

Chapter 2

Engineer Information

Engineer information is the result of organizing, collating, comparing, processing, analyzing, and filtering raw data requested by or provided by engineer units. It is then related to specific military activities and used by commanders in planning military operations and construction. Engineer information is comprehensive—it covers fields and levels of MAGTF engineering activity. It is also a part of geospatial intelligence. Engineer information includes, but is not limited to—

- 1 Terrain, encompassing the location, identity, and physical description of natural and manmade features.
- 1 Research, design, and employment of materials; techniques corresponding to that material; and techniques of interest and use to engineers.
- 1 Order of battle of engineer units and similar information on civilian organizations capable of performing engineer missions.

INTELLIGENCE PREPARATION OF THE BATTLESPACE

Intelligence preparation of the battlespace (IPB) is a systematic and continuous approach to analyzing the enemy, weather, and terrain in a specific geographic area. IPB uses enemy doctrinal norms and orders of battle to template enemy forces. It also attempts to anticipate their capabilities and predict their intentions. Engineers must understand the G/S-2 doctrinal and situation template to analyze threat capabilities and the order of battle. The situation template becomes the foundation for the G/S-2 and engineer coordination. For example, obstacle intelligence and templating are developed in concert with the G/S-2's templating of a motorized rifle battalion's defense. The engineer G/S-2 will use the situation template to further develop intelligence requirements (IRs), priority intelligence requirements (PIRs), and named areas of interest (NAIs) to support the event template and the collection plan. The engineer will ensure obstacle intelligence collection is integrated into the collection plan.

The IPB consists of the following three elements:

- 1 Modified combined obstacle overlay.
- 1 Enemy mission and capabilities.
- 1 Friendly capabilities.

ENGINEER BATTLESPACE ASSESSMENT

The engineer battlespace assessment (EBA) is developed in conjunction with the IPB, and focuses on engineer-specific intelligence. The engineer develops facts and assumptions and supports the IPB process by analyzing the terrain and weather and assessing their impact on military engineer operations.

The engineer will analyze the terrain using the following five military aspects of terrain:

- 1 Key terrain.
- 1 Observation and fields of fire.
- 1 Cover and concealment.
- 1 Obstacles.
- 1 Avenues of approach (AA).

Terrain analysis reduces the uncertainties regarding the effects of natural and manmade terrain on friendly and enemy operations.

Modified Combined Obstacle Overlay

Analyzing the military aspects of the terrain is accomplished primarily through preparing the modified combined obstacle overlay (MCOO) developed by the G/S-2 with the engineer's assistance. The MCOO graphically identifies AAs, cross-country mobility classifications, mobility corridors, and existing and future obstacle systems. A slope overlay can determine trafficability and intervisibility for intelligence collection, target acquisition, weapons capabilities, and obstacle integration. These products will be used for COA development and analysis.

Enemy Mission and Capabilities

The second component of the EBA is to analyze the threat engineer mission and capabilities. The first step is to understand the enemy's mission and

consider its doctrinal use of engineers. The engineer staff uses the G/S-2's doctrinal and situation template to develop the threat engineer order of battle. The engineer staff officer will further assess the enemy's mobility, countermobility, and survivability capabilities and template the enemy's engineer effort. In coordination with the G/S-2, engineers will recommend IR and/or PIRs, attempt to augment the reconnaissance effort, and monitor the collection effort to confirm or deny the situation template.

In the defense, the engineer templates the enemy's—

- ┆ Mobility capabilities and locations.
- ┆ Use of scatterable mine (SCATMINE) and other mines.
- ┆ Engineers in the reconnaissance effort.
- ┆ High-value targets (HVT) (e.g., bridging and breaching assets).

In the offense, the engineer templates the enemy's—

- ┆ Tactical and protective obstacle effort and reinforcing fires.
- ┆ Use of SCATMINE and other mines.
- ┆ Survivability and fortification effort.

Friendly Capabilities

Friendly capabilities are based on available manpower, equipment, resources, and training. Specific friendly considerations include relationship between survivability and countermobility (e.g., construct antitank ditch versus construct hull defilade positions versus construct turret defilade positions). The engineer staff uses the information developed in the mission analysis to produce the friendly capabilities analysis. While task-organizing the engineer organizations, the engineer staff considers the possibility of additional support from the maneuver force and the higher-ranking engineer. Engineers must also consider the availability of critical resources. After determining the total assets available, the engineer staff uses planning factors or known unit work rates to determine the friendly capabilities.

The engineer staff officer combines the analysis of the terrain and the enemy and friendly capabilities to form facts and assumptions about—

- ┆ Enemy engineer effort and the most probable enemy COA.
- ┆ Critical friendly and enemy tactical events.

- ┆ Enemy vulnerabilities.
- ┆ Potential effect of these factors on the mission.

The facts-and-assumptions process is lengthy, and the engineer staff must focus on the information required by the maneuver commander and the commander's staff to make decisions. The EBA is a continuous process. Each time new information is collected, the engineer must evaluate the impact and/or effect on the mission and refine the facts and assumptions as necessary.

TARGETING

The purpose of targeting is to attack vulnerable enemy installations, units, or equipment that best support the mission's accomplishment. The targeting effort is focused on the commander's intent. Targeting is "The process of selecting targets and matching the appropriate response to them, taking account of operational requirements and capabilities. The analysis of enemy situations relative to the commander's mission, objectives, and capabilities at the commander's disposal, to identify and nominate specific vulnerabilities that, if exploited, will accomplish the commander's purpose through delaying, disrupting, disabling, or destroying enemy forces or resources critical to the enemy. See also joint targeting coordination board." (JP 1-02)

The engineer's role in the targeting process is analyzing facility targets and providing targeting information on obstacle plans to the fire support coordinator (FSC). Target analysis examines potential targets to determine military importance, priority of attack, and weapon effects required to obtain a desired level of damage. The engineer staff must analyze the loss or damage to terrain, facilities, and infrastructure and their effect on the mobility, survivability, and sustainability of the force. If the facility or infrastructure is only targeted for damage, the engineer staff needs to determine the level of destruction the target can withstand yet be repairable with organic engineer capabilities for friendly use.

The engineer staff must provide the FSC the following information on obstacles for inclusion in the target list:

- ┆ Location.
- ┆ Altitude.

- | Description (type of obstacle and construction).
- | Vulnerability.
- | Recovery time (estimated time for the enemy to repair obstacle).
- | Accessibility (location of the obstacles to other terrain or cultural features that may limit the direction or angle of attack).
- | Importance.

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Chapter 3

Engineering Reconnaissance

Engineer reconnaissance collects data that provides engineers within a MAGTF information on terrain, hydrographics, meteorological, and infrastructure (e.g., built-up areas, transportation networks, utilities, existing natural or manmade obstacles) necessary to support the commanders with their planning for ongoing or future operations. Engineer reconnaissance is vital to successful MAGTF operations. The following are the fundamentals of engineer reconnaissance:

- | Orient on the location or movement of the objectives relative to engineers.
- | Discover gaps and other weaknesses in enemy dispositions.
- | Confirm trafficability and other terrain characteristics.
- | Report all information accurately.
- | Avoid decisive engagement.
- | Develop situation and rapidly—
 - n Deploy.
 - n Reconnoiter.
 - n Take a course of action.
 - n Report.
 - n Egress.

RECONNAISSANCE MISSIONS

The reconnaissance mission relates not only to the engineer mobility mission but also to countermobility, survivability, and general engineer missions. See MCRP 3-17A/FM 5-34, *Engineer Field Data*, and MCRP 3-17B, *Engineer Forms and Reports*, for the appropriate forms to support the following missions.

Route Reconnaissance

Route reconnaissance obtains information about enemy obstacles (including NBC contamination), route conditions, and critical terrain features along a specific route. The techniques are less time-consuming and are performed more rapidly than other types of reconnaissance. Imagery, maps, and intelligence studies identify likely beach, landing zone, or inland exits and movement routes.

Zone Reconnaissance

Zone reconnaissance is used when the enemy's location is in doubt or if it is desired to locate suitable routes or determine conditions of cross-country trafficability. It obtains detailed information about routes, obstacles, key terrain, and enemy activity in a zone established by definite lateral boundaries.

Area Reconnaissance

Area reconnaissance obtains detailed information about all routes, obstacles, and enemy forces within any clearly defined area. Details can include size and layout of towns; types, densities, and locations of woods; or possible fording sites of water obstacles. It is the most time-consuming of the three types of reconnaissance. Types of area reconnaissance include—

Water Reconnaissance. Initially, the landing force brings potable water ashore. Engineer reconnaissance locates and develops additional water sources ashore. Ground engineer reconnaissance confirms sources previously determined by aerial photos, maps, and intelligence studies.

Engineer Material Reconnaissance. Engineer reconnaissance locates sources of lumber, timbers, standing timber, gravel, rock, sand, and other local construction materials. It may also locate enemy engineer construction equipment and/or facilities such as parts stores, asphalt or concrete batch plants, and heavy machinery.

Airfield Site Reconnaissance. Airfield site selection begins prior to friendly forces going ashore. This can be accomplished by studying maps, photos, and products from other imagery and intelligence sources and flying over the site. Because micro-terrain can severely affect airfield operations, final selection is not done until physical reconnaissance confirms the utility of the landing sites designated prior to the assault and quantifies upgrade and/or repair requirements.

Reconnaissance Considerations

An important consideration in all reconnaissance activities is the impact of large quantities of unexploded ordnance. The EOD support in the

MAGTF should be involved in evaluating the impact of this on any mission. Reconnaissance considerations for missions also include—

- I Mobility—
 - n Route reconnaissance. Enemy obstacle barrier reconnaissance.
 - n Bypasses identification.
- I Countermobility—
 - n Barrier Planning.
 - n Target and/or obstacle folders and target analysis.
- I Survivability—
 - n Friendly forces emplacement.
- I General Engineering—
 - n Utility assets location.
 - n Water points location.
 - n Local construction materials identification.
 - n Existing facilities location.

OFFENSIVE AND DEFENSIVE OPERATIONS

Engineer reconnaissance in the offense should be placed far enough forward of the maneuver elements perform proper route and obstacle reconnaissance. This must be done in order to return information to the rear in a timely manner. Engineer reconnaissance should have the capability to—

- I Provide a detailed report of all existing and reinforcing obstacles along the maneuver

element's axis of attack. The reports should include estimates for breaching.

- I Provide information on routes along the axis of advance that may influence the commander's plan such as vulnerabilities and critical choke points.
- I Provide information on water, electric, fuel, and other engineer resources.
- I Locate bypasses far enough in advance of the lead element to prevent slowing the momentum of the maneuver element's attack.
- I Provide information about the countermobility capability of the enemy.

The major use of the engineer reconnaissance in the defense is to provide information for the obstacle and/or barrier plan. This information may be obtained forward of the forward edge of the battle area (FEBA), to the rear of the FEBA, or to the flanks. Specific requirements in the defense are—

- I Detailed information on choke points.
- I Detailed demolition estimates for the creation of obstacles.
- I Resources for obstacle construction.
- I Routes in support of a retrograde or lateral movement.
- I Route reconnaissance on likely avenues of approach for the enemy.
- I Enemy's breaching capability.
- I Obstacle emplacement in the enemy's rear capability.
- I Close lanes in obstacles during delay and/or defend operations.

Chapter 4

Combat Engineering Operations

“Every successful military operation is directed toward a clearly defined, decisive, and attainable objective. The ultimate military objective is to defeat the enemy’s forces or destroy his will to fight.”

—MCWP 3-1, *Ground Combat Operations*

Combat engineering is an integral part of the MAGTF’s ability to maneuver. Combat engineers enhance the force’s momentum by physically shaping the battlespace to make the most efficient use of the space and time necessary to generate mass and speed while denying the enemy unencumbered maneuver. By improving the battlespace, combat engineers accelerate the concentration of combat power, increasing the velocity and tempo of the force necessary to exploit critical enemy vulnerabilities. By reinforcing the natural restrictions of the battlespace, combat engineers limit the enemy’s ability to generate tempo and velocity. These limitations increase the enemy’s reaction time and physically and psychologically degrade his will to fight.

BARRIER, OBSTACLES, AND MINES

“Employment of barriers, obstacles, and mine warfare can, in concert with other capabilities, enhance a commander’s ability to mass combat power, sustain the force, conduct offensive or defensive operations, achieve surprise, and use key terrain, airfields, or sea routes. A commander must consider both friendly and enemy employment of these capabilities in preparing plans and conducting operations.” (JP 3-15, *Joint Doctrine for Barriers, Obstacles, and Mine Warfare*) Barriers, obstacles, and mines have a significant impact on operations. Commanders must constantly consider the advantages and disadvantages of their employment and countering them during planning and execution.

Barriers, obstacles, and mines—

- I Inflict significant equipment and psychological damage and personnel casualties on the enemy with minimal risk to friendly forces.

- I Extend, strengthen, and deepen other defensive and offensive measures to support the concept of operations.
- I Immobilize the enemy until barriers, obstacles, or minefields are bypassed, breached, or cleared.
- I Exploit geographic features.
- I Free forces for other employment.
- I Create uncertainty for the enemy commander.

Disadvantages of barriers, obstacles, and mines include—

- I Amount of time, material, equipment, and transportation that their creation and removal can consume. Creation and removal will be manpower-intensive and hazardous.
- I Bypassability, breachability, or clearability.
- I Unintended casualties to friendly forces and noncombatants, as well as limited friendly mobility.
- I Defensive minefields must be rendered safe following their operational usefulness. (JP 3-15, *Joint Doctrine for Barriers, Obstacles, and Mine Warfare*)

Rules of Engagement

Rules of engagement (ROE) are mission-oriented and action-specific directive guidance that authorize and delineate the circumstances and limitations of the use of force. ROE are published by the geographic combatant commander based on guidance from the National Command Authorities. MCRP 5-12.1A/FM 27-10, *The Law of Land Warfare*, and JP 3-15 provide details on the rules governing the employment of barriers, obstacles, and mines. Commanders should address the authority to emplace barriers, obstacles, and mines in operation plan (OPLAN) development and when determining post-hostility ROE.

Planning Considerations

To achieve the maximum effect from a barrier, obstacle, or minefield—

- | Form barriers, obstacles, and minefields around an existing terrain feature (e.g., mountain chain or a strait) or a manmade structure (e.g., air base, canal, highway, or bridge).
- | Cover them with observation and fire. Fields not covered by observation and fire are rarely effective.
- | Analyze the friendly and enemy forces' ability to maneuver on land and sea or to conduct effective air operations.

Offensive considerations include—

- | Enhancing and protecting the friendly force's ability to maneuver.
- | Preventing enemy reinforcement or counterattack.
- | Facilitating economy of force.
- | Providing security.
- | Degrading enemy air and naval capabilities.
- | Fixating on the enemy.

Defensive considerations include—

- | Directing toward degrading the enemy's ability to maneuver.
- | Integrating systems of barriers, obstacles, minefields, and fires.
- | Identifying reinforcing obstacles and minefields early.
- | Identifying assets to restore the integrity of a barrier, obstacle, or minefield if breached by the enemy.
- | Creating massive obstacles in land operations.

OBSTACLES

Obstacles are any physical objects that impede the mobility of a force.

Categories of Obstacles

Existing Obstacles. Existing obstacles are obstacles that are present on the battlefield as inherent aspects of the terrain. The two types of existing obstacles are natural and cultural. Natural obstacles are terrain features, such as rivers, forests, or mountains.

Cultural obstacles are manmade terrain features, such as towns, canals, railroad embankments, or buildings.

Reinforcing Obstacles. Reinforcing obstacles are obstacles specifically constructed, emplaced, or detonated by military forces. The categories of reinforcing obstacles are—

- | Tactical. The primary purposes of tactical obstacles are to restrict enemy maneuver and multiply the effects and capabilities of firepower.
- | Protective. Hasty or Temporary obstacles created next to positions to protect defending forces.
- | Deliberate. More permanent obstacles created at strong points or fixed sites.
- | Phony Obstacles. Units may also use phony obstacles that give the appearance of actual obstacles but require only minimal resources to emplace.

Obstacle Effects

Tactical obstacles and fires manipulate the enemy in a way that supports the commander's intent and scheme of maneuver. The intended effect that the commander wants the obstacles and fires to have on the enemy is called the obstacle effect. Obstacle effects—

- | Drive integration.
- | Focus subordinates' fires.
- | Focus obstacle effort.
- | Multiply the effects of firepower.

Obstacle effects occur because of fires and obstacles, not just obstacles alone. All tactical obstacles produce one of the following obstacle effects (see fig. 4-1):

Disrupt—focuses fire planning and obstacle effort to cause the enemy to break up formation and tempo, interrupt timetable, commit breaching assets prematurely, and piecemeal the attack.

Turn—integrates fire planning and obstacle effort to divert an enemy formation.

Fix—focuses fire planning and obstacle effort to slow an attacker within a specified area, normally an engagement area.

Block—integrates fire planning and obstacle effort to stop an attacker along a specific AA or prevent him from passing through an engagement area.

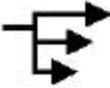
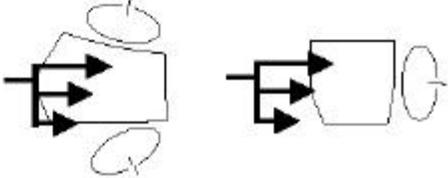
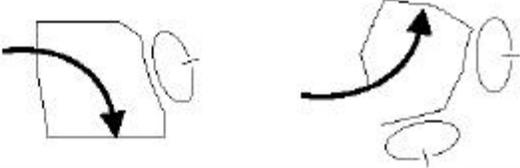
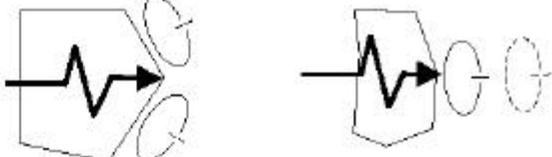
OBSTACLE EFFECT GRAPHIC	APPLICATION	EXAMPLES CONVEYING INTENT
<p>Disrupt</p> 	<p>Short arrow indicates where enemy is attacked by obstacles.</p> <p>Long arrows indicate where bypass is allowed and attacked by fires.</p>	
<p>Turn</p> 	<p>Heel of arrow is anchor point.</p> <p>Direction of arrow indicates desired direction of turn.</p>	
<p>Fix</p> 	<p>Irregular part of arrow indicates where enemy advance is slowed by obstacles.</p>	
<p>Block</p> 	<p>The ends of the vertical line indicate the limit of enemy advance.</p> <p>The ends of the vertical line also indicate where obstacles lie in NO-GO terrain.</p>	
<p>Direction of enemy attack →</p>		

Figure 4-1. Obstacle Effects.

OBSTACLE PLANNING

Commanders and staffs consider the use of obstacles when planning offensive and defensive operations. During the decisionmaking process, obstacle planning is incorporated to ensure obstacle integration effectiveness and that the obstacle plan is flexible enough to allow changes during the phases of the operation. Obstacle planning requires integrating information from the staff and includes—

- l Intelligence—
 - n AA (friendly and enemy).
 - n Enemy combat power.
 - n Location of enemy forces (location and formation).
 - n Enemy objectives, main effort, and options.
- n NAI and/or target areas of interest (TAI) and/or decision points (DPs).
- n Enemy vulnerabilities and enemy DPs.
- n Enemy breaching capabilities.
- n Time in the battle zone that friendly and/or enemy forces will be active.
- l Logistics—
 - n Type and quantity of material available.
 - n Location of the material.
 - n Where the material is required.
 - n Distance from current location to required location.
 - n Transportation assets available to move the material.
 - n Schedule for moving the material.
 - n Availability of personnel.
 - n Availability of construction equipment.

- l Fire Support—
 - n Total fire-support capability (such as batteries, battalions, attack helicopters, or fixed-wing sorties).
 - n Family of scatterable mines (FASCAM) capable assets (artillery- or air-delivered; priority of fires, and deployment authority).
- l Engineers—
 - n Terrain analysis.
 - n Enemy engineer mission and mobility and/or survivability capabilities.
 - n Friendly mobility and/or survivability capabilities.

Obstacle-Control Measures

Obstacle-control measures are used to ensure that subordinates emplace obstacles that support the higher commander's scheme of maneuver and that do not interfere with future operations. Obstacle control measures are groups, belts, and zones (see fig. 4-2).

Obstacle Groups. Obstacle groups are two or more obstacles grouped to provide a specific obstacle effect. For example, three obstacles are planned to turn the enemy into the battalion's AO. While each obstacle could have a different effect such as fix, turn, disrupt, or block, the overall effect would turn the enemy into a kill zone.

Obstacle Belts. Obstacle belts are a collection of obstacle groups that provide a specific effect. In the same way that obstacle groups use individual obstacles to achieve a desired effect, a series of groups are used to disrupt, turn, fix, or block the enemy on a larger scale. Belts are also a control measure for the regimental commanders to constrain tactical obstacle employment. They plan obstacle belts within assigned AO to grant obstacle emplacement authority to their major subordinate units to achieve a specific effect and/or outcome. Obstacle belts also focus obstacles in support of the regiment's scheme of maneuver and ensure that obstacles do not interfere with the maneuver of higher headquarters (HQ).

Obstacle Zones. Obstacle zones are used in the infantry division plan and are composed of a group of obstacle belts. Divisions plan obstacle zones based on regimental AO and ensure they do not impede future operations.

Situational Obstacles

Situational obstacles are obstacles that units plan and possibly prepare before starting an operation; however, do not execute unless specific criteria are met. The commander can use situational obstacles to attack an enemy vulnerability, exploit success, separate follow-on enemy forces, or provide flank protection. Unlike directed or reserve obstacles, a

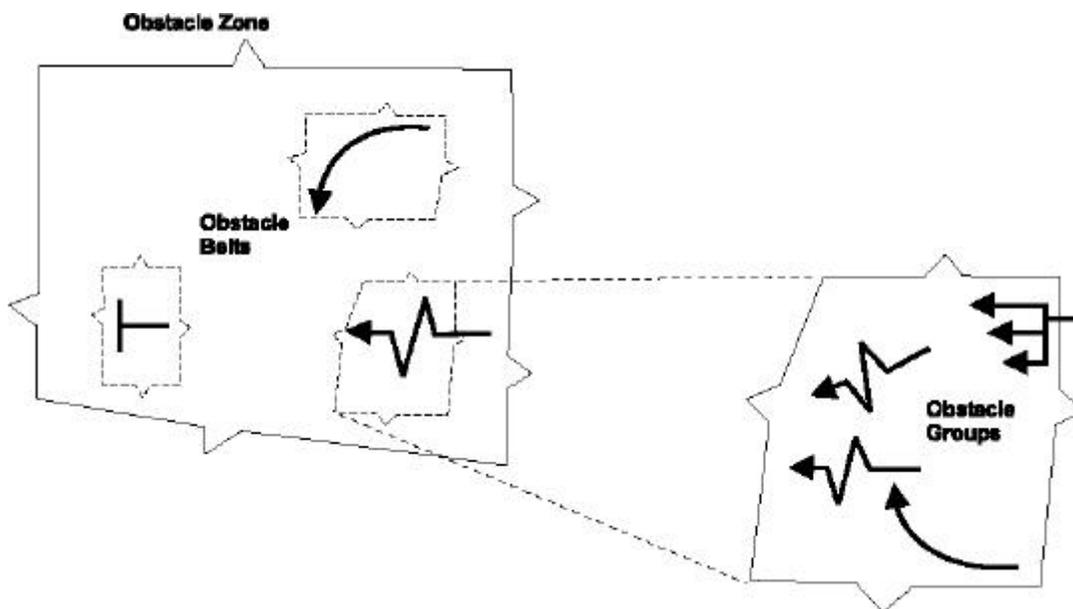


Figure 4-2. Obstacle Groups, Belts, and Zones.

situational obstacle may be executed. Normally, units plan several situational obstacles that rely on the same assets for emplacement. This allows the commander to shift scarce assets to the location where he needs them the most. When planning, preparing, and executing situational obstacles, commanders and staffs—

- 1 Identify the need and prioritize.
- 1 Plan for appropriate resources.
- 1 Integrate the obstacle with friendly fires.
- 1 Plan the obstacle.
- 1 Identify obstacle execution triggers.
- 1 Withhold execution of the obstacle until it is needed.

MINE WARFARE

Note: The United States (U.S.) military does NOT employ non-self destructing antipersonnel land mines (NSDAPLs). All instruction and training on the employment of NSDAPLs by the U.S. will stop. However, it is understood that allies of the U.S. as well as other nations of the world continue to use these weapons. Therefore, it is imperative that USMC engineers understand the mechanics and standard layout of minefields containing NSDAPLs. It is also imperative that USMC engineers continue to train to breach and clear ALL types of mines.

Land mines are a unique weapon system in the battlespace. They are inexpensive, easy to use, and as complex or simple as the user needs. Mines can be employed miles ahead of the FLOT to disrupt, fix, turn, or block the momentum of the enemy without endangering friendly forces. Land mines can silently reinforce ground forces deceptively creating surfaces that appear as gaps, or be hidden in streams and surf to deny the transit of the shallow water areas. Psychologically, mines can unnerve a force creating uncertainty, low morale, and even an unwillingness to fight. Most importantly, they are used by friendly and enemy forces.

Combat engineers are responsible for employing or countering the use of this weapon in support of offensive and defensive operations. Detailed planning and coordination are required with all levels of command to ensure the use and location of the mines supports the operation.

Conventional Mine Categories

Standard land mines consist of a small amount of high explosives contained in a metallic or nonmetallic casing, fitted with a fuze and/or a firing device for actuation by enemy vehicles or personnel.

Antipersonnel Mines. Antipersonnel mines consist of a small amount of high explosives in a container, fitted with a detonating fuze arranged for actuation by pressure, release of pressure by pulling on a tripwire, or release of tension.

Antitank Mines. Antitank mines consist of a charge of high explosives in a metallic or nonmetallic case. Antitank mines require a pressure of 290 to 500 pounds to actuate a detonation. There are a variety of antitank mine fuzing systems (e.g., pressure, tilt-rod assembly, magnetic influence).

Chemical Mines. Chemical mines are antipersonnel mines with target contact or command-detonated fuses. They are filled with a persistent chemical agent (nerve agent or blister agent). National policy, as announced by the theater commander, will govern the use of chemical mines in the joint operating area or amphibious operation area. When authorized, they are normally used in defense and retrograde operations, and mixed with high explosive mines to form a combined high explosive chemical minefield. Adding chemical mines to existing high explosive minefields is done by laying additional strips of chemical mines in a random pattern, or by adding high explosive-chemical strips to the front or rear of existing fields. Chemical mines may be included in tactical, interdiction or point minefields, but not in protective minefields. When an integrated high explosive-chemical minefield is laid, it discourages the use of explosive rapid mine clearing devices. Use of such devices creates a chemical hazard in the area. High explosive mines reduce the speed of enemy forces crossing the minefield. Speed is further reduced by forcing the enemy to use protective clothing and masks.

Anti-helicopter Mines. Anti-helicopter mines (AHM) have been prefabricated using explosives configured to direct projectile material (nails, metal scrap, rocks, etc.) toward airborne targets. First used in Vietnam, they were actuated by the rotor wash of descending helicopters into potential landing zones. AHM systems currently under development will use acoustic sensors and have a range more than 200 meters. Antitank mines may also have their tilt rods

fitted with a small parachute that will catch the rotor wash and activate the mine.

Family of Scatterable Mines. FASCAM type mines are air, artillery, mechanical or hand emplaced. They can be either antipersonnel or antitank mines. The U.S. Army, Air Force, Navy, and Marine Corps all employ a variety of FASCAM systems. Three of the most common FASCAM systems employed by the U.S. Marine Corps are described in appendix A.

Purpose of Minefields

In land warfare, a minefield is an area of ground containing mines laid with or without a pattern. They are the most effective means of reinforcing the terrain to stop, slow, or channelize the enemy into areas where he can be killed. Mines and minefields can and should be emplaced where and whenever the tactical situation dictates. Additional information on the employment of mines and minefields can be obtained in FM 20-32, *Mine/Countermine Operations*, and FM 90-13-1, *Combined Arms Breaching Operations*.

Classification of Minefields

Minefields are classified according to their tactical purpose.

Hasty Protective Minefield. Used as a part of a unit's defensive perimeter to give close-in protection and warning, a hasty protective minefield is usually emplaced by squad-sized units. It is laid on short notice, for a limited time, and mines must be detectable. If time permits, the mines should be buried or camouflaged, but they can be laid on top of the ground in a random pattern. No antihandling devices are used. The mines are employed outside hand grenade range, but within small arms range. A Minefield Record Form (DA Form 1355, March 87) is prepared and held as a record at the company level. Copies are forwarded to the approving (normally battalion-level) headquarters. Several Marines should know the exact location of each mine. As authorized by the GCE, a battalion commander can normally approve the emplacement of hasty protective minefields.

Deliberate Protective Minefield. This type minefield is used to protect static installations such as airfields, ammunition depots, etc. The mines are normally emplaced by engineers in standard patterns and remain so for an extended time. The minefield is usually fenced, marked, and covered by fire and

observation. FASCAM type mines will not normally be used in deliberate protective minefields.

Point Minefield. Point minefields are used to disorganize enemy forces and hinder enemy use of key areas. They are of irregular size and shape and include all types of antitank and antipersonnel mines, as well as antihandling devices. They are used to reinforce obstacles or rapidly block an enemy AA. Marine infantry personnel may be required to provide security and/or assist engineers in the installation of a point minefield to expedite its construction. FASCAM mines may be used exclusively or in conjunction with standard mines to construct, reseed, close breached lanes or augment a point minefield.

Interdiction Minefield. These minefields are emplaced by special operations forces in enemy-held areas. They are designed to kill, disorganize, and disrupt lines of communications and degrade the efficiency of command and control facilities. Combat engineers assist in the planning and execution of tactical operations employing interdiction minefields. FASCAM type mines may be used exclusively or in conjunction with conventional mines to construct an interdiction minefield.

Phony Minefield. A phony minefield is an area of ground used to simulate a live minefield and deceive the enemy. Phony minefields can supplement or extend live minefields and are used when construction time, effort, or material for live minefields is limited. Marine infantry personnel may be required to provide security and/or assist engineers in the installation of a phony minefield to expedite its construction.

Minefield Installation

Engineer organizations are currently only capable of installing minefields by hand emplacement. The exact location, size, type, fuzing, and antitampering devices on each mine should be accurately recorded. This information is extremely useful if the field requires future maintenance. Normally, a minefield is considered effective if 60 percent of the mines emplaced are still functional. Although slow, time-consuming, and a significant logistic burden, the hand emplaced minefield offers one major advantage to maneuver warfare over other mechanical, artillery, or air delivered systems (e.g., FASCAM). Lanes can be constructed and accurately identified, thus eliminating the minefield as an obstacle to the MAGTF commander yet maintaining its

effectiveness as an obstacle to the enemy. Minefields, regardless of how they are constructed, are obstacles used by the commander to shape the battlefield.

Marking of Minefields

When enemy minefields are discovered in any area to the rear of positions along the forward edge of the battle area (FEBA), an immediate spot report will be initiated and, time permitting, the discovering unit will attempt to mark the outer boundary of the mined area. The following guidelines govern the marking of standard minefields.

Minefields to the Rear of Positions Along the FEBA. At the time of laying, the minefield must be completely fenced on all sides with two strands of barbed wire or concertina. To avoid indicating the exact boundary of the field, the fence does not follow the minefield trace exactly. The fence is not less than 15 meters from the nearest mine. The top strand of barbed wire fence is about waist-high, the lower strand about ankle-high. Standard mine marking signs spaced approximately 10 to 50 meters apart, depending upon terrain, are hung on the upper strand with the word “Mines” facing away from the field. As an alternative to barbed wire fencing, concertina wire may be used. The distance between lane markers and marking signs is determined by terrain and visibility conditions. Minefield lanes in rear areas are fenced on both sides, and the fences are linked with the minefield perimeter fencing at entrances and exits. In addition, lane entrances and exits, as well as the passage itself, are marked with signs to indicate the safe and dangerous sides. In darkness or poor visibility, lane markers are illuminated. In non-English speaking areas, signs in the native language must also be erected. It may be necessary to post guards at lane entrances to prevent friendly personnel from entering dangerous areas. Additionally, large animals and/or animal herds may require modified or additional fencing to prevent their entry into mined areas.

Minefields Forward of Positions Along the FEBA. Minefields forward of positions along the FEBA are usually fenced on the friendly side and/or the flanks as necessary to protect friendly troops. These minefields may also be completely enclosed to influence the enemy to bypass the field. Lanes in forward areas are marked inconspicuously because use of standard methods would expose lane locations to the enemy. Suggested methods of lane marking include placing wire, tape, or closely spaced objects

on the ground on each side of the lane, with an easily identifiable lane entrance made by markers such as pickets wrapped with tape or piles of stones. All lanes in standard minefields should be registered artillery targets to allow mine re-seeding with FASCAM systems to prevent entry.

Minefields in Enemy Territory. Minefields established within enemy territory are reported but not marked.

Reporting and Recording Minefields

Reporting and recording minefields are essential steps in mine warfare. The following reporting and recording criteria govern mine warfare conducted by the MAGTF. Forms for minefield reports can be found in MCRP 3-17B, *Engineer Forms and Reports*.

A minefield report is a verbal, electronic or written communication concerning mining activities, friendly or enemy. The exact format of the report is specified within the MAGTF operation order (OPORD). These reports are submitted by the emplacing unit commander through operational channels to the operations officer (G/S-3) of the authorizing headquarters or command element. That headquarters integrates the reports with terrain intelligence and disseminates them with tactical intelligence. The reports will be sent by the fastest, most secure means available. The following reports are used to convey mine warfare information:

Report of Intention. The report of intention serves as notification to a unit’s higher headquarters that the unit intends to emplace a minefield. The report of intention doubles as a request when initiated at levels below those with emplacement authority. Conventional minefields that are part of an OPLAN approved by the authorizing commander do not require a report of intention; that the minefields are included within such a plan implies an intention to lay. Minefields not authorized in an OPLAN require a separate report of intention. The report includes data regarding the tactical purpose of the minefield, the estimated number and type of mines to be emplaced, the location, and the proposed start and completion times.

Report of Initiation. The report of initiation is a mandatory report that informs higher headquarters that emplacement has begun, and the area is no longer safe for friendly movement and maneuver. It should specify the time emplacement began and

identify the location and target number of the minefield.

Report of Completion. The report of completion is usually an oral report to the authorizing commander that the minefield is complete and functional.

Report of Change. The report of change is made immediately upon any change or alteration made in a previously reported minefield and is sent to the next higher commander. It is then sent through channels to the headquarters that keeps the written minefield record.

Additional Reports

Progress Report. During the emplacing process, the commander may require periodic reports on the amount of work completed.

Report of Transfer. The responsibility for a minefield is transferred from one commander to another in a report of transfer. This report is signed by both the relieved and relieving commanders and includes a certificate stating that the relieving commander was shown or otherwise informed of all mines within the commander's zone of action or sector of defense. The report states that the relieving commander assumes full responsibility for those mines. The report of transfer is sent to the next higher commander who has authority over both relieved and relieving commanders.

FASCAM Minefield Report and Record. Since the locations of individual scatterable mines are unknown, the reporting of the minefield is based on the aiming point or points. For example, a remote anti-armor mine system (RAAMS) or Gator minefield would be recorded based on the target location (the grid coordinates given to the firing battery). The size of the minefield would depend on the number of rounds fired (ordnance delivered), the number of aim points, and the angle of fire. Artillery- and air-delivered minefields are recorded by plotting them on a map based on the aim point(s) and a safety zone area specified in the scatterable minefield report and record prepared by the delivering unit. To facilitate the reporting and recording of scatterable minefields, a simple uniform procedure is used. This procedure combines the report and the record into one document—the Scatterable Minefield Report and Record—applicable for all FASCAM delivery systems.

FASCAM Warning. Along with the scatterable minefield report and record, a separate report of the

scatterable minefield warning (SCATMINEWARN) is used to notify affected units that scatterable mines will be employed. The SCATMINEWARN report is designed to give units that may be affected by the employment of scatterable mines the necessary warning to plan and execute their operations. The information in the report is kept to a minimum to ensure rapid dissemination. The report is sent by voice, digital, or hard copy means, either prior to or immediately after the mines have been emplaced.

MOBILITY

Mobility is a quality or capability of military forces that permits them to move in time and space while retaining their ability to fulfill their primary mission. A commander must be able to mass forces quickly at a chosen place and time to accomplish the assigned mission. The commander must be able to achieve superior tempo through a relatively quicker observation, orientation, decision, action (OODA) loop than the enemy. Mobility is critical to achieving this situation and maintaining it for extended periods of time over great distances.

Functional Areas

Mobility operations are intended to maintain this freedom of both tactical maneuver and operational movement through five functional areas which are—

- 1 Countermine activities—the detection, neutralization (by breach or bypass), marking, and proofing of mined areas.
- 1 Counter Obstacles—the employment of tactics and equipment to breach or bypass and ultimately reduce obstacles other than mines.
- 1 Gap-crossing—fills gaps in terrain in order to allow passage of personnel and equipment.
- 1 Combat Roads and Trails—expedient preparation or repair of routes of travel for both personnel and equipment.
- 1 Forward aviation combat engineering (FACE) is the preparation or repair of expedient landing zones, FARPS, landing strips, or other aviation support sites in the forward combat area.

Countermine Operations

Countermine operations are all efforts taken to counter an enemy mine effort. Countermine operations are difficult because detection systems are imperfect and mine neutralization systems are only

partially effective. Normally, countermine operations using explosive systems will be conducted under enemy observation and fire. Countermine operations include—

- 1 Mine detection.
- 1 Reconnaissance for enemy minefields.
- 1 Breaching.
- 1 Prevention of enemy mine operations.

Detection of Mines

Visual. Visual detection of mines is a reliable and increasingly effective method of locating minefields. The increasing proliferation of FASCAM type mines produces a high percentage of surface laid evidence. FASCAM mines can be recognized from a combat vehicle from a distance of up to 20 meters given normal ground vegetation. Visual detection and recognition of mines should be emphasized during MAGTF employment. The following indicators suggest the presence of FASCAM mines:

- 1 Dust clouds in the terrain without the presence of vehicles or equipment movement or recognizable shell explosions (clouds of dust are created by impact of scatterable mines).
- 1 Small parachutes in the air or spotted blowing on the ground.
- 1 Breaks in an area with otherwise uniform vegetation.
- 1 Mines or dispensing debris (casings, parachutes, etc.) hanging in trees and in underbrush.
- 1 Approaching or departing aircraft (fixed- or rotary wing) in association with any of the indicators.

Auditory. Listening for evidence of FASCAM type mine systems during their employment is a viable method. When artillery or multiple-launched rocket systems project their ordnance overhead and the impact report cannot be heard, the use of FASCAM mines may be suspected.

Probing. Probing is the method of detecting mines by penetrating the ground with an instrument such as a non-metallic or wooden mine probe. Metal objects such as a bayonet or stiff wire are not recommended. When the mines are armed with pressure-only type fuzing, probing is the safest way to locate mines. Modern fuzing systems that employ magnetic,

acoustic and/or seismic sensors cannot be safely located by the probing method.

Electronic Detection

Hand-held Systems. The Marine Corps currently employs the PSS-12 mine detector to locate electronically mines below the surface (soil or water). It is a hand-held, battery-powered system.

Vehicular-mounted Systems and Aircraft-mounted Systems. They are currently under development. Systems that identify potential mines from a distance and in some cases, prematurely detonate them before they can endanger a vehicle. Although not yet fielded, these countermine systems have great potential for defeating the mine threat.

Reconnaissance for Enemy Minefields

After detection, the characteristics and limitation of enemy barriers, obstacles, and minefields must be determined using both ground and aerial reconnaissance and remote imagery. Reconnaissance must—

- 1 Locate enemy barrier, mine, and obstacle locations.
- 1 Identify and locate enemy fire support.
- 1 Identify remaining enemy employment capabilities.
- 1 Locate enemy breaching assets.

If possible, it is important to determine the types of mines used and their physical characteristics, i.e., dimensions and material from which manufactured. This can aid the planning of how to clear the minefield.

Breaching Operations

Enemy obstacles that disrupt, fix, turn, or block the force can affect the timing and force of the operation. Most obstacles can and will be observed by the enemy and protected with fires; they should be bypassed if possible. For those that must be breached, constant coordination and integration of all elements of the MAGTF is vital for success. Combat engineers are the key to the orchestration of the operation and are responsible for employing the tactics and techniques necessary to penetrate obstacles in the path of the force.

Breaching operations are some of the most complex of modern warfare, but are not an end unto themselves. They exist as only a part of the maneuver forces operation that is focused on the objective.

The goal of breaching operations is the continued uninterrupted momentum of ground forces to the objective. They should be planned and executed in support of the ground forces' needs to ensure actions at the objective are supported by actions at the breach. Breaching operations require the constant application of the fundamentals of ground combat and the concentrated uses of supporting arms. Fundamentals of breaching operations have evolved in concert with the fundamentals of ground combat and provide a logical and time-proven set of rules. These fundamentals are—

- 1 Suppress the enemy to maneuver and fire.
- 1 Obscure the enemy's ability to observe the operation.
- 1 Provide security for the breach force.
- 1 Reduce the obstacle.
- 1 Reconstitute.

Prevention of Enemy Mine Operations

The most effective means of countering a mine threat is to prevent the laying of mines. Proactive countermine operations destroy enemy mine manufacturing and storage facilities or mine-laying capabilities before the mines are laid. Planners must consider enemy storage and mine production facilities and assets for inclusion on the target lists.

Counter-Obstacle Operations

Many issues encountered in countermine operations apply to non-mine obstacles. Engineer reconnaissance should detect the presence of enemy obstacles and determine their type(s) and provide the necessary information to plan appropriate breaching or by-pass plans developed to negate their impact on the scheme of maneuver.

Another important consideration to be gained from reconnaissance is to anticipate when and where the enemy may employ obstacles that could impede the MAGTF's operations. It is prudent to incorporate plans to deny the enemy the opportunity to establish effective obstacles whenever possible. Achieving this goal can be accomplished by—

- 1 Occupying the area before the enemy can exploit it.
- 1 Preplanning artillery and close-air support to deny or harass enemy units attempting to establish obstacles.

- 1 Looking for or creating alternative routes for the MAGTF's units.
- 1 Using engineering knowledge of obstacles to create contingency plans for breaching or bypassing to allow quick neutralization of the obstacles, if established by the enemy.

Gap-Crossing Operations

Combat engineers can aid gap crossing through employment of their heavy equipment to modify the existing gap or through the use of expedient bridging (e.g., rope bridges, small nonstandard bridging using local materials). However, CEBs do not possess organic standard bridging equipment. If the plan calls for this type of gap-crossing asset or the situation arises unexpectedly they will need support from the engineer support battalion. See additional information in chapter 5.

Combat Roads and Trails

The ability to move personnel and equipment is essential to maneuver warfare. This ability provides the commander with the means to increase tempo, increase speed, and concentrate mass at crucial times and places. The construction and maintenance of trails and roads are normally considered general engineering tasks and are therefore performed by engineering support units. However, areas at or near the FLOT or time constrictions may require the forward combat engineer units to perform these functions in an expedient manner or for short durations of time until support engineers are available.

The two most likely scenarios that would involve this requirement would be by-pass operations or to support FACE operations. It is important for the engineer commander and staff to only perform this function in support of the maneuver plan. They should not allow engineering assets to be dissipated and thus unable to perform their primary role of supporting the MAGTF commanders operational scheme of maneuver.

Engineers should always strive to take full advantage of existing infrastructure and natural terrain features when constructing combat trails and roads.

Forward Aviation Combat Engineering

Engineers acquired a mission in the battlespace to support aviation assets with the advent of airpower and its associated support requirements. This

frontline support will normally take the form of creating expeditionary landing zones for helicopters and vertical and/or short taking off and landing aircraft or parachute drop zones for personnel, equipment, or supplies. Engineers should always strive to take full advantage of existing infrastructure and natural terrain features when constructing expeditionary landing and/or drop zones. Airpower is important to the MAGTF's maneuver warfare and the use of expeditionary landing and/or drop zones can increase the speed and tempo of operations by decreasing turn-around time for aircraft (e.g., FARP sites), decrease travel from rear areas to the forward combat area of personnel, equipment, and supplies, or decrease response times of close-air support mission.

COUNTERMOBILITY

Countermobility is the physical shaping of the battlespace to alter the scheme of maneuver of the enemy. Countermobility operations block, fix, turn, or disrupt the enemy giving the MAGTF commander opportunities to exploit enemy vulnerabilities or react effectively to enemy actions.

When planning countermobility obstacles, it is important to understand the commander's intent, timetable, and scheme of maneuver. Along with available manpower, equipment, and materials, these ultimately determine what is feasible to support the OPLAN. Two key actions in obstacle plans are—

- 1 Avoid obstacle plans that require so much materials and manpower they can not be emplaced in a timely manner to provide useful support to the MAGTF's maneuver plan, i.e., the maneuver elements bypass the obstacle field before it is completed, and the engineer units lose pace with the combat elements.
- 1 Do not impede friendly forces later in the operation with friendly obstacles.

The engineering staff must consider these in the operational plan and ensure the commander is aware of these issues. What is used to impede the enemy may also impede friendly forces in another phase of the operation.

Rarely does the engineer unit have sufficient time, materials, personnel, or equipment to emplace the 'perfect' obstacle plan. Engineers must be creative in their operations. The adage ". . . a good plan implemented in a timely manner is better than a

perfect plan implemented too late" is especially true for engineers.

Another consideration is that nonengineer units may need to augment the engineer unit with security and personnel in order to execute countermobility operations. The MAGTF commander and various unit commanders must be aware of this support requirement in planning operations.

SURVIVABILITY

Survivability is the ability of personnel, equipment, and facilities to continue to operate within the wide range of conditions faced in a hostile environment. It includes all aspects of protecting personnel, weapons, and supplies. In order for the MAGTF to survive, it must be able to reduce exposure to threat acquisition, targeting, and engagement. Engineer support tasks such as construction of field fortifications (hardening of command, communication and combat train locations, weapon system firing positions, and infantry fighting positions) are critical to this effort.

Field Fortifications

(DOD, NATO) "An emplacement or shelter of a temporary nature which can be constructed with reasonable facility, by units requiring no more than minor engineer supervisory and equipment participation." (JP 1-02) Engineers construct fighting positions for combat vehicles, direct fire weapons systems, artillery, and air defense. Field fortifications provide a degree of protection from the effects of enemy weapons systems and a more stable weapons platform from which to sustain accurate volumes of fire. They sustain confidence in a Marine's ability to fight effectively where they otherwise could not survive.

Strong Point

(DOD, NATO) "A key point in a defensive position, usually strongly fortified and heavily armed with automatic weapons, around which other positions are grouped for its protection." (JP 1-02) Strong points are heavily fortified battle positions that cannot be overrun quickly or bypassed easily by enemy forces. They consist of an integrated series of well-protected fighting positions connected by covered routes and reinforced with extensive protective obstacles. They are designed to withstand artillery fire, air strikes, and both mounted and dismounted assaults. The

enemy can reduce them only by expending significant time, personnel, and equipment assets in the application of overwhelming force.

SPECIALIZED DEMOLITION

Combat engineers and EOD Marines are capable of executing demolition work of a constructive and destructive nature. Demolition missions requiring the use of formulas or calculated quantities of explosives with specific placement to produce the desired effect are normally performed by engineers. These tasks include placing hand explosives near heavy weapons, destroying cave systems; facilities; and equipment, and improving mobility in urban terrain and designated or reserve targets. Engineers are assigned those tasks that require greater control in execution, more precision in effect, and are generally larger in scale and more technical in scope.

The MAGTF's EOD team(s) have specialized demolition skills. They are specifically trained to use explosives and do so more often than combat engineers. The EOD team can help economize demolition materials and assist in the explosives training of combat engineers. Engineers should use the EOD team's practical knowledge for ideas and solutions regarding the commander's mission.

Explosives

Standard Military Explosives. Military explosives procured through the supply system meet certain military specifications that make them less sensitive to the effects of a combat environment than their commercial (nonstandard) equivalents. They are safer to handle and are designed for the common tasks encountered in combat.

Commercial (Nonstandard) Explosives. Commercially available explosives and combustibles are available worldwide and may be encountered and employed by the MAGTF. The greatest deficiency in the use of commercial or expedient explosives is their unknown explosive power. Accurately evaluating their explosive power is difficult thus making their effect unpredictable. Whenever possible, standard military explosives should be employed to support MAGTF demolition requirements. Reserved targets should only use standard military explosives.

Explosive Configurations and Techniques

Economy of Effort. Economy of effort is extremely important to the employment of explosives. By modifying the size and/or shape of explosives, a variety of special effects can be produced that have military significance. The diamond charge and the shape charge are examples of militarily effective demolition using the minimum of explosives, accomplished by modifying the configuration of the charge.

Explosive Effect. Evaluating explosive power and effect against a given material allows the engineer to use the correct type and quantity of explosive at the critical points necessary to produce the desired effect. The result is that only the minimum required explosive is used to complete the task. Additional information on calculating explosives in a field environment can be found in MCRP 3-17A/FM 5-34, *Engineer Field Data*.

Demolition Reinforcing Obstacles. These obstacles are created by the detonation of explosives. Demolition obstacles include structures like road and rail bridges, airfields, and the denial of structures such as seaports, offshore oil rigs, and other facilities and material. There are two types of demolition reinforcing obstacles:

Designated Targets. Maneuver force commanders designate targets for demolition to support their scheme of maneuver or fire support plans. Designated targets are identified and destroyed through hasty or deliberate planning. Although not critical to the commander's mission, designated targets can be destroyed more efficiently through selection of the appropriate demolition, accurate calculation of explosives, and positive charge placement to obtain the desired effect. Infantry personnel create or remove individual obstacles, and engineers create or remove obstacle systems. The difference is the degree of complexity in planning and execution required.

Reserved Targets. Reserved targets are critical to the commander's tactical plan and are specifically controlled at a command level (MAGTF CE/GCE) appropriate to the commanders concept of operations. They are normally astride high-speed avenues of approach or control-significant static energy sources (dams, reservoirs, and earthen overhangs over mountain passes). Reserved targets are usually constructed by engineers in safe

conditions (charges calculated and placed waiting to be armed). To ensure proper execution, a target folder (obstacle folder) is prepared. Personnel remain at the target site to guard, arm, and execute the target on order.

Supported units guard and execute most reserved targets within their zone of action or sector of defense. Securing the target site and executing the target do not normally require engineer skills. Depleting engineer resources through security and firing responsibilities at every obstacle location is usually counterproductive to the MAGTF engineer effort. An engineer firing party will remain with certain key targets as designated by the authorizing commander. Engineer firing parties should be used for targets that—

- 1 Represent an advance force objective for enemy forces.
- 1 Are exposed to enemy fires before detonation, thus possibly requiring repair or replacement of demolition or firing circuits.
- 1 Use special demolition (atomic demolition munitions, gas enhanced explosives, etc.) and complex firing systems.

Obstacle Folders

The obstacle folder is normally only employed when time permits the consolidation of all pertinent information required to destroy a target. As a minimum, it will contain the following four parts:

- 1 Detailed target location.
- 1 Explosives and supporting equipment location.
- 1 Preparing and firing orders.
- 1 Demolition report.

Appropriate standardization agreements may govern the control of reserved targets and require additional information with the obstacle folders.

ENGINEERS AS INFANTRY

Engineer organizations have, throughout history, been required to fill the role of infantry as a secondary mission. The CEB is a well-armed and well-equipped organization capable of executing light infantry tasks in conjunction with other combat units. The only significant organizational deficiency is the lack of organic fire control personnel and communications equipment. Augmentation in this area would produce a credible and flexible light infantry organization.

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