Engineer

THE PROFESSIONAL BULLETIN FOR ARMY ENGINEERS

February 1998

The Grizzly

Headquarters, Department of the Army
PB 5-98-1 Approved for public release, distribution is unlimited

CLEAR THE WAY

By Major General Robert B. Flowers
Commandant, U.S. Army Engineer School

A recurring headline in the last few months has concerned an international effort to ban antipersonnel land mines [APLs]. After wading through the half-truths, emotional diatribe, and disparaging remarks made about our President, I want to set the record straight. I will address our policy, our nation's role in demining, and our current mine doctrine.

First our policy, which is very clear: U.S. forces do not use or train with nonself-destructing (NSD) APLs. The only exceptions to this policy are for the defense of Korea and to train demining teams.

Korea is a unique situation. The minefields along the demilitarized zone (DMZ) have helped maintain the peace for 44 years while South Korea has prospered. Poised just 25 miles from the capital of Seoul (the distance from Dallas to Fort Worth) is the vanguard of more than 1 million North Korean soldiers. This army, with more artillery than NATO, has vowed to reunite Korea by force. This is not a hypothetical situation; it is real and it is now. When occupied by the North Koreans in August 1950, thousands of civilians in Seoul vanished. Today, more than 11 million people live in Seoul. In an interview with the Dallas Morning News, published November 23, 1997, our President stated he would not put our military or any South Korean in jeopardy. He does not want one death occurring "...because of a decision I made that seemed compassionate and was popular at the moment and 8 or 9 or 10 years later looked like a terrible mistake."

The world must also consider the second-order effects of removing mines from Korea and how the North Koreans might easily misinterpret our actions. A clear indicator for the Germans of an impending Russian attack during World War II was a buildup of infantry, tanks, artillery, and aircraft and the removal of Russian minefields. North Korea rails against regularly scheduled military maneuvers in the south. What signal will North Korea—a desperate, starving country with an unpredictable government—receive as we compensate for the lack of mines by increasing all our forces in Korea? How will North Korea react if it misinterprets our good intentions for signs of an impending attack? We must leave our mines where they are protecting a fragile peace: harming no one, threatening no one.

Mr. Cornelio Somaruga, president of the International Committee of the Red Cross, stated after the signing of the APL Treaty in Ottawa that "The real victory will come only when all mines have been cleared from battlefields and farm fields." This is *exactly* the problem the world faces. Neither our mines in Korea nor our smart mines stored for combat are the problem. It is the indiscriminate use of APLs in countries such as Cambodia, Afghanistan, and Angola that the world needs to address. The United States leads the world in demining spending and in training deminers. This year we almost tripled our spending effort to nearly $80 million, and next year we will increase that amount to more than $100 million. Many nations have also joined us, including Canada and Norway, by pledging millions for demining.

During the December 2 CNN special program titled "Land Mines: Hidden Assassins," one very committed British deminer, who had been blinded and maimed while demining, commented, "The land-mine ban has not dealt with the problem [human suffering] and will not deal with the problem. The real problem...can only be addressed by clearance." Our Countermine Training Support Center at Fort Leonard Wood is training Special Forces teams to train deminers worldwide. Soon we will train Bosnian deminers in Missouri. Although some have chosen to chide our President for not signing the Ottawa treaty, I agree with the British deminer: Actions speak louder than words.

We have destroyed 2.3 million APLs and soon will destroy another 1 million. In reality, our situational obstacles, which use self-destructing/self-neutralizing mines, give the APL ban advocates exactly what they profess to want:

- They pose no residual threats to civilians.
- They normally are in storage and are used only during intense combat.
- They are not suited for use by guerrilla forces or terrorists.

Some claim that a mine is a mine and that any risk to civilians is unacceptable, but such statements show a basic misunderstanding of our mine doctrine. Self-destructing mines are used to delay and disrupt armored assaults to allow the enemy to be engaged by artillery, tanks, attack helicopters, antitank guided missiles, A-10s, and F-16s. During the four hours the mines are active, there won't be any civilians in this extremely intense environment.

Bottom line: The United States is clearly the world leader for demining activities, and our actions will contribute significantly to ridding the world of NSD mines. As Jan Egeland, the Norwegian Deputy Foreign Minister, recently stated, "In all the countries I have visited to observe the effects of the land-mine plague, I have never encountered an American mine." We are not the problem, but we have the solution.

The next big event at your Engineer Center is the ENFORCE Conference in April, and my staff is busy planning for it. We have reviewed last year's comment sheets and have made adjustments to both improve the conference and meet your needs. My next article will be dedicated to ENFORCE and the engineer vision.

Engineer

February 1998 | Headquarters, Department of the Army | *Volume 28 PB 5-98-1*

***Front Cover:** The Grizzly, shown here reducing a wire obstacle, will provide Army engineers with a digitized, situationally aware breaching platform. See article beginning on page 2.*

***Back Cover:** A severe storm on 19-22 June 1944 destroyed the floating pier at Omaha Beach. See article beginning on page 15.*

FEATURES

DEPARTMENTS

ENGINEER (ISSN 0046-1989O) is prepared quarterly by the U.S. Army Engineer School, 320 Engineer Loop, Suite 370, Fort Leonard Wood, MO 65473-8929. Second Class postage is paid at Fort Leonard Wood, MO, and additional mailing offices.

POSTMASTER: Send address changes to ENGINEER Magazine, 320 Engineer Loop, Suite 370, Fort Leonard Wood, MO 65473-8929.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to ENGINEER at the preceding address. Telephone: (573) 563-4104, DSN 676-4104. ENGINEER's e-mail address is: eubanksc@wood.army.mil. Our Internet home page is located at: http://www.wood.army.mil/ENGRMAG/emag_hp.htm.

DISCLAIMER: ENGINEER presents professional information designed to keep U.S. military and civilian engineers informed of current and emerging developments within their areas of expertise for the purpose of enhancing their professional development. Views expressed are those of the author and not those of the Department of Defense or its elements. The contents do not necessarily reflect official U.S. Army positions and do not change or supersede information in other U.S. Army publications. Use of news items constitutes neither affirmation of their accuracy nor product endorsement. ENGINEER reserves the right to edit material.

OFFICIAL DISTRIBUTION is targeted to all engineer and engineer-related units.

PERSONAL SUBSCRIPTIONS are available by contacting the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7950. Address changes for personal subscriptions should also be sent to the Superintendent of Documents.

The Grizzly and its companion, the Wolverine heavy assault bridge, will provide engineers digitized, situationally aware breaching platforms. The Engineer School will host a warfighting seminar on 3-4 March 1998 to explore doctrine for digitized breaching operations. A breakout session is planned during the ENFORCE Conference in April to continue the dialogue.

The Grizzly: Mobility Support for Force XXI

By Lieutenant Colonel Donald P. Kotchman, Wesley I. Glasgow, and Lieutenant Colonel Harry Greene

"The capability to rapidly breach obstacles has evidenced almost no improvement since World War II. Techniques in use are conceptually the same as those used in the 1940s."

Headquarters, U.S. Department of the Army,
After Action Report for Operation Desert Storm, 1991

Changes are on the horizon. With the fielding of the Grizzly in FY 2004, the U.S. Army will have a survivable, mobile, complex-obstacle-reduction system. These capabilities do not exist in any army today and respond to a growing threat.

The Challenge

As we look to the 21st century and Force XXI operations, our Army expects to have a technological advantage in information and weapons over any potential adversary. To counter our advantages, adversaries will attempt to use asymmetric threats, such as obstacles, which cost little but provide them great benefits.

Obstacles are expected at all levels of conflict, and obstacle technology is improving and proliferating. Rapid ditching machines; artillery-, rocket-, and air-delivered mines; and ground minelayers are available on world markets. They allow our adversaries to rapidly emplace complex obstacles, giving friendly forces little or no warning of their existence. Mine fuzings for hand-emplaced and scatterable mines are moving toward greater sophistication and lethality that overmatch our current reduction assets. A low-cost fuze upgrade to a World War II-era mine (millions of which are available around the world) transforms a simple, pressure-fuzed mine into a full-width, multisensor mine capable of killing our $6 million tanks. We can expect an increase in enemy countermobility operations as a counter to our superiority in information and weapons technology.

"Breaching a complex obstacle covered by enemy fire is the toughest attack mission a unit can get."

General Frederick Franks Jr. (Retired)
Commander, VII Corps
Operation Desert Storm

Preparation for breaching operations traditionally includes the following requirements:

- Extensive intelligence.
- Sophisticated preparation of reduction assets brought forward from "one terrain feature back."
- Extensive rehearsals (days, weeks, or even months).
- Massive combat and support preparation.

The complex nature of these requirements necessitates deliberate breaches for all but the most simple obstacles, with a corresponding loss of tempo.

Executing a breach is difficult today due to the large number of vehicles involved and the synchronization required for success. For example, approximately 30 percent of the tank assets in the combined arms battalions of Force XXI will be dedicated to carrying rollers and plows to support breaches. The smaller, more agile units of Force XXI will use information to dominate maneuver. The ability of potential adversaries to rapidly emplace increasingly destructive and effective minefields and complex obstacles mandates new ways to execute breaches to enable dominant maneuver.

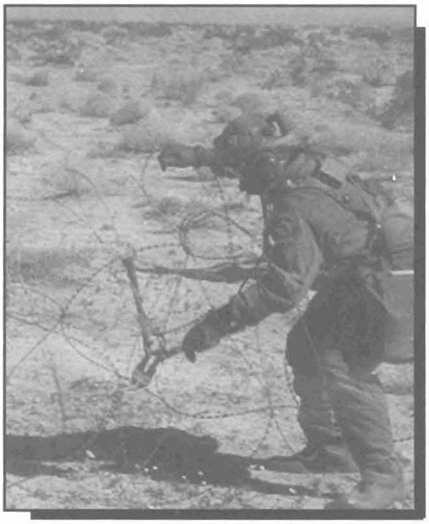
Operational Advantage

Today's methods of defeating complex obstacles require a complex operation involving several types of specialized equipment, none of which offer the versatility, mobility, or survivability of the Grizzly. Using

Why Grizzly?

"Got to get a mechanical breach to maintain the tempo on the battlefield...Got to get the soldiers out of harm's way. Grizzly...need it quickly."

MG Paul Kern, CG, 41D (M) (EXFOR), 2 May 1997



Today

Tomorrow

Figure 1

current systems, the task force commander and engineer must orchestrate a variety of reduction assets to conduct breaches. Since each complex obstacle is unique, each breach requires employment of the various assets in a different order, effectively preventing the use of battle drills, complicating task organization, and mandating the requirement for lengthy reconnaissance and rehearsals.

Consider a complex obstacle consisting of wire, minefields, and antitank ditches. After completing the preamble to the breach (reconnaissance, planning, assembly of equipment, etc.), the breach begins with removing the wire, typically accomplished by soldiers using wire cutters, bangalore torpedoes, or an M58 mine-clearing line charge (MICLIC). Their efforts may be complicated by antipersonnel mines and fires. After the soldiers create a lane in the wire, they fire a series of MICLICs into the minefield. The number of MICLICs needed depends on the linear depth of the minefield. When the first MICLIC is fired, the breach site is immediately visible to the enemy. After each MICLIC is fired, the lane must be proofed, typically with a mine roller or plow mounted on an M1 tank. Using current allocation rules and the decreased size of the Force XXI combined arms battalion, 30 percent of the combat vehicles are required to push either rollers or plows. The resulting lane is cleared only along the width of the M1 tank tracks, requiring that additional passes or sappers improve the lane for follow-on forces.

The presence of antitank ditches adds complications since neither tanks equipped with battalion countermine sets nor MICLICs are effective against this obstacle. Either an armored combat earthmover (ACE) or an armored vehicle-launched bridge (AVLB) (Wolverine in the future) must be brought to the lane to breach the ditch. Both the ACE and the AVLB lack the Grizzly's survivability. If more mines are encountered beyond the ditch, additional assets are required to continue the breach. The assault force will be very vulnerable to counterattack until sufficient lanes are created to push additional combat power through the breach. In summary, breaching operations currently require a high degree of coordination, skill, and training on the part of the soldiers attempting to accomplish the mission (Figure 1).

This situation is complicated by emerging full-width, multisensor mine fuzings designed to defeat our current reduction assets. The Grizzly will more easily and rapidly defeat this threat and provide an integrated breach system.

The Solution

The Grizzly promises to greatly improve the effectiveness of our maneuver forces. Under development as a variant of the proven M1 Abrams main battle tank, the Grizzly takes advantage of the M1's mobility and survivability features. With these capabilities, it can maintain the operating tempo of the Bradley- and Abrams-equipped Force XXI combined arms battalions. The Grizzly's integrated system has the capability to reduce all parts of typical obstacles (mines, wire, ditches, rubble, and log obstacles), providing responsive support to the force. The Grizzly incorporates both countermine and counterobstacle capabilities into a single survivable system that, in one pass, creates a lane trafficable

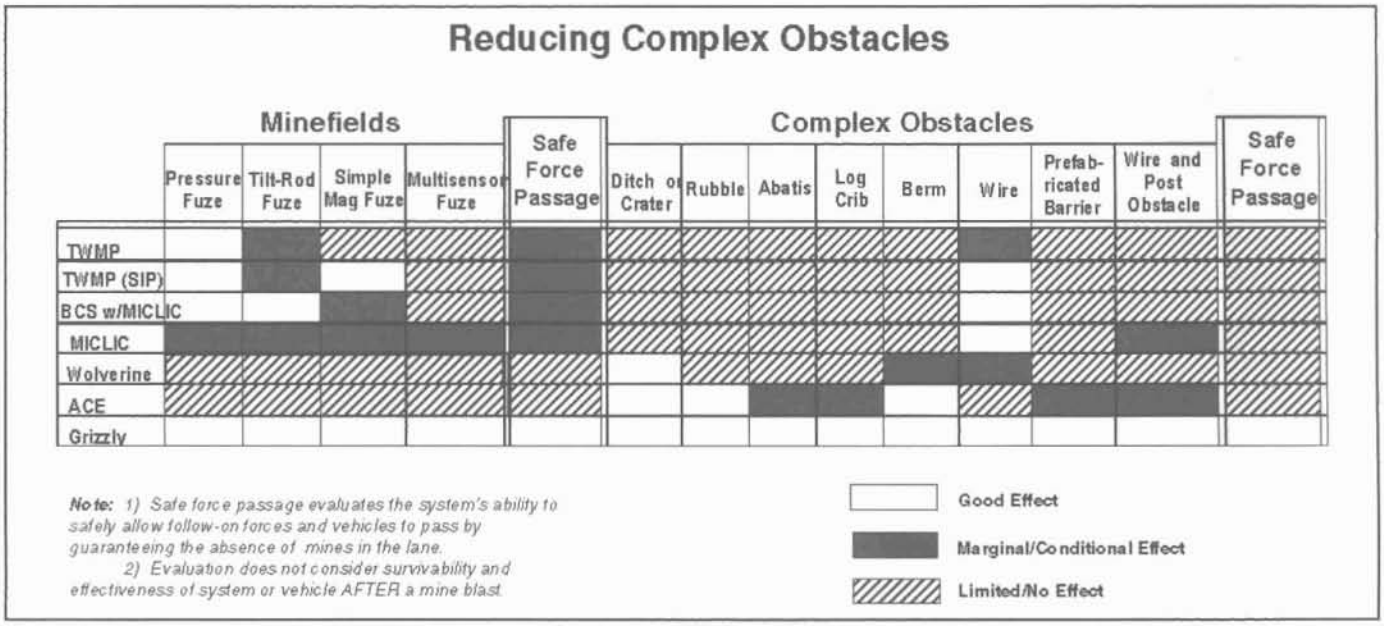


Figure 2

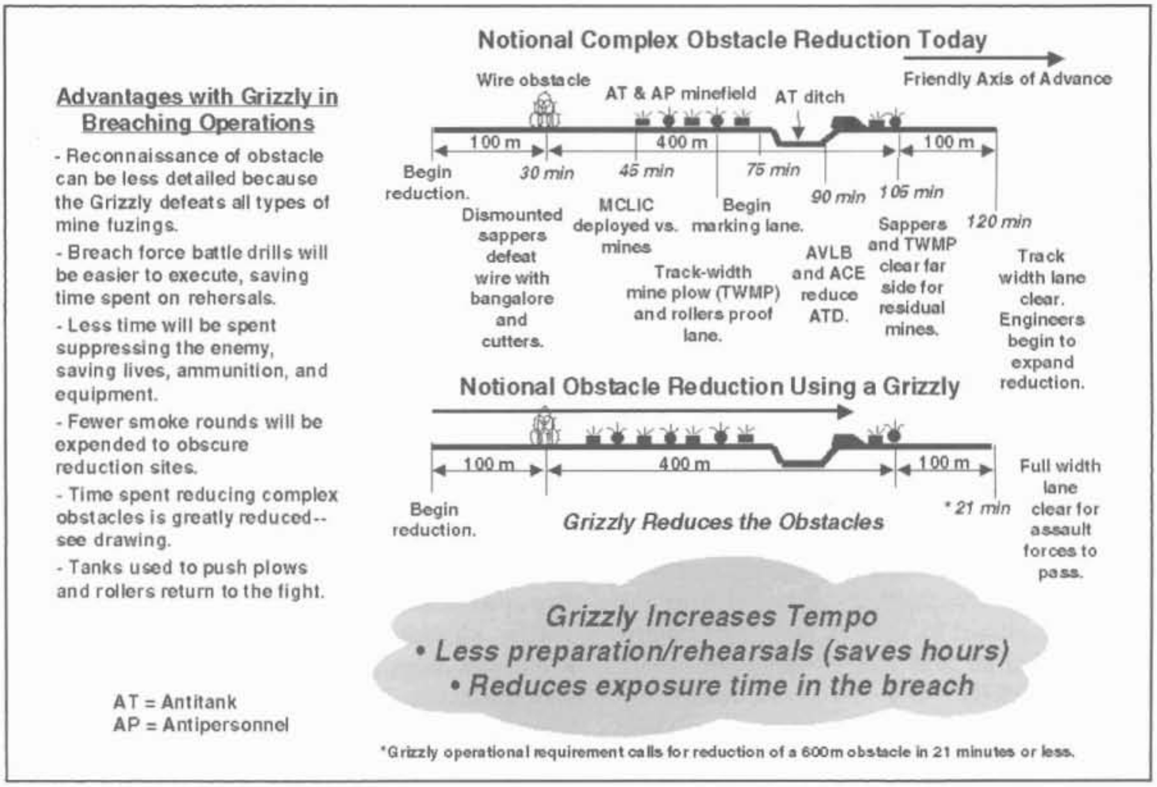


Figure 3

by the entire maneuver force. Figure 2 compares the breach capability of current equipment with the Grizzly. Only the Grizzly is effective across the full spectrum of the threat.

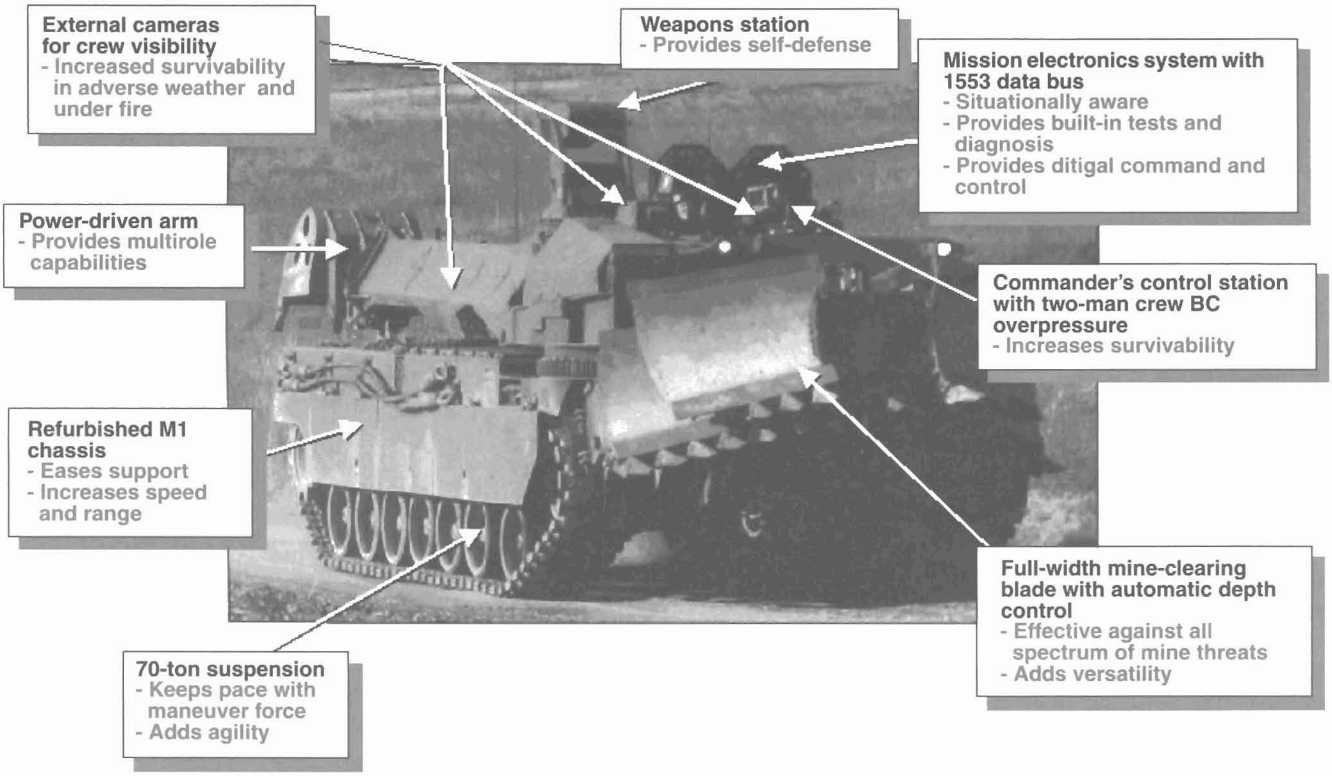
Contrast the previous situation with the same breach conducted by a Grizzly-equipped force. The Grizzly is capable of breaching wire, mines, and ditches; thus, battle drills for the breach are possible. Battle drills eliminate the orchestration of obstacle reduction and ease the battle command challenge. The task force commander can concentrate on suppressing, obscuring, and securing the breach site, leaving obstacle reduction to the engineer and his Grizzly. A Grizzly crew of two can complete a breach that currently requires numerous soldiers in less survivable systems, and the Grizzly allows tanks to fight rather than breach. Perhaps most importantly, the additional tempo provided by the Grizzly allows the assault force to pass combat power sooner than is possible today.

The presence of a rapidly employed, complex obstacle system may be decisive in a battle if it permits adversaries to slow the tempo of our forces. Employing the Grizzly with maneuver task forces allows them to rapidly react to aerial- or artillery-delivered scatterable mines, point obstacles at chokepoints, mechanically emplaced mines, or a combination of these. The Grizzly enables friendly forces to dominate maneuver and strike before the enemy can effectively react. Figure 3 illustrates some of the differences the Grizzly can make to the maneuver force during a breaching operation.

Grizzly Design Characteristics

The Grizzly is a leap ahead in both capabilities provided to the force and in combat vehicle systems. It is a full-tracked, heavily protected vehicle that integrates the following M1 chassis technologies, modernized standard Army components, and Grizzly-unique mission modules:

- M1 chassis with an NBC overpressure system and advanced track and suspension components.
- Standard Army components include the weapons system, digital command and control communications systems, and a wide variety of other standard combat vehicle components, which are integrated in the Grizzly system through an aggressive technology-insertion initiative. This technology-insertion program will ensure the Grizzly remains interoperable with the Bradley and Abrams fleet.
- Grizzly-unique components include a mine-clearing blade with automatic depth control, drive-by-wire operations, a power-driven arm for obstacle reduction and lift, a remotely controlled weapon station, a commander's control station for the organic two-person crew, and a sophisticated vision system for operating the Grizzly "closed hatch."



Key Features

Key to the Grizzly's success is an automatic depth-control system that enables the blade to move at a consistent depth regardless of terrain conditions. This system detects changes in terrain contours and automatically directs hydraulic controllers to adjust blade height, pitch, and roll (angle). Unlike a bulldozer, which provides a final planar surface regardless of the ground contour, the Grizzly blade maintains a constant plow depth while following an undulating surface. The primary system consists of tactile sensor units, which "feel" the surface of the ground. A backup depth-control system is provided by a series of strain gages that measure shear forces on the blade and adjust the depth to maintain a constant force. Manual controls in the crew station provide additional redundancy for depth control. Research continues on sensing technologies for future product improvements.

The mine blade provides a tremendous improvement over the existing mine plow. It is designed to survive mine blasts and retract for road travel while not significantly degrading the mobility of the M1 chassis. The blade incorporates a series of tines (see photo above) that uplift mines onto the dirt spoil moving in front of the blade. The mines are then rolled to the side and deposited with soil astride the cleared lane as the vehicle moves forward. Blade action helps preclude

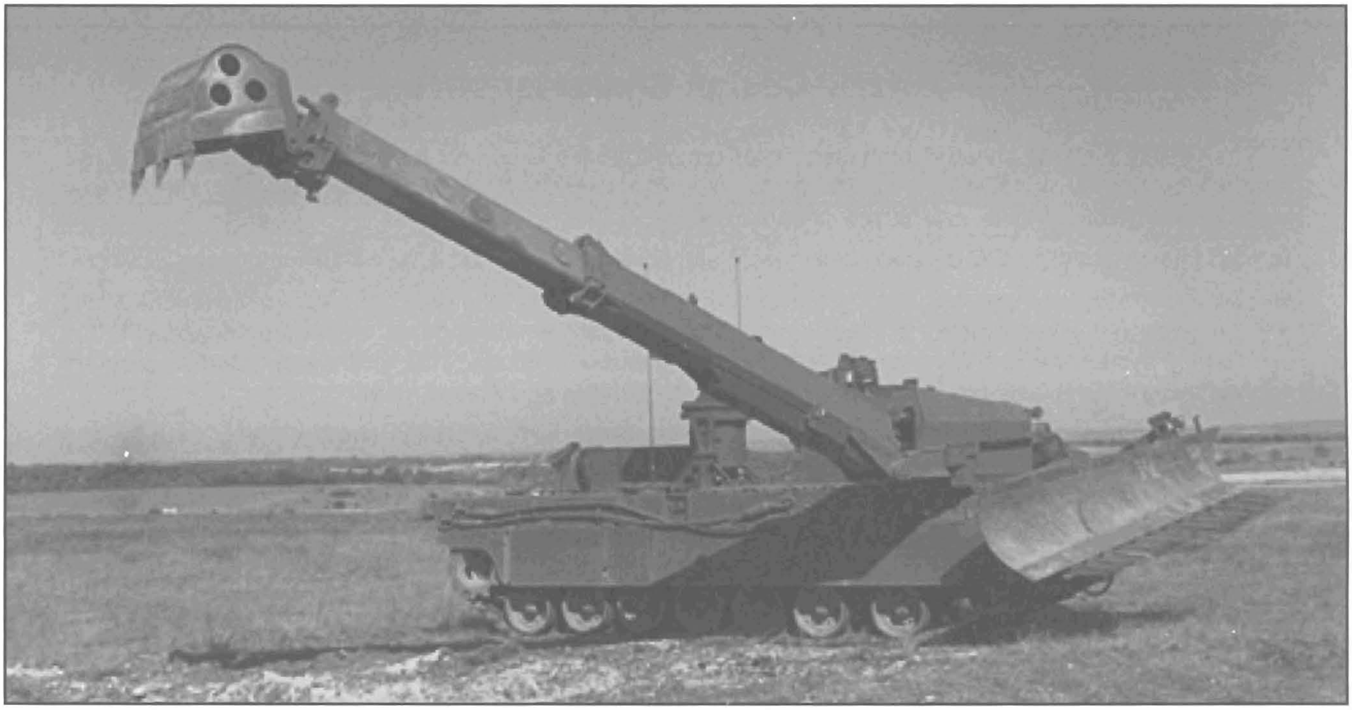


Figure 4. The power-driven arm on the Grizzly provides lifting, grappling, and dirt-moving capabilities to breaches. The arm and the blade work together to enable the crew to reduce tank ditches and log cribs and move rubble.

detonation of pressure-fused mines. The Grizzly blade is also effective against the full spectrum of the the mine threat. Perhaps most importantly, the Grizzly clears the full width of the lane, in contrast to the track-width clearance available today.

A power-driven arm (Figure 4) on the Grizzly is adapted from commercial construction equipment. It provides lifting, grappling, and dirt-moving capabilities to breaches. Working together, the arm and the blade enable the crew to reduce tank ditches and log cribs and move rubble.

The Grizzly is designed for under-armor operations, which require external cameras to permit day, night, and all-weather operations. In addition, the Grizzly will be fully integrated into the Force XXI digital information system using the Force XXI Battle Command, Brigade and Below (FBCB2) software. The Grizzly will be the first drive-by-wire (computer-controlled) vehicle in the Army inventory.

Program Status

United Defense Limited Partnership is under contract to mature existing prototype vehicles for government evaluation and testing before the low-rate initial production decision, which is scheduled for the spring of FY 2000. Testing will include operational tests with soldiers, technical testing, and live-fire tests (including mine-blast tests). A total buy of 366 vehicles is planned, with fielding to heavy division and corps (mechanized) engineer battalions scheduled to begin in FY 2004.

Prospects

The Force XXI Army promises to possess an information advantage over our adversaries. Effective mobility support is essential to exploit this advantage. The Grizzly provides a revolutionary capability to the force—the ability to defeat complex obstacles while maintaining the pace and momentum of the attack. The Grizzly is essential for our Army to meet the Force XXI objectives to dominate maneuver and win the information war.

Lieutenant Colonel Kotchman, an ordnance officer with more than 18 years of service, is product manager for the Grizzly program at the Detroit Arsenal, Warren, Michigan. He is a graduate of the U.S. Military Academy and holds a master's degree from Rensselaer Polytechnic Institute, Troy, New York.

Mr. Glasgow is a military equipment analyst and technical writer with Camber Corporation, in Warren, Michigan. A former U.S. Army officer, he trained as a research, development, and acquisition specialist with assignments as an operational tester at Fort Sill and materiel developer at the U.S. Army Tank-Automotive and Armaments Command, Warren, Michigan.

Lieutenant Colonel Greene is Division Chief, TRADOC Systems Manager, Engineer Combat Systems, U.S. Army Engineer School, Fort Leonard Wood, Missouri. He is an engineer officer in the Army Acquisition Corps and a registered professional engineer. LTC Greene holds a doctorate from the University of Southern California.

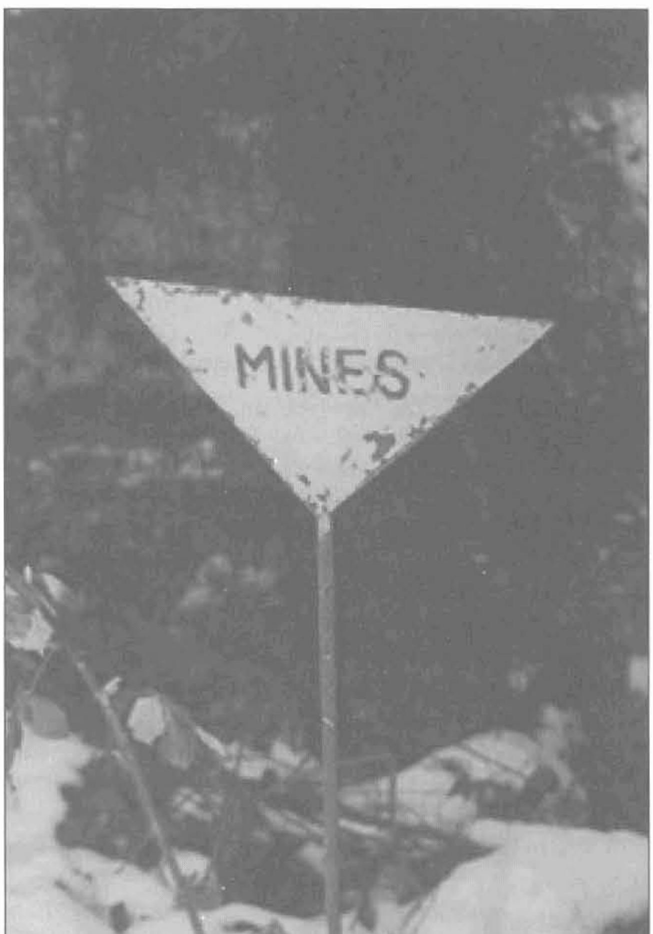
GRIZZLY

BE AWARE

MINES DON'T CARE

Promoting Effective Countermine Operations in Bosnia-Herzegovina

By Lieutenant Colonel Christopher J. Toomey and Major John Q. Killip



Mines continue to be a major threat to reconstruction in Bosnia-Herzegovina.

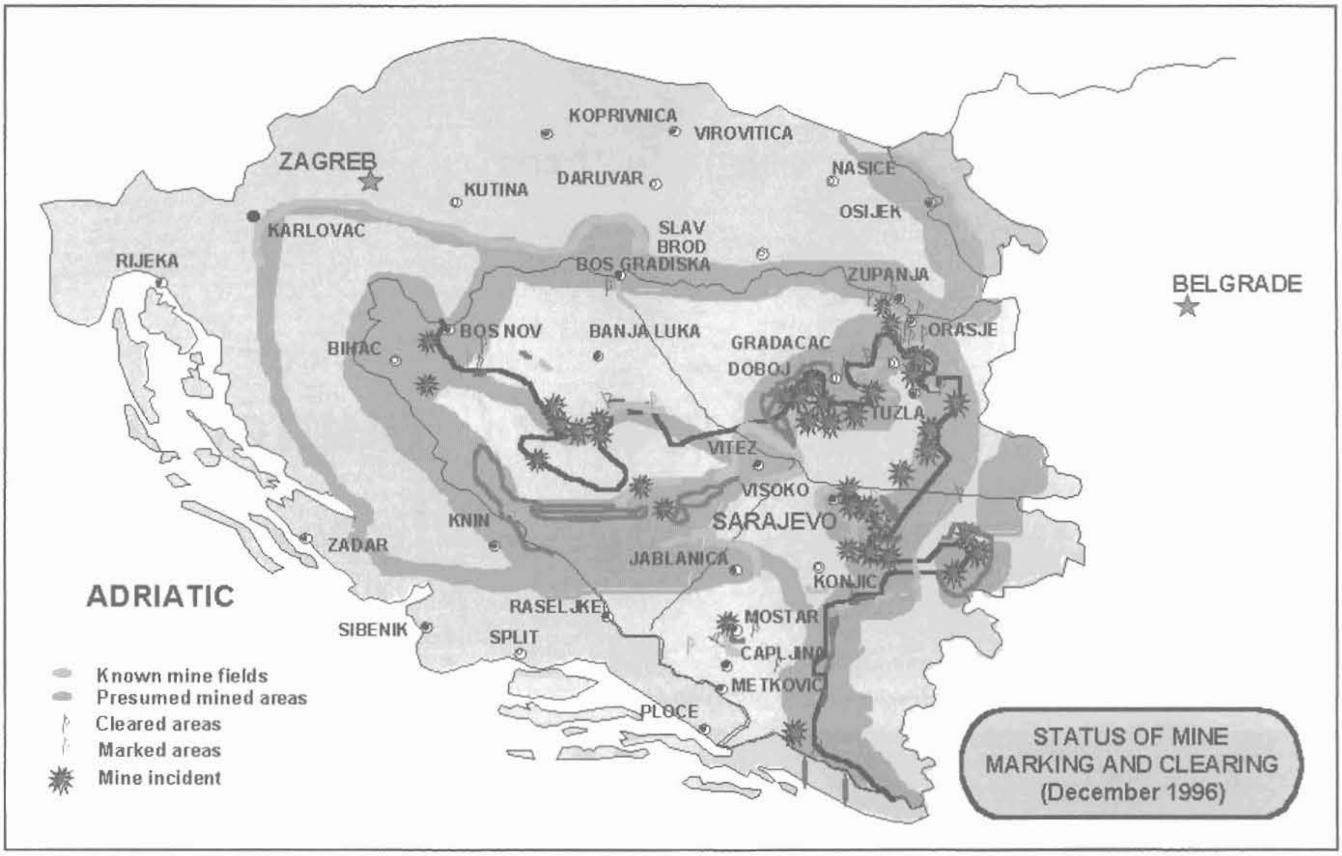
With an estimated 3 to 6 million mines and pieces of unexploded ordnance (UXO) left on the ground, the pervasive mine threat in Bosnia-Herzegovina continues to be a major obstacle to achieving lasting stability and furthering reconstruction efforts in the country. Mined areas include many roads, bridge sites, and industrial complexes, as well as nearly 22 percent of cultivable land. There are about 150 mines per square mile. Plans for every project to rebuild a bridge, grade a road, or repair a building must consider costly and time-consuming mine surveys and clearance operations.

Key to Stability

Within this environment, NATO's Stabilization Force (SFOR) has the mission to ensure peace and stability. From the start, the SFOR recognized that the mine threat had to be reduced to ensure the safety of the population and NATO forces and to encourage the international community's long-term support for reconstruction.

A fair amount of interest and investment exists in Bosnia for removing mines (referred to as *demining*). Among the organizations with a role in promoting countermine operations are the United Nations Mine Action Center (UNMAC), the SFOR (which works through the Chief, Combined Joint Engineer (CJENGR), Entity Armies (EA), governmental agencies, and nongovernmental agencies. Because the country lacks centralized direction and a national demining policy, the actions of these organizations often are uncoordinated and nonsupporting.

This article focuses on efforts of the SFOR CJENGR to develop and shape humanitarian demining programs in



Bosnia. The intent of these programs is to systematically reduce the mine threat, promote stability, and foster economic regeneration. We will outline the development of a theater-wide strategy to promote effective demining within the framework of peace support operations.

Terminology

Far from being a trivial exercise in semantics, the myriad of terms used to discuss mine-removal operations in Bosnia requires clear understanding. One of the CJENGR's first jobs was to work with the various participants and establish consistent terminology. The United States distinguishes between countermine operations (military breaching and mine-clearance activities in support of a mission) and humanitarian demining (the removal of mines as an end in itself). This distinction is not universally accepted within the theater's international community. Some key terms used in theater follow:

- ***Mine lifting.*** The removal of specific mines, as shown on a minefield record. It is not the systematic inspection of each piece of ground; it is the removal of known mines from a record. This technique often leaves unrecorded mines and UXO on the ground.

- ***Mine clearing.*** The systematic checking of each portion of ground to a particular standard. Most organizations in theater use a mix of manual and mechanical techniques, including probing, to conduct clearing operations.

- ***Humanitarian demining.*** A clearing standard that removes 99.6 percent of existing mines. In practice, mine-clearance techniques are discussed in terms of the "ability to produce a humanitarian standard." Probing at 10 cm^2 intervals can theoretically produce this result. The standard originated with the UNMAC, which has used similar standards in other parts of the world.

The Demining Community

Several groups are involved in demining activities throughout Bosnia.

Stabilization Force

Across the theater, the SFOR (primarily combat engineers) removes mines using military techniques. Because mine removal is a risky operation, the SFOR developed a rather conservative policy that reflects their force-protection concerns. Demining by the SFOR takes place only when it—

- Supports freedom of movement or training the SFOR (e.g., it is in the interest of the force).
- Is approved by the nation executing the mission.
- Is approved by the SFOR commander.

Entity Armies

According to the Dayton Accords, the three EA (also known as the Former Warring Factions) are responsible for ensuring the timely marking and removal of mines and UXO in the country. Until spring 1997, this effort was lackluster for several reasons:

Humanitarian demining requires painstaking and careful probing.

- ***Incomplete information.*** A 1996 study by United Kingdom Royal Engineers operating in Bosnia's Multinational Division Southwest indicated there was a less than 60-percent correlation between minefield records and mines on the ground. Since mines were employed by all forces at all levels (from well-trained, corps-level engineers who produced detailed, highly accurate records to embattled infantry platoons with "back-of-the-envelope" diagrams), a wide disparity exists in the accuracy and clarity of reports. Many minefields never were recorded or marked.

- ***Lack of training.*** Due to post-hostility demobilization, the EA lost much demining expertise and mine-clearing equipment.

- ***Lack of will.*** Although never explicitly stated, a lack of willpower on the part of the EA to conduct mine-removal operations is evident—particularly in certain areas. It is clear that some mined areas are still considered viable for use in the event hostilities recommence. Thus, targeting specific areas for EA demining activities meets with resistance.

According to the Dayton Accords, the EA will record, mark, and lift minefields. These actions are monitored by the SFOR. Monitoring involves verifying that EA forces remove the density (number) of mines shown on minefield records or the number of mines the EA claim are in a minefield.

United Nations Mine Action Center

The United Nations has charged the UNMAC to coordinate the efforts of all civilian demining activities in Bosnia. Staffed by civilians with a wealth of demining experience, the UNMAC does not physically take out mines. Instead, the UNMAC performs the following functions:

- ***Maintain minefield information.*** The UNMAC maintains the minefield database, which lists all known and suspected mined locations.

- ***Certify demining companies and teams.*** A major task is to review the training documentation and techniques used by demining organizations and certify their competency. The UNMAC gives demining organizations a "seal of approval" but does not take responsibility for their demining actions.

- ***Synchronize demining activities.*** The UNMAC attempts to synchronize the activities of various demining organizations within the country to ensure that the "right" areas are addressed at the right time.

International and Nongovernmental Organizations

Numerous agencies and groups, including commercial deminers, are involved in mine-removal operations in the region. They profit from the extensive demining requirements associated with reconstruction. Normally led by experienced personnel from outside Bosnia, these organizations employ civilians and former soldiers of the EA. The UNMAC certifies the techniques used by private companies hired by both local governments and other agencies, such as the U.S. Agency for International Development (USAID). Some agencies, such as USAID, routinely budget the cost of hiring deminers in their projects.

In addition to the commercial demining companies, some U.N.-certified volunteer organizations come to Bosnia to contribute to the demining effort.

Obstacles to Success

Initially, the mine-removal community did not agree to accept a specific standard. The UNMAC focused on endorsing clearance to a humanitarian standard (99.6 percent). The EA originally conducted only mine-lifting operations because that was the extent of their capabilities. As far as the UNMAC was concerned, the EA did not conduct any recognizable humanitarian demining operations. Although the EA removed mines from minefield records, the UNMAC believed that mined areas must be cleared to a humanitarian standard in order to be considered "safe." In practice, the UNMAC position nullified the clearance activities of the EA and fostered a lack of confidence in mine lifting as a viable method for clearing well-recorded minefields.

Reliable data concerning the location, composition, and extent of minefields in Bosnia are lacking. Even though the EA are charged to turn over all minefield and UXO records, many of the minefields are either unrecorded or the records are not released. Many of the records turned over to the SFOR and the UNMAC are inaccurate and incomplete, and record management is a continuing problem. At the start of

1997, minefield records were kept at the Multinational Divisional level, the SFOR level, and with the UNMAC. In addition, several independent databases were kept by other organizations, such as the World Bank.

Early in 1997, uncoordinated efforts resulted in discrete mine-removal activity, but there was no systematic approach to clearing areas tied to reconstruction or the priorities of other lead organizations, such as the United Nations High Commission for Refugees and the Organizations for Security and Cooperation in Europe.

SFOR Campaign to Promote Effective Demining

Ultimate responsibility for formulating and continuing an effective humanitarian demining program is not an SFOR responsibility. The civilian leadership—both U.N. and national authorities—are ultimately responsible for the success of an effective countermine program. However, the climate in late 1996 and early 1997 was such that SFOR determined it *had* to take the lead in jump starting a country-wide demining program.

When developing a campaign plan, the CJENGR determined that a major goal of the campaign must be to promote effective demining activities. To accomplish this goal, the CJENGR established several initial objectives:

- Develop the EA humanitarian demining capabilities.
- Foster mine-awareness programs.
- Synchronize demining activities.
- Strengthen the position of the UNMAC as the leader in demining activities.
- Encourage greater participation by international organizations.

Developing Entity Army Capabilities

For various reasons, EA demining activity was at a virtual halt by December 1996. Not only were the EA not conducting viable mine-removal activities, they did not possess valid plans to begin mine-removal operations. Therefore, the CJENGR took several steps to re-energize the EA:

- ***Link mine-removal activity to movement and training.*** The commander of SFOR has authority to take actions necessary to ensure EA compliance with the military provisions of the Dayton Accords, including the requirement to conduct demining. A major step was to firmly link EA privileges—notably their ability to train and move their forces—to evidence of demining activities. This step provided excellent motivation for the EA to initiate demining activities.
- ***Make the policy concrete.*** The EA and subordinate multinational divisions were unclear as to what constituted successful demining activities. The CJENGR clarified demining policies and spelled out concrete objectives and requirements in the COMSFOR-endorsed *Instructions to Parties*. A companion document, not given to the EA, is Campaign Directive 21, *Countermine Operations*, which provides additional guidance on administering activities to monitor demining.
- ***Review EA plans.*** The EA were required to produce detailed plans outlining how and where their mine-removal assets would be used. The CJENGR took the ini-

The damaged Lipovac railroad bridge was demined by the Entity Armies in the summer of 1997 and repaired by USAID later that fall.

tiative to recommend adjustments to the plans to ensure an adequate pace and priority of demining. In addition, emphasis was placed on demining areas targeted for reconstruction.

- ***Support bilateral initiatives for equipment and training.*** Several bilateral initiatives emerged, notably one initiated by the U.S. Department of State's Demining Commission (USDC). The USDC sponsored countermine training for about 450 EA soldiers that focused on clearing mines to a humanitarian standard (vice mine lifting). The CJENGR recognized this training as a great opportunity and developed strict requirements for compliance.
- ***Promote certification through the UNMAC.*** One problem with EA mine-removal operations was the lack of recognition they received as credible deminers. With the enhanced training provided by USDC, the CJENGR and UNMAC worked to gain recognition for EA mine-clearing activities.

Fostering Mine Awareness

To foster mine awareness, the CJENGR supported the SFOR's information campaign to make the local population cognizant of the mine threat. The campaign focused on developing posters and making radio broadcasts to describe the mine threat.

The information campaign on mine awareness was also directed at the international community to encourage support for demining and reconstruction activities. A major initiative was to develop brochures outlining current successes and shortcomings. These brochures were distributed at a World Bank donors' conference and other meetings.

The CJENGR established a training team to enhance mine awareness among the SFOR and local organizations. The team consists of several highly trained mine experts, who are available to conduct briefings and training on mine awareness.

Synchronizing Efforts

The CJENGR chaired a series of meetings throughout the spring of 1997 with the UNMAC, the United Nations High Commission for Refugees, the World Bank, and other interested parties. Dialogue at these meetings tied demining activities to reconstruction efforts, proposed refugee-return programs, and supported pending municipal elections in various sectors. The goal was to ensure that demining occurred in high-payoff areas.

During these meetings, the role of the EA evolved within the total mine-clearance scheme. Although the UNMAC refused to recognize the EA capability as viable to achieving a humanitarian standard (even with the USDC-sponsored training), the UNMAC agreed to incorporate EA mine removal in their overall assessment of mined and cleared areas. Additionally, the UNMAC recognized that EA mine removal at any level was preferable to no action and supported using the EA to lift and clear high-density minefields.

Promoting the UNMAC

It is important for the UNMAC to be the recognized leader in the long-term mine-removal program in Bosnia for several reasons. First, the UNMAC is charged with this role by both the United Nations and the London Agreement of January 1997. The London Agreement specifies the UNMAC as the lead agency in orchestrating mine-removal operations throughout the country until the Bosnian Commission on Demining is established. Second, as a prime agent of the United Nations, the UNMAC must have the confidence of the international community. Also, because the SFOR's charter is limited, that agency should not be the demonstrative leader in the long-term, mine-removal program.

Promoting the UNMAC took two forms. First was the consolidation of mine databases. As late as December 1996, the SFOR and the UNMAC maintained separate databases of information on mined areas. Most of the information in the SFOR database came from the EA through subordinate units, while the UNMAC received its data through civilian agencies. After publicly proclaiming the UNMAC as the lead agency, the SFOR reformatted its database to ensure compatibility with the UNMAC's database and transferred all information to it. To ensure a smooth transition, the CJENGR established a liaison cell at the UNMAC to assist in data collection and transfer. By March 1997, the data transfer was complete and the UNMAC, assisted by the SFOR cell, was in the lead.

The second form of promoting the UNMAC was to create situations where that organization could demonstrate its leadership, such as at countermine working groups. Whenever possible, the CJENGR supported and promoted these meetings. While they did not always produce concrete results, the meetings served to maintain dialogue within the demining community.

Encouraging Support from International Organizations

The long-term success of mine-removal operations in Bosnia hinges on the commitment of the international community to resource the effort. Through loans for either humanitarian demining or as part of reconstruction projects, the eventual clearing of most land mines will happen only if the international community establishes an indigenous, sustainable program.

The CJENGR seeks ways to encourage support. One way is through direct contact with organizations working in Bosnia, such as the World Bank. For example, the CJENGR asked the World Bank to provide loans to support additional dog mine-survey teams to increase the tempo of clearance verification. A practical problem with this sort of funding is that it requires loans to the Bosnian government, making it necessary to convince Bosnian leaders to accept the loans. (This problem is also prevalent in many construction loans, but that's another article.)

Examples of the numerous mines and UXO that litter the Bosnian countryside.

Development of a viable information campaign that targets the international community is instrumental in garnering support. By working with the SFOR's information campaign, the CJENGR produced pamphlets and flyers to alert the international community of mine-removal successes and to solicit assistance.

A Success Story

The SFOR's efforts improved the overall mine situation in Bosnia. An example is EA demining at the Lipovac and Kalavac bridges along the Tuzla-Brcko Railway.

A major initiative in the region was to re-establish a viable commercial rail system. Among the sections of rail line targeted for reconstruction was the section between Tuzla and Brcko, which would link with rail systems in Croatia and Hungary. Funded by USAID, the construction involved local contractors and NATO troops. Two bridges along the line at Lipovac and Kalavac were critical. These bridges had been severely damaged during the war and were heavily mined. To reduce the cost to USAID, SFOR decided to pursue demining using EA soldiers trained by the USDC. Direct coordination with contractors executing the construction established that this plan was acceptable, and the area was demined.

This example illustrates the relative success of the SFOR CJENGR initiatives. With increased training and multi-agency coordination, the EA conducted humanitarian mine clearance in direct support of civil reconstruction. The initiative could not have occurred several months earlier.

An Uncertain Future

Humanitarian demining in Bosnia-Herzegovina is not nearly as effective as it could be, despite the outstanding efforts of the SFOR and other agencies. Although the CJENGR's efforts were positive, mine-clearance operations will be ongoing for many years and will be successful only if the international community continues to provide funding. Mine clearance is very expensive, both in terms of training and contracting. Costs can be minimized by targeting areas that yield the greatest benefit for reconstruction. Nonetheless, it will take countless millions of dollars and years of effort through a sustained program to make mine clearance a success.

More importantly, government leaders in Bosnia-Herzegovina must actively support mine clearance. They must turn over minefield records, actively pursue mine removal by the EA, and prove to the international community that they are committed to removing the mines. In short, they must make the country safe for its own people.

Lieutenant Colonel Toomey, U.S. Army Corps of Engineers, recently served as the SFOR's Chief, Engineer Plans. A 1981 graduate of the U.S. Military Academy, he is currently serving in NATO's Land Forces Central Europe.

Major Killip, Royal Engineer, United Kingdom Army, served as the SFOR's Engineer Intelligence Officer. He is a 1986 graduate of the Royal Military Academy, Sandhurst.

30 Years Held in Reserve:

Nothing's Easy, but the Team Can Do It!

This article could be a historical review, but I want it to be a glimpse toward the future. My experiences of the past 30 years are used to examine how we might consider moving into the 21st century. In particular, I will focus on the need for team-building communication that informs, seeks continuous feedback to improve team accomplishments, and trains the force.

Inform

We were moving through the pine-forested mountains of northeastern New Mexico in early August 1967. I was beginning my enlisted service with a military unit—this was my first drill. Uniforms and equipment would not be issued to me until I started basic training at Fort Bliss, Texas, in September. I remember feeling like the odd man out, because I was not in uniform. No one had informed me that we were going to the field, so I was dressed in casual clothes and wore slip-on loafers. We were in the mountains to complete a compass-orienteering course set up by the unit's noncommissioned officers. My teammate and I, along with the other teams, successfully completed the course.

Overall the day had gone well, even though I had slipped and slid over the rough terrain, but the day was not over. Riding down the Rocky Mountains in the back of an uncovered 2 1/2-ton truck, we rode most of the way back to the armory unprotected in a midsummer downpour of cold rain. The other soldiers had ponchos, but the new private did not. No one offered to assist me. My impression was that teamwork was reserved for military operations, not for personal problems or new recruits.

Now, 30 years later, I can recall this incident with a little humor. But let's look into the future. How many of today's service members consider themselves to be uninformed members of a military team or only part-time team members? How many service members find themselves without the information and communications they need to remain true "team members" in times of personal crisis? I am speaking of job-related as well as personal crises. Some units find it easier to replace an individual than to determine a team solution that will move a team member and the team beyond a crisis.

We don't know what crises may face those who will serve our country in the years ahead, but one we can foresee is that of unnecessary stress. Most people agree that some stress is beneficial, because it can build character. Unnecessary stress, however, such as that resulting from a failure to communicate effectively, harms the very team cohesiveness we seek to build. Informing, seeking continuous feedback, and training go a long way toward reducing the magnitude of a crisis.

Let's return to the introductory vignette, where I am dressed inappropriately in a field setting and in a summer rainstorm, and look for lessons that will apply to future teams. My circumstances could have been alleviated easily if the weekend's planned events had been passed to me. With proper information, responsibility of how to dress would have been mine. The team could not be faulted had I been informed. So one major way to relieve undue stress is simply to ensure that everyone on the team gets the word.

Seek Feedback

In these high-tech days of phones, faxes, e-mail, Internet, intranets, video teleconferencing, etc., there are many ways to get the word out. What is equally crucial, though, is obtaining feedback to check the clarity

By Lieutenant Colonel Richard Reid

of the message sent. The future of military operations looks bright with regard to our ability to broadcast messages. I feel our leadership needs to focus on ensuring that every message (be it information or formal training) has an interactive piece. In my case, a short phone call from an assigned enlisted sponsor would have alerted me of the weekend events in the mountains and provided an opportunity for me to query my sponsor. Information is power, and power builds teams. Two-way (interactive) communication is key.

Interactive information helps alleviate inordinate stress. The military is not a "democratic" organization, nor can it be, but in most circumstances feedback from team members is extremely useful and should be sought. The phrase "I just can't get anyone to listen" is never the norm in a vibrant military organization, today or in the future.

As we move into the 21st century and commend ourselves on the successes of the past 100 years, we should remember that interactive communication has been a critical piece in achieving military successes. Our failure to achieve overall victory in Vietnam is attributable, in part, to weak interactive communication, which hindered operations at the highest strategic levels and extended throughout the services and commands to field-level combat teams. Although this century is apparently ending in relative peace, soldiers still face the possibility of a cold, wet ride down a mountain. How does your team prepare for potential eventualities and stressful military operations that may suddenly appear?

Train

One way military units keep team members informed is through training that occurs at all levels. Future training may be provided on an as-needed, per-request basis to an individual, a team, or a unit. Training courses will be available for students on-site when necessary, but a large portion will be conducted in distance-learning formats via the Internet, intranets, satellite links, virtual reality, and CDs, as these media become available.

Distance learning and computer-generated training are not training modes of the future—they are used in industry, academia, and the military today. Simulations, including virtual reality and enhanced virtual reality, soon will be more widely available to military trainers and will provide authentic training experiences for students. Pros and cons can be made for how simulations impact interpersonal communications. The capability for communication transmission is growing exponentially, but management of communication traffic will remain a challenge for individuals and organizations for the foreseeable future.

Realistically, some equipment training must advance beyond the use of simulators and simulations, and some training will continue to be performed on-site. Hands-on training for specific equipment ultimately will require that soldiers be on-site with the equipment. Much of the stress and expense associated with relocating, even temporarily, for training soldiers can be eliminated if most of it is accomplished close to home. This will be possible when both Active and Reserve Component soldiers can access real-time training at their convenience or participate in training activities on their personal time by using the Internet and other distance-learning modes.

Another way to reduce undue stress is to ensure that effective training is prepared, produced, and provided by professionals who understand the medium used to present the material and who select the proper method of delivering it. The Army and the Engineer School are working hard at developing the staff to better use new training technologies as they become available at reasonable cost.

A Final Look at Feedback

Communication is key. A common complaint I hear when attending active duty training as a Reserve officer, is the expressed and implied grievance that workers can't get those above them to listen to their ideas and observations. "Worker bees" often feel left out of the feedback and improvement loop. Some of this cannot be helped, but I have observed that communication between supervisors and workers often needs improvement. It is easy to slide into the trap of telling supervisors only what they want to hear, and some supervisors imply they only want to hear "good" news. Obviously, any management technique that fails to communicate fully produces great stress for all concerned. Such techniques hinder mission accomplishment and do not help the organization grow and prosper.

There are many ways to disseminate training, and we should use them to engage in effective dialogue regarding matters affecting training. For example, each revision to Army training affects many individuals and organizations. We must use all of the communication tools at our disposal to make training more effective and to sharpen our communication skills.

Information is power. To prevent future "cold rides down the mountainside," we must provide information to everyone who needs it. Two-way, interactive communication will help reduce unnecessary stress on all members of our team. Because we fight like we train, we must employ up-to-date training and training methods.

Lieutenant Colonel Reid, an air defense artillery officer, is assigned at the U.S. Army Engineer School as executive officer, U.S. Army Reserve (USAR). He also serves as USAR Commander, 5555th Individual Mobilization Augmentation Detachment, Fort Leonard Wood. Since 1990, he has held the USAR posts of instructor/writer and senior instructor/writer at the Engineer School. LTC Reid enlisted in the National Guard in July 1967.

"Colonel, You're Fired!"

By Richard Chaney

Maps have always been paramount during military operations. Wise planning includes a mechanism for timely map production and dissemination, but even the best-planned operations may meet with disaster. An example of this occurred during World War II when unexpected problems caused map shortages that threatened the success of the European invasion. Although today's military has committed to the digital mapping environment, the technology creates new hazards as well as solutions. We must carefully consider both logistic and production factors.

The words in the title of this article were directed at Lieutenant Colonel Daniel Kennedy during the Battle of the Bulge in World War II. As chief of the Army Topographic Section of the 652d Engineer Topographic Battalion under Lieutenant General George S. Patton's Third Army, Kennedy was doing his best to improvise and make up for map shortages and rapidly changing battle plans.

Kennedy's reprimand came from Major General John S. Wood, commander of the 4th Armored Division, XII Corps, Third Army. At about the same time, Patton ordered General Wood to spearhead the attack into Alsace-Lorraine. Wood and his troops were exhausted from earlier battles and Wood replied, "Dammit George, we're not robots. We need a rest." Many officers and historians believe that Patton "fired" Wood at this point[1]. At about the same time, Wood sent a letter to the XII Corps commander concerning "the rotten map situation."[2] He "fired" Kennedy soon after.

Although General Wood reprimanded Kennedy more than 50 years ago, Kennedy still vividly recalls the sting. The words were a bitter reminder of the frustrating events that plagued battlefield engineer units during that

LTG Patton and MG Van Fleet examine a map layout of the Danube River area.

historic but trying period. Today, Kennedy's experience may serve as a "heads-up" for future engagements.

World War II

Much of the planning for the European invasion of World War II began in 1943. The General Staff estimated that the four U.S. Armies involved would need approximately 7 million maps each month. Since this was more than the base and field topographic units and local civilian facilities could provide, additional British and American facilities located in England were tasked for support. This wise planning was overshadowed by the disruptive events that followed.

During World War II, and particularly in the European Theater, most battles were characterized by rapid advancement over new and difficult terrain. "Go where you can, as fast as you can" was Patton's buzz phrase during his campaigns in France, and General Wood echoed this philosophy in his actions. However, when troops began their rapid advances, they were plagued by map shortages.

Map Shortages

Two major factors led to map shortages during the Battle of the Bulge. The first was directly related to enemy action, which impacted the situation early in the invasion; the second was logistical problems, which compounded most of the later shortages. Changes in distribution demands and weather conditions also took a heavy toll on early supply and logistics efforts.

Enemy Action. According to LTC Kennedy, most of the advance maps were aboard transport ships that sunk in Cherbourg harbor during the first days of the invasion. Many ships were sunk as they crossed the English Channel, while others were destroyed as they approached or entered French harbors. The few strategically located harbors (most notably, Cherbourg) were either heavily mined or too damaged to allow adequate discharge of ship cargoes.[3]

Logistical Problems. Subsequent to direct enemy action, most of the research indicates that logistics (specifically, distribution) was one of the biggest problems and bottlenecks to the mapping equation. Once inside the harbors, no one knew which ships to unload first. Although well-defined priorities were established, depending on the cargo type, strict adherence to these priorities meant time-consuming investigations of each load, followed by unloading only specific, partial cargoes. Meanwhile, other vessels and cargoes sat idle, creating additional congestion. The staff finally agreed to discharge each ship as quickly as possible regardless of cargo and then sort the supplies once they were ashore. This method greatly reduced harbor congestion, but it created confusion at several depots. During the unloading of Project Overlord, one frustrated staff officer jokingly summed up the entire harbor logistics problem: "The general principle is that the number of divisions required to capture the number of ports required to maintain those divisions is always greater than the number of divisions those ports can maintain."[4]

Distribution Demands. Although combat actions and congested harbors set the stage for many map shortages, additional problems compounded the situation. Topographic battalions were well-equipped and well-organized, but they were not adequately prepared to handle unexpected changes in demands. According to some experts, "The transportation [of map stocks] between depots and from depots to troops was to cause more trouble than any other aspect of map distribution on the continent."[5]

In some instances, maps were of no value because troop locations did not match the map coverage. However, this was not necessarily due to improper delivery of the maps. During the invasion of Utah Beach, the combination of naval artillery bombardment and Army Air Force bombs created so much dust and smoke that terrain features could not be seen. Radar could not distinguish between the different beaches, and strong tidal streams pulled about 20 of the first-wave landing craft completely off course. Although they met little enemy resistance and there was little surf to contend with, the troops soon realized that none of the local features matched their maps. Later Brigadier General Theodore Roosevelt Jr. discovered the problem. Having studied the terrain maps earlier, he realized that the troops had "slipped" about 2,000 yards south of the designated point.[6]

Weather. Record-breaking storms between 19 and 22 June 1944 caused heavy losses to supplies and equipment. According to the commander of assault force O, 90 ferrying craft and an undetermined number of larger craft were lost on Omaha Beach alone. The British estimate that they lost 250 ferrying craft, and about 800 additional craft were stranded on U.S. and British beaches. On 22 June, one eyewitness on Omaha Beach counted 335 LCMs (landing craft, mechanical), 11 LCTs (landing craft, tanks), 3 LCIs (landing craft, infantry), 9 rhino ferries, and more than 20 other craft piled up.[7]

Changes in Tactics

The demand for accurate maps on short notice has always been a high priority that requires constant reorganization and logical thinking to contend with changing cir-cumstances. In France, map shortages due to enemy action, logistics, distribution, and weather were exacerbated by changing tactics, particularly those of Patton's rapidly advancing forces. Patton's attack plans changed so often that there was insufficient time to make new maps to support the latest strategy. Kennedy remembers an all-too-familiar scene: "Each morning at 0900, Patton held a general's meeting and determined where each unit was going. Then he would leave to check the front lines. By 1900, he would have another meeting, and all the earlier decisions would change. We had to pitch the first maps and start on the new ones. This went on throughout most of the campaign."[8]

Because Patton demanded such quick map-support response, the Army Survey Center was cannibalized into a topographic section to better meet his needs. A photogrammetric camera and printing press capabilities were added to make it self-contained and capable of providing quick response. LTC Kennedy recalls many instances where the topographic section received carte blanche status to commandeer whatever supplies and facilities it needed.

The demand for maps exceeded all expectations, and a paper shortage became a major engineer supply problem. Local supplies of French paper stock were inadequate, so U.S. Army engineers printed about 10 million maps on the reverse side of captured German maps.[9] In areas such as the upper Rhone valley, small-scale maps were particularly scarce, and French units relied on Michelin road maps supplemented by information from local residents.[10]

Today's Army

Today's Army is committed to pursue digital technology and to provide cartographic products as they are needed. According to current map doctrine and AR 115-11, *Army Topography*, the U.S. Army Corps of Engineers remains the proponent for topography. Engineer topographic battalions are responsible for the production of special maps and terrain-related products and services. They also retain the ability to produce limited quantities of standard maps in the field.

Present and future technology allows us to use huge, global databases in many useful ways, but managing that information requires comparable levels of administration. System administrators must monitor and provide quick access to a wide spectrum of data through a more controlled intranet versus Internet environment. Simultaneously, organizations such as the National Imagery and Mapping Agency need access to deposit traditional or specialized cartographic products. Data managers must control both input and access to digital data from all sources, civilian and military. Additionally, many scenarios may require specific physical locations and levels of control, although physical location is less critical than it was during World War II.

The transfer medium poses another dichotomy. Many technological advances have geometrically increased the data storage capacity on either magnetic- or laser-imprinted materials. But these advances come with a price in survivability. One frequently asked question is: "Which would you rather have, a CD-ROM with a bullet hole or a paper map with a bullet hole?" Although a high-tech, "shoot-and-scoot" Army may reduce the possibility of receiving bullet holes, CDs are also more susceptible to damage from dust and moisture.

Learning From the Past

History reminds us that we should not place too much faith in technology. "Look what happened with the fratricide during Desert Storm," LTC Kennedy explains. "Technology is fine in controlled situations, but combat is usually unpredictable and far from controlled...[In combat situations] you have to be able to do anything. You have to adapt to situation requirements. There are basic things every engineer should know, but they need a broad range of knowledge to better prepare them for a wide set of circumstances. Then they must use common sense and make do with what they have."

After we survived the problems during the Battle of the Bulge, historians placed a "mark on the wall." It was a strong reminder that we need to possess and be able to disseminate critical terrain information on demand. When a general requests maps from an engineer, the engineer must produce them. To accomplish this, he must have appropriate equipment and supplies and be able to disseminate the finished products.

Could a similar mapping problem occur today? In this age of advanced digital imaging, can we still lose maps on a sinking ship? Many experts believe a similar scenario is possible. The logistics of transfer medium, data management, training, and support are elements that we must scrutinize from every angle. If we fail to learn from the past, we may find ourselves in a situation similar to LTC Kennedy's. We cannot afford to be lulled into technological complacency or to produce critical information only to let it "sink in Cherbourg Harbor." If that happens, the next outcry we hear may be more tragic than "Colonel, you're fired!"

Mr. Chaney is a physical scientist at the U.S Army Engineer School and a terrain analyst warrant officer with the Missouri National Guard. He previously worked as a cartographer for the U.S.Geological Survey, National Mapping Division, Rolla, Missouri, and was editor of the division's publication Topographically Speaking. *Mr. Chaney holds a master's degree in geography from Oregon State University.*

Endnotes:

[1] Nat Frenkel and Larry Smith, *Patton's Best: An Informal History of the 4th Armored Division*, Hawthorn Books, Inc., New York, 1989.

[2] John Wood, Commander, 4th Armored Division. Letter to Commander, XII Corps, referencing the "rotten map situation."

[3] *Samuel E.* Morison, *The Invasion of France and Germany, 1944-1945. History of United States Naval Operations in World War II, Vol. II.* Atlantic Monthly Press, Little Brown and Company, Boston, 1957, p. 304.

[4] Roland G. Rupenthal. *Logistical Support of the Armies*, Vol. II, 1958, p. 46.

[5] Alfred M. Beck, et al. *United States Army in World War II. The Technical Services. The Corps of Engineers: The War Against Germany*, Center of Military History, Washington, D.C., 1985, p. 297.

[6] Rupenthal, p.100.

[7] Gordon A. Harrison, *Cross-Channel Attack*, 1997, pp. 423, 426.

[8] Interview with Daniel Kennedy, Rolla, Missouri, 3 October 1996.

[9] Rupenthal, p. 216.

[10] Beck, p. 454.

(Continued on page 20)

THE MARTEN:
A QUANTUM LEAP FOR ENGINEERS

By Alan Schlie

Let me introduce you to a skid steer called the MARTEN. We have the Grizzly and Wolverine, which are system names, and we have the ACE and the DEUCE, which are acronyms. So I present to you the MARTEN—manpower augmentation, robotics-capable tractor for engineers.

The marten (the animal) is a small, aggressive, agile, and quick carnivore of the weasel family. Its sharp claws are excellent for burrowing, climbing, attacking, and defending. The MARTEN (the skid steer) is a small, agile tool platform with the capability to significantly reduce man-hour requirements for obstacle emplacement and reduction, protective structures construction, and line-of-communications improvements.

Performance

In recently completed evaluations at Fort Knox, Kentucky, the MARTEN enabled combat engineer squads from the 19th Engineer Battalion to construct double-apron fence and triple-standard concertina wire fence 40 percent faster than the Army Training and Evaluation Program (ARTEP) standard (see table). The MARTEN excavated fighting positions and trenches in one-fourth the time allowed in the ARTEP standard (done by hand) and faster than excavating with a small emplacement excavator (SEE). The MARTEN and a squad of combat engineers completed log crib and log post obstacles so quickly that the ARTEP standard can be changed

Task Completion Times (Man-Hours)

Task	ARTEP Standard	MARTEN
Construct log crib	144	19.6
Construct log post	16	10.8
Construct triple-standard concertina fence	8	5.2
Construct double-apron fence	24	16.3
Construct two-soldier position	6	1.5
Construct machine-gun position	7	2.2
Construct fighting trench	12	10.5
Clear landing zone	24	16.2
Construct road crater	16	8.8
Install culvert	16	9.5

A soldier uses the MARTEN with its dirt bucket attachment to finish an antitank ditch.

from a platoon- to a squad-level task.

In a wooded area, the MARTEN helped a squad clear a landing zone in one-half the time allowed in the ARTEP. The MARTEN reduced by one-third the time needed to construct protective earth walls and substantially reduced the time required to excavate a trench for culvert emplacement and create boreholes for road-cratering charges.

The news isn't all good though. Two MARTENs would take 100 times as long as two bulldozers to construct a 300-meter tank ditch and twice as long as the dozers to reduce the same ditch.

The MARTEN represents the first conscious effort to augment the manpower of the combat engineer squad across the wide spectrum of field engineering tasks. With its 12 attachments, the MARTEN can bulldoze, bucket load, fork lift, compact, level, auger holes, backhoe, mix cement, sweep, fill sand bags, break concrete, drive pickets, carry logs, pull posts, pound nails, saw wood and metal, and flail mines. In other words, the MARTEN performs the repetitious and physically demanding activities associated with the combat engineering effort to shape the battlefield.

Think of the MARTEN as a first-generation exoskeleton for combat engineers. During the evaluation, 12Bs operated the skid steer and its attachments after only one week of training and stick time. It enables a single soldier to pick up, move, and accurately position objects weighing more than three-fourths of a ton, which is equivalent to two Bailey bridge panels and a transom. And operating in most terrain is not a problem with the MARTEN. It was evaluated in loose sand, deep mud, standing water, close woods, and uneven terrain.

The MARTEN is capable of increasing a combat engineer squad's productivity by 25 percent, which means that eight soldiers can do the work of ten. As the squad wears down physically, the MARTEN allows productivity to remain high. In some cases, with polished battle drills, the MARTEN enables a squad to complete platoon tasks, which enhances productivity and effectiveness.

The MARTEN is usable worldwide, in every deployment scenario imaginable. It is the perfect piece of equipment for engineers involved in natural disaster recovery and environmental cleanup, fighting forest fires, humanitarian relief, border security, base-camp construction, and unit bed down, as well as other battlefield uses.

Robotics Capable

The MARTEN is capable of being fitted with robotics controls operable through the standardized teleoperating system (STS) currently in use. Wiring for the STS remains in place without hindering soldier-in-the-seat operation. The robotics capability allows continued use of all attachments and significantly increases the combat engineer squad's countermine operational capabilities. Skid steers already carry the miniflail and have been credited with saving lives in Bosnia.

Evaluation

The next step is a "right-size" evaluation being conducted at Fort Polk to determine which size skid steer performs best in various scenarios. The current limiting factor is obtaining a properly sized trailer for both the load and towing capacity of the prime mover.

As a system, the skid steer does not require further testing or evaluation. Its versatility and utility have been proven in commercial construction, utility, and landscaping industries. Our sister services already use skid steers within their organizations. The Engineer School will continue to review military applications, such as attachments to assist in bridge construction and McPherson-style plow blades.

Thirty-five platoon training and evaluation outlines (T&EOs) listed in ARTEP 5-145-11-MTP involve field engineering, obstacle construction or reduction, or construction of protective structures. Nine of these were evaluated during the skid steer concept evaluation at Fort Knox. Except for two of the T&EOs—tank ditch construction and reducing—the MARTEN performed better than the current methods.

This MARTEN is being used to drive U-shaped pickets for a double-apron fence.

Considering the results of the concept evaluation, we anticipate that an additional 20 tasks can be completed faster and more efficiently by using the skid steer instead of the current methods.

Shaping the Battlefield

Engineer organizations have heavy-duty, bladed equipment capable of moving substantial amounts of material to create tank ditches, berms, and fighting positions. Engineers also have access to mine-dispensing systems capable of creating large minefields in short periods of time. But squads are ill-equipped to handle the physically demanding and repetitive activities that constitute the major portion of the combat engineer's contribution to shaping the battlefield.

The MARTEN represents that missing system. It can work in restricted terrain while presenting the smallest practical target to quickly accomplish soldier-sized excavations, conduct assault and countermine operations without putting the soldier at risk, and help the shrinking combat engineer squad complete manpower-intensive tasks. The MARTEN completes the suite of equipment required to make engineers true architects of the battlefield.

Mr. Schlie is a Force Development Analyst with the Directorate of Combat Developments, U.S. Army Engineer School. A retired command sergeant major, he has served in various capacities in Europe, Korea, and CONUS throughout his career.

(Continued from page 17)

References:

Anderson, Duncan. *D-Day: The Story of the Longest Day*, Smithmark Books, New York, 1993.

Army Regulation 115-11, *Army Topography*, 30 November 1993.

Blumenson, Martin. *United States Army in World War II. The European Theater of Operations. Breakout and Pursuit*, Office of the Chief of Military History, Department of the Army, 1961.

A Brief History of Operations in Europe, 652d Engineer. (Top) Battalion (Det.), Third Army.

Cole, H.M. *United States Army in World War II. European Theater Operations. The Lorraine Campaign*, Office of the Chief of Military History, Department of the Army, 1950.

Essame, H. Patton. *A Study in Command*, Charles Scribner's Sons, New York, 1974.

Forty, George. *Patton's Third Army at War*, Arms and Armour Press, London, 1976.

Rupenthal, Roland G. *Logistical Support of the Armies, Volumes I and II. U.S. Army in World War II. European Theater Operations*, Office of the Chief of Military History, Department of the Army, 1953.

Utah Beach to Cherbourg (6 June-27 June 1944). American Forces in Action Series. Historical Division, Department of the Army Center of Military History, U.S. Army, Washington, 1947.

Whiting, Charles. *Patton*, Ballantine Books, Inc., New York, 1970.

Wright, Marshal S., ed. 652d Engineer Topographic Battalion. *We Followed Patton*. A Battalion Book.

Engineer Reconnaissance Platoon: Overcoming the Lack of Engineer Recon Assets

I am writing in regard to an article by Michael W. Sayer in the August 1997 issue of *Engineer.* I currently serve as the British Exchange Officer, Royal Engineers, with the Engineer Brigade, 3rd Infantry Division (Mechanized) (3rd ID). My duty post is that of deputy engineer coordinator, until recently known as the assistant division engineer, a post I have filled for the past two years.

Mr. Sayer's article caught my attention, because what he proposes for the establishment of an engineer reconnaissance platoon within heavy engineer battalions mirrors almost identically the existing engineer reconnaissance troop (platoon) of a British Army close support engineer regiment (battalion), i.e., one that supports a manoeuvre brigade. I understand that plagiarism is just another form of flattery!

One area that Mr. Sayer's article and proposal do not address, however, is the provision of similar engineer expertise and capability to the heavy division's primary means of division-level ground reconnaissance—the division cavalry squadron. With all engineer battalions of the engineer brigade neatly aligned to manoeuvre brigades, providing engineer support to the division cavalry squadron is not a new problem or one that is easily solved. The need for a permanent engineer reconnaissance capability, however, could easily be included with the case put forward by Mr. Sayer.

During the 3rd ID's recent deployment to Egypt for Exercise Bright Star 97/98, we had the opportunity to work with the divisional reconnaissance battalion of the 3rd (UK) Division, the Household Cavalry Regiment. A British divisional reconnaissance battalion does not have the combat power of a U.S. division cavalry squadron, but its reconnaissance mission is very similar. To enable it to fulfill this mission, it is assigned an engineer reconnaissance platoon with sufficient squads to support the reconnaissance companies. As Mr. Sayer points out, engineer teams/squads will be very thinly spread across the battlefield. But with engineer capability available with both the division forward deployed reconnaissance (division cavalry) and with scout platoons within manoeuvre brigades, the opportunity exists to better direct and employ scarce assets.

By way of a simple example: The division is advancing with two brigades up with the division cavalry leading in a reconnaissance role. Intelligence preparation of the battlefield (IPB)/terrain analysis has identified a river line that crosses the division sector. The division cavalry is tasked to identify brigade avenues of advance forward. The information that is sent back, with engineer confirmation, is that the river will require AVLB bridging in the eastern sector between grids X-Y, while pontoon bridging will be needed in the western sector between grids A-B, hopefully confirming the IPB. This information allows engineer commanders and staff to prepare appropriate units. Perhaps more importantly, the information acts as a cue for limited brigade engineer reconnaissance teams, in conjunction with task force scouts, to target likely crossing sites. Other examples where engineer reconnaissance would be a bonus when integrated with the division cavalry are not hard to imagine.

Where this fourth engineer reconnaissance platoon should be established I am probably not best qualified to say. Perhaps it could be a permanent part of the division cavalry squadron's modified table of organization and equipment, with the very real difficulties of developing and monitoring appropriate training. Another option is to establish the platoon as part of the headquarters and headquarters detachment, engineer brigade—although this probably is not a long-term starter in view of current proposals to remove the engineer brigade headquarters from heavy divisions.

In summary, I think that the debate started by Mr. Sayer's article should be broadened to include an engineer reconnaissance capability for the division cavalry squadron.

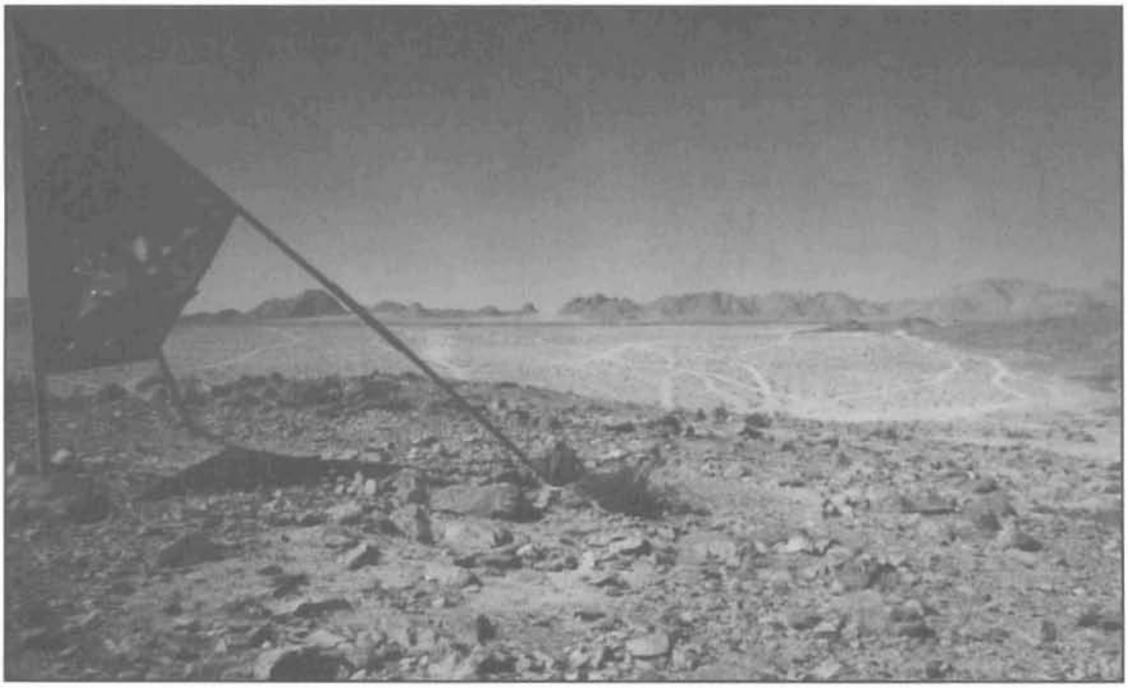
Major Allan P. Dennis
Royal Engineers

Author's reply:

Thank you for contributing to my discussion. Although America and Great Britain are, to quote Will Rogers, "two countries separated by a common language," great ideas arise from both sides of the "pond." So I'll plead not guilty to plagiarism but hope the debate helps our Engineer Regiment.

When writing my article, I purposely limited discussion to the heavy brigades, because I have not seen the reconnaissance weakness inherent within the heavy brigades replicated in the division cavalry squadrons. Although dedicated support units do not routinely train with the squadron, the division engineer provides one engineer company (I hope one of the best) to the squadron for engineer support. A military occupational specialty (MOS)19D Scout NCO is required to perform most of the same reconnaissance tasks as those performed by an MOS 12B Scout NCO. Therefore, it would be difficult to support the manpower requirements for a reconnaissance element with a division cavalry support mission. In a perfect world, with sufficient manpower and money available, I have some definite ideas as to what would provide great support. Unfortunately, given current manpower constraints, none of those ideas are feasible.

Michael Sayer
Military analyst



Command and Control: Seeing the Battlefield

By Colonel Thomas Bostick and Captain Matthew Pasvogel

Many maneuver commanders throughout history have made key decisions regarding commitment of important resources with very little information or time. During the Battle of Gettysburg, for instance, lack of information from J.E.B. Stuart's cavalry had a significant impact on Robert E. Lee's decisions. Unknown to Lee, Stuart was involved in an independent operation, which denied Lee the "eyes" necessary to gather information about the Union Army. This lack of timely information contributed to the Army of Northern Virginia's defeat in a battle that became the turning point of the Civil War.

At times the "fog" of war makes disseminating information difficult. In many instances, however, standard operating procedures for communicating information leads units down a path of potential problems. Staffs can simplify the complex battlefield decision-making process to help commanders mass combat power. By preparing an effective matrix or sketch, staffs can help commanders "see" important elements of the battlefield, including friendly and enemy capabilities, terrain, and key decision points.

This article describes simple techniques used in offensive and defensive operations that facilitate the decision-making process and allow commanders to better "see the battlefield." The 1st Brigade Combat Team (BCT) and the 1st Engineer Battalion of the 1st Infantry Division from Fort Riley, Kansas, successfully validated these techniques at the National Training Center (NTC).

Offensive Operations

During offensive operations, friendly forces often face formidable enemy obstacles. Commanders must understand the assets needed to reduce or bypass these obstacles. Equally important, commanders must know the decision points where they can reallocate mobility assets within the combined arms team. To achieve this understanding, planners must identify the minimum critical resources at the breach site (M-CRABS).

Based on the engineer estimate, planners allocate critical reduction assets. These include engineer platoons, mobility reserve, armored combat earthmovers (ACEs), mine-clearing line charges (MICLICs), and tank plows to either bypass an obstacle or reduce, mark, and proof a lane. Reduction assets are task organized to subordinate units using appropriate planning factors (see Figure 1, page 23). Those factors include:

- A 50- percent loss of reduction assets while reducing, marking, and proofing a lane.
- A 60- to 90-meter enemy minefield depth, which friendly forces can reduce, at some risk, by using two MICLICs.
- An engineer platoon to mark a bypass around scatterable minefields or two tank plows to reduce them if necessary.

Main Effort 1 16	Support Effort 1 34	Reserve C 1-34	Engineer Reserve 1 (-)	Current Phase
Assets required to complete each phase and follow-on phases				
2 MICLICs 4 Plows 2 ACEs 2 Platoons	0 MICLICs 2 Plows 3 ACEs 1 Platoon	1 Volcano	3 MICLICs 2 ACEs 1 Platoon	LD: Total starting assets (on hand)
2 MICLICs S 2 Plows 2 ACEs 2 Platoons (mark bypass)	0 MICLICs 2 Plows 2 ACEs 1 Platoon	1 Volcano	2 MICLICs 2 ACEs 1 Platoon	LD to PL San Antonio
2 MICLICs (reduce) 2 Plows (reduce) 2 ACEs (proof) 1 Platoon (mark lanes)	0 MICLICs 2 Plows 2 ACEs 1 Platoon	1 Volcano	2 MICLICs 2 ACEs 1 Platoons	1st Belt (security zone)
0 MICLICs 0 Plows 0 ACEs 0 Platoons	0 MICLICs 2 Plow(reduce) S 2 ACEs (proof) 1 Platoon (mark)	1 Volcano	2 MICLICs (reduce) 2 ACEs (proof) 1 Platoon (mark lanes) *no redundancy (risk)	2nd Belt (main battle area)

Figure 1. Minimum Critical Resources at Breach Site.

In this example, Task Force (TF) 1-16 has two MICLICs, four plows, two ACEs, and two engineer platoons before it begins breaching operations in the first obstacle belt. The task force marks one scatterable minefield between the line of departure (LD) and Phase Line (PL) San Antonio and creates two lanes in the first belt or security zone. Mobility assets from the engineer reserve create two lanes in the second obstacle belt. If the M-CRABS are not available, the maneuver commander proceeds to the point of breach with great risk.

Engineer Mobility Reserve. To successfully reduce enemy obstacles, the commander requires detailed information on their size, orientation, and composition. Is there a tank ditch in front of or behind the minefield? What is the minefield depth, length, and orientation? Are there antitank and/or antipersonnel mines? If so, how are the mines dispersed in depth and across the front? Answers to these questions are vitally important when planning breaching operations, but unfortunately they often are not available until just before or during the attack, if at all. If key information is not available, it may help to form a mobility reserve that can provide the commander flexibility when responding to changing situations on the battlefield. As the intelligence and the battle develop, the brigade commander may decide to commit the mobility reserve to the task force breaching the obstacle.

Composition of the mobility reserve will vary depending on the amount of intelligence gathered and the size of the obstacle that planners anticipate. Planners may decide to form the reserve from engineers habitually attached to, or under the operational control (OPCON) of, the task force providing support. Using a platoon as the mobility reserve provides the command and control necessary when the reserve assignment changes from brigade to maneuver battalion. The mobility reserve will require reduction assets such as MICLICs and ACEs.

There is no doctrinal method to command and control the mobility reserve. Since this element is a brigade asset, the engineer battalion operations officer (S3), who understands the entire brigade plan, is a good choice to initially command and control it. At some point in the battle, the brigade commander may change the task organization and assign the mobility reserve to one of the battalion task force elements. The engineer platoon leader of the mobility reserve then begins working for the task force. Therefore it is important that the mobility reserve, or at least key representatives from this element, participate in the brigade and battalion rehearsals. After the mobility reserve reverts to task force control, the engineer battalion S3 provides additional "eyes" for the brigade at the point of breach.

Despite the absence of intelligence information, engineers must plan in detail for commitment of the mobility reserve. Even if planning is based on an enemy situation template, detailed engineer planning will facilitate a decision process that is based on well-thought-out trigger points for executing important decisions. The timing of decisions to move breaching assets is key to the outcome of the battle. M-CRABS provide the analysis that supports construction of a simple decision support template (DST) (see Figures 2 and 3, page 24).

Decision Support Template. A DST helps commanders identify trigger points for key decisions concerning when to move the mobility reserve forward or when to move tank plows from

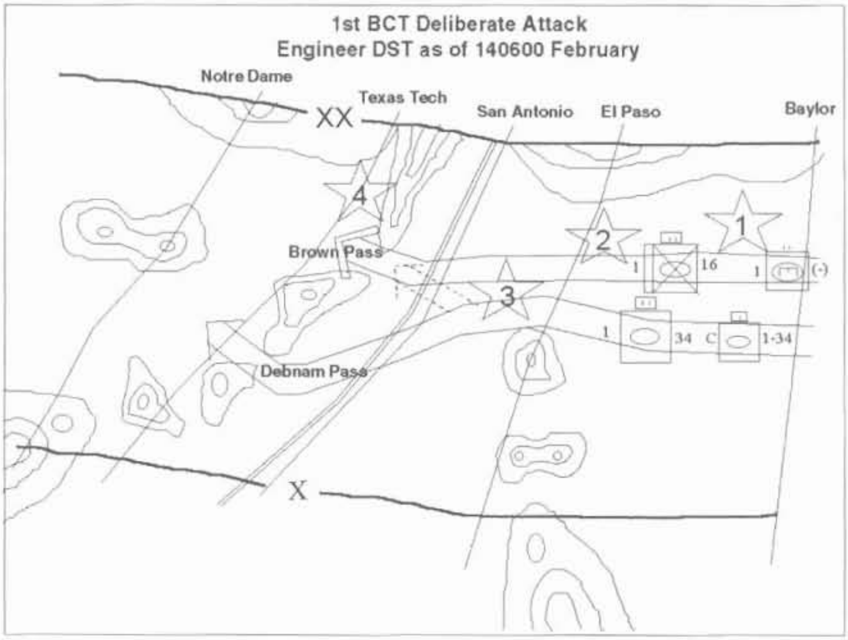


Figure 2

Engineer Decision Points

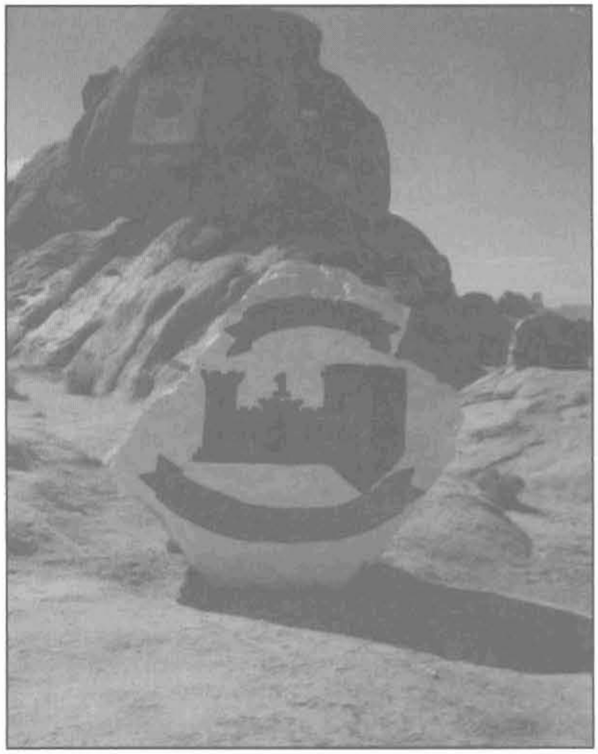
Decision Points	Events	Decisions and Critical Events
1	Engineer recon team disabled or destroyed	1. Send second recon team. 2. Replace dismounts with mounted team, if team is capable. 3. Recover vehicles and evacuate casualties.
2	Maintenance/combat losses prior to PL El Paso	1. TF 1-16 must retain 2 MICLICs, 2 plows, 2 ACEs, and 2 engineer platoons or obtain reinforcements. 2. Reinforce with mobility reserve and 2 MICLICs.
3	Brigade commander decides to breach north or south	1. If north, mobility reserve is OPCON to TF 1-16. 2. If south, mobility reserve is OPCON to TF 1-34. 3. Trail task force battle position to support breach with 2 plows.
4	Initial breach complete across PL Texas Tech	1. Assault force must retain 2 MICLICs or 2 plows. 2. Mobility reserve becomes OPCON to TF 1-34 with 2 MICLICs or conduct reload operations; continue attack with risk and 2 plows.

Figure 3

an uncommitted unit to one needing mobility assets. Figure 3 shows the timing of key decisions to shift engineer assets based on M-CRABS. For example, if there are maintenance or combat losses at decision point 2 that reduce TF 1-16's reduction assets below those shown in Figure 1, the brigade commander may decide to commit the mobility reserve, including an engineer platoon with two MICLICs and two ACEs. If there is no change in task organization of the mobility reserve, the brigade commander will arrive at another decision point after PL El Paso. Then he must decide to commit the mobility reserve to either TF 1-16 to breach in Brown Pass or to TF 1-34 to breach in Debnam Pass. At decision point 4, the brigade commander must decide whether to continue with the attack or pause to refuel vehicles and reload the MICLIC.

The Battle of Brown Pass. At the NTC, the opposing force (OPFOR) defeated the 1st BCT during its deliberate attack through Brown and Debnam Passes. All friendly scouts were dead, so the brigade had no "eyes" forward. The lead task force could not destroy the enemy on the far side of the obstacle. The OPFOR, which was overlooking the obstacle, destroyed all engineers during breaching operations.

In a repeat battle, the 1st BCT was successful. This time, an engineer scout team walked more than 10 kilometers into position at Brown Pass and provided the brigade's only "eyes" as it began to attack. The brigade commander decided to attack through Brown Pass because Debnam Pass was heavily fortified (there were no "eyes" in that pass). At decision point 3, the brigade commander changed the task organization by making the mobility reserve OPCON to TF 1-16. The engineer scout team called for indirect artillery fire, which destroyed most of the enemy positions on the far side of the obstacles. When the lead engineer commander's vehicle was destroyed, he took his backpack radio and moved to high ground near the breach site. The TF 1-16 commander spotted the enemy's combined arms reserve, but due to intense fighting, he was not in position to call for air support. The engineer commander, who oversaw the breaching operations, helped identify the exact location of the enemy reserve. Then friendly air support destroyed it. Assault forces pushed through the breach and ultimately destroyed every OPFOR vehicle. The brigade won the difficult battle of a deliberate breach on the reverse slope of Brown Pass.



Using similar techniques during a later battle at the NTC, the mobility reserve successfully completed breaching operations with one task force and then moved to a location 10 kilometers north. The reserve linked up with another task force and began breaching operations without delaying the attack. Without well-planned decisions on moving and commanding and controlling the critical assets, shifting these resources would have been extremely difficult. M-CRABS and DST cards, handwritten or computer-generated, can facilitate decisions by helping commanders "see the battlefield."

Defensive Operations

During defensive operations, the focus of effort is on engineers—from digging survivability positions to building obstacles for engagement areas (EAs). Two key lessons often learned at the NTC are the importance of starting the engineer effort early and the need to efficiently and accurately track the battle.

Begin the Engineer Effort Early. This is a two-edged sword. A hasty start may result in work that does not contribute to the task force plan. Usually the task force does not develop its plan before nightfall, and attempting to site obstacles and direct-fire systems in the dark is ineffective. Having to wait for the task force to develop a plan often results in countermobility/survivability assets remaining idle for several hours. Various solutions to this problem would allow engineers to initiate work effort in areas that will ultimately support the task force plans. Options include digging survivability positions for artillery, mortar, and command and control systems. These missions are valuable for the defense, but the highest priority mission is to develop the EA with obstacles and survivability positions for direct-fire systems.

A brigade-directed obstacle group and battle position (BP) facilitate rapid emplacement of obstacles or survivability positions, but they must support the brigade's scheme of maneuver. The task force's ultimate plan should include the brigade-directed obstacle group and BP. When the task force is ready to execute its plan, engineers should have very little work remaining on their brigade-directed task.

Key players involved in a brigade-directed obstacle group and BP must meet on the ground to resolve differences before work begins. Key individuals may include the task force/company team commander, the fire support officer, the S2, the engineer, and others. The brigade commander will help clarify their understanding of the mission by explaining his intent at the site of the brigade-directed obstacle group and BP. This meeting, which should occur immediately after the operations order briefing, is perhaps the last time the group can assemble before nightfall.

Track the Battle. The second area of importance during the defense is tracking the progress of defensive preparations. Many units track defensive preparations using detailed charts that require an engineer to explain them.

The 1st Armored Division Engineer Brigade in Germany experimented with various methods to graphically track and portray progress in defensive preparations. While in the division tactical assault center one night, the division commander called the operations officer (G3) for an update on defense preparations. The G3 walked over to the engineer battle-tracking board, removed a countermobility/survivability chart (similar to Figure 4, page 26), and began to update the division commander. It was clear that maneuver elements could easily communicate information using this chart. Engineers in the 1st Engineer Battalion S3 and assistant brigade engineer sections helped refine this system of reporting prior to and during two NTC rotations.

The countermobility/survivability tracking chart is simple but includes enough details to give the commander a complete picture of defensive preparations. Using this chart, the brigade staff can efficiently track defensive preparations and start and completion times, and the commander can better understand

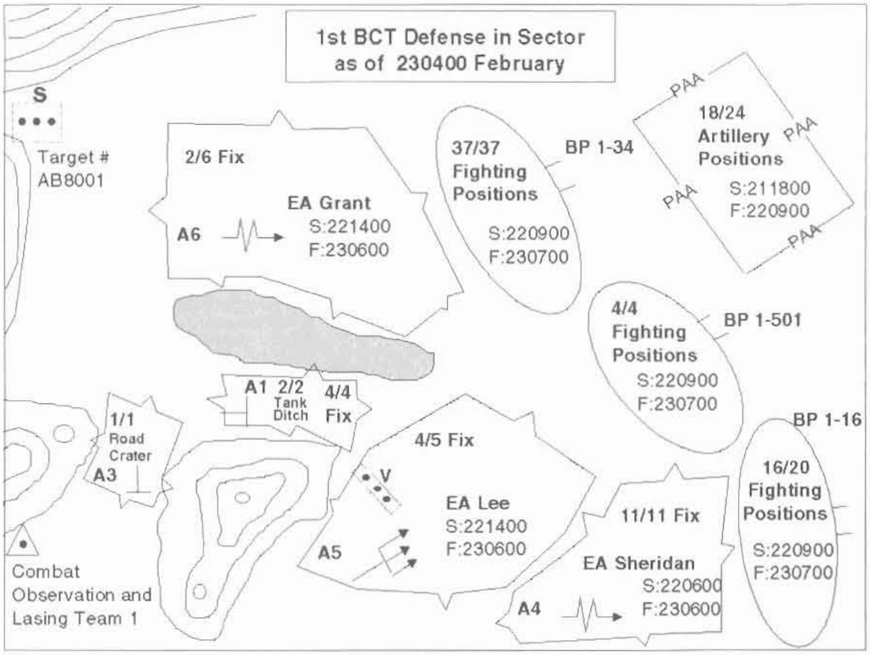


Figure 4

when and which engineer assets to shift to support his intent. For example, in Figure 4 (as of 0400 hours on 23 February, in obstacle belt A6) only two of the six planned obstacles were completed. In BP 1-34, which covered that obstacle, all of the 37 planned fighting positions were completed, while 16 of 20 planned positions in BP 1-16 were completed. Start and finish times on the tracking chart help Tactical Operations Center (TOC) personnel track the battle. Battle tracking helps commanders understand planned versus actual engineer work effort and the approximate time when they will receive engineer assets.

TOC personnel must know the commander's key decision points. When he is asleep, planners or subordinate commanders must know which trigger points require that someone awaken him for a decision. In this particular defense (Figure 4), the brigade commander decided to move additional engineer platoons to Belt A6 and additional digging assets from BP 1-34 to BP 1-16. The logic for these decisions was based on information depicted on the countermobility/survivability chart.

The brigade, task force, and engineer commanders carry similar countermobility/survivability cards. Their TOCs track the defensive preparations in the same manner. By using these cards, staffs can update the commander and higher command posts quickly, efficiently, and accurately. A report from the TF 1-34 commander may be simply "Status of defensive preparation follows: Two of six obstacles were completed in Belt A6, and 37 of 37 positions were completed in BP 1-34."

The countermobility/survivability chart works well for developing a common understanding of the overall defensive plan and progress, but engineers must maintain more detailed battle-tracking information, such as the start and end points of specific minefields. During this particular battle, the brigade built an unprecedented number of obstacles (more than 3,000 mines, two tank ditches, and more than 75 vehicle survivability positions). The battle ended at 2000 hours on 23 February. The final disposition re-flected the success of the brigade's defensive preparation: no enemy penetration of friendly positions and every enemy vehicle destroyed.

Conclusion

Facilitating command and control through better battle tracking in both offensive and defensive operations is a combined arms team effort. Each member of the team must understand and work to achieve the commander's intent. Staffs at all levels can help commanders "see the battlefield" and make informed decisions. Good battle tracking through clear, efficient, and understandable processes provides the commander with the "eyes" and information necessary to make key decisions with confidence and success.

Colonel Bostick is Commander, 1st Armored Division, Division Engineer, Germany. He previously commanded the 1st Engineer Battalion, served as a planner with USAREUR DCSENG, was a White House Fellow, and served as executive officer to the Chief of Engineers. COL Bostick is a graduate of the U.S. Military Academy and the U.S. Army War College and holds master's degrees in mechanical and civil engineering from Stanford University.

Captain Pasvogel is a training and doctrine staff officer, Office of the Deputy Chief of Staff for Engineering, U.S. Army Europe (USAREUR). He was previously the Assistant Brigade Engineer, 1st Engineer Battalion, 1st Brigade, 1st Infantry Division, Fort Riley, Kansas. He is a graduate of the U.S. Military Academy and the Engineer Officers Advanced Course and holds a master's degree in engineering management from the University of Missouri-Rolla.

Book Review

Stormtroop Tactics: Innovation in the German Army, 1914-1918, by Bruce I. Gudmundsson, Praeger Publishers, Westport, Connecticut, 1989, 210 pages.

The stunning German *blitzkrieg* campaigns of early World War II were in part the product of their experiences in World War I and of a Prusso-German military culture stretching back through Moltke the Elder (1800-1881) to the great military reformers of the Napoleonic era (Scharnhorst, Gneisenau, and Clausewitz). This tradition encouraged small unit leader initiative, flexibility, risk taking, and relative military open-mindedness.

With the onset of stalemate on the western front late in 1914, the Germans began to experiment with various means of breaking the deadlock of trench warfare. These experiments included unrestricted submarine warfare, strategic bombing, massed artillery fire, and new tactical techniques based on several siege warfare innovations. The innovations were the domain of the German pioneers (combat engineers). After much experimentation, the most effective innovations were combined to create the "storm-trooper tactics."

The author traces the origin and development of German storm-trooper tactics (sometimes incorrectly referred to as *infiltration* or *Hutier tactics*) from 1914 until the end of the war. The many technical innovations introduced by the pioneers included the first use of modern grenades, trench mortars, man-packed flamethrowers, chemical warfare, and, belatedly, the first German tanks. These innovations, combined with the tactical flexibility inherent in the pioneer corps, resulted in the development of highly effective combined arms teams at company and battalion levels. The reasons for the somewhat surprising contributions of the pioneers are described by the author:

The reasons that the German pioneers, rather than line infantry, were able to innovate so quickly are many. In 1914, the pioneers were already used to working, with very little supervision, in squad sized teams. Pioneers were trained for fortress warfare before the outbreak of hostilities. This gave them a head start in thinking about the problem of crossing "no man's land," which, after all, is an easier proposition than crossing the glacis of the masonry fortress, as well as providing them with the tools, particularly hand grenades, of trench warfare. Pioneers were, moreover, free of romantic notions of battle. War to them was a dangerous job, like the digging of a mine or the building of a bridge over a fast-moving river. Martial virtue consisted of finding the most efficient way of doing the job, not in the beau geste of a bayonet charge. Finally, pioneers, whose training in prewar infantry tactical forms was not as thorough as that of the infantry, had fewer bad habits to break.

The first and most famous of the storm-trooper units, Sturm Battalion Rohr, was named after its commander. It was formed in 1915 from the replacement companies of two pioneer battalions of the 8th Corps and a flamethrower detachment from the 3rd Guard's Pioneer Battalion. Many more storm-trooper units were formed later, primarily from pioneer and Jager (light infantry) units. Storm troopers spearheaded attacks at Verdun, Cambrai, Riga (in Russia), the 12th Battle of the Isonzo, and the German "Peace Offensives" of 1918. German storm troopers were able to restore operational maneuver to the deadlocked western front by using flexible, dismounted infantry tactics at the same time that the allies were turning to the tank. Because the German army was unable to logistically support the storm troopers after they had broken through allied lines in 1918, they were unable to exploit their tactical successes.

Combat engineers should find this book to be fascinating reading. It is recommended to all combat arms leaders.

Major William C. Schneck, Assistant Division Engineer, 29th Infantry Division, Virginia Army National Guard.

Maintaining Engineer Equipment

By Major Charles Radke

In his "State of the Engineer Branch 1997" (*The Army Engineer*, June 1997, page 20), MG Clair F. Gill, then commandant of the U.S. Army Engineer School, asked that we help move the branch forward into the next century. He presented seven challenges to remember as we go about our daily activities. Challenge number four was "Maintain your equipment to standard and train your soldiers to use it to its full effectiveness." MG Gill explained why this is important and tried to influence maneuver commanders to voice their concerns about engineer equipment.

Maintenance Imperatives

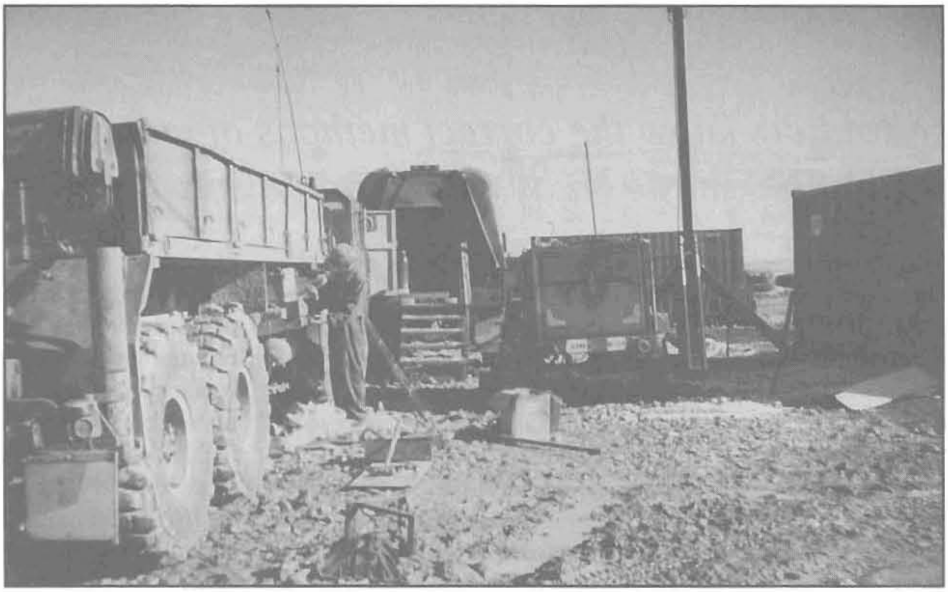
That challenge reminded me of my experiences as executive officer in an engineer battalion deployed to Bosnia and Herzegovina. The following information includes some of the items I believe are necessary for a successful maintenance program. The Army Maintenance Management System describes other requirements in DA Pamphlet 738-750, *Functional Users Manual for The Army Maintenance Management System (TAMMS)*. Additional requirements in local SOPs and regulations help ensure successful maintenance operations. The imperatives in this article were extracted from several of these documents.

Manage repair parts load lists to maximize on-hand parts. Prescribed load lists (PLLs) are automated in the Unit-Level Logistics System (ULLS). Stockage is based on demands (as required by Army regulations) and on monthly inventories conducted by parts specialists. Insist that the PLL clerk record parts used and then double-check the availability of each part monthly. Parts that receive fairly regular demands must be stocked in the PLL. When authorized, keep on hand at least two of each item in the PLL to avoid a zero balance.

You must manage quick-service-supply, low-cost items (under $25) that can be retained and do not count against PLL ceilings. Know what you have on hand, organize it, and make it accessible to users. If small parts from a set, kit, or outfit are at zero balance, order replacements immediately. O-rings, bolts, connectors, and hardware are just as important to have on hand as new starters.

Participate in authorized stockage list (ASL) review boards and insist that

Instead of running this ACE to maintenance without its track, a plan was executed to move it as shown here and not cause additional damage.



Maintenance in the mud should be anticipated. Truck-mounted shop equipment and a trailer-mounted hydraulic fabrication set help accomplish the maintenance mission.

the ASL of the direct support unit (DSU) supports your repair parts stockage and is tailored to support engineer equipment. Army regulations allow ASLs to stock repair parts for low-density equipment (like engineer equipment) on the basis of "three demands to add and one to retain." Regulations require that "nine to add and three to retain" criteria be used for more common parts. Help the DSU identify the low-density equipment repair parts you need. Most major assemblies (such as engines, tracks, road wheels, and transmissions) are stocked and carried at the DSU. It took 25 to 30 days for parts to be shipped from CONUS to Bosnia. If the DSU did not have a major assembly on hand, we had at least a month of non-mission-capable (NMC) time.

Don't collect excess repair parts, whether serviceable or unserviceable, because they take up valuable space and require a separate management system. Turn in unserviceable parts and get them into the rebuild program. Also turn in unauthorized serviceable parts. You may need them someday, but let the system hold them until then.

Manage each part that makes a piece of equipment NMC—from diagnosis through installation. Order the right part the first time. In Bosnia we let organizational maintenance personnel identify deficiencies and establish requirements for parts. Then, we managed the required parts by exception. If parts requests were passed to the wholesale supply system, experienced personnel reviewed the problem to ensure that the correct part was ordered. Usually the battalion's maintenance technician, sergeant, or officer performed the task, but sometimes it was a technician from the Logistics Assistance Office, the DSU, or a contracted maintenance advisor.

Once a repair part is ordered, a record of the request is in the repair parts system. Important items to verify are stock numbers, nomenclature, quantity ordered, unit of issue, acquisition advice (one of the most commonly disregarded codes), urgency-of-need designator, and required delivery date. If the delivery date block is left blank, regardless of priority, there is no NMC request in the system.

Periodically check the status of the request at the unit and take the necessary action. Now that the entire Army operates on ULLS and the Standard Army Retail Supply System-Objective (SARSS-O), a maintenance supervisor can quickly determine if parts have been ordered and if requests have been passed to the next higher level of supply. The request is printed on the Maintenance Inspection Worksheet 5988-E and includes a list of parts on order for the equipment. Both the ULLS and SARSS-O must exchange information daily to ensure that valid requisitions get into the system. If the ULLS status is incorrect, something is wrong with the human side of the system and must be corrected.

Follow parts from the source of supply through delivery to the equipment. Requests are quickly established in the wholesale supply system, and the status is returned just as quickly. DSU operations personnel can determine the status of all requests and speed a shipment or solve problems. They also maintain contact with the entire supply infrastructure, which was developed to fix problems as they are identified. With modern tools such as "Total Asset Visibility" and "In-Transit Visibility," we can determine when a part arrives at the local parts warehouse. If necessary, means are available to quickly get the part from the warehouse to the equipment.

Train operators, maintenance and supply personnel, and supervisors on maintenance and operation of engineer equipment. Training operators saves time and saves equipment from operator-induced failures. Training is often performed at the unit level, but formal training elsewhere is available. Begin operator training with a well-structured drivers' training program. Once soldiers know the correct methods of maintenance and operation, *"Once soldiers know the correct methods of maintenance and operation, they usually follow proper procedures."*

they usually follow proper procedures.

Maintenance personnel in a division receive training from the Maintenance Assistance and Instruction Team and other sources. Logistics Assistance Office personnel, the local representatives from the Army Materiel Command, are positioned forward to provide training assistance.

Personnel who supply repair parts also require training. Regardless of their military occupational specialty, well-trained parts specialists and assistants are cornerstones of maintenance management.

Current engineer doctrine places the company first sergeant in the role of maintenance support supervisor. To perform this function, NCOs must be trained on the entire maintenance process as they move through the echelons of leadership. Training to go beyond the company and battalion to solve maintenance issues must be instilled early. Then, when small units are away from the parent unit, the NCO supervisor can continue a maintenance program.

Fabricate repair parts locally to save time and money. In Bosnia, the engineer battalion was the conduit for the fabrication of repair parts for the brigade combat team. A hydraulic shop and two machine shops were under contract. In addition, our fully stocked shop van, welding outfit, and hose-fabrication outfit made many items quickly, saving transportation costs. Nearby aviation maintenance units usually are an excellent source for hydraulic hose fabrication.

Perform periodic services on time and to standard. Technical manuals, lubrication orders, and regulations provide the standards. Don't forget to check out-of-sight items (such as weapons; night-vision devices; and nuclear, biological, and chemical equipment) when scheduling and completing services. Task organize maintenance and engineer units to complete a block of services. When one leader is given the responsibility, time, and tools to complete a service mission, the results are very close to optimal. The overarching goal of periodic service is to have equipment leave the service process in like-new condition. Make every effort to identify problems and institute corrective actions. Ensuring that parts are on hand for scheduled services requires a well-planned, systematic ordering process. If the wheel seal needed during scheduled services is not on hand, chances are it will never be installed.

Complete, document, and correct problems identified during periodic checks. Some maintenance checks are listed in technical manuals for the equipment, and others come from Army safety regulations. Each set of guidance specifies that checks be performed before, during, and after operations. Too often, maintenance checks consist of a quick walk around the equipment and starting the engine. It's better to put an entire weapon system together and run it through normal operation. Put the weapon on the vehicle, turn on the communication devices, and move the system to complete all required checks. If an operator identifies a problem during the checks, maintenance personnel must correct it without delay.

Exercise equipment to help identify problems and keep it fully mission capable (FMC). Equipment stored for any length of time begins to deteriorate. Seals lose resiliency, rubber rots, electrical connections corrode, and rust invades spaces that should be clean. Our equipment in Bosnia hit record highs in terms of miles and hours but continued to stay FMC. One reason was that by operating complete systems often enough to prevent deterioration, we helped prevent early component failure.

Plan well and consistently enforce standards to ensure safe maintenance operations. Planning ensures that standard procedures are in place to reinforce the safety program. Include detailed procedures for inflating split-ring wheels, backing vehicles, handling hazardous material, and operating the shop. After policies are established, enforce them. Also enforce common safety rules. Safety is a force multiplier, and maintenance operations are one of the biggest benefactors from this practice.

Maintenance Success

With successful maintenance practices established, our battalion followed the directive to deploy to Bosnia only equipment that could shoot, move, and communicate, and that could self-load onto the rail cars. After the equipment arrived in Hungary, we road marched to Croatia and drove every vehicle across the Sava River to a remote base camp. Our battalion accomplished this trip without leaving anything in Germany and without borrowing replacements from other units. In Bosnia, we enjoyed higher-than-average readiness rates even though we logged additional miles and hours.

Maintenance imperatives are long-term events. Getting started on them as soon as possible will lead to earlier success. Perhaps the imperatives described above will help satisfy MG Gill's challenge to "Maintain your equipment to standard and train your soldiers to use it to its full effectiveness."

Major Radke is assigned to the Concepts Division, Directorate of Combat Developments, U.S. Army Engineer School. Previous assignments include executive officer, 9th Engineer Battalion, 1st Infantry Division, Bosnia and Herzegovina; and chief of automation for logistical systems, 3rd Infantry Division Support Command. MAJ Radke is a graduate of the Armor Officer Advanced Course, Systems Automation Course, and the Command and General Staff College.

Mission Analysis:
Getting It Right

By Major Joey Wyte

With the battle rhythm in place, the brigade staff initiates planning for an upcoming deliberate attack. The brigade S3 tries to keep to the established timeline. He rips annexes from the division operations order and passes them to his staff, instructing them to "conduct your mission analysis and provide your input to the battle captain." With annex in hand, the brigade engineer returns to his work station, gives the annex a cursory look, conducts his mission analysis, and passes his input to the battle captain. The time spent was less than 15 minutes.

At the Joint Readiness Training Center (JRTC), Fort Polk, Louisiana, task force engineers at brigade and battalion levels often experience difficulties with providing mobility/survivability input to the military decision-making process (MDMP). Due to the MDMP's logical sequence, engineer planners must get it right from the beginning. This means they must correctly identify and integrate the specified and implied mobility/survivability tasks during their initial mission analysis.

Engineer Planning

Engineers who participate in the MDMP usually rely on tasks specified in the higher headquarters operations order as the primary source of input for their mission analysis and seldom focus on the mobility/survivability battlefield operating system (BOS). Our maneuver counterparts, who facilitate the MDMP, often say, "How are you going to get your dog in the fight?" This phrase tends to focus engineer planners on engineer-specific tasks rather than mobility/survivability tasks. Understanding the difference between the two will ensure that critical tasks are identified and integrated into the overall plan.

The question isn't how to get "your" dog in the fight as much as it is how to get "the" dog in the fight. Instead of viewing the MDMP as a function of a particular BOS, engineer planners (as well as other BOS representatives) see the "dog" as a specific unit. Hence, task force engineers at the JRTC often provide the same generic input, which is directed entirely at engineer units. The result is a one-sided approach to identifying tasks.

Table 1 shows common phases of an operation and helps illustrate the input routinely provided by engineer planners. Because the MDMP is sequential, the lack of detailed input directly influences other steps of the decision-making process, including the staff's ability to fully synchronize courses of action (COAs). An insufficient mission analysis normally leads to an incomplete COA. Therefore the engineer planner must analyze the mission from a mobility/survivability perspective. Although Table 1 addresses critical mobility/survivability tasks, it doesn't fully identify those that maneuver units must accomplish. Experience at the JRTC shows that when critical mobility/survivability tasks are not specified—either from a higher headquarters operations order or as a result of mission analysis at the brigade or battalion level—those tasks are not incorporated into the COA. This subsequently leads to critical tasks not being included as an event during the "action, reaction, counteraction" drill of wargaming. The end state is a desynchronized plan that often leads to disastrous results for the unit and the "dog" never making it to the fight.

Table 2, page 32, highlights the multiple mobility/survivability tasks that can be associated with any operation, regardless of the mission, and the type or level of maneuver unit responsible for executing them. This method of analysis stresses the function of the mobility/survivability BOS and is not limited to a specific type of unit. Analyzing the mission from this perspective creates several ways to get the "dog" in the fight. The input does not address only engineer tasks but identifies tasks the brigade and battalions must execute as a combined arms team.

Table 1. Generic mission analysis input directed at engineer units

Phase I (Reconnoiter and Set Conditions	Phase II (Conduct Air Movement)	Phase III (Attack)	Phase IV (Consolidate and Reorganize)
❐ Conduct precombat checks and inspections. ❐ Rehearse battle drills.	❐ Conduct air assault.	❐ Conduct assault breach.	❐ Provide countermobility support.

Table 2. Mobility/survivability tasks associated with any mission.

Phase I (Reconnoiter and Set Conditions)	Phase II (Conduct Air Movement)	Phase III (Attack)	Phase IV (Consolidate and Reorganize)
❒ Identify possible main and alternative routes (MSR and ASR). ❒ Recon MSR/ASR. ❒ Recon axis of advance. ❒ Locate and identify enemy obstacles along MSR. ❒ Identify enemy battle positions and supporting tactical obstacles. ❒ Identify and locate possible bypasses. ❒ Recon landing zone (LZ) and pick-up zone.	❒ Conduct air assault. ❒ Secure primary LZ. ❒ Clear alternate LZ.	❒ Confirm or deny the presence of obstacles along MSR and axis of advance. ❒ Conduct in-stride breach and bypass obstacles. ❒ Conduct assault breach. ❒ Conduct route clearance. ❒ Employ scatterable mines to isolate and fix counterattack.	❒ Employ hasty protective obstacles. ❒ Prepare hasty fighting positions. ❒ Establish tactical command posts. ❒ Upgrade minefield-marking systems on reduced obstacles.

Engineer and maneuver staff planners must realize that a mobility/survivability task does not necessarily equate to an engineer-specific task. The brigade has at its disposal a variety of assets—such as scouts, long-range surveillance detachments (LRSD), and aviation and maneuver companies—to help accomplish the mobility/survivability tasks. For example, scouts and LRSD are tasked to confirm or deny enemy obstacles, while aviation assets conduct aerial recons to determine the suitability of main supply routes (MSRs) and planned axes of advance.

By applying the methodology in Table 2, engineer planners focus on the function of the BOS and ensure critical mobility/survivability tasks are identified, addressed, and synchronized in the tactical plan. This forces the brigade and battalion staffs to consider using a wide variety of assets without relying solely on engineer units. The end result equates to a more detailed maneuver plan and highlights the necessity for proper implementation of limited engineer assets.

Engineer Annex

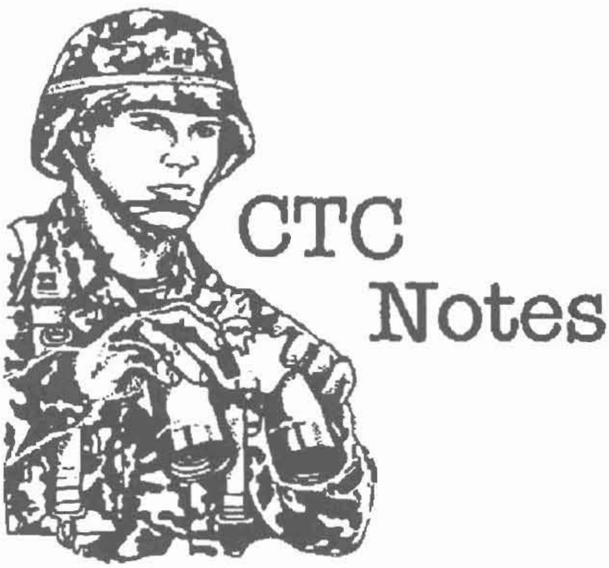
A product of the MDMP, and closely associated with mission analysis, is the engineer annex. A developing trend at the JRTC revolves around how input to the engineer annex is addressed. Engineer staff planners continue to use the annex as the primary means to task engineer units (versus maneuver units) with specific engineer tasks. The engineer annex is where maneuver units should go to seek additional information and tasks related to the mobility/survivability BOS that are not covered in the base operations order. However, the engineer annex is consistently viewed as a source of information useful only to engineer units. To compound the problem, engineer leaders view the engineer annex as their version of an engineer operations order. Hence, they use this as an excuse for not issuing detailed operations orders at company and platoon levels. This shortcut fails to use the annex as the primary tool for addressing specified mobility/survivability tasks for maneuver units, as identified during mission analysis.

Key to Success

Success of the MDMP—and the unit—depends on a complete mission analysis. If we persist in viewing our piece strictly from an engineer perspective, critical mobility/survivability tasks will continue to be overlooked and will be absent during the MDMP. As task force engineers and staff planners, we must learn to distinguish between the need for engineer advice and the need for advice pertaining to the function of the mobility/survivability BOS.

To ensure our success as members of a combined arms staff, engineers must gain a better working knowledge of the MDMP and understand the importance of comprehensive mission analysis. This includes broadening our vision and providing input based on the function of the mobility/survivability BOS. If we overcome the temptation to see the fight just from an engineer viewpoint, then the "dog" stands a better chance of not only getting to the fight but also of winning.

Major Wyte is the Chief, Engineer Plans and Operations Section, and served as the Engineer Company Senior Observer/Controller at the Joint Readiness Training Center. He has completed tours with the Royal Australian Engineers, 10th Mountain Division (Light), and the 9th Engineer Battalion (Corps, Mechanized).



Battle Command Training Program

By Lieutenant Colonel Aaron Bush

Every year the Battle Command Training Program (BCTP) publishes perceptions for each battlefield operating system (BOS). Engineer and chemical perceptions are combined into mobility and survivability BOS. The 1997 mobility/survivability perceptions are basically the same as those identified in 1996. Engineer commanders and staffs should keep in mind that mobility/survivability perceptions focus on key items that contribute significantly to mission accomplishment for corps and divisions. This does not mean that units are not working hard to solve these problems, because the perceptions address very difficult tasks that present challenges to every newly assembled staff. During the past 18 months, I have seen tactical and technical expertise at all levels. The soldiers, noncommissioned officers, and officers are using their expertise in conjunction with emerging technology.

Technological improvements provide great benefits for tracking, collecting, and reporting information. Most units are using computers, headsets, and telephones in very innovative ways, and the speed at which data can be transferred is impressive. But, the data remains "information" until someone analyzes it. Staffs perform analyses and then make recommendations to commanders based on the analyses.

Engineer brigade and battalion commanders must maximize the use of technology without stifling staff interaction or analysis. It should not require a captain with a degree in computer science to operate computer programs and software. If a young specialist cannot understand a computer program or the software, the staff will lose valuable time. Commanders and staffs should ask, "How does this software save us time?" or "What is the value added by using this system?" The most important question is, "How will this process help the commander?" Technology will continue to provide wonderful benefits to commanders and staffs by producing more timely and accurate information that enables both groups to do their missions.

Note: To obtain a complete copy of the 1997 mobility/survivability perceptions, call LTC Bush at (913) 684-9904 or DSN 552-9904. The e-mail address is: busha1@leav-emh1.army.mil.

Lieutenant Colonel Bush is the Mobility/Survivability BOS Chief for Team A, Battle Command Training Program, Fort Leavenworth, Kansas. He previously served as executive officer, 588th Engineer Battalion, 4th Infantry Division, Fort Hood, Texas.

Joint Readiness Training Center

By Captain John DeJarnette

The Joint Readiness Training Center (JRTC) provides light engineer companies and their supported maneuver brigade combat teams excellent opportunities to train in realistic major regional contingency and lesser regional contingency operations. Observers note that many units rotating through the JRTC have experienced difficulty in the following areas:

Observation. *Rotational brigades do not conduct mobility and survivability training as part of reception staging, onward movement, and integration operations. The result is confusion and needless mine casualties at platoon and squad levels.*

Discussion

- Vehicle drivers are unfamiliar with standard minefield lane-marking systems. Therefore, they often drive vehicles on uncleared lanes, resulting in injured personnel and damaged equipment.
- Soldiers and vehicle crews do not understand the correct actions to take when they strike a mine. As a result, additional losses occur during vehicle recovery operations and casualty evacuations.
- Minefield locations are not reported and disseminated to other units in a timely fashion.
- Battalion and brigade staff are unfamiliar with the mine-strike battle drills described in the unit standing operating procedure (SOP).

Recommendations

- Engineers construct a standard vehicle lane-marking system at entrances and exits to unit motor pools and staging areas. Leaders ensure that drivers understand how lanes are marked.
- Unit leaders conduct a mine-strike "action drill" rehearsal for both crews and unit staff. Stress individual and collective tasks as well as timely reporting in the action drill.
- Battalion and brigade staffs include mine contact and obstacle intelligence dissemination procedures in unit communication exercises.

Observation. *Engineer company SOPs are not consistent across engineer units within the same division, and they frequently conflict with the supported maneuver brigade's SOP.*

Discussion

- Many engineer companies develop SOPs that are independent of existing battalion or division standards. This practice complicates the task organization across companies that support the divisional main effort.
- The format of engineer SOP reports is not consistent with the format used by the supported maneuver brigade, resulting in difficulty using the personnel replacement and logistics systems. While differences often are minor, they are confusing.

Recommendations

Engineer battalions develop and enforce the use of one SOP for all subordinate units that are assigned or attached. The SOP should be endorsed by the division and targeted for use by the engineer platoon in support of infantry battalions and artillery batteries. The SOP should include—

- Appropriate reports and clear time lines for submitting them.

- Tactics, techniques, and procedures and battle drills for standard tasks.

- Mission-specific precombat checklists for squad and platoon leaders.

- Standard planning factors and clear standards for mobility, countermobility, and survivability operations.

- Pro forma operations orders, warning orders, and execution checklists for use by task force engineer planners.

A standard SOP that includes the above items will reduce friction at engineer squad, platoon, and company levels.

Captain Dejarnette is an engineer observer/controller at the Joint Readiness Training Center, Fort Polk, Louisiana. He previously served with the 37th Engineer Battalion, Fort Bragg, North Carolina, and as commander, B Company, 11th Engineer Battalion, Fort Stewart, Georgia.

Sergeants Major Homepage

A sergeants major homepage on the Fort Leonard Wood web site provides topics of interest to sergeants major throughout the Engineer Regiment. To date it includes information on safety, training, promotions, doctrine, equipment, quality-of-life issues, and the EN-FORCE Conference. While the homepage is up and running, your advice and suggestions for improvements are welcome. To access the homepage, access the Fort Leonard Wood homepage (http://www.wood.army.mil), click on "Leadership," and then click on the ECCSM homepage hot button under CSM Dils' photo.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Department of Training and Doctrine Development (DOTD)

Field Manual (FM) Update. The following FMs will be available on the Engineer School's Publications homepage about 1 March (http://www.wood.army.mil/PUBS/pubs.htm). Paper copies will be distributed throughout the spring.

- FM 5-170, *Engineer Reconnaissance*, sets forth the principles of conducting engineer recon activities in support of a maneuver brigade or task force. It provides guidance on conducting enemy obstacle recons as well as technical recons such as bridge, ford, and tunnel recons. The manual supersedes FMs 5-36 and 5-30.
- FM 20-32, *Mine/Countermine Operations*, provides tactical, technical, and procedural guidance for conducting mine and countermine operations. It is presented in three parts: mine operations, countermine operations, and special mining operations. The manual incorporates recent guidance on the use of training on antipersonnel land mines.
- FM 5-428, *Concrete and Masonry*, is primarily a training guide and reference text for engineer personnel using concrete and masonry materials in field construction.
- FM 5-250, *Explosives and Demolitions*, is the technical compilation of the explosives and explosive techniques used by U.S. military forces. It provides soldiers with the ability to conduct demolition operations using the conventional detonating cord initiation systems as well as recently approved modernized demolition initiators. The manual serves as a guide to familiarize leaders with the demolition effects simulators program. It superseded TC 5-250.

POC is Lucius Warrick, -7767.

Staffing of Draft Publication. The draft version of FM 90-13-1, *Combined Arms Breaching Operations*, is posted on the Engineer School's Publications homepage (address above). Comments are due by 1 April. POC is CPT Joe Birchmeier, -7762.

Directorate of Combat Developments (DCD)

Digital Topographic Support System-Light (DTSS-L). Approval to proceed with production of the DTSS-L, which will provide commanders with tactical decision aids, was received on 9 January. Production will begin in FY 99, with fielding scheduled for FY 00. POC is Don Monton, -7970.

Feedback Page. A feedback page on DCD's homepage includes items of interest about which DCD requests readers' comments. The address is: http://www.wood.army.mil/DCD/feedback.htm. Let us know what you think about the information posted. POC is Larry Allen, -4080.

Maneuver Support Battle Lab (MSBL)

Joint Countermine Advanced Concept Technology Demonstration (JCM ACTD) II. The MSBL and Night Vision and Electronic Sensor Directorate, Fort Belvoir, Virginia, are working to execute the Army's part of JCM ACTD II. Soldiers of the XVIII Airborne Corps used novel countermine equipment to detect, report, and reduce surface and buried minefields during Joint Task Force Exercise 98-1 in January. The Close-in, Man-portable Mine Detector (CIMMD) uses a combination of a metal detector, ground-penetrating radar, and forward-looking infrared thermal imaging to locate buried metallic and nonmetallic mines. The Airborne Standoff Mine Detection System is used to detect surface and buried antitank mines. The Digital Reconnaissance System uses laser ranger-finder binoculars, the Global Positioning System, and SINCGARS to send digital mine and obstacle reports over the communications net. Another demonstration is planned for March 1998 at the Joint Readiness Training Center, Fort Polk, Louisiana. Additionally, Marines from Camp LeJeune, North Carolina, will demonstrate the equipment during a Joint training exercise in Newfoundland later this summer. POC is CPT Paul Aufschlager, -4082.

Biological Defense Experiment. The program manager, Integrated Biodetection Advanced Technology Demonstration, and the Chemical School are working with the MSBL to demonstrate a new concept in biological detection. The Distributive Biological Detection System is intended to provide warning of a biological attack. Two kinds of experiments are planned. First, the atmosphere at several installations will be sampled to determine what is normally there. Later, trials using nontoxic materials that simulate a biological attack will be conducted at Dugway Proving Ground, Utah. The experiments will test a prototype system of three technology applications. Sensor units are based on laser-particle counters, the Global Positioning System, and a telemetry system. In addition, a state-of-the-art miniature laboratory is being developed to identify biological material. POC is Mike Cress, -4083.

News and Notes

Global Positioning System (GPS) Tutorial. A GPS tutorial is available on CD-ROM from the National Imagery and Mapping Agency. The national stock number is: 7644-01-445-4559. POC is Ed Forman, Defense Mapping School, (703) 805-3215 or DSN 655-3252.

MANSCEN Construction

Visitors to Fort Leonard Wood will notice a difference in the skyline as they enter the post, due to the major construction program underway to support the relocation of the U.S. Army Chemical and Military Police Schools and related functions from Fort McClellan, Alabama. Initial planning and design for the facilities under construction began in 1995 after the Base Realignment and Closure (BRAC) Commission's recommendation to close Fort McClellan became public law.

Construction projects totaling more than $230 million will be completed at Fort Leonard Wood to support BRAC 95. In May 1997, a contract worth more than $160 million was awarded to Hensel Phelps Construction Company, headquartered at Greeley, Colorado. This contract includes a 300,000-square-foot General Instruction Facility that will provide classrooms, support facilities, and administrative areas to support officer and advanced noncommissioned officer training; an 888-person unaccompanied enlisted personnel housing complex; and a Chemical Defense Training Facility, which will provide an applied instruction area for training to identify and decontaminate toxic chemical agents. Included in the Hensel Phelps contract is the Applied Instruction Facility. This project will provide approximately 163,000 square feet of facilities to support Military Police one-station unit training and advanced law enforcement training; a Decontamination Apparatus Training Facility; and an extension to the existing Engineer Museum to store historical artifacts from the Military Police and Chemical Museums. At the end of January 1998, the Hensel Phelps contract was approximately 30 percent complete with overall completion scheduled for summer 1999.

Additional contracts were awarded in FY98 and work is underway for other facilities to support the BRAC 95 program. This work includes range modifications and a training site for military operations in built-up areas (MOBA). The MOBA site will provide a 16-building facility for training soldiers in tactics and techniques for urban operations under simulated combat conditions. Range work involves modifications to 13 static and mobile smoke ranges, pistol and shotgun ranges, and vehicle operations training areas.

Relocation activities are expected to begin during the last quarter of FY98, and all BRAC missions should be relocated to Fort Leonard Wood and fully operational by September 1999. POC is CPT (P) Mike Dunn, 596-0081.

Lead the Way

By Command Sergeant Major Robert M. Dils
U.S. Army Engineer School

Achieving Balance

Thousands of Noncommissioned Officer Developmental Programs have been conducted and volumes of information have been written about the Army Senior NCO Centralized Promotion System and how soldiers can make it to the top. The centralized promotion system or a particular centralized promotion board are favorite topics of discussion any time two or more senior NCOs get together. Many NCOs falsely believe that doing a good job every day and waiting until they have enough time in grade are the keys to success in our promotion system. Nothing could be further from the truth. Another misconception many senior NCOs have is that high proficiency in physical training is the key to success. Some think that a college degree will ensure that next stripe. Others wrongly think that a token amount of time in a key leadership position will put them over the top. The following information explains how senior NCOs can successfully compete in the Senior NCO Centralized Promotion System.

In our down-sized, right-sized, right-functioned Army, achieving career balance will become a key factor in career progression. Balance will be important in every facet of an NCO's career: leadership, versatility of assignments, performance, potential, and military and civilian education. To be "best qualified" for promotion, an NCO cannot have specialized achievements in one or two key areas and minimum experience in the others. He or she needs significant achievements in all areas. Achieving a high degree of balance will ensure NCOs their best opportunity to make it to the top. The following examples describe NCOs who have attained a high degree of balance:

- An Advanced Noncommissioned Officer Course (ANCOC) graduate, Sergeant First Class Smith has successfully completed two years of college and is a member of the Audie Murphy Club. She is in the primary zone for the first time and has been a platoon sergeant for 2 1/2 years after serving two years as a drill sergeant. SFC Smith has received two or three "Excellent" ratings, a "1" in the potential block, and a "1" in the performance block on her last five Noncommissioned Officer Evaluation Reports.
- An ANCOC graduate, Sergeant First Class Jones has completed one year of college and was the Division NCO of the Quarter as a staff sergeant. His academic efficiency report reflects that he exceeded course standards in ANCOC. SFC Jones is in the primary zone and has served as a recruiter for three years and as a squad leader/section sergeant for three years. He currently serves as a platform instructor.

Neither of these soldiers has a blemish on his record; both have current photos in their personnel files. Both soldiers reviewed their records before the promotion board met. While it is impossible to totally describe every component of a well-balanced career, these two examples reflect excellence in every area considered by the board, and they show excellent balance in all career areas.

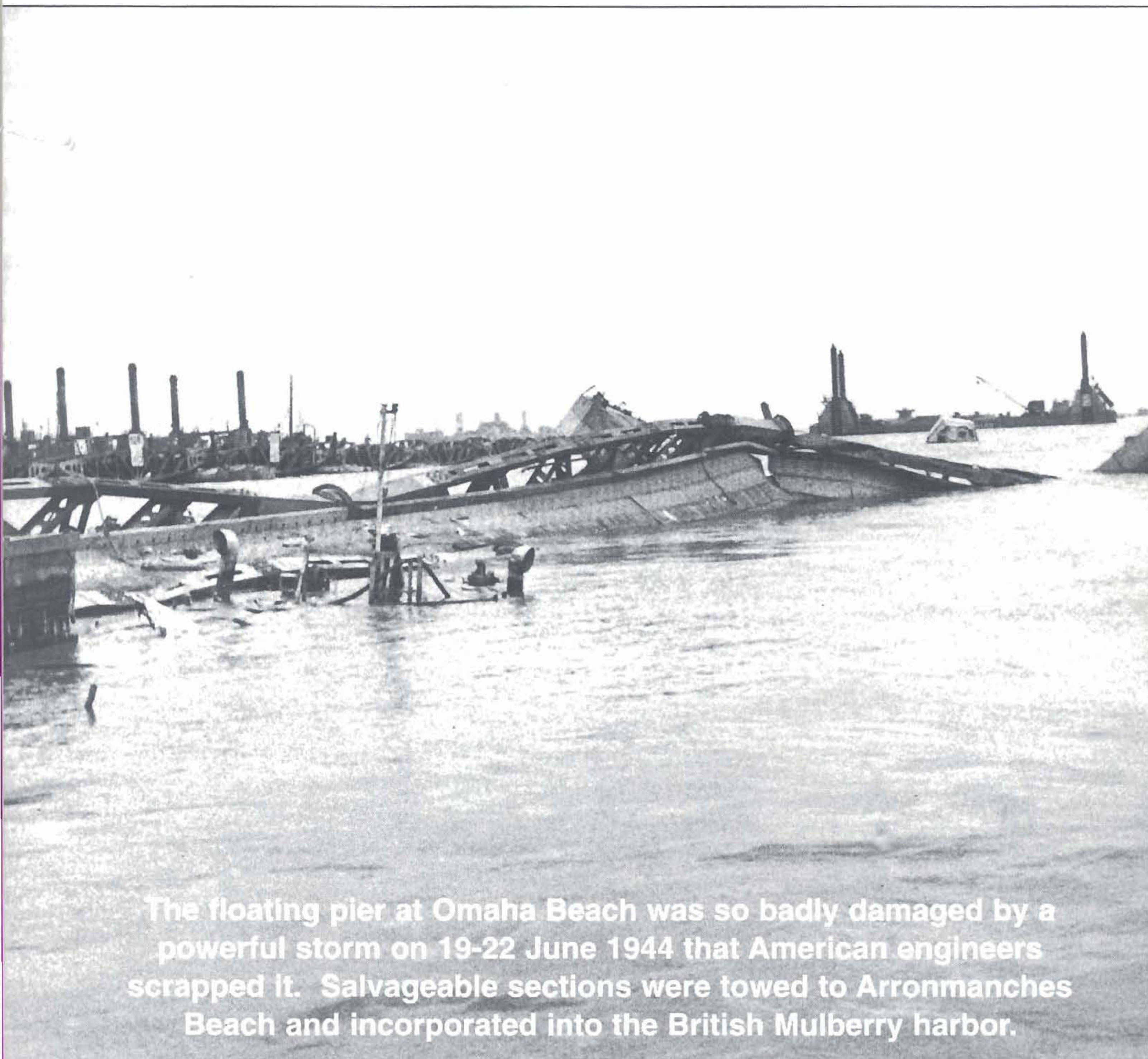
As engineer proponent, the Engineer School is responsible for providing NCO Centralized Promotion Boards with job, unit, and functional information on the various engineer military occupational specialties. We also advise the boards on the importance of the areas they will consider when determining which NCOs are best qualified. On future boards, career balance will be increasingly important. Good luck.

ENFORCE XXI-98

Planning for ENFORCE XXI-98 is moving along at a rapid pace. This year's conference promises to be the best ever, and we need your suggestions on how to make it a more valuable training tool. The Council of Sergeants Major will meet on Tuesday, 21 April, and all engineer command sergeants major are welcome to attend. I look forward to seeing you in April.

SGT Rogelio Martinez (12B20), A Company, 588th Engineer Battalion, 4th ID Engineer Brigade, is the 1st-Quarter FY98 NCO of the Quarter for III Corps and Fort Hood.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1998—655-120 / 80001



The floating pier at Omaha Beach was so badly damaged by a powerful storm on 19-22 June 1944 that American engineers scrapped it. Salvageable sections were towed to Arronmanches Beach and incorporated into the British Mulberry harbor.

PIN: 076043-000