Engineer

THE MAGAZINE FOR ARMY ENGINEERS WINTER 1985-86



PROFESSIONAL DEVELOPMENT

ALSO: ADVISOR OR LEADER □ EVOLUTION OF DOCTRINE
SAPPER LEADER COURSE

Engineers to the Rescue

A Personal Viewpoint

by CPT Marc E. Marszalek

A terrorist attack on the American Embassy in Beirut killed 63 people in April 1983. Many of the dead were not extracted from the rubble until days later. In September 1983, over 200 marines were killed and 81 injured after terrorists bombed their headquarters. Cranes and bulldozers excavated the twisted concrete and steel while marines dug down toward the survivors with their bare hands.

The increase of terrorist bombings, the destructive forces of modern warfare, and natural disasters have escalated the need for emergency rescue operations. At present, the Corps of Engineers is not properly equipped to remove injured and trapped people from collapsed structures. Bulldozers and cranes chewing at rubble is not an effective nor safe rescue technique, and a major earthquake in California or a terrorist bombing of the Pentagon would tax local rescue resources beyond their capability.

Currently, disaster recovery teams from the Corps of Engineers handle natural disasters, and engineer units responsible for area damage control at corps level handle warfare destruction recovery operations. However, according to MAJ Riley Jacobs, Directorate of Combat Developments, USAES, the training and unique equipment needed to rescue casualties from rubble is not available within the Army.

Engineers need rescue teams to carry out this task in the United States and overseas. We must integrate newly formed rescue teams into present organizations with the ultimate goal of saving lives. Specialized training and equipment are key factors.

Training

Successfully rescuing people from collapsed buildings requires fast and precise hand-intensive labor which can only be developed through special training.

Special training for the rescue team leader in areas like civil or structural engineering will expedite decisions at the disaster site. Evaluating the balance, material composition, and structural soundness of the remaining structure will enable the leader to make decisions for bracing the remaining structure and removing debris without weakening the building and causing further collapse.

Most of the officers in the Corps have these required skills associated with civil engineering. Engineer officers receive special training in leadership, rigging, vertical structure design, utilities, and many other important skills at EOBC and EOAC. With this special training, the team leader can direct tasks to the team members and local labor.

In addition to training and skills related to civil engineering, rescue team leaders and members need more advanced training in medical treatment. The Medical Services Corps provides classes in which team members can learn about burns, fractures, internal injuries, and other medical areas. Students learn the effects of heavy weights on people and how to remove debris without causing further injury.

If the rescue team leader understands how the body works during times of stress and traumatic injury, he can make educated decisions when rescuing injured persons from rubble. He must see that they are given immediate first aid treatment and quickly evacuated from the danger area.

Also critical for the rescue team is knowing how local fire fighting teams function and deploy. The fire departments of large American cities provide training in rescue techniques. In these classes, the team can learn ladder safety and the use of new rescue equipment: power cutoff saws, hydraulic spreaders and cutters, life lines and belts, and pumps and ventilators.

The heavy rescue course developed by California's Heavy Rescue Committee Fire Service Training and Education Program was created for the Federal Emergency Management Agency. The course objectives include:

- Information on basic types of building construction and their collapse characteristics from various causes.
- Information on different equipment used during heavy rescue operations.
- Methods for using heavy rescue equipment.
- Methods of improvising rescue equipment using available materials.

This course, modified to meet Army requirements on or off the battlefield, would be an excellent way to educate rescue teams.

Rescue team training must also include rapid deployment, quick hand-intensive excavation, and the use of specialized equipment. The team must be lightly equipped and easily air-transportable. Most disasters will not occur within driving distance of the rescue team.

Training by many diverse programs and concentrating on modern specialized equipment form the structure and objective of the rescue team—to save lives. However, the special training required for rescue missions will prevent the team from performing other engineer-related tasks such as countermobility or survivability. A rescue team in a corps battlefield rear area performing area damage control would be ineffective if reorganized as infantry. Their specialized training in noncombat areas and lack of combat equipment would be fatal.

Equipment

Combat heavy battalions are tasked with emergency rescue operations.

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Engineer

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Special thanks to Lee M. Rivas, the Directorate of Evaluation and Standardization, and the Engineer Proponency Office.

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The Sapper Leader Course (page 12) trains engineers to fight as light infantry. The 13th Engineer Battalion masters air assault. (U.S. Army photo).

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News & Notes

New Camouflage Fits Soldier's Pocket



Soldiers using the new individual camouflage net vanish at will. Buttoned together, these nets help conceal units of battalion, brigade, and division size. The nets become a combat multiplier by adding the element of surprise to the light infantry soldier (Belvoir R&D photo).

A small, lightweight camouflage net developed by Belvoir R&D Center was used successfully in Korea during Team Spirit '85. The individual concealment cover (ICC) is a solid color net (5 feet by 7 feet) made of incised, rip stop nylon.

Each unit weighs less than a pound and can be folded to fit into the pocket of a soldier's uniform. The nets can be joined together to form a larger cover to conceal fighting positions, weapons emplacements, and soldiers.

The nets were developed in response to Army doctrine for the future which calls for a new kind of soldier—light and mobile. During the Team Spirit exercise, the ICC was used by elements of the 7th Light Infantry Division for concealment before a surprise attack.

Work is underway on improved versions of the net for use in desert, woodland, and snow. The ICC is being developed under a quick response program at the request of the 9th Infantry Division and the Army Development and Engineering Agency (ADEA).

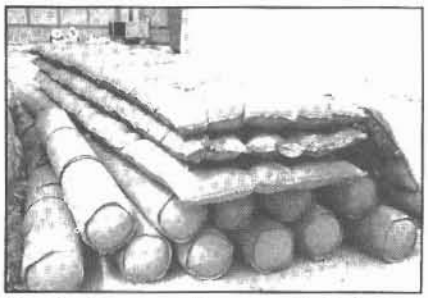
Foam Bridging and Rafting for a Fast-Moving Army

The U.S. Army Construction Engineering Research Laboratory (CERL) is developing foam applications for bridging and rafting operations—applications that can get troops and vehicles quickly and safely across unfordable streams and rivers.

- Foam can be transported in small containers and then expanded up to 30 times its original volume to build a bridge or flotation system.
- When needed in the field, polyurethane foam can be mixed by hand or with high speed mixers.
- Once formed, foam flotation devices are lighter and easier to handle than comparable conventional bridging and rafting systems.

Two flotation systems are designed to move people across water. The foam footbridge consists of 20-foot by 3-foot bridge sections lashed together. Each section can support 1,200 pounds. The foam-filled reconnaissance boat is the same size as the inflatable boat currently used by the Army. The three-man boat resists puncture, will not sink, and supports up to 700 pounds.

CERL researchers have also developed foam flotation systems for vehicles. The utility truck rafting system consists of two cylinders (11 feet long, 25-1/4 inches in diameter) attached to the sides of a 1/4-ton truck. Each cylinder weighs 100 pounds, yet can support up to 2,200 pounds in water. A larger version, the MLC20 rafting system, uses two 500-pound cylinders which can support up to 13,000 pounds in water. With both systems, troops use a guide rope and tow rope to pull the vehicles across water. The floats can be detached and used again.



Footbridge sections and flotation cylinders get Army troops and vehicles safely and quickly across unfordable streams or rivers (CERL photo).

Future plans include developing a vehicular bridge for military load classes 5 through 30 and a rafting system for vehicles up to military load class 70.

Water Detection Team Supports Bright Star '85

U.S. forces participating in maneuvers in the Middle East this summer got some help from the Army Corps of Engineers' newly formed water detection response team.

Seven civilian scientists from the Engineer Topographic Laboratories, Fort Belvoir, VA, and Waterways Experiment Station, Vicksburg, MS, located well-drilling sites for Army, Navy, and Air Force units participating in Bright Star '85. They identified three well sites, two in Egypt and one in Jordan, for the combined joint training exercise involving the United States, Egypt, Jordan, Somalia, and Oman.

The team will support future military operations as well as training exercises. It will identify and develop equipment and techniques which terrain teams and well-drilling units can use to detect subsurface water, according to Allan DeWall, an ETL geologist who manages the detection team and served as team leader for the Bright Star mission. The team will be ready to support U.S. forces in emergencies and will also act as a referral service.

Finding groundwater is particularly difficult in arid regions. Evaluating well sites involves interpreting geological factors, analyzing geophysical data, and making complex technical judgments—tasks which drilling detachments are neither trained nor equipped to handle. Military planners, however, count on wells to provide over 15 percent of the water needed for soldiers and equipment deployed in arid regions. The water detection team will help drilling crews meet this goal.



Tony Dardeau and Dwain Butler, Waterways Experiment Station, set rods for an electrical resistivity survey at a potential well site west of Cairo. Team members and other civilians wore uniforms during Bright Star '85 (Engineer Topographic Lab photo).

Two Light Infantry Divisions Reactivate

Two engineer units now support light infantry divisions reactivated this fall. The 41st Engineer Battalion, Fort Drum, NY, is part of the 10th Mountain Division. The 229th Engineer Battalion, Fredericksburg, VA, supports the 29th Infantry Division—the only National Guard unit of the Army's five light infantry divisions.

The light division, one of the Army's latest tactical developments, has fewer troops and less equipment than a standard infantry division. It relies more on agility, stamina, and cunning than on firepower. The division can deploy rapidly to trouble spots and sustain itself for 48 hours anywhere in the world. It clears and defends urban areas or hostile terrain, provides antitank defense, conducts raids and heliborne operations, and protects rear areas.

Wanted . . . Computer Programs

The U.S. Army Engineer School is developing automated computer programs which will aid engineer command and control functions. Presently, engineer tasks are being analyzed and selected for inclusion in the Engineer Command and Control and Digital Topographic Support systems.

If your unit is using computer-based applications authored by unit members or adopted from other sources, please contact CPT Leo Fontana, AV 354-3953 or write to: Commandant, U.S. Army Engineer School, ATTN: ATZA-TE-TT, Fort Belvoir, VA 22060-5331. Your programs may be used as a prototype for applications Corps-wide.

News & Notes

The Pyramid Project

"People come up to me on the street and ask me what it is we're building and when we will be finished with it," said SGT Mark Dorminey of C Company, 307th Engineer Battalion, 82nd Airborne Division.

The project is an outdoor amphitheater built in South Camp on the Sinai Peninsula where soldiers of Task Force 1-508 stay when they aren't occupying observation posts or check points. Dorminey and four other men from C Company are engineers who volunteered to be part of the U.S. battalion currently stationed in the Sinai as members of the Multinational Force and Observers (MFO).

The amphitheater is used as a movie theater and stage for the bands and entertainment tours that visit South Camp. The audience sits in the semicircular tiers and enjoys entertainment in the atmosphere of the Red Sea just beyond the stage. The rough cutting of the tiers and stage area was done with explosives and a bulldozer, and all fine cutting was done by hand. According to Dorminey, "This is basically a pick and shovel job; we aren't allowed the luxury of earthmoving equipment."

In its early stages of construction, the project was halted because it was feared that the added weight to the shelf of land could cause that area to drop off into the sea, explained 1LT Craig LaBelle, a platoon leader from the 307th Engineers at Fort Bragg, NC. "SP4 Rowsey has some land surveying experience. Based on his survey results and some tests of the earth's firmness in the area, we determined that the theater even with a capacity crowd would not be hazardous," he said.

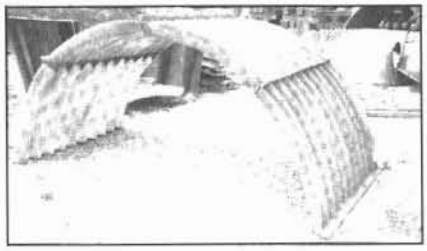
The engineers were assisted by a squad of infantrymen from one of the line companies that were on a break from their sector duties. "We can feel a sense of accomplishment from our work here," said one soldier from A Company. "This isn't like building a fighting position that we work hard on and then have to tear down. This is something that will be here for a long time. We can take pride in having contributed to it," he said. **(SGT Ken Hudson, 82nd Airborne)**

Fiberglass Cover Protects Against Aerial Attack

The fiberglass overhead cover developed by CERL will protect Army fighting positions against aerial explosive rounds. Weapons systems like the TOW antitank weapon are particularly vulnerable because they are prime targets for enemy fire.

Four 32-pound corrugated fiberglass sections (59 inches by 40 inches) are fastened together to form a complete arch. This forms the necessary support for a protective layer of soil or sandbags to shield personnel from shrapnel. The soil-covered arch can be camouflaged for further protection.

CERL researchers designed the arch so that sections can be closely stacked and easily transported. Future plans include evaluating other materials and designs that will reduce the structure's weight and size, yet increase its load-bearing capacity.



Fiberglass overhead covers provide foundations for protective layers of soil or sandbags (CERL photo).

Letter To The Editor

The article in News and Notes, *Engineers Help Feed Hungry Children*, (Fall, 1985) contains erroneous information in the last paragraph. ("This is the first time Malian and American soldiers have worked together.")

Prior to 1964, an airborne team (US) trained a Malian parachute company. From June 1964 to June 1965, a 20-man team (MTT Y69) trained the Malian engineer company in vertical and horizontal construction, ordnance and engineer equipment maintenance, surveying, and rock crusher operations. The 20-man team was replaced by a 5-man team in June 1965.

The mobile training teams were assembled at Fort Bragg, equipped at Fort Belvoir, and the liaison officer at that time was MAJ Fred Lenoach (CPO Training Officer).

An additional interesting fact is that MTT Y69 also trained the Malian engineers on a light tactical raft on the Niger River at Bamako.

Twenty years ago the road from Abidjan, Ivory Coast, was partially paved (150 miles); and heavy truck traffic was hauling all the import-export materials that could not be hauled by rail from Dakar, Senegal, to Bamako.

Walter S. Lockard, Chief, 52D10, Department of Military Logistics, USAES.

Past in Review



Members of Company D, 11th Engineers (Railway) work near the Meuse River. They were among the first Americans to fight in France during World War I (U.S. Army photo).

Eleventh Engineers in World War I

by Dr. William C. Baldwin, Historical Division, OCE



On April 6, 1917, the United States declared war on Germany and entered World War I. Britain and France, America's new allies, requested immediate engineering assistance in building, maintaining, and operating railroads in France. The War Department responded by quickly organizing nine new regiments of railway engineers.

Two months before the outbreak of war, the Chief of Engineers, BG Willliam M. Black, had begun forming a reserve engineer regiment in New York City. Using the slogan, *First to France—Join the Engineers*, the First Regiment, Reserve Engineers, opened its recruiting office in early May and soon filled its ranks. To avoid confusion with the First Engineers of the regular Army, the War Department redesignated the new unit the 11th Engineers in July 1917 and made it the first of the new railway regiments. The present 11th Engineer Batallion (CBT)(HVY) traces its lineage to this unit.

The 11th Engineers (Railway) trained at Fort Totten, NY, during June and set sail for Europe on July 14. Three American engineer regiments, including the 11th, were attached to the British army in France. On September 5, 1917, a German artillery shell wounded two soldiers of the 11th Engineers. These engineers were the first battle casualties of the American Expeditionary Force (AEF) in France.

In mid-November, the regiment joined in the British preparations for the Cambrai offensive. Amid great secrecy, the 11th Engineers helped move and unload the primitive tanks that the British had massed for the offensive. The attack made some gains initially, but like most offensives on the Western Front, soon bogged down. The 11th Engineers supported the British advance by building and repairing rail lines.

On November 30, two and a half companies of the 11th, along with some Canadian engineers, began constructing a rail yard just behind the British front lines. Sporadic German artillery fire interrupted their work. German shelling was routine, but this fire suddenly became a barrage of gas and artillery shells.

The officers ordered a withdrawal, but the engineers were already caught up in a surprise German counterattack. Some hid in dugouts to escape the shelling and found themselves trapped behind the German advance. Others used their picks and shovels to fight the advancing infantry. Most of the American engineers got back to their camp where the rest of the regiment had taken up defensive positions to help the British stop the counterattack. Six of the 11th Engineers were killed, eleven were wounded, and thirteen were taken prisoner.

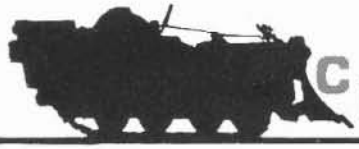
GEN John J. Pershing, commander of the AEF, wrote that Cambrai deserved special attention because "it was here that American troops (11th Engineers) first participated in active fighting." Engineers of the 11th received three Distinguished Service Crosses and three British decorations. The regiment was credited with campaign participation in the Battle of Cambrai, the first campaign credit given to American units in World War I. A quarter of a million U.S. Army engineers eventually served in World War I, but the men of the 11th Engineers (Railway) were among the first American soldiers to fight in France.

Suggestions for further reading:

V.T. Boughton, *History of the Eleventh Engineers*, United States Army.

William Barclay Parsons, *The American Engineers in France.*





CLEAR THE WAY

by MG Richard S. Kem, Commandant, U.S. Army Engineer School

Rapid Modernization:

The Army Must Answer the Demands of New Technology

All of us have been exposed to the many initiatives which our Army continues to develop in creating a force which is the best equipped and the best trained. The primary focus of the rapid modernization is to ensure that our Army is successful in either peace or war.

Our mission is among the most varied and important of any branch. To guarantee that our efforts will be fully and successfully coordinated throughout the complex Army organization, a special concept has been established. To fulfill that concept, each branch school commandant has been designated as the proponent for a number of functions within his branch since the reorganization of the Army in the early 1970s.

As commandant of the U.S. Army Engineer School, I am the proponent of the Engineer Branch. As branch proponent, I am responsible for the development of concepts, doctrine, tactics, techniques, procedures, organizational designs, material requirements, training programs, training support, personnel requirements, education requirements, and other engineer matters as they pertain to the total Army.

In addition to the branch proponency, I am the personnel specialty proponent for engineers. Specialty proponency from the Army staff agencies was transferred to the field by the Army Chief of Staff in 1981. It focuses on coordinating personnel policy throughout the Army. The entire life-cycle issues are followed from structure and acquisition to separation. My role is to articulate our professional needs which consist of a wide spectrum of concerns. Our goal is to have a competent and professional engineer force and provide it with the greatest opportunities for development, education, and advancement.

Although the other specialty proponency issues are important, let me concentrate on personnel professional development. This vital issue affects all of us throughout our careers. Requirements are continuously developed throughout our careers to ensure that the necessary skills are identified and will be attained when needed. Training and education requirements are analyzed with regard to assignment priorities; patterns of professional development are established for our career fields (officer, warrant officer, and enlisted); and qualification standards are reviewed and established for each of our specialties. Likewise, functional area and special skill requirements are identified.

Currently, we are working on a number of significant engineer professional development issues. The Total Warrant Officer Study (TWOS), the Enlisted Personnel Management System (EPMS) Review, and the Officer Personnel Management System (OPMS) Review are examples of ongoing personnel policy actions which will affect us all.

In addition, the Army must answer the demands of new technology. This occurs at a time of extensive force modernization. We must maintain an active role in obtaining the best qualified individuals and sustaining our professional force through training and education. Engineers have always excelled in technical and decision-making skills. We must ensure that we continue to provide the opportunities for future developments.

I hasten to add that leadership skills are cultivated and exercised as an integral portion of professional development. Historically, the Corps has provided the Army with capable leaders who have met the challenge in both peace and war. Certainly we must never forget the important role we play in the Army and the nation as we continue to develop officers, NCOs, and civilians who can meet the challenge.

As you know, this is the Army's year of leadership. I believe that, as never before, the engineers have major roles in leadership both within and outside the Corps. Ours is a branch of unique opportunities, and we are working hard to maintain our lead by pursuing proponency issues. Essayons!





by CSM Charles T. Tucker, U.S. Army Engineer Center & School

Professionalism:

An NCO's Viewpoint

Professionalism. We always hear the term, but what does it mean really?

Professionalism means unique. It means special talent. It means pride in yourself, your work, and your troops, and dedication to the same.

Professionalism means you are better at your job than anyone else, but you share your knowledge. It means you are an expert, an artist, and a specialist. It means you are never satisfied with the status quo. You have pride in what you do, but try to do it better. You have pride in your troops, but try to make them better. You have pride in your unit, but strive to improve it.

A professional is that drill sergeant you despised at boot camp, yet you came to respect and admire. In fact, you tried to outdo him. Nothing he could do or say could break you. No challenge he gave could stop you. Before you knew it, he made you a soldier.

Professionalism means duty before self. It means putting your soldiers before yourself. It means putting your leaders before yourself. It means putting your unit before yourself. It means refusing to enter the chow line until every one of your soldiers has been served first. It means you are willing to die for those troops and, perhaps, they are willing to die for you. It's that platoon sergeant at Vietnam who went back through the jungle to look for you when you were separated from your unit. It's that private manning the perimeter who dies protecting his unit.

A professional is the squad leader who kept his composure when your platoon was ambushed. He feared the battlefield, but overcame that fear. He did not leave soldiers to die, but risked himself to save them. He knew how to fight, but knew when to stop. When hope was gone, he hoped. When all was lost, he found answers.

Professionalism means integrity and loyalty—to yourself, to your leaders, and to your troops. It means stepping forward when your troops fail, but stepping aside when they shine. It means adopting a code of ethics and sticking by it when others don't.

A professional knows when to push and knows when to comfort. He knows when to act and knows when to watch. He knows when to lead and knows when to follow. He knows when to work and knows when to joke. He enjoys his work and so do his troops. His enthusiasm is contagious. He sparks drive, intensity, and determination. He is renowned, yet removed.

A professional is that first sergeant who worked nights and weekends to finish the paperwork so you could get your award. But he's the same first sergeant who denied you a weekend pass when you failed a barracks inspection. He's the platoon sergeant who attended night school to further his education and, at the same time, helped you to study for your high school diploma. But he's the same platoon sergeant who put you on 30 days extra duty when you missed a formation.

A professional accepts criticism. He admits his faults, yet strives to erase them—and does. He offers criticism, but offers it soundly, tactfully, and intelligently. He shows you your faults, but compliments your strengths. He tells you when you're wrong, but takes the time to tell you when you're right.

A professional sets goals—challenging goals. He's that platoon sergeant who challenged you to your limit; yet when you reached it, you found you could do better. He told you to build that bridge in 30 minutes, yet you did it in 20 minutes (under MOPP IV conditions).

A professional accepts himself, knows his troops, and studies his enemy. He's the engineer who continues forward when everyone else stalls, yet he clears the way and assures their progress during the attack. He is confident and optimistic. He will outdo his troops and strive to better his leaders. He's that battalion command sergeant major everyone calls "Pops," yet he runs circles around you on the PT track.

Professionalism. What is it?

It's duty, honor, country—all of the time. Professionalism is an NCO—a soldier, an engineer. Work at it.

School News

Directorate of Training and Doctrine (DOTD)

Plumbing Course Revised:

The 51K10 Plumbing Specialist Course has been revised to enhance performance-oriented training and provide a greater challenge to the student.

Each soldier is now required to construct a complete plumbing system from a given construction plan. This is done in four phases using the same work station for each phase of construction. Previously, the phases were performed in different work areas. Upon completion of the system, the soldier will understand how the quality of work done on each phase affects the completed system.

The course is taught in the new Brown Hall vertical skills building at Fort Leonard Wood, MO.

FC 5-104-1, Airfield Damage Repair:

Airfield Damage Repair (Pavement Repair), a joint Army-Air Force publication, was distributed in October 1985. The Field Circular (FC 5-104-1) is a user's manual for the field. It gives U.S. Air Force techniques for emergency repair and U.S. Army techniques for work that goes beyond emergency repair.

The point of contact for more information is chief of Roads and Airfields Branch, Department of Military Engineering, AV 354-2527.

Defense Mapping School (DMS)

APPS IV Training Package:

The Defense Mapping School has converted Room 203A, Wheeler Hall, into a high-tech computer center by installing two APPS IVs (Analytical Photogrammetric Positioning System), a high-resolution graphic display system, a powerful VAX 11/750 minicomputer, and comprehensive software.

The Department of Topographic Sciences will be using the APPS IV to train Rapid Strike Planning System (RSPS) operators in support of the Tomahawk cruise missile program. This APPS IV training package allows DMS instructors and students to work with modern high-technology systems.

The first two-week APPS IV operators course was completed by students in August. Upon graduation from this course, students will continue their RSPS training at other locations and then serve a tour at one of the theater mission planning centers which control the Tomahawk cruise missiles.

Department of Military Engineering (DME)

Scatterable Minefield Estimations:

Several requests have come to the Engineer School from field units regarding scatterable minefield requirement estimations. FM 5-102, *Countermobility*, Appendix D, gives a quick method of determining the number of mines/rounds for ADAM, RAAMS, GEMSS, and M56 systems.

A simplified (step-by-step) method for determining scatterable minefield requirements estimations is given in the *Engineer Officer's Handbook for Scatterable Mine Systems*. This handbook can be obtained by sending a written request to: Department of Military Engineering, ATTN: ATZA-TE-FE, Fort Belvoir, VA 22060-5331. POC is CPT Ronald Young, (703) 664-3411, AV 354.

Math Pretest for BNCOC:

Before attending the MOS 12B (combat engineer) BNCOC, all soldiers must pass a two-part math pretest. Since it became mandatory in January, the pretest and basic skills education program (BSEP-II) have reduced the number of academic failures in the course.

The pretest consists of a common portion of 35 questions and a 12B portion of 40 questions that evaluate the soldier's ability in 10 math skills essential to the course. If a soldier misses two of four questions in a given math skill, he will have to use the BSEP-II module for that skill.

A soldier may fail up to three blocks in the common portion and one block in the 12B portion without retaking the entire exam. He must retake the blocks he missed. All soldiers must pass the math pretest before attending BNCOC.

The math pretest is available for review by the chain of command (E-7 and above) at local education centers.

Department of Combined Arms (DCA)

Topographic Instructor:

To fully integrate topographic operations with department instruction, a topographic instructor/writer has been assigned to the Department of Combined Arms.

Presently teaching map availability and terrain analysis to EOAC students, the instructor will be evaluating existing programs of instruction (POI) to see where topographic operations can be included. To this end, input from the field is desired and may be sent to: Commander, U.S. Army Engineer School, ATTN: ATZA-TC-T (CPT David Jones), Fort Belvoir, VA 22060-5341. CPT Jones can be reached at (703) 664-2986, AV 354.

Department of Combined Arms (continued)

Doctrinal Literature Update:

DCA has produced and distributed two publications during the last quarter to update engineer doctrine. Training Circular (TC) 90-13-1, *Deliberate River Crossing Planning*, is designed as a guide for engineer planners in division level deliberate river-crossing operations.

Field Circular (FC) 5-100, *The Brigade/Task Force Engineer*, establishes doctrine on the employment of the brigade engineer section and the task force engineer. It lays down the functions and responsibilities of the brigade engineer and the task force engineer and contains sufficient detail on how they operate to guide development of standing operating procedures.

Reserve Component Advisory Staff (RCS)

Reserve Component Advisors:

The Reserve Components Advisory Office at the U.S. Army Engineer School is staffed with an ARNG advisor, LTC John B. Cunningham Jr., and a USAR advisor, LTC James W. Shoff II. They advise the Commandant and his staff on Reserve Component (RC) matters and act as POC for RC members. The phone numbers for their office are: 1-800-336-3095 (extensions 4166/4434/5921), commercial (703) 664-4166, AV 354.

EOAC-RC:

The Engineer Officer Advanced Course for Reserve Components (EOAC-RC) consists of seven two-week modules. Officers attending the course should report on Sunday for classes beginning on Monday. Uniform for the classes is BDUs. Quotas for EOAC-RC must be obtained from ARPERCEN, Engineer Branch, for USAR officers and through channels to National Guard Bureau for ARNG officers. The Reserve Component advisors at the Engineer School have no control over quotas, nor do they issue them.

ADT Phases:

The 2071st USAR School, Owings Mills, MD, will conduct the ADT Phases of EOAC (Phases II, IV, VI, and IA) at Fort Belvoir between June 1 and June 13, 1986.

EOAC-RC Class Schedule FY 86
(14 Weeks/2-Week Modules)

Class	Module	Report Date	Availability Date
1-86		27 OCT 85	15 FEB 86
	1	27 OCT 85	9 NOV 85
	2	11 NOV 85	23 NOV 85
	3	24 NOV 85	7 DEC 85
	4	8 DEC 85	21 DEC 85
	5	5 JAN 86	18 JAN 86
	6	20 JAN 86	1 FEB 86
	7	2 FEB 86	15 FEB 86
2-86		8 DEC 85	29 MAR 86
	1	8 DEC 85	21 DEC 85
	2	5 JAN 86	18 JAN 86
	3	20 JAN 86	1 FEB 86
	4	2 FEB 86	15 FEB 86
	5	17 FEB 86	1 MAR 86
	6	2 MAR 86	15 MAR 86
	7	16 MAR 86	29 MAR 86
3-86		2 FEB 86	10 MAY 86
	1	2 FEB 86	15 FEB 86
	2	17 FEB 86	1 MAR 86
	3	2 MAR 86	15 MAR 86
	4	16 MAR 86	29 MAR 86
	5	30 MAR 86	12 APR 86
	6	13 APR 86	26 APR 86
	7	27 APR 86	10 MAY 86
4-86		16 MAR 86	21 JUN 86
	1	16 MAR 86	29 MAR 86
	2	30 MAR 86	12 APR 86
	3	13 APR 86	26 APR 86
	4	27 APR 86	10 MAY 86
	5	11 MAY 86	24 MAY 86
	6	26 MAY 86	7 JUN 86
	7	8 JUN 86	21 JUN 86
5-86/6-86		27 APR 86	2 AUG 86
	1	27 APR 86	10 MAY 86
	2	11 MAY 86	24 MAY 86
	3	26 MAY 86	7 JUN 86
	4	8 JUN 86	21 JUN 86
	5	22 JUN 86	4 JUL 86
	6	6 JUL 86	19 JUL 86
	7	20 JUL 86	2 AUG 86
7-86		8 JUN 86	13 SEP 86
	1	8 JUN 86	21 JUN 86
	2	22 JUN 86	4 JUL 86
	3	6 JUL 86	19 JUL 86
	4	20 JUL 86	2 AUG 86
	5	3 AUG 86	16 AUG 86
	6	17 AUG 86	30 AUG 86
	7	1 SEP 86	13 SEP 86

EOAC-RC Class Schedule FY 86
(14 Weeks/2-Week Modules)
(continued)

Class	Module	Report Date	Availability Date
8-86		20 JUL 86	25 OCT 86
	1	20 JUL 86	2 AUG 86
	2	3 AUG 86	16 AUG 86
	3	17 AUG 86	30 AUG 86
	4	1 SEP 86	13 SEP 86
	5	14 SEP 86	27 SEP 86
	6	28 SEP 86	11 OCT 86
	7	13 OCT 86	25 OCT 86
9-86		1 SEP 86	6 DEC 86
	1	1 SEP 86	13 SEP 86
	2	14 SEP 86	27 SEP 86
	3	28 SEP 86	11 OCT 86
	4	13 OCT 86	25 OCT 86
	5	26 OCT 86	8 NOV 86
	6	9 NOV 86	22 NOV 86
	7	23 NOV 86	6 NOV 86

EOAC Class Schedule FY 86
(20 Weeks)

Class	Report Date	Availability Date
1-86	24 OCT 85	1 APR 86
2-86	5 DEC 85	13 MAY 86
3-86	30 JAN 86	24 JUN 86
4-86	13 MAR 86	5 AUG 86
5-86	24 APR 86	16 SEP 86
6-86	24 APR 86	16 SEP 86
7-86	5 JUN 86	28 OCT 86
8-86	17 JUL 86	9 DEC 86
9-86	28 AUG 86	3 FEB 87

EOBC/EOBC-RC Class Schedule FY 86

Class	Report Date	Graduation Date
1-86	20 OCT 85	24 FEB 86
2-86	5 JAN 86	6 MAY 86
1-86 (RC)	5 JAN 86	5 MAR 86
3-86	9 FEB 86	10 JUN 86
4-86	16 MAR 86	15 JUL 86
5-86	27 MAY 86	26 SEP 86
2-86 (RC)	27 MAY 86	23 JUL 86
6-86	13 JUL 86	12 NOV 86
7-86	12 AUG 86	11 DEC 86
8-86	28 SEP 86	13 FEB 87

Sapper Leader Course

A New Rope to Climb

by CPT Michael J. Grove



The UH-1H banks hard to the right and accelerates down the final approach along the shoreline. As the butterflies begin to surface, the soldier receives the signal to unhook the safety belt and prepare to execute. The helicopter lurches as the speed decreases.

The soldier pushes the rucksack out and follows it to the water's surface. After recovering from the impact of the water, the lightfighter pulls his rucksack to the shore and prepares to move out on his combat mission. A scene from ranger school? No. It is the Sapper Leader Course for the members of the newly formed or newly forming light engineer battalions.

The helocasting operation just described is one of the many exciting and demanding blocks of training. The Sapper Leader Course was conceived to prepare members of the new light engineer battalions to better support their new light infantry divisions. The course is divided into four phases: the confidence phase, the engineering phase, the battle drill phase, and the situational training exercise phase.

Symbolic of the course was the 20-foot rope that hung in the barracks area. This obstacle was negotiated before breakfast, lunch, and dinner. It represented the difficulty of the course and became a symbol of the strength we would gain and the team building we would undergo. At the beginning of the course, little more than half of the students could negotiate the rope all the way to the top. Students failed for several reasons: lack of upper-body strength, improper technique, or fear of heights. As the course progressed, our class went farther and farther up the rope.

During the confidence phase, physical training was stressed as well as other confidence building skills critical to light forces. During this phase the students learned and practiced rappelling, helocasting, helicopter rappelling, hand-to-hand combat, and RB-15 movement. The difficulty of the course was increased by the severe heat and humidity of July at Fort Leonard Wood, MO, the home of the Sapper Leader Course.

The confidence phase also provided training on both hand-to-hand and bayonet fighting. The way the cadre handled these blocks of instruction indicated the professionalism and innovation that made the course such a worthwhile experience. Instead of starting from the basics, they took off from our levels attained at the Rites of Passage Course conducted at Fort Ord, CA. The Sapper Leader Course cadre taught us kicks, punches, street fighting and other tricks picked up from collective experience in ranger battalions, special forces, and other units. The way they treated us and

Expedient poncho rafting trains soldiers for engineer missions in hostile environments. In the light infantry, engineers will take to war what they can carry on their backs (photo by Steve Gaynor).

The 28-day Sapper Leader Course stresses physical stamina, technical expertise, and troop leading skills under simulated combat conditions (photo by Steve Gaynor).

gave us more than the basics made us yell louder, throw harder, and feel more special—another foot up the rope.

Instruction on rappelling was both a great confidence builder and a valuable movement tool for light forces. Several classes were given on buddy rappelling, litter rappelling, and helicopter rappelling. It was the first time that many students had used these advanced techniques. One NCO insisted he could not do the buddy rappel, but the cadre refused to let him fail. With the entire class at the bottom of the cliff screaming encouragement, the instructors skillfully talked the student down the rope and then made him do it on his own to standard. He was obviously still terrified, but we as a unit were stronger because he had conquered his fears and learned an important technique in casualty evacuation.

One of the most exciting days was insertion training at the Lake of the Ozarks. In the morning the students participated in several helicopter rappels, and in the afternoon each man performed at least four helocasts. For individuals who were not strong swimmers and afraid of heights, this was a double horror show. These soldiers getting ready to board the helicopters were portraits of fear; but after the first jump into the water, the war stories were flying hot and heavy and people were running back from the beach to jump again. The day ended with RB-15 training, and the class was ready for the engineering phase—another foot up the rope.

The engineering phase provided demolitions training that was extensive and extremely valuable. The instructors from the Sapper Leader Course had attended the special forces demolitions course and brought back much information. The two most worthwhile concepts were the cherry knot and the dual detonating assembly. The advantages of these techniques are that they significantly reduce the time it takes to set up a complete firing system and they enable a soldier to set up a firing system safely and quickly in complete darkness.

We used these techniques on a night mission where the patrol moved down a stream using poncho rafts. When the demolitions team reached the target, a bridge, all they had to do was place the charges, attach them to a ring main by pulling the running end of the cherry knot, and attach the dual detonating assembly with a square knot. Safe, simple, and effective. Considering the importance of night operations to light forces, this knowledge is invaluable.

We also learned about several special-purpose charges: platter, satchel, soap dish, and dust initiator charges. We got hands-on experience with each.

Mountaineering was also given special attention. Expert instructors gave extensive rigging and climbing classes that will be extremely beneficial to the light engineer. Some of the NCOs who had problems with rappelling did extremely well climbing, and the soldier that had difficulty with the buddy rappel went right up the mountain. We also discovered that some mountaineering equipment can be adapted to other techniques that will help us and the division become more mobile.

Air assault operations were covered. We did extensive work with preparing and hooking up sling loads, aerial resupply, and helicopter insertions. Team building was becoming more evident as the two air assault corporals in the class shared their skills. The fact that the corporals volunteered their





Light engineers can respond rapidly to a wide variety of threats anywhere in the world. The light infantry is 100 percent air-transportable, is equipped to defeat tanks, and can sustain itself in rough terrain (photo by Steve Gaynor).

expertise was not earth-shaking, but the fact that everyone else was eager to listen showed the unifying effect that the course was having. The actual hooking of a sling load was a unique and valuable experience that provided still more war stories. Imagine what the pilot of the helicopter thought when one of the students wanted to cut the sling load and gave the pilot the patrolling hand and arm signal for danger area ahead.

We received extensive instruction on patrolling techniques during the course and incorporated them into all facets of training. Troop leading procedures were stressed as each hands-on portion of the training was conducted on a mission basis. The patrolling classes were given in a field setting by former members of the ranger battalions with emphasis on walk-throughs and practical exercises. Besides the patrolling techniques, the course provided an excellent preparation for light force operations because we moved almost always on foot. With this phase behind us, we were prepared for the next foot of the rope, the battle drill phase.

During the battle drill phase, the instructors concentrated on training to standards. We performed each of 16 tasks to a set of drill standards; if we didn't perform a task properly, we would do it again. The drills ranged from neutralizing a bunker to crossing a danger area. This phase was physically challenging as we found out on the first night when we got 40 minutes of sleep in the patrol base before stand to.

The drills accomplished several things. First, they established a standard way to perform 16 combat-essential tasks so the unit increases its combat power and its ability to work comfortably with different maneuver units. Another benefit of the drills was that they helped in team building, as each member of the patrol had to count on every other man to perform his job. You could feel the bonds of loyalty and respect being formed.

An example of this is how the soldiers came together for the one-rope bridge drill. Throughout the course, the strong swimmers had been looking out for the weak swimmers; this bond gave the weak swimmers the confidence to cross the river. Even one soldier rescued by the far shore lifeguard on an earlier operation was

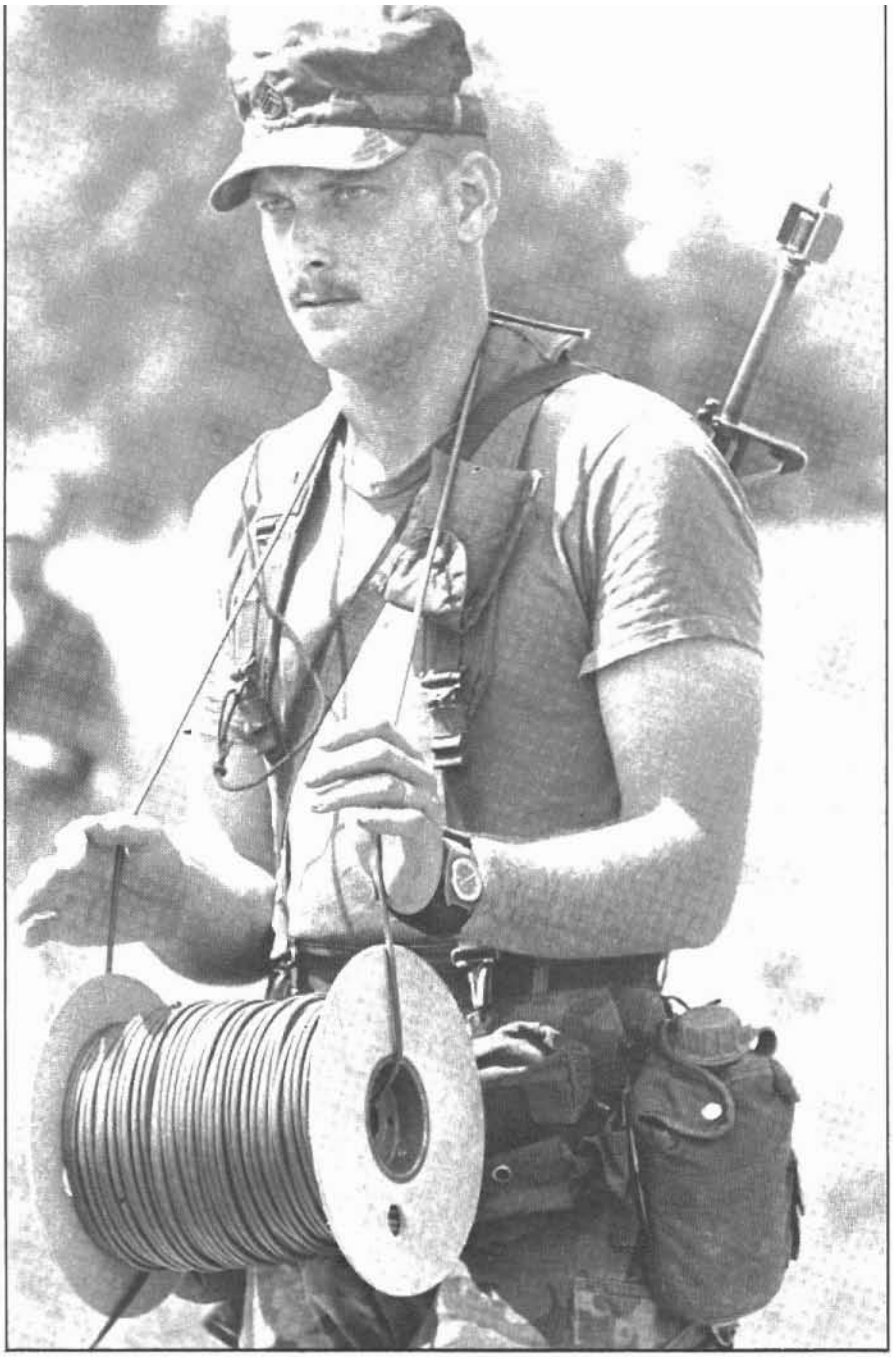
confident making the crossing because of his faith in himself and his fellow students. One more foot up the rope, and we were on to the STX phase.

According to COL Mike Malone, we took the *will* from the confidence phase, added the *skills* from the engineering phase, and combined them to *drill* during the battle drill phases. The final STX put everything together into a 72-hour exercise that served both as a review and a final exam. After three days of foot pounding, raiding supply points, and blowing abatis, we found the final truck movement was a joyous occasion. The class had reached the top of the rope and was very proud to be there. The minute we hit the barracks, the war stories came out from all corners, orders for Sapper Leader T-shirts went in, and we all felt a deep sense of accomplishment.

However trite it may sound, the course actually has something for everyone. The engineering phase had something new for almost everyone; and the patrolling instruction set the same standards for all, from the ranger-qualified to the brand new corporals. A perfect example of the team building encountered was the camaraderie formed with the noncombat engineers who went through the course. The members of the assault/barrier platoon, mostly heavy equipment operators, not only completed the course, but they performed all tasks in an outstanding manner. Although some had prior experience in 12B tasks, their main attributes were physical fitness and a desire to succeed.

The seeds of the Sapper Leader Course have taken root. Members of the assault/barrier platoon are teaching the HHC hand-to-hand combat. Several NCOs are teaching the infantry demolition techniques. Sapper Leader cadence rings out during company runs.

The Sapper Leader Course was Army training at its finest. The Army generated a special training requirement for light engineers and developed a program that gave worthwhile training to fulfill the requirement. For many of the NCOs, the course was the opportunity for a chain of command to refine small unit leadership techniques in a physically demanding environment. It is a challenge for engineers of all backgrounds that should not be missed. The Army gave the light engineers a rope to climb; and the Sapper Leader Course gave them the strength, technical knowledge, and desire to get to the top. Sappers . . . lead the way!



The Sapper Leader Course teaches the use of explosives, equipment, and other materials available to engineers operating on foot (photo by Steve Gaynor).

CPT Michael J. Grove is the commander of C Company, 13th Engineer Battalion at Fort Ord, CA. He was the student OIC of the first certified class of the Sapper Leader Course at Fort Leonard Wood, MO. CPT Grove is a graduate of the U.S. Army airborne and ranger courses and has a degree in engineering from the U.S. Military Academy.

Units wishing to attend the Sapper Leader Course must submit requests through their appropriate MACOM to TRADOC for approval. For more information, the POC at Fort Leonard Wood is CPT Matthew Bogart, AV 581-3195. At Fort Belvoir, call CPT David Depastina or Donita McGeary, AV 354-2684.

Sapper

by Dr. Charles Hendricks
Historical Division, OCE

A sapper, according to *The Oxford English Dictionary*, is "a soldier employed in working at saps, the building and repairing of fortifications, the execution of field-works, and the like." The same dictionary states that the word *sap* may mean "the process of undermining a wall or defensive work," "the process of constructing covered trenches in order to approach a besieged place without danger from the enemy's fire," or "a covered trench made for the purpose of approaching a besieged place under the fire of the garrison."

The English word *sap* was used in this military sense as early as 1591 by an English ambassador to the French court who was reporting on the siege of Rouen during the French wars of religion. The ambassador spelled the word *zappe* and *sappe* after the Italian and French words from which it derived. Although the Italian word *zappa* had long been used to denote a garden hoe, it was first applied to a military trench early in the sixteenth century.

The art of military engineering changed rapidly after gunpowder was introduced into European warfare in the fifteenth and sixteenth centuries. Before that time, armies could attack Europe's forts and fortified cities either by storming the walls or by denying provisions to the defenders through a lengthy siege.

Sixteenth-century commanders discovered that they could have trenches or tunnels dug to the walls of a fort and there emplace large explosive charges that would destroy those walls. As European manufacturers developed heavy bronze and cast-iron artillery pieces, commanders gradually began using trenches to bring their big guns within range of the besieged fort without exposing them to direct fire from the emplaced batteries of the fort. The trenches used for mining or advancing artillery were called *saps*, and the men who dug them became known as *sappers*. The men who placed the explosive mines under the walls of fortifications were called miners.

The illustration is from *A Manual of Seigecraft and Fortification* by Sebastien LePrestre de Vauban, Copyright 1968, The University of Michigan Press, Ann Arbor.

The French army in 1679 created the first permanent company of miners in Europe, more than a century and a half after explosive mines had been introduced into the warfare of that continent. Although initially organized under engineer officers, the French army's companies of miners were subsequently placed under artillery command. In 1720 a squadron of sappers and miners led by a sergeant was incorporated into each of the 40 companies of the French Royal Artillery Regiment. The squadron of sappers and miners comprised 27 men in each 84-man company. The sappers were placed in a separate company in each of the five battalions of this regiment in 1729.

The French army removed the sapper companies from its artillery regiment in 1758 and made them separate companies. They were placed under the Corps of Engineers in May 1759, but returned to the Artillery Corps in 1760. In 1776 a company of sappers was again added to each battalion of the Royal Artillery Regiment. In short, while sapper organization varied considerably in the French army during the eighteenth century, the sappers were normally under artillery command, although they might be given engineer direction during actual siege operations.

In the eighteenth-century French army, engineer officers did not normally command troop units. The French engineer captain Philippe Maigret complained about this as early as 1725, arguing that "engineers are the natural officers of workmen." He concluded that sappers and miners ought to be placed under engineer command in peacetime to develop the skills that they would need to employ during a siege. Maigret's arguments did not prevail in the eighteenth century French army, but many French engineer officers accepted them.

During the American Revolution, the Continental Congress named the French engineer officer Louis Duportail as commandant of the Continental Army's Corps of Engineers. Drawing on his French experience, Duportail in 1778 proposed and Congress authorized the creation of three companies of sappers and miners to provide experience in military engineering to American soldiers and officers. The American companies of sappers and miners were organized in 1780 and served under engineer direction until 1783.

When the first engineer troop units were subsequently organized in the U.S. Army Corps of Engineers, Congress gave them names that included the words *sappers* and *miners*. Thus the company of Bombardiers, Sappers, and Miners was organized in 1812 and served until 1821. A new company of Sappers, Miners, and Pontoniers was organized in 1846 and served under that name—notably in Mexico, at West Point, and in the American West—until 1861. The latter company is still perpetuated by the 1st Engineer Battalion. During World War I, divisional engineer regiments were referred to as sapper regiments. Thus by the twentieth century, the word *sapper* had gradually assumed a more diffuse meaning as an engineer soldier without specific connotations of trench building.

Dr. Charles Hendricks is a historian with the Historical Division, Office of the Chief of Engineers. He has also worked at the U.S. Army Center of Military History. He received his bachelor's degree from Columbia University and his PhD from Cornell University.

Technological Enrichment Program

by
MAJ Richard J. Treharne

The Technological Enrichment Program (TEP) offers newly commissioned second lieutenants an opportunity to earn master's degrees in emerging technologies at prestigious colleges and universities. The TEP students are on active duty and draw full pay and allowances. The Army also pays for their tuition, fees, books, and supplies. After graduation, TEP officers are awarded a functional area and serve consecutive utilization tours. Most TEP officers can expect branching in the engineer, signal, or ordnance corps. Upon graduation, TEP officers have a three-for-one active duty service obligation (ADSO), not to exceed six years.

The TEP selection board meets each November and can select up to 30 participants. Seventeen second lieutenants entered graduate programs as TEP-sponsored students in FY 84; 30 in FY 85. For FY 86, the TEP selection board will consider applicants for graduate programs in the following fields:

- Artificial intelligence
- ADPS-engineering
- Astrodynamics
- Chemical engineering
- Composite materials
- Computer science
- Electrical engineering
- Electronic engineering
- Industrial engineering
- Instructional technology (computer-based instruction)
- Metallurgy
- Operations research systems analysis (ORSA)
- Physics
- Robotics (automated manufacturing)

Who Qualifies?

Participants may be:

- Senior ROTC cadets graduating during spring commencement.
- Senior lieutenants graduating in spring who were commissioned under the early commissioning program and can be brought to active duty.
- Officer candidates assigned to the 5th Student Battalion (OCS), Fort Benning, GA.

Applicants must have a bachelor's degree and at least a B grade point average. They must be commissioned on active duty before attending graduate school.

To Apply

Applicants should apply for TEP on DA Form 1618-R. The form must be forwarded through their professor of military science or commander of the 5th Student Battalion (OCS) to: Commander, MILPERCEN (DAPC-OPA-E), 200 Stovall Street, Alexandria, VA 22332-0400, with the following enclosures:

- A copy of their undergraduate and any graduate level transcripts.
- A narrative addressing their career intentions, desires, and qualifications for TEP participation.
- The names of colleges and universities where the applicant has applied or has been accepted for graduate school.

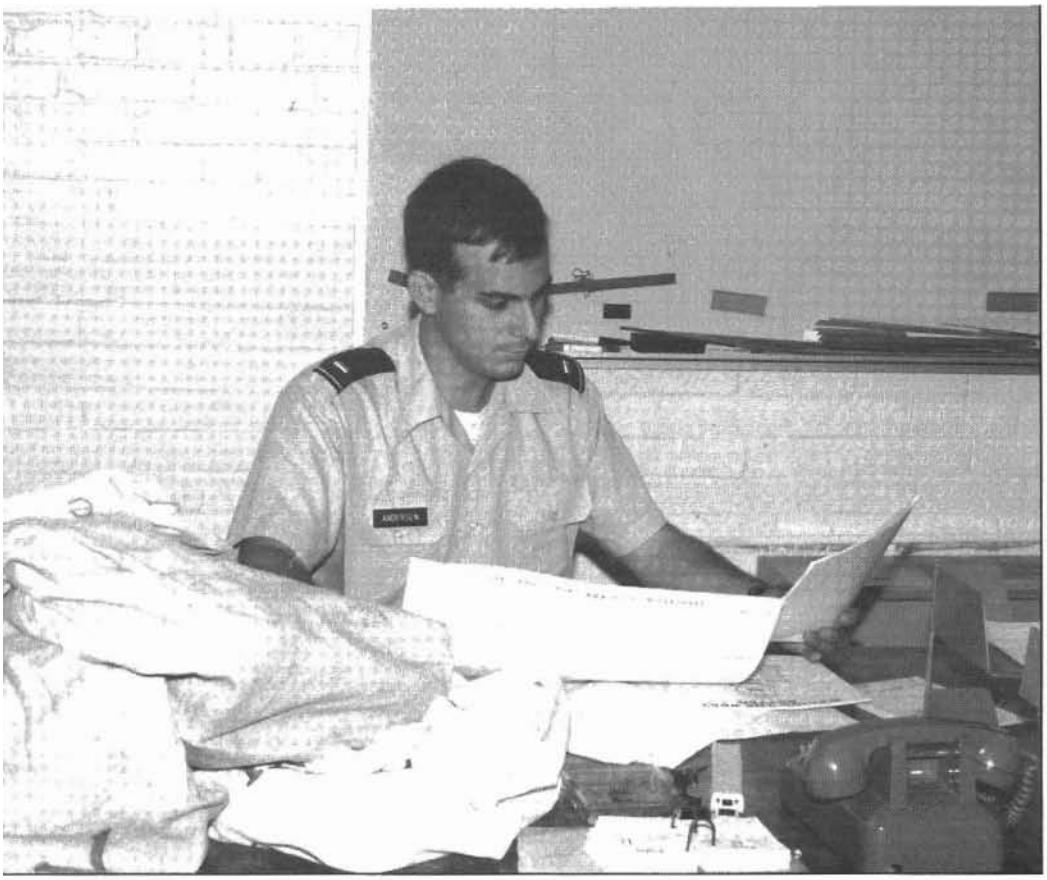
Applications are endorsed forward by the professor of military science or the 5th Student Battalion (OCS) commander. The endorsement must include the ROTC cadet's summer camp results (TRADOC Form 958) or the officer candidate's standing on the order of merit list and distinguished military graduate status.

The selection board will determine appropriate institutions and fields of study for all officers selected. Individuals who are chosen must gain admission to their designated graduate program in time to begin their studies in the FY of selection. The Army is only interested in sending students to premier institutions for the selected field of study. Applicants should not view TEP solely as a means to stay at their undergraduate institution or remain near friends and family.

After commissioning and spring commencement, TEP officers attend the Officer Basic Course, then graduate school. Following graduate school, they complete an initial four-year utilization tour, the Officer Advanced Course, and a second utilization tour. They are considered for doctoral programs following the second utilization tour and then serve consecutive utilization assignments for the duration of their careers. Most assignments are within the Army Materiel Command, the Corps of Engineers, and the Training and Doctrine Command.

TEP is governed by AR 621-1, *Training of Military Personnel at Civilian Institutions*. Additional information can be obtained by writing Commander, MILPERCEN (DAPC-OPA-E) or by calling (202) 325-8101, AV 221.

MAJ Richard J. Treharne currently serves as the civilian education officer in OPMD, MILPERCEN. He is a graduate of the FAOAC and the Command and Staff College. He has a bachelor's degree from Iowa State University in industrial administration and an MBA from Campbell University.



1LT Walter Andersen reviews thousands of surveys returned to the Directorate of Evaluation and Standardization. Comments from a soldier and his supervisor on how his performance is affected by engineer training are used to evaluate courses at the Engineer School (photo by L.J. Leto).

The Engineer Graduate Follow-Up Training Evaluation

or

How Many Surveys Can You Handle?

by Dave Abraham

Mail call at battalion headquarters, and the distribution clerk drops a bulky package on your desk. As the battalion S-3, you recognize yet another survey package from the Engineer School, probably the third your office has received in the past month. What do those guys at the Directorate of Evaluation and Standardization (DOES) at the Engineer School do anyway, just send out surveys?

Well, you're partly correct. The surveys piled on your desk do represent one of the most important elements of our job. In the course of a year, we send out thousands of surveys to hundreds of locations around the world. Our ability to effectively evaluate current engineer training depends primarily on receiving data from as many soldiers in the field as possible.

Each year, DOES, in conjunction with other departments of the U.S. Army Engineer School (USAES), identifies 20 to 30 engineer training courses for external evaluation. This evaluation process, known as the Graduate Follow-Up Program, is used to determine the adequacy of the training received by soldiers in all engineer training courses through analysis of the soldier's performance in the field.

The Graduate Follow-Up Program uses the surveys to answer three primary questions:

- Can the soldier perform the tasks for which he was trained?
- Does he actually perform the tasks in his current assignment?
- Are the tasks the soldier was trained for actually necessary to fulfill the mission of the unit?

The first two questions are asked of the engineer course graduate and his supervisor. The last question is answered only by his supervisor.

Occasionally we have the opportunity to administer the surveys directly to the troops (such as Engineer Orientation Team visits), but most often we must rely on mailing the surveys to the battalion operations officer. To improve our survey return rate, we ask that the S-3 distribute the surveys, have them completed, and return them, en masse.

The survey forms, when properly completed and returned to DOES, are fed into our computer. From the computer analysis and any additional soldier's or supervisor's written comments or complaints, we can determine whether the engineer training is meeting its objectives and the needs of the field.

Upon completion of each engineer training evaluation, we send a report to all units included in the initial survey. Each report includes the significant findings, conclusions, and recommendations arising from the study. This information is used by the Engineer School to modify programs of instruction and various manuals.

Included in the report you receive will be a task-by-task printout which is helpful in developing individual training plans for your soldiers. The information included in the report will document any areas that need either increased or decreased emphasis.

So, when that next packet of surveys makes it to your in-basket, you can help improve the quality of the Army's engineer training by getting those surveys to the right people. Consider it an investment in your unit's future.

Dave Abraham is an operations research analyst in the Directorate of Evaluation and Standardization, USAES. He has a bachelor's degree in mathematics from St. Vincent College and worked as a computer performance analyst with the Air Force.

FY 86 Promotion Boards

Were You Ready?



by SFC Carl V. McKinzey

If you are an E-7 engineer NCO and were in the primary zone for the FY 86 promotion board, chances are you were not ready. And, you were not alone. Surprisingly, there were not enough CMF 12 soldiers to meet the primary zone promotion objective.

The most recent selection board used "the best qualified to meet the needs of the Army" method of selection, as prescribed by AR 600-200, *Enlisted Personnel Management System*, to identify "fully qualified" and recommend the "best qualified" to meet the required number of soldiers for promotion. In determining whether an NCO under consideration was fully qualified for selection, the board had to satisfy itself that the NCO was fully qualified professionally within the respective CMF, had demonstrated integrity, was physically fit, and was capable of performing duties expected of an NCO in the grade of E-8.

The selection was based upon a review of each soldier's official photo, personnel qualified record (PQR), DA Forms 2A and 2-1, *Personnel Qualification Record* (parts one and two), and the contents of the soldier's official military personnel microfiche and records containing enlisted efficiency reports (EER), MOS/SQT evaluation results, and recent hard-copy EERs.

Correspondence to the board president was also considered. However, letters to the board president which did not depict factual information were not given much consideration.

Those soldiers selected were the best qualified by virtue of their demonstrated performance, potential value to the Army, and ability to absorb and apply their military and civilian education in positions of greater responsibility throughout the Army. The promotion board placed special emphasis on leadership, physical fitness and appearance, professional development and reports, EERs, and official and commendatory files.

Leadership

Leadership rates the highest for E-7s who want to get to the top. Successfully performing in a TOE leadership position such as first sergeant or operations sergeant at the battalion level or as a platoon sergeant was an overriding factor in the promotion of E-7s, especially if the soldier had repetitive assignments in such positions.

Credit toward promotion was also given for outstanding performance as a drill sergeant, as well as duties with the Reserve Components, recruiting commands, and as an instructor at a service school, if the soldier did not remain in these positions for long periods of time. On the other hand, soldiers

were penalized who, in the opinion of the board, were avoiding tough jobs by remaining in the same type of nonleadership duty for long periods of time. When the promotion board did not find the requisite number of qualified primary zone CMF 12 soldiers to recommend for promotion, additional highly qualified secondary zone soldiers were recommended. It was apparent that NCOs in CMFs 12 and 51 needed to seek leadership positions.

The competition for "fully qualified" and "best qualified" classifications was intense. Many of the soldiers labeled as "not best qualified" in the engineer CMFs had not successfully served as a platoon sergeant.

A number of soldiers (in all CMFs) who had been assigned outside of their CMF for more than one tour in such duties as recruiter or Reserve Component advisor had difficulty upon returning to the CMF. But, successful service in these types of assignments clearly complemented the overall professional development of the soldier and made a favorable impression on the board.

- There was not a sufficient number of CMF 12 soldiers to meet the primary zone promotion objective.
- There is a large pool of talented, hard-charging secondary SFCs in CMF 12.
- Many SQT scores were low or not available for CMF 51 and 12 soldiers.
- Many secondary zone soldiers had out-of-date photographs or none at all.
- CMF 51 is experiencing an inordinate number of soldiers with profiles and/or ANCOC incompletion.
- The commendatory portion of CMF 51 soldier files was somewhat lacking.
- EER duty titles and descriptions require improvement.
- Greater emphasis is needed to complete the record EERs.
- Civilian education and GT improvement were adequate.
- Many soldiers are not taking advantage of the opportunity to remove potentially derogatory information from their official military personnel records.

Figure 1. Board Conclusions.

Tips for Promotion

(Requirements for NCOs and officers are similar.)

NCO	Officer
• SQT preparation.	• Officer record brief.
• Photograph.	• Official military personnel file.
• Physical condition.	• Photograph.
• Military education.	• Letters to the board.
• Commendatory data.	• Height/weight standards.
• EER duty titles and job descriptions.	• Civilian education.
• Complete record EER.	• Military education.

Figure 2. Board Recommendations.

Physical Fitness and Appearance

Physical fitness in terms of APRT pass or fail on the EER did not appear to be a problem. In the cases where a failure was noted on the most recent EER, the soldier was severely penalized. There seemed to be an inordinate number of profiles in CMF 51. In most cases, Military Medical Review Board (MMRB) data was not available for review for those soldiers with a P3 profile. This is an Armywide problem because MMRB data is not reaching the promotion boards.

Weight problems were also evident, especially in CMF 51. Soldiers appearing to be overweight in their photographs and records were carefully examined to determine if they exceeded the Army standard. Only a small percentage of records had the completed pinch test data. In far too many instances, the board found either outdated pinch test data or soldiers who exceeded the body fat percentage.

Often, the soldier verified he was a certain height and weight. Yet, during the same time frame, the rater's certification on the EER indicated a different height and weight for the soldier. Soldiers who did not meet the height and weight requirements of AR 600-9, *The Army Weight Control Program*, were not selected for promotion.

In addition, the board put heavy emphasis on the soldier's having a current photograph and presenting a good military appearance. Records missing photographs had a negative impact as did photographs that were not recent or that contained deficiencies. The deficiencies included incorrect length of the blouse, sleeves, and trousers.

Photographs also revealed many soldiers with mustaches that did not meet the Army standard. All of these were viewed as an indication of apathy and a failure on the part of the soldier.

Although Army regulations only require a photograph every five years for a senior NCO, a more current photograph is an indication of professional pride and initiative. In most cases, soldiers in the primary zone had an up-to-date photograph. However, far too many soldiers in the secondary zone lacked an up-to-date photograph.

Professional Development and Reports

With the exception of CMF 51, most engineers have successfully completed ANCOC. Very few of those who had not attended had taken the opportunity to enroll in the nonresident course. Honor graduates of such courses were given an advantage. Likewise, soldiers who failed any military course of instruction were penalized.

The GT scores were not a significant discriminator. The board was favorably impressed with those soldiers who had taken the initiative to be retested to raise their GT scores above 106. The panel also noted that some soldiers have started their college education, yet have not taken the initiative to retest and raise their low GT scores.

Generally, any education beyond high school was viewed with favor except in those cases where soldiers had concentrated their efforts on civilian education and had failed to achieve the military education standard. The board was impressed by those soldiers who exceeded the military education course standard, but there was some evidence that a large number of soldiers in CMF 12, CMF 51, and MOS 52E ceased their college work once they were selected for E-7. Soldiers in CMF 81 appeared to be more active in acquiring both military and civilian education.

Most CMF 81 SQT scores were current and respectable. However, there

was a decided lack of recent SQT scores for CMF 51 and CMF 12 soldiers. Generally, soldiers who had been tested either passed with unimpressive scores or failed. Scores below the verification level raised questions among board members regarding the soldier's technical competency and motivation.

EERs

While the quality of the comments on performance was sufficient for the board to make a reasoned judgment for promotion, those relating to potential require improvement. The EERs reviewed often contained guarded or very vague statements as to advancement potential. The selection of the best qualified would be facilitated if both rater and endorser clearly stated the soldier's advancement potential.

Members of the rating chain are, for the most part, rendering evaluations that are helpful in the selection process. More emphasis is required in identifying shortcomings in height and weight requirements, physical profiles, appearance, APRT results, and physical fitness.

Discrepancies between EERs and verifying data on the soldier's official military personnel record microfiche were frequently noted. This, coupled with a missing or outdated photograph, brings the integrity of the rating chain into question.

The board noted that the description of nontraditional duty assignments needs improving. They viewed the title "project NCO," for example, with skepticism. Supervisors must specify what a soldier does, the number of soldiers led, the level of difficulty, and the environment in which the duty is performed. The identification of an equivalent duty position would be helpful to board members.

Official and Commendatory Files

The board was not impressed when they found a soldier had failed to review and verify his official military personnel record as shown by such things as an outdated photograph, poorly reproduced copy of DA Form 2-1, an outdated pinch test, or the failure of the soldiers to sign and date their records. The board mentioned that some soldiers had failed to take advantage of the provisions to remove or transfer records on nonjudicial punishment. Commendatory data files for soldiers in CMFs 81 and 12 were in excellent condition. This gave the board an in-depth view of the whole soldier. DA Forms 2A and 2-1 were in satisfactory condition. They provided helpful explanations for comments in files such as "not allowed to reenter the drill sergeant program" or indicated why a recruiter incentive award was revoked.

The results of any selection for promotion can be no more valid than the information upon which the board bases its judgment. For that reason, it is important for NCOs to ensure that their personnel records are current and accurate before they are reviewed by a selection board.

If soldiers prepare their records with the same attention to detail as if they were preparing themselves to appear in person, they would greatly enhance their chances for selection. If NCOs take care of their records, their records will take care of them.

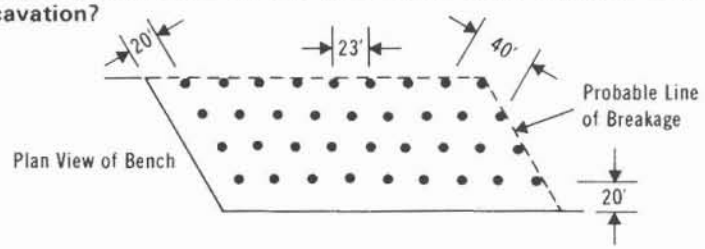
In order to prepare for promotion, a copy of the *Engineer Enlisted Professional Development* informational pamphlet may be obtained by writing to the Engineer Proponency Office, U.S. Army Engineer School, ATTN: ATZA-EP, Stop 248, Fort Belvoir, VA 22060-5248.

SFC Carl V. McKinzey is assigned to the Engineer Proponency Office, USAES, Fort Belvoir, VA. He has served as an instructor in mine warfare and a drill sergeant at Fort Leonard Wood, MO, and was a platoon sergeant and squad leader in Germany. SFC McKinzey received his associate's degree from Columbia College, MO.

Engineer Problem

You command an engineer construction support company deployed to a theater of operations to support friendly forces fighting there. You need high-quality aggregate to help upgrade the main supply route (MSR) through the COMM-Z. Engineer reconnaissance teams found an abandoned basalt quarry located conveniently close to the MSR. The enemy used the quarry until friendly forces overran it last week. You arrive at the site to find a staggered pattern of blastholes as shown below. The holes are drilled vertically to a depth of 47 feet, the bottom 7 feet of which is subdrilling.

QUESTION 1: If you decide to use the existing hole pattern, what volume of aggregate should you obtain from a proper explosive excavation?



You have access to some local commercial explosives of the same type and quality as found in the U.S. Due to the lack of delay electric blasting caps (DEBC) and for the sake of safety (no caps in the blastholes), you elect to fire the shot in echelon using detonating (det) cord and millisecond (MS) delay cord connectors. The shot will be initiated with two instantaneous electric blasting caps (EBC) taped lengthwise to the det cord at the same point. The holes will be bottom primed (primer resting directly on the bottom of the hole).

QUESTION 2: How much detonating cord and how many MS connectors should you obtain to properly rig the shot?

REFERENCE:

TM 5-332, *Pits and Quarries;* **Chapter 6.**

Engineer Problem/Solution submitted by CPT Randy R. Rapp, EOAC Team Leader, Department of Military Engineering.

The Engine

ADVISOR

A Study of the Ba

by CPT William

On July 30, 1864, a group of coal miners from Schuylkill County, Pennsylvania accomplished one of the "most extraordinary feats of military engineering up to that time—the explosion of a mine under the fort blocking the Union advance toward Petersburg and Richmond, Virginia."[1] However, only a few short hours later, the improper employment of engineer officers and working parties would later be determined to be one of the primary reasons for the failure of the Union attack at the Battle of Petersburg.[2]

The Battle of Petersburg provides the student of military engineering a unique contrast. On one hand, the success of the Union mine should have arguably provided the means for a stunning Union victory. After all, a 500-yard gap existed in the Confederate line after the explosion. On the other hand, the failure of the Union engineers in clearing friendly and enemy obstacles following the explosion contributed enormously to the Northern defeat.

This action, called the *Battle of the Crater*, has been examined in great depth by many military historians. The most common lessons gleaned from this battle center on leadership, the employment of surprise, and the use and effect of a mass-destruction weapon. However, this battle provides a striking historical example of a problem facing all engineer officers today. This problem revolves around the inherent conflict involved between the engineer officer's roles of both an advisor and a leader under the AirLand Battle doctrine.

This problem will be examined during both the successful and unsuccessful engineer phase of the Battle of Petersburg. In addition, a combination of solutions will be developed to specifically aid junior grade engineer officers in forging favorable relationships with their supported maneuver commanders.

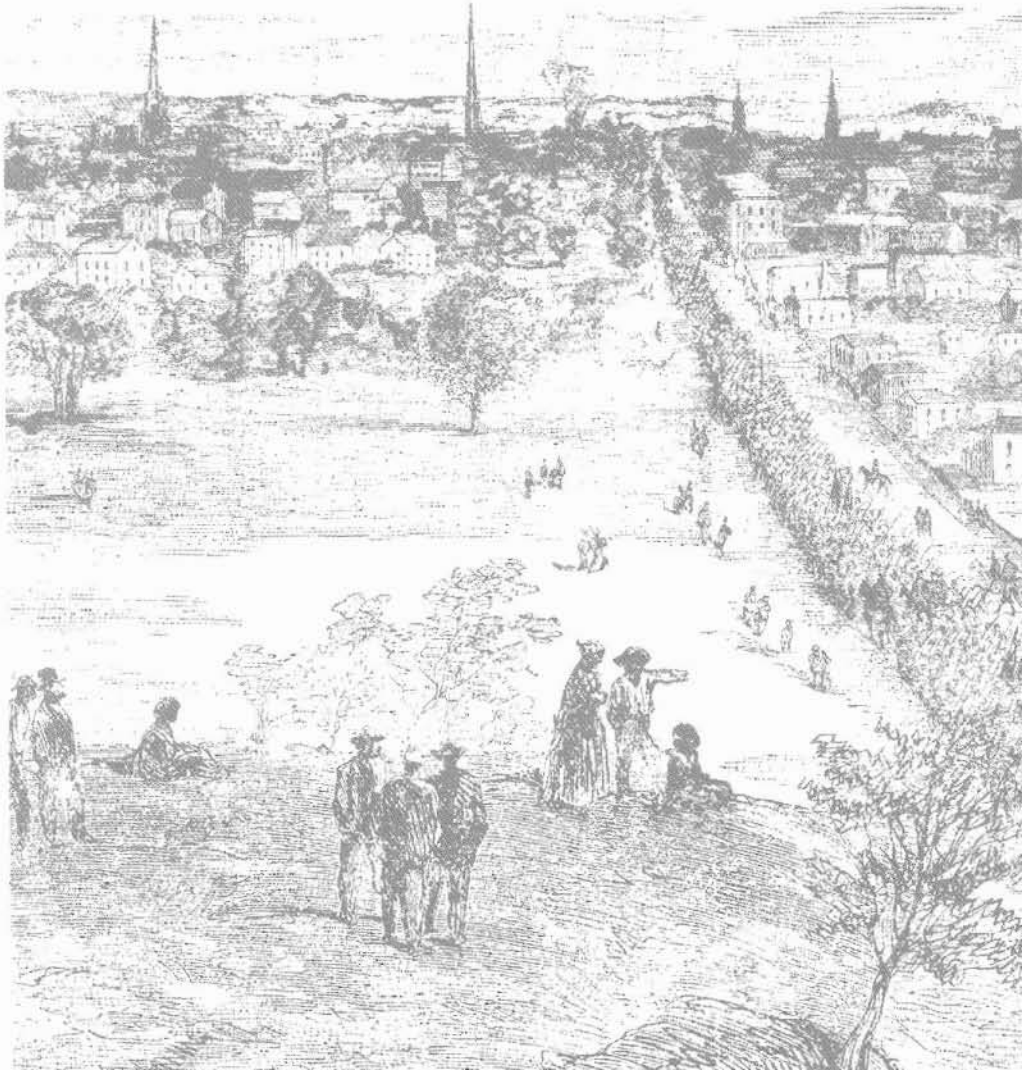
The 48th Pennsylvania Regiment of Volunteers, commanded by LTC Henry Pleasants, had become weary of the siege at Petersburg and the resulting casualties incurred during the summer of 1864. On June 23, LTC Pleasants overheard two enlisted men say, "We could blow that damned fort out of existence if we could run a mine shaft under it."[3]

This idle discussion fell on fertile ears since Pleasants was a registered anthracite mining engineer from Pottsville, Pennsylvania. He had extensive experience in the art of tunneling and had been the senior assistant engineer in the construction of the Sand Patch Tunnel for the Pittsburgh and Connellsville Railroad.[4] In addition, the 48th Pennsylvania Volunteers consisted of 85 enlisted men and 14 officers who were professional miners before the start of the war.[5]

During the next two days, LTC Pleasants made tentative plans and drew a preliminary sketch of the enemy positions under which he proposed to construct the mine. On June 25, he briefed BG Robert Potter, the 2nd Division commander, on his plan to excavate a mine, fill it with gunpowder, and blow a hole in the Confederate lines.[6] Potter relayed the request to the IX Corps commander, LTG Burnside, who gave his immediate approval to commence work.[7]

At this time, MAJ James Duane, the acting chief engineer of the Army of the Potomac, was advising MG George Meade, commander of the Army of the Potomac, against the project. Duane stated that "such a length of mine had never been excavated in military operations and could not possibly succeed."[8] In particular, he felt that inadequate shoring materials were available; and the mine was too long to be properly ventilated.[9] Given these difficulties, Meade is said to have consented to, rather than approved the project, if, for no other reason than to keep the men occupied during the siege.[10]

The work on the mine progressed rapidly, and each succeeding difficulty was confronted and overcome by the ingenuity of the former coal miners. The completed mine measured 512 feet in length and required the removal of



neer Officer

R or LEADER

Battle of Petersburg

liam J. Sandbrook

over 18,000 cubic feet of material.[11] The engineering effort accomplished by LTC Pleasants and the difficulties he encountered while trying to obtain support from the Army of the Potomac are extremely interesting, but are not relevant to the development of the basic topic of this article.[12]

Early in the morning of July 30, 1864, the mine was exploded after having been charged with 8,000 pounds of gunpowder. The ensuing crater tore a huge gap in the Confederate line and killed over 270 men outright. The resulting hole measured 170 feet long, 60 feet wide, and 30 feet deep.[13] For a length of 500 yards, the Southern line was unoccupied as a result of the massive explosion.

In order to proceed into the second phase of the battle, the initial orders issued by MG Meade concerning the engineer effort required subsequent to the explosion of the mine must be examined. Recognizing the need to maintain the momentum of the initial assault, Meade ordered Burnside to "prepare his parapets and abatis for the passage of the columns and have pioneers equipped for work in opening passages for artillery and for destroying enemy abatis."[14] The order went into great depth on the intended use of the engineers and also stated that each corps was to place its pioneers well forward in order to quickly neutralize enemy obstacles hindering the advance.

In addition, MAJ Duane was detailed to assign an engineer officer to each corps staff who would act as the corps engineer during the battle. The assignment of these engineer officers was left completely to the discretion of MAJ Duane.[15]

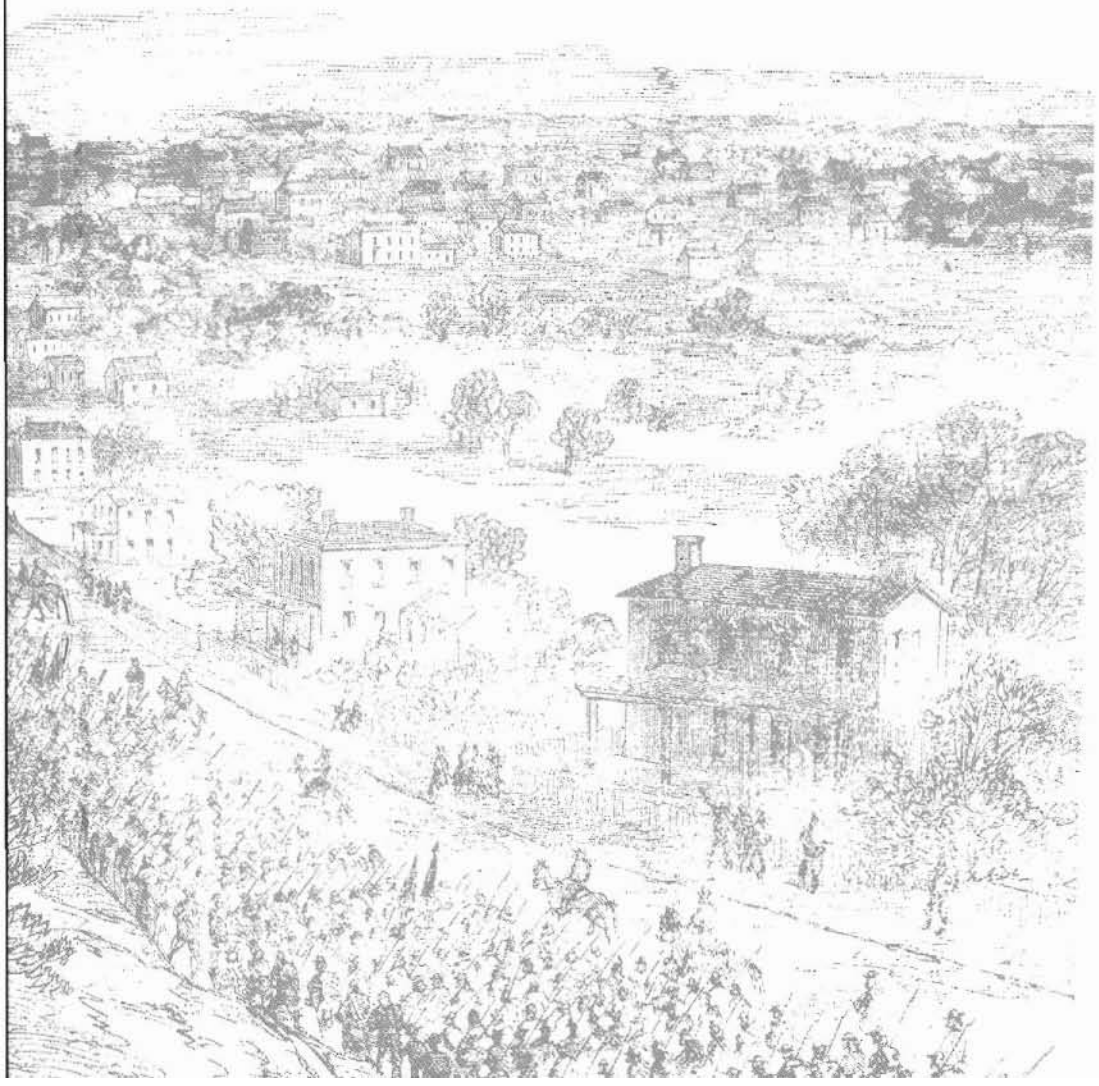
MG Meade's orders were quite specific in nature concerning the employment of engineers. This was due to the preponderance of obstacles which each side had constructed in front of their lines. Abatis, parapets, and trenches had been constructed in depth; and the Union obstacles had to be prepared for the passage of the IX Corps during the night before the attack.

Following the explosion of the mine, BG James Ledlie's 1st Division led the IX Corps attack over the high parapets and abatis of the Union works; neither of which had been removed by Burnside's engineers.[16] MG Burnside did not prepare his own obstacles for passage, in direct violation of orders, because he feared that it would give the Confederates advanced warning of the pending attack. In addition, Ledlie placed his engineer units and pioneers at the rear of his attacking brigades which seriously hampered their responsiveness.[17]

The corps engineer detailed to IX Corps was 1LT William Benyaurd who had no previous dealings with MG Burnside. During the course of the battle, he remained with Burnside and simply advised the general on the employment of the engineer units. Unfortunately, 1LT Benyaurd's advice was ignored by MG Burnside. When it was obvious that the lack of engineer effort forward was holding up the advance, Benyaurd failed to go to the front in order to assume command of the forward work parties. In fact, Benyaurd remained at the IX Corps headquarters for the majority of the battle and never did personally observe the action that day.[18]

History has documented the ensuing failure and slaughter of the Union forces who had their advance broken by the myriad of obstacles in their path. Even though the Union Army obtained the initial important element of surprise, their continuity of attack had been broken and led GEN Grant to state, "The effort was a stupendous failure."[19] This failure resulted from a set of complex variables, but only the issues relating to the utilization of LTC Pleasants and 1LT Benyaurd will be examined further.

During the successful phase of the battle, that part leading up to and including the explosion fashion of the mine, Pleasants acted in a fashion comparable to a division engineer in today's Army. He was the principal engineer advisor to BG Potter during



the construction of the mine and also was the regimental commander of the unit tasked to build the mine. In this instance, the relationship between the engineer officer's role as an advisor and leader worked to perfection. Pleasants was able to keep Potter completely informed as to the capabilities and possible employment of his soldiers.

In addition, after completing his advisory role, Pleasants was allowed the freedom to remain constantly with his unit, adding his personal leadership, engineering knowledge, and supervision to the task of constructing the mine. This is perhaps the primary reason for the success of the project.

The second phase of the battle shows the results of an improper relationship between the maneuver commander and his supporting engineer officer. Even though the ranks and force structure differ, this phase is analogous to today's engineer company commander advising a maneuver brigade commander. During the assault, MG Burnside ignored the advice of his corps engineer officer and additionally would not let him personally supervise the employment of the corps' engineer assets.[20] These decisions proved disastrous for Burnside's IX Corps as has already been discussed.

An analysis of these decisions results in some definitive conclusions in support of the current brigade engineer concept in today's AirLand Battle doctrine. As the second phase of the Battle of Petersburg points out, maneuver commanders are historically inclined to require their engineer support officer to be physically nearby in order to provide instant advice on the employment of the engineer effort. This perceived requirement made it physically impossible for the engineer company commander to break away from his supported brigade in order to personally lead and supervise his platoons at critical points in a battle.[21]

A perfect example of this was exhibited when 1LT Benyaurd could not receive MG Burnside's permission to go forward to lead the engineer effort in attack, even though it was critical that he do so. Under current doctrine, an engineer major will become the brigade engineer and will assume the duties of the engineer staff officer responsible for advising the commander on engineer asset employment and utilization. This will free the engineer company commander to lead forward and thus personally influence the performance of his unit.[22]

The second lesson to be learned from this phase of the battle is that the brigade engineer has to be of the rank, persuasion, and experience to stand up to the maneuver commander when it relates to advice concerning the employment of engineer assets. It is very probable that 1LT Benyaurd's advice was ignored partially because MG Burnside was not in the habit of taking advice from a somewhat inexperienced lieutenant . . . even if the advice was sound.

This type of incident remains a common occurrence on major combined arms exercises where junior grade engineer officers, acting as brigade engineers, give somewhat timid advice to brigade commanders who are three to four ranks higher than themselves. The result of the inequity in rank and experience can degrade the overall effectiveness of the entire combined arms operation. This makes it imperative that today's brigade engineer be at least a senior captain or major who has successfully commanded an engineer company.

In addition, the position cannot be perceived as a place to "retire" captains and majors who are not performing well in engineer maneuver battalions. Obviously, the successful performance of a brigade engineer is critical to the accomplishment of the brigade's mission. The failure of Burnside's corps ultimately rests with himself, but conjecture lets one envision more favorable results if a strong willed, higher ranking, more experienced engineer officer had been available to act as the IX Corps engineer during the attack at the Battle of the Crater.

The lessons derived from this battle can also be applied to a lower level of the engineer support relationship. Specifically, the modern engineer lieutenant is not afforded the luxury of having a dedicated engineer staff officer within his supported maneuver battalion. Therefore, he must assume the roles of both advisor and leader. As in the case of 1LT Benyaurd, the improper balance of these somewhat conflicting duties can lead to a disaster for an entire operation.

A combination of the following solutions will aid the junior grade engineer officer in discovering the proper balance between his advisor and leader roles.

The primary factor in determining to what degree a supporting engineer will be allowed to lead rests with his professional relationship with the supported maneuver commander. This relationship must be determined at the very outset and must be characterized by mutual respect between the commander and his engineer officer.

The most difficult part of this interaction rests squarely on the shoulders of the engineer lieutenant. It is he who possesses the lesser rank and experience. The engineer officer must overcome the natural fear that will arise the first time he is called upon to give advice to this senior combat arms commander. The engineer must square his shoulders, look straight ahead, and give his professional opinion in a clear, unwavering voice that leaves no room for doubt in the maneuver commander's mind as to the abilities of this young officer.

Without these personal attributes, a situation might well develop where the maneuver commander does not trust the advice given by a timid, inexperienced engineer officer. The evidence supporting this fact is well documented in the professional relationship that existed between 1LT Benyaurd and MG Burnside.[23]

One method of strengthening the bond between a maneuver battalion commander and his engineer is to explicitly follow the tenet of normal association. FM 5-100 states that in the employment of engineers, "the concept of normal association is followed, in that the same engineer units, as a normal procedure, operate with the same maneuver elements."[24] This principle enables a bond to develop over a period of time between the support commander and his supporting engineer officer. This was not the case in the Battle of Petersburg where an engineer officer "support lottery" was held in order to determine who the IX Corps engineer officers were going to be.[25]

Even though the preceding solutions may be implemented, the junior engineer officer must still reach an agreement with his supported commander as to the degree of latitude he will be permitted in leading his engineer platoon from the front, rather than battalion headquarters.

At this point, the engineer battalion commander's role becomes critical. It is his duty to come to terms with each supported maneuver commander, who will hold the same rank, as to the use of the engineer officer in his task force. This interaction should set the tone for the use of the engineer lieutenant as an advisor before a battle and as a leader during the actual employment phase. LTC Pleasants used this strategy during his mining operation and thus was able, after an initial advisory role, to assume total control over his mining project.

The final resolution of the problem between an engineer's role as an advisor and leader rests solely on the shoulders of the engineer lieutenant. He must do everything within his power to personally convince the maneuver battalion commander that he belongs at the head of his platoon, leading them from the front when the situation dictates it. Only there can he directly influence the performance of his men.

However, he must be careful in maintaining constant communication with his supported commander so that he can provide instant engineering advice when required. The communications link is vital since the engineer lieutenant might possibly lose sight of the overall operation once the strings holding him to the battalion commander's side become stretched.

Obviously the degree to which an engineer lieutenant is employed in his dual role as an advisor and leader rests ultimately with the supported commander. His orders must be carried out explicitly by the supporting engineer officer, regardless of his personal opinions and feelings. The maneuver commander will determine the final utilization of the engineer officer.[26]

In conclusion, the Battle of Petersburg provides a striking example of both the effective and ineffective utilization of engineer officers. The efficient use of engineers on today's modern battlefield has not changed drastically in over 100 years. The Army still needs engineer leaders for the front lines and engineer advisors for the headquarters.

The degree to which a maneuver commander accepts engineering advice and the degree to which he permits his engineer to lead will greatly influence the outcome of future conflicts under the AirLand Battle doctrine just as it influenced the Battle of the Crater in 1864.

CPT William J. Sandbrook is working on joint master's degrees in systems engineering and business administration at the University of Pennsylvania and the Wharton School. A U.S. Military Academy graduate, he has completed airborne and ranger training and the Engineer Officer Advanced Course. CPT Sandbrook was a cavalry platoon leader in the 2/2 Armored Cavalry Regiment and a company commander in the 82nd Engineer Battalion in Bamburg, West Germany.

"*The Engineer Officer: Advisor or Leader; A Study of the Battle of Petersburg*" won first place in the 1984 Military History Writing Awards for the Center of Military History in Washington, D.C.

Suggestions for further reading:

Bernard, George S. *The Battle of the Crater.* Petersburg, Virginia: Fenn and Owen, 1892.

Catton, Bruce. *A Stillness at Appomattox.* New York: Doubleday, 1954.

Crafts, W.A. *The Southern Rebellion.* Boston: Samuel Walker and Company, 1867.

Notes

[1]Henry Pleasants Jr. and George H. Straley, *Inferno at Petersburg* (Philadelphia: Chilton Company, 1961), p. 1.

[2]*Report of the Joint Committee on the Conduct of the War* (Washington, D.C.: The U.S. Government Printing Office, 1965), Vol. I, p. 215.

[3]Pleasants, p. 48.

[4]Pleasants, p. 11.

[5]Pleasants, p. 54.

[6]Pleasants, p. 51.

[7]Alfred H. Guernsey and Henry M. Alden, *Harper's Pictorial History of the Civil War* (New York: The Fairfax Press, 1975), p. 697.

[8]Pleasants, p. 66.

[9]Larry George, "Battle of the Crater: A Combat Engineer Case Study," *Military Review*, February, 1984, p. 38.

[10]Raymond O. Miller, "A Stupendous Failure," *Military Review*, July, 1960, p. 32.

[11]James F. Bell, "A Lesson in Nuclear Effects," *Military Review*, July-August, 1961, p. 47.

[12]Pleasants, pp. 59-120. (A detailed account of the engineering effort accomplished by LTC Pleasants can be obtained in this reference.)

[13]Frank B. Case, "The Petersburg Crater and Nuclear Weapons," *Military Review*, November, 1960, p. 23.

[14]*War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies* (Washington, D.C.: The U.S. Government Printing Office, 1892), Vol. XL, p. 43.

[15]Miller, p. 36.

[16]Miller, pp. 37-38.

[17]George, pp. 42-43.

[18]George, p. 42.

[19]Miller, p. 31.

[20]George, p. 46.

[21]The requirement imposed on the engineer officer to remain physically near the maneuver commander was experienced by me during all maneuver exercises involving the Second Armored Cavalry Regiment between 1980-1983 in West Germany.

[22]William C. Burns and others, "Engineer Doctrine for the AirLand Battle," *Engineer*, Spring, 1984, pp. 12-13.

[23]George, p. 46.

[24]Field Manual 5-100, *Engineer Combat Operations* (Washington, D.C.: The U.S. Government Printing Office, 1979), pp. 2-9.

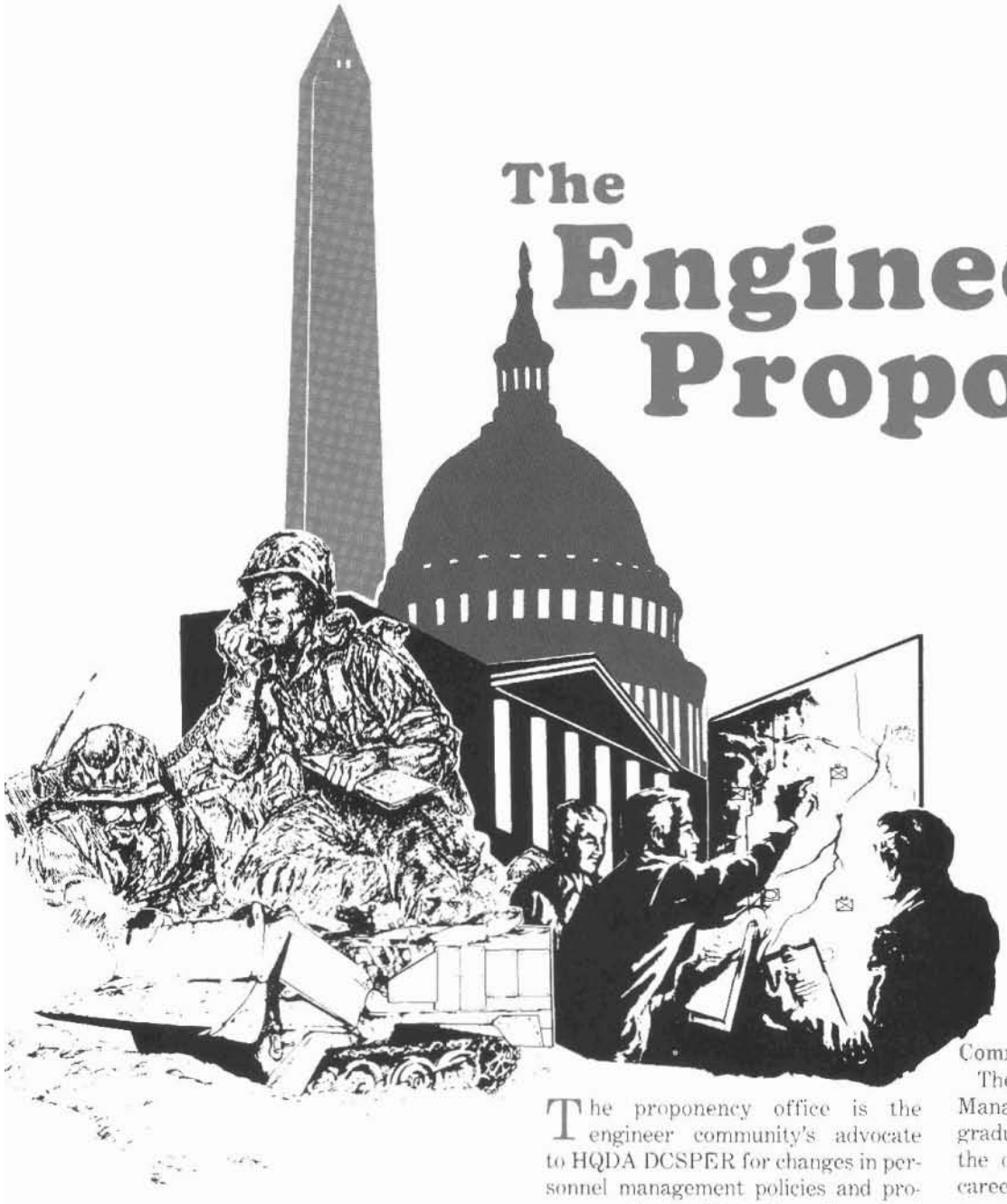
[25]George, pp. 41-42.

[26]Field Manual 100-5, *Operations* (Washington, D.C.: The U.S. Government Printing Office, 1982), pp. 7-3 and 7-4.

The Engineer Proponency Office

Your Career Advocate

by Lee M. Rivas



"What's proponency?"

That's the first question people usually ask when they hear about the Engineer Proponency Office. If you consult the Army's standard dictionary, ***The American Heritage College Edition****, you'll find that, like much of the jargon the Army is fond of using, proponency isn't listed. However, a terse definition of the parent word cuts to the heart of the matter:*

Proponent: One who argues in support of something, an advocate.

The proponency office is the engineer community's advocate to HQDA DCSPER for changes in personnel management policies and programs that affect the Corps of Engineers. The staff works on behalf of the Engineer School Commandant to identify solutions to problems that affect the careers of engineer officers, warrant officers, and enlisted personnel. They evaluate:

- Force structure
- Acquisition
- Training and education
- Distribution
- Deployment
- Sustainment
- Professional development
- Separation

The figure provides a more detailed listing of the proponency office's responsibilities.

Here are highlights of a few of the on going initiatives currently shaping the military engineering profession.

Commissioned Officers

The newly revised Officer Personnel Management System (OPMS) will gradually offer more engineer officers the opportunity to single-track their careers within the engineer branch by concentrating on professional development in one of the three engineer specialty codes:

- Combat engineer
- Topographic engineer
- Construction (facility/contract management) engineer

Warrant Officers

As part of the Army's Total Warrant Officer Study, the warrant officer management system is being restructured to better define the profession and system of appointments and to properly manage the force. All warrant officers will be automatically integrated into the regular Army upon promotion to CW3. Positions are to be grade coded to provide promotion progression and improve utilization. Creation of a master warrant (CW5) series is recommended for the future. The

proponency office provides the engineer warrant officer representative on the USAMILPERCEN Warrant Officer Accession Board.

Enlisted Specialties

Many impractical grade structures exist within the engineer MOSs. These MOSs are being reviewed and realigned whenever feasible to provide soldiers in all specialties a fair, competitive chance at promotion.

The handbook, *Engineer Enlisted Professional Development*, published by the proponency office, offers advice for engineer soldiers on how to get selected for promotion and advanced schools. The booklet consolidates information gathered from numerous promotion boards and Engineer School experts.

For a copy of the book or information on personnel issues that affect engineer specialties, contact the Engineer Proponency Office, ATTN: ATZA-EP, Stop 248, Fort Belvoir, VA 22060-5248, or phone (703) 644-3760, AV 354.

Lee M. Rivas is the deputy chief, Engineer Proponency Office, USAES. Mr. Rivas has a bachelor's degree in business and management from the University of Maryland and is working on a master's degree in management and supervision from Central Michigan University.

Field Circular Helps Heavy Force

Field Circular 71-4, *Combined Arms Live Fire Exercise (CALFEX)*, provides a list of planning considerations for integrating all members of the combined arms team and a detailed formula for resource coordination i emplacement guidance, and safety diagram procedures. The publication also includes four sample scenarios, a sample LOI, and control plans.

Distribution was made in October to all members of the close combat (heavy) force to battalion/squadron level. Units may obtain additional copies by writing to: Commander, U.S. Army Armor Center, ATTN: ATZK-DPT-NRT (AWTS), Fort Knox, KY 40121.

Proponency Office Responsibilities

IAW AR 600-3

Structure
- Analyzes spaces on TAADS
- Recommends changes to TOE
- Analyzes SGA in TOE/TDA units and recommends changes as required
- Recommends classification criteria
- Forecasts future needs

Acquisition
- Recommends accession criteria
- Performs job task analysis of branches/functional areas
- Recommends procurement numbers by year/branch
- Recommends criteria for selected recall programs
- Recommends percentages of company grade to be assigned branches

Training and Education
- Identifies training criteria
- Identifies civilian education
- Develops and revises training
- Recommends standards for service school instructors
- Validates/revalidates AERB positions
- Recommends selection criteria for DA centralized boards
- Ensures functional area/branch training agrees with commissioned officer professional development

Distribution
- Accesses against authorizations
- Accesses by grade for schooling
- Identifies functional areas required
- Recommends changes to policy for assignments, details, and transfers
- Recommends initiatives to counter space imbalanced MOS (SIMOS)

Unit Deployment
- Evaluates unit distribution/home basing related to regimental system
- Evaluates effects of mobilization on personnel management systems

Sustainment
- Establishes/maintains communication with constituents
- Represents professional interests of constituents
- Fosters a positive attitude toward personnel system and programs
- Evaluates continuation/retention rates of functional areas
- Recommends MOS changes to improve health of branches
- Recommends changes to retention
- Recommends percentages by grade for functional areas

Professional Development
- Establishes professional development patterns
- Analyzes training and education requirements vs assignment priorities
- Determines qualification standards for each branch
- Identifies functional area skills required
- Identifies special skills required

Separation
- Recommends selected shortage specialties as an exception to elimination policy
- Recommends minimum qualification standards at selected grades by branch
- Recommends changes to retirement policies
- Recommends minimum time of service for military or civilian training or education prior to separation

Series Presents Official Army History of the Vietnam War

The authoritative history of the Vietnam War is being published in a 20-volume series by the U.S. Army Center of Military History. The books, to be printed over a 10-year period, cover the Army's involvement from its early advisory years to 1973 when the American troops left Vietnam.

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Dear Friends at Home

The letters and diary of Thomas James Owen reveal the life and duties of a volunteer engineer during the Civil War. Union forces needed far more engineers than the regular Army could furnish. Volunteer engineers supported operations ranging from constructing pontoon bridges under fire to building fortifications for siege operations. *Dear Friends at Home* conveys the author's reactions to the extreme conditions of wartime, from the rigors of combat to the boredom of camp life.

The book from the Historical Division, Office of the Chief of Engineers, was edited by Dale E. Floyd. It may be ordered from the U.S. Government Printing Office, Department SSMC, Washington, D.C. 20402.

Hotline Q & A

Q. What is the FSN for staples and tie wire used in constructing triple-strand concertina wire obstacles? Last summer the Hotline Q&A said no NSN existed, but there was a FSN.

A. The DME Field Engineering Branch investigated further and discovered NSNs for both staples and tie wire. Here are the numbers:

Staples:

Size	*NSN*
5/8	5315-00-664-7035
3/4	5315-00-664-7038

Wire:

Gage	*NSN*
9"	9505-00-833-6433
12"	9505-00-180-7212
14"	9505-00-180-7204

Q. I was unable to find any reference to barrier free zones in the new FM 5-100 series. Has any information been published on the barrier free zone concept? What is the exact definition of barrier free zone, barrier restricted zone, and barrier zone?

A. Authority to designate these zones is usually held at field army/corps level, and the scope of the barrier free zone is determined by the authorizing commander. This action is under consideration by HQ Allied Forces, Central Europe. The Northern Army Group is in favor of the new designations, but the Central Army Group opposes them. The NATO Combat Engineer Working Party Terminology Group has the definitions under study and worked on them during its September 1985 meeting in Munich. The definitions are:

Barrier free zone—No executed barriers. The force can maneuver in combat formations throughout the sector with the exception of existing natural and cultural obstacles.

Barrier restricted zone—Selected barriers executed. The force can maneuver in specific portions of the sector for operations such as counterattack.

Barrier zone—No restriction on obstacles except for designated reserve targets.

Q. According to an ARTEP evaluator, my company was advised not to use the JD-410, tractor utility, during foxhole digging. I understand that engineers do use heavy equipment for that kind of construction. Can you send me some kind of verification on that point?

A. It is the commander's option to use his equipment according to the priorities of the unit's mission.

Q. Can the AVLB be rail-loaded standing on its side?

A. The bridge cannot be rail-loaded on its side. The cross bracing and scissor cylinder must be removed. Also, the hinge pins should be removed and each ramp loaded separately. The procedure for loading the bridge is found in FM 5-12F1/2, task number 051-226-0305.

Q. I need information concerning tactical employment of ring-mounted 50-caliber machine guns. Our TOE has changed to issue us ring mounts and take away our tripods. How do you employ these ring-mounted 50s in a perimeter defense?

A. Tripod M75577 is needed for perimeter defense. TOE 05115 is being redesigned to include M75577 tripods. References for ring mounts are TM 9-1005-245-14, TM 9-1005-213-10, and TM 23-65.

New The Engineer Orientation Team

SFC Da

The Engineer Orientation Team is a group of representatives from the Engineer School and the Engineer Training Center that meets with units in the field to discuss changes occurring in the engineer arena. These visits are primarily meetings with the engineers from squad leaders on up.

Direct Communication

At these meetings, the school representatives give a short presentation of recent changes and developments; then they open the meeting to questions and comments from unit personnel. The meeting gives individual engineers an opportunity to communicate directly with the Engineer School. Many of the questions raised at these sessions are answered on the spot by the team members. Questions the team cannot answer are researched at Fort Belvoir, and the answers are sent back to the unit. Subjects brought up for discussion during the meeting are later presented to the rest of the School.

Such feedback is critical to the operation of the Engineer School. The Engineer Orientation Team (EOT) is a very effective way to obtain information about the quality and effectiveness of Engineer School products. To help the Engineer School obtain this feedback, the EOT may ask selected individuals to fill out surveys or questionnaires, or to sit in on an interview. The EOT may also ask to visit unique training opportunities taking place at your unit or installation. Conversely, if you know of unique or unusual training going on, you should suggest that it would be beneficial for the team or its representatives to visit the training site.

The Players

The director, Directorate of Evaluation and Standardization, is the team chief. The EOT normally includes members from the Directorates of Training and Doctrine, Combat Developments, and Evaluation and Standardization; the Department of Combined Arms; the Engineer Proponency Office; and the Engineer Training Center at Fort Leonard Wood. Topics include:

Formerly
The
Engineer Branch
Training Team

Rexrode

- Skill qualification tests, soldier's manuals, course development, the Army training and evaluation program, training devices, simulations, and other training-related matters (Directorate of Training and Doctrine).
- Information about material and equipment development and tables of organizational changes (Directorate of Combat Developments).
- Matters related to personnel management policies (Engineer Proponency Office).
- AirLand Battle doctrine and the engineer role on the AirLand battlefield (Department of Combined Arms).
- All aspects of training at the Engineer Training Center at Fort Leonard Wood.

Training Information

The key to the success of the EOT is the exchange of information and open discussion of problems and ideas. An equally important factor is disseminating discussion results to the field. Current plans call for each active component engineer battalion to be visited by an EOT once every two years. The EOT will also visit as many Reserve Component units as possible, depending on resources. During FY 86, the Engineer Orientation Team will visit engineer units at the following locations:

Fort Devens, MA	Feb 3-7
OCONUS-Germany	Apr 6-18
Fort Knox, KY	Apr 14-18
Fort Stewart, GA	May 12-16
Fort Benning, GA	
Fort Rucker, AL	
Fort A.P. Hill, VA	June-Aug
Presidio, San Francisco	June 23-27
Fort Ord, CA	
Fort Carson, CO	July 28-29
Fort Riley, KS	July 30-Aug 1
Fort Leonard Wood, MO	Sept 8-12
Fort Sill, OK	

SFC David M. Rexrode is the NCOIC of the Engineer Orientation Team, Directorate of Evaluation and Standardization at the Engineer School.

Engineer Solution

ANSWER 1: 24,500 cubic yards.

The plan area of the likely zone of breakage will form a parallelogram defined by the open faces of the bench and the innermost blastholes.

Length of the zone	(23 ft x 9)	=	207 ft
Width of the zone	(20 ft x 4)	=	80 ft
Area of the breakage zone	(207 ft x 80 ft)	=	16,560 sq ft
		=	1,840 sq yd

Blasthole subdrilling is that portion of the hole which extends below the quarry floor. A bench tends to break more evenly at the quarry floor if subdrilled holes are used in the shot.

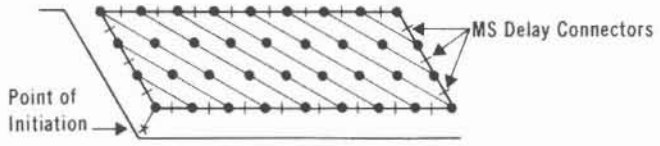
Bench height	(47 ft - 7 ft)	=	40 ft = 13.3 yd

The volume of aggregate that you should obtain from the shot:

(1,840 sq yd x 13.3 yd) = 24,500 cu yd

ANSWER 2:

To figure how much det cord and how many MS connectors are needed, you should have designed the echelon delay firing system as depicted below. Note that sound blasting practice emphasizes redundancy in all types of circuits. As a result there are two cord paths to any echelon.



By inspection, 22 MS det cord delays are required.

The det cord lying on the surface and connecting the blastholes (the trunk lines) must have a total length of 22 hole spacings (around the perimeter), plus 24 staggered spacings (diagonally across the pattern).

Trunk line length:

(23 ft x 22) + (40 ft x 24) = 1,470 ft

You should add 10 percent to this amount for slack, plus an extra foot for the overlap at each MS connector. Also, a foot of cord should be provided to tie a diagonal line to the perimeter line at the point of intersection. Diagonal trunk lines intersect the perimeter at 20 locations.

Minimum length of det cord required for the trunk line:

1,470 ft + (1,470 ft x 10%) + (1 ft x 22) + (1 ft x 20) = 1,660 ft

The det cord extending into the blastholes (the down lines) must reach the primers. Each bottom primed hole requires 47 feet. To this amount, you should add 2 feet for slack, 1 foot for connecting to the trunk line, and 1 foot for securely attaching the cord to the primer.

The minimum length of det cord required for the 36 down lines:

(47 ft + 2 ft + 1 ft + 1 ft) x 36 = 1,840 ft

The total quantity of det cord required:

1,660 ft + 1,840 ft = 3,500 ft

Practicalities may demand that you obtain more than this quantity. You must allow for splicing of two lengths of det cord where one roll of cord ends and another begins. Each splice requires about 2 feet of cord. You need enough det cord to reach from the open corner blasthole to the point of initiation.

National Guard *Blazes Trails*

by CPT Lynda Mann



Central America has surfaced as a challenging area for National Guard training exercises. One such exercise, Blazing Trails '85 set in the isolated Azuero Peninsula of Panama, truly tested the road-building mettle of the combat engineers from Missouri.

The Reconnaissance Mission

In November 1984, CPT Clyde A. Vaughn, project engineer of the 135th Engineer Group, and eight other men from the Missouri National Guard were dropped into the wilds of the Azuero Peninsula on a reconnaissance mission for Blazing Trails '85. They came via a CH-47 Chinook helicopter with two jeeps, two trailers, and enough provisions for two weeks. Their task was to observe the area during the wet season (the Azuero gets more than 150 inches of rain during a five-month period) and to determine the best location for the Missouri Guard to build their portion of the road.

According to MAJ Charles Friend, 880th Engineer Battalion, "They couldn't have dropped us in a worse place!"

Ten-foot-high grasses, swamps, and flooding rivers required difficult passages to be made on horseback. The water was often so high that the horses carrying their riders had to swim across creeks. The first impression, which proved correct, was that the road couldn't go over the mountaintop as planned.

"We looked over the terrain and knew the road had to go through a nearby saddle," Vaughn said. "Otherwise we'd have to move 100,000 yards of dirt, and 20 percent would be the best grade we could get."

The Base Camp

In January 1985, CPT Vaughn and SSG Mike Phillips returned to the Azuero with two Panamanian Defense Force (PDF) personnel to establish the Missouri base camp.

According to Phillips, "At that time we didn't speak very much Spanish, and they didn't speak any English. But they were really good soldiers, so the communication gap really wasn't there."

Vaughn and Phillips met a local landowner, Roy McKone, a Canadian expatriate of 44 years. McKone spoke fluent English, and he immediately offered one of his rice fields as a base camp location. The agreement was sealed on a handshake.

While McKone finished his rice harvest, Vaughn and Phillips aligned the base camp. They determined entrances, streets, and airstrip locations. A few days later, LTC Tom Seavers, commander of the 880th Engineer Battalion, arranged for a priority load of two bulldozers, two loaders, and a dump truck to be delivered to a port near the base camp.

Vaughn and Phillips unloaded the equipment and cut the port road to accommodate future port activities and then stripped out the base camp. Engineers had to take the first four inches off the rice field so the residue would not burn. Next, they located a water point, cut a road, and made a borrow pit for the rock haul. Once the 880th arrived and the base camp was under way, the port was cut in, and Vaughn turned his attention to the road design.

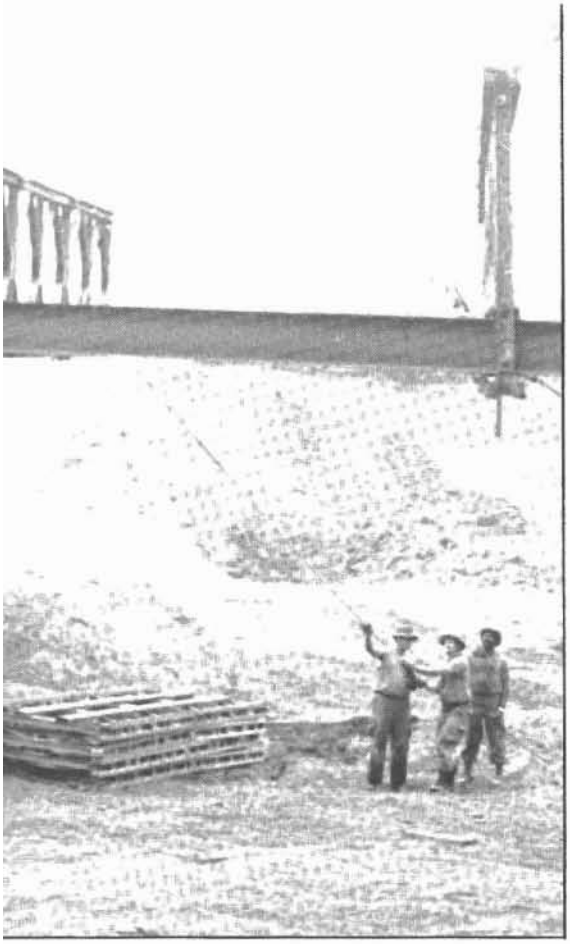
Designing the Road

The whole sequence of building the road included road location (design), surveying, earthwork computations, earthwork, and final grading—but most important was road location.

The old road went straight up a mountain and then crossed a river several times. According to Vaughn, "It was doubtful that we could build anything along that route that would last beyond two rainy seasons."

The combat engineers talked with residents and local elected representatives about where the road should go for the sake of the people. They also considered the engineering requirements such as drainage structures and the location and availability of Class IV materials. In order to avoid going over the mountaintop, the engineers stepped into high ground and bypassed a swamp.

It was a major construction effort to



Engineers constructing bridges in Panama often had to fabricate parts due to the shortage of materials and stringers. Here, a crane lifts a Bailey Bridge to its pilings at Rio Marillo (photo by CPT Lynda Mann).

get to the saddle. It took two weeks and required diverting the headwaters of a stream into another valley. Vaughn said, "You couldn't possibly do this in the United States. The years that it would take to get the easements and the ground leased would be prohibitive."

One of the greatest challenges was an area dubbed *Monkey Mountain*. This area was a large vertical drop in a very short space. To get the desired 12 percent grade, the engineers designed a straightforward massive cut and fill which would require taking 65 feet from the top of the mountain. The resulting road base on this section was 30 feet wide with 20-foot shoulders on each side.

Drainage Structures

The Missouri National Guard also built 49 drainage structures and 6 bridges in the 9½ miles of road. This included 3 combination Bailey Bridges and 3 timber trestles, a combination of 9 low water crossings, 38 low water crossings with culverts, and 2 box culverts.

The Missouri engineers really had to adapt to change. Often the Bailey Bridges were fabricated. PLT SGT George Arth, Company C, 110th Engineer Battalion, cut bearing plates to place between the wood pilings and the bridges. "We've had difficulty getting materials, and stringers were at a premium," Arth said. "We took panels and turned them on their sides, welded channel iron to them, and made fabricated stringers. I think it will be just as strong as what would normally be there—it might even be something to look at for the future," he added.

Low water crossings, although unhandy, were often the answer because there would be so much water coming through the structures, they did not have enough culverts to carry it all, and the gaps were not deep enough for a bridge.

In many cases, natural drainage was diverted to avoid a drain structure or to create a larger one. In each case, watershed was calculated to determine if the pipe could handle additional water flow from another natural drain. A smooth transition was necessary to be sure the new drain did not cut back into its old channel.

The availability and timeliness of delivering materials also affected the design of the road. According to Vaughn, "Rather than there being, for example, a 12-foot or 15-foot fill with an area that we could easily have kept balanced, we had to fill it 5 feet because of the availability of only 48 feet of pipe for a concrete culvert."

Almost all drainage and culverts used 36-inch and 48-inch pipe. The road was designed with a basic 36-inch culvert because of the Azuero rainfall.

According to Phillips, "In the United States you're not talking about anything like 36-inch culvert, but here it's necessary. It's just unbelievable the amount of water that flows through these valleys."

Construction Rotations

Blazing Trails demanded that earthwork continue every day in order to complete the mission on time. Units were on the ground for 10 days, so while they were deploying and getting oriented, personnel assigned for the duration of the exercise operated the equipment and built the road. There was always a smooth transition when duration personnel were replaced by the current rotation units.

A major factor to the mission's success was the planning done by the 135th Engineer Group. As each rotation arrived, the engineers knew exactly what to do. They never stopped building the road. As a result, exercise participants were able to improve their engineer skills. According to Vaughn, "When they leave here, they are experts because they've never moved as massive an amount of dirt as they've moved here."

Benefits of the Experience

Because of the road, good things will come to Azuero—utilities, medical care, education—things to raise the standard of living. But it meant a lot to the combat engineers, too.

Blazing Trails '85 displayed the capabilities of the National Guard. They mobilized outside of the country and completed a huge mission. Every type of unit received excellent training.

"The number of ARTEP tasks we have accomplished is unbelievable," Vaughn said. "We now need to sit down and really define tasks—like driver's training. We don't drive vehicles under these conditions and terrain anywhere in the U.S."

"Very few people have this kind of opportunity," he added. "It's the most rewarding thing I've ever done. It will be on record from now on that the combat engineers from Missouri came through this part of the Azuero Peninsula and built this road. And the people will never forget what the National Guard has done here."

CPT Lynda Mann is the community relations officer of the 100th Public Affairs Detachment, Texas Army National Guard. She served 11 years on active duty, including an assignment with the 9th Infantry Division. CPT Mann established the Organizational Effectiveness (OE) program for NATO/SHAPE in Belgium and managed the OE program for the 21st Support Command, Kaiserslautern, West Germany.

She is working on her dissertation toward a PhD in human resource development from the University of Texas and is now attending the Command and General Staff College at Fort Leavenworth, KS.

The Evolution of Doctrine:

Development of Engineer Tactical Doctrine and Equipment 1939-1944

by MAJ Stanley J. Murphy and MAJ F. Marion Cain III

The situation of LTC Floid A. Davidson's 1st Battalion, 110th Infantry Regiment, was most discouraging. The time was early morning September 15, 1944. Their mission was to capture Hill 553, a Siegfried Line strongpoint along the Heckhuscheid-Uettfeld Highway. Without tank support, the infantry could make no headway against the German pillboxes. Five rows of concrete dragon's teeth and a roadblock prevented the tanks from closing in on the pillboxes.

Not until 1700 did the engineers and tanks arrive. Under cover of fire from tanks and towed tank destroyers, 10 unarmed engineers, each carrying 50 pounds of TNT, began to creep slowly, carefully toward the roadblock. As they inched forward, tension mounted, passing almost electrically to the waiting infantrymen and tankers.

Reaching the roadblock at last, the engineers found six steel I beams embedded in concrete caissons on either side of the road. Several large, portable iron tetrahedrons reinforced the obstacle. Working swiftly, they placed their charges. An hour and a half after they started their perilous task, the charges were set. Activating the charges, the engineers jumped to their feet and "ran like hell to the rear." The roadblock disintegrated with a roar.

Acting on cue, the tanks advanced and fired pointblank at the pillboxes. The infantry went forward on the run. Forty-five minues later, Hill 553 was secure. It yielded 17 pillboxes and 58 prisoners. After almost three days of mounting casualties and frustrations, the 110th Infantry in a quick, coordinated assault at last gained a significant objective within the Siegfried Line.[1]

World War II saw the use of obstacles, minefields, and barriers on a scale never before imagined. To cope with these obstacles to mobility, the U.S. Army Corps of Engineers rapidly developed new equipment and doctrine to support maneuver forces. This required a change in emphasis from constructing bunkers and field fortifications in support of World War I attrition warfare to breaching minefields and other obstacles in support of World War II maneuver warfare.

Like the Army of the mid-1980s, the Army of the late 1930s was also struggling with the problems of changing from a doctrine based on attrition to a doctrine based on maneuver. Therefore, a discussion of the development of tactical doctrine and equipment during the early years of World War II provides valuable insight into the development of contemporary tactical doctrine and equipment. This article examines one aspect of the evolution of tactical doctrine by the U.S. Army Corps of Engineers—the development of mobility doctrine and equipment from 1939 to 1944.

Background

The Japanese attack on Pearl Harbor in December 1941 caught the U.S. Army Ground Forces in the process of transitioning from a small peacetime army to a vast mechanized force. During this period, responsibility for developing mobility doctrine and training was vested in the Engineer School at Fort Belvoir, VA. The Engineer Board was responsible for developing equipment, and the Ordnance Department was responsible for procurement and production.[2]

Many senior officers, including GEN Malin Craig, U.S. Army Chief of Staff from 1935 to 1939, and GEN Leslie McNair, Chief of Staff, Army Headquarters from 1939 to 1940 and later Commander of the Army Ground Forces from 1942 to 1944, thought the new style of mobile warfare required only limited mobility support, primarily for emergency road repair. In fact, in the 1936 reorganization of the infantry division, GEN Craig recommended divisional engineers be deleted from the new triangular division.[3]

Search for a New Mobility Doctrine 1939-1942

Mobility in the Old Army

Throughout the 1920s and 1930s, few substantial changes were made in the methods of providing mobility support to the infantry division. The infantry division of the interwar years was primarily the square division, a large, cumbersome organization of over 22,000 men designed for the attrition warfare of World War I. Since most of the division's vehicles were horse- or mule-drawn and the infantry either walked or rode the train, there was little need for mobility support. The major function of the division's engineer regiment was to construct fortifications (survivability) using picks and shovels. In 1930, hand labor was supplemented by the addition of horse- or mule-drawn wagons, road graders, and scrapers.[4]

Reorganization

Seeking to increase the division's ability to maneuver, the new triangular division was organized in 1936. The organization had 13,552 men and contained three infantry regiments. The square division engineer regiment of 816 men was reduced to a battalion of 518. Convinced that the triangular division did not need significant mobility support, the strength of the divisional engineer battalion was further reduced to 420 men by 1939.

This marked the low tide of mobility support to the division. Many argued that proper reconnaissance would enable the division to detour around destroyed bridges and other obstacles. There seemed, therefore, little need for divisional engineers in maneuver warfare.

This concept was swept aside when Germany invaded Poland in September 1939. Analysis of German army operations in Poland revealed a larger number of engineer troops were required to provide mobility support for motorized and mechanical forces. Subsequently, in December 1939, the General Staff approved increasing the strength of the divisional engineer battalion to 520 men.[5]

In addition to changing the strength of the divisional engineer battalion, improvements were also made in equipping the battalion. In the fall of 1939, the Engineer Board used the 5th Engineer Battalion to test a 4 1/2-ton dozer by comparing its performance to a slip scraper pulled by a mule team. In the test, the dozer moved 16 times as much earth as the animal-drawn scaper. The test results were so impressive that before the end of the year, 7 1/2-ton dozers were authorized for divisional combat engineer battalions.[6]

Impact of the German Blitzkrieg

The German Blitzkrieg through France in 1940 also had a tremendous impact on the development of U.S. Army mobility doctrine and equipment. Throughout late 1940 and early 1941, several articles appeared in the *Infantry Journal* and *The Military Engineer* describing the importance of mobility support to breach obstacles, assault fortified positions, and conduct river-crossing operations.[7]

In 1940, maneuvers also provided another opportunity to demonstrate the need for increased mobility support. For the first time, it became standard practice to attach a platoon of engineers to infantry regiments. As a result, the strength of the engineer battalion increased to 734 men over the objection of GEN McNair who advocated only a single company of 175 men for divisional engineers.[8]

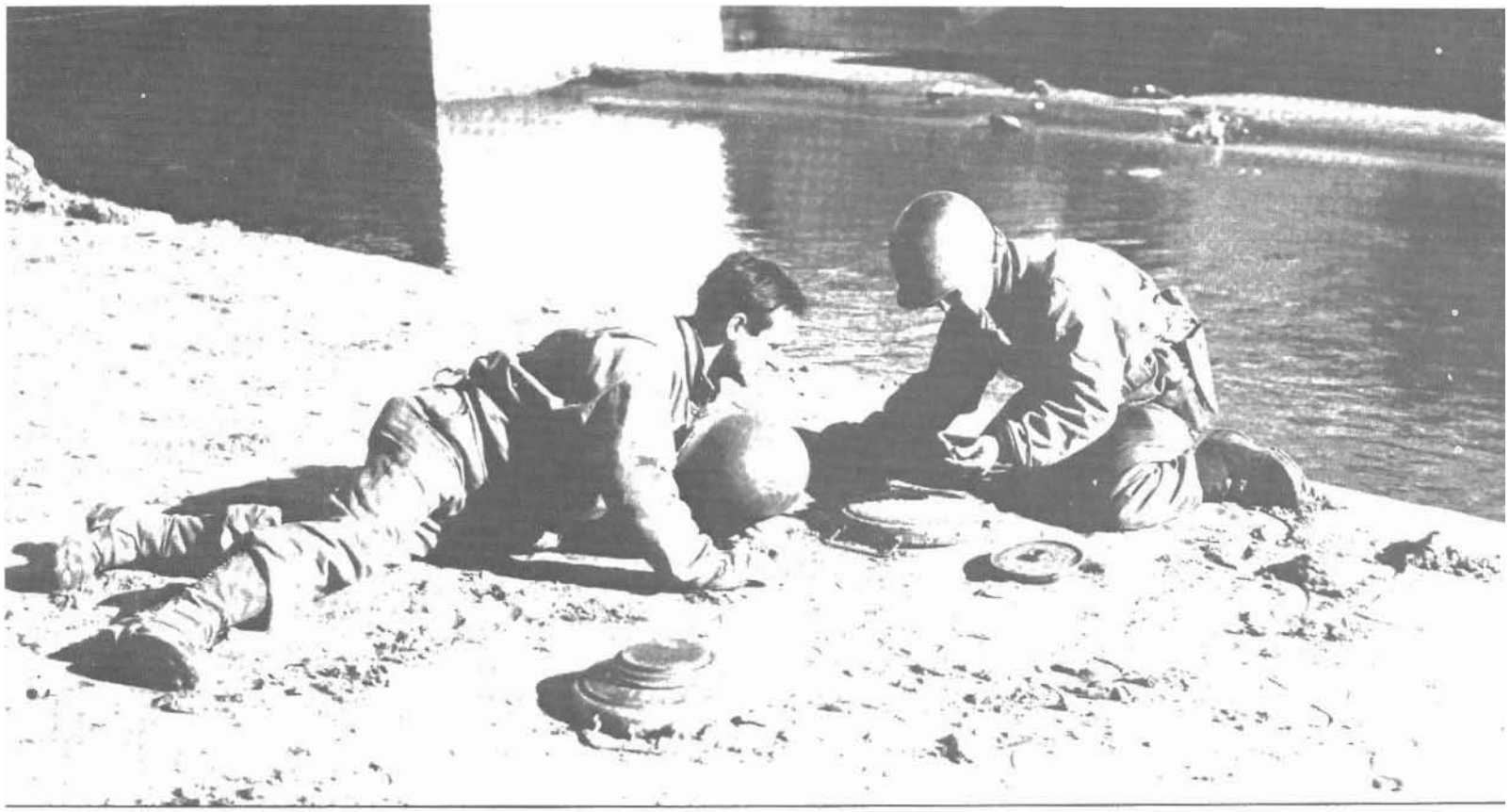
During the 1941 maneuvers, it became common practice to attach two platoons of engineers to each of the division's regimental combat teams. Based on the increased realization of the need for mobility support, the divisional engineer battalion strength was further increased in January 1942.

Impressed by the ability of German engineers to breach obstacles and assault fortified positions, the Engineer School conducted a series of tests in 1941 and 1942, stressing mobility support to armor and infantry units by breaching obstacles and supporting the assault of a fortified position using the Siegfried Line as a model. The purpose of these tests was to evaluate current Army doctrine and techniques and make recommendations.[9]

The Engineer School's final report, published in September 1942, reached several conclusions. First, assaulting obstacles and fortified positions required specially trained soldiers. Another key finding was that infantry, as well as engineer troops, should receive demolitions training. The report concluded that the infantry division organization was not suited to breaching and assaulting fortified positions and that present U.S. doctrine in FM 100-5 was sound, but needed clarification.[10]

In addressing specific assault techniques, the report stated the use of hand-placed charges would be successful against isolated obstacles. However, this method would not be successful against obstacles covered by fire from mutually supporting emplacements. The test committee thought that success would depend largely upon the ability of artillery and air force to suppress enemy fire and that use of smoke would significantly reduce casualties.[11]

A revised version of FM 5-6, *Engineer Field Manual – Operations of*



Engineers remove the detonator of a teller mine found on the beach at Nettuno, Italy, February 6, 1944. Americans created special mine training centers to counter the Germans' large-scale use of mines. Other methods of breaching obstacles included hand-placed charges, removal by hand, artillery fire and bombardment, bridging, and direct fire from tanks (U.S. Army photo).

Engineer Field Units, published in April 1943, established countermine and counterobstacle doctrine for the remainder of the war. FM 5-6 discussed five methods of breaching obstacles: hand-placed charges, hand removal, artillery fire and aerial bombardment, bridging, and direct fire from tanks or tank destroyers. The manual emphasized hand-placed charges as the most efficient method for breaching minefields and all other obstacles. Minefields could also be breached by hand removal using probes to locate the mines and then digging them out or exploding them one by one. Artillery fire and aerial bombardment was not considered a reliable method, and direct fire from tanks was only effective against some obstacles. FM 5-6 also stressed the importance of reconnaissance and the use of smoke to mask breaching operations.[12]

FM 5-6 and FM 100-5 stated that assault of a fortified zone would be conducted in four phases by a combined arms team consisting of infantry, armor, artillery, and engineers. Phase I was reduction of the enemy outpost system. Phase II was breaching a gap through the obstacles. In Phase III the gap was extended, and in Phase IV mobile forces would pass through the gap and continue the attack. Assault units would require specialized training, and special units should be organized to breach a major fortified position.[13]

An infantry battalion supported by attachments from tank, tank destroyer, artillery, engineer, and chemical units would conduct the assault. The assault would be preceded by a heavy preparation and aerial bombardment. As preparatory fires shifted to enemy reserves and counterbattery fire, direct fire from tank and tank destroyer units would suppress enemy fire and cover the assault and breaching detachments as they moved forward. Using smoke to conceal their movements, the breaching detachment would breach a gap through the obstacles. The assault detachment would then move through the gap and assault the fortification using a combination of hand-placed charges, hand grenades, antitank rockets, flamethrowers, and rifle grenades.[14]

Final Reorganization of Combat Engineer Battalions

In early 1943, the strength of the divisional combat engineer battalion was reduced from 745 to 647 officers and men. The battalion consisted of a headquarters company and three line companies. This reduction in strength was part of a general cut in the strength of the infantry division. The 1943 reorganization was the last major change in troop strength and organization of the divisional combat engineer battalion.[15]

During this period, the armored engineer battalion of the armored division was also reorganized. In early 1943, GEN McNair insisted the strength of the armored engineer battalion be reduced by more than 40 percent. He argued that since tracked vehicles could move easily cross-country, less mobility support was required to construct and maintain roads. Therefore, the treadway bridge company was removed from the division and placed under Corps control. Under the September 1943 reorganization, the armored engineer battalion was reduced from a strength of 1,174 to a strength of 693. This organization remained relatively unchanged throughout the remainder of the war.[16]

Improvements to Mobility Doctrine 1943-1944

The Impact of Combat Experience

Not until 1943 did actual combat experience overseas begin to influence development of mobility doctrine and equipment in the U.S. Army. Up to then, development of mobility doctrine and equipment was based primarily on theoretical work, observations, and tests conducted by the Engineer School and the Engineer Board.

By 1943, evidence began to pile up from the Russian Front and the British experience in North Africa. Throughout the year, *The Military Engineer* ran a series of articles on various aspects of combat engineering from the Russian Front. One of these articles by LT B. Marchenko of the Soviet army specifically addressed breaching German obstacles. LT Marchenko's article stressed the need to breach obstacles quickly to reduce the exposure of friendly units to enemy fire. He also discussed the importance of conducting a detailed reconnaissance, usually at night, to determine the exact nature and location of the obstacles prior to the assault. LT Marchenko's article recommended engineers accompany the lead elements in the assault. Breaching methods included hand removal of mines or detonating with explosives. Wire obstacles could be cut by hand or blown with demolitions.[17]

Retreating German units began employing obstacles in increasing numbers to slow down the advance of attacking units. In North Africa, Rommel placed large numbers of antipersonnel and antitank mines to impede British attacks. Later in Italy, retreating enemy forces went to great lengths to modify terrain with obstacles to slow the Allies' advance. GEN Eisenhower remarked that retreating Germans ". . . made certain that every culvert and bridge on the miserable roads were blown out; every shelf road cut into the steep mountain sides was likewise destroyed."[18]

Combat in North Africa in early 1943 revealed that not enough attention was focused on training for placing and removing mines. Present practice was for only engineer units to receive training in mine warfare. However, the large-scale use of mines by the Germans required that everyone be able to breach minefields. As a result, special mine training centers were established. Before deploying overseas, each combat unit sent a quota of officers to a one-week course in laying hasty minefields and breaching German minefields. Engineer officers received an additional week of instruction which included laying and marking deliberate minefields and disarming enemy mines.

Stressing the importance of realistic training prior to combat, CPT Robert Rigg published an article in the October 1943 issue of *The Military Engineer* describing a training course in the removal of mines. The mile-long course contained 11 obstacles with mines and booby traps. Realism was enhanced by connecting the mines and booby traps to 1/4-pound blocks of TNT buried off to the side of the obstacle. Another interesting fact is that CPT Rigg was not an engineer but a cavalry officer and the training course he recommended was established not for an engineer unit but for the 106th Cavalry.[19]

Countermine and counterobstacle techniques were becoming important not only to engineers but to other combat units as well.

Development of Mobility Equipment

Clearance of land mines and other obstacles presented many significant



1LT C.A. Post, attached to a combat engineer unit in France, prepares to detonate two German teller mines, November 15, 1944 (U.S. Army photo).

problems, and the Corps of Engineers pursued several lines of investigation. Basically, mines and obstacles may be cleared by either explosive or mechanical means. By 1943, the greatest progress in clearance techniques was in the area of explosives. Late in 1941, the Engineer Board conducted detailed experiments in the Tennessee Valley to determine the best types, amounts, methods of placement, and relative effectiveness of various explosives. Further tests were conducted at Aberdeen Proving Ground, MD, on antitank obstacles such as log blocks, tetrahedrons, hedgehogs, and log posts.

Explosive Methods

The Engineer Board determined that satchel charges of 25, 50, and 75 pounds were effective against large concrete obstacles such as dragon's teeth, while line charges, such as the bangalore torpedo, were effective for breaching lanes through minefields and wire obstacles.

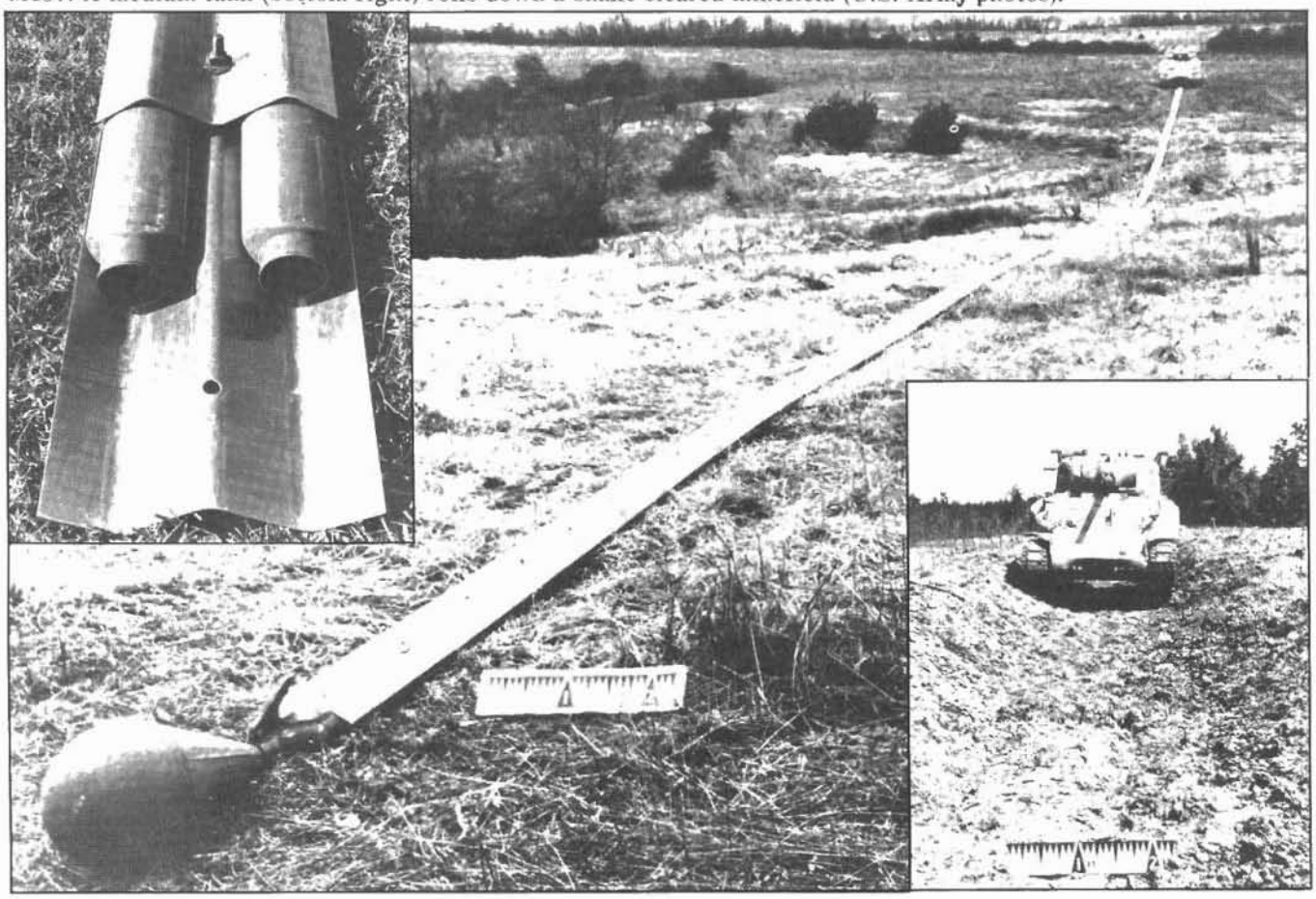
The bangalore torpedo, invented by a British Army officer in Bangalore, India, before World War I, was a metal tube filled with explosives. After several tests, the Engineer Board, with the assistance of DuPont, American Can Company, and Republic Steel Corporation, designed a prefabricated bangalore torpedo five feet long, two inches in diameter, and containing 8 1/2 pounds of ammonium nitrate.[20]

Meanwhile, soldiers were still being trained to breach minefields by loosening mines with a probe and either removing them by hand or exploding them with TNT. This was a very slow and dangerous method, especially under fire. Although several bangalore torpedoes could be joined together to breach a minefield, the lane was only one to two meters wide, not enough for a vehicle.

In January 1943, the Engineer Board began testing a Canadian line charge called the snake. Similar to today's M157, the snake was designed to be assembled in the field out of enemy view, then pushed out into the minefield by a tank. When detonated, the snake cleared a path sufficient for vehicles. Although assembly was time-intensive, the tank protected the breaching team from small-arms fire.[21]

In addition to line charges, the Engineer Board investigated several other explosive methods for breaching minefields such as artillery fire, bombs, and rocket-propelled charges. All these methods worked up to a point, but explosives always left sensitive mines on the edges of the cleared lane. These sensitive mines were extremely difficult to remove and became very dangerous. Bombs larger than 250 pounds left a large crater which also became an obstacle to mobility. Consequently, by mid-1943, the Engineer Board and the Ordnance Board began to seriously investigate mechanical or pressure methods.[22]

The snake was used to clear a path wide enough for vehicles. It was assembled out of the enemy's view, and a tank pushed it into the minefield. The closeup (top left) shows a detail of the snake, a Canadian line charge similar to today's M157. A medium tank (bottom right) rolls down a snake-cleared minefield (U.S. Army photos).



Mechanical Methods

Throughout 1942 and 1943, the Ordnance Board experimented with several different types of disk rollers as a method of breaching minefields. These devices consisted of a number of large steel disks mounted on a medium tank. The tank pushed the disks through the minefield, detonating mines in its path. Major limitations of the rollers were their extreme weight and slow speeds. They also tended to break down frequently. Over 15 devices were tested before one model, the T1E3, proved more satisfactory than the rest. Named the Aunt Jemima, the T1E3 was fielded by early 1944.[23]

As early as January 1942, the Engineer and Ordnance Boards experimented with bulldozer blades mounted on medium tanks. Various straight and V-blades were developed and tested by LaPlante-Choate Company and LeTourneau Corporation. However, by the spring of 1943, a satisfactory solution had not been found.

Meanwhile, reports from the Pacific and North Africa emphasized the requirement for an armored vehicle to provide mobility support to front-line units where the operator was often exposed to enemy fire. Since the tank dozer was still in the developmental stage, another method had to be found.

The concept of armored bulldozers was suggested back in 1942, but steel plate was too scarce in the summer of 1942 to be diverted for this purpose.



This medium tank is equipped with a T1E3 mine exploder. The Ordnance Board tested several types of disk rollers. However, they were heavy, slow, and frequently broke down (U.S. Army photo).

By mid-1943, the situation had changed, and the Engineer Board designed an armored cab for bulldozers. The cab was constructed of 1/2-inch steel plate and could be assembled in the field. The armor plate protected the dozer operator against bullets smaller than .30 caliber, but it was heavy and tended to overload the tractor. Cabs also reduced operator visibility and efficiency. By the summer of 1944, armored cabs were in the field.[24]

By late 1943, LeTourneau Corporation developed a successful tank dozer. This model employed a hydraulically controlled straight blade mounted on a medium tank. Its earth-moving capabilities compared favorably with those of a D-8 tractor. The LeTourneau tank dozer performed well under a series of demanding tests, easily overcoming obstacles previously classed as rendering direct assault useless. Rushed into production, the tank dozer was deployed to Italy by the spring of 1944.[25]

Impressed by the improvements in equipment and techniques for breaching minefields and other obstacles, the Office of the Chief of Engineers (OCE) directed the Engineer School to take advantage of Engineer Board test facilities to test techniques and doctrine and to bring tactical considerations to bear upon the Board's work. The School decided that unless U.S. Army doctrine changed, the infantry would precede the arrival of the tanks and must be prepared to breach obstacles using simple expedients such as wire cutters and ramps. Wide gaps through obstacles were not needed until the tanks arrived. Furthermore, vehicle lanes could not be provided until the infantry silenced the enemy's fire.[26]

Obstacles, minefields, and barriers in World War II created a demand for new equipment to support maneuver warfare. The Army experimented with various straight and V-shaped blades on tanks (U.S. Army photo).





The armored bulldozer protected the operator and provided mobility support essential after the German invasion of Poland and the Blitzkrieg through France. However, the armor plate overloaded the tractor and the cab reduced visibility (U.S. Army photo).

Encouraged by the successful tests of the tank dozer, the Engineer Board decided to develop a more versatile engineer armored vehicle. Based on a medium tank chassis, the engineer armored vehicle included a dozer blade, a trailer for carrying extra demolitions, a doozit (device for mechanically placing explosives), and substituted a rocket launcher for the 75-mm main gun. This vehicle was reasonably efficient and afforded good protection to its operator, although the rocket launcher was accurate only at short ranges and the launcher and doozit were vulnerable to enemy fire.

The engineer armored vehicle was successfully tested in the spring of 1944. However, procurement was blocked because the vehicle did not fit into the organization and doctrine of the Army. The Engineer Board concluded the vehicle could only be absorbed in the armored engineer battalion. The Engineer School recommended forming special units similar to the British approach. The Office of the Chief of Engineers thought the vehicle should be placed in all divisional engineer units. Consequently, the engineer vehicle was not deployed in time to participate in the fighting in Europe. On V-J Day, two engineer armored vehicles with crews and instructors were at the port of embarkation ready to deploy overseas.[27]

Throughout the prewar years, the Office of the Chief of Engineers resisted pressure from many senior officers to reduce the strength of the divisional engineer battalion below 300. During this period, they also struggled to field new mobility equipment replacing man power—first with horse power and then with machine power.

Initially, developments in organization, doctrine, equipment, and training were based on results of maneuvers and field tests. Later, lessons gleaned from analyzing German army combat operations were used to modify original concepts and theories. Finally, recent combat experience in the Pacific and North Africa was used to further refine doctrine, equipment, and training.

As a result, by D-Day 1944, the U.S. Army was equipped with a variety of mobility equipment to include: bangalore torpedoes, snakes, mine detectors, mine rollers, armored bulldozers, and tank dozers. Nevertheless, none of these methods was entirely satisfactory. The armored engineer vehicle had completed development, but disagreements over how and where it should be employed delayed fielding until the end of the war. The tank dozer was the closest approach to an engineer assault vehicle capable of providing mobility support to frontline units under fire.[28]

During the late prewar years of 1936 to 1941, the Office of the Chief of Engineers struggled to convince the Army that mobile warfare did not decrease the need for mobility support, but actually increased it. Throughout a period of seven years from 1936 to 1943, the U.S. Army tried to adapt the organization of the division to meet the demands of mobile warfare by testing new organizations, incorporating new equipment, and developing new doctrine.

Initially, development of mobility doctrine was largely theoretical and based on experience gained in World War I and more recent maneuvers in Louisiana and North Carolina. Later, mobility doctrine was influenced by the success of the German Blitzkrieg. Development of mobility doctrine and equipment during 1943 and 1944 was primarily guided by actual combat experience of Soviet, British, and American armies on the Eastern Front and in North Africa and Italy.

FM 5-6 and FM 100-5 emphasized the use of firepower to breach obstacles and assault fortified zones. These manuals did not discuss the use of mobility to bypass or outflank obstacles or fortified positions. The assault and breaching detachments were expected to lead the attack with only supporting fire and smoke to protect them from enemy fire and to breach enemy obstacles using hand-placed explosives.

Even though the 1941 tests by the Engineer School clearly showed that hand-placed charges would not succeed against obstacles covered by fire from mutually supporting positions, FM 5-6 and FM 100-5 did not mention the use of any mechanical methods of breaching obstacles or the need to provide the breaching detachment with armor protection.

GEN McNair's insistance on a lean, flexible organization played a key role in limiting the mobility support available to the division. McNair's concept was reinforced by his belief that tracked vehicles would require less mobility support as they traveled cross-country. This decision often came back to haunt U.S. Army units when obstacles and terrain restricted movement of tracked vehicles to roads.

American industry played a vital role in the development of mobility equipment for the U.S. Army. The military establishment simply did not have the necessary experience or technology to develop sophisticated mobility equipment such as the mine detector, bangalore torpedo, snake, and tank dozer.

Throughout the development process, the U.S. Army placed too much emphasis on perfection instead of set-



Soldiers place a bangalore torpedo under barbed wire, England, August 1943. Line charges were effective for breaching lanes through minefields and wire obstacles (U.S. Army photo).

tling for equipment capable of clearing sufficient obstacles to get a large percentage of vehicles through. This held up equipment development and delayed production. The result was that fewer items were available in the field.

Combat units deploying to Europe in the summer of 1944 were not adequately equipped to breach obstacles under fire. Despite extensive testing and development, the U.S. Army failed to develop a really satisfactory (quick and safe) method of breaching minefields under fire. The roller and and bangalore torpedo were simply the best of the lot.

Training could be changed rapidly based on actual combat experience, for example, correcting deficiencies in mine warfare training based on North African experiences. Equipment changes, however, took longer. When a particular item of equipment did not perform as expected in the field, it could not be quickly modified by the CONUS industrial base to meet actual field requirements. Therefore, a great deal of emphasis had to be placed on innovation and initiative in the field.

World War II witnessed the development of specialized mobility equipment and doctrine on a scale unforeseen and unpredicted in the preceding years of peace. The greater part of this specialized mobility equipment was actually developed after the majority of combat units deployed overseas. Consequently, there were initially no units specifically trained to employ most of this equipment. Furthermore, the number of officers and men in the European Theater familiar with the doctrine, capabilities, and limitations of this specialized mobility equipment was negligible.[29]

Experience and doctrine drive the development of equipment. The U.S. Army had not experienced Dieppe. None of their landings in North Africa and southern Europe had been heavily opposed. Doctrine emphasized the use of hand-placed demolition charges to clear obstacles, not the use of specialized equipment. Therefore, when the Engineer Board began to study the problem of clearing obstacles, they failed to evaluate the real strength of defenses and miscalculated the ability of the individual soldier to breach obstacles under fire.[30]

The eminent military historian Michael Howard once said, "It is the challenge of military science in an age of peace to prevent doctrines from becoming too badly wrong."[31] The final test of an army's doctrine is the battlefield. Perhaps there is no greater challenge to a peacetime army than the development of a viable doctrine for future war.

AirLand Battle doctrine is the U.S. Army's operational concept to meet the challenges of future war. However, AirLand Battle is not fully implemented. Problems still exist in applied doctrine, equipment, training, organization, and tactics. This is not to say that AirLand Battle should be discarded. On the contrary, this doctrine has established an ideal that should be strived for continually.

Like the Army of the late 1930s, we are struggling with the problems of changing from a doctrine based on attrition to one based on manuever. An understanding of the problems associated with the development of mobility doctrine and equipment during the early war years may prevent us from making some of these same mistakes.

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Notes

[1] Charles B. MacDonald, *The Siegfried Line Campaign (U.S. Army in World War II: European Theater)*, 1963, pp. 46-47.
[2] Blanche C. Coll, Jean E. Keith, and Herbert H. Rosenthal, *The Corps of Engineers: Troops and Equipment (U.S. Army in World War II: The Technical Services)*, 1958, p. 8.
[3] Ibid., p. 12.
[4] Ibid., p. 29.
[5] Ibid., pp. 14-16.
[6] Ibid., pp. 32-33.
[7] CPT Paul W. Thompson, "Engineers in the Blitzkrieg," *Infantry Journal*, 47, 1940, pp. 424-432. CPT Paul W. Thompson, "Engineers in Battle," *The Military Engineer*, 35, 1941, pp. 1-5, 116-120, 209-214, 276-282, 374-376, 434-437, 514-516, and 559-560.
[8] Coll, Keith, and Rosenthal, *Engineer Troops and Equipment*, pp. 22-23. U.S. Army Engineer School, *A Report on the Attack of a Fortified Position*, 1942, p. 4.
[9] U.S. Army Engineer School, *Report*, p. 4.
[10] Ibid., pp. 71-73.
[11] Ibid., pp. 73-76.
[12] U.S. Army, FM 5-6, *Engineer Field Manual — Operations of Engineer Field Units*, Washington, D.C., 1943, pp. 72-77.
[13] Ibid., pp. 78-79. FM 100-5, *Tentative Field Service Regulations — Operations*, Washington, D.C., 1939.
[14] Ibid., pp. 80-82.
[15] Coll, Keith, and Rosenthal, *Engineer Troops and Equipment*, p. 225.
[16] Ibid.
[17] LT B. Marchenko, "Removing German Obstacles," *The Military Engineer*, 35, 1943, p. 578.
[18] Dwight D. Eisenhower, *Crusade in Europe*, 1948, pp. 201-202.
[19] CPT Robert Rigg, "Training Course in Removal of Mines," *The Military Engineer*, 34, 1943, pp. 511-515.
[20] Coll, Keith, and Rosenthal, *Engineer Troops and Equipment*, pp. 468-469.
[21] Ibid., pp. 469-470.
[22] Constance M. Green, Harry C. Thompson, and Peter C. Roots, *Planning Munitions for War (U.S. Army in World War II: The Ordnance Department)*, 1955, pp. 387-389.
[23] Ibid., pp. 390-392.
[24] "Armored Cabs for Tractors," *The Military Engineer*, 36, 1944, p. 340.
[25] Coll, Keith, and Rosenthal, *Engineer Troops and Equipment*, pp. 471-475. "Tank Dozer," *The Military Engineer*, 36, 1944, p. 341.
[26] Coll, Keith, and Rosenthal, *Engineer Troops and Equipment*, p. 475.
[27] Ibid., p. 481.
[28] Ibid., p. 480.
[29] U.S. Forces European Theater, Study No. 52: *Armored Special Equipment*, February 21, 1946, p. 3.
[30] K. J. Macksey, *Armoured Crusader: A Biography of Major General Sir Percy Hobart*, 1967, p. 293.
[31] Michael Howard, "Military Science in an Age of Peace," *RUSI Journal*, 119, March 1974, pp. 3-9.

The Impact of Dieppe on the Development of Mobility Equipment

In August 1942, British and Canadian forces conducted a large-scale amphibious raid on the occupied French coastal city of Dieppe. This first attempt to land forces in Europe was a disaster. The raiding force of approximately 5,000 men suffered over 3,000 casualties. Over 1,000 of these casualties occurred on the beach before the raiders could breach the German obstacle system. The raiders encountered a formidable array of obstacles including steel spikes, barbed wire, concrete walls and blocks, antitank ditches and mines—all covered by persistent enemy fire.[1]

From this experience the Allies learned many valuable lessons. One was that engineers cannot consistently perform deliberate tasks under fire unless they are given armored protection. In March 1943, therefore, the British army converted the 79th Armored Division into an experimental formation and ordered its commander, Major General Sir Percy Hobart, to devise and develop specialized armor and equipment to breach enemy obstacles.[2]

Rather than design one vehicle to accomplish several tasks, the British thought each type of obstacle required a special antidote. Therefore, every conceivable method of breaching every known German obstacle was worked out on full-scale models at the division training base at Oxford, England. The 79th Division then designed and manufactured prototypes in the division's own workshops.[3]

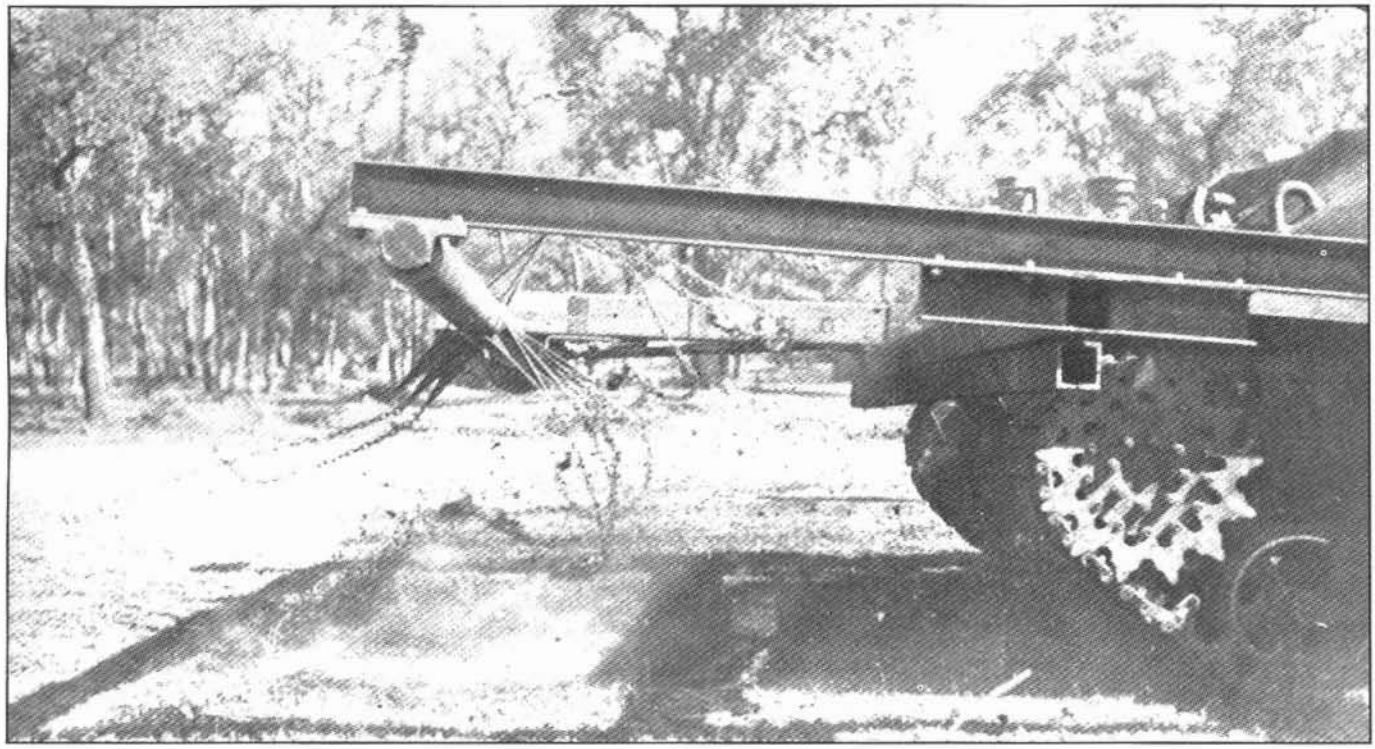
One of the best known pieces of specialized armor developed by the British was the crab or flail tank. This vehicle consisted of 43 chain flails fastened to a rotating drum mounted on the front of an M4 series medium tank. The crab was an improvement upon the earlier model scorpion flail developed by the British during the North Africa Campaign. By rotating the drum, the chains flogged the ground in front of the tank and detonated mines buried in its path.[4]

Another important British armored vehicle was the Armored Vehicle, Royal Engineers (AVRE). Designed around a Churchill tank chassis, the AVRE carried a crew of six engineers and could fire a shaped charge round 80 yards from a 12-inch spigot mortar mounted in the turret. This versatile vehicle could carry several devices to enhance friendly mobility. Among these were:

- **Fascine: a 7-foot diameter bundle of chestnut paling which was carried in the AVRE and dropped in ditches and craters.**
- **Bobbin: a 70-foot roll of prefabricated matting mounted on the AVRE and rolled across patches of boggy ground to permit the AVRE and other vehicles to cross.**
- **Skid Bailey: a 60-foot Bailey Bridge mounted on skids and pushed in place by the AVRE.[5]**

The British also developed the ark. This armored vehicle consisted of a Churchill tank with the turret removed and trackways installed along the top of the hull. The ark simply drove itself into the ditch or gap to be bridged, providing a 54-foot span. Other vehicles could then cross over the gap.[6] Other vehicles developed by the 79th Armored Division included the searchlight, flamethrower, and amphibious tanks, as well as armored personnel carriers.

In practice, the British system of consolidating specialized armor in a single unit worked quite well. These vehicles were used extensively during the Normandy landings to breach German defenses and were in great demand after D-Day. During the remainder of the war, it became the practice not to commit specialized ar-



The crab or flail tank used 43 chains on a rotating drum to flog the ground and detonate mines. The British developed a different vehicle for each type of obstacle unlike the Americans who used one vehicle for several functions (U.S. Army photo).

mor unless the 79th Division staff was involved in planning the operation. This ensured effective utilization of a scarce resource.[7]

Furthermore, specialized armor remained with the supported unit only long enough to accomplish its mission. The equipment was task-organized for each mission and then returned to the 79th Division base which was equipped with special maintenance shops to repair and rebuild damaged or worn equipment.[8]

The 79th Division continued to improvise and solve problems even after deploying to the continent. The division headquarters was always close to Montgomery's headquarters to facilitate command and control, and the division commander roamed the battlefield ensuring his specialized armor was properly utilized.[9]

The British army developed completely different doctrine and equipment than the U.S. Army. The British experiences at Dieppe and in North Africa taught them early that unprotected, exposed troops could not breach obstacles under fire without exceptionally high casualty rates. For this task the British developed special-purpose armored vehicles.

Instead of integrating this specialized equipment into regular units, a special organization was created to centralize control of the equipment, doctrine, and training. Centralized control was necessary because there was not enough time to retrain the entire army in the use of this specialized equipment.

During World War II, the British realized that a specialized type of vehicle was required to breach each particular obstacle. The result was a proliferation of many different specialized vehicles. The American approach, on the other hand, was to combine several different functions in one vehicle. Since the U.S. Army often insisted on nearly perfect performance, its mobility equipment took longer to develop and was more complicated to maintain than British mobility equipment.

Two radically different systems for the employment of mobility equipment evolved during the war. The British, a year before D-Day, designed the 79th Armored Division as a special equipment division with the mission of developing, testing, training, and employing specialized mobility equipment in combat. There was no counterpart to this unit in the U.S. Army. Instead, mobility equipment was added to conventional tactical units. The British system was more effective because their system provided combat units with specially trained troops accompanying the special equipment. The American system did not.[10]

Notes

[1] Blanche C. Coll, Jean E. Keith, and Herbert H. Rosenthal, *The Corps of Engineers: Troops and Equipment (U.S. Army in World War II, The Technical Services)*, 1958, p. 472.

[2] Chester Wilmot, *The Struggle for Europe*, 1952, p. 181.

[3] K. J. Macksey, *Armoured Crusader: A Biography of Major General Sir Percy Hobart*, 1967, p. 261.

[4] U.S. Forces European Theater, *Study No. 52: Armored Special Equipment*, February 21, 1946, p. 7.

[5] USFET, *Study No. 52*, p. 43.

[6] Ibid, p. 43.

[7] Macksey, *Armoured Crusader*, p. 300.

[8] Ibid, p. 311.

[9] Ibid, pp. 301-302.

[10] USFET, *Study No. 52*, p. 3.

Engineers to the Rescue
A Personal Viewpoint

(continued from inside front cover)

Yet, these units are not equipped to remove injured or trapped persons from collapsed structures. These battalions do have cranes, dump trucks, bulldozers, and air compressors which are fine for heavy work, but clumsy for the precision work of moving massive beams and clearing rubble in passageways. The specialized equipment needed does not exist in the combat heavy battalions.

An example of a rescue team with specialized equipment is the Israeli Civil and Home Defense Corps (CHDC). This equipment, which has been successfully used for many years, is configured around three main groups:

Light rescue trailer or wagon. A 2.5-ton cargo trailer is outfitted with equipment for light rescue operations (Figure 1). The equipment is compact, portable, and can generally be carried by one person.

Heavy rescue trailer. In addition to the equipment in the light rescue trailer, the heavy rescue trailer also has a small gas generator, a portable light set, and additional pneumatic cutting tools and manifolds or air-circulating devices (Figure 2).

Heavy equipment. The most versatile heavy equipment is the American-produced Bobcat, a small rubber-tired loader capable of accepting several front-end attachments. In the CHDC rescue system, the Bobcat has a pneumatic pavement breaker attached to the front boom. Because of its small size, the Bobcat can be placed inside a structure to perform clearing operations.

All the components of the Israeli rescue system are off-the-shelf and have been obtained from a variety of worldwide sources. Each item has been selected for its simplicity, durability, and suitability. All this equipment is air-transportable. The CHDC has developed an excellent rescue set that is combat tested. This equipment should be adapted by the engineers without further development or testing.

- Air-operated lifting cushions (2.7-ton, 18.3-ton, 54-ton)
- Jacks, mechanical and hydraulic (6 to 10 ton capacity)
- Cutting scissors (pneumatic, manual, hydraulic)
- ORBIFON, high-sensitivity microphone to detect voices to a depth of 25 meters
- Polyurethane supports to assist jacking devices
- Miscellaneous tools (axes, pry bars, rope, pulleys)

Figure 1. Equipment for light rescue operations.

- Hurst and Lucas cutting and spreading systems
- Gas cutting system (oxygen/acetylene)
- KOBRA engine drill
- Chain and disc saws
- Ladders
- Air-mover ventilators
- Lighting systems
- TIRFOR heavy lift rigging system
- Dehydration pumps to drain water

Figure 2. Equipment for heavy rescue operations.

Rescue teams must also have help from local and battalion assets. Most fire departments have hydraulic ladders. The lifting capacity for heavy lifts can be supplied by follow-on assets from the combat heavy battalion: scoop loaders, forklifts, and 25-ton cranes.

Most of this equipment can be purchased in the United States, and many tools listed are already in the Army supply system. A squad-sized rescue team should have:

- Two 5-ton dump trucks with winches which can pull the Bobcat and its attachments and the heavy equipment trailer.
- An M-880 contact maintenance truck which can carry light sets, saws, generators, compressed air cascades, and compressors. It can also pull the light equipment trailer.

A Bobcat, which can be a great asset to the team, is not in the Army supply system. The Bobcat can supply the power required for the jobs that jacks and hands cannot do swiftly. It can fit into tight locations to clear rubble quickly, yet it will perform its intended mission smoothly and carefully, not like a D-7 dozer or scoop loader. Rescue teams must carefully employ the equipment to reduce further injury to the casualties.

The Case Uni-Loader 1845B should be selected for engineer rescue teams. It can be equipped with an auxiliary hydraulic tool attachment similar to the one equipped on the new small emplacement excavator (SEE). Stanley Corporation makes many tools already in Army stocks that could be attached to this auxiliary. Breaking hammers, hydraulic lifting equipment, and saws for cutting steel and wood beams could be added to the rescue sets as well.

The hand-operated hydraulic jacks and hydraulic cutting scissors, in the CHDC sets, could be adapted to fit an auxiliary hose from the Bobcat. This would reduce manual fatigue and provide sleek movement.

In addition to the preceding equipment, the air-operated lifting cushions in Figure 1 could have adapters so the air compressor can supply air directly to the cushions through half-inch air lines. If air lines are not practical, the self-contained air cylinders could be used. The compressor mounted on the truck could be hooked to a cascade

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system to refill compressed air cylinders. The air-operated lifting cushions are important to the rescue missions.

The need for a properly equipped rescue team exists now. If one life is saved, the expense for the equipment and training will be worthwhile. How many marines in Beirut could have been saved if the United States had a well-trained and well-equipped rescue team standing by?

Deployment

These rescue teams and their equipment should be placed in combat heavy battalions usually assigned to corps-level headquarters. The AirLand Battle doctrine stresses the rear battle and magnifies the importance of rear area damage control. Because the corps is tasked with this mission, developing a rescue team organization into the combat heavy battalion is logical. In its TOE, the combat heavy battalion does have the heavier equipment required to supplement the rescue team's efforts, but not the specialized equipment.

The Corps of Engineers civil works districts in the United States and overseas perform many emergency operations. During wartime, the districts will have increased responsibilities. Even today, several sets of equipment could be used for relief during natural disasters. The Corps must ensure that the rescue teams are centrally located to better cover areas that may call for their services and to reduce the expense of organizing a team everywhere one is required.

This is the very reason why deployment in the civil defense network would be prohibitive. In the United States during wartime, the civil defense network will perform many tasks including recovery of injured people from damaged buildings. If a nuclear war occurs, this task is incomprehensible.

A study called *Civil Defense Rescue Requirements Following a Nuclear Attack* explains why equipping and manning enough rescue teams is impractical. In the first 15 minutes following an attack on a single metropolitan city, there would be 15,000 people trapped in debris. The study calculates that 150,000 man-hours and 600,000 rescue workers would be required. The specialized rescue team would be insignificant. During natural disasters, the Corps of Engineer districts and the Army could provide the support that the civil defense would require.

The Corps of Engineers must meet its tasked requirements or surrender responsibility. Developing and deploying specialized rescue teams will ensure that the Corps of Engineers will continue to accomplish its assigned tasks. Since emergency recovery operations may be required anywhere at any time, the Corps of Engineers must be prepared now.

Training team leaders and procuring off-the-shelf equipment to outfit several rescue teams must start as soon as possible. The Corps of Engineer's mission and the ultimate goal of the rescue team is to save lives.

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LTC Dennis Demeyer
CSM Robert Ward

3rd Bn., 390th Regt., 2nd Bde.
Niagara Falls, NY
LTC Ronald Mis
CSM Joseph Daniels

1st Bn., 391st Regt., 2nd Bde.
Buffalo, NY
LTC Bohdan Bejger
CSM John Lindner

2nd Bn., 391st Regt., 2nd Bde.
Newark, NY
MAJ Laurence Feasel
CSM James Shaw

3rd Bde. (Engineer OSUT)
Ithica, NY
COL Michael R. Wilton
CSM Clarence Michaud

3rd Bn, 391st Regt., 3rd Bde.
Norwich, NY
LTC James Moravec
CSM Edward C. Gregoire

1st Bn., 392nd Regt., 3rd Bde.
Corning, NY
LTC Edward Castellana
CSM Gordon Bauman

2nd Bn., 392nd Regt., 3rd Bde.
Horseheads, NY
LTC James Cochran
CSM James Ruscitto

3rd Bn., 392nd Regt., 3rd Bde.
Binghamton, NY
LTC William Hammett
CSM Richard Romano

770th Engineer Co.
Penn Yan, NY
CPT Robert Cyranna
1SG Roger Morey

Active Army

522nd Engineer Co.
Fort Knox, KY
MAJ William B. Rynearson
1SG Herman L. Mitchell

The names of commanders and command sergeants major were provided by Headquarters, 98th Division. Readers are encouraged to send any additional information to ENGINEER.

Correction: The 204th Engineer Battalion, New York Army National Guard, is located in Binghamton.

Career Notes

Commissioned Officers Branch

Expanded Information Program:

Engineer Branch, Officer Personnel Management Division, MILPERCEN, mailed Engineer Bulletins 1 and 2 to all engineer commands. These bulletins contain information concerning promotions, assignments, military and civilian education, and career programs. Current plans are to publish the bulletin quarterly.

Several personnel update messages also were sent to engineers in key positions. These messages provide information concerning engineer officer personnel matters. Messages are released monthly.

Engineer Branch Chief:

LTC John Basilotto is now Chief of Engineer Branch, Officer Personnel Management Division, MILPERCEN.

Professional Registration:

Registration as a professional engineer (PE) for qualified engineer officers to enhance their credibility and professional stature with the civilian engineering community has been a goal for several years. Registration as a PE for an engineer is similar to the recognition a lawyer receives for passing his bar exam. A person taking the PE exam is required to have engineer work experience and education and possess the engineer-in-training (EIT) certificate.

As a positive step in promoting the PE registration, all officers starting fully funded advanced civil schooling in engineering or related fields will be required to take the engineer-in-training (EIT) exam. Engineer officers who began studying engineering in FY 84 or FY 85 and who are currently in school are encouraged to take the exam if they have not already done so. AR 621-1, *Training of Military Personnel at Civil Institutions*, is being revised to incorporate this change.

U.S. Army Register:

The U.S. Army Register will no longer be sent automatically to organizations which were on the special distribution list, according to MILPERCEN officials.

The register is now designated DA PAM 600-100. Organizations must use DA Form 12-9C, *Requirements for Classified DA Administrative Publications*, to request it from the Baltimore Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220.

The register which lists all active duty and retired Army officers is published annually by MILPERCEN.

Warrant Officers Branch

Warrant Officer Education:

The Army's goal is for all warrant officers to have MOS-related associate degrees by their 15th year of service. Education and experience are major factors when an officer is being considered for schooling and assignments.

Comments from the last CW3/CW4 selection board showed that maintenance warrant officers fell well below the norm in both military and civilian education levels. Selection rates for the Warrant Officer Senior Course were higher among officers who had attained the DA education goal.

If you have not attended the Warrant Officer Advanced Course (WOAC), you should remember that the only time MILPERCEN can send you to the WOAC is in conjunction with PCS orders. You should ask your commander about TDY funds to attend the school on a TDY and return basis. One other option is to take the Warrant Officer Advanced Course by correspondence.

You should review DA PAM 600-11, *Warrant Officer Professional Development*, Chapter 5, "Warrant Officer Education System," and consider all the options available to you regarding civil schooling. You should apply for schooling after two years on station. Don't wait until you are being considered for assignment. Keep in mind, however, that the degree completion is available on a "best qualified" basis.

Ask MILPERCEN

Q. I'm an E-4. Why can't I get a homebase assignment when I go to Korea? My wife and daughter need a place to stay while I'm over there.

A. The Department of Defense directive authorizing the Homebase/Advanced Assignment Program (HAAP) applies uniformly to all services and specifically identifies the authorized grades as E-5 through E-8 and O-1 through O-5. The program applies to soldiers being assigned to dependent-restricted areas only. If a soldier is entitled to move his or her family at government expense, that family can still be moved to a designated CONUS location while the soldier is serving overseas.

Q. I did not get 125 on my last EER. Can I still get promoted to E-7?

A. It basically depends on your MOS, your overall performance record, and the current trend in promotions. In a critically under-strength MOS, a relatively low EER score might still allow an individual to be promoted. An overstrength MOS has less promotion opportunity; fewer selections are made from only the very best qualified.

Q. Why was my joint domicile assignment disapproved? I know there are openings?

A. Joint domicile assignments are approved only when valid requirements exist for the MOS and grade of both service members. In addition, both members must meet the particular requirements for the respective vacancies.

If you have questions to ask MILPERCEN, call (202) 325-8856, AV 221.



Tactics have changed since engineers in World War II marked cleared roadways in France. *The Evolution of Doctrine,* p. 32, traces changes in engineer equipment and methods to meet the challenges of the AirLand Battle (U.S. Army photo).