effort. Self-help will be the principal means for protective construction. Engineer efforts should be confined to technical advice and the limited use of special equipment. Detailed supporting plans will reference each components' commander's assessment of the self-help activities in support of protective construction requirements.

j. Contractor. Discuss the availability and possible use of US or third-country construction contractors.

(1) Contract Support. The DOD CCAs have been integrated into the theater-contingency engineer-management organization to perform contract-management support. The subordinate units should identify the requirements for the responsible DOD CCAs during detailed peacetime planning.

(2) Civilian Construction Forces.

(a) The USCINC****subordinate units will use civilian construction forces and US, international, and HN-civilian construction firms that operate routinely in the USCINC****AOR to the maximum extent possible before attempting to use out-of-country assets. It is anticipated that many of these firms will be available for contracting through the DOD contract-construction agencies. The subordinate unit's support plans should identify the requirements that civilian construction forces could perform according to the existing USCINC****policy.

(b) Construction equipment generally exists in populated areas throughout the AOR. The equipment tends to be used and is in marginal condition. The subordinate units, in concert with contracting officials, are responsible for locating and researching for local construction equipment.

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN (continued)**

(c) The subordinate unit's support plans should include provisions for supporting the contracted effort if hostilities force contract-labor forces to withdraw.

2. RESPONSIBILITIES FOR ENGINEER-SUPPORT PLANNING.

a. Primary Responsibility. Identify each echelon of the joint command having civil-engineering-support-planning responsibility (for example, multinational, subordinate, unified, or joint TF) and identify the specific tasks of each.

(1) The USCINC****is the theater engineer (until a theater engineer is delegated) who ensures that all available engineer resources, including those provided through HNS, are according to the USCINC****priorities.

(2) The theater engineer provides adequate engineer support to meet the USCINC****subordinate unit's requirements. The subordinate units are encouraged to plan and interface with the theater engineer as early in the planning process as possible to improve the effectiveness and the economy of operations by eliminating engineer-support duplication.

b. Supporting Responsibility. Identify the civil-engineering-support-planning responsibilities of each service-component command to the OPLAN. Note that LOC and bases, such as ports, depots, and airfields, may be jointly used and will require designating one component commander with the responsibility of ensuring complete integrated planning, subsequent programming, and necessary coordination and construction.

The USCINC****Army service component engineer ensures that all available Army engineer resources are according to the USCINC****priorities. His responsibilities include coordinating overall engineering support for Army engineer resources, coordinating with the USCINC****for the engineer-support effort, and coordinating with the ASCC for engineer-support planning.

3. COMMAND RELATIONSHIPS. Indicate in this paragraph any requirements to deviate from existing command relationships as they relate to executing the support described in this appendix.

4. TIME-PHASED REQUIREMENTS. Provide time-phased summaries and analyses of at least the following five areas. Summaries consist primarily of the JEPES output with a CESP analysis, to include input assumptions and a scenario for each subparagraph. If the JEPES is not used, indicate how the information was derived.

a. Facility Shortfalls. Indicate in the analysis the availability of alternate means to accommodate major functions.

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN (continued)**

b. Materials Requirements. Indicate in the analysis significant out-of-theater requirements by general type and gross tonnage.

c. Civil-Engineering-Force Shortfalls. Analyze the man-hours that are required versus those that are available at theater and regional levels. Identify shortfalls by area, duration, and specific skill types and assess their impact on OPLAN execution.

d. War-Damage Repair. Identify the locations where heavy attacks are assumed and the percent of the engineer workload that is estimated for repairs. Assess the expected effect of repairs on the material and the equipment, the people's readiness, and the adequacy of the assigned engineer force to repair equipment.

e. HN Assignments. Identify the extent of reliance on HN engineering assets and the impact if HN engineers are available. Subordinate units should not plan on using HN military units to offset requirements.

5. SUMMARY OF CRITICAL FACTORS AFFECTING THE CESP. Indicate the major problem areas in the CESP that may inhibit OPLAN implementation until they are resolved. Analyze possible solutions to these problem areas and evaluate the implications of each alternative in terms of its effect on the OPLAN.

a. Engineer-Force Deficiencies. The COMMZ's general-engineering-support requirements in the theater are expected to meet or exceed available military engineer-force-structure and time-phased deployment capabilities. List the expected shortfalls and their expected impacts. List the options to overcome engineer man-hour deficiencies.

b. HN Infrastructure Support. Summarize how HN infrastructure support fits into OPLAN implementation.

c. Leased Facilities. Summarize leasing considerations and the impact to the OPLAN.

d. Water Support. Summarize the effects of water support on OPLAN implementation.

e. Class IV Construction Materials. Summarize the effects of Class IV construction materials on OPLAN implementation.

f. Electrical Utilities. Summarize the effects of power generation and distribution on OPLAN implementation.

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN (continued)**

TABS:

TAB A:	Construction Standards
TAB B:	Definitions
TAB C:	Engineer Facility Study
	C-1 JEPES Data
	C-2 Engineer Requirements Analysis
TAB D:	Engineer Responsibilities
	D-1 Infrastructure Support Plan
TAB E:	Engineer Intelligence
TAB F:	Real Estate
TAB G:	Bridging
TAB H:	Fire Protection
TAB I:	Engineer Organizations
	I-1 COMMZ
	I-2 Forward CZ and Rear CZ

Figure C-1. Sample of an appendix to an annex of a USCINC**OPLAN (continued)**

CLASSIFICATION

HEADQUARTERS, ________________
APO XX XXXX
DATE

TAB A TO APPENDIX 5 OF ANNEX D TO THE USCINC****OPLAN XXXX-YY (U)
SUGGESTED CONSTRUCTION STANDARDS FOR MILITARY CONSTRUCTION AND CIVIL-ENGINEERING SUPPORT OF JOINT CONTINGENCY OPERATIONS (U)

1. REFERENCES. List all references pertinent to this tab.

2. PURPOSE. To provide suggested construction standards that should be used in the planning, design, and construction of facilities in support of joint operations.

3. STANDARDS OF CONSTRUCTION.

a. Construction standards are used to determine the types of material and construction techniques to use when constructing facilities in support of joint operations. Contingency construction standards provide construction criteria to accomplish the engineer combat-support mission efficiently. Facilities that are built using these standards are of a quality consistent with mission requirements, personnel health and safety, and the expected availability of construction resources. Where mission requirements are similar, all services use the same construction standards.

b. The JEPES contains listings of facility components by a facility category code. The services are able to establish construction standards for each category code by selecting specific components that are consistent with the construction standards defined in the following paragraphs (see *Table C-1*). Initial and temporary construction standards are described as follows:

(1) The initial standard provides for immediate austere operational support of units upon arrival in theater, which minimizes engineer construction effort. Facility use is for a limited time, normally ranging from 1 to 6 months (depending on the specific facility). In some cases, replacement by more substantial or durable facilities is required.

(2) The temporary standard provides for sustained operations. The facilities provided are the minimum required to increase efficiency of operations for periods of time extending to 24 months. In some cases, the temporary standard replaces the initial standard. Where mission requirements dictate, the temporary standard can be used from the start of the operation.

Figure C-2. Sample of a tab to an appendix of a USCINC**OPLAN**

Table C-1. Construction standards

Construction Type	Initial	Temporary
Site preparation	Clearing and grading for facilities sites that include drainage, revetments for POL, ammo storage, aircraft parking, aggregate for heavily used hardstands, and soil stabilization	Preparing the engineering site (to include the pavement for vehicle traffic areas and aircraft parking) and building foundations and concrete floor slabs
Troop housing	Erecting tents (may be wood frame and flooring)	Constructing wood-frame structures, relocatable structures, and mobile structures
Electricity	Installing tactical generators with high- and low-voltage distribution systems	Installing nontactical generators with high- or low-voltage distribution systems
Water	Locating water points, drilling wells, supporting other portable water-production operations, and installing pressurized water-distribution systems	Installing limited distribution systems to hospitals, dining halls, and other large users
Cold storage	Installing portable refrigeration with freezer units for medical, food, and maintenance storage	Installing refrigeration in structures
Sanitation	Constructing evaporative ponds, pits or burnout latrines, lagoons for hospitals, and sewage lift stations	Constructing austere waterborne waste-treatment facilities for high-priority structures (hospitals, dining halls, bath houses, and decontamination sites)
Airfield pavement	Emplacing/constructing tactical surfaces, to include matting, aggregate, soil stabilization, and concrete pads	Emplacing/constructing conventional pavements[1]
Fuel storage	Emplacing fuel bladders	Emplacing fuel bladders and steel tanks and a limited distribution system

[1]The type of airfield surfacing to be used will be based on the expected number, types, and weight of aircraft involved in the operations.

Appendix D

Sample Construction Directive

This appendix provides a construction directive format from the TCMS. (See *Figure D-1* for a sample of the TCMS extract.) The TCMS has been designed to automate construction planning, design, and management functions for Army engineers. Project planning and management capabilities are provided to those tasked to quantify construction requirements and manage construction missions.

TO:

FROM:

SUBJECT:

PROJECT: DESCRIPTION:

PRIORITY: LOCATION:

COORDINATION: Include the start date, the completion date, the notes recorded from the successive subordinate HQ, and any special instructions on how to handle the administrative policies of the project, to include materials and funding.

CONSTRUCTION MATERIAL:
WEIGHT: VOLUME: COST:

CONSTRUCTION EFFORT:
HORIZONTAL HOURS: VERTICAL HOURS:
GENERAL HORIZONTAL: GENERAL VERTICAL:
TOTAL MAN-HOURS REQUIRED:

ADDITIONAL EQUIPMENT: Include rental-equipment fund allocations for the project.

ADDITIONAL MAINTENANCE:

Figure D-1. TCMS sample construction directive format

Initially demonstrated during the deployments for Operations Desert Shield/Desert Storm, the TCMS has undergone various changes and improvements. As an electronic version of the technical manuals covering the Army Facilities Components System, it integrates various commercial off-the-shelf software with Army databases to form a comprehensive construction planning, design, and management tool. Fielding of the system is down to the engineer combat heavy battalions' level.

Directions for troop construction are normally transmitted through engineer channels by a directive. For every project, a construction directive is authorized. The projects are construction tasks that are assigned to an engineer unit in support of an ASCC mission. The projects may also be in support of stability or support operations, such as interdiction camps, refugee camps, exercise-related construction, humanitarian civic assistance, or nation-building exercises.

The following is the essential information that is needed for a construction directive:

- Addressee (executing unit).
- Directing authority (higher HQ).
- Subject (project name and project number).
- Mission (what is to be done).
- Priority (priority of the project).
- Location (location, building number, or grid coordinates).
- Start date (determined from the in-progress reviews from the engineer planners or specified by the higher HQ).
- Completion date (determined from the latest event in the construction schedule or specified by the higher HQ).
- Scope of work (detailed description expanding on the mission statement).
- References (plans and specifications or the report for the project).
- Resources (materials and required work effort, including rental-equipment fund allocations).

Appendix E

Engineering Services and Troop Construction SOP Sample

Figure E-1, pages E-1 through E-9, is a sample of an engineering services and troop construction SOP.

1. Purpose. This SOP outlines the process for accomplishing engineering services (reports; planning studies; design calculations; construction drawings, specifications, and schedules; a BOM; cost estimates; project documentation files; troop-construction and related construction training; and maintenance and repair activities throughout the command).

2. Application. This SOP applies to all subordinate units assigned, attached, or OPCON to this unit.

3. References. List references that provide guidance.

4. General.

a. The objective of this SOP is to ensure that engineering services are accomplished to uniform standards and executed in a professional, high-quality, economical, and expeditious manner.

b. The objectives of all engineering services are to—

(1) Provide programs whereby each soldier is trained in a hands-on mode to perform tasks required for his/her military occupational specialty and to perform them to the standards set forth in the soldier's manual.

(2) Provide the opportunity for units to accomplish battle-focused collective training on mission-essential tasks.

(3) Develop those technical, supervisory and management skills that the unit requires to achieve a high state of operational readiness.

Figure E-1. Engineering services and troop construction SOP sample

5. Administration.

a. Project assignment. All projects originated by this unit, a subordinate unit, or a higher HQ will be authorized a project directive.

b. Project priorities. All assigned projects will be given a priority designation. The priority, normally assigned by the battalion if initiated at the battalion level, will be indicated on the project directive by one of the following numeric designators:

(1) Priority 1. This is the highest priority. It will not be assigned unless the project is required to prevent death or extensive property loss. This priority requires maximum effort to complete the project on time, even if other projects must be halted and resources diverted.

(2) Priority 2. This is the highest priority normally assigned to a project. This priority requires maximum effort to complete the project on time. It is conceivable that this type of project may not enhance other training yet must be done.

(3) Priority 3. This the normal priority assigned to projects. Individual unit training will be given significant consideration as to the order in which projects are done.

(4) Priority 4. This priority will normally be assigned to projects initiated at the company level. These projects will be completed on a time-available basis, or they will be completed while waiting to start on higher-priority projects.

c. Project files. These files will be maintained according to the guidelines in Annex J.

d. Project planning.

(1) The Operations and Training Officer (US Army) (S3)/engineering section will complete the planning by—

(a) Performing the initial site reconnaissance to determine the specific training value of the project, the resources needed to accomplish the project, and the units that are capable of performing the project. The S3/engineer will define the project scope.

(b) Preparing and issuing the project directive to the performing unit.

(c) Preparing a design-charette planning study with the project user to translate customer needs into specific features, sizes, shapes, and sketches. The S3/engineering section will obtain a project-user signature for approval of the finalized design charette.

Figure E-1. Engineering services and troop construction SOP sample (continued)

(d) Conducting a design analysis complete with calculations, construction drawings and specifications, a BOM, design and construction schedules, a construction-cost estimate, and a quality-assurance plan.

(e) Coordinating, as required, with appropriate agencies for necessary permits (excavation permits and environmental-impact assessments).

(f) Initiating soil-reliability explorations and obtaining appropriate reports. The S3/engineer section will also incorporate or direct the necessary design/operational changes.

(g) Identifying survey requirements and developing survey-project objectives, such as horizontal and vertical controls.

(h) Assisting the construction unit with engineering services to clarify needed techniques, methods, or materials.

(i) Developing a critical-path-method (CPM) schedule, a BOM, and construction drawings and specifications. These items may be directed to the performing unit to prepare and submitted to the ______ for approval.

(2) The performing units will complete planning by—

(a) Performing a thorough site reconnaissance. The site-reconnaissance report may be optional when a comprehensive report has been prepared by the battalion's S3, the group's S3, or the brigade's S3.

(b) Preparing a list of specific activities needed to accomplish the project.

(c) Preparing a manpower and equipment utilization estimate to determine specific resource constraints.

(d) Developing a CPM schedule, to include early and late start and finish dates, manpower estimates, and activity duration according to Annex B.

(e) Identifying the material required for each activity and preparing a BOM to complete the project.

(f) Identifying tasks that will require technical and/or other support from a higher HQ (soils analysis and surveying).

Figure E-1. Engineering services and troop construction SOP sample (continued)

(g) Selecting an appropriate estimated start date (ESD) that coincides with the present training/construction program. The estimated completion date (ECD) will be derived from the CPM construction schedule.

(h) Providing a specific date on which critical BOM items are needed for critical-path activities. For troop-construction projects, coordinate with the installation's troop-construction coordinator and ascertain the status of construction materials, inventory, and requisitions. The performing units will obtain, as necessary, a commitment to materials delivery and plan contingency requisitions, if appropriate. For overseas deployments, separate the supply-acquisition schedule by CONUS and OCONUS sources.

(i) Preparing a public-affairs plan, to include pictures of the project from start to finish. The performing units will coordinate for photographic support through the S1 at the battalion, the group, or the brigade, as applicable.

(j) Identifying the mission-essential tasks and the soldier's manual tasks that may be incorporated into the construction activity as a means of instructing individual soldiers and supervisors.

(k) Preparing a safety plan to identify potentially dangerous situations to eliminate/reduce accident risks.

(l) Preparing a drainage plan to implement throughout the project to minimize weather delays.

(m) Identifying special tools (heavy-duty jacks and scaffolding) that will be essential to complete specific activities and determining the time frame they may be required.

(n) Preparing a maintenance plan, to include daily and weekly preventive maintenance checks and services (PMCS) and Class IX and POL support.

(o) Preparing a QC plan to explain specifically how the officer in charge (OIC)/ noncommissioned officer in charge (NCOIC) ensures that the project is constructed according to specifications. The plan addresses QC of materials before placing soil and aggregate and QC of materials before the initial step in construction (placing the first layer of concrete). The plan should emphasize centralized planning by the leaders and decentralized execution by the subordinates.

(p) Preparing a force-protection plan for deploying units with the appropriate measures and warning notifications against the current threat.

Figure E-1. Engineering services and troop construction SOP sample (continued)

e. Project Management

(1) The unit commander—

(a) Ensures that all projects are being managed to obtain maximum training and according to the construction specifications and schedule and project plans.

(b) Provides accurate accounting and security of all project materials.

(c) Maintains strict accountability of personnel man-hours and equipment hours expended for each principal feature within the project.

(d) Provides daily and weekly unit-construction progress reports.

(e) Provides all official visitors with a site briefing by the senior member of the unit who is on site. The individual should be prepared to brief the visitor on the following: the scope, the description and the dimensions, the total funded cost, and the schedule of the project; the project customer; the planned functions; and the estimated completion date.

(2) The unit's construction officer (company level or higher) will be responsible for the following:

(a) Completing the construction specified by the project directive according to construction drawings and specifications and the CPM construction schedule.

(b) Coordinating with the group/brigade S3 and/or construction-management section or the installation's troop-construction coordinator for rental equipment to ensure that special equipment and skills are available when they are needed according to the construction schedule.

(c) Coordinating with unit assets to gain maximum use.

(d) Notifying the group's/brigade's S3 of any changes to the project schedule.

(e) Coordinating the procurement and delivery of materials according to the construction schedule, the budget, and the project requirements.

(f) Conducting an operations and personnel security briefing to all personnel employed on classified projects in restricted areas.

(g) Submitting a copy of the CPM construction schedule to the group's/brigade's S3 for approval.

Figure E-1. Engineering services and troop construction SOP sample (continued)

(h) Coordinating with the group's/brigade's S3 and/or the construction-management section on any design changes, specification changes, construction-drawing clarifications, BOM modifications, inspection requests, and a certificate of acceptance.

(i) Updating and revising the CPM construction schedule daily. The ECD and the CPM construction schedule will be thoroughly reevaluated any time the actual completion percentage falls behind the planned completion percentage more than 10 percent.

(j) Rejecting materials that do not meet specifications and documentation.

(k) Maintaining a project notebook containing, as a minimum, the following documents: the project directive, construction drawings and specifications, a QC plan, a safety plan, a CPM construction schedule, a visitors log, and a force-protection plan.

(l) Maintaining a project log. The project log is a diary of the daily activities on the project. It is used to document working hours, weather, delays, accelerations, decisions, and field changes. The project log will be the basis for daily and weekly construction-progress reports. The unit's construction officer will maintain the log. He will employ a bound notebook. It will be initiated on the first day of construction, continued through completion, and filed with the project-completion documents. The mandatory entries in the log are the date and the location, the weather description, the workforce size, the equipment used and the number of hours operated, the activities completed and initiated (keyed to the CPM with a description), the coordination comments, the materials received, the QC tests, and the project delays.

6. Project extension request.

a. Project duration frequently exceeds the initial estimate for various reasons. It is imperative that the new completion dates be determined for all activities to accurately forecast future construction progress. Construction schedules will be updated when a project deviates from the current schedule by more than 10 percent.

b. Extension requests will be in a memorandum format from the constructing unit. It will include the project directive number, the completion date, and a specific explanation for the required additional time (delays or design changes).

7. Project completion.

a. The constructing unit will ensure that the project is complete and functional. It should be the goal of the constructing unit to finish and sign over the project with no deficiencies.

Figure E-1. Engineering services and troop construction SOP sample (continued)

b. The following paragraphs are the sequence of events for signing over the project.

(1) The constructing unit's OIC inspects the project to note deficiencies and eventually verify completion.

(2) The constructing unit's OIC and the construction directive authority will verify completion according to the specifications.

(3) The constructing unit prepares the project acceptance certificate for the customer's/higher HQ signature.

(4) The constructing unit's OIC and the construction directive authority will perform the final inspection with the customer. The constructing unit will provide three copies of the signed project acceptance certificate to the originating HQ.

8. Reports required. Specify the construction progress reports that are required by the higher HQ. Brevity and maximum use of automation in construction management are encouraged by using the TCMS reports.

9. Uniforms. Refer to the unit's field SOPs. Wearing commercial-design protective headgear (hard hat), work gloves, and safety shoes/boots and goggles with the field uniform are authorized by the construction unit. The using unit will request all additional safety equipment.

10. Construction practices.

a. Field changes. The constructing unit to the appropriate approving authority will submit proposed field changes to construction drawings or specifications. The approving authority will be the design engineer who will consult with and have the approval of the using agency or higher HQ. Approving authority may be delegated to the subordinate S3 sections with engineering and design capabilities.

(1) Field changes will not be made by any personnel except, or with the written concurrence of, the original designer. Field changes considered essential to successful project execution are encouraged. Such changes may be made with the approval of the construction unit's commanding officer and the concurrence of the approving authority.

(2) Field changes will not be accomplished by the unit until the original approving authority has approved the changes.

(3) Verifying the completion date and the construction schedule will be required when any field changes are made. The unit's construction officer will take appropriate action to update the CPM construction schedule, as required.

Figure E-1. Engineering services and troop construction SOP sample (continued)

(4) Field changes will be shown in red on the "Record Construction Drawings" set. This set will be submitted to the drawing originator who will prepare the final record drawings set and distribute the drawings to the user.

b. Construction drainage.

(1) Before the start of any construction, a detailed plan will be developed to ensure minimal damage to the construction in progress due to surface runoff or flooding.

(2) At the close of each construction day, a check will be made and the necessary actions taken to ensure that all water will drain freely from the site. The water will be directed from the project area to adjacent areas where it will not cause significant damage or hinder construction for the next day.

(3) Extra materials that are needed are culverts and hay or straw. The construction officer should identify these materials early so that they can be properly acquired before the project starts.

c. Compaction. Compaction will be required on all horizontal construction. All compaction effort will be as stated in the specifications and accomplished according to the techniques stated in the appropriate technical manual. Test strips will be accomplished at all projects. The date from the test strips will be used by the constructing unit's OIC in case a nuclear densometer is not available.

d. Job-site appearance.

(1) During construction, sites will be policed daily for all waste materials, empty containers, and other items to present an orderly appearance.

(2) All construction materials will be stored properly, protected from the elements, and secured against theft.

(3) Construction areas will be graded and reseeded, if necessary, to restore the area to its original condition. The construction unit is responsible for turning over a well-groomed project.

e. Protection of existing utilities.

(1) Before starting any construction effort on a project, the constructing unit will coordinate with the local authorities to ensure that projects will not hinder their utilities. If there is a possible conflict, representatives from the constructing unit will visit the appropriate agency to resolve conflicts.

Figure E-1. Engineering services and troop construction SOP sample (continued)

(2) During construction, all known facilities must be marked clearly and be protected. Any damage to utilities must be reported immediately to the appropriate agency and through the higher HQ.

(3) Under no circumstances will a vibratory roller be operated near an occupied building during business hours.

f. Communications. Communications will be maintained between the project site CP and the unit HQ. This will include a force-protection warning system for individual soldiers.

g. Project briefing board. A platoon- or larger-size project will have a project briefing board on site.

h. Project sign. Each major project will have a project sign posted at the entrance to the project and kept in good condition.

Figure E-1. Engineering services and troop construction SOP sample (continued)

Appendix F

Metric Conversion Chart

This appendix complies with current Army directives which state that the metric system will be incorporated into all new publications. Table F-1 is a conversion chart.

Table F-1. Metric conversion chart

US Units	Multiplied By	Metric Units
Cubic yards	0.7646	Cubic meters
Feet	0.3048	Meters
Tons (Long)	1.016	Metric Tons
Tons (Short)	0.9072	Metric Tons
Metric Units	**Multiplied By**	**US Units**
Cubic meters	1.308	Cubic yards
Meters	3.281	Feet
Meters	1.0936	Yards
Tons (Metric)	2,204	pounds

Glossary

abn	airborne
ACO	Administrative Contracting Officer
ADA	air-defense artillery
ADAM	area denial artillery munition
AFB	assault float bridge
AFJPAM	Air Force joint pamphlet
AFR	Air Force regulation
AFRCE	Air Force regional civil engineers
AGR	Active Guard Reserve
AO	area of operation
AOR	area of responsibility
APO	Army post office
APOD	aerial port of debarkation
AR	Army regulation
ARFOR	Army force
ASCC	Army service component commander
ASG	area support group

ASL	authorized stockage list
ASP	ammunition supply point
attn	attention
avail	available
bde	brigade
BDP	base-development plan
BEEF	base engineer emergency force
BOM	bill of materials
C^2	command and control
C^3	command, control, and communications
C4I	command, control, communications, computers, and intelligence
CAO	chief administrative officer
cbt	combat
CCA	contract-construction agent
CCD	camouflage, concealment, and deception
CEB	combat-engineer battalion
CENTCOM	US Central Command
CERL	Construction Engineering and Research Laboratory
CESP	Civil-Engineering Support Plan
CI	counterintelligence
CIA	Central Intelligence Agency

CINC	Commander in Chief
CINCLANT	Commander in Chief, Atlantic
CINCPAC	Commander in Chief, Pacific
CJCSM	Chairman of the Joint Chiefs of Staff Manual
CMOC	civil-military operations center
COA	course of action
COB	command operating budget
COMMZ	communications zone
CONPLAN	contingency plan
CONUS	continental US
COR	Contracting Officer's Representative
COSCOM	corps support command
CP	command post
CPM	critical path method
CRAF	Civil Reserve Air Fleet
CREST	contingency real estate support team
CRREL	Cold Regions Research and Engineering Laboratory
CS	combat support
CSC	combat support company
CSE	combat support equipment
CSS	combat service support

cu	cubic
cyl	cylinder
CZ	combat zone
DA	Department of the Army
DASD	Deputy Assistant Secretary of Defense
DC	District of Columbia
DCD	Directorate of Combat Development
DEA	Drug Enforcement Agency
DISCOM	division support command
DMA	Defense Mapping Agency
DOD	Department of Defense
DODD	Department of Defense Directive
DODI	Department of Defense Instruction
DPPDB	digital point-positioning database
DPW	directorate of public works
DS	direct support
DSAA	Defense Security Assistance Agency
DTD	dated
EA	engagement area
EAC	echelons above corps
EAD	echelons above division

ECAS	Environmental Compliance and Assessment System
ECD	estimated completion date
ENCOM	engineer command
engr	engineer
EOD	explosive-ordnance disposal
EPA	Environmental Protection Agency
EPW	enemy prisoner of war
ERC	exercise-related construction
ESD	estimated start date
ESF 3	emergency support function 3
ESP	engineer supply point
EWL	engineer work line
FAR	federal acquisition regulation
FARP	forward-area refueling point
FC&CE	flood control and coastal emergencies
FE	facilities engineer
FEMA	Federal Emergency Management Agency
FF	fire fighting
FM	field manual
FMFM	Fleet Marine Force manual
FPOL	forward passage of lines

FRP	Federal Response Plan
fwd	forward
FY	fiscal year
GAO	General Accounting Office
GI&S	geospatial information and services
GOJ	Government of Japan
gp	group
GS	general support
HAB	heavy assault bridge
HAZMAT	hazardous material
HCA	humanitarian and civic assistance
HEMMT	heavy expanded mobility tactical vehicle
HHC	headquarters and headquarters company
HHD	headquarters and headquarters detachment
HN	host nation
HNS	host-nation support
HQ	headquarters
HUMINT	human intelligence
HVAC	heating, ventilation, and air conditioning
hvy	heavy
IEB	inter entity boundary

IPB	intelligence preparation of the battlespace
IPDS	Inland Pipeline Distribution System
ISB	intermediate staging base
J2	Intelligence Directorate
J3	Operations Directorate
J4	Logistics Directorate
JCMB	Joint Civil-Military Coordination Board
JCMEB	Joint Civil-Military Engineer Board
JEMB	Joint Environmental Management Board
JEPES	Joint Engineer Planning and Execution System
JFUB	Joint Facilities Utilization Board
JIC	Joint Intelligence Center
JMMO	Joint Material Management Office
JOA	joint operations area
JOC	Joint Operations Center
JOPES	Joint Operation Planning and Execution System
JP	joint publication
JTB	Joint Transportation Board
JTCB	Joint Targeting Coordination Board
JTF	joint task force
JTFCEM	JTF contingency engineering management

LOC	lines of communication
LOGCAP	logistical civil augmentation program
LOTS	logistics over the shore
LSA	life support area
lt	light
LTG	lieutenant general
M-day	mobilization day
M/CM/S	mobility, countermobility, and survivability
MACOM	major Army command
MCC	Movement Control Center
MCWP	Marine Corps warfighting publication
MEAPO	Middle East Area Project Office
MEDEVAC	medical evacuation
METT-TC	mission, enemy, terrain, troops, time available, and civilian considerations
MG	major general
MGB	medium-girder bridge
MILCON	military construction
MISP	Multispectral Imagery Processor
MMC	Material Management Center
MOPMS	Modular Pack Mine System
MOUT	military operations on urbanized terrain

MP	military police
MSC	major subordinate command
MSCA	military support to civil authorities
MSR	main supply route
MTOE	modification table of organization and equipment
MTW	major theater war
MWR	morale, welfare, and recreation
NATO	North Atlantic Treaty Organization
NAVFAC	Naval Facilities Engineering Command
NBC	nuclear, biological, chemical
NCA	national command authority
NCOIC	noncommissioned officer in charge
NGO	nongovernmental organization
NIMA	National Imagery and Mapping Agency
no	number
NOAA	National Oceanic and Atmospheric Administration
OAS	Organization of American States
OCONUS	outside continental US
OEBGD	Overseas Environmental Baseline Guidance Document
OFDA	Office of Foreign Disaster Assistance
OIC	officer in charge

OPCON	operational control
OPDS	Offshore Petroleum Discharge System
OPG	Operations Planning Group
OPLAN	operation plan
opns	operations
OPORD	operation order
OPTEMPO	operational tempo
OSCE	Organization for Security and Cooperation in Europe
OVE	on-vehicle equipment
P&C	planning and control
PDC	protective design center
PIR	priority intelligence requirements
PLL	prescribed load list
PLS	palletized load list
PMCS	preventive maintenance checks and services
POL	petroleum, oils, and lubricants
PSRC	Presidential Selective Reserve Call-Up
PSS	personnel service support
PVO	private voluntary organization
QA	quality assurance
QAR	quality-assurance representative

QC	quality control
QOL	quality of life
RAAM	remote antiarmor mine
RC	Reserve Components
RCEM	regional contingency engineering management
RED HORSE	rapid, engineer-deployable, heavy, operational repair squadron
RIBS	readiness in base support
ROE	rules of engagement
RPMA	real-property maintenance activities
RSO&I	reception, staging, onward movement, and integration
S1	Adjutant (US Army)
S3	Operations and Training Officer (US Army)
SCBA	self-contained breathing apparatus
SEE	small emplacement excavator
SFO	support for others
SOFA	Status of Forces Agreement
SOP	standing operating procedure
SPOD	seaport of debarkation
spt	support
TAACOM	Theater Army Area Command
TACAIR	tactical air

TCEM	theater contingency engineering management
TCMS	Theater Construction Management System
TCN	third country nationals
TDA	table of distribution and allowances
TEC	Topographic Engineering Center
TF	task force
TO	theater of operations
TOC	tactical operations center
TOE	table of organization and equipment
TPFDD	time-phased force-deployment data
tph	ton(s) per hour
TPU	tank pump unit
TRADOC	US Army Training and Doctrine Command
TSC	theater support command
TTAD	temporary tours of active duty
TUSA	Third US Army
UIC	unit-identification code
UK	United Kingdom
UN	United Nations
US	United States
USACE	US Army corps of engineers

USAES	US Army Engineer School
USAREUR	US Army, Europe
USCINC	US commander in chief
USGS	US Geological Survey
USMC	US Marine Corps
util	utility
vs	versus
WAM	wide-area mine
WES	Waterways Experiment Station
yd	yard

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FM 5-116

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