# Engineer

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## *Engineers and the Environment*

PB 5-91-3

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# Supporting CINCs in Peacetime

The U.S. Army may be a key player in a bold, new program aimed at developing free, stable, and prosperous nations throughout the Western Hemisphere. This conceptual program will encompass the Department of Defense (DOD) and use existing flag units (general officer units from Army, Navy, and Air Force), and agencies affiliated within their functional responsibilities. These units will assist commanders in chief (CINC) during peacetime to support other government agencies, particularly the State Department and drug law enforcement agencies.

The program has merit. Looking into the future need for U.S. armed forces, we see it is logical and practical for military organizations to support CINCs in nation assistance. While the Army and other DOD services now participate in nation assistance activities, many projects are accomplished independently, with little or no coordinated planning. Under the new, joint service concept, planning for all agencies will be coordinated, with the recipient country's U.S. ambassador assuming overall responsibility.

## Engineer Roles

This article describes the part engineers will play, using Central and South America as a concept model. I will describe engineer unit/agency affiliation and tailoring for campaign planning, crisis response, and special studies in consonance with proposals being developed for nation assistance policies, doctrine, and training. With some modification, the program can be applied to medical, civil military cooperation (CIMIC), and logistical units.

Let's define the major activities.

***Campaign planning*** includes the preparation of long-range engineer, country, and campaign plans, activity development and evaluation, and development of host nation civilian and military institutions.

Planning support to the U.S. counternarcotics campaign will link nation assistance activities to counternarcotics operations. It will anticipate counternarcotics facility requirements as narco-trafficking routes migrate, and promote counternarcotics and nation assistance activities that support U.S. ambassadors' country plans.

Engineers will ensure that counternarcotics considerations are built into construction projects. For example, an airfield built by the Army as part of a nation assistance project will be located where it can later serve commercial traffic. Or, we will ensure that Army-built schools are complete packages, equipped with books and teachers.

***Crisis response augmentation*** includes assistance with natural disasters, noncombat and evacuation operations, and operations short of war.

In a crisis, U.S. military forces will be augmented from the same organizations that provided the planning and host nation support. Functions performed by U.S. military will include damage surveys and assessments, emergency operations, contracting, and natural disaster and hazard mitigation.

The U.S. will look for short-notice, brief deployments of selected personnel to serve on joint task forces and to augment command staffs. Primary resources for these missions will be U.S. Army Corps of Engineers (USACE) South Atlantic Division, U.S. Air Force (USAF) Engineering and Services Center, and Navy Commander Construction Battalions Atlantic (COMCBLANT) and Naval Facilities Engineering Command (NAVFAC) in the Southern Command's (SOUTHCOM) administrative offices.

***Special studies*** include host nation infrastructure assessments, installation plans, and surveys of U.S. and host nation owned facilities.

Army personnel must be teachers as well as doers. We must ensure that host nation personnel participate to the maximum extent practical in all construction-related activities. Future host nation institution development must include opportunities to advance the capabilities of their military and civilian organizations. Seminars and short courses, exchange programs, and mobile training teams can provide training. We will tap engineer resources throughout DOD, including USACE laboratories, the Army Engineer School, Naval Facilities Engineering Command, and Air Force Engineering and Services Center.

## Organization Requirements

In Central and South America, SOUTHCOM will take the lead in activity evaluation, selection, and execution. Support will be provided by the 412th Engineer Command, selected Army National Guard and Reserve engineer brigades, USACE South Atlantic Division, Navy COMCBLANT, NAVFAC, and Reserve Navy Facilities Command, and the USAF Engineering and Services Center. Key players and their functions are:

***The 412th Engineer Command*** will provide planning direction and continuity, and theater-level planning and support. It will maintain a

*(Continued on page 31)*

*By Major General Michael A. Schulz, Jr.*

# Engineer

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**UNITED STATES ARMY ENGINEER CENTER AND FORT LEONARD WOOD**

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***Cover photo:*** *Engineer monitors air at drilling construction site (photo by J.M.S. Co., Inc.).*

## *FEATURES*


4 **Engineers and Environmental Protection**
*by Lieutenant Colonel Christopher P. Werle*

9 **Training and Fighting with the Saudis**
*by Major John R. Jones, Captain Everett McDaniel and Captain Stephen R. Zeltner*

14 **Tackling Hazardous Waste at Fort Bragg**
*by Stephen J. Mackmull and George D. Sample*

18 **Area Damage Control: The Forgotten Mission**
*by Major Edward M. McClure*

24 **Underground Storage Tanks: The Silent Menace**
*by Scott Murrell*

28 **Operation Cross My Heart**
*by Major Thomas J. Kelly*

37 **Terra Geode: The Army in Space**
*by Captain John Karpiscak III*

49 **A District's Environmental Learning Curve**
*by Colonel Wilbur H. Boutin, Jr.*

53 **Commanders and the 15-6 Investigation**
*by Captain Andy K. Hughes*


## *DEPARTMENTS*


Inside Front Cover: **Personal Viewpoint**

2 **Clear the Way**
3 **Bridge the Gap**
23 **Engineer Safety**
32 **Engineer Problem**
42 **Lessons Learned**
44 **Book Review**
45 **Engineer Solution**
56 **Engineer Update**
59 **Past In Review**



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# CLEAR THE WAY

***By Major Daniel R. Schroeder,***
***Commandant, U.S. Army Engineer School***

When I assumed my duties as 47th Commandant of the U.S. Army Engineer School, I said that it was an exciting time to be an engineer soldier. I was honored to accept the position and the challenges that went with it. In retrospect, I may have underestimated just how exciting things would be. In the past three years we have witnessed sweeping changes in the world order. These changes provided opportunities and presented challenges that will carry our engineer community well into the future.

The move to Fort Leonard Wood and establishment of the Engineer Center as "home" for our Regiment has been accomplished. We now provide great training at one location for all engineer soldiers, from private to colonel. We will continue to exploit our capabilities in this area.

Engineer combat developments experienced unprecedented opportunities as the Army officially adopted the Engineer Restructure Initiative (ERI). Years of hard work were rewarded when our forces organized under ERI during Desert Storm and provided superb support to the combined arms team. The M9 ACE, which was fielded to many units during Desert Shield, proved itself and became a valued addition to our combat engineer capabilities. The successes of the CEV mine rake, countermine equipment, and other minefield breaching equipment are tributes to the dedicated efforts of combat developers.

The understanding and application of topographical engineering operations in support of combat operations increased greatly in the past three years. The concept of automated graphic terrain visualization support at the tactical level was validated time and again as our forces deployed to fight at locations around the world. The Engineer School is on the cutting edge of this evolving technology and leads the way in developing it for use in AirLand Operations.

Our engineer doctrine is evolving from AirLand Battle, with a primary focus on a strong forward defense in NATO, to AirLand Operations, which focuses on power projection with global responsibilities across the operational continuum. During this evolution, engineer soldiers were employed in roles ranging from domestic support (counterdrug), disaster relief, and nation assistance, to low-intensity conflict and mid- to high-intensity coalition warfare. Sound, flexible doctrine has never been more important than it is today, as we prepare to meet future challenges.

The dynamics of shaping a smaller Army while improving the professional development of officers and noncommissioned officers (NCO) has caused us to scrutinize accession criteria, training and operational assignment opportunities, and distribution of engineers. This effort coincides with the fielding of ERI. Rather than limiting opportunities, the new engineer force has a proportionally greater number of command and leadership positions for officers and NCOs. Quality performance in the full range of leader and staff assignments will continue to determine the successful progression of soldiers. And for those who demonstrate excellence, the opportunities for school, promotion, and special assignments will be available at nearly the same rates as today.

The competitive edge of the engineer force has never been better. The quality of new enlisted soldiers and junior officers has improved with tougher standards for enlistment and commissioning. The accomplishments in southwest Asia reflect these new standards in soldier development.

The Army's top priority now is to shape the force for the future as its size decreases by as much as 25 percent, while maintaining a structure capable of timely response to every contingency. Engineers must maintain the ability to meet these challenges. We must attract and retain high quality personnel; maintain forward-looking warfighting doctrine; continue tough, realistic training; sustain modernization; and develop competent, confident leaders.

The foundations for this work are sound. Thanks to the unselfish, dedicated efforts of many people, military, civilian, and contractor, your engineer force is a respected member of the combined arms team. Maneuver commanders are our strongest advocates for the improvements required to bring our capabilities up-to-date. The heritage of this great school and the engineer force is the result of the work of our predecessors, to whom we owe our continued dedicated efforts. To them, and those who still labor in our vineyard, I give my respect and appreciation for your loyal support during my tenure.

Many of you know my successor, General Dan Christman, who is a distinguished soldier. I am sure he will continue our tradition of solid training and responsive support to the field. General Christman is uniquely well qualified to be the engineer proponent as we embark into what I believe will be a watershed



# BRIDGE THE GAP

***By Command Sergeant Major W. E. Woodall***
***U.S. Army Engineer School***

With all the changes taking place within the Army and throughout the world, it is important that we noncommissioned officers (NCO) retain a clear picture of our mission. We must continue to meet today's challenges, as we have in the past, with professionalism and a "we can do it" attitude. Whatever the future brings, we must remain flexible and eager to meet the challenge.

We noncommissioned officers are the best trained and most highly qualified group of soldiers the Army has ever produced. The performance of engineer NCOs in support of the Gulf War effort was outstanding, and reflects our dedication and pride in supporting the Commander in Chief.

As I reflect on the qualities that make an outstanding NCO, the terms "technical competence" and "tactical proficiency" come to mind. These terms best describe the attributes NCOs need to succeed in a changing environment. I will take this opportunity to stress the importance of these attributes, and to describe what NCOs must do to prepare for an ever-changing future.

Technical competence, as related to our ranks, is a combination of schooling, job assignments, and self-development. It includes both formal and informal civilian and military education that develops specific job-related skills and leadership abilities.

To remain competitive in the NCO system, you must continually seek jobs that require training at the next level higher than your current pay grade. It is not enough to wait for training to be scheduled. Take the initiative by enrolling in service school correspondence courses or courses in the civilian education system.

Technical competence is more than being able to perform your tasks. It is the building block of confidence, respect, and trust your soldiers will have in you as a leader. Because it is essential for soldiers to have confidence in their leaders, you must set an example by taking advantage of every training opportunity. You must encourage your soldiers to identify their shortcomings and then eliminate those shortcomings through remedial or advanced training.

Some soldiers fail to graduate from basic or advanced courses because they lack the reading, comprehension, or mathematical skills needed to understand the instruction. If you see a soldier having difficulty with basic skills, encourage him or her to enroll in remedial courses that will strengthen them. To develop future leaders in light of current decreasing resources challenges us to take advantage of every developmental opportunity.

Tactical proficiency refers to knowledge of tasks critical to our current warfighting doctrine. These are the skills NCOs need to survive on the battlefield. Tactical proficiency is essential to meeting our mission, and it requires tough, realistic training at home stations and at combat training centers.

We must ensure that every NCO is prepared to deploy anywhere, at any time, to fulfill our national defense needs. To achieve this proficiency requires that we take the initiative to train ourselves in critical tasks and encourage others to do the same. We must take the initiative for our self-development as opportunities occur to prepare for battlefield contingencies. Training at each of the schools in the NCO eduction system is another building block in preparing NCOs for success in their military mission.

Leader development is our business. I ask senior NCOs to provide their soldiers opportunities to be successful. Give them all the responsibilities they can handle, and hold them responsible for their actions. Above all, do not compromise the Army's professional standards. If we do these things, NCOs will be prepared to meet, with confidence, any change the future brings.

*CSM Woodall assumed duties as TRADOC Command Sergeant Major in May 1991.*

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*(Clear the Way, continued)*
period in our history. Give him the same loyal support you have demonstrated to me and my predecessors, and I am confident engineers will continue to Clear the Way.

One parting comment: Do not forget the nature of your business—it is warfighting! That is, to support combined arms operations across the continuum. Keep the sapper spirit alive and there is no challenge we cannot overcome. Essayons!

# Engineers and Environmental Protection

*By Lieutenant Colonel Christopher P. Werle*

Over the last 20 years, the environmental conscience of this nation has experienced an unprecedented awakening. As members of the global society, we have moved our environmental concerns to the forefront. We have an increased sensitivity to diminishing resources and the potentially disastrous impact of continued indifference and neglect. As a result, legislators have enacted statutory requirements to control potentially harmful industrial activities in the public and private sectors. Toward that end, the Congress, enforcement agencies, and the public have clearly stated that federal facilities should be models of compliance to these guidelines.

As one of the largest federal real estate holders (over 2,000 installations on more than 24 million acres of land), the Army is keenly aware of its responsibilities in the areas of environmental protection and enhancement. In consonance with its defense mission, the Army has established an environmental management policy that will ensure the long-term protection of the land and resources entrusted to its care.



**Technicians from the Army Corps of Engineers check decontaminated pipe used for a test well on a hazardous waste site (U.S. Army photo).**

Issued jointly by the Secretary of the Army and Chief of Staff, this policy charges the Army with being the environmental leader within DOD. It mandates that taking care of the environment is a necessary cost of business that must be fully integrated into all aspects of mission accomplishment.

A key concept inherent in this policy is that our actions must be "environmentally sustainable." That is, we must enable mission accomplishment without compromising the environmental integrity of future generations.

To ensure proper focus and continued development of this program, the Army has established a comprehensive, forward-looking military environmental program. Falling under the purview of the Chief of Engineers, day-to-day management is provided by the Office of the Assistant Chief of Engineers, the Army Environmental Office, and the Army Corps of Engineers' Directorate of Military Programs. Funded for FY91 at more than $1.2 billion, it addresses the major functional areas of compliance, restoration, prevention, and stewardship. It also provides for incorporating military programs, civil works, and support for other agencies.

## Environmental Compliance

Army installations and facilities are required to comply fully with all applicable federal, state and local environmental statutes and regulations. Because there are more than 50 major federal environmental statutes on the books, with more being introduced every year, total compliance is a challenging and sometimes elusive goal.

To help meet its responsibilities, the Army established the Environmental Compliance Achievement Program (ECAP), which is funded for FY91 at $364 million. ECAP is an umbrella program which integrates the five basic steps needed to achieve and maintain environmental compliance: training, planning and programming, resourcing, assessing, and correcting deficiencies. The program addresses all environmental areas (except restoration), and ensures that the Army will:

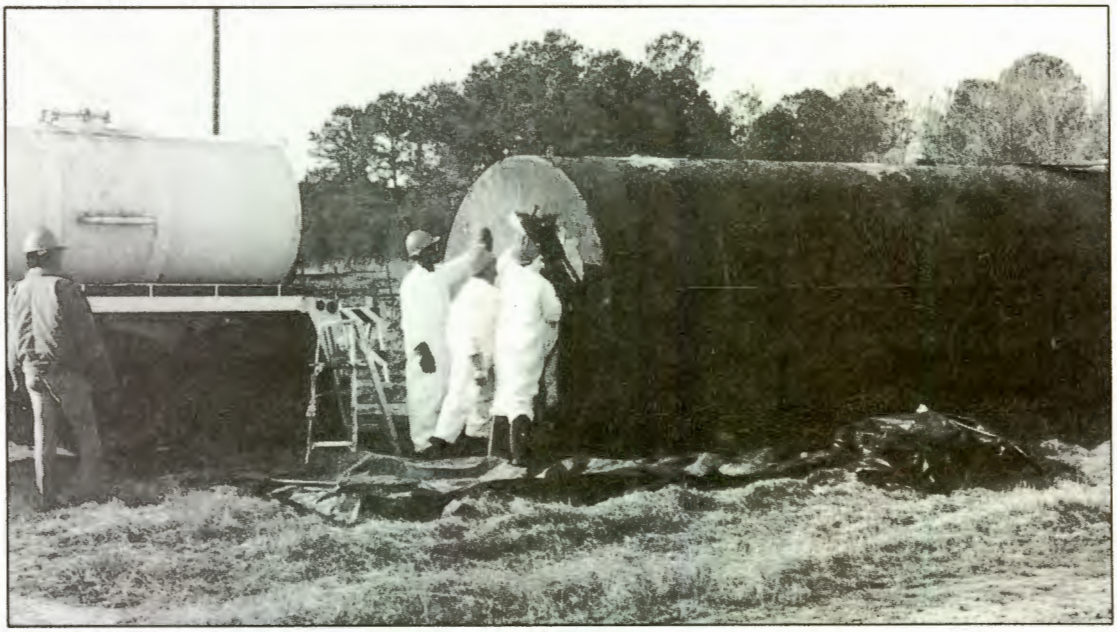
- Program adequate funding and resources.
- Require and provide environmental training.
- Develop reports on compliance status and improvement efforts.
- Provide technical assistance to installations for implementing the program.
- Reduce the production of hazardous waste.
- Monitor expenditures on the program.
- Track environmental compliance issues.
- Recognize outstanding environmental efforts by installations and employees through an awards program.

The ECAP concept incorporates provisions of the National Environmental Policy Act (NEPA) of 1969. NEPA requires that all federal agencies consider the environmental impact of their actions, and take positive steps to eliminate or mitigate operations that have an adverse environmental impact.



**Preparing a monitoring well for insertion of tubing (U.S. Army photo).**

A key element of ECAP is the newly established Environmental Compliance Assessment System (ECAS). Essentially an expanded auditing program, ECAS determines how well Army installations are complying with applicable federal, state, local and host nation environmental regulations. Under this program, environmental compliance assessments are conducted for installations every four years by an independent agency. Internal, or self audits, are conducted at the mid-point of every four-year cycle. Such assessments help installations identify deficiencies, develop corrective action plans, and manage their program resources in order to achieve compliance. While auditing has always been required, it was not always effectively implemented because of budget constraints. The ECAS program will formally begin in FY92, and will receive about $25 million in funding.



**An underground storage tank is inspected after removal from a contaminated site (U.S. Army photo).**

## Environmental Restoration

The magnitude of the hazardous waste problem in this country is so great that it almost defies comprehension. In addition to what's buried in thousands of disposal sites nationwide, the Environmental Protection Agency (EPA) estimates that our country generates 700,000 tons of hazardous waste every day—or more than 250 million tons a year. Of that figure, the Army generates some 100,000 tons a year, chiefly through its industrial operations within the Army Materiel Command.

Recognizing that federal laws were needed to address the potential dangers of abandoned hazardous waste sites, Congress passed the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). As the first major piece of legislation to address the problem on a national level, CERCLA has these key objectives:

- To hold responsible parties liable, where possible, for the cost of cleaning up hazardous waste sites.
- To establish a $1.6 billion Hazardous Waste Trust Fund (Superfund) to enable site cleanup when responsible parties cannot be found, and to respond to emergencies involving hazardous materials.
- To foster improved scientific and technological capabilities to deal with hazardous waste management, treatment, and disposal.

The Superfund Amendments and Reauthorization Act (SARA) of 1986 clarified that "each department, agency, and instrumentality of the United States..." was required to comply procedurally and substantively with the statute to the same extent as private companies.

While this was clearly a landmark piece of legislation, it was upstaged by Army efforts to deal with hazardous waste sites. In 1974, a full six years before the Superfund law was enacted, the Army initiated the Installation Restoration Program (IRP), which is now part of the larger Defense Environmental Restoration Program (DERP). Funded for FY91 at $287 million, the IRP is designed to identify and remedy contamination from hazardous substances and wastes at all Army installations. Army policy under the IRP is to clean up sites on a "worst first" basis. To date, 17,482 sites on 1,855 installations have been surveyed to determine what needs to be done. While only about 40 percent of these installations will ultimately require cleanup, the large number of sites surveyed is testimony to the thoroughness of the IRP program. By the end of FY90, the Army had completed cleanup on 130 sites.

In some cases, site contamination has been extensive enough to warrant placement on the National Priorities List (NPL) by the Environmental Protection Agency. Currently, the Army has 36 NPL sites located at 32 installations. Federal Facility Agreements (FFA) have been negotiated at 22 of these sites, and we're making good progress on the remainder. FFAs serve as regulatory "blueprints" for facility cleanup. They also provide for state and EPA oversight of the cleanup process, and, in most cases, reimbursement for states' cleanup costs.

In addition to managing its own program, the

Army serves as executive agent for DOD in managing the Formerly Used Defense Sites (FUDS) program. Under FUDS, some 7,000 additional sites are being surveyed for possible cleanup operations. Surveys have been completed on 2,400 sites, with 1,700 found to need no further action. Of the remainder, 85 have been cleaned up. FY91 resources dedicated to the FUDS program total $87 million.

It's important to note that the majority of environmental contamination problems on today's Army installations originated many years ago. At that time, the Army was in full compliance with applicable environmental laws. Unfortunately, we now know that the old laws were inadequate.

While work done under the IRP has been an expensive and sometimes necessarily slow process, we're confident the Army is doing the right thing to repair the damage. Our goal is to have cleaned up—or at least initiated cleanup on—all contaminated sites by the turn of the century.



A Corps geologist checks contaminated soil brought to the surface by a drilling rig (U.S. Army photo).

## Prevention

Most environmental legislation over the past 20 years has been geared toward controlling pollution. That is, pollutants are permitted to enter the environment in reduced concentrations, or hazardous wastes are placed in landfills designed to eliminate or reduce their detrimental effects. While this philosophy has done much to limit the uncontrolled spread of contamination, it has done little to actually preclude the introduction of waste materials into the environment.

The Army believes that prevention must be the focus of our efforts over the next 20 years. In other words, if we limit waste generation, our disposal and containment problems are similarly reduced. To do that, we have initiated several programs aimed at reducing the amount of hazardous materials used in daily operations.

One of our key initiatives is the Hazardous Waste Minimization (HAZMIN) program. Instituted in 1984, it established the Army's goal of reducing hazardous waste generation 50 percent by the end of 1992. Methods being employed under this program include recycling, using non-hazardous materials in place of hazardous ones, modifying specifications for system acquisition, developing more stringent procurement policies, improving material tracking, and improving our knowledge and use of new waste reduction technologies.

In addition, the Army recently completed development of a 5-year Integrated Hazardous Material/Hazardous Waste Management Plan (HM/HW). Under this plan, we have identified 13 major areas where additional emphasis is needed to streamline and improve the overall effectiveness of our efforts at controlling waste materials. Other ongoing and planned activities include precious metal recovery, recycling used oil, and the Used Solvent Elimination (USE) program.

## Stewardship

In the traditional sense, stewardship relates to proper land management, including the preservation of cultural, natural and archaeological resources. Programs like Integrated Training Area Management (ITAM) help us identify environmentally sensitive areas on each installation. This helps us make smart environmental decisions as

we plan and develop training ranges, maneuver areas, and other capital improvements.

But from a larger perspective, being good stewards means that we also comply with environmental laws and regulations as a normal way of doing business. It also requires that we clean up our past mistakes, take positive steps to prevent recurrences, and pursue new ways to reduce the amount of pollution we generate. It means that we need to be more sensitive to the potential impact of our operations on our country.

To further this stewardship philosophy, the Army is working hard to improve communications with other federal agencies as well as the general public. It's hoped that mutual understanding of environmental problems and programs will foster greater involvement and commitment among all parties.

## Program Initiatives

The Army is committed to the long-term development and continued effectiveness of environmental programs. To support that dedication, we have completed or initiated these major programs:

- Revised AR 200-1, *Environmental Protection and Enhancement.*
- Published Commander's Guide to Environmental Management.
- Established new tracking procedures to provide better management of environmental compliance funds.
- Established an environmental "hotline."
- Established an Army Automated Environmental Management Information System (AAEMIS) to provide needed management tools.
- Established an Army Environmental Response and Information Center (ERIC).
- Established a Senior Executive Environmental Council to foster a proactive stance in anticipating future requirements and implementing needed policies.
- Developing an Army Environmental Training Master Plan to promote environmental awareness in the Army community.
- Developing an environmental career management field staffing guide.
- Developing an increasingly effective support structure to provide environmental support to installations.

## Strategy for the Future

The Army is moving toward the next century with a sound environmental program. But we recognize that there are many challenges still before us. Our key areas of focus will be prevention, developing a more proactive compliance program, and fostering better public understanding and support of our efforts.

To provide the proper foundation and impetus for our efforts, we're working hard to develop a comprehensive environmental strategy through the auspices of the Senior Environmental Leadership Conference (SELC), and the Defense and Environment Initiative (D&EI). The strategy will be centered on an assessment of the next decade's major environmental concerns; the programs needed to meet those concerns; scheduling actions and funding for DERA; assessment of federal, state and local requirements and their impact on operations, and a detailed analysis of all available environmental information.

While the future will undoubtedly bring changing missions for the Army, the goal of its environmental program will remain the protection and enhancement of our country and its resources.

The need to achieve this goal is well illustrated by the theme of the Army's Senior Environmental Leadership Conference:

*"We don't inherit the earth from our ancestors, We borrow it from our children."*

*Lieutenant Colonel Werle is serving with the Kuwait Reconstruction Task Force in the Persian Gulf. He was formerly assigned to the Army Environmental Office in Washington, D.C. Previous assignments include command and staff positions in Europe, Turkey and Conus, and a Training-With-Industry tour with the Environmental Protection Agency. He holds a bachelor's degree in mathematics from Virginia State University, and a master's degree in environmental engineering from Virginia Tech. He is a registered professional engineer in Virginia.*

Readers wishing to comment on material appearing in ENGINEER are encouraged to address their comments to: ENGINEER Professional Bulletin, ATTN: ATSE-TDM-PB, Fort Leonard Wood, MO 65473-6650. Selected correspondence may be used in the bulletin's upcoming "Letters to the Editor" department.

# Training and Fighting with the Saudis

*By Major John R. Jones, Captain Everett McDaniel and Captain Stephen R. Zeltner*

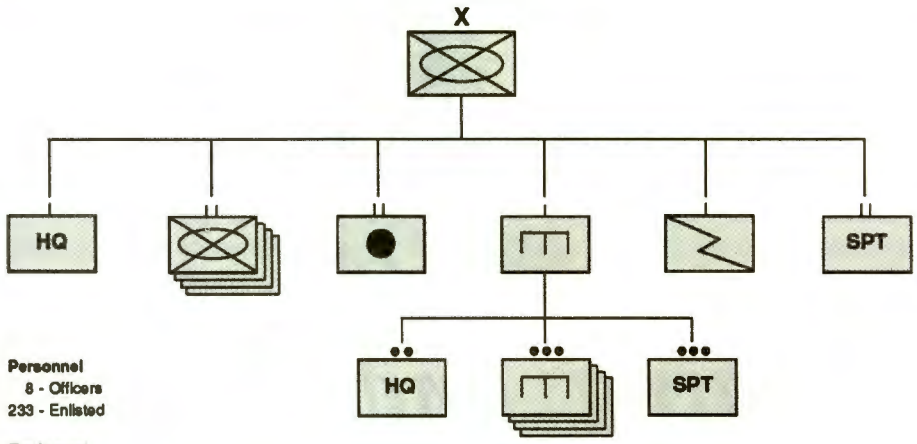
On August 2, 1990, Iraq swept through Kuwait and massed combat units within striking distance of Saudi Arabia. To help counter the threat of invasion, and provide time for outside assistance to arrive, the Saudi Arabian King Abdul Aziz Brigade (KAAB), a National Guard infantry unit, moved to the Kuwaiti border. Within 24 hours, the Saudis were conducting a screening mission along a 60-kilometer (km) front.

We were fortunate enough to have the opportunity to deploy with the brigade, an assignment arranged through the Office of the Program Manager—Saudi Arabian National Guard (OPM-SANG). An American agency headquartered in Riyadh, OPM-SANG provides assistance to the Saudi Arabian National Guard. The agency was formed to support a 1974 U.S.-Saudi cooperative agreement which provides for the modernization of SANG. The agency is composed of 55 military and 134 civilian personnel with widely diverse training and experience backgrounds.

One of us (Major Jones) was assigned full-time to OPM-SANG at the outbreak of hostilities, with normal duties focused on the planning, design and construction of SANG facilities. When it became clear that wartime advisors were needed, two captains from Fort Leonard Wood (McDaniel and Zeltner) were deployed to assist OPM-SANG. The three of us were then deployed with the Saudi brigade. The senior man served as primary engineer advisor to the



**An American advisor conducts M17A2 protective mask training with soldiers from Saudi Arabia's King Abdul Aziz Brigade (KAAB) (U.S. Army photo).**




**Personnel**
8 - Officers
233 - Enlisted

**Equipment**
19 - V150 Armored Personnel Carriers
8 - 5 Ton Dump Trucks
2 - D7 Bulldozers
4 - 2.5 Cubic Yard Scoop Loaders
1 - Backhoe
2 - Road Graders
20 - .50 Caliber Machine Guns

**The King Abdul Aziz Brigade**

brigade, while the other two served as company advisors.

Unlike the U.S. Army National Guard, SANG is a full-time force. It is capable of conducting short-notice operations anywhere in the Saudi kingdom. Commanded by Crown Prince Abdullah bin Abdul Aziz Al Saud, heir apparent to the throne, SANG is known as the "Ikwan," which means "brotherhood" in English. It is composed primarily of intensely loyal Bedouin tribesmen totally dedicated to the royal family, the nation, and Islam. Major missions include protection of vital installations such as oil refineries, industrial facilities, and communications installations.

## Training

Our initial task was to gain the trust of our Saudi allies.

Taking a cue from Special Forces doctrine, we quickly learned their customs and traditions. We lived with the unit, ate the same food, learned their language, and suffered the same hardships. We also took a participatory approach to training that attempted to combine our own knowledge with the Saudis' extensive desert experience. Initially, progress was slow, but as the Saudis' began to see their accomplishments taking shape, pride and comradery soon followed.

In the early days of the crisis, the KAAB was the only combat force on the Saudi-Kuwaiti border. With much of the brigade's attention focused on the Iraqi forces stationed only a few miles away, any time given to training had to be very battle-focused. Working with the Saudi engineer company officers, we helped develop company mission essential task lists (METLs), and prioritized defense-oriented missions. Leader training with the Saudi officers included terrain walks throughout the brigade sector, and the development of a brigade barrier plan.

As Operation Desert Shield took shape, our training activities focused on countermobility and survivability operations. With the increased allied buildup, the possibility of a coalition offensive called for even more intense training. A realistic training area was needed to provide the Saudis with advanced defensive and offensive operations. To accomplish this, we recommended to the KAAB commander that his engineers build a full-scale, company-sized Iraqi strongpoint to facilitate realistic training. He approved, and the resulting construction proved a valuable training tool—not only for the Saudi sappers, but for the brigade's infantry units as well. Because of time constraints, construction and training assistance for the project was provided by the Marine Corps' 1st Combat Engineer Battalion, and the Army's 7th Engineer Support Battalion.

Such joint cooperation boosted the training efforts. The Army's 307th Engineer Battalion also conducted interoperability training with the KAAB, focusing on individual engineer skills and several crew and collective tasks. The 37th Engineer Battalion provided the Saudi's with extensive training on dismounted and mounted breaching operations. The use of live anti-tank mines, anti-personnel mines, and other demolitions provided the Saudi engineers with the most realistic training they had ever conducted. They performed superbly, and built a renewed confidence in their ability to support the brigade's offensive operations.

To overcome some shortages of equipment and other resources, we





***Top:*** **Gaining the trust and acceptance of the Saudi soldiers was the first step for the advisors. Here, Saudi spiced coffee is served during a break in training (U.S. Army photo).**

***Right:*** **A KAAB soldier prepares Iraqi mines for demolition (U.S. Army photo).**

had to do some quick improvising. For example, a field-expedient minefield marking system was developed with locally available materials. Grappeling hooks were also in short supply, and were needed to support breaching training and operations. Using re-bar and nylon rope, and working with a local American contractor, we were able to fabricate enough hooks to outfit the Saudis. Too, there were no mine probes for the sappers. A quick survey of available equipment resulted in a decision to carve up some Saudi bamboo tent posts into 18-inch probes.

## Fighting

As Desert Shield turned to Storm, it was time to see if the hard work and training had paid off. The answer came quickly.

Twenty-four hours prior to the start of the ground offensive, the Saudi sappers got the mission to prepare breach lanes through a complex Iraqi obstacle consisting of a tank ditch, berm and cyclone fence. This obstacle marked the southern edge of the Saudi-Kuwaiti border. The Saudis are not equipped to conduct mounted breaching operations. They lack mineplows, minerollers, and mine-clearing charges. Even so, the KAAB sappers executed the breach superbly. The combat engineer platoons provided site security, while engineer equipment platoons cleared and marked six 10-meter-wide breach lanes through the obstacle.

For its part in the initial allied ground offensive, the KAAB's orders called for the unit to conduct a supporting attack into Kuwait. They had to secure the sector, and clear the coastal highway for use as the coalition's main supply route (MSR) into Kuwait City. Without quick repair of the severely damaged highway, resupply of ammunition, fuel and water would



be severely hampered.

On the morning of February 24, 1991, one of the KAAB's motorized infantry battalions, supported by two sapper platoons, moved through the breaches and into Kuwait. As the infantry secured the first line of Iraqi defensive positions, the sappers began clearing mines along the highway, reconnoitering the area for minefields, and marking unexploded ordnance. Once the area was secured, an engineer equipment platoon began MSR repair and clearing operations. Other KAAB sappers initiated mine clearing operations along the Kuwaiti coast.

The coastal highway in Kuwait is an asphalt, six-lane, divided highway. Iraqi combat engineers had destroyed the three northbound lanes, making a near-term repair effort an act of futility. The three southbound lanes had been cut, tank-ditch-style, about every 100 meters (m) over the first three kilometers. Over the succeeding 7km, they were partially cut at the same interval. Destroyed Iraqi combat vehicles littered the MSR, and several artillery craters in the



***Top:*** **Saudi engineers display the different types of Iraqi mines and munitions they recovered during their breaching and clearing operations in Kuwait.**

***Left:*** **A KAAB infantry squad celebrates their victory after the battle for the town of Al-Khafji (U.S. Army photos by CPT Zeltner).**



***Left:*** **Iraqi forces severely damaged the southbound lane of Kuwait's coastal highway, the main supply route (MSR) for the coalition forces. The northbound lane was completely destroyed (U.S. Army photo by CPT Zeltner).**

***Lower Left:*** **Members of the advisory team prepare captured munitions for demolition (U.S. Army photo).**



highway hindered repair progress.

Within a few hours of starting work, the Saudi engineers had opened one-way traffic. By nightfall, they had opened two lanes of the highway, allowing both north and south-bound traffic. Other KAAB sappers continued breaching operations, clearing a 1,500m minefield, and widening breach lanes through several minefields adjacent to the MSR.

Over the next two weeks, the Saudis continued their clearing and cleanup operations. They filled in more than 3km of the infamous "fire trench" within the first Iraqi defensive belt. They also cleared an additional 6km of Iraqi minefields, destroying over 14,000 anti-tank and anti-personnel mines in the process. Tons of unexploded ordnance were also destroyed.

The Saudi sappers' achievements were extraordinary. Both the Saudi and Kuwaiti royal families, as well as senior American officials, applauded their accomplishments. Eight months of tough, realistic training had paid off. The Saudi engineers returning from the battlefield were a significantly improved fighting force.

While we hope our engineer expertise played a small part in their success, we think another factor deserves a significant portion of the credit: the warrior spirit of the Saudi soldiers. The men with whom we lived and worked were true warriors who had the will to close with and destroy the enemy.

That kind of spirit is something that can't be taught. And because of it, we also returned from the battlefield as better soldiers.

*Major Jones served as senior engineer advisor to the KAAB. He normally serves as engineer branch chief, OPM-SANG. Previous engineer assignments include tours with the New York District, and the 3rd Armored Division. He holds a masters degree in civil engineering from Pennsylvania State University, and is a graduate of Command and General Staff College.*

*Captain McDaniel served as an engineer company advisor in the KAAB. He is assigned to the 589th Engineer Battalion at Fort Leonard Wood. Previous assignments include duties with the 101st Airborne Division (Air Assault), and the 8th Infantry Division.*

*Captain Zeltner served as an engineer company advisor in the KAAB. He is assigned to the 87th Engineer Battalion at Fort Leonard Wood. Previous assignments include company commander and battalion S1/S4/S4. He also served as company executive officer and platoon leader with the 197th Infantry Brigade.*

# Tackling Hazardous Waste At Fort Bragg

*By Stephen J. Mackmull and George D. Sample*

When Fort Bragg found itself with no less than ten hazardous waste sites, an avalanche of regulatory requirements, and an impending environmental nightmare on their hands—they knew it was time to tackle the problem head-on.

When the post issued its first Installation Hazardous Waste Management Plan in June 1990, in coordination with state and federal environmental officials, it found that the administrative requirements for ten separate waste sites were a headache. The plan requires the designation of waste accumulation site managers and weekly inspection of each site by these managers. In addition, it calls for monthly site inspections by the major unit/activity environmental coordinator, and quarterly inspections by the post. The plan also requires training for all inspectors and managers, and annual recertification of these personnel. Since most managers and inspectors are frequently rotated military personnel, the training requirement alone was seen as a significant burden to the post.

To better manage their hazardous waste program, the post's Directorate of Engineering and Housing (DEH) decided to build an accumulation site to consolidate waste storage, utilization and disposal. In addition to eliminating Fort Bragg's relatively large number of dispersed sites, the single facility allows better management of waste materials, provides adequate security, and eases the job of transferring the waste.



**A DEH employee takes a sample from an "unknown" fluid brought to their hazardous waste storage site.**





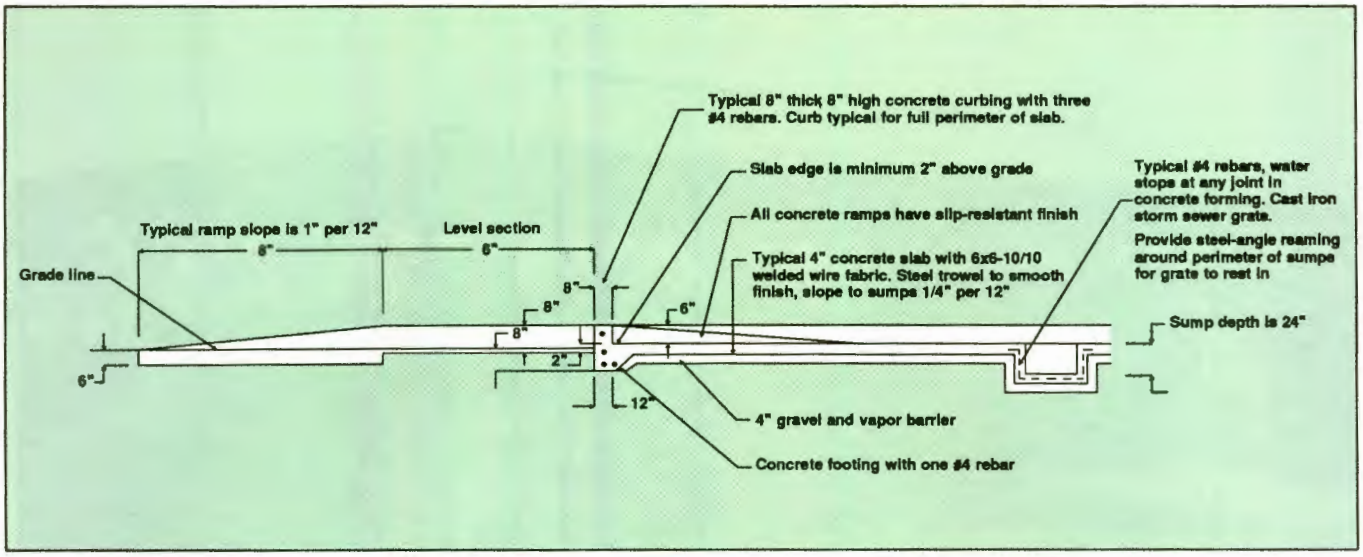
***Top:*** **Fort Bragg's new hazardous waste storage facility. The site provides better control and monitoring of hazardous materials, and improved safety for post employees and residents.**

***Above:*** **A forklift eases the job of moving large drums of material inside the facility.**

## Site Design

The site was designed by DEH's Design Branch, in cooperation with the organization's Environmental Branch. The storage area, or pad, measures 30 feet by 60 feet. The floor is 4-inch-thick, 3,000 pounds-per-square-inch (PSI) concrete, with a 6-inch curb surrounding the entire pad. The pad has two sealed sumps, 24 by 24 by 24 inches, to catch any spills from stored materials.

The facility has no walls, and the roof—with its 36-inch overhang—is supported by 18 6-inch by 6-inch timbers. The site includes two fluorescent light fixtures, and one 110-volt electrical outlet. All electrical items are vapor-tight, industrial cast aluminum. A freeze-proof safety shower and eye wash assembly was also installed at one corner of the pad. Drainage is maintained within the pad's 6-inch curb, for obvious safety reasons.




**Section through ramp, curbing and sump pits**

A 9-foot-wide concrete ramp leading to the pad allows personnel to move hazardous materials by forklift. The site is surrounded by a 7-foot-high chain-link fence, topped with barbed wire. The ground between the storage pad and the fence is covered with crushed rock.

## Waste Sources

Most of the toxic and hazardous waste used or generated at Fort Bragg is tightly controlled, and is part of a "continuous waste stream" system. That is, it comes from sources that generate such waste as part of their daily operations. Such materials include waste paints, used photographic chemicals, chemical cleaning solutions, and used oils. These wastes are carefully collected, placed in appropriate containers, tested to ensure their chemical composition, and then transported to the Fort Bragg Defense Reutilization and Management Office (DRMO). Civilian waste disposal companies, under contract with DRMO, then take charge of this waste.

The rest of the hazardous waste, and the kind most often handled at the accumulation site, is usually the result of what we call "one-time events." For example, a particular job on the post may require the use of a toxic chemical, a toxic solution may result from mixing two or more chemicals, or suspected toxic material is found somewhere on the installation. Such materials often come from cleanup operations, and include decontamination solution No. 2 (DS-2), and supertropical bleach (STB).

One of the biggest sources of toxic waste is the so-called "mystery drums." This catch-all phrase includes long-forgotten containers of various sizes found in wooded areas, behind barracks, in motor pools, and any other conceivable location. These containers are usually rusted and unlabeled, requiring storage in the accumulation site while tests are made to determine the contents.

Sometimes, new containers are mislabeled, posing a potential toxic risk to employees. Recently a motor pool labeled a group of containers as "used lead-acid battery electrolyte." However, a spot check by a waste management contractor found that several containers did not contain battery acid—but another potentially dangerous chemical. This batch of chemicals was placed in the "unknown" section of the accumulation site to await analysis.

## Waste Disposition

The accumulation site's pad is divided into pallet-sized storage zones (see illustration next page), with specific areas for flammables, corrosives, oxidizers, reactives, and unknown materials.

Incoming wastes are placed in the appropriate storage zone for up to 90 days. "Mystery" containers are sampled and analyzed. When the test results are known, the material is moved to the proper zone to await removal. Material in deteriorated containers is repacked and labeled correctly for subsequent transfer. Most materials temporarily placed in the accumulation site are ultimately transferred to one of DRMO's waste contractors for proper disposal.

There are a couple of exceptions, however. If flammability is determined to be the only hazard associated with material brought to the site, it may be taken to the 82d Airborne Division's heating plant. The plant is authorized to burn waste oil products, providing the

products meet certain environmental criteria. Recently, a rusted drum with no labels or other markings was found on post. The bung seals, while badly deteriorated, were still in place—indicating that the drum had not been opened. Testing revealed that the drum contained petroleum naphtha, which can be burned by the heating plant. The drum itself, after being thoroughly drained, will be taken to a local landfill. Non-flammable materials, if testing reveals that they pose no toxic danger, will also be deposited in the landfill.

## Minor Problems

Some lessons were learned during site construction. The initial ramp to the pad turned out to be too narrow. The original 6-foot ramp was wide enough for a forklift to move materials up to the pad—but only if it was perfectly positioned. However, in hindsight, we felt that toxic and hazardous materials needed more of a safety margin than "just wide enough." The ramp was widened to 9 feet before the site was officially opened.

We also found that grates over the sumps would not support the weight of a forklift because the rim around the inside of each sump was too weak. Three inches of angle iron was subsequently added around each sump to correct the problem.

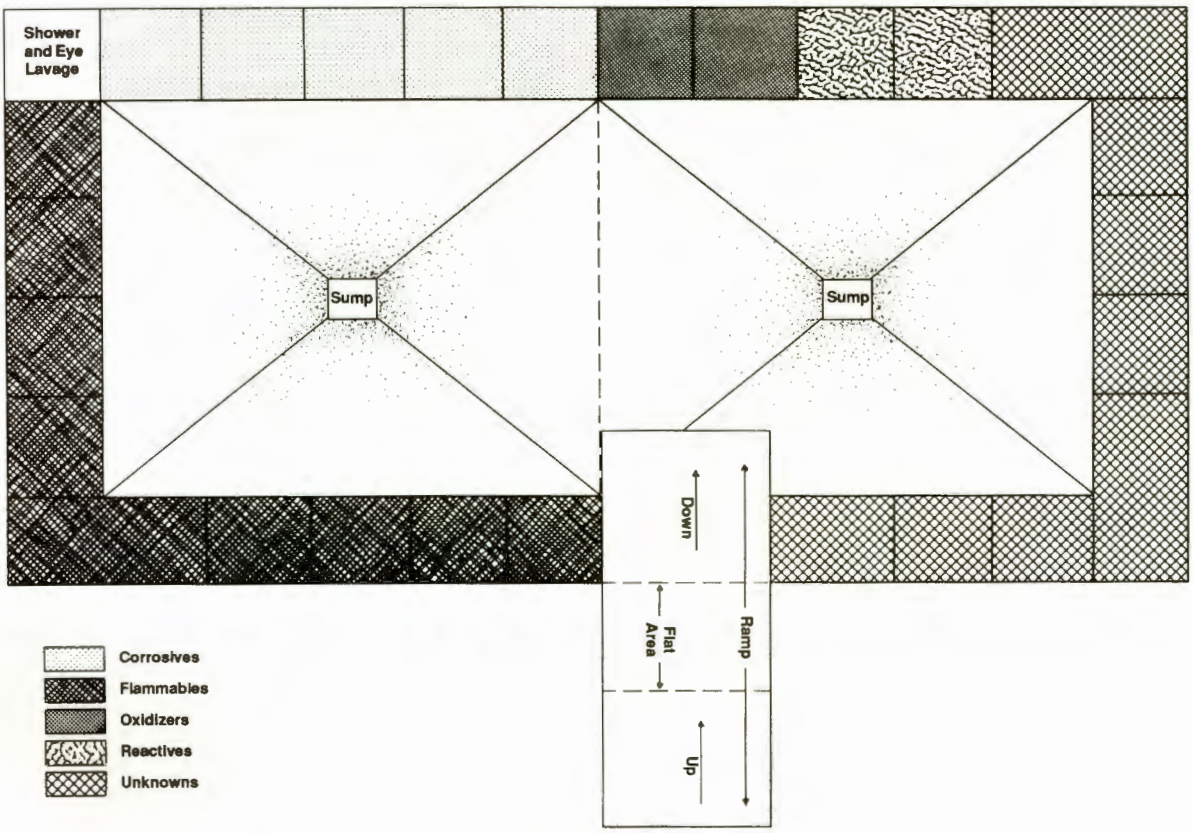
## A Success Story

Fort Bragg's accumulation facility has been a proven success. During calendar year 1990, the site played a major role in helping the post eliminate more than 400,000 pounds of hazardous waste. The site has also helped to facilitate management of toxic and hazardous wastes, improve safety conditions for Fort Bragg personnel and their families, and brought the post into compliance with current state and federal environmental regulations.

Military or civilian engineers interested in more information on the accumulation site are invited to contact George Sample or Stephen Mackmull at Autovon 236-3341 or commercial (919) 396-3341.

*Mr. Mackmull is an environmental engineer and chief of the Environmental Branch of Fort Bragg's Directorate of Engineering and Housing.*

*Mr. Sample is a chemical/environmental engineer and the hazardous waste manager for Fort Bragg's DEH.*




**Storage Area**

# Area Damage Control:
## The Forgotten Mission

*By Major Edward M. McClure*

When enemy action, accidents or natural disasters wreak havoc in the rear area, it's usually engineers who are tasked to lead the restoration effort. While I have no doubt that we are capable of handling damage control, we don't usually get much training or guidance on how to do it. This article is intended to serve as a primer on planning and executing damage control in the rear area of operations, division and corps rear areas, and the communication zone (COMMZ).

Area damage control (ADC) is described in FM 90-14 and FM 90-23 as "Measures taken before, during and after hostile action or natural or man-made disasters to reduce the probability of damage and minimize its effects." Note that this definition calls for minimizing the effects of damage, not damage itself. Damage control is not the same thing as damage repair. There are five basic principles of damage control that I'll cover through the article.

### Principle #1

Repair—rebuilding something back to its original state—takes place after control. This is the first and most important principle of damage control. Translating this into operational terms, the ADC mission is to ensure freedom of action and restore operations. This is accomplished by preventing damage, preparing for expected damage, and responding to damage after it occurs.

ADC is an operations function, although FM 90-23 overemphasizes the role of engineers in ADC. ADC actions have a direct impact on the commander's ability to complete his missions and take care of his soldiers. The impact may be direct, as in cases of soldier injuries, damage to militarily-useful facilities, and destruction of equipment. Indirect impact includes diversion of manpower and equipment from primary missions, interference with movement, and degradation of morale.

### Principle #2

Area damage control is not exclusively an engineer mission. In fact, the primary operators in ADC missions are the soldiers in or near the affected areas and facilities. However, eight times out of ten, local engineers will be tasked to take care of the problem—or at least lead the ADC effort. But engineers cannot do the job alone, even with host nation assistance. Even simple ADC efforts require circulation control and communications.

Almost everyone in the rear area has an ADC mission. These are some of the non-specialized functions of an ADC effort:

Rescue
First Aid
Firefighting
Communications
Earthmoving
Evacuation
Site Security
Reconnaissance
NBC Reconnaissance
Decontamination
Mess and Water Supply

These are the specialized functions normally performed by specific types of units:

| | |
|---|---|
| Heavy Earthmoving | Engineers |
| Demolition | Engineers |
| Construction | Engineers |
| Facilities Inspection | Engineers |
| Road and Bridge Recon | Military Police |
| Circulation Control | Military Police |
| Combat Patrolling | Military Police |
| Crowd Control | Military Police |
| Large-Scale NBC Decon | Chemical |
| Ordnance Disposal | Explosive Ordnance Disposal (EOD) |
| Emergency Medical Care | Medical |
| Medevac/Dustoff | Medical |
| Long-Range Commo | Signal |
| Supply | Support |
| Transportation | Support |
| Maintenance | Support |
| Civil-Military Liaison | Civil Affairs |
| Graves Registration | Adjutant General's Corps |
| Personnel Accounting | Adjutant General's Corps |

In addition to these, numerous resources are provided by other services, allied forces, civilian contractors, local civilians, and the host nation.

The rear command post (RRCP), rear tactical operations center (RTOC), or rear area operations center (RAOC), will coordinate the ADC plans and operations for its area of responsibility. If these control centers are not available to oversee ADC operations, engineers are most frequently nominated to run the show.

## Principle #3

The best way to control damage is to prevent it from happening. Terrain managers can control damage by exploiting readily available natural and man-made cover and concealment, and by dispersing and concentrating, as appropriate, troops and facilities. Then, we can look at enhancing cover through site hardening, and concealment through additional camouflage.

Units, bases and base clusters need to start with self-help, using organic resources, and then request support through normal organizational channels. Decisions about who gets scarce resources must be coordinated at the RAOC/RTOC/RRCP.

The principles of METT-T (mission, enemy, terrain, troops, resources available, and time) apply to this decision process.

In setting priorities for ADC protection operations, determine the mission-essential activities and facilities for the division, corps and theater. Note that we are not looking at the rear area's mission, but the mission of the entire command.

Then we must identify the threats: enemy, accidental, and natural. Both the likelihood of the threat(s) and the vulnerability of personnel, facilities, systems or operations must be evaluated. The result of this estimate process should be a set of priorities for ADC operations, which are then translated into mission orders and Class IV supply guidance.

## Principle #4

There are never enough resources or time to do everything. The priorities we developed to guide the prevention effort also serve as a pattern for our response to damage. Somebody must set the priorities for ADC response operations, and it must be somebody with sufficient authority to make them stick when the going gets rough—like the division commander or assistant division commander. When the damage is done and things need to get fixed in a hurry, it's too late to go through an analytical process to determine who gets the relief effort. And the need to get facilities and operations back on track is too critical to allow subordinate commanders to squabble over who gets what slice of the ADC pie.

As far as possible, analyze your potential ADC problems in advance, gauge your ability to respond to them, and get some priorities down on paper. Identify and continue to monitor the status of ADC assets, especially heavy engineer equipment, chemical decontamination units, and emergency medical capabilities. Identify and monitor the ADC resources available in units, bases and base clusters. Determine the distance between bases and their ADC assets. In other words, how long will it take to get the nearest decon platoon to a certain base? The monitoring process must be continuous and must track both commitments and movements. The bottom line is knowing where your ADC assets are, and what their capabilities are at any given time.

Review the positioning of units from an ADC perspective. We've already looked at cover and concealment, dispersion and concentration, and vulnerability. Now consider access to ADC assets for the bases, and the disposition of the ADC assets themselves. Do they match the load? Are they where they need to be to get the job done? Do we have high-priority bases that are too far away from medical, chemical, or engineer support? Do we move the base, move the asset, or just sweat?







***Top left:*** **Engineers make a damage assessment of cratered runway. In wartime, repair of such damage is likely to be a major focus of engineer effort.**

***Top right:*** **A soldier compacts soil in a crater as part of the repair process.**

***Above:*** **Engineers clean up the edges of the concrete surrounding a bomb crater.**

Whatever level you're at, remember to advise your higher headquarters and the local RAOC/RTOC/RRCP if there is an unfilled need or an uncovered vulnerability.

Local measures are the foundation of effective damage control. Every level—unit, base, base cluster, and higher—needs to plan and coordinate response to damage. Develop generic responses to general categories of threats. Develop specific contingency plans for likely, dangerous and known threats. Identify specific local vulnerabilities. In addition to coordinating with the potential "victims" and ADC assets, coordinate with the command and control systems in the rear area, including the movements control center (especially the highway traffic headquarters, or HTH). the echelon's logistical headquarters (DISCOM, COSCOM, Area Support Group), and higher and adjacent headquarters.

Part of this preparation process is a review of lower level ADC plans. You need to make sure that units, bases and base clusters for which

you are responsible know how they are going to conduct ADC operations. Each individual unit or base plan must have procedures for identifying and monitoring ADC resources, both on and off base. For example, where is the nearest surgical facility, and how will casualties be transported?

Each base must have an alarm system with distinct signals (air attack, ground attack, NBC attack, fire, and all-clear). Base plans must also direct units to furnish ADC reaction teams for firefighting, NBC reconnaissance, NBC contamination, casualty transport, first aid, light rescue (with jacks, shovels, rope and pry bars), heavy rescue (with wreckers, forklifts, and vehicle-mounted winches), and EOD reconnaissance. Personnel must be organized, trained and rehearsed. Personnel accountability and emergency supplies must be included in the plans, along with alternate operating locations and rally points.

The unit, base and base cluster ADC planning process is basically the same as that used at higher levels: What are our most important facilities? (Note that this question must be based on guidance from higher headquarters in the tactical chain of command. The local base commander may not know what facilities are the most important for his higher command's current operations.) What are the threats? How does each threat affect each facility? What do we have to do to preclude damage? What time and resources do we have available? How will we respond to identified contingencies?

Finally, contingency plans must be rehearsed or they won't work when they're needed. Unit, base, base cluster and area commanders must supervise. Rehearsals are a pain, and drumming up any enthusiasm for them is a challenge for commanders. But no plan will work effectively without practice, especially for operations as potentially complex as ADC.

When your area is hit, and ADC is implemented—you will probably find that even well-planned efforts will be stretched beyond their capabilities.

Your first step is to assess the damage and/or contamination. This requires information. If bases in the impacted area do not conduct the necessary reconnaissance, then you will have to direct it. Technical experts—engineers, signal, ordnance, and chemical—may be needed to determine:

- What happened and where?
- What impact does it have on operations?
- How do we get around it or do without it?
- What time and resources do we need to get it operational?

Report the extent and location of the damage to the RAOC/RTOC/RRCP, higher headquarters and relevant command and control systems as soon as possible. For example, the movements control center (MMC), or movements control agency (MCA) in the COMMZ, needs to know about road and rail problems immediately so they can reroute convoys and trains. If an airfield is knocked out, the support command needs to know that supplies cannot make it through. The intelligence community needs the information to pick out patterns in enemy behavior that indicate their intentions.

At the scene, isolate the danger area and prevent continuation or extension of the damage. Mark contaminated areas and keep traffic out so possible contamination cannot spread further. Troops in a contaminated area must remain there until a decontamination site is established and a safe route is established to it. Make sure this route does not cross any important roads or pass anything else of importance to the operational effort. Prevent fires from spreading by clearing firebreaks. Mark and rope off unexploded ordnance and other hazardous areas.

When it comes, you won't find damage in isolated incidents. You will usually have many things happening at the same time. And you won't have the resources or time to deal with all incidents at once. Look at your priorities, swallow hard, and start at the top of the list. Then, conduct an "ADC triage" by posing three questions for each case:

- First, does it have an impact on operations? If not, go to the next case. You have a war to fight, and damage that doesn't impair or threaten operational capabilities will have to wait until later.
- Secondly, will your efforts help? Will it do any good? If nothing can be done to restore the base or facility to operation, then don't waste time or resources on it. Just like a medical triage situation, hard decisions are required. But you do not have the luxury of taking care of hopeless cases.
- Lastly, can the damage be controlled by on-scene personnel? If local base resources can deal with it (fighting fires, clearing rubble, filling craters), then let them do it and get your people to more critical areas.

Next, determine what is needed to restore operations and ensure freedom of movement. This is a three-step process:

- Determine which operations and movement routes are really required. Ask yourself:

What does this facility, bridge, road, or unit contribute to the mission? Answering this question requires a depth and breadth of knowledge about combat, combat support, and combat service support operations—as well as access to appropriate staff planners and operators. If you have done your priority analysis well, this information will be at your fingertips.

- Once you know the value of the damaged facility, determine what level of restoration is required to reach the needed level of operation. Remember, more extensive or long-lasting repairs can wait until after the war. We just want to get operating again. For example, you may need to clear rubble off a highway, but only enough to open one lane—not two. You may need to replace a bridge, but only up to class 24—not 60.
- Finally, translate those critical requirements into specifics: blade hours, soldier-shovel hours, medics, EOD specialists, fixed bridge bays, and so on. Again, you'll need technical specialists for this process unless you make yourself knowledgeable in fields other than your own. Learn how much of each resource is required to take care of each kind of problem. This may be the most difficult part of organizing damage control responses. Often you will need to rely on the analysis of soldiers on the scene. If you have the opportunity, train them to make good ADC estimates. Keep a reference guide so that your successor can use the same knowledge without having to "re-invent the wheel."

Once you know what needs to be done, somebody has to make it happen. Someone in authority must task units and personnel to take care of the damage. An SOP annex will not make it happen. One practical thing I've learned from ADC operations is that this requires someone who can speak for the corps or division commander. If the order does not come from someone in the tactical chain of command, it won't get done. Operators in the field have many pressures—so many tasks, missions, and requests—that the damage control effort will be pushed low on the list unless significant command attention is brought to bear.

The operations order (OPORD) for an ADC response uses the same principles as any other OPORD. The usual five-paragraph field order works just fine. A few things, however, need special attention. In a tactical OPORD, unity of command is not a problem; it comes with the tactical organization. In ADC operations, it's not that simple. The base and base clusters contain many command structures. Add the ADC response forces, and it can be a real nightmare. You must ensure unity of command at the site by setting out a clear task organization. Based on METT-T, you can either place the response forces under the base commander, base cluster commander, or vice versa.

## Principle #5

Everyone in the impacted area must be placed under the control of one commander. That commander must mesh operational priorities in the OPORD with the resources available to control damage and resume operations.

In summary, when you're planning or implementing area damage control, remember these points:

- Unity of command is vital to getting the job done. Somebody has to be in charge.
- There are never enough resources or time to do everything. Do a triage of each situation. We get paid to make hard decisions.
- The best way to control damage is to keep it from happening in the first place.
- Engineers are not alone when damage hits. Know what everyone else does, and use them.
- Your mission is to restore operations—not repair facilities.

Damage control is a combat multiplier that, when properly conducted, can minimize the enemy's ability to affect your operations. Make it happen.

*Major McClure is an engineer officer and member of the North Carolina National Guard. He currently serves as an assistant professor of military science at North Carolina State University at Raleigh. Previously, he served with the 139th Rear Area Operations Center—the first RAOC deployed in Desert Shield/Desert Storm. He has also served as commander of an area damage control task force, and worked as a Middle East analyst for Intelligence and Security Command.*

# Safe Port Operations

The timely shipment of thousands of tons of equipment, ammunition, and supplies was critical to our victory in the Gulf War. This task required the orchestration of several Department of Defense agencies and all aspects of port operations, including port support activities (PSA).

For the Engineer Branch, PSA are a necessary and recurring part of our deployments. And all facets of PSA, rail movements, staging, and ship loading/off-loading operations, have inherent hazards.



**Lopsided loads are a common hazard during load-up operations. This truck's center of gravity changed due to the weight and height of the secondary load. As the truck was lifted it began to lean dangerously toward the heavier side.**

Army leaders must assess these hazards to prevent or minimize the number and severity of mishaps and injuries their soldiers sustain. They must inform soldiers about the risks associated with each part of a port operation. As in any activity, the success of our prevention efforts depends on how well we communicate.

The tailgate session is a successful method of presenting a safety message. Its name came from the practice of employees sitting beside a truck's tailgate while they listened to their supervisor's safety briefing. Tailgate sessions are effective because they allow a supervisor to describe specific tasks and associated hazards at the job site—where the rubber meets the road. Supervisor involvement lends authenticity to the safety message.

The following safety tips apply to port support activities in any deployment situation. Use them to develop and implement a meaningful accident prevention plan for your unit.

- Commanders, ensure that PSA personnel are given specific guidance on their duties before they start an operation.
- Warn all personnel about smoking in unauthorized areas, and that violations will not be tolerated.
- Ensure that all soldiers are drownproofed; develop and practice a soldier-in-the water drill.
- Brief port operators on how to safely climb on a helicopter covered with shrink wrap.
- Ensure all helicopters on board a vessel are properly grounded.
- Clearly mark tie-down points and lift points to avoid confusion.
- Brief your personnel not to stand under cargo as it is being hoisted.
- Inspect rail car spanners for potential instability.
- Ensure cargo and secondary loads are secured before loading them aboard the vessel.
- Ensure only licensed/qualified operators are allowed to operate loaded equipment.
- Alert your personnel that commercial stevedores often back vehicles without ground guides.
- Never allow personnel to walk in front of a vehicle that is coming down a ramp.
- Avoid stopping a vehicle midway on a ramp; this practice may result in clutch damage or brake failure.
- Brief soldiers never to stand in front of a parked vehicle when ground guiding another.
- Remind soldiers to use hand tools correctly and never to use a body part as a tool.
- Enforce the use of personal protective devices for head, eyes, ears, hands, feet, and lungs.
- Brief proper lifting techniques: Think before lifting. Analyze the task. Get help. Find a better way. Save a back or muscles from injury.
- Keep the work area clean. Look for surface hazards before starting an operation.
- Know the hazards associated with pressurized hoses and energized wiring. Decompress or disconnect—save a limb or a life.
- Split rim tires can kill. Always use a safety cage. Use only tools designed for mounting and demounting tires.

Leader involvement is required for a successful safety program. Safety is a graded exercise, and a single preventable mishap may cause you to fail. Supervisors must review their daily activities and assess risks before a job is started. Commanders must keep their standing operating procedure current with changing missions and unit equipment.

*By Captain Miguel Torres, Engineer Branch Safety Manager, Fort Rucker*

# Underground Storage Tanks:

## *The Silent Menace*

*Most underground storage tanks are made of steel, which started corroding the day they were placed in the ground.*

***By Scott Murrell***

The story is becoming all too familiar. Someone turns on their kitchen faucet one day and finds water reeking of gasoline. The bewildered person calls the fire department and the utilities company. There's no immediate fire hazard, but further investigation reveals that the ground water has been contaminated by gasoline from a neighborhood filling station. The sole water source for the neighborhood is now undrinkable, and will probably remain so for years.

The gasoline contamination was caused by a leaking underground storage tank (UST), one of hundreds of thousands buried all over the country. While putting gasoline and oil tanks underground minimized fire hazard problems and improved esthetics, it also gave us a monumental environmental problem. Most USTs are made of steel, which started corroding the day they were placed in the ground.

As these tanks aged, corrosion caused tiny holes in many of them. Gasoline and oil leaks usually took place slowly—too slowly for the owner to notice the problem. By the early 1980s, some experts estimated that 25 percent of all USTs were leaking. Many private water wells and some municipal water supplies became contaminated. In the state of Missouri alone, some 6,000 leaking USTs have been discovered, enough to contaminate the state's entire ground water supply if corrective action was not taken.

As the scope of the UST problem became apparent, the Environmental Protection Agency (EPA) began to take action. In 1988, the Resource Conservation and Recovery Act was amended to provide close regulation of USTs. The new legislation calls for determining the location of all existing USTs, and requires their owners to conduct leak testing. Leaking tanks must be repaired or replaced. Corrosion protection systems must be installed on all existing tanks by 1998, and new tanks must be double-walled, and made of corrosion-proof materials. New tanks must also be equipped

with sensors which sound an alarm if a tank develops a leak.

## Fort Leonard Wood

A decade ago, Fort Leonard Wood had hundreds of USTs. Over the post's 50-year history, almost any unit with vehicles had been given its own fuel storage tanks. More than a hundred of the post's USTs were large gasoline and diesel fuel tanks. Many small heating fuel tanks were also spread throughout the installation.

Beginning in the mid-1980s, in anticipation of the new regulatory requirements, the post's Directorate of Engineering and Housing began to remove unneeded USTs. By the time the new regulations started taking effect in 1988, the post still had 74 regulated tanks that had to be registered with the Missouri Department of Natural Resources (MDNR). These tanks were then prioritized for a testing and upgrade program.

During 1988 and 1989, tanks at the post airfield and at a unit motor pool were discovered to be leaking and were removed. Both tanks had contaminated small amounts of soil, which were easily removed. The MDNR was satisfied with our cleanup efforts, and our experience to that point seemed to indicate that USTs were not going to pose a significant problem. However, this turned out to be the proverbial calm before the storm.

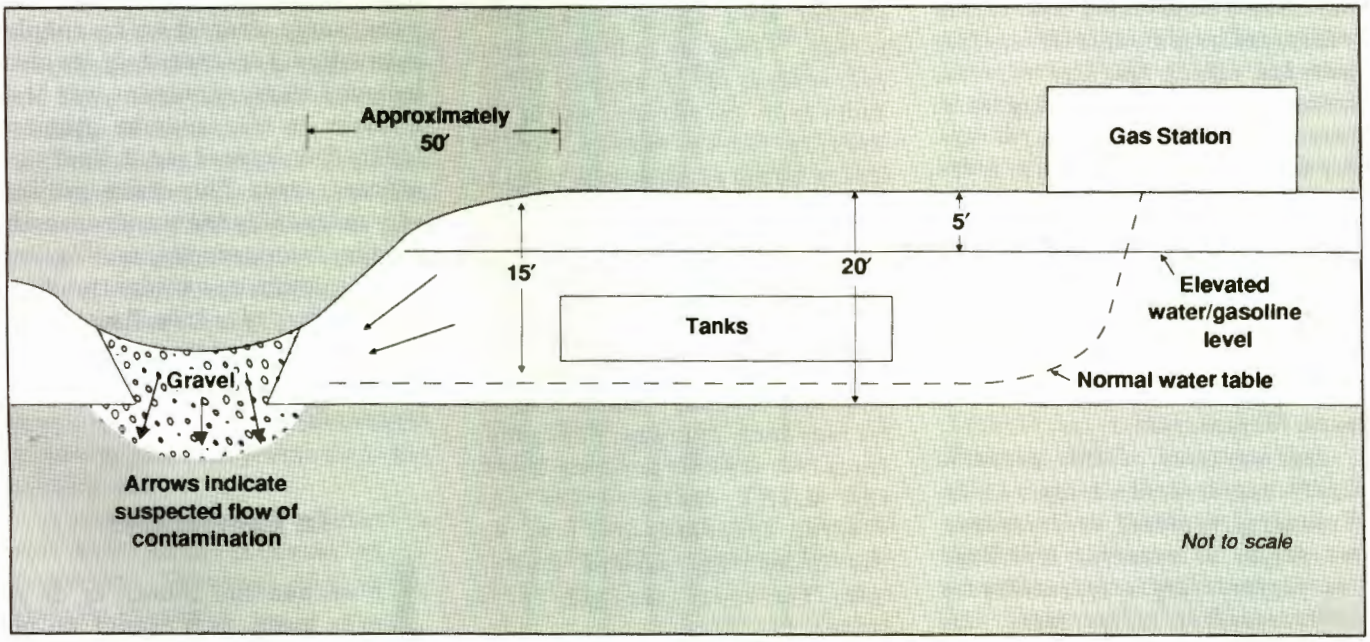
## The Gas Station

Two years ago, DEH turned its attention to four large gasoline tanks located at the post exchange service station. Since inspection of these tanks would involve considerable excavation, a decision was made to go ahead and put in new fuel pumps and supply lines that had been scheduled for installation later. The entire project had an estimated cost of $400,000, and the service station was expected to be closed for about four months.

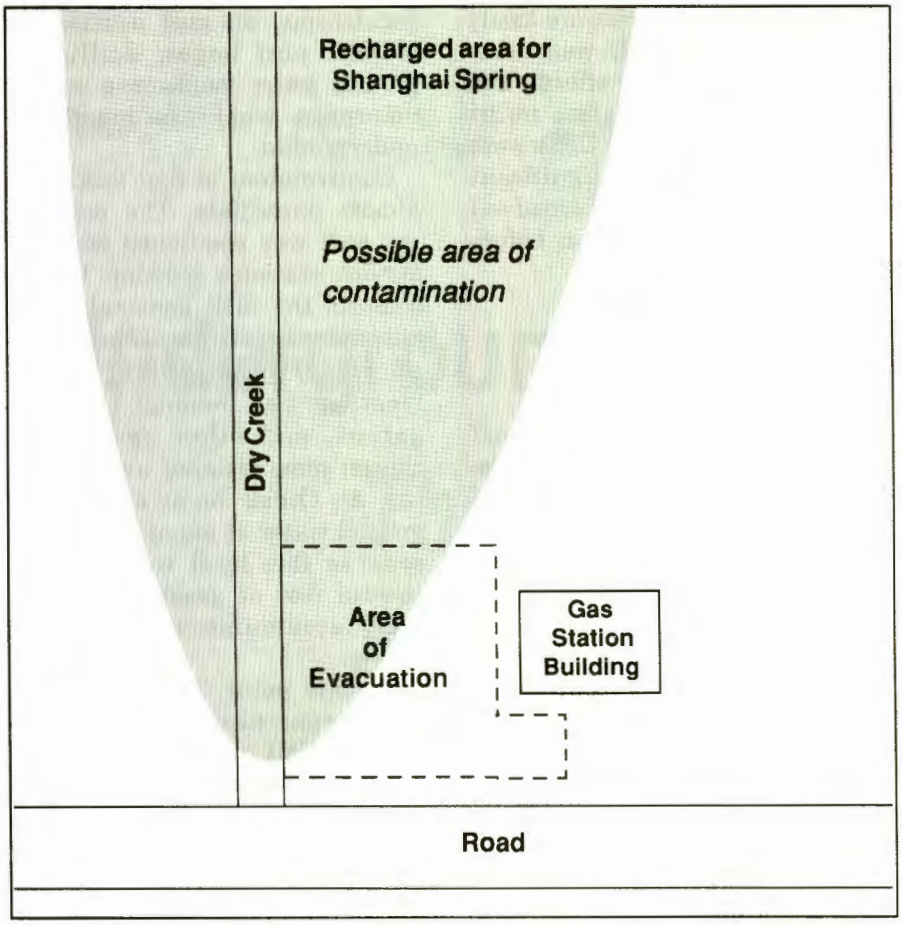
But in February 1989, before work on the project had begun, the service station manager reported discrepancies in gasoline inventories. Leaking tanks were suspected, although there was no outward evidence of this. As required by the new storage tank regulations, the post notified the MDNR and began drilling a ground water monitoring well to determine what was happening underground.

Confirmation of fuel leaks was almost immediate. The monitoring well was positioned over the service station's parking lot. As soon as the drill penetrated the pavement, gasoline welled up in the hole. Further drilling at that location was deemed too dangerous, and other spots were chosen some distance away. Drilling at these locations found ground water at about 20 feet. As soon as this level was reached, several feet of gasoline immediately accumulated in the well casing.

At this point, it was obvious that the gas station posed a more serious UST problem than our earlier tank projects, but we still believed that the contamination was localized. A project to replace the tanks was still in the design stage, and was not scheduled for completion until later that year. The MDNR agreed to delay a full-scale excavation of the site until the UST replacement project was ready. As part of the agreement, the post maintained ground




Location of leaking USTs




water monitoring wells, and periodically pumped out leaking gasoline that accumulated in the wells.

The service station was built in 1959, on a site which originally had been a deep valley. Half of this valley had been filled with earth to provide space for the pumps, storage tanks, and a parking lot. A small creek flows through the valley along the bottom edge of a 20-foot-high earth fill embankment bordering the station parking lot. In hindsight, it should have been apparent to the original project engineers that any spilled gasoline and diesel fuel would pass easily through the relatively loose fill material.

Replacement of the station's USTs began in December 1989. Following removal of the tanks, we began to excavate soil from the surrounding area, testing for contamination as we went. The MDNR required that any soil remaining in the excavation zone show a contamination level of less than 100 milligrams of total hydrocarbons per liter. But as the hole grew deeper and wider, contamination levels stayed well above acceptable levels. Veins of contaminated soil snaked off in several directions from the original site of the leaking tanks. Weeks turned into months as backhoes tried to dig out these contaminated veins. By the end of the summer, almost 11,000 cubic yards of contaminated soil had been removed from the service station site. Although some contamination had "snaked" under a nearby four-lane highway, and under the main station building itself, the MDNR declared the site cleanup complete—but only for the immediate service station area. The worst news was yet to come.

## The Creek

Contamination from the leaking USTs had reached the creek at the bottom of the valley. Water and soil samples from the creek indicated that gasoline had permeated the gravel streambed, and levels of contamination were well above the allowable level. The DEH is now in the process of investigating the extent of contamination, and will be responsible for Fort Leonard Wood's obligation to clean up the creek.

When the service station reopened in December 1990, the total cost of the project had reached $800,000. Over half that amount consisted of UST contamination cleanup costs. The station is now equipped with four 10,000-gallon, double-walled, fiberglass tanks with double-walled fiberglass connecting pipes. The tanks and pipes are also equipped with electronic leak detectors.

In the early stages of this project, we had no idea of the full magnitude of the problem. Up to this point, we had not encountered serious problems with USTs. The few "leakers" we had dealt with were easily cleaned up by simple excavation. Unfortunately, we also believed that excavation was the answer to the service station USTs. This turned out to be a significant error. The entire project was delayed by the massive earth moving requirements, and by the need to obtain new project funding at the start of a new fiscal year. During the entire year-long project, the post was without a service station.

## In Retrospect

If we had the chance to do it over again, how would we go about it? A more logical approach




**The service station's new USTs await installation. The fiberglass tanks are corrosion-proof, double-walled, and contain electronic leak detection devices (U.S. Army photo).**

would have been to tackle the leaking USTs and the soil/water contamination as separate projects. Temporary, above-ground tanks could have been installed to keep the station operational while the UST problem was studied further. With more time to study the problem, and with more monitoring wells and soil samples, we could have identified the true magnitude of the problem before we began moving dirt. Conceivably, excavation may not have been the best choice for cleanup of the site.

Three basic methods exist for cleanup of underground contamination. Excavation is the most common, with subsequent disposal of the contaminated soil in a sanitary landfill. This is a relatively inexpensive method, as long as small amounts of soil are involved. But it has the drawback of posing potential problems at the landfill site.

A more permanent solution is soil excavation, followed by incineration. However, this is extremely expensive.

The third method is treating the contamination in sutu, that is, without soil excavation. This usually involves a pumped well, positioned to lower the water table under the area of contamination. A cone of depression is then created in the water table, trapping the contaminates and preventing their further migration. Oil products are easily recovered from the extracted water by gravity separators.

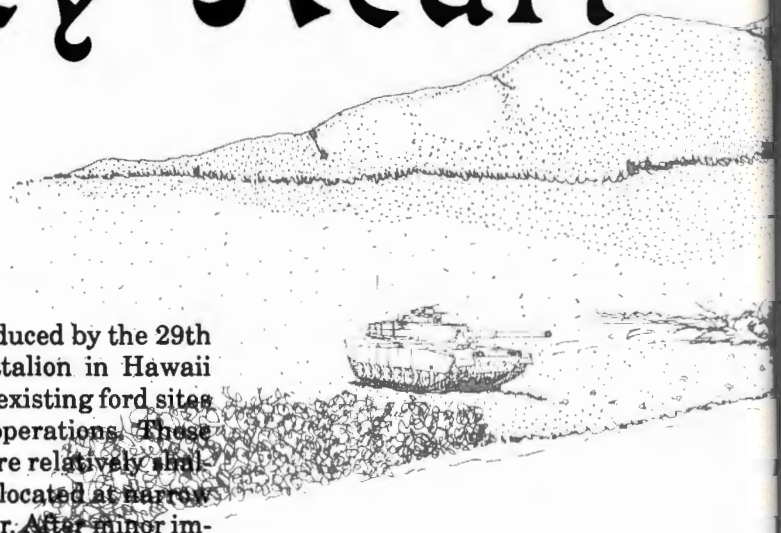
Once most of the contaminates are removed, microbes are introduced to the site. Under oxygenated conditions, these aerobic bacteria feed on hydrocarbons. Although they are naturally occurring to depths of several thousand feet, they do not normally get enough oxygen to consume significant amounts of petroleum. But when used for in sutu treatment, these microbes are supplied with oxygen, nitrogen and phosphates from injection wells installed on the site.

The effectiveness and speed of the treatment depends on the permeability and moisture content of the soil. This technique provides a permanent solution to the problem, but it's comparatively slow, requiring months or even years to complete. It's also expensive, though in some cases the cost can be comparable to incineration.

The Army's experience with underground storage tanks has been unhappy and expensive. We are gradually eliminating USTs completely, unless real and compelling necessity dictates their placement in the ground. And from now on, tanks that are put in the ground will have state-of-the-art construction with electronic monitoring for leaks. Though we must work under the burden of decades of past national ignorance of environmental concerns, we are learning fast—and making progress.

*Mr. Murrell is chief of the Environmental and Natural Resources Branch for Fort Wood's DEH. He previously served as a mechanical design engineer for DEH. He holds a bachelor of science degree in mechanical engineering from the University of Missouri at Rolla.*

# Operation Cross My Heart



*By Major Thomas J. Kelly*

For engineers, getting mechanized maneuver forces across rivers is one of the riskiest—and most rewarding—missions around. Aside from being at the head of an advancing attack force (and bearing a good portion of the enemy's ire), engineers must overcome unpredictable rivers, too little bridging for the number of missions, and less-than-desirable crossing sites dictated by tactical necessity.

During Team Spirit 1990, the 44th Engineer Battalion, in Operation Cross My Heart, crossed three brigades of the 2nd Infantry Division over the Nam Han River in the Republic of Korea. The operation provided the battalion with a number of training and operational lessons that might be valuable to other engineer units—principally in ford site selection and construction.

Several important considerations need to be taken into account when selecting fording sites. Obviously, the first is the potential site's width and depth. This directly impacts on speed of construction—a critical factor in almost all tactical crossings. We were able to obtain maps produced by the 29th Topographic Battalion in Hawaii that detailed all existing ford sites in our area of operations. These existing sites were relatively shallow, and usually located at narrow points in the river. After minor improvement, these locations provided the quickest option for river crossing sites.

Fluctuations in river levels can play havoc with ford construction. In the case of the Nam Han River, we were at work on several crossing sites when a dam was opened upstream to release excess accumulated water. As the water level went up, and the current speed increased, it became impossible to continue construction. While operations were halted, we stockpiled borrow material at each site. Once the water level went back down, we were able to make up for lost time by quickly placing the stored material into the water.

The speed and route of river currents are also crucial. For successful ford construction, the current must be less than 3.5 meters (m) per second. Anything greater than this, and the ford will suffer rapid erosion. Depending on the location of the strongest currents, a straight-line ford may not always be the best choice. In fact, one of the fords put in by our D Company was curved. At this particular site, the presence of large rocks in the stream and their potential use in ford construction led to the curved design.

A rapid current may also cause gaps in an otherwise fordable site. High current speed will then prevent repair of the gaps, with fill material being swept away as fast as it's dumped in. In building one of their fording sites, B Company encountered just such a situation. The middle of the ford kept washing away, but there were no tactically-suitable alternatives available. Gabbeons made of chicken wire and large rocks were considered as a possible solution, but we ended up using an AVLB (armored vehicle-launched bridge).



The AVLB was brought to the middle of the river and placed across the gap in the ford. With the AVLB in place, the ford was passable for both tracked and wheeled vehicles.

Tactical suitability is the key consideration in fording site selection. The site must support the maneuver commander's operational scheme. Unfortunately, the rugged, compartmentalized Korean terrain doesn't allow many easy choices. Many sites chosen by maneuver commanders for their tactical advantage were not ideal choices in terms of engineering considerations. However, we made the best of the selected sites, as in the case of B Company's "AVLB ford." Needless to say, there should be close coordination between supporting engineers and the maneuver commander and his staff. While this will not eliminate technically awkward fording sites, an engineer who accompanies the maneuver commander on his ground recon and participates in operational planning will often be able to offer perfectly suitable alternatives.

Material availability should also be considered when planning or conducting ford construction. We found that for the Nam Han River, we needed river run material in about a 6-inch grade. The location of this material in relation to the ford site affected the type and number of vehicles needed to haul it. This, in turn, affected the speed of construction and the availability of equipment for other sites.



**When swift currents kept washing out the center section of a ford, the battalion's Bravo Company used an armored vehicle launched bridge (AVLB) to complete their mission (U.S. Army photo).**

Using a dozer/scraper team was the fastest technique for ford construction. At least two dozers were on each team; one with a winch to pull out mired vehicles. We also tried to have as many scrapers as possible on the site. The technique called for using the scrapers to haul in borrow material and stockpile it at the entrance to the ford. The dozer team would then push the material out into the river. Once the dozers had built the foundation of the ford across the river, the scrapers no longer stockpiled, but spread fill directly on the ford. For the scrapers to do this, the water had to be no higher than the center of the 621B scraper's tires (about 36 inches).

After the scrapers started depositing material directly on the ford, the speed of construction increased dramatically. The scrapers could usually pick up material on both banks of the river, allowing them to build up the ford each time they crossed the water. Sometimes the water was shallow enough to begin this process right away. We always checked ford sites with a dozer, testing the water depth as the dozer made its way across the river. If the river was less than 3 feet deep, the scrapers were put to work right away.

The other technique we used was the dozer/dump truck/scoop loader team. This worked best when the nearest borrow site was more than two kilometers away, or when scrapers were not available. This method is basically the same as the dozer/scraper team, but material is hauled by dump trucks filled by scoop loaders at the borrow site. This method works, but it's slow and requires more equipment. When using this technique, I recommend against the use of 20-ton dump trucks because of stability problems (they tend to tip over in rough terrain). Five-ton dumps are better because of their rough terrain capabilities. On the flip side, of course, they can't haul as much fill.

Marking kits for the fords were prepared well in advance of our arrival at the sites. Each kit marks 200 meters of ford, and consists of 8-foot U-shaped pickets, engineer tape, and chemlights. The pickets were placed 10 to 20 meters apart on both sides of the ford, with the concave side of the picket facing the friendly shore. A 6-inch chemlight was then placed in the concave side of each picket. We also tied white engineer tape around each picket to help highlight it. Initially, we tried stringing engineer tape between the pickets in the river. But the tape quickly became wet and heavy, and had a tendency to pull down the pickets (we were never able to anchor these pickets securely to the river bottom). Marking these fords is much like marking a lane through a minefield, and we executed them like battle drills.

One of the most valuable lessons we learned during the exercise was how to best care for equipment used in the water. Water contamination of lubricating fluids and air filters was our biggest headache. The most seriously affected were transmissions and differentials on the 621B scrapers. As the scrapers moved through the river, water splashed between the tractor and the pan. Water then entered the breather tubes that vented the transmission. Early in the exercise, we had to take a number of scrapers off the job to replace the contaminated fluids. We quickly went through all of our on-hand stock of fluids, and had to send back to our home base for more. The 16-hour round trip caused significant down-time for the scrapers.

To help alleviate the problem, one of our maintenance warrant officers developed a scraper modification that extended the length of the breather tube about two feet. This gave us pretty good insurance that water would not enter the tube. Even with the modification, we had to carefully monitor the scrapers for water contamination, checking them about four times a day.

We also had a problem with dozers and scrapers moving too fast in the water. This caused water to splash into the air filter housing intake and soak the filter. Operators checked the air filters regularly during operations. If a wet filter was caught soon enough, we could wipe out the housing and air dry the filter. If it stayed wet too long, we had to substitute a new filter. This quickly expended our available supply of filters.

The water contamination problem with the scrapers and dozers drove home the need to ensure extra POL and filter packages for equipment that was expected to operate in water for any length of time. I recommend stocking at least two changes of transmission and differential oil, along with two air filters, for each vehicle that will be over water (including dump trucks). Even if water contamination was not detected during operations, we felt it was necessary to change all fluids and air filters after fording activities were concluded. So be sure to take along at least one change of engine oil for each vehicle as well.

Several safety procedures need to be observed during fording operations. All operators and supervisors must wear life vests when they are over water. When working at night, operators need to have chemlights in their helmets so they can be seen if they fall into the water. If the river is fast and deep, it's wise to string a safety line downstream from the construction site. Soldiers who might fall in the water then have something to grab onto before they are swept away.

One of our companies also recommended tying scraper doors open so if a scraper overturns, the operator can quickly escape from the cab. It's also a wise precaution to have a safety NCO with the sole responsibility of watching for unsafe acts or conditions. In addition, we placed supervisors with signal flags on each side of the ford to safely pace crossing traffic.

Team Spirit provided the 44th Engineers (the "Broken Heart" battalion) with some valuable training experience in fording operations. And while we took some lessons learned home with us, the success of moving three brigades across a Korean river gave us that rewarding sense of accomplishment that I mentioned earlier.

*Major Kelly is executive officer of the 44th Engineer Battalion. During Team Spirit 90, he served as the battalion's S-3. Previous assignments include engineer group S-2, engineer group assistant S-3, battalion S-4, and company commander. He is a graduate of Command and General Staff College, and holds a masters degree in robotics from Carnegie Mellon University. He is a registered professional engineer in Virginia.*

*(Personal Viewpoint, continued)*

full-time staff in theater to perform special studies and assessments.

***Army brigades and Navy COMCBLANT*** will provide regional planning support and region/country expertise, and perform preliminary project planning.

***USACE South Atlantic Division*** will provide technical support and life-cycle program management. The Corps will conduct institution improvement programs, function as DOD construction agent, and maintain a full-time staff element in theater.

***USAF Engineering and Services Center*** will provide technical support, conduct institution development programs, and provide staff augmentation as required.

This program applies CAPSTONE program concepts to theaters and regions for which CAPSTONE was not designed or appropriate. It addresses CINC requirements during peacetime and operations short of war. The same organizations can be used for low-, mid-, and high-intensity conflicts in any theater. Success in this program, however, is likely to prevent such conflicts by alleviating economic problems within host nations.

The mission will be given to flag headquarters in addition to their CAPSTONE affiliation. This will allow headquarters to tailor the support they provide. Individuals will stay under the command and control of their parent unit but will work for and within the joint arena. No changes in the functions performed by headquarters now in place are anticipated in planning, preparing, and executing the program.

## End Results

The economic benefits are many. By combining expertise from many agencies and coordinating planning, we will eliminate duplication and locate developments where they will most benefit host nations. U.S. ambassadors will play a major role to ensure America receives a maximum return for every dollar spent.

And, the program works. The 412th Engineer Command, headquartered in Vicksburg, Mississippi, is successfully working under this concept. In conjunction with CINC, SOUTHCOM, the 412th is planning nation assistance activities that are integral parts of the CINC's counternarcotics campaign plan and the ambassador's country plans.

The United States must work to prevent conflicts in developing nations. We must help them develop an infrastructure that will improve their citizens' lives. At the same time, our units will receive valuable training. It is a true win/win situation. Let us support this joint service concept!

*General Schulz, commander of the 412th ENCOM since November 1986, assumed command of the 377th Theater Army Area Command in May 1991. He has worked on war planning in Europe for 14 years and with engineer deployments in Central and South America since 1981.*

# Engineer Problem

## ASSAULT BREACH

*This is the third of four engineer problems dealing with breaching operations. The problems reflect concepts outlined in FM 90-13-1,* Combined Arms Breaching Operations, *which was distributed in February 1991. Previous problems dealt with in-stride and deliberate breaching operations. This problem focuses on an assault breach.*

*The scenario depicted in each problem illustrates specific teaching points on that type of breach. An excerpt from FM 90-13-1 describes the characteristics of the breach and when it will be used. The problem-solving process is presented using the engineer estimate process and includes some key discussion points.*

***Problem:*** As the task force (TF) engineer of a light/heavy task force and the engineer platoon leader, you are to recommend a task organization of engineer assets to the TF commander.

***Mission:*** You are the platoon leader of 1st Platoon, Company C, 21st Engineer Battalion (1/C/21 EN BN), which is attached to TF Steel. The task force's mission is to secure a section of Highway One, from its intersection with Highway Two to the bridge over the Blue River (Figure 1). Control of this highway will allow follow-on heavy forces access to Highway Two and deny the enemy a supply route over the river.

***Situation:*** TF Steel has one light infantry battalion, one company of M1A1 tanks (equipped with three mine plows and one mine roller), two stinger teams, and your engineer platoon.

Hill 165 (Figure 1) is the dominant terrain feature in TF Steel's zone. Thick forest and dense underbrush prohibit vehicular movement through most of the sector. The enemy is dug in on Hill 165 in company strength. Another enemy company is dug in near the intersection of Highway One and Highway Two. One enemy squad is guarding the bridge over the Blue River. The enemy is armed with assault rifles, medium machine guns, rocket-propelled grenades (RPG), and Sagger anti-armor missiles. They can also call upon indirect fire from mortars and artillery. Enemy artillery is capable of delivering scatterable mines.

One of your engineer squads has completed a reconnaissance of enemy obstacles. The squad leader reports that the only bridge over Green Creek has been destroyed; a bypass just west of the bridge is the only site where vehicles can cross the creek. An anti-tank point minefield followed by an abatis, located north of the bridge on Highway Two, can also be bypassed.

The position on Hill 165 has an anti-personnel (AP) minefield located from 25 to 75 meters in front the fighting positions. This minefield is about 25 to 35 meters wide and consists of surface-laid mines with trip wires. The squad leader is certain there are some M16A1 AP mines, but he does not recognize the

# Engineer Problem

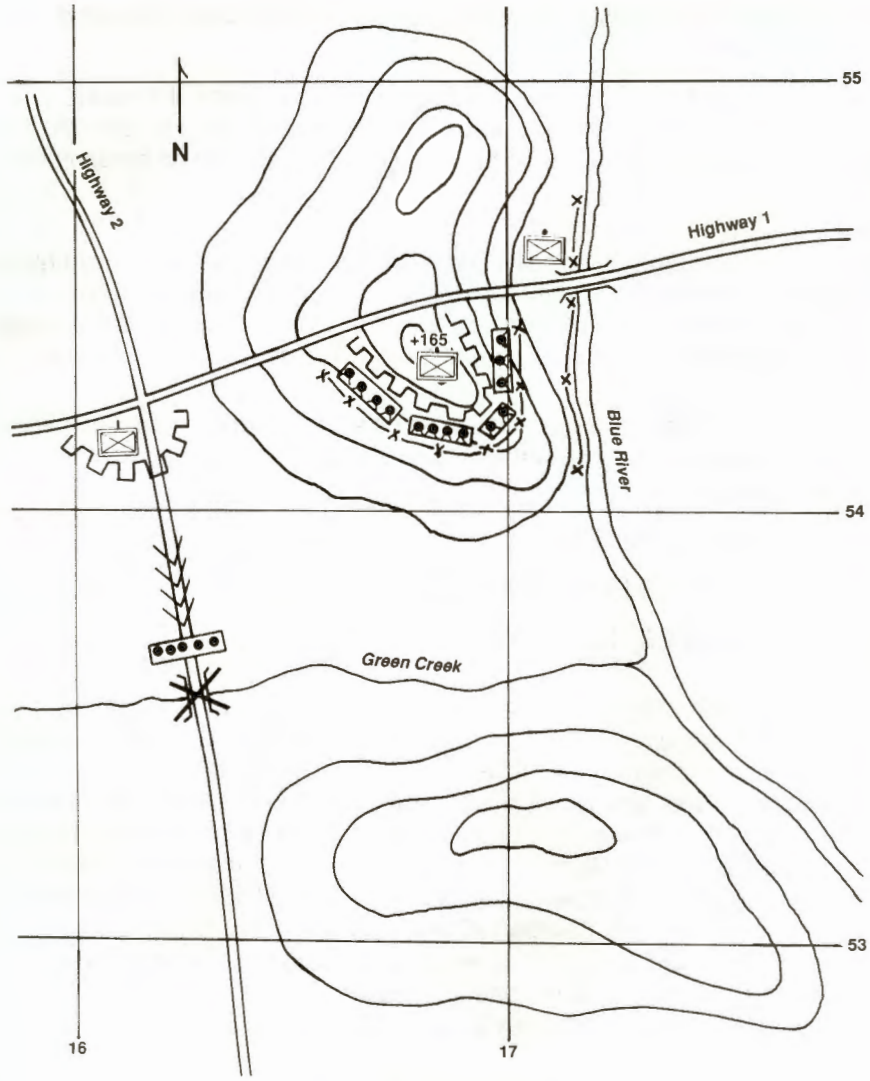



**Figure 1. Situation Template**

others. They are shaped somewhat like an M16A1 AP mine, but have a half-dome with one pin sticking straight up out of the top. Four other pins stick out of the canister in various directions. The squad leader does not know if other mines are buried in the minefield—he could not detect any obvious signs of buried mines.

A concertina fence near the edge of the minefield consists of two rolls of concertina stacked one on the other. The rolls are held in place by metal pickets. The fence is anchored with barbed wire strung over the top concertina roll and staked in the ground with wooden tent pins. A 4-strand barbed wire cattle fence stands



# Engineer Problem

at the far edge of the minefield. Most of it is strung around trees, but some is strung on pickets.

Along the bank of the Blue River is a large concertina fence. It consists of eight rows of concertina that are stacked three high and held in place by pickets. There are no gaps between the rows, and the squad leader detected no break in the fence.

***Commander's Intent:*** "The key is Hill 165 (OBJ TOP). We must move quickly and violently to secure the hill. OBJ X-RAY, near the intersection of Highways 1 and 2, cannot be taken until we occupy OBJ TOP. I would like to take the bridge intact, but I am more interested in securing OBJ TOP as quickly as possible."

***Execution:*** The task force commander selects the scheme of maneuver shown on the Task Force Operations Overlay (Figure 2, page 35). The operation will consist of three phases:

*Phase 1* - Secure OBJ TOP

*Phase 2* - Secure OBJ X-RAY and OBJ AXE

*Phase 3* - Secure OBJ HATCHET

*Phase One:* Team Tank, which includes one tank company, one infantry platoon, and the battalion TOW (tube launched, optically tracked, wire guided) missile will occupy attack by fire (ABF) position 1, oriented on Hill 165 (OBJ TOP). Division artillery assets will provide preparatory fire on OBJ TOP, and battalion mortars will fire smoke to obscure the assault. Companies A and B will attack in echelon along Axis Right to OBJ TOP. Company A is tasked to breach footpaths through the protective obstacles and to gain a foothold in the enemy entrenchments (OBJ TOP). Company B will then pass through Company A, secure OBJ TOP, and occupy ABF 2, which is oriented near the road intersection (OBJ X-RAY). Company C (-), the battalion reserve, will prepare to assume the missions of Company A or Company B, as necessary.

*Phase Two:* As soon as Company B has occupied ABF 2, Team Tank will attack along Axis Left and secure OBJ X-RAY. On order, Company A will secure the bridge (OBJ AXE).

*Phase Three:* After OBJ X-RAY is secured, Companies B and C will occupy OBJ HATCHET, and the task force will prepare to pass follow-on forces to the north.

The commander of Company A informs you that he plans to assault OBJ TOP with two infantry platoons. The TF commander then asks you to recommend an engineer task organization to support this mission.

# Engineer Problem

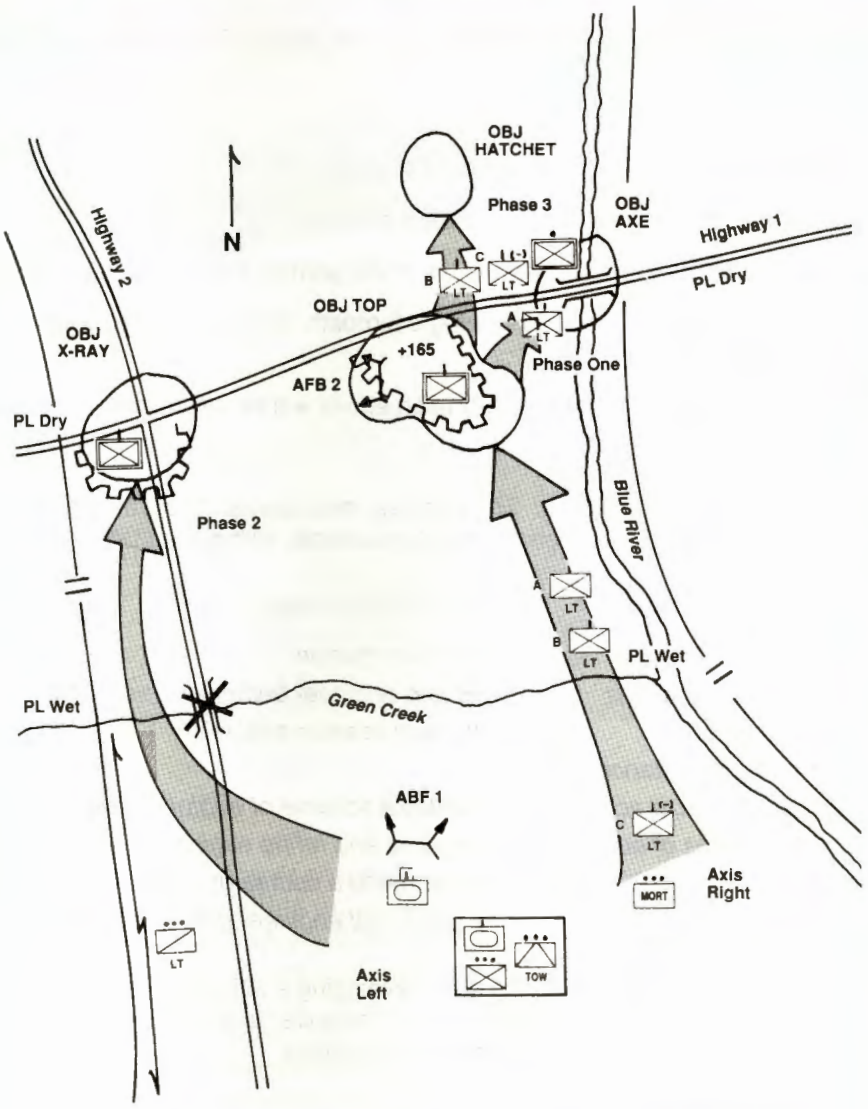



**Figure 2. Task Force Operations Overlay**

## ASSAULT BREACH DESCRIPTION

***Definition:*** A unit conducts an assault breach during the penetration and destruction phases of action on the objective, when the mission requires destruction of an enemy that may have emplaced protective obstacles.

The commander uses an assault breach to break a dismounted force through enemy protective obstacles to the enemy position. The assault breaching procedure may be a variation of either deliberate or in-stride breaching techniques.

# Engineer Problem

The type of procedure used depends on the size and complexity of the defensive obstacle system.

***Characteristics:***

The commander uses an assault breach for—

- ▶Small unit actions (squad or platoon teamwork)
- ▶Actions when enemy small-arms fire is the primary threat to be suppressed
- ▶Obstacle reduction when breaching a footpath that has few if any assault markings
- ▶Extremely decentralized fights; breach efforts will be synchronized by small unit leaders

***Problem Solving Process:*** The engineer estimate, an integrated extension of the command estimate, is conducted concurrently with other staff estimates.

| ***Command Estimate*** | ***Engineer Estimate*** |
|---|---|
| *Mission* | *Engineer mission* |
| *Facts and assumptions* | *IPB and engineer battlefield assessment (EBA)* |
| *Mission analysis* | *Engineer mission analysis* |
| *Commander's guidance* | - - - - - |
| *Develop courses of action* | *Develop a scheme of engineer operations* |
| *Analyze courses of action* | *Wargame and refine engineer plan* |
| *Decision* | *Recommend a course of action* |
| *Action and orders* | *Prepare final engineer plan and issue orders* |

You have enough information to start developing a scheme of engineer operations. Use essentially the same steps the commander used to develop courses of action to develop the scheme of engineer operations.

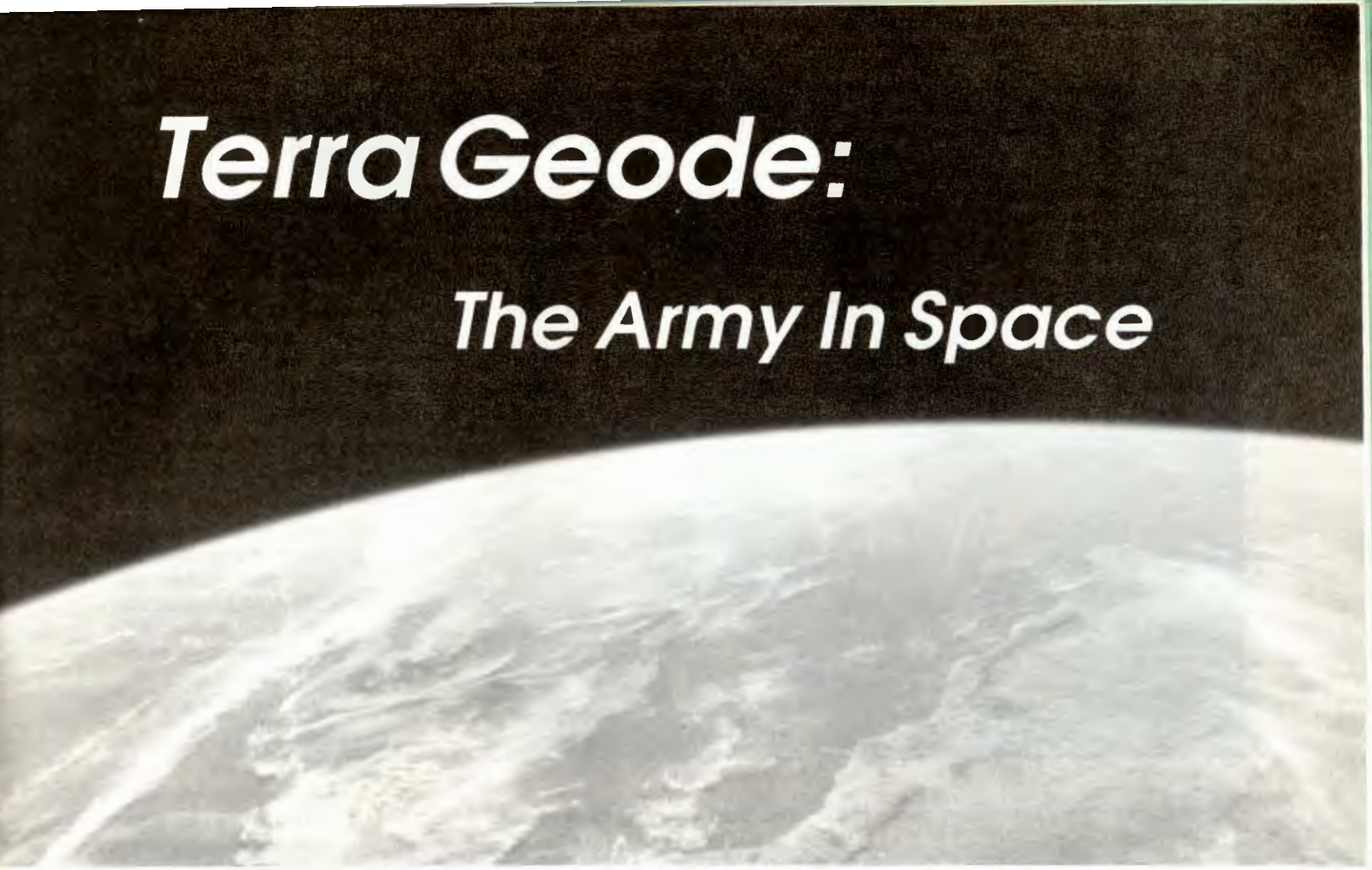
1. Analyze relative combat power
2. Identify engineer battlefield missions and allocate forces
3. Develop a scheme of engineer operations
4. Balance force allocation with available assets
5. Integrate decisions into the maneuver course of action sketch

After developing a scheme of engineer operations, the next step in the engineer estimate is to wargame and refine the engineer plan. Once completed, this step should provide a recommended course of action.

*Engineer Solution begins on page 45.*

# Terra Geode:

## The Army In Space



*By Captain John Karpiscak III*

The modern battlefield, as so vividly illustrated during the Gulf War, is dominated by high-tech, well-trained forces who can strike the enemy at will throughout the theater of operations. To assist ground commanders in determining terrain conditions and enemy disposition, the Army Corps of Engineers has initiated its Terra Geode space program.

Terra Geode is an experimental program designed to determine the value of having a soldier in space who can make military mobility predictions from Earth orbit. It's one of a series of experiments sponsored by the Department of Defense (DOD) to conduct space-related military experiments from Earth orbit. The Army, Navy, and Air Force all have ongoing or planned space experiments falling under the Military Man in Space (MMIS) program. MMIS covers defense-related experiments involving direct military astronaut participation, and experiments that have a military application but do not require the presence of a military astronaut.

Why is the Army involved in space when many people say its attention would be better focused on the ground? Simply put, the Army is reaching into space precisely because it has an increasingly complex and demanding job on the ground.

Time and world events are reshaping modern warfare. A shrinking force structure that's transitioning from a deployed to a deployable force, and increasing emphasis on non-linear warfare will mean a greater need to assess enemy strengths, intents, terrain, and movements. The Army's use of space will help us do just that. It is out of this need for rapid information gathering and analysis that Terra Geode came about.

The experiment began in 1986 when the Chief of Engineers proposed a program to provide terrain and geomorphological analysis from Earth orbit. Designed to provide near-real time battlefield perspective for maneuver commanders, the Terra Geode concept is well on its way to becoming reality.

Terra Geode is organized into four phases, with the first two already completed. The first involved basic terrain observations by military astronauts. The next phase include terrain



**Dr. Kathy Sullivan, the only trained geologist on the NASA astronaut staff, makes observations of the earth's surface during a space shuttle flight (NASA photo).**

observations by an astronaut with a background in geology.

The third phase will call for a synthesis of the talent found in the first two phases: an astronaut who has both the scientific/geologic background to recognize terrain features, and the military background to translate the terrain observations into military operational considerations and terminology.

The final phase of the experiment will see an Army payload specialist making observations of the Earth while stationed aboard a continuously-manned platform.

In 1988, the Engineer School accepted responsibility for the project, now overseen by the school's Directorate of Combat Developments. A year later, Army personnel were invited to apply for the position of Terra Geode payload specialist. Four highly qualified soldiers would be chosen. One would be the payload specialist, the person who would conduct the Terra Geode experiment in orbit. Another would be a backup, fully capable of conducting the experiment should something happen to the primary. Two other persons would serve as alternates; qualified for flight but not involved in training with the crew or development of the experiment.

By January 1990, 21 military personnel had applied for the positions. After an initial qualification scrub, the field was narrowed down to eight. Two later withdrew from consideration for medical reasons. In June 1990, the remaining six were interviewed at Fort Leonard Wood by a panel of engineer officers, and the final four were selected.

## Man vs. Machine

In discussing observations of geological forms from Earth orbit, an argument can be made that there is no need for a manned presence in space. It has been said that unmanned assets, such as remote sensing satellites, are available for conducting such missions. However, in observing the Earth from orbit, it turns out that the human eye has a greater visual range capability than remote sensors.

Man's unique advantage over orbiting sensors is his ability to not only gather raw information, but to instantaneously evaluate the situation. Sensors may provide follow-on supporting information. However, it's important for the human eye to take the first cut at Earth observations.

The National Aeronautics and Space Administration (NASA) noted the limitations of remote sensing when it wrote "...fixed automated sensors...do not have the capabilities of human observers in space to search for (in this case), sources of moving sand or to relate evidence of eolian transport to changes on the land surface." NASA went on to say that "A human observer in space has the unique capability to take high-oblique photographs and stereophotographs and to select areas to photograph with a telephoto lens. This capability should be used to the fullest extent in future missions."

With regard to geological

observations, NASA has also said that "The great value of photographs is in the effective selection of a view of the subject in which lighting and camera position, as well as other transient conditions, permit the geologically significant aspects of the subject to be photographed. This requires a value judgement on the part of the operator of the hand-held camera, which distinguishes his work from mapping-camera photography. There is a tendency to view geological subject material as static and therefore automatically capturable. This is erroneous. Informative photographs of geological features are the result of an educated photographer recognizing an effective opportunity."

Another unique advantage of manned observation from earth orbit is a human's ability to shift his field of view—tightening and widening his area of focus—to concentrate on areas of current interest.

Unlike a machine, a human also has the ability to discriminate or filter out unneeded data while making evaluations. He can make more subtle color distinctions and comparisons than are possible by machine. Too, the human being can take advantage of exploring and exploiting other opportunities, interpreting previously documented but hitherto unexplained phenomena. The human eye also has a greater 'dynamic range' for detecting light in the visible spectrum than either color film or orbiting instrumentation.

## Eye vs. Camera

As an example of this, William Pogue, a former Skylab astronaut, along with the rest of his crew, noted with disappointment at his post-mission debriefing, that the pictures of earth taken from orbit looked 'washed-out', and did not record the details of texture and hue that were visible to the naked eye. Pogue explained that "the tone sensitivity of the color film emulsion was inadequate." Pogue went on to say that, in some cases, items clearly visible to the eye didn't even show up in the pictures, although properly exposed film was used.

Pogue also noted that the eye-brain system has the ability to probe, or see through partially opaque layers of clouds such as haze, scattered light clouds, aerosols or thin clouds. After filtering out the opaque, the brain reassembles the partially obscured image into one that provides a more complete picture than would be available to a camera. This is similar to looking through blinds or an insect screen in a window out at the ground below. The brain "restores" the tiny missing pieces of the picture, and gives the viewer the impression of a complete image.

Soviet views on the subject are similar. Jim Oberg, in his book, *Pioneering Space*, cites Vladimir Lyakhov, a veteran of almost an entire year of orbiting the planet on two flights, as stating that "No form of optics can replace the human eye."

Recognition of patterns, shapes, sizes and textures are other qualities that enable man to transcend the abilities of machines. While film is able to discriminate better with respect to size, the human eye is vastly superior when it comes to the color and tone of an object.

It is virtually impossible for a remote sensor to observe and discriminate between patterns on the Earth's surface. For example, it's been demonstrated aboard the Skylab orbiting workshop that the



**A photo of the Lake of the Ozarks area of central Missouri, taken during a space shuttle flight (NASA photo).**



**A satellite photo of the Libyan chemical weapons facility. Army astronauts, with both tactical experience and geological training, could be invaluable to military planners when observing such potential targets (EOSAT photo).**

human eye is far superior to a remote sensor in its ability to distinguish between snow, ice, and cloud formations.

The human is also able to take advantage of opportunities that are beyond the capabilities of automated sensors. For instance, waiting for the right time (lighting, cloud cover, etc.), to accentuate a particular feature for photographic purposes. By the same token, the human is able to recognize differing geographical and geological areas under a wide variety of light and perspective conditions. Features such as ice and snow, sand dune formations, along with atmospheric disturbances such as dust storms, fire, and haze are some of the things more easily distinguished by the human eye than by machine.

Again, NASA has stated that previous space crews "were able to observe selected areas, taking full advantage of changing solar illumination (Sun elevation and azimuth); varying degrees of obliqueness, and shifts in line-of-sight azimuth. Geologically, this target-of-opportunity capability is very useful because one particular combination of viewing angle and illumination may provide the key to recognizing new features in well-mapped terrain."

A benefit that will never be surpassed by machine (with the possible exception of a highly advanced, artificial intelligence system), is man's ability to adapt. Man has the ability to react to a changing environment and take advantage of unforeseen and unpredictable opportunities by restructuring standing instructions and protocols. Views of eruptions, fires, storms, and storm damage, once detected, would take long periods of time to program into an orbiting automated sensor and an almost equal length of time to process into an acceptable image. A human in orbit would be able to analyze the situation instantly.

## Geology and the Military

The concept of predicting military mobility from space faces an unusual challenge. While we tout the capabilities of manned observation, there is only one trained geologist on the NASA astronaut staff: Dr. Kathy Sullivan. Herein lies a dilemma. We have military astronauts, some with ground combat experience, but none with backgrounds in geology. Conversely, we have one geologist astronaut who has no ground combat experience.

Terra Geode will provide the Army with a payload specialist who has the geology and terrain analysis training, as well as the military expertise necessary to make mobility predictions from low Earth orbit.

Military experience is a prime requirement for the Terra Geode payload specialist. While a geologist may be able to answer some basic questions about terrain

analysis, more involved terrain questions—and certainly mobility predictions—require experience beyond classroom instruction. And qualifying military experience is acquired only after a comprehensive tour of duty in line units.

To illustrate, if a non-military astronaut were to try to obtain sufficient military experience by participating in exercises such as REFORGER, he or she would get an appreciation for only one particular type of Army operation. The scenario would include a handful of basic military unit types, and would be conducted in a single operating environment. While such experience would be helpful, it would be so narrow as to create the false impression that this is the standard (or only) way that the Army conducts operations. This could lead to misleading or erroneous conclusions in assessing and making mobility predictions for the terrain being observed.

Astronauts (or mission specialists) are charged with piloting shuttle and other spacecraft, and don't have the time to be sufficiently trained in military operations. It's vital that this experiment be conducted by a military payload specialist with broad-based field operations experience and a geological background.

## Maps

In addition to the inherent problems of using remote sensors for terrain observation, maps used for military operations also have their limitations. The Defense Mapping Agency, contrary to popular belief, does not have the entire surface of the Earth mapped at either the strategic (1:1,000,000) or operational (1:500,000) levels. At the tactical level (1:50,000), only 6 percent of the Earth has been mapped.

A look at recent history is telling. In his book, *Urgent Fury: The Battle for Grenada*, Major Mark Adkin, a retired British officer, wrote that "Perhaps the most serious handicap, aside from the conspicuous lack of good intelligence on all aspects of the operation, was that nobody had a map. To plan a military operation without a map is a sure way of ensuring participants are confused and unclear about their objectives."

Additionally, the information that some maps carry is inaccurate or out of date. This may lead to poor mobility predictions regarding threat movements. A recurring reason for many military failures has been the inability to predict the movements of an enemy force, or to have underestimated its mobility. For example, when a commander looks at dune patterns on a 1:500,000 scale map, he must decide if the patterns are current, or if they have shifted since the map was produced. Do the maps indicate a continuous sand floor, or exposed bedrock between the dunes? How old are the maps that are being used in this area, and what data was used to construct them? Looking at dense forest terrain, can it be determined if the area you are looking at is thick South American rain forest, or has the area been a recent victim of slash-and-burn clearing activity? All of these questions are important to a terrain analyst, and Terra Geode is expected to help address them.

## Things to Come

None of this information is new. What have been described are proven techniques and capabilities that have apparently been set aside or forgotten over time with the advent of (or perhaps preoccupation with) newer, more sophisticated remote sensors.

But scientists and astronauts have recommended that a well-designed Earth observatory be put into orbit to monitor both the sunlit and dark sides of the Earth. Such a facility would be equipped with manual pointing capabilities, surface feature automatic tracking, zoom optics, field-of-view alpha-numeric displays, time tagging of verbal comments and data, and film/video recording of active viewing sequences. These are all features we envision being used during Terra Geode Phase IV.

Gerald Carr, a Skylab IV astronaut, wrote "I think that we have discovered a new national resource. With better equipment and more sophisticated training, space observers can capitalize on their initiative, discrimination, and judgement to obtain information to better understand and manage our environment and to conduct Earth science experiments from space."

While much has been accomplished on the Terra Geode project, a lot of work remains. As yet, there is no firm timeline on the program, and full NASA acceptance and subsequent completion of the program will likely depend on competing projects, projected launch schedules, and funding.

But when Terra Geode reaches its goal, it will give the Army an unprecedented advantage in military mobility predictions—an advantage that cannot be attained by machines alone.

*Captain Karpiscak is the space officer for the Engineer School's Directorate of Combat Developments. He previously served as commander of HHC, lst Engineer Brigade. Other assignments include battalion S-1, DEH staff officer, commander of 95th Engineer Detachment, combat engineer platoon leader, and vertical construction platoon leader. He holds a degree in architecture from Kansas State University, and a masters degree in business administration from Rider College.*

# LESSONS LEARNED

## Tactical Lane Marking Procedures

*By Captain Martin B. Dorey*

Engineer doctrine for marking tactical lanes during combined arms breaching operations changes frequently. To help you cope with the changes, we have gathered the following information from observations made at the National Training Center, REFORGER, and Operation Desert Storm. Use this information to help develop or improve the field standard operating procedure (FSOP) on breaching operations for your unit.

***Tactical Lane Marking.*** The breach force has initial responsibility to mark a tactical lane. After the breach is completed, the breach force commander reports it to higher headquarters. On order, breach force engineers then begin to tactically mark the lane, as described in FM 5-71-100.

Tactical lane markings must be easily seen and recognized by crews in buttoned-up vehicles. The breach force must mark a breach lane at the entrance, along the left side, and at the exit.

***Entrance Markings.*** Entrance markings must be easily distinguished from all other lane markings. Establish a funnel-shaped entrance and spread it over a 100-by-50 meter rectangular area. The funnel shape provides an opening that narrows in width from 100 meters at the outer edge to 50 meters at the entrance to the tactical lane. This shape allows dispersed, mounted forces to transition to a column formation.

Establish far recognition markers to guide follow-on assault forces to the breach lane. Place these markers as far as 1 kilometer (line of site dependent) from the breach lanes. Place unmanned, intermediate recognition markers about 500 meters (line of site dependent) out from the obstacle.

***Breach Lane Marking.*** Observations and experiences from the Combat Training Centers indicate that drivers of M1, M60, M2/3, and M113 series vehicles prefer left-hand rail markings on lanes. They find it difficult to remain on a centerline due to dust and smoke. To be clearly visible, drivers need markers that are at least 3 to 5 feet tall. These markers should be reusable. If possible, emplace left-side markers from an armored vehicle to protect the sappers or infantrymen from direct small arms or indirect fires.

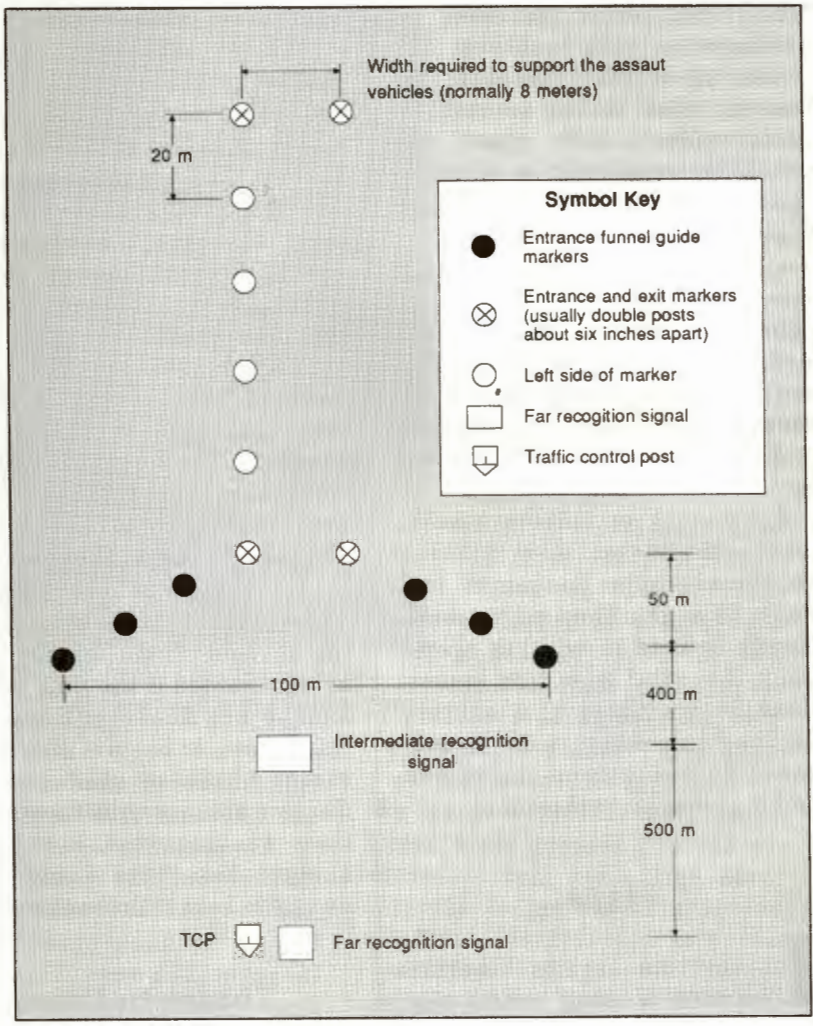



**Figure 1. Tactical lane marking system**

***Exit Marking.*** Like the entrance, the tactical lane exit must be clearly distinguishable. The driver and track commander must know when they are out of the lane and free to maneuver (Figure 1).

Use a standard tactical lane marking system throughout the division. The division engineer will

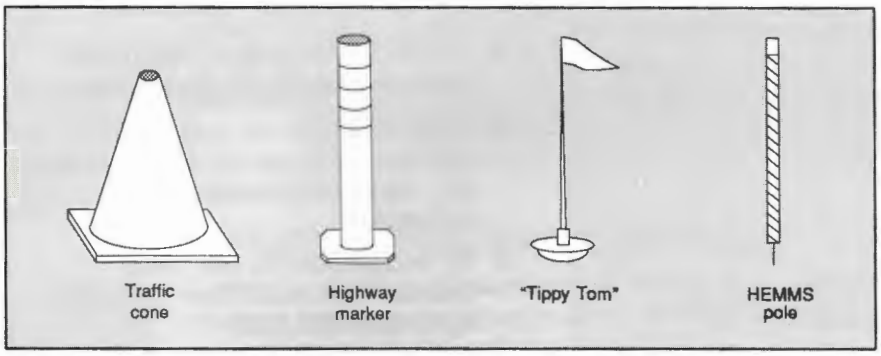



**Figure 2. Currently available lane markers**

determine which method to adopt.

Marking systems currently in the supply system are —

- Hand-Emplaced Minefield Marking System (HEMMS), NSN 9905-01-019-0140
- Minefield Marking Set #2, NSN 9905-00-375-9180
- CLAMS, NSN 2590-01-205-3082.

Nonstandard items that can be used include traffic cones, highway markers, and locally fabricated "Tippy Toms." A Tippy Tom, copied from an Israeli system, is made from a fabricated base and HEMMS poles (Figure 2).

***Expanding Tactical Lane Marking.*** Up to this point we have discussed the minimum requirements for a tactical lane marking system. However, we also need a simple, workable system to improve the markings for expanded tactical lanes.

As a situation develops, regimental sappers will reduce the number of lanes and place markers on the right side of the breach lane. Engineers will place markers as far out as required to control traffic flow.

Engineers must widen the original breach lane, which is 4 meters wide, to accommodate two-way traffic. This high priority mission will expedite passage of divisional units and facilitate the evacuation of casualties from the front. After the widened lanes are proofed, engineers will establish a centerline and emplace an exit funnel marking system.

Prepare lanes to standard widths—8 meters for one-way traffic and 16 meters for two-way traffic. Install one-way traffic signs on each lane, for both directions, to assist traffic flow (Figure 3).

As the final step, follow-on corps combat engineer units expand and mark the breached lanes. The lanes are marked in accordance with procedures on page 67, Chapter 3, FM 20-32, using Standard Minefield Marking Set #2, (Figure 4, page 44). The final marking system must be standard throughout the corps.

The Engineer School is requesting information about effective methods of marking breach lanes. If your unit has developed an effective marking system, or if you have an idea you'd like us to explore, write to:

Commandant
U.S. Army Engineer School
ATTN: ATSE-ESA (Captain Dorey)
Fort Leonard Wood, Missouri 65473-6630

Include your name, address, unit, and telephone number.

**References.** The following references provide information about breaching obstacles:

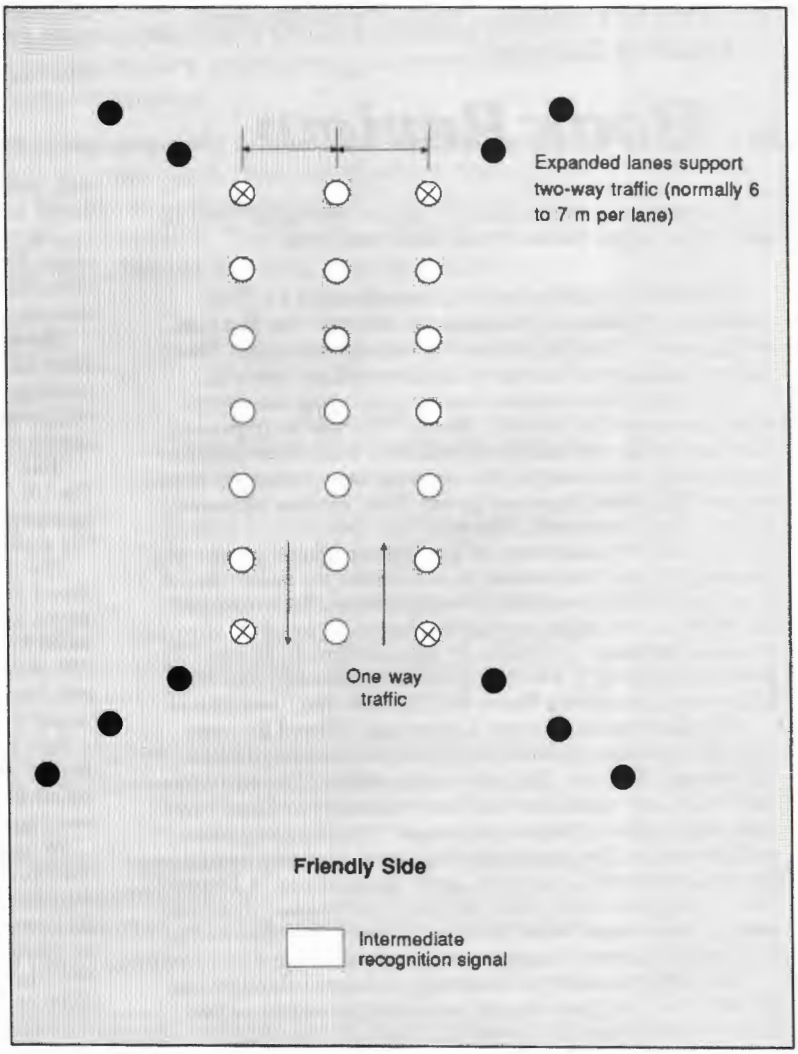



**Figure 3. Expanded tactical lane marking system**

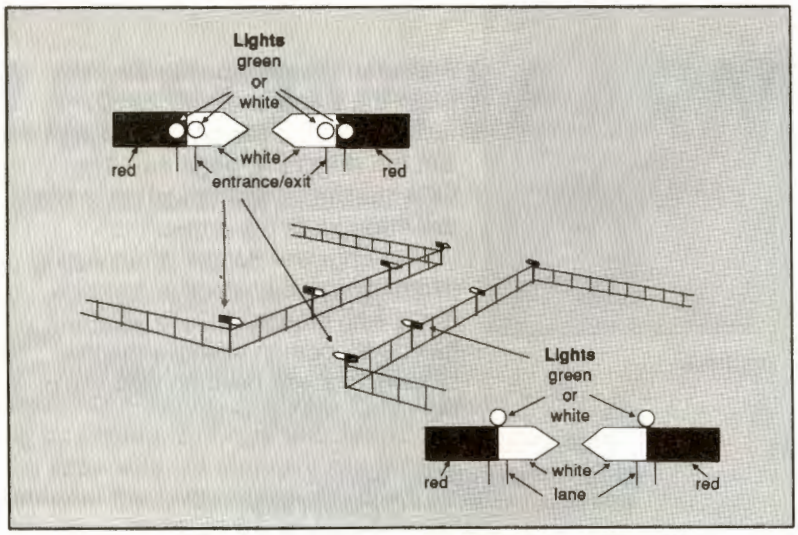



**Figure 4. Marking lanes with Standard Minefield Marking Set #2**

- FM 20-32, December 1985 (under revision) *Mine/Countermine Operations*
- TM 5-9905-200-10, August 1979, *Operator's Manual; Minefield Marking Set, Hand Emplaceable, M133 (HEMMS)*
- TM 9-2590-508-10, July 1989, *Operator's Manual; Clear Lane Marking System (CLAMS)*
- REFORGER, National Training Center, and Operation Desert Storm observations (Lessons Learned)

*Captain Dorey is an evaluation officer with the Directorate of Evaluation and Standardization, U.S. Army Engineer School. He previously served as brigade engineer, company commander and S4 with the 7th Engineer Battalion, 5th Infantry Division, and platoon leader and executive officer with the 58th Engineer Company, 11th Armored Cavalry Regiment. He is a graduate of the Engineer Officer Basic Course, Armored Officer Advanced Course, and the Combined Arms Services and Staff School.*

- FM 5-71-100, February 1991, (Coordinating Draft) *Regimental Engineer Combat Operations*
- FM 90-13-1, February 1991, *Combined Arms Breaching Operations*

# Book Review

*"The Forgotten War. America in Korea 1950-1953,"* by Clay Blair, 1136 pages, Anchor Books, New York, 1989.

Clay Blair is a former military correspondent for *Time* magazine and editor of *The Saturday Evening Post*. His best-selling study of the U.S. submarine war against Japan, "Silent Victory," established his reputation as a military historian.

Blair wrote this detailed history to tell about the Army's first year on the battlefield in Korea. This was an important war—its impact intensified the cold war, resulted in the arms race buildup, and fostered the idea that communism could be stopped by limited American power. This last idea ultimately led to US intervention in Vietnam.

The political background of the Truman administration set the stage for our intervention as a symbolic act rather than a threat to US vital interests. Once committed, the Army was set up for defeat before the fighting began. It was not prepared mentally, physically, or organizationally for war. The leadership generally was overaged, inexperienced (most had staff experience during World War II), and often incompetent.

Blair presents two human factors that affected the war: The representation of West Point graduates among the combat commanders, and the performance of black troops in combat. The reader concludes that true leadership in Korea came from professional officers in command of infantry regiments and battalions. The black units did not perform well in combat and, as a result, the entire Army desegregated in October 1951. In defense of the black soldiers, Blair reveals that some senior Army leaders were racist and many white officers who led black units were incompetent or cowardly.

The battle narrative is thoroughly presented through each phase of the war, from the sad and shameful retreat to the Pusan Perimeter, to the invasion of North Korea. Blair depicts the Army as poorly trained and ill-equipped, but with each passing battle and buildup of US divisions, it becomes battle hardened and successful when properly led.

The introduction of Chinese forces marks a major turning point. The United Nation (UN) Command's poor intelligence and underestimation of China's response were major strategic failures.

Much is written about the spell MacArthur had on the Joint Chiefs of Staff and the Administration. His push for expanding the war is seen as an attempt to save face for his failure as the Far East Commander, and in the process the Eighth Army was nearly destroyed.

Blair fairly portrays the history of the infantry in Korea. The US "drew the line" and UN forces stopped the communist aggression. It was the first test of UN forces, and the last true UN coalition until the recent Gulf War.

The performance of the US Army so shortly after the victory of World War II was disheartening to read. I was dismayed by the politics and power play by US senior military leaders. Battlefield leadership was absent or infrequent until LTG Ridgway arrived in December 1950. The book abounds with reports of cowardice and retreat on one hand, and heroics by small unit leaders on the other. The price we paid in lives for not properly preparing, training, and leading soldiers is a black mark on our Army's history. For this reason, the book must be read and studied by all leaders. We must never again go to war like we did in June 1950.

We partially learned our lessons from Korea in Vietnam. But like Korea, the nation tired of the war and did not acknowledge returning soldiers. In contrast, the success of the coalition forces in the Gulf War is in part a result of several factors: our learning the lessons of Korea (and Vietnam); never to go to war unprepared; never piecemeal the fight; develop a professional army and leadership corps; and have the commitment and support of the nation to the soldiers who fight.

*By LTC Ralph Grieco, commander of the 31st Engineer Battalion, Fort Leonard Wood.*

# Engineer Solution

### *DEVELOP A SCHEME OF ENGINEER OPERATIONS*

***Step 1.*** ***Analyze relative combat power.*** The analysis of relative combat power is based on the Situation Template (Figure 1, page 33) and an assessment of enemy and friendly engineer capabilities. Use an engineer battlefield assessment (EBA) to determine these capabilities.

Enemy engineer capability. The terrain and vegetation from phase line (PL) Wet to PL Dry will prohibit vehicular movement except along Highway Two. Tanks can cross Green Creek only at the ford site, just west of the destroyed bridge. Extensive protective obstacles, including barbed wire and AP mines, are on OBJ TOP. These mines probably are well camouflaged, and some probably are equipped with anti-handling devices. The bridge across the Blue River may be rigged for demolition. The enemy is capable of delivering scatterable anti-tank (AT) and AP mines from artillery.

Friendly engineer capability. The mobility assets of the task force are emphasized in this problem. The attached tank company has one mine roller and three mine plows. Each of the nine infantry platoons is capable of limited breaching operations, and the task force is accustomed to integrating your three sapper squads when they conduct breaching operations.

***Step 2.*** ***Identify engineer battlefield missions and allocate forces.*** Use the reverse planning process to identify engineer tasks from the objective back to the start of operations. Each time you identify an engineer mission, you must determine what resources are needed to accomplish it. The Engineer Working Overlay (Figure 3, page 46) shows the engineer missions identified and resources required to accomplish them.

*Summary of engineer tasks:*

**Axis Left**

1. Assist clearing bunkers on OBJ X-RAY. (one engineer team)

2. Breach potential scatterable minefield. (three mineplows, two engineer squads)

3. Clear bypass of mines. (one engineer squad)

**Axis Right**

Clear bridge of demolitions. (one engineer platoon)

Assist in clearing bunkers on OBJ TOP. (three enginer teams)

Breach one footpath per infantry platoon assaulting through the protective obstacles. (two engineer squads)

Remember, you must consider all engineer assets at the task force's disposal, not just those from your engineer unit. Remember that the resource estimates are unrestrained.

As you allocate resources, you realize there are not enough engineer assets on hand to successfully breach the potential obstacles on Axis Left. You bring this to the attention of the task force S-3. He requests an additional engineer platoon from the follow-on forces, but instructs you to complete the task organization on the

# Engineer Solution

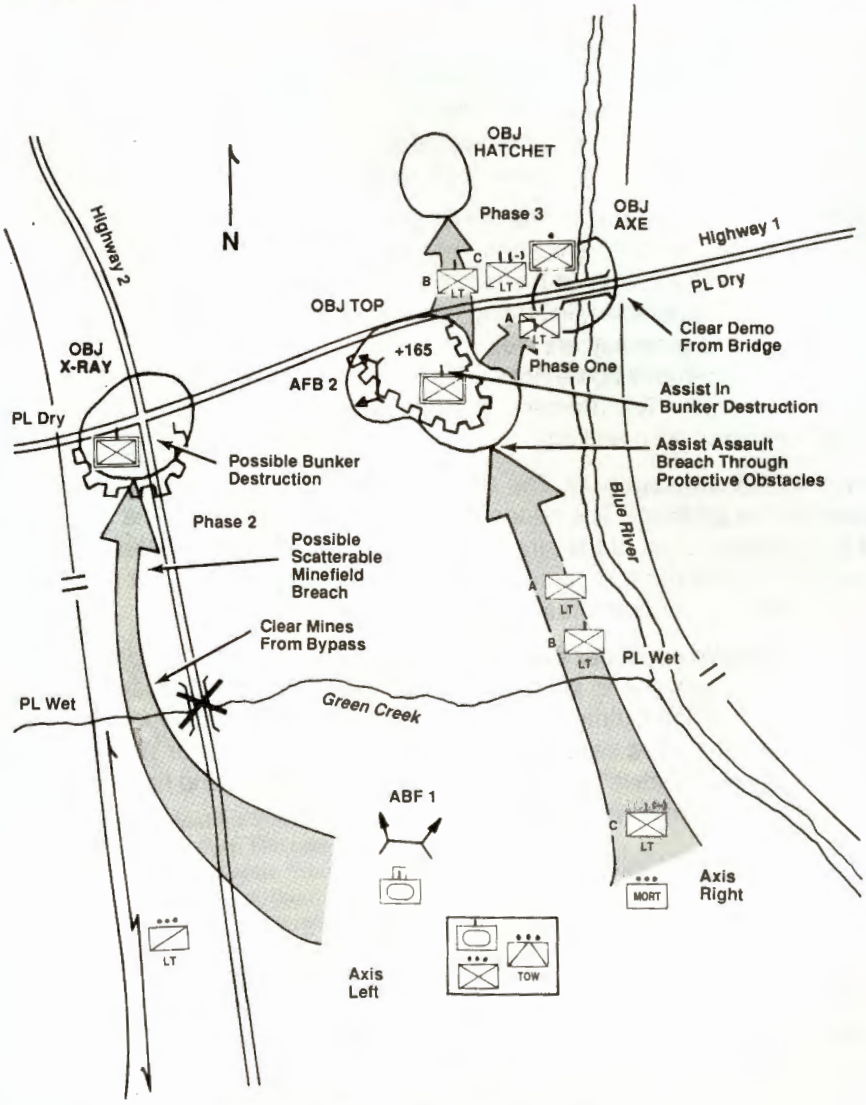



**Figure 3. Engineer Working Overlay**

assumption that the task force will not receive additional assets.

*Step 3.* ***Develop a scheme of engineer operations.*** The goal of this step is to allocate the resources available to accomplish tasks identified in Step 2. Experiment with various resource allocations, considering the task force' mission and the commander's intent. As assets become scarce, determine where they can reasonably accomplish several tasks. Determine where maneuver elements may be called upon to accomplish engineer tasks, or revise your estimates.

*Step 4.* ***Balance force allocations with available assets.*** In this problem, Axis Right has priority. At the end of Phase 1, an engineer platoon is needed at

# Engineer Solution

the bridge over the Blue River, and three engineer fire teams are needed on OBJ TOP. Because the commander is more concerned about OBJ TOP than the bridge, Company B is allocated three fire teams. Company A, with assistance from one engineer fire team, must remove demolitions from the bridge.

Two engineer squads may be required on Axis Left. One squad probably can accomplish most of the mobility tasks on the left with equipment organic to the armor company. If necessary, the infantry platoon will provide assistance.

*Step 5.* ***Integrate into maneuver course of action sketch.*** Prepare a statement describing the scheme of engineer operations. The statement must address—

- How engineer assets support the maneuver course of action
- Engineer mission priorities for each phase
- Critical engineer events and activities
- Task organization for combat

***Wargame and refine engineer plan.*** Using the course of action developed in Step 1 through Step 5, visualize the operation as the TF commander. Begin with Phase 1 of the operation and continue through Phase 3. Note any shortfalls. Be aware of other staff members' plans and ensure all plans (including your's) are mutually supporting.

While wargaming this mission, you see a potential problem in Phase 1. Two engineer squads are attached to Company A for the assault breach, and then three of four engineer fire teams switch to Company B when they move into OBJ TOP. You decide to refine the plan and place yourself with Company A for the breaching operation. This will allow you to ensure the fire teams transition smoothly to Company B.

***Recommend a course of action.*** According to the commander's intent, taking Hill 165 is key to the operation. Thus, the mobility tasks to breach through the protective obstacles and to provide fire teams to assist in destroying bunkers are the first priority. Because Company A is tasked to complete an assault breach into OBJ TOP, two engineer squads will be attached to it. Company B requires three engineer demolition teams to destroy bunkers, and Company A requires a platoon to clear the bridge of demolitions. The commander is more interested in securing Hill 165 than in keeping the bridge intact. Therefore, as Company B passes through Company A, it will pick up three engineer fire teams from Company A. The remaining engineer fire team will stay with Company A and assist that unit in clearing demolitions from the bridge.

Team Tank has three mineplows and one mine roller. In addition, the remaining sapper squad will be attached to Team Tank to breach potential obstacles on Axis Left and possible bunkers on OBJ X-RAY.

Should the additional engineer platoon requested from follow-on forces arrive, it will be allocated to Team Tank. In this case, the remaining sapper squad from your

# Engineer Solution

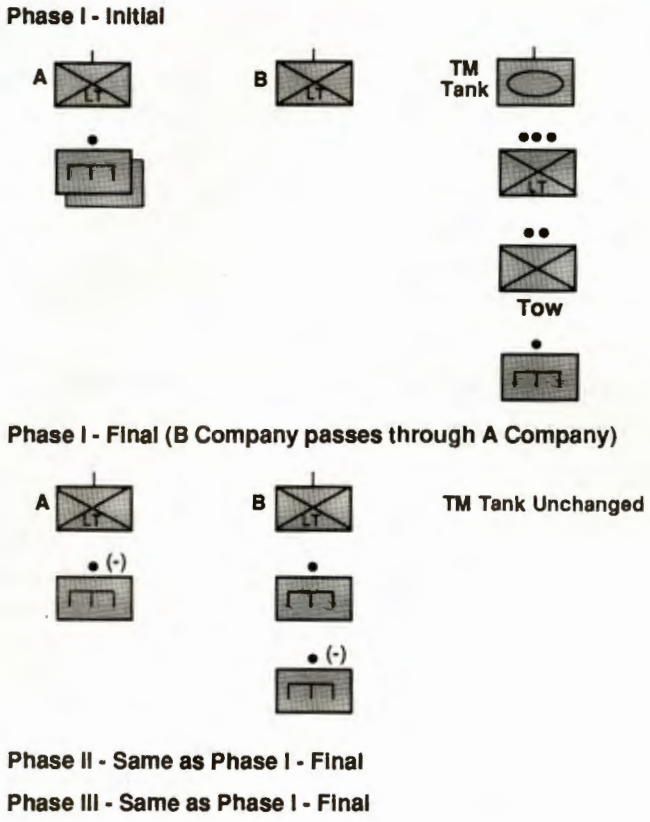



**Figure 4. Task Organization**

platoon will be attached to Company A to assist with the assault breach mission.

The platoon leader will be with Company A for the breaching operation, and he will ensure that the three engineer fire teams transition properly to Company B. Because this is an assault breach, the engineer squads attached to Company A will be under the command and control of the infantry platoons that conduct the breaching operations. They will not be under the control of the engineer platoon leader (Figure 4).

*This Engineer Problem was submitted by Captain Jon Jones and Captain Michael Premo. Captain Jones is currently assigned to the 554th Engineer Battalion, Fort Leonard Wood. Previous assignments include the 37th Engineer Battalion and as a task force engineer in the 2nd Infantry Division and the 82nd Airborne Division. Captain Premo is an instructor/writer in the Department of Combined Arms, U.S. Army Engineer School. He previously served as a platoon leader, 52nd Engineer Battalion, and commander, A Company, 79th Engineer Battalion.*



# A District's Environmental Learning Curve

*By Colonel Wilbur H. Boutin, Jr.*

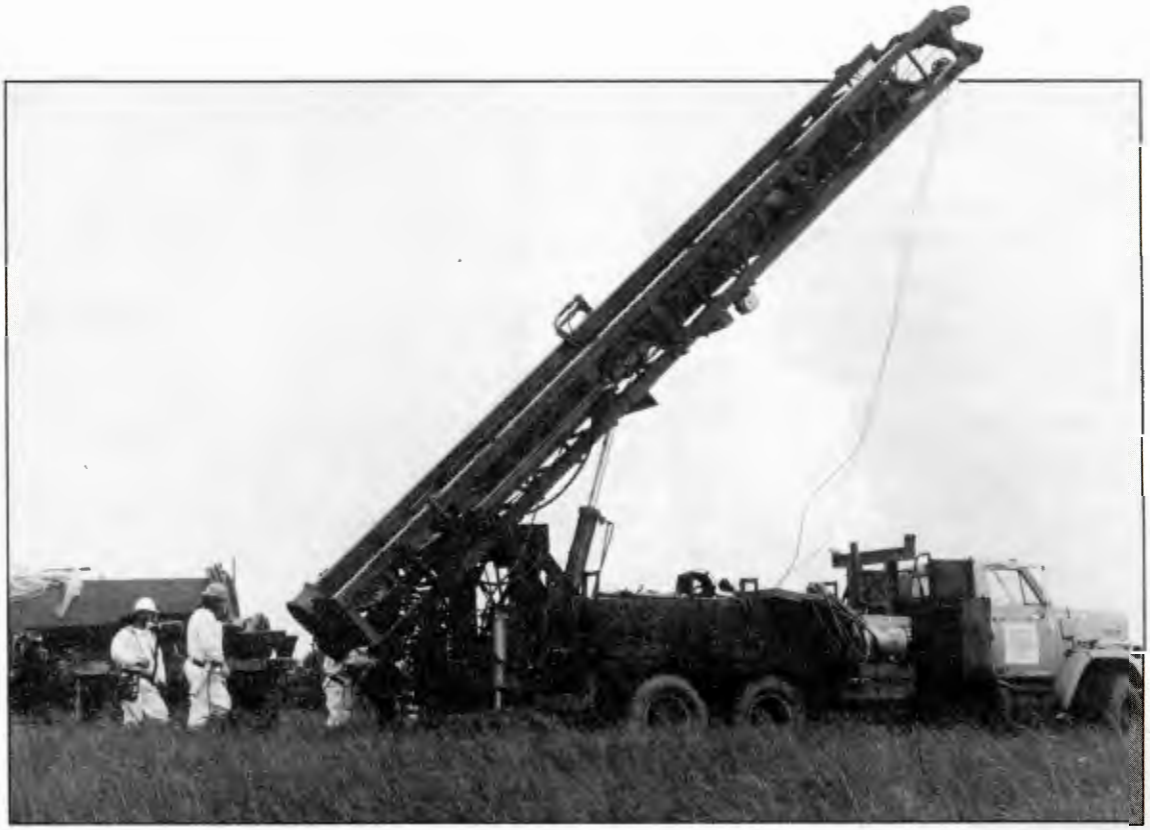
The nation's growing awareness of the environment has led to a new mission for the Army. With the Corps of Engineers in the lead, the Army is playing a key role in cleaning up current and former Department of Defense (DOD) properties, and providing support to the Environmental Protection Agency in hazardous and toxic waste (HTW) operations.

To help expedite the Army's contribution to the cleanup effort, the Corps' Kansas City District has been designated as a design center for HTW activities. Design centers conduct the geotechnical groundwork that helps identify hazardous waste sites and provide recommendations for treatment. In its new role, the district will provide HTW operations support to DOD, the Environmental Protection Agency (EPA), and other federal agencies.

## Background

The Corps is a logical choice to assist in the nation's HTW cleanup efforts. As early as 1982, the Corps provided assistance to the EPA in its efforts to manage and clean up the worst of the country's HTW locations—the so-called Superfund sites. What then appeared to be a transitory project for the Corps has now been mainstreamed into its future missions.

This early opportunity to learn the "ins and outs" of environmental program management has proven invaluable to the Corps. When the Superfund program was expanded in 1985 to include federal facilities, the Corps of Engineers enjoyed the advantage of considerable experience in the HTW field. Against a backdrop of growing national concern for the environment, a significant portion of Corps resources is being turned to the HTW effort. As a result, engineer officers assigned to Corps



**Civilian contractors set up a drilling rig to dig an extraction well on an HTW site. The HTW field is a relatively new one for both private companies and the Army (J.M.S. Co., Inc. photo).**

districts are likely to be heavily involved in such activities.

As "point man" for the HTW effort, the Corps operates on a solid foundation of support within DOD. Secretary of Defense Richard Cheney said in 1989 that he wanted the Department of Defense to be "...the Federal leader in agency environmental compliance and protection." Lieutenant General Hatch, Chief of Engineers, has taken that mandate and made the environmental mission part of his vision for the Corps' future.

## Mission Overview

Our HTW missions fall into two broad categories: support of the EPA, and support of DOD environmental programs. Support for the EPA includes design work, construction contract management, and technical support. Of course, our work with the EPA leads to a broad range of cooperative projects with both private industry and other government agencies, such as the Department of Energy.

Within DOD, a significant portion of our work deals with the management of government-owned sites which may need rehabilitation. For such sites, we provide preliminary assessments, investigations and feasibility studies, and remedial design. If necessary, we can also provide remedial or cleanup action. Additionally, we provide DOD organizations with legal representation in what we call "potentially responsible party" (PRP) negotiations. This usually involves a DOD organization which was a previous tenant—or current tenant—of a site which now has a HTW problem.

## Be Prepared

Army engineers can expect significant demands on their time and expertise in the rapidly expanding HTW field. For the young engineer officer who may one day serve in the Corps, the lessons we've learned in the Kansas City District may prove valuable. What follows is some general advice in the areas of customer support, staffing, contracting, regulatory compliance, and innovative technology.

## Customer Support

Once a course of action is selected for an HTW site, the focus of project management will generally shift to the district office during the remedial design phase. In its role as a quasi-contractor for the EPA and other federal agencies, the district must view customer support—especially during remedial design and action—as a central part of its duties. There are alternative sources of expertise, both government and private-sector, available to our customers. If we are not sufficiently responsive to their needs, they will go elsewhere. Make sure your scheduling requirements are straight, and your projects on-line. The HTW mission is an important one for the Corps and for Army engineers in general. We don't want to lose it.

Another aspect of customer support is our duty to the public. Include public participation in your programs whenever possible. Environmental citizen-action groups may express their concern about your activities, and they will be vocal about the pros and cons of district activities. So don't ignore the public. Work with your public affairs office to develop a public involvement/public information plan so your energies won't be diverted from your engineering tasks.

## Staffing

In the HTW field, staffing is a primary consideration for both the government and the private sector. Demand for qualified personnel exceeds the supply. Sometimes it's difficult to find sufficient personnel with the technical expertise to oversee contractors and quality control for field activities. Keep in mind that most of the contractors you will deal with are having the same trouble hiring and retaining experienced HTW professionals. Often, relatively inexperienced contractor personnel are handling difficult environmental assignments with little internal oversight or review.

Engineer action officers and project managers working in the HTW field should carefully consider whether they have adequate personnel resources. If not, they need to get the system working to fill authorized positions.

## Contracting

Contracting for HTW operations is difficult and challenging. Many aspects of these projects don't fit neatly under construction or service contracts. Unpredictable work requirements, highly advanced technologies, and widely varying site conditions can complicate even the smallest project.

A good example is subsurface contamination remediation projects. Site characterization and problem definition are critical to putting together a sound contract. But these are difficult things to determine. This means accurate cost estimates are nearly impossible until the project is well into the design phase. This is quite a switch from the typical construction projects most engineers are familiar with.

The contracting strategy should be pinned down early in the development of each project, especially if sole-source contracting is needed to obtain a specific technology. Current working estimates (CWE) on computer-aided drafting and design (CADD) projects need to be continuously updated. This will help avoid unpleasant surprises when you get ready to award a contract. This is particularly true if you will be using someone else's design. One of the innovative contracting methods we're pursuing is a large, indefinite-delivery architect/engineer contract, with a $2 million limit per delivery order, and a $20 million total contract limit.

Bonding for HTW work is also a major consideration, and is particularly important in light of heightened public interest in such projects. If the government determines that the public interest needs protection during the course of a particular project, all HTW contracts, from service (normally requiring no bond) to construction



**A private contractor tests the perimeter of a hazardous and toxic waste landfill site. District offices of the Army Corps of Engineers often work with private firms in the management and cleanup of HTW materials (J.M.S. Co., Inc. photo).**

(requiring 100 percent bonding) can have a bond requirement imposed. Several contractors have discovered that environmental activism and protection of the public trust are major considerations in pursuing HTW work—and can influence bonding requirements.

## Regulatory Compliance

As mentioned earlier, HTW activities often do not fit neatly into the regulations—even guidelines that have been written expressly for that purpose. State and EPA regulations can often differ on HTW matters, and each can take precedence over Corps guidelines and procedures. We've found that some regulations even contradict each other. So early on, establish contact with personnel in other agencies who are knowledgeable about their HTW regulations, and can help guide your actions.

But don't count entirely on other agencies. Develop a working familiarity with all HTW regulations. The smallest oversight can ensnare a project for weeks or even months. You must have a thorough knowledge of regulations, site conditions, and remediation technologies in order to prepare sound proposals.

To be a fully functioning member of a district's HTW team, you must also be familiar with the Comprehensive Environmental Response, Compensation and Liability Act (CERLA), and the RCRA. Superfund sites and most formerly used defense sites (FUDS), fall under CERLA. Installation Restoration Program (IRP) sites may be covered by either CERLA or RCRA.

## Innovative Technologies

Don't be afraid to use innovative technologies in solving HTW problems. The advantages can sometimes be significant, and the additional risk can be minimized by making full use of treatability studies. Such studies will indicate the applicability of specific technologies for each site.

Also make sure that you are properly sequencing your project. Your project planning process should include opportunities to discard the technology if it proves ineffective or too expensive. In other words, have a backup plan.

When considering new technologies, use design firms with extensive remedial design experience and a proven record for design implementation. The combination of innovative technologies and HTW can be extremely challenging. You want to deal with a firm that already knows the ropes. In any event, require contract firms to do thorough research of existing literature and field application problems. The design effort necessary to implement innovative technologies is often greater than most firms are accustomed to.

To further minimize risk, try to perform pilot-scale field demonstrations at your site prior to full-scale operations. This will help avoid costly contractor claims resulting from unforeseen problems and delays. Also, be wary of incomplete data sets which appear to prove the proposed technology—even if the data was derived from a previous full-scale operation.

Don't lose sight of the fact that an innovative technology is usually only part of the site treatment process. Associated operations like material handling, soil moisture, and disposal of side streams may be difficult to accomplish.

Be realistic about matching a new technology with site cleanup criteria. A particular technology may provide significant advantages at a particular site, but may not be effective enough to meet the required cleanup standards. We have found, however, that cleanup criteria may be legitimately "softened" to accommodate a particular technology. The EPA's Technology Innovation Office is a good source of information and support when considering the use of innovative technology.

## The Challenge

The Corps has taken the lead in DOD efforts to clean up and control our hazardous and toxic waste problem. For officers serving in an engineer district, HTW operations promise an exciting, demanding challenge. Traditional engineering skills will still be needed, backed by new expertise gained in the HTW field over the past several years.

The road has not been easy so far. Mistakes have been made, partly because the problem is so large, and partly because engineers—military and civilian alike—are still on the upward side of the HTW learning curve. But getting a handle on HTW is now a significant part of the Corps—and the country's—future.

I hope that our experiences will serve others who will come to meet the challenge.

*Colonel Boutin is the Kansas City District Engineer. He previously served as deputy commander of the 18th Engineer Brigade. He also commanded the 5th Engineer Battalion, as well as engineer units in Vietnam and Germany. Previous engineer district service includes a tour with the New York District as assistant chief of operations, and chief of the Regulatory Branch. He holds a bachelors degree in engineering management from the University of Missouri at Rolla, and a masters degree in business administration from Boston University.*



# Commanders and the 15-6 Investigation

*By Captain Andy K. Hughes*

The military justice system enjoys a well-deserved reputation, even among the nation's civilian law community, for procedural fairness. Through the informal 15-6 investigation, the Army's legal framework also gives commanders flexibility in handling disciplinary matters which may not warrant immediate criminal investigation.

All commanders—and all leaders, both officer and NCO—need to be aware of the informal 15-6 and how it works. This article explores this legal option which, like the famous Dragnet line, gives "just the facts, ma'am."

## For Example

A battalion commander receives information that one of the higher ranking men in his unit may be fraternizing with junior female enlisted soldiers. The allegations include information that the man might be using his rank and position to influence the female soldiers into "sex-for-favors" situations.

For obvious reasons, the battalion commander must find out the truth about these allegations in the interest of his unit's good order and discipline. On the other hand, the commander doesn't yet want a formal criminal investigation by military police or agents of the U. S. Army Criminal Investigation Command (USACIDC). Until he has further information, he wants to protect the man from the professionally embarrassing spotlight that a full criminal investigation would bring.

## Getting the Investigation Started

The first two things that the battalion commander must decide appear simple on the surface, but are critical to the success of the investigation:

- Who should conduct the investigation?
- What should be the scope of the investigation?

Army Regulation 15-6 directs that unless the investigator possesses certain technical qualifications that are essential to completing the proposed investigation, the investigator will be an officer (including warrant officers). As a matter of common sense, the commander should select an officer who, in his opinion, has the ability, judgment, and maturity required to conduct a thorough investigation.

The commander should also decide what area(s) of concern the investigator should look into. Since the investigation is informal, the answer to this question is limited only by the commander's discretion. A common method that commanders use to determine what areas should be Investigated is to make a list of questions that the commander would like the investigator to answer. This list will become important as a means of expressing the commander's intent concerning the investigation and providing initial guidance to the investigating officer.

After the commander makes these first two determinations, the next step is to appoint the investigating officer and brief him on the mission. Although this information can be given to the investigating officer verbally by the commander, a much better method is through a memorandum of appointment to the investigating officer. This memorandum should contain, at a minimum, the following:

- A statement that the officer has been appointed to conduct an informal investigation concerning certain allegations.
- The area(s) which the investigator must cover, and on which he must make findings and

recommendations (this is similar to the mission statement in an operations order). The commander should include the list of questions developed earlier to assist the investigator in focusing his investigation. However, the investigator should be told that the list of questions is not all inclusive, and he should use discretion.

- The method for reporting to the commander any findings and recommendations made (verbal or written), and the names of persons to contact for special assistance or administrative support (such as legal advisors, technical experts, or typists).

- The suspense for the completion of the investigation and procedures for extending that suspense if needed.

Once this memorandum is completed and presented to the investigating officer, the investigation has begun. The investigating officer is now prepared to start his work.

## Conducting the Investigation

After he receives the appointment memorandum (or other guidance), the investigating officer's method of proceeding can almost be defined by the famed musical title "Anything Goes." Unless his appointment memorandum directs otherwise, the investigating officer may obtain statements (both sworn and unsworn) from witnesses, copies of documents, summarized records of oral conversations, or any other source of information that will yield "just the facts."

However, there are some practical considerations that investigating officers should take into account while conducting their investigation. One such consideration is that the regulation indicates a preference for sworn statements compared to unsworn statements. The reason for this preference is twofold: The requirement of an oath or affirmation impresses upon persons giving statements the importance of the truth. Secondly, if it is later discovered that someone knowingly made a false statement, they can be prosecuted for false swearing under Article 134 of the Uniform Code of Military Justice (for military personnel) or Section 1001, Title 18, United States Code (for civilians). Since investigating officers are authorized to administer oaths (Sections 936 and 1044a, Title 10, United States Code), sworn statements should be taken whenever possible, using either DA Form 2823 or its equivalent.

Another consideration is whether an individual should be advised of their rights against self-incrimination under either Article 31, Uniform Code of Military Justice, or under the Fifth Amendment to the Constitution of the United States (the so-called "Miranda" rights) prior to conducting an interview. The general rule is that since no individual is designated as a respondent in an informal investigation, the individual does not have any of the "rights" of a respondent (which includes a rights warning). Therefore, in an informal 15-6 investigation, the investigating officer is not required to provide a rights warning in advance unless he has information leading him to suspect that the person may be guilty of a crime. If the question is too close to call, the investigating officer should get guidance from a legal advisor.

However, like most general rules, there are exceptions. For example, during the course of an interview, if the person being interviewed begins to make statements that may tend to incriminate him for being involved in criminal acts, then the prudent investigating officer should stop the interview and advise him of his rights.

A rights warning certificate (DA Form 3881) should be used to advise the person of his rights and to determine if the person wants to proceed with the interview. If the individual wishes to consult with counsel before proceeding, the interview should be terminated and the individual allowed to seek legal assistance.

In light of recent decisions of the U. S. Supreme Court, if an individual consults with counsel, the individual should not be further questioned unless either the individual comes to the investigating officer and wishes to make a statement, or counsel for the individual is present during the interview.

So while the investigating officer has wide discretion as to his procedures for conducting the investigation, that discretion is not unlimited. The wise investigator should consult legal counsel at the outset of his investigation, and develop a plan or road map for how he plans to conduct the investigation. He should maintain contact with his legal advisor until the mission is completed.

## The Final Report

Gathering information is only half of the investigating officer's job. The officer must now organize that information into a form that his appointing authority (the battalion commander in the example above) can easily understand. Depending on the scope of the investigation, this task can be relatively simple or extremely complicated.

The investigating officer must examine all of the

material he has gathered, and make findings of fact based upon the evidence he has discovered. Usually, these findings are made in narrative form, and should answer the questions or issues that the investigating officer was tasked to answer in the appointment memorandum. In addition, the investigating officer should recommend to the commander actions that should be taken in light of the findings.

Unless the appointment memorandum states otherwise, the exact form of the report is left to the discretion of the investigating officer. DA Form 1574 is a recommended tool that can be used to organize the report, but its use is not required. The report should contain the findings, recommendations, and copies of all documents (witness statements, etc.) which the investigating officer used to make his findings. These documents should be marked as lettered exhibits to the report (for example, "Exhibit A").

The findings should reference the exhibits upon which the investigating officer based each of his findings of fact. This will assist the commander in understanding the investigating officer's thought process.

In all reports, the answers to the following questions must be 'yes':

- Are the findings consistent with the evidence? If the investigating officer makes a finding of fact that is not supported by the attached evidence in the report, then the finding is improper. For example, a finding based upon pure speculation must not be included in the report. However, it is acceptable to make a finding of fact based on the investigating officer's determination of which witnesses are telling the truth.
- Are the recommendations consistent with the findings? To illustrate, assume that the investigating officer in the example found that the man in question was involved in a fraternization situation with a junior enlisted woman. However, in this case, the investigating officer recommended that no disciplinary action be taken and that the man be reassigned to division headquarters. It's obvious that either the investigating officer did not make sufficient findings of fact (maybe the man shouldn't be disciplined, but the investigating officer did not explain his reasoning). Or, the recommendation is inconsistent with the finding that the man was engaged in misconduct (a consistent recommendation might be a recommendation of some form of administrative action or discipline against the NCO).

To insure that reports are properly prepared, investigating officers should obtain assistance from legal counsel.

## Post-Report Actions

After the commander receives the report, several events may take place. The commander may approve all of the findings, or may approve some of them. The commander who initiated the investigation is not bound by the findings of fact or the recommendations of the investigating officer. He may draw different conclusions from the evidence and take a course of action other than that recommended by the investigating officer. He may direct that the original investigating officer (or officer appointed to succeed the original investigating officer) conduct further investigation concerning areas previously stated in the memorandum of appointment or into additional areas.

If the commander wishes to look into additional areas, he should give the investigating officer a supplemental memorandum outlining them. If the commander wishes additional areas explored, the report should be amended to incorporate these new areas.

The commander may use the report of investigation in a variety of ways. It could, for example, be the basis for referring a case to the USACIDC, for relieving an officer, for initiating a report of survey, or for revising administrative procedures in the unit.

## Just the Facts

In the example of the alleged fraternization case, if both the battalion commander and the investigating officer follow the guidance described in this article, the result should be a report that clearly states "just the facts" to the battalion commander and makes recommendations supported by the evidence. With the facts discovered in the informal 15-6 investigation, the battalion commander should be in a far better position to make an intelligent decision about whether to take action himself or to refer the matter for possible criminal investigation.

This flexibility makes the informal 15-6 investigation, when properly executed, one of the most effective and useful investigative techniques available.



*Captain Hughes is chief of the Administrative Law Branch of Fort Leonard Wood's Staff Judge Advocate. He previously served as Administrative Law Attorney in the same office. Other assignments include senior defense counsel, trial counsel, and legal assistance officer for Fort Rucker's Staff Judge Advocate. He is a graduate of Combined Arms and Services Staff School. Captain Hughes received his law degree from the University of Mississippi.*

# ENGINEER UPDATE

*Autovon numbers are 676-XXXX, and commercial numbers are (314) 563-XXXX, unless otherwise written.*

## Directorate of Training and Doctrine (DOTD)

***New Director Welcomed.*** DOTD welcomed LTC Robert Martin as director in June. LTC Martin last served as director of the Engineer School's Department of Military Engineering. COL John Pierce left in June to assume his new position as commander, U.S. Army Engineer District-Alaska.

***Engineer Hotline.*** For hard-to-find information regarding military engineer issues, call the engineer hotline at -7324. The service is available 24 hours a day, seven days a week. Most questions are answered within one or two working days—we are here to serve you! POC is SGM Donald Rasmus, -7528.

***Combined Arms Training Strategies (CATS).*** Starting in FY 92, CATS will incorporate a tailored training strategy in Mission Training Plans (MTP). The first set of CATS will be included in ARTEP 5-605-series MTP (topographic engineering). POC is CPT Jim Glass, -7784.

***ARTEP 5-145-32 and 5-145-12-MTPs,* Bridge Company and Platoon.** New MTPs for engineer bridge companies and platoons will be distributed in the 4th quarter, FY 91. These MTPs, which replace ARTEP 5-64, dated July 1982, provide training and evaluation guidance for units with assault float, medium girder, panel, and M4T6 class 60 bridges. POC is Russ Hinkle, -7513/7786.

***Medium Equipment Transporter Training Package.*** An exportable training package will beavailable in the 4th quarter, FY 91, for the M916 and M920 truck-trailer combination vehicles. The 13-day program includes preventive maintenance checks and services (PMCS), engine brake (Jake's brake), and driving techniques for the M916 (with M172A2) and M920 (with M870). The package will be available upon request from the Individual Training Branch, DOTD. POC is CPT Karl Rhynes, -6144/7785.

## Directorate of Combat Developments (DCD)

***AN/PSS-12 Mine Detector.*** Purchase of the sensitive AN/PSS-12 Mine Detector for distribution to Army units depends on results of an in-process review scheduled for August 1991. The AN/PSS-12 is a hand-held, portable mine detector that can detect buried metallic antitank and antipersonnel mines, and small metallic firing pins on buried non-metallic controls. The device weighs about 8 pounds; its handle extends from 19 to 57 inches.

The mine detector will be used by combat, combat support, and combat service support troops in both forward and rear areas to locate land mines and unexploded ordnance. Initial basis of issue will be one-for-one replacement of the AN/PSS-11/12 mine detectors, followed by other combat support and combat service support units. POC is SFC Wilder, -7993.

## Directorate of Evaluation and Standardization (DOES)

***Special Projects and Studies.*** The Engineer School matches requests from students for thesis research projects with topics submitted from agencies and units for research. The research will be performed at the Command and General Staff College, War College, equivalent Department of Defense schools, or graduate schools. If your agency or unit has a topic to submit, or if you are a student seeking a thesis topic, call CPT Martin Dorey, -5321.

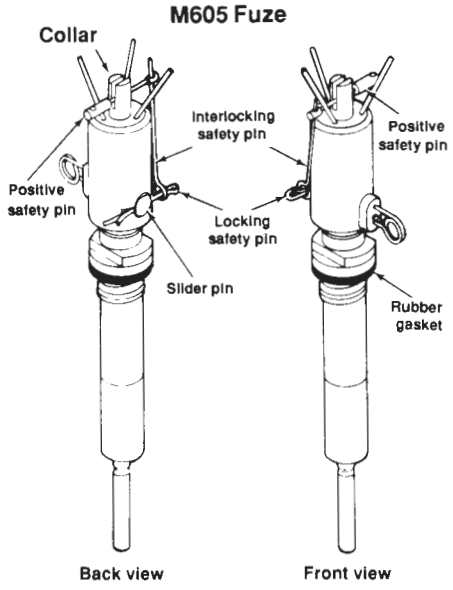
## Department of Instruction (DOI)

***Engineer School Reorganization.*** Effective 17 June, the Departments of Combined Arms and Military Engineering were reorganized into a single department, the Department of Instruction. This move was made to consolidate all teaching requirements into one department, and to create overhead space savings for the school. Faces, phone numbers, and office locations initially will not change much. As they do, additional announcements will be made in *ENGINEER*.

Request you bear with us and have patience when dealing with DOI. We will continue to support the field in the same manner that DCA and DME did in the past. When writing to us, the new office symbols are:

ATSE-DI — Director
ATSE-DI-CE — Combat Engineering Division
ATSE-DI-CC — Combat Construction Division
ATSE-DI-AC — Engineering Office Advanced Course Division
ATSE-DI-TT — Tactics, Training, and Doctrine Division

POC is SFC John Williamson, -5746.




***Additional Arming/Disarming Procedures for M16 Series Antipersonnel Mine (M605 Fuze).*** The following information is in addition to the procedures published on page 46 of the January 1991 issue of *ENGINEER Professional Bulletin.*

▶M16 mines must have collars on the M605 fuze. The collar provides additional clearance between the striker and primer, adding a greater margin of safety in case the striker is accidentally released. When arming or disarming the M605 fuze, soldiers must ensure that the metal collar over the top of the striker is in place.

▶The term "collar" refers to the cylindrical piece of metal that slides over the top of the firing pin. It rests on the upper-most part of the fuze body, between the three prongs. The collar has a slot that lines up with the hole in the striker (firing pin). When the positive safety pin is inserted through the slot in the collar and the hole in the striker (firing pin), the collar helps prevent the striker from making contact with the primer.

▶The collar comes with the fuze when it is first issued; it is not an additional part. The metal collar should not be discarded when arming the fuze. It must be in place before attempting to insert the

positive safety pin. If the collar is missing from the fuze, do not arm or disarm the mine. POC is CPT Green, -5596.

## Department of Topographic Engineering (DTE)

***Director Change.*** In June we said farewell to our director, COL Kirby, who will become director of the Defense Mapping Agency's Hydrographic and Topographic Center, in Washington, D.C.

We will welcome the new director, LTC Schnabel, in August. LTC Schnabel is commander of the 29th Engineer Battalion, Fort Shafter, Hawaii.

## Engineer Branch Safety Office (EBSO)

***Road Grader Operation Update.*** An item in the January 1991 issue of *ENGINEER* (p. 45) reported that road grader operators should stand up when moving the vehicle in reverse. That statement is true for all older model road graders used by the military (Caterpillar 120 and Westinghouse 440 HAHA).

Caterpillar M130G road graders operate differently. Operators must remain seated with the seatbelt on when moving this vehicle in reverse. POC is Paul Rusinko, -5002.

## Engineer Personnel Proponency Office (EPPO)

***Army Diving Open to Women.*** Military occupational specialty (MOS) 00B, Diver, is now open to female soldiers. This decision opens 153 Active, National Guard, and Army Reserve positions to female soldiers. POC is SFC Eelman, -5361.

## Reserve Component (RC)

***Army National Guard (ARNG) Officer Welcomed.*** Effective 8 July, 1991, LTC Mark L. Juneau (LAARNG) assumed the duties of assistant deputy assistant commandant ARNG at the U.S. Army Engineer School. He replaces LTC Charles Doll (OHARNG), who was selected as a senior service college fellow at Tufts University, Fletcher School of Law and Diplomacy. LTC Juneau may be reached at -7742.

## 1st Engineer Brigade

***Reorganization and Realignment.*** Engineer training units at Fort Leonard Wood are being realigned under a multi-phase plan to bring the installation in line with the TRADOC school model. The 31st, 35th, and 589th Engineer Battalions (one station unit training) are now attached to the 3d Training Brigade. The 577th Engineer Battalion will inactivate on 12 July, and its horizontal construction and engineer equipment maintenance training missions will transfer to the 87th Engineer Battalion. The final phase of the reorganization will redesignate the 1st Engineer Brigade as the 1st Engineer Brigade (Center). It will absorb missions and units from the 136th Engineer Brigade, which will inactivate 20 July. POC is CPT David Kline, AV 581-4128, or (314) 596-4128.

# CLEANUP IN THE ALEUTIANS

*By Charles Hendricks*

Few locations in the United States have endured as dramatic a physical impact from warfare in this century as Alaska's Aleutian Islands. Scene of the only foreign military occupation and land combat in the 50 states during World War II, these islands until recently remained scarred by the aftereffects of hasty military construction and rapid post-war demobilization.

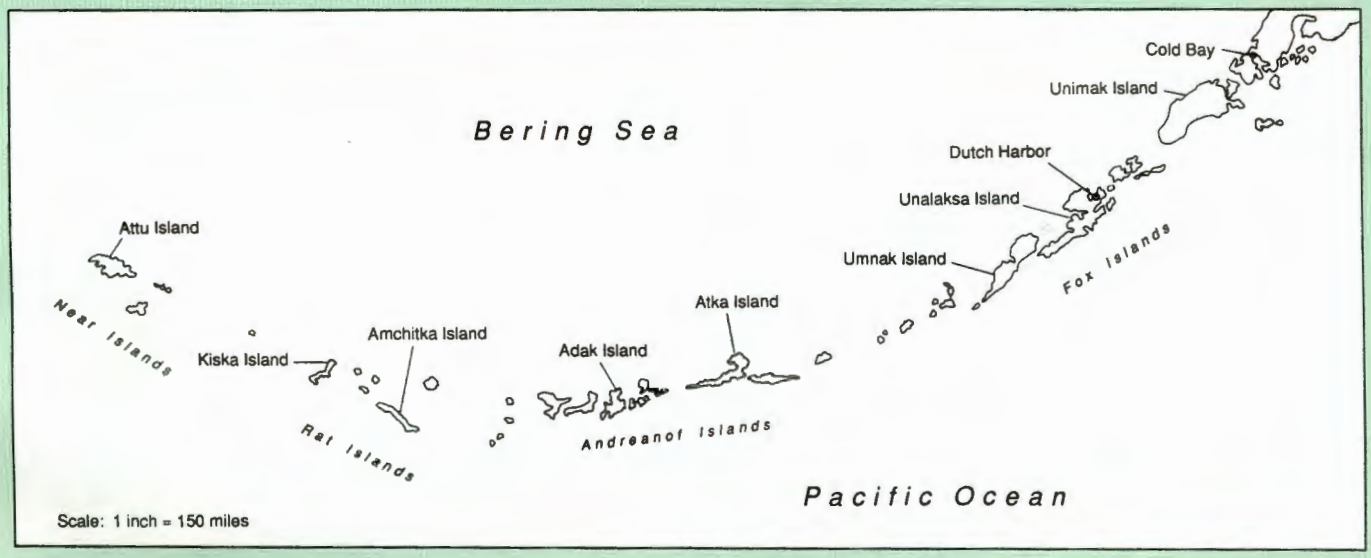
The Corps of Engineers has now begun a broad effort to clean up unsightly remnants of World War II on these once pristine islands. At the same time, engineers are collecting artifacts and records that preserve the memory of the area's significant historical events. Alaska's story, although unique, portrays the magnitude of the environmental restoration effort currently confronting the Department of Defense.

In 1940 the United States began to build substantial facilities for naval and land forces at Dutch Harbor, near the eastern end of the archipelago. These forces were assigned to defend the islands from the threat of Japanese aggression. Unalaska Bay, on which Dutch Harbor was situated, had been the commercial hub of the Aleutian Islands since Russian traders settled there in the 18th century.

Navy contractors and troops, including the first Seabee construction regiment, built a $44 million operating base at Dutch Harbor during the period 1940-44. It included a seaplane station, submarine base, Marine barracks, and radio facilities. The base had 17 office buildings, a 200-bed hospital, and seven operating docks. Navy builders also erected a typical Army mobilization-type garrison for 10,000 men adjacent to the Navy base. When the build-up of forces made it desirable for Navy personnel to occupy those facilities, Seabees built another Army base on nearby Unalaska Island. Army engineers, meanwhile, built an airfield on Umnak Island, just west of Unalaska Island.

Japanese planes bombed Dutch Harbor in early June 1942 in an unsuccessful attempt to divert American forces from the critical battle at Midway Island. Attacking aircraft destroyed two Army barracks and four large oil tanks; damaged three quonset huts, a hospital, and a naval radio station; and set the barracks ship *Northwestern* afire. American fighters at Umnak engaged the Japanese planes but lost eight aircraft to the enemy's seven. American ground casualties amounted to 43 killed and 50 wounded.

Immediately after this attack, Japanese seized the undefended islands of Attu and Kiska, in the western Aleutians. At this point, the U.S. Army recognized the serious threat that the Japanese posed to the predominantly Native American population inhabiting the island chain. The Army reacted by hastily evacuating most native Aleuts in the Aleutian and nearby Pribilof Islands to camps in the Alaskan panhandle. The residents of Attu, unfortunately, were interned by the Japanese in Japan.




**Aleutian Islands**

**Dutch Harbor. . .**



**During 1942 bombing raid**



**In disrepair**



**After 1985 restoration**

General Simon Bolivar Buckner, commander of the Army's Alaska Defense Command, responded to the Japanese attacks by expanding Army bases on the Alaska Peninsula and pushing his forces westward from island to island in the Aleutians. By January 1943 Buckner's forces, which included U.S. and Canadian troops, had reached Amchitka Island, 80 miles southeast of Kiska. Army engineers quickly constructed airfields on the occupied islands, which enabled American fighters and bombers to launch destructive raids on the Japanese garrisons at Kiska and Attu.

When 11,000 American forces landed on Attu on May 11, 1943, they found 2,400 Japanese well entrenched on the island's rocky heights. The Japanese were in no mood to surrender, and only a combination of intense naval shelling, aerial bombardments, and ground attacks eventually forced them from their mountaintop positions. Before the battle ended 18 days later, the American commander had been relieved, 550 Americans had been killed, and 1,150 had been wounded. Only 29 Japanese were taken prisoner.

The Aleutian campaign came to an anticlimactic end in August 1943, when 34,000 allied troops landed on Kiska. The assault troops soon learned that the estimated 9,000 to 10,000 Japanese had already been evacuated. The Americans, nonetheless, suffered 21 killed from friendly fire in the operation.

After the Japanese in the Aleutians were defeated, the number of U.S. and Canadian troops in Alaska, which had reached 144,000 in September 1943, declined steadily. By the war's end, most of Alaska's wartime military installations were abandoned, except for substantial garrisons near Anchorage and Fairbanks, on Kodiak Island, and at

Adak Island in the Aleutians.

The displaced Aleuts returned to their islands in 1944 and 1945 only to find their homes ransacked or destroyed. The Aleuts' Russian Orthodox churches had been vandalized, and the village on battle-torn Attu had been obliterated. The United States spent $250,000 after the war rehabilitating the Aleut communities, but the money did not adequately compensate for the damage inflicted by souvenir-hungry troops. Many small Aleut settlements were abandoned. While the federal government built 24 homes on Atka, including six for Attuan families returning from Japan, most Aleuts had to rebuild as best they could on their own. Many found useful building materials at abandoned military facilities.

The Aleutian economy improved significantly in the 1970s, aided by the United States' declaration of a 200-mile domestic fishing zone in 1976. Also, the Native Land Claims Settlement Act of 1971 provided substantial benefits to the Aleut community. In the midst of this prosperity, the continued presence of dilapidated, abandoned military buildings formed an unsightly contrast.

Congress asked the Corps of Engineers to plan the removal of abandoned military buildings in the Aleutian Islands and at the two largest wartime installations on the Alaska Peninsula in a 1974 water resources act. During the next five years, the Corps' Alaska District prepared two inventory and planning documents for the environmental restoration work. It concluded that a respectable cleanup would cost at least $22 million.

Recognizing the magnitude of the military cleanup problem throughout the United States, Alaska's Senator Ted Stevens proposed, and Congress in December 1983 enacted, legislation creating a Defense Environmental Restoration Account. This account contained appropriated funds that could be used only to clean up hazardous wastes and unsafe and unsightly buildings and debris at current and formerly used defense sites.

The Corps' Alaska District moved quickly to clean up Aleutian and Pribilof Island sites. By 1985, the district had awarded contracts totaling $2.8 million to clean up Dutch Harbor and Unalaska Island, $4.4 million for environmental restoration at Atka and Amchitka Islands, and $2.8 million for clean-up work at Cold Bay.

The Corps maintained a lively interest in historic preservation as it undertook the cleanup operations. Joined in its effort by the State of Alaska's Historic Preservation Office and the National Park Service, the Corps carefully documented wartime construction in Alaska and preserved the best surviving structures. Project staff recorded detailed structural information about several historic sites before buildings were razed. These included the Navy's administrative headquarters at Dutch Harbor, the first Marine barracks erected there in 1940, and the air operations building, which later served for 37 years as Dutch Harbor's airline terminal. The group also documented the standard Pacific hut, a lightweight, easily assembled plywood structure similar in design to the steel quonset hut. Pacific huts had proliferated in the Aleutians during the war, proving impervious to the wind and rain for which the islands are renowned.

Cleanup operations were especially extensive on isolated Amchitka and Atka Islands. On Amchitka, the contractor removed 417 frame buildings, more than 1,500 quonset and Pacific huts, 3,300 barrels, 129 tanks, and some 37,000 cubic yards of wood and metal debris. A Corps contractor removed thousands of 55-gallon oil drums and excavated oil-saturated soils from a landfill site used by the military in the Pribilof Islands.

While these cleanup efforts were underway, the National Park Service conducted a survey of wartime sites in the Aleutians. The Park Service's study led to national historic landmark status for the Attu battlefield and Army and Navy airfields on Attu Island, the Japanese occupation site on Kiska Island, Army and Navy bases on Adak Island and at Dutch Harbor, and the Umnak Island airfield. The U.S. Fish and Wildlife Service now administers the once-occupied Kiska and Attu Islands as part of its Aleutian Islands National Wildlife Refuge.

The initial defense environmental restoration projects in the Aleutians have been completed, but work continues on recently issued contracts. These include a $7.6 million contract for site restoration at Port Heiden, on the Alaska Peninsula, where an Army base was built after the 1942 bombing raid at Dutch Harbor. Two contracts totaling $1.7 million have been awarded for additional restoration work at Dutch Harbor and Unalaska Island.

More work is in the offing. The Alaska District will survey the environmental restoration needs of Attu and Kiska Islands this summer, in advance of anticipated work there. These projects, aimed at removing the scars of war from a land of great natural beauty, form a colorful part of the more than $300 million of defense environmental restoration work which the Corps of Engineers executes annually.

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