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CLEAR THE WAY

By Brigadier General Daniel W. Christman
Commandant, U.S. Army Engineer School

The old and stable Army mold is being broken. The Army of this decade will be smaller, primarily CONUS based, and must be trained and ready for contingency operations anywhere in the world.

This will drive changes in the way engineers do their jobs. We must be forward-looking and design doctrine and equipment that will allow us to accomplish future engineer battlefield missions. At the Engineer Center we are doing just that. Working together, we will establish a sound foundation for Army engineers in the 21st century.

I've talked to many of you in my first two months as Commandant, and your feedback has helped me outline four priorities for engineers to successfully contend with the challenges of a complicated, diverse, and resource-constrained world. The first is professional development. We have done an excellent job in the past to prepare our junior engineer leaders, and I want that to continue. In this regard, I recommend you read TRADOC Pamphlet 525-5, dated 1 August 1991. This pamphlet previews the Army's Air-Land Operations concept and helps set the doctrinal azimuth we will be following in the 90s. It is an *extremely* important document!

Second is communication with the field. I want the school to do a better job in this area. As part of the team, you need to help us design and build the future combat engineer force. Since you deal with unit problems daily, I know you are identifying innovative solutions to solve them. A lot of great ideas are out there, but if you don't share them, they will only be great ideas for a few. In turn, we at the school need to stay in touch with you on the full range of issues on our plate. I'll do all I can at this end to open the communication lines.

I have already started working my third priority: force structure enhancements. Despite the successes of the Engineer Restructure Initiative (ERI), we do not yet have the final solution. We must keep ERI on track for the armored and mechanized divisions and watch out for "nibbling" on the margins. We still have to work out the structure at the corps level and above to ensure we can sustain the future contingency fight. This means we will look closely at the roles of combat heavy battalions, combat support equipment companies, and bridge companies.

Last but not least, we must work on equipment modernization. This is broken, and fixing it with the sharply reduced resources will not be easy. Mobility enhancements are a critical Army shortfall. Vern Lowrey's article on engineer observations from Desert Storm (pages 42-48) highlights our inability to breach complex obstacles quickly and effectively. We need to aggressively field the equipment required to accomplish our warfighting missions. The M1 breacher/bridger is, consequently, our number one equipment priority.

To meet these enormous challenges, we must maintain a sense of balance—a balance that places attention on our work and family priorities, and doing all that we do with a sense of purpose and humor. The teamwork we develop will help us speak with one voice for the engineer community and greatly enhance the effectiveness we will need in the demanding environment of the 90s.

We at the Engineer Center are committed to helping our Total Army "maintain the edge" during the transition to the smaller, quality force of the future. With your help, we will ensure engineers "Clear the Way" for this force, as we have for every force fielded by this nation since the founding of our Republic. Essayons!

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Cover photo: *Two armored combat earthmovers (ACEs) of the 9th Engineer Battalion move to their next objective during Operation Desert Storm (Photo by SFC Bob Crockett, VII Corps, Public Affairs Office).*

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The Engineer Role in Helping the Kurdish People

After the Desert Storm victory, coalition forces provided humanitarian support to the Kurdish people of northern Iraq through Operation Provide Comfort. The operation presented a unique set of challenges for participating military units—and especially for the U.S. 18th Engineer Brigade.

Deployed from Karlsruhe, Germany in April of this year, the brigade was part of Joint Task Force Bravo (JTF-B)—responsible for overseeing operations in northern Iraq. The brigade was given responsibility for all engineering in the region, and was headquartered in Zakho (see map).

In turn, the brigade controlled all coalition separate engineer units in the region. These units included the 94th Engineer Combat Battalion (Heavy) (ECB(H)) (US), the 133rd Naval Mobile Construction Battalion (NMCB) (US), the 51st Field Squadron (United Kingdom) (UK), and the 11th Engineer Relief Battalion (Netherlands) (NL). The 94th and 133rd were deployed from Darmstadt, Germany and Rota, Spain, respectively. The Dutch unit was a composite battalion created specifically for Operation Provide Comfort, and included an engineer company, a medical company, and a staff company.

Elements of the Air Force 564th Civil Engineering Squadron (Prime Beef), Air Force 39th EOD flight, Army 72nd EOD Detachment, 524th Special Team Royal Engineers (STRE) (UK), and 6th Field Squadron (UK) rounded out the tactical organization of the brigade. Due to a shortage of lift assets, it took about a month from the arrival of the brigade headquarters until all units had arrived in Iraq. The brigade task force eventually reached a strength of about 2,000 personnel from three countries.

Only organic engineer platoons remained under the control of their parent units. These elements were primarily used to provide combat engineer support to their higher headquarters, but were called on from time to time by the brigade to augment scarce engineer resources as the mission dictated.

The urgency of the mission at hand transcended language barriers and interservice rivalries.

By Colonel Stephen A. Winsor and Major Stephen D. Austin

The Kurds had to be moved out of the mountains on the Turkish border, relocated to transient camps and/or their homes, and their health and well-being ensured. So, despite the diversity of units under the brigade's control, cooperation and a sense of purpose were the rule rather than the exception.

After setting up operations, the brigade prioritized several primary engineer missions. The first and most difficult was to provide engineer command and control. This would enable the brigade to manage the construction of sufficient camps to handle the expected flow of displaced Kurds. These camps were located primarily in the Zakho valley, but camps were also planned just east of Zakho near Suri, and to the south, just outside of Dihok.

The second mission was to provide sustainment engineering for coalition forces in northern Iraq. This was a demanding responsibility, considering that troop units from six countries had to be supported. As JTF-B became a division-sized force with a troop strength exceeding 15,000 personnel, engineer support became critical.

The third mission was to manage real estate allocation and use, primarily in the Kakho area, where the bulk of JTF-B forces were located. With limited space and a plethora of units, this was no easy task.

An additional "be prepared" mission called for the brigade to provide mobility, countermobility, and survivability engineering for coalition forces should the Iraqi Army initiate an attack from the south.

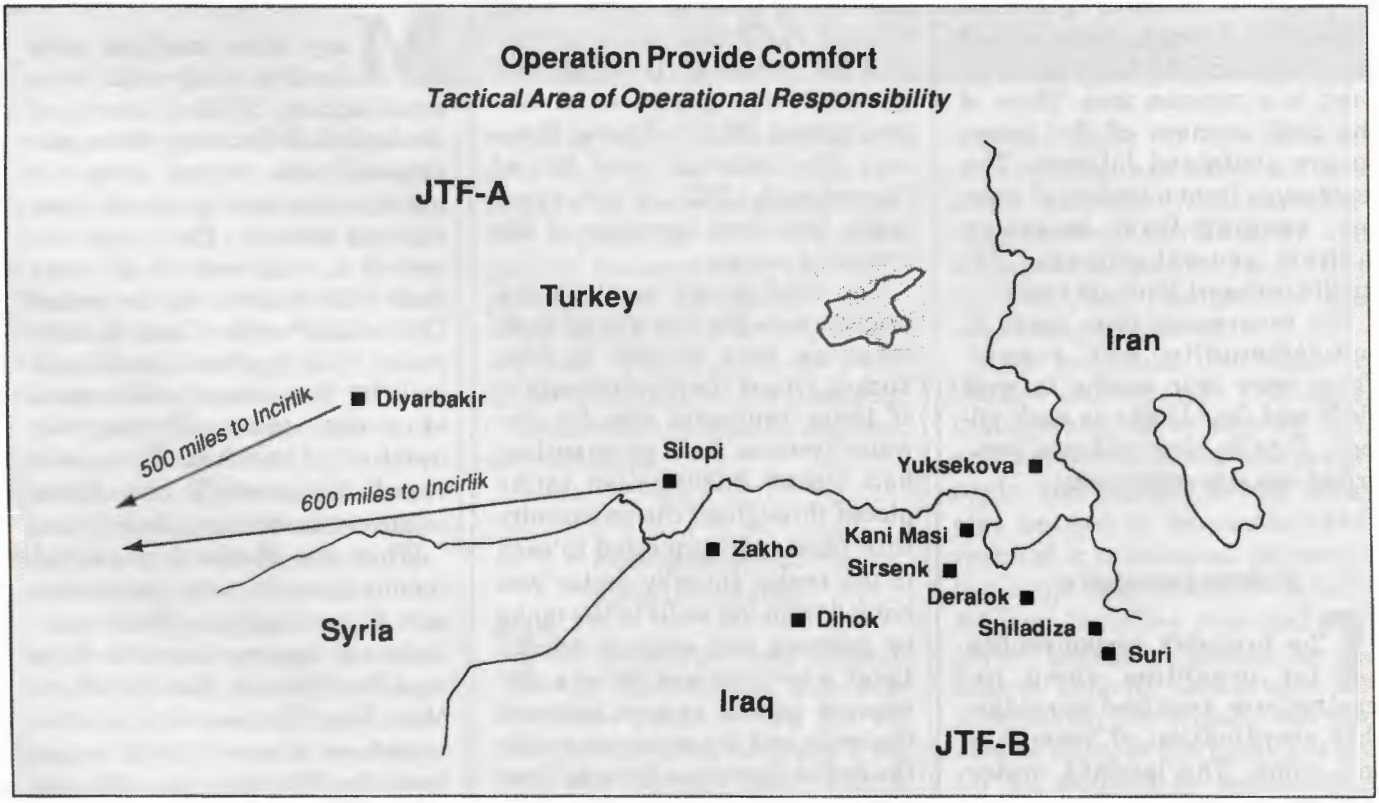
The humanitarian assistance mission was dynamic and evolved through several stages before the final concept emerged. All construction which supported the camps had to be adapted to the Kurdish lifestyle to ensure the facilities were accepted and used. From the start of the operation, professional relief experts advised us on important cultural and sanitary considerations for the Kurdish people.

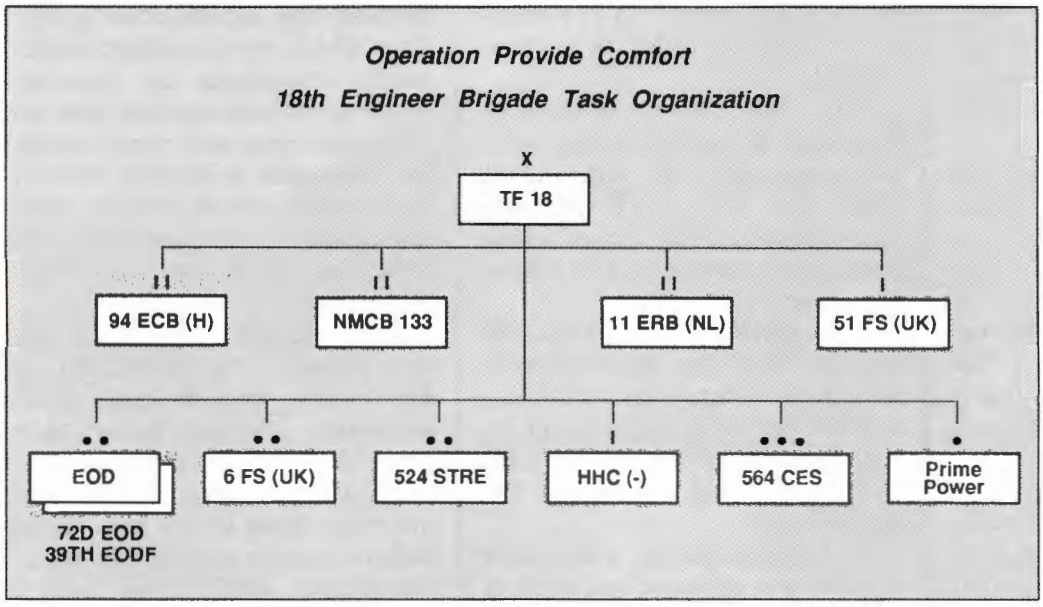
In response, the command devised five construction guidelines which were excellent benchmarks throughout the exercise. These guidelines directed that all infrastructure and construction be: adaptable to Kurdish culture, easily taken over by civilian relief organizations, temporary in nature, economical, and easily constructed.

Both cultural and religious customs had to be considered. Latrines, for instance, were designed to accommodate only one person at a time and were positioned to preclude the individual from turning his or her back to the east. While such restrictions made the construction projects less "efficient" from a purely engineering standpoint, they were well worth the effort when the Kurds moved in.

Originally, ten transient camps were planned, each capable of handling about 21,000 people. They were planned to be built in the Zakho valley area east of the city.

Each camp, covering about 1.5 square kilometers (km) was composed of a city center and five





sub-communities of approximately 4,200 people each. The city center handled food warehousing, health care, administration, security, engineering, and logistics services. The sub-communities were further divided into villages, blocks and "zozans"—or basic building blocks of the Kurdish community.

The zozan was designed to hold 66 people in 12 tents. The tents were set in a rough square with 3 tents to a side. All tents faced inward to a common area. Three of the four corners of the zozan square contained latrines. The tents came from a variety of sources, ranging from American military general purpose (GP) smalls to desert Bedouin tents.

The progression from zozan to sub-community was simple. There were four zozans to each block and four blocks to each village. Finally, four villages comprised one sub-community.

Infrastructure

The brigade's responsibility for providing camp infrastructure required considerable coordination of resources and effort. The latrines, water system, and food warehouse facilities were contracted through TUSEG (The United States Army Engineer Group of the Europe District of the U. S. Army Corps of Engineers). Representatives of TUSEG worked with the construction management section of the brigade to provide quality assurance of contractor operations. TUSEG also assisted in coordinating with the United Nations High Commission for Refugees (UNHCR) and various non-government organizations (NGO). Among these was the International Relief Commission (IRC), which eventually took over operation of the transient camps.

The contractors used by the brigade were Turkish and all their materials were brought in from Turkey. One of the most important of these contracts was for the water systems. Each camp system had eleven 6,000-gallon tanks placed throughout the community with tapstands connected to each of the tanks. Initially, water was hauled from the wells to the tanks by military and contract trucks. Later, a contract was let for a permanent piping system between the wells and the water tanks. By the end of Operation Provide Comfort, permanent piping systems were constructed in two camps.

Another major contract was the fabrication and erection of latrines. While contractors were initially responsible for construction of the latrines, the heavy influx of displaced Kurds soon outdistanced the number of latrines. Troops were used to expedite construction, averting a potentially life-threatening health and sanitation problem.

Each camp required a minimum of 960 latrines, and latrines were constructed for three complete camps. The latrines generally consisted of an augered hole, plywood base, concrete baseplate, sheetmetal roof, door, walls, and a vent stack. Although not visually attractive, they served their purpose well.

Troop Construction

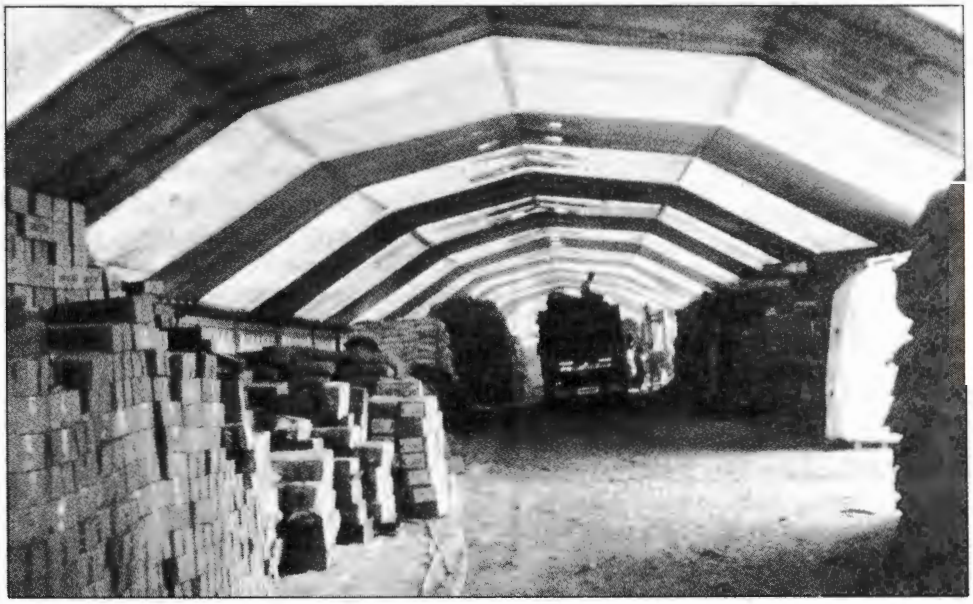
Many other missions were handled solely with troop construction. Soldiers surveyed the layout of the camp sites, constructed roads, erected tents, and put up contractor-procured fencing and lighting. Each camp required a road system of more than 9,000 meters. By the end of Operation Provide Comfort, complete road systems had been built for four camps, and a total of seven camps throughout northern Iraq had been surveyed. Fortunately, only three camps were ever occupied.

When the Kurds first started coming down from the mountains, one of the highest priority missions was the improvement of the road from Umzulu, Turkey to Kani Masi, Iraq. This was critical to the movement of over 130,000 people from the Cukurca and Umzulu



Top: **A Kurkish transient camp in the Zakho valley area. Each of the camps was capable of handling 21,000 people (U.S. Army photo).**

Right: **One of the food warehouses set up as an integral part of each transient camp's city center (U.S. Army photo).**



refugee camps back to their homes in Iraq. In fact, it was the only road from these two camps back into Iraq. The job was accomplished expeditiously by Seabees of the 133rd NMCB, who worked on more than 25 kilometers of unimproved roads for more than two weeks.

Humanitarian assistance took on many forms other than camp construction. These included construction of hospital administration areas, school furniture, construction and erection of playground equipment and the construction of storage facilities for CARE and the IRC. These projects were carried out as engineer assets became available. Over 300 sets of school furniture, including chairs, desks and tables, were built by the 18th Engineer Brigade. As the word got out that the engineers could provide quality construction, the nongovernmental organizations kept carpenters busy with numerous requests. These products were destined not only for the transient camps, but for villages throughout northern Iraq.

Sustainment Engineering

The second primary mission for the brigade was sustainment engineering for all coalition forces in northern Iraq. This was no easy task, with a tactical area of operational responsibility exceeding an area 250km by 80km. While construction standards were austere and units used abandoned Iraqi Army facilities when possible, the task was still monumental.

Each individual unit required latrine and shower facilities. Protective berms for aircraft, fuel, and ammunition storage areas, roads, and logistics storage areas also needed to be constructed, repaired or maintained. Moreover, two large hospitals and multiple medical facilities required continual engineer support. As the higher priority tasks were accomplished, the brigade was also able to improve the quality of life for all soldiers by constructing

numerous articles of miscellaneous furniture.

When tallied up, the brigade maintained over 225 kilometers of main supply routes (MSRs) and local highways for more than 45 days. It constructed over three kilometers of 10 to 15-foot-high POL and aircraft protective berms, and built numerous latrines, showers and other facilities. The brigade was also in the water supply business, as the 133rd NMCB and 51st Field Squadron (UK) contained organic water supply units.

Sirsenk Airfield

One of the brigade's high-profile sustainment engineering missions was returning Sirsenk Airfield to an operational status. Sirsenk Airfield was approximately 50 kilometers west of Zakho and—until Desert Storm—was under construction by Saddam Hussein's forces to service his palaces in the area. It was bombed by the coalition air forces and sustained heavy crater damage during the war.

The brigade tasked the Air Detachment of 133rd NMCB, augmented by an earthmoving platoon from the 94th ECB(H) to create a C130-capable airstrip from the remains of the airfield. This was accomplished in approximately 6 days. Abandoned Iraqi construction equipment at the airfield, particularly dozers, was used to augment scarce heavy engineer equipment. Twelve large craters and numerous smaller ones were filled and compacted to create an 80-foot by 5,000-foot airstrip.

Airfield repair operations also included laying geotextile fabric in two craters to preclude drainage problems. The fabric was flown in from existing stocks at Incirlik AFB, Turkey. This combat strip proved its worth, allowing airlift operations for more than 60 days, sometimes handling up to eight flights a day.

As resources became available, the brigade was also able to pursue a number of civil affairs assistance projects to aid the local Iraqi population. Most of these projects worked toward improving the electrical or water systems in the area.

Two Corps of Engineers prime power experts, called in from Saudi Arabia, were instrumental in providing power to the Zakho hospital. They repaired the hospital generator, which operated more than 45 days while domestic power was restored. This same two-man team, working with electrical experts from the 133rd NMCB and 524th Special Team Royal Engineers (STRE) (UK) were solely responsible for reestablishing domestic power to over half of the city of Dihok (population: 250,000-plus). Their efforts provided power to seven city water wells, the Dihok city hospital, and the Dihok dam, which provided water to many parts of the city. Ironically, the Iraqis initially did everything they could to stall the electrical team's efforts. But after seeing the results of their work, they did not want the team to leave Dihok.

Dihok

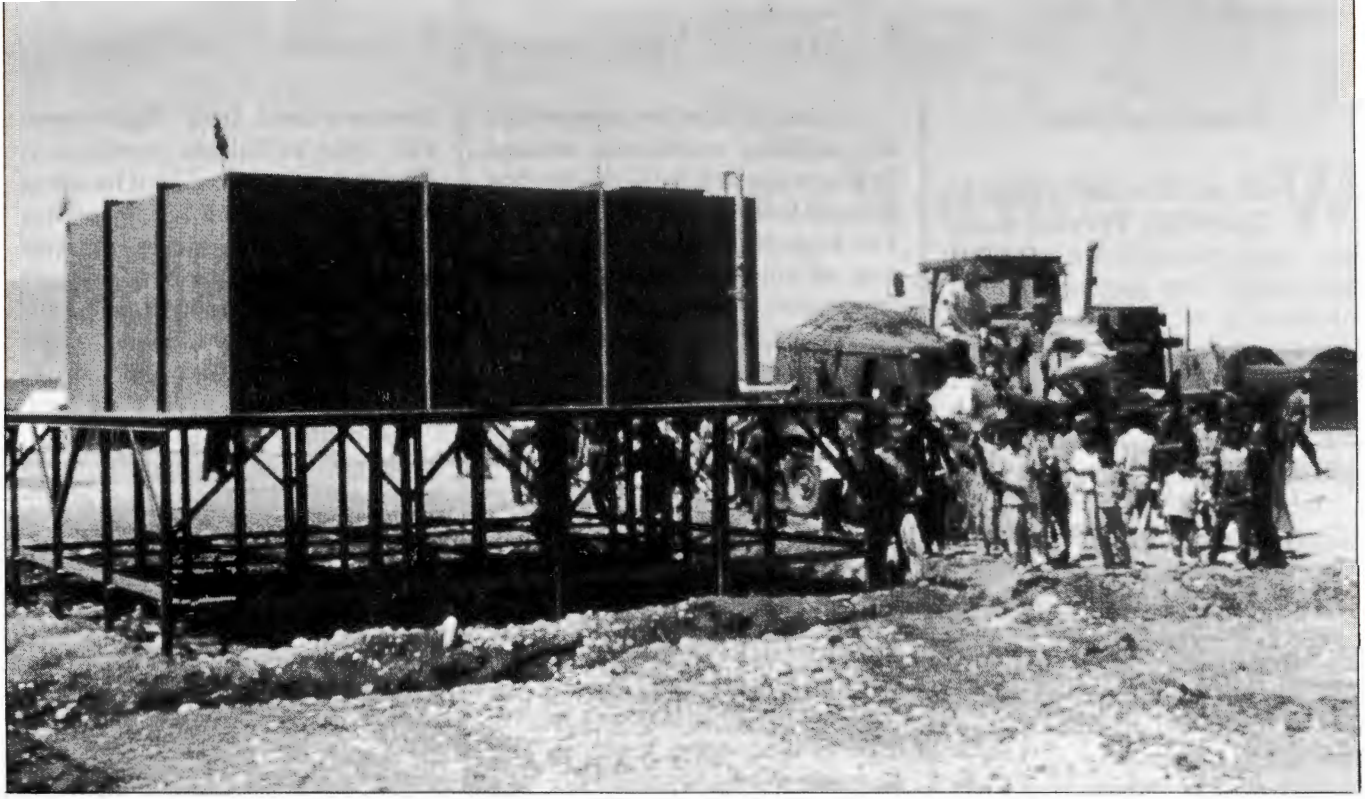
Engineer operations in the city of Dihok proved to be one of the most interesting and valuable contributions to the entire support mission. Dihok is the largest northern city with a substantially Kurdish population. As such, it holds great emotional significance for the Kurds. Many Kurds who lived in and around Dihok waited in camps for coalition forces to bring the city into the security zone.

But Dihok also held great political significance for the Iraqi government. The government indicated that it would not move Iraq military and police forces out and allow coalition forces into Dihok as it had done in Zakho and locations to the east. As negotiations stalled, the lack of a sense of security within the city stalled the return of displaced Kurds to their homes. Coalition negotiators finally convinced the Iraqi government that it would be in their best interest to accept a non-threatening assistance team made up of coalition soldiers with special skills to "help" them restore basic services to the city.

A team of approximately 100 soldiers, consisting of engineers, explosives specialists, medical personnel, civil affairs experts, and military police was allowed into Dihok to begin a very visible period of assistance. Seeing the coalition soldiers dispersed throughout the city convinced the Kurds that the city was safe, and they began returning to the city by the thousands each day. As the city came to life, the soldiers were replaced with a small UN security police force, along with private relief organizations. Because of the special skills they possessed and their very visible presence, the engineers and other soldiers on the team were able to accomplish what might have taken thousands of combat soldiers.

Water

Water was a constant problem and much effort was addressed to supplying the local population with safe and adequate supplies. Toward this end, four wells in the Zakho valley were put into service to supply the transient camps and the local population. These wells were activated primarily by bringing in new pumps and generators. The 133rd NMCB also accomplished a first for Iraq when they successfully drilled a 250-foot well in Deralok, providing 60 gallons of water per minute to coalition forces and local citizens.



Kurdish children gather around a water storage tank built by the engineers (U.S. Army photo).

The wells, along with siting and locating fourteen 6,000 gallon tanks throughout the sector, made a considerable impact on alleviating water problems in Kurdish settlements throughout northern Iraq.

Munitions

The unusual unit diversity within the brigade task force led to missions not usually encountered by the 18th. The 39th EOD flight, 72nd EOD Detachment, and EOD teams from the 11th EN BN (NL), removed and destroyed over 3 million pounds of Iraqi munitions while in northern Iraq. Confiscated munitions ran the gamut from small arms ammunition, rockets, grenades, and mines, to mortar rounds and large projectiles up to 152 millimeters (mm).

These munitions, manufactured in several countries, were strewn everywhere. Many times, coalition soldiers had to take items of ammunition from Kurdish children. Ammunition of every description was left in almost all positions formerly occupied by the Iraqi soldiers.

Minefields were also prevalent throughout the area and were a constant danger, but as little as possible was done about these obstacles to preclude risk to coalition personnel. Coalition forces were tasked with marking minefields, but mines were not removed unless they presented a direct hazard to coalition forces. Fortunately, mine neutralization proved to be necessary in only a few cases.

Combat Engineering

On at least one occasion, the brigade served as a combat engineer unit. The JTF-B commander was concerned about the possibility of an Iraqi attack as coalition forces expanded the sector south to Dihok. Accordingly, the brigade provided combat engineer planning and prepared for this contingency by task organizing elements of the 94th ECB(H), 133rd NMCB, and 51st Field Squadron (UK) into a provisional organization under the brigade S-3. This organization was prepared to support the 24th MEU and 3/325 Infantry by constructing obstacles and building fighting positions. Engineer platoons organic to the 3/325 and 24th MEU would support their own units in conjunction with brigade task force elements.

The construction of obstacles was complicated by the lack of munitions and the nature of the terrain. An obstacle trace was devised, consisting of hand-placed point minefields, short tank ditches and bridge destruction. The obstacles were sited on high-speed avenues of approach. Point minefields were necessarily small as the only mines available in the area were captured Iraqi mines. Because of the shortage of dozers, tank ditches were designed to be short and were sited only in the vicinity of roads. Lastly, since there were few bridges in the sector, destruction of identified bridges did not overtax critically short engineer assets and available demolitions. Road craters would have been ideal in many locations. They were planned but not executed for lack of suitable charges.

Observations

With all the challenges in Operation Provide Comfort, many valuable observations were noted. One that we seem to continually relearn is that engineers need to deploy very early—and in sufficient strength to do the job. Initially, only the Air Detachment of the 133rd NMCB and B company (minus heavy equipment) of the 94th ECB(H) were on the ground. Even these two companies would have made a tremendous difference and been more fully employed if they had arrived a week or more earlier. Eventually, the brigade built up enough strength to handle all missions.

However, during the critical early stages of the operation, more engineers were badly needed. In order to make this happen, better contingency engineer packages need to be developed. These packages must be capable of being quickly tailored to meet specific needs, be able to deploy rapidly by military aircraft, and be able to sustain and protect themselves for at least 30 days. Small dozers, SEEs (small emplacement excavators), graders, and forklifts are critical to these packages. The brigade is now in the process of developing such packages for future missions.

The mix of engineer forces is important. The organic combat engineer forces that arrived with the combat elements were not adequate to satisfy all the combat engineer missions. Although operations in northern Iraq were humanitarian in nature, mobility, countermobility, and survivability missions were very real. The 18th Engineer Brigade undertook the planning and execution of these missions, but lacked mine detection and clearing capability. For future contingency missions, a mix of engineer capabilities should be tailored to respond to possible engineer missions.

Our lack of local experience and the austere conditions around Zakho made the local contracting process both difficult and critical. The brigade learned very quickly that an efficient, on-site contracting capability is almost a necessity. We depended on the established Corps of Engineers apparatus, but the distance from Incirlik to the brigade was over 600 miles and less-than-desirable communications hindered the process.

A contracting cell, co-located with the brigade headquarters, would have greatly enhanced our ability to better tailor the contracts to the situation at hand and quickly locate and procure engineer construction materials. It is unrealistic to expect a contingency engineer force to move in and establish its own contracting capability. Locating a local expert with the engineer headquarters on the ground seems to be the answer.

Engineer materials were a problem. Class IV was slow to arrive and even upon arrival, high priority humanitarian needs in Iraq competed with low priority needs—such as tent floors— farther to the rear in the supply system. The brigade established a central construction material yard in Zakho to control all class IV in northern Iraq. Run by experts—the 6th Field Squadron (UK)—the yard worked flawlessly, but was at the whim of a slow and non-responsive supply system. Only a dedicated crew of contracting "expediters"—scroungers if you will—kept the brigade alive in terms of real-time mission accomplishment.

These actions should not have been necessary. Local-purchase authority is absolutely necessary for any engineer organization on a contingency mission. Elimination of the diversion of engineer material in the supply system can only be done by bringing it to the attention of the tactical commander.

Other problems encountered by the brigade came from splitting the brigade headquarters between Germany and Iraq. There were still four battalions working in Germany which could not be left to operate independently. This necessitated dividing each staff section in order to best support both operations. The headquarters, of course, is not structured or resourced to operate in this manner.

Difficulties arose from the almost exclusive "European" focus and mature-theater mission of the brigade. Equipment presumed to be adequate in the European environment—especially communications equipment, MHE, and haul assets—proved to be inadequate for operations in Iraq.

The Main Lesson

But the main lesson to be learned was that dedicated, well-trained, spirited engineers—regardless of their country or branch of service—adapt very well to the situation at hand and routinely perform miracles. If we did not know that before Operation Provide Comfort, we know it now.

Colonel Winsor is commander of the 18th Engineer Brigade. He previously served as commander of the 547th Engineer Combat Battalion, and executive officer of the 54th Engineer Combat Battalion. He is a graduate of Command and General Staff College and the Naval War College. He received his commission from the U.S. Military Academy. He is a registered professional engineer in Virginia.

Major Austin is S-3 plans officer for the 18th Engineer Brigade. He previously served as assistant resident engineer for the South Dakota District Office of the Corps of Engineers. He has also served as a company commander with the 82nd Engineer Combat Battalion. He is a graduate of Command and General Staff College. He was commissioned from the U.S. Military Academy. He is a registered professional engineer in Virginia.

What Are You Worth?

As the Army begins to build down, many in my year-group (1981) are feeling the anxiety of waiting two years for our promotion board. Many officers and noncommissioned officers (NCO) I know, especially those who "missed" the Gulf War, are wondering if they will survive the coming cuts. While Congress worries about taking a little more time to make the cuts, some of us just worry.

One day you may get the word, a quick personal meeting with your commander, closed door, somber: You were not selected for retention (reduction in force (RIF) scenario). Perhaps it's even more personal: You were passed over for promotion, not selected (very low selection rate scenario). A lot of good soldiers will hear words like those in the next few years. It's a shame, but how else can the Army cut 25 percent of its force? Somebody has to go.

So now what? How do you react? What is the "right thing" to do? Let me offer some suggestions and propose a reality check for your perspective.

Assess. During the eight, ten, twelve, or more years spent serving your country, you have learned a lot. What is in your head is of great value. What is in your heart is of even greater value. Professional (mid-career) officers and noncommissioned officers are leaders. They are responsible for the lives, training, discipline, care, and development of people.

You may not be a Dale Carnegie graduate, but you are a people person. You get things done through the direction and leadership you provide to others. That skill and experience are of enormous value. Just because the Army has a smaller need does not diminish your inherent value. Pick up your chin and think for a moment.

Prior to active duty I was a project engineer for a small, heavy highway construction firm. Let me tell you what most employers really want: capable, flexible, trainable, dependable people who are honest, hardworking, and willing to accept and bear responsibility. They want mature people who are ready to work, prepared to deal with life and get the job done. They want men and women who know and understand people and know how to direct, lead, and motivate them. And, they want people who are at least as interested in the company as they are in themselves. Those descriptions sound like a good company commander or top-notch NCO to me. If you take a close look at your experiences with people, getting tough jobs done, going the extra mile for someone or for the mission, you begin to get the picture. You probably are worth much more than you thought.

Accept. The experiences of being fired once and laid off once taught me a basic lesson: Other people do not dictate my personal self-esteem. The Army's need to drawdown should not dictate your self-esteem either. When you go job hunting, some places won't want you, and others may not need you. Life is often that way. But remember that the Army gave you another important asset: an understanding of justice, human dignity, and personal rights.

The work environment in the private sector may differ greatly from that in the Army. Not every business is as color or gender blind as the Army. Not every boss rates on performance and merit alone, and promotions sometimes go to less qualified people. The U.S. Army holds the unique distinction of living out the promises of our constitution for every service member. Such is not always the case on the "outside."

This is where you can make the most difference. Take the lessons of personal integrity, honesty, fairness, and justice with you. Of all the values you have learned, those are the most important.

Act. Many good soldiers will take a multitude of valuable skills into the private sector in the next few years. If you are invited to take up another occupation, view it as just another opportunity in life. By no means view it as a measure of your value as a person or a soldier. Get ready for it. Deal with it, and then get on with your life. Take the pride and values of the U.S. Army into the private sector and show the people who work with you and for you how good you really are.

There is a trade deficit to erase, products to improve, services to fine tune, new technologies to develop, and another generation of young Americans to educate. We have drugs to fight, crime to control, people who need help. Who can do these jobs better than a soldier, than an Engineer soldier!

CPT Brannon is an analyst for the U.S. Army Engineer School. Previous assignments include platoon leader, DEH operations and executive officer, assistant S-3, and company commander. CPT Brannon is a registered professional engineer in Texas.

THE BRIGADE DELIBERATE BREACH

By Major Greg S. Kuhr and Major John F. Antal

For units undergoing Desert Storm preparation at the National Training Center (NTC), the greatest challenge was breaching Iraqi-style complex obstacles.

The obstacle developed at the NTC was about 500 meters (m) in depth. It consisted of a belt of buried anti-tank and anti-personnel mines, supplemented by a tank ditch and several wire obstacles. The infantry trench was approximately 200m behind the last minefield. The whole obstacle was supported by fighting positions for tanks and anti-tank weapon systems. Such a formidable defense, when properly employed by the enemy, can be penetrated only by a well orchestrated deliberate breaching effort.

This article describes how a brigade, as part of a heavy division deliberate attack, can synchronize a deliberate breach of a complex obstacle and trench line. While the model used in this study is based on Iraqi doctrine, the principles apply to all deliberate breaching operations.

The primary reference for this article is FM 90-13-1, *Combined Arms Breaching Operations.*[1] This manual identifies four fundamentals used for achieving synchronization during deliberate breaching operations:

- Detailed reverse planning.
- Clear sub-unit instructions.
- Effective command and control.
- Well rehearsed forces.

Reverse Planning

Planning for a deliberate breach begins with a thorough mission analysis. The commander and his staff must determine the following:

- Purpose of the higher headquarters' mission.
- Intent of commanders two echelons up.
- Specified, implied and essential tasks to be performed.
- Assets available.
- Constraints and restrictions.
- Degree of risk involved.
- Analysis of available time.

After completing the mission analysis, the commander should give a warning order, and give the staff his guidance. The staff then develops courses of action, analyzes each one, and presents them to the commander. After he makes his decision, the order is prepared and issued.

The reverse planning technique assists the staff during this process. Reverse planning will "ensure that actions at the obstacle support actions on the objective."[2] This technique requires that the commander and his staff have a full understanding of the organizations that are required for breaching operations.

Breaching Organization

Once the brigade commander has determined (by analyzing relative force ratios) that the breaching operation is beyond the capabilities of a single or reinforced battalion task force, he must task organize to conduct a brigade deliberate breach. The brigade should give specific support, breach and assault roles to appropriate subordinate task forces. Forces are allocated for each mission using a force ratio analysis.

The Support Force. The support force mission should be assigned to an armor heavy task force. The mission of the support force is to destroy the enemy's ability to interfere with the obstacle reduction operation. It does this by winning the direct fire battle over the breaching area, controlling



An armor unit practices breaching operations at the NTC. Complex obstacles, when properly employed by the enemy, can be penetrated only by a well orchestrated effort (U.S. Army photo).

indirect suppressive fires, and obscuring the breach site from enemy observation. The support force also secures the area of penetration with fire prior to deployment of the breach force. (While securing the breach site by infiltrating into the trench is an option, it is generally not feasible because of the depth and complexity of such obstacles).

The support force should deploy into an attack-by-fire position that is within the range of its direct fire suppressive weapons. For tanks and infantry fighting vehicles, this means that the support force must be within 1,500m to 1,800m of the trench line. To accomplish this, the support force must attack using a "creeping" overwatch from successive attack-by-fire positions starting at 3,000m. Once the breach force is deployed, the support force must continue to isolate the breach site from enemy fires.

The Breach Force. The breach force mission should be assigned to a balanced or infantry-heavy task force. The majority of the brigade's breaching equipment should be assigned to this force. The mission of this task force is to provide secure passage lanes for the brigade assault force and clear the enemy trench line. The force must be a combined arms team capable of executing all of the breaching fundamentals: suppression, obscuration, security and reduction (SOSR). When faced with a complex obstacle defended by an infantry trench line, the breach force is organized into the following sub-units:

- A support team to provide local suppression.
- A breach team to reduce the obstacle.
- An assault team to secure the breach site by attacking the enemy in the trench line, and blocking possible enemy armored counterattacks.

Depending on the availability of forces, the task force may designate company teams to play more than one role in the breaching operation. For example, a portion of the support team may be designated as an assault team once a breach lane is established. (To avoid confusion in terms, refer to all of the breach force's subunits as teams.)

The breach team is built around breaching assets (armor and engineer). Armored breaching assets (mine-roller tanks, mine-plow tanks, combat engineer vehicles, armored vehicle launched bridges, and armored combat earthmovers) are critical because of their survivability. Explosive breaching using mine clearing line charges (MICLICs), and manual breaching done by sappers and designated infantry units, complement the armored breach. The assault team should be infantry-heavy in order to clear a defended trench line. The support team should be balanced with armor and mechanized infantry in order to suppress and destroy all of the enemy's direct fire systems.

The Assault Force. The assault force is either

balanced or infantry heavy. The brigade may designate one task force as the breach/assault force if the brigade has only two task forces. The mission of the assault force is to pass through the breach lanes and seize defensible terrain 1,000m to 1,500m on the enemy side of the penetration. The assault force then defends against enemy counterattacks, giving the brigade time to pass forward the support force or other follow-on forces. These follow-on forces continue on to seize the brigade objective.

Other task forces should be designated by division headquarters to exploit brigade penetrations of the enemy obstacle belt. These forces should have an on-order mission to be the division main effort once a brigade breach site is secured. These follow-on forces maintain the tempo of the attack by passing through the breach and seizing the division objective.

Reverse Planning Sequence

Deliberate breach planning should take place in the following order:

(1) Actions on the objective: The "who, what, where and when" must be determined for the far side of the enemy obstacle and trench line. This will focus the size, composition and missions of the assault force and the number of breaching lanes required to support it.

(2) Identify potential enemy vulnerabilities: A METT-T (mission, enemy, terrain, troops available, and time) analysis, based on the situation template, should be conducted to determine where the enemy may be vulnerable to attack. Typical opportunities include sites lacking protection of the enemy's mobile reserves, enemy positions lacking adjacent unit supporting fires, seams between units, and defensive positions supported by weak obstacle systems.

(3) Select breach sites: Primary and alternate sites are planned, then finalized after considering the results of silent breach teams, direct reconnaissance, or the support force commander's observations. The brigade must allocate sufficient company/teams to the breaching task force to clear lanes through the obstacle belt, fight and win the trench battle, and hold the breach site until the assault force can pass through. The breach force should organize its company/teams into breach, support and assault teams.

(4) Determine support force requirements: The support force is balanced with long-range anti-tank systems and infantry weapons that will enable it to win the direct fire battle at the breach site. The force should use a combination of tank fires and heavy machine gun fire to suppress enemy infantry in the trench system. The same fires will also isolate the breach sites once the breach force moves forward to conduct the breach.

(5) Development of scheme of maneuver: Commanders and staffs develop task organizations, unit missions, and other plans to support the requirements identified above.

Clear Subunit Instructions

Subunit commanders must understand exactly what is expected of their forces. If the support force does not win the direct fire battle over the point of penetration, the breach force will be jeopardized. Likewise, if the assault force is committed prior to the establishment of secure lanes, it could dissipate its combat power by having to fight through the obstacle lanes. Each subordinate commander must understand the interdependence of the breach, support and assault forces (and teams). They must understand each force's mission and how each successful mission develops the commander's decision making. Clear subunit instructions include the following:

Phase	*Co-located Command Groups*
1. Movement to the obstacle	Brigade command group and support force commander co-locate in vicinity of support force's attack-by-fire position.
2. Breach of the obstacle	Brigade command group and breach force commander co-locate to observe breach lanes.
3. Assault the defending enemy	Brigade command group accompanies assault force commander through the obstacle.
4. Continue the attack	Brigade command group accompanies the main effort.

These instructions must define the measure of success. For example, the support force is successful when the enemy can no longer place effective anti-tank fires on the breach sites because of destruction, suppression or obscuration. The breach force is successful when it has at least one secure lane through the enemy obstacle belt and has cleared the trench line in the near vicinity of the lane. The assault force is successful when it has destroyed the enemy's ability to place effective anti-tank fires on the intermediate objective on the far side of the obstacle.

The instructions must limit the responsibility of each subunit. The support force's suppression and obscuration mission should be limited to a specific breaching area. This enables the force to achieve

sufficient mass to overwhelm the enemy's direct fire systems at the breach point. The breach force should be limited to clearing two lanes—the obstacle belt and the trench line—all within a well defined breach objective. The assault force should be limited to racing through the cleared lane and seizing a defensible terrain feature on the far side of the enemy trench line.

Lastly, the subunit instructions must clearly address the timing of the operation. This timing is determined more by events than by designated times. The breach operation must be quick, thereby limiting the force's exposure to enemy fires. The plan must address the timing of obscuration fires to preclude interference with suppressive fires. The breach and assault forces must be committed as early as possible, but not before the enemy's antitank fires are rendered ineffective at the breach site.

Effective Command and Control

Command. Effective command is critical to successful breaching operations. For a deliberate breaching operation, the commander must be far enough forward to see the breach sites. His command organization can play a vital role in this effort.

Field Manual 71-3, *The Armored and Mechanized Infantry Brigade,* stipulates that "the command group moves to a position that allows the commander to observe the battlefield, issue appropriate orders at critical times, and influence the battle with his personal presence."[3] For a brigade deliberate breach, that position is clearly one that gives him a good view of the planned breach site. Additionally, since this operation involves several units passing through each other, the co-location of command groups is critical. Here is the recommended co-location of command groups for each phase:

Depending on the location of the task force commander, the task force tactical operations center (TOC) may substitute for the task force command group. Terrain, communications and security must also be considered when deciding the best way to co-locate command groups.

While the brigade command group is co-located with the task force command groups, the brigade tactical command post (TAC) has four primary missions:

- Assist in the implementation of the commander's decisions.
- Serve as a backup should the brigade command group become ineffective.
- Control movement of units into the crossing area.
- Continue to synchronize combat operations, combat support, and combat service support for the close fight.

Traffic Control. The crossing area should be defined by release lines on each side of the obstacle. The crossing area is initially limited to the friendly side, and is extended as the assault force secures the far side. A far side release line should be planned to provide sufficient space for the assaulting task forces to deploy into attack formations.

Until the brigade has secured its objective, it must manage unit movement into the crossing area and across the obstacle. Movement control is passed to the brigade main command post prior to passage of the battalion task force field trains or follow-on brigades. Before the main command post can accept control of the crossing area, it must be in a position to effectively control the area and communicate with units.

During the first three phases of the operation, brigade main command post missions include executing the deep operation, tracking the close fight, coordinating combat support and combat service support requirements, and planning future operations. When the objective is secured, control of crossing operations for the remainder of the brigade should pass from the brigade TAC to the main command post.

A brigade crossing plan must be developed to control this part of the operation. The brigade S-4, assisted by the MP platoon leader, can organize a temporary traffic control cell at the brigade TAC to control movement through the crossing area. Once control is passed to the brigade main, this traffic control cell can relocate to the main command post.

The brigade commander should designate an officer, initially the brigade S-3, then the XO, to control the movement of forces through the crossing area. The brigade plan should detail the transfer of obstacle lane control from the breach force to the crossing area commander. This delegation of responsibility to a crossing area commander frees the brigade commander to concentrate on forward battlefield leadership. The crossing area commander controls:

- Movement and positioning of all elements transiting or occupying positions within the crossing area.
- Security elements (i.e., maneuver, air defense) at crossing sites.
- Support forces such as engineers, military police, and chemical units within the crossing area.

If the brigade is supported by an engineer

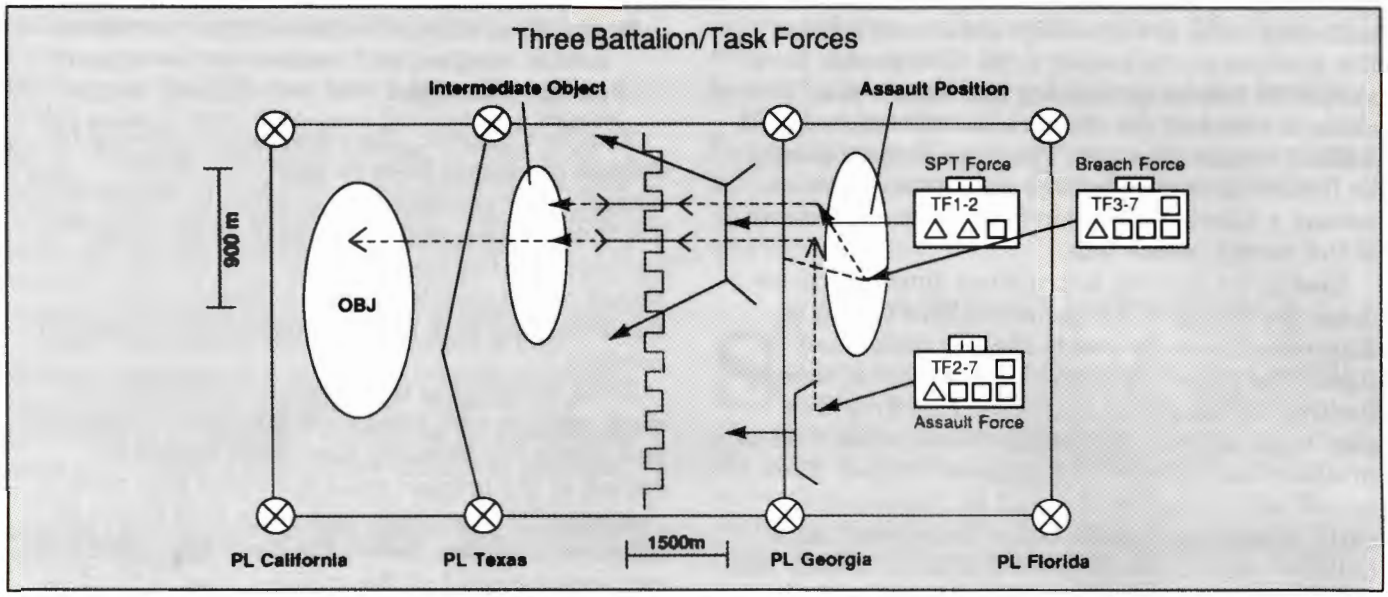


Figure 1

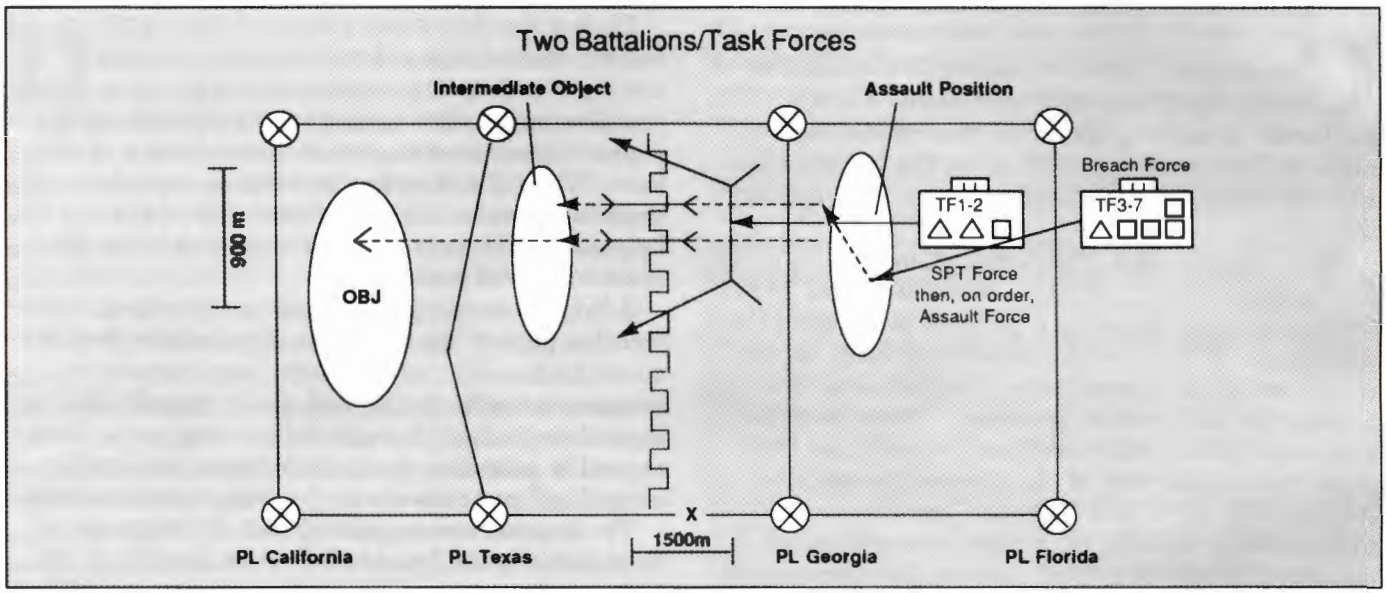


Figure 2

battalion, the engineer battalion commander should be designated as the crossing area engineer. He reports directly to the crossing area commander and is responsible for:

- Developing an engineer support plan, which recommends the combined arms battle drills needed to reduce the obstacle, allocation of armor and engineer breaching equipment, lane marking, and plans for improving/increasing assault lanes.
- Tracking the progress of obstacle reduction and advising the commander when changes in the plan are needed.
- (On behalf of the crossing area commander), assuming control of breach sites from the breach force commander as soon as possible after the sites are secured. Duties include keeping the lanes open, improving the lanes, and advising the crossing area commander of their condition.

Initially, the breach force is responsible for traffic control through the breach sites. The breach force must designate a breach site commander for each lane to control movement through the lanes. Site commanders should be company executive officers or platoon leaders whose responsibilities include:

- Maintaining cleared and well marked lanes.
- Establishing traffic control posts (TCPs) to guide units through the lanes.
- Reporting any lane closures to the breach

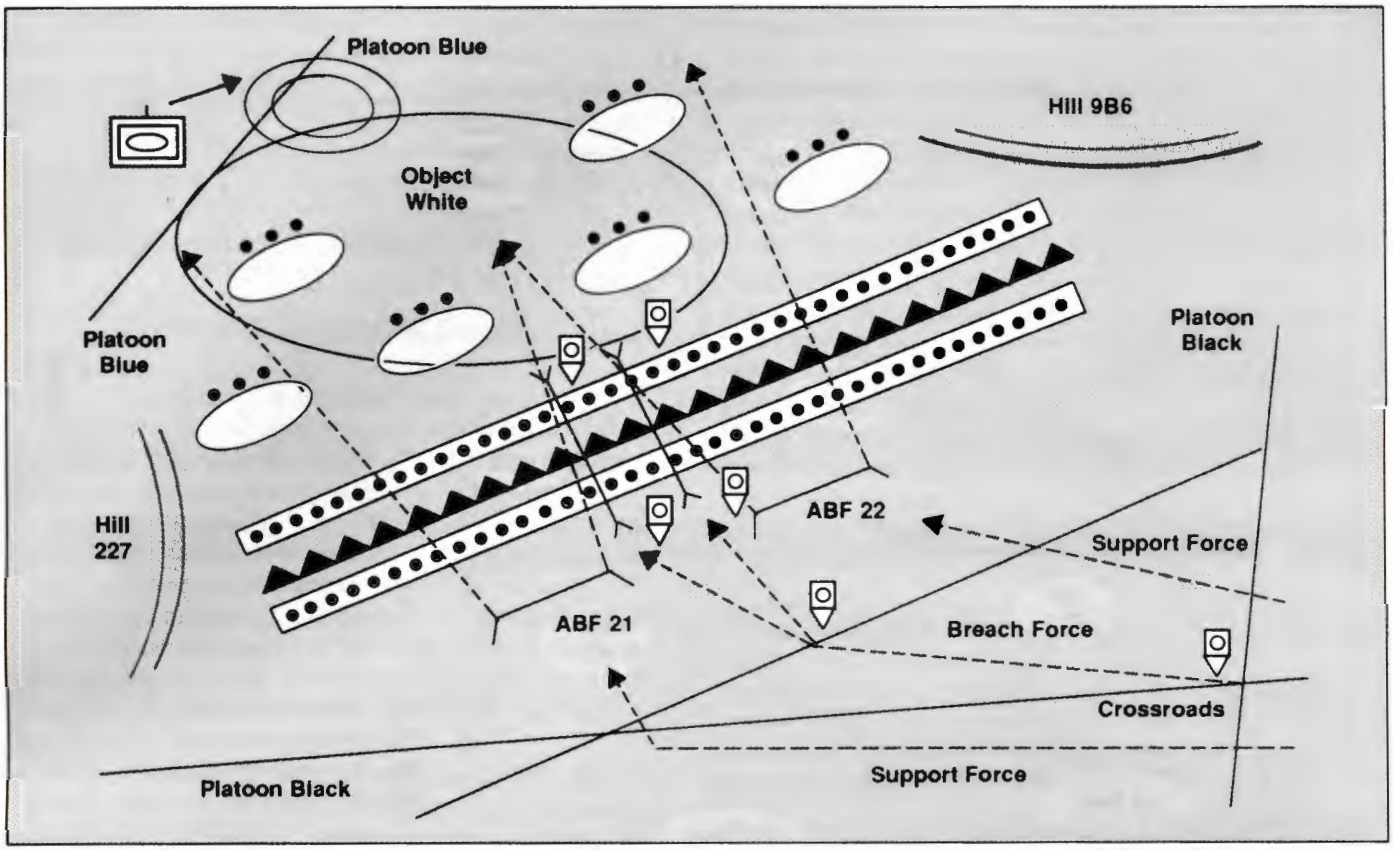


Figure 3

team commander (who in turn reports to the breach force commander).

The crossing area engineer should assume control of the breach sites as early as possible in order to begin lane improvements. Military police should quickly assume traffic control responsibilities from the breach force to facilitate an increase in the number of TCPs and to improve necessary route markings. Once relieved of these duties, the breach force can consolidate and prepare for follow-on missions.

Graphic Control Measures. Graphic control measures are established to facilitate cooperation between units without imposing unnecessary restrictions on the freedom of subordinate unit leaders. The minimum graphic control measures can be displayed three ways: the brigade operations overlay showing the overall brigade concept, a large-scale sketch to graphically portray actions at the obstacle, and a movement control overlay for traffic control within the brigade zone. Here are some examples of each of these:

Figures 1 and 2 show the minimum information to include on the brigade operations overlay:

- A direction of attack or axis of advance from the assembly area to the obstacle and beyond for the support, breach and assault forces.
- Location of assault positions where the assault force or other task forces will locate prior to commitment through the obstacle lanes.
- Primary planned breach lanes.
- Location of the support force attack-by-fire positions, with arrows extending over the range and direction of the direct fire systems.
- Intermediate and final objectives for the assault force and for any follow-on task forces.
- Phase lines and release lines.

If the brigade has a contingency plan to attack in a different location, the same graphics are required, but are drawn with dashed lines.

Figure 3 depicts the brigade's plan for actions at the obstacle. This is accomplished with a sketch map of the obstacle area. It's not possible to show this level of detail on a 1:50,000 overlay. At a minimum, the sketch should have the following information:

- Approximate locations of recognizable terrain features in the area.
- Location of enemy platoons in the main defensive belt and any reserve forces which could interfere with the breaching operation.
- Planned breach lanes.
- Support force attack-by-fire (ABF) positions, with arrows showing the range and direction

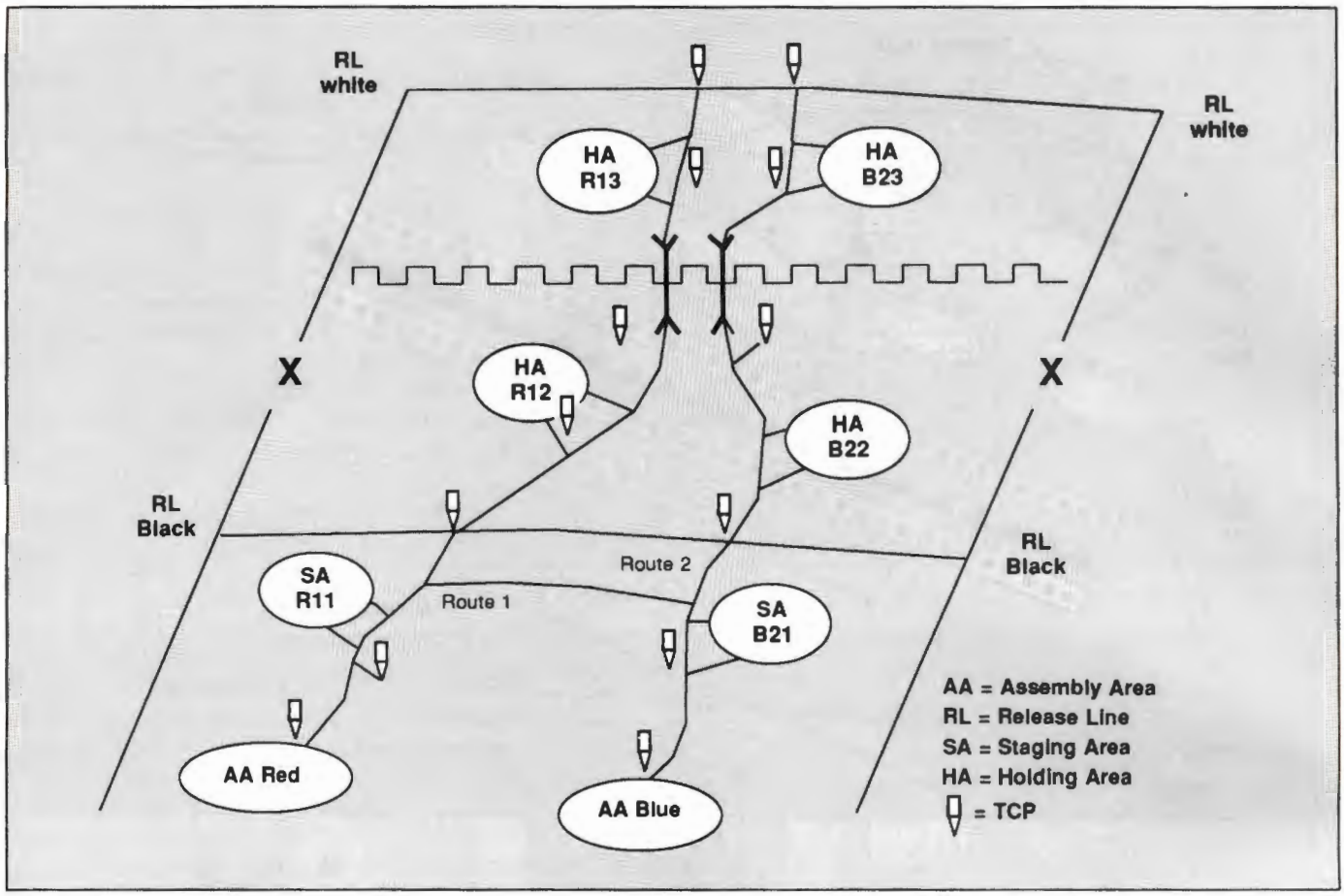


Figure 4

of suppressive fires.

- Routes for the support, breach and assault forces, to and through the obstacle.
- All objectives for the breach elements.
- Location of planned TCPs.
- Phase lines and release lines.

Figure 4 shows a movement control plan through the brigade's zone. As a minimum, this 1:50,000 overlay should have routes, holding and staging areas, phase lines and/or release lines, TCPs, and initial assembly areas.

Additionally, the brigade must identify designated routes, near and far signals to guide units to the lanes, and lane limits. Initial markings must be placed rapidly and should be improved and maintained as soon as the situation permits.

Control measures are also used to maximize the effectiveness of direct and indirect fires in support of maneuver and to reduce the possibility of fratricide. The brigade deliberate breach plan must include the following control measures for fires:

- Priority of fires. Who has it during each phase, who will decide to change it, and under what criteria?
- Coordinated fire line (CFL). Brigade CFLs will be used to protect units conducting forward passage of lines. These CFLs should be included on the operations overlay. The plan must note when the CFL changes, and who makes that decision.
- Hand-over line. The hand-over line will identify at what point the assault force takes over responsibility for the direct fire battle. It will be identified on the brigade operations overlay as a phase line, and can coincide with the far side release line.
- Target reference point (TRP). The brigade should have a standard methodology for designating TRPs. Subordinate unit commanders must coordinate the specific placement of TRPs to ensure that their fires are supportive.
- Smoke. Obscuration is a critical component of the breach. Too much or too little smoke can hinder the breaching effort. Smoke must be carefully controlled and coordinated to ensure that it supports the breaching effort. The chemical officer, fire support officer, brigade S-3, and engineer are the key planners. When planning smoke, consider the following:

- designate smoke targets for indirect fire systems, and use smoke generators for smoke objectives.
- identify who controls the smoke.
- coordinate the delivery systems (artillery, mortars, generators, vehicle engine exhaust smoke systems).
- determine effects of weather.

Well-Rehearsed Force

The purpose of a combat rehearsal is to improve agility, ensure synchronization, foster initiative, improve the depth of the force, and reinforce the scheme of maneuver and fire plan.

Rehearsals should "identify problem areas and contingency actions, determine movement reaction times, enhance coordination and refine the plan."[4] Rehearsals should be conducted for "actions critical to the accomplishment of the mission to ensure the unit can accomplish these actions given its state of training, the orders issued, and the terrain and weather conditions expected."[5]

When conducting a rehearsal, the commander should emphasize key events that trigger friendly actions. Rehearse both fire support and maneuver actions. The rehearsal becomes a tool that the commander can use to reinforce understanding of the plan, and help subordinate commanders visualize his intent. This assists subordinates in understanding what they are to do when the battle does not go according to plan.

The two essential ingredients of a brigade rehearsal are training down to the company commander level and carefully reviewing the details of the operation. It's recommended that the brigade conduct a minimum of two rehearsals. The first is a key leader rehearsal with a walk-through on a terrain model. The second is a full-scale, drive-through rehearsal which includes the company commanders. The brigade staff must prepare for the rehearsals by developing a script that describes the sequence of actions. An action-reaction format should be used, with the S-2 acting in the role of the enemy. While rehearsal techniques are beyond the scope of this article, engineer leaders should pursue combat rehearsals as a means of improving synchronization.

Conclusion

The Army must be able to bust through complex obstacle systems. For years, in-stride breaching techniques have been emphasized as a way of maintaining momentum and the initiative.

However, when an in-stride breach fails, or analysis of the force ratios confirms an enemy situation is beyond the capability of a subordinate unit[6], a deliberate breach must be conducted.

The four fundamentals outlined in this article will give the engineer officer a solid foundation for successful breaching operations. Detailed reverse planning focuses the force on mission accomplishment. Clear subunit instructions and effective command and control are essential to coordinating the actions of the support, breach, and assault forces—thus minimizing casualties. Lastly, a well-rehearsed force will have the agility to adapt to unexpected battlefield conditions.

By following these breaching fundamentals, engineer leaders and maneuver commanders can place combat power at the decisive point, and maximize their chances for a successful brigade deliberate breach.

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Major Antal, an armor officer, is XO of the NTC's Operations Group. He previously served as the NTC's brigade S-3 trainer. Other assignments include S-3 for for the 272nd Armor Battalion, S-3 for the 2-8 Cavalry, and company commander for both the 332nd Armor Battalion, and the 172nd Armor Battalion. He is a graduate of Command and General Staff College, where he earned a master's degree in military science. He received his commission from West Point.

Notes:

[1]Department of the Army, Field Manual 90-13-1, Combined Arms Breaching Operations. (Washington: U.S. Army, 28 February 1991).

[2]Ibid, pp. 2-7.

[3]Department of the Army, Field Manual 71-3, The Armored and Mechanized Infantry Brigade. (Washington: U.S. Army, May 1988), p. 2-5.

[4]Department of the Army, Field Manual 71-2, The Tank and Mechanized Infantry Battalion Task Force. (Washington: U.S. Government Printing Office, September, 1988), p. 2-21, 2-22.

[5]Department of the Army, Field Manual 71-1, The Tank and Mechanized Infantry Company Team. (Washington: U.S. Government Printing Office, September, 1988) p. 2-14.

[6]Department of the Army, Field Manual 90-13-1, Combined Arms Breaching Operations. (Washington: U.S. Army, 28 February, 1991), p. 4-1.

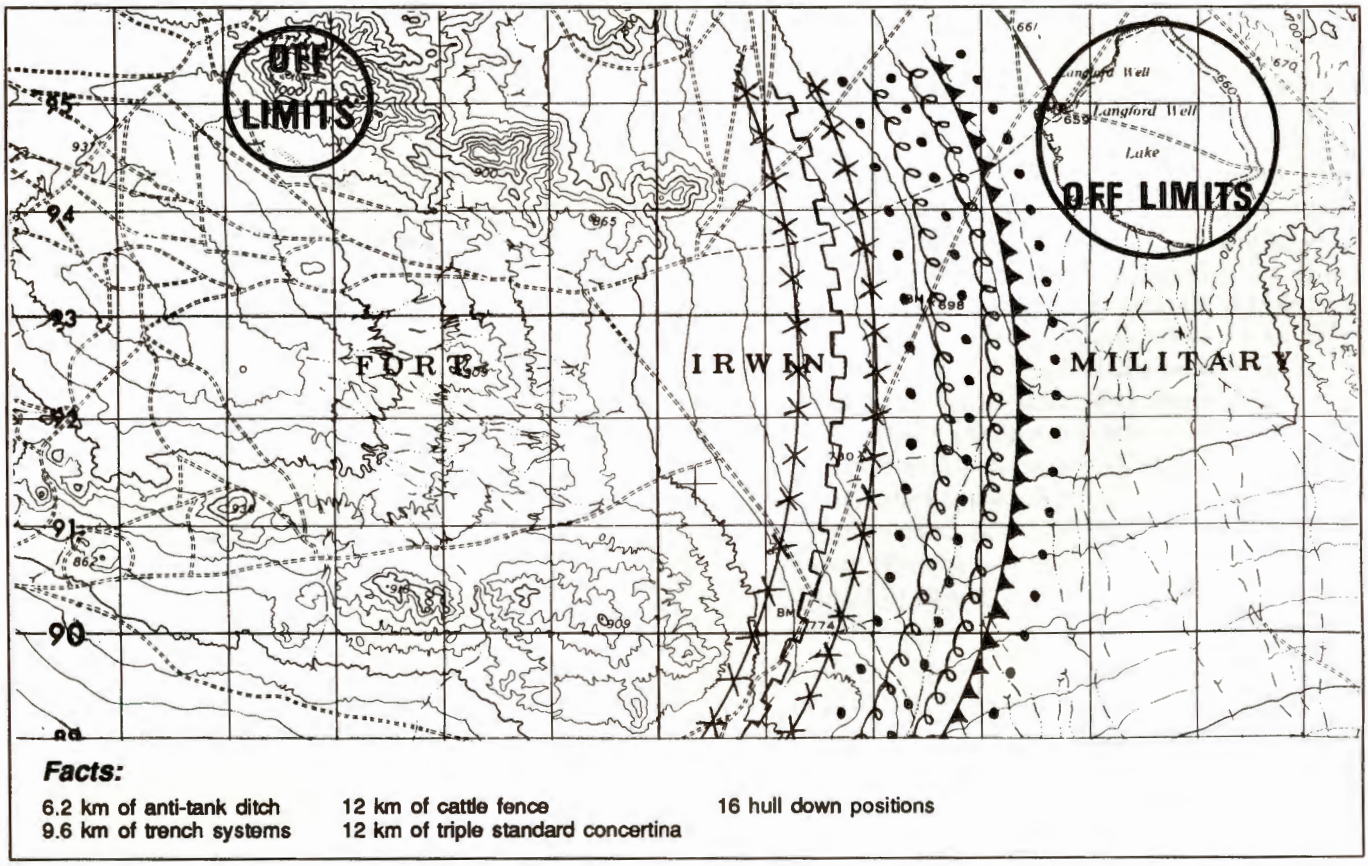
Constructing Iraqi-Style Obstacles at the NTC

Before Operation Desert Storm, the Iraqi Army possessed a formidable combat engineer force. These engineers had performed remarkably well during the eight-year Iran-Iraq War, emplacing millions of mines, diverting rivers to create obstacles, constructing hundreds of miles of combat roads, and building intricate defensive obstacles. The Iraqis did just as well in Kuwait—at least initially—where they constructed extensive obstacle belts along the border with Saudi Arabia.

The Mission

To familiarize mobilized Reserve Component forces with Iraqi-style obstacles, the 14th Combat Engineer Battalion (Corps) at Fort Ord was ordered to the National Training Center (NTC) at Fort Irwin in late November 1990. There, the battalion was given the mission of replicating the obstacles being built in Kuwait by the Iraqis.

The 14th served as a supporting engineer unit to the NTC's 177th Armor Brigade (OPFOR) (Opposing Force). During peace-time training rotations, the 177th plays the part of the mythical "Krasnovian Army," which fights with Soviet equipment and tactics. During preparations for Desert Storm, however, the 177th became the "Samaran Army," which mimicked Iraqi fighting forces. This part of the transition was relatively easy, because Iraqi military doctrine and equipment largely paralleled those of the Soviet Union and the now-defunct Warsaw Pact. The most difficult part of the "Samaran" mission turned out to be combat engineering.



Obstacle 14: Largest obstacle ever constructed at NTC, 5-17 December 1990

By Captain Thomas E. Sawyer

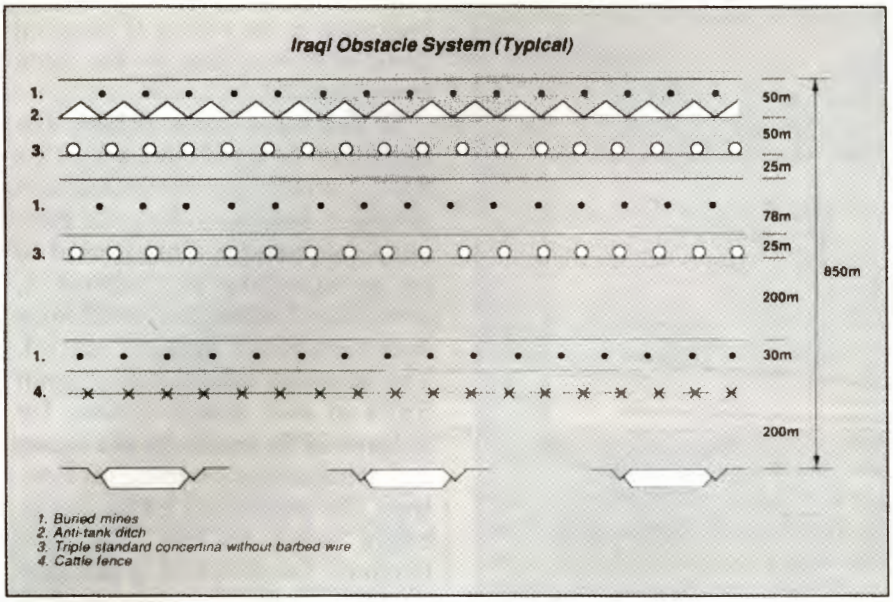


Figure 1

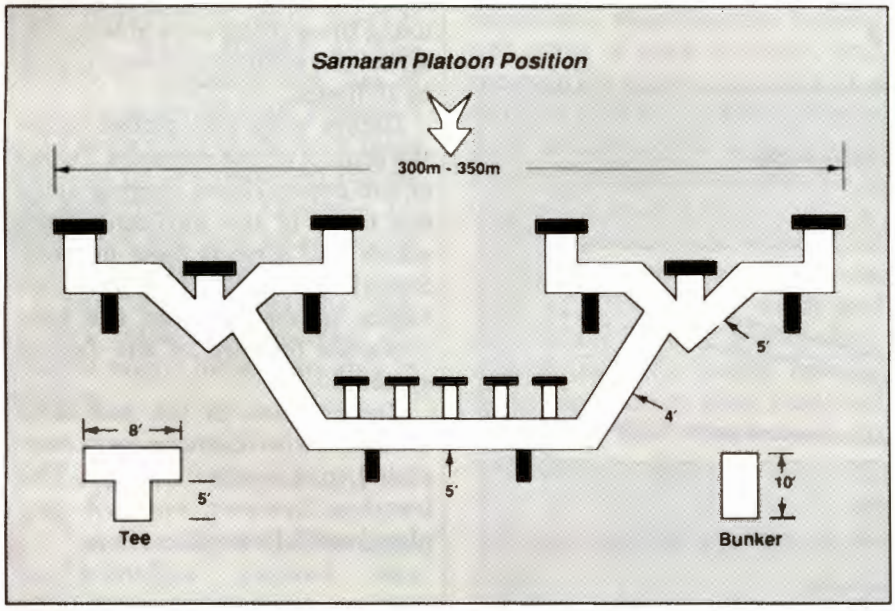


Figure 2

Iraqi Obstacles

The Iraqi obstacles in Kuwait consisted largely of concertina wire fences, anti-tank ditches, minefields, berms, barbed wire, flame ditches, and trenches. Figure 1 shows a typical obstacle layout. The minefield on the enemy side is normally a condensed minefield with buried anti-tank and anti-personnel mines. Most of these were pressure-fuzed and overpressure-protected. The wire obstacles were generally triple-strand concertina and four-strand barbed wire fences. The anti-tank ditch was slightly larger than American tank ditches, and did not have a berm on the friendly side, where the spoil is spread.

Not all Iraqi trench systems in Kuwait were constructed to a standard design. Though they were generally platoon-sized trenches, individual commanders apparently had the flexibility to modify the trenches to support METT-T (mission, enemy, terrain, troops and time available). There is also some evidence to suggest that standard designs were not followed because of engineer constraints in time or equipment. While most of these trenches were linear, some were shaped like a "lazy W" or a champagne glass.

Behind these trench systems were vehicle fighting and survivability positions. These usually consisted of horseshoe-shaped berms built up to at least the hull defilade level. These positions were generally well located to allow the vehicles to make full use of long-range tank-killing weapons systems.

Samaran Obstacles

In an attempt to replicate the Iraqi obstacles in Kuwait, without compromising current intelligence-gathering activities, the NTC developed a "Samaran" obstacle system, incorporating minefields, wire, tank ditches and platoon trenches.

The minefields in this design were notional buried minefields. Friendly forces would have to "go through the motions" to breach the minefield. The anti-tank ditch design was similar to our own doctrine, with a berm on the friendly side. Wire fences were triple-strand concertina, but without barbed wire strung on top of the concertina. The design of the trench system took on the "lazy W" design, with three squad trenches connected by two communication trenches. (Figure 2).

Each trench system had a "T" shaped fighting position, with berms and overhead cover across the front, and bunkers across the back. These systems were 300 to 350 meters long, and were constructed linearly along the back of the obstacle belt. These could also have been constructed in depth. This design provided a good

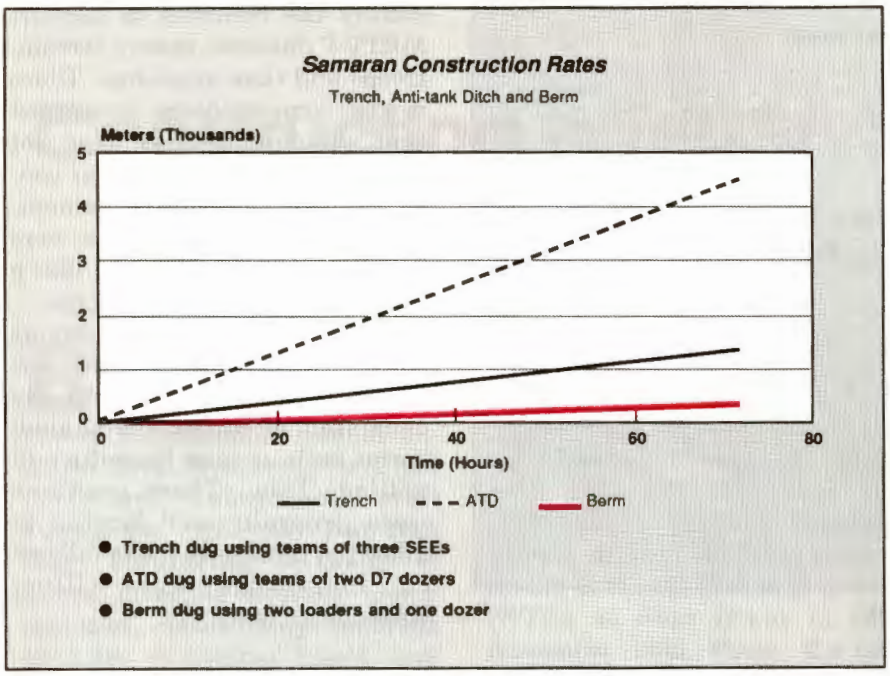


Figure 3

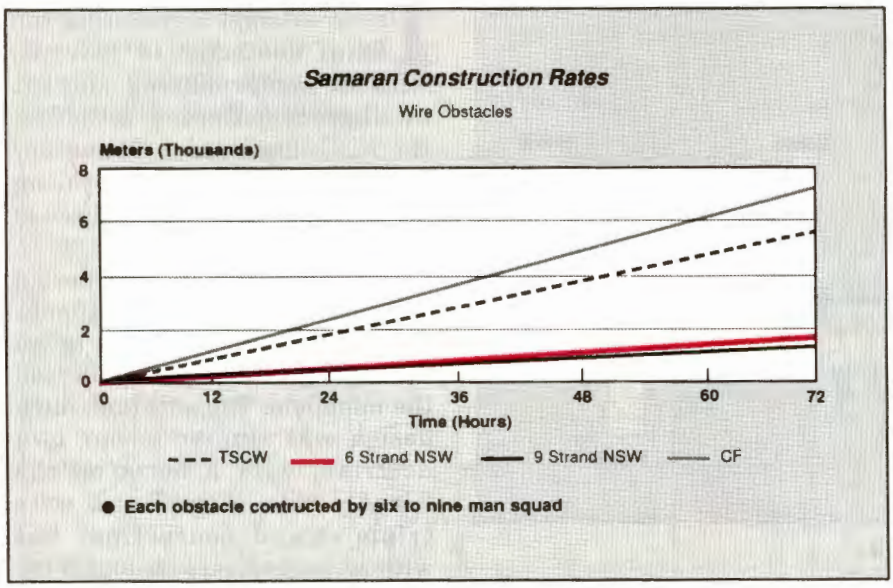


Figure 4

approximation of Iraqi obstacles, without compromising the extent of our knowledge of the obstacle systems in Kuwait.

Obstacle 14

Soon after arriving at the NTC, the battalion began construction of what was to become the largest obstacle ever constructed at Fort Irwin. Obstacle 14, as it came to be known, was 6.2 kilometers (km) long, and included 24 platoon trench systems.

Construction started on December 5, with the initial planned size to be 10 km, with 32 platoon trenches. However, to ensure completion by the time the first Saudi-bound unit arrived for training on January 3, the obstacle was downsized. The obstacle was oriented to the east, beginning in the vicinity of Langford Lake, and stretching to the south (map, page 18).

To facilitate construction, the battalion consolidated all of its SEE (small emplacement excavator) assets under one company commander. This proved to be a valuable arrangement, providing leadership continuity and consistent quality control. The battalion used three to seven SEEs on each trench system. Up to three SEEs would dig the squad and communication trenches first, then the remaining SEEs would begin work on the "Ts" and bunkers. Construction of the first trench system was completed in nine hours using seven SEEs. After some practice, operators using three SEEs were able to construct one complete platoon trench in 19 hours.

Dozers were also placed under the control of one company. Teams of two dozers began digging along the trace of the anti-tank ditch which had already been marked. Simultaneously, line platoons began construction on the wire obstacles forward of the trench systems.

Construction of the anti-tank ditch and wire obstacles were completed in a matter of days. The trenches, however, were not completed until December 17.

Construction Rates

After analyzing construction data, the battalion was able to determine real-world work rates, and compare them to American planning rates, and intelligence figures on Iraqi engineers. As suspected, the heavy equipment operators were not able to maintain the planned work rates.

Several factors contributed to the slower work rate, including maintenance downtime, refueling, crew rest, and—most significantly—the hard soil conditions at

Obstacle Construction Rates

U.S. Planning Rates	NTC Experience	Iraqi Intelligence
73m/hr (2 dozer team) 69m/hr (2 ACE team) (11' wide x 6' deep)	Ditching 62m/hr (2 dozer team) (11' wide x 6' deep)	74m/hr (2 dozer team) (4m Wide x 3m deep)
22m/hr (1 SEE) (2.5' wide x 4.5' deep)	Trenching 12m/hr (1 SEE) (2.5' wide x 4.5' deep)	672m/hr (1m wide x 2m deep)

Figure 5

Fort Irwin. Generally speaking, companies maintained a 16-hour work day, starting at 6 a.m., with about 12 hours being productive work time.

The larger pieces of equipment, like bulldozers and bucket loaders, were staged at the obstacle to minimize the loss of work due to travel time. Figures 3 and 4 show some of the work rates achieved by the battalion during the construction of Obstacle 14. Shown are non-stop rates for one piece of equipment or team.

Figure 5 compares the battalion's rates to what Iraqi engineers might have been able to achieve.

Equipment Experiences

Construction of the Samaran trenches pushed the battalion's equipment to the limits. The maintenance lessons learned center around the rugged NTC terrain, and the high operations tempo.

The SEE was the workhorse for the trench system, but it experienced some problems. Initially, operators had to tighten frame bolts after every hour of work. The battalion motor officer, after some field-expedient experimentation, came up with a replacement bolt system that solved the loosening problem.

Problems also surfaced with the SEE buckets. During the early stage of the operation, the buckets failed after about three hours of work and had to be repaired. Again, an expedient modification—welding an additional plate to the bottom of the bucket—saved downtime. Maintenance personnel went a step further, and replaced the original bucket with a stronger bucket purchased locally. Both modifications significantly reduced the amount of time lost to inoperable equipment.

Other precautions included inspection and as-needed replacement of SEE bucket teeth and dozer blade cutting edges, along with twice-daily, on-site lubrication. Mechanics also removed dozer belly pans once a week for inspection.

Operation Lessons

The battalion found that dozers with rippers were valuable digging assets during the construction of the anti-tank ditch. If only a limited number of dozers with rippers were available, then they would dig from within the ditch. Non-ripper dozers would push the spoil to the friendly side. Because of high wind conditions during the winter, we found that we had to push spoil further away from the back edge of the ditch to decrease the amount of fall-in. This lesson was learned the hard way, when the battalion returned from a Christmas break to find much of the tank ditch partially or completely filled in with blown sand.

When the SEEs were digging the trench systems, the most effective organization was found to be SEE teams—as mentioned earlier—with NCOs supervising the digging. During limited visibility, SEE operators found it difficult to judge the depth of the trench, and the supervisors proved valuable in directing the operators.

Battalion graders cut a combat trail along the front and back of the trench systems, so that the SEEs could easily move up and down the line of trenches. This speeded construction because the top-heavy SEEs were able to travel faster on these trails than on the bumpy desert floor. Too, the creosote bushes found at the NTC can cause tire punctures, and the combat trails enabled the SEEs to avoid these hazards.

The Samaran obstacles at the NTC were designed and constructed specifically for preparing Reserve Component units for combat against Iraq. Though they were a departure from the standard OPFOR regimen, the obstacles were of tremendous training value for maneuver units as well as the 14th battalion. And for the 14th Combat Engineer Battalion, that value came not only through construction operations, but through the first-hand experience of building an Iraqi/Soviet-style obstacle complex.

Captain Sawyer is assistant S-3 for the 14th Combat Engineer Battalion. Previous engineer assignments include company executive officer and platoon leader. Before transferring to Engineer Branch, he served as an infantry rifle platoon leader, mortar platoon leader, and S-1. He is a graduate of West Point and the Engineer Officers Advanced Course.

Engineer Problem

The following problem will acquaint you with the activity on the node (AON) method of preparing logic networks and solving resource-constrained problems.

Students learning project management in the Engineer School are presently introduced to two methods of solving logic networks. The first, activity on the arrow (AOA), is the method currently promoted as the Army standard. The second is AON. Both methods are described in FM 5-333, Construction Management (AOA is discussed in Chapter 2, and AON is in Appendix B).

Beginning in January 1992, the Engineer School's focus of instruction will shift from AOA to AON. This move will have advantages for both students and instructors. Activity on the node has a simplified logic network and a simplified resource constraining procedure. It is easier to learn and requires less time to teach. Also, AON is the technique taught in most engineer colleges and is the method most widely used in the private sector.

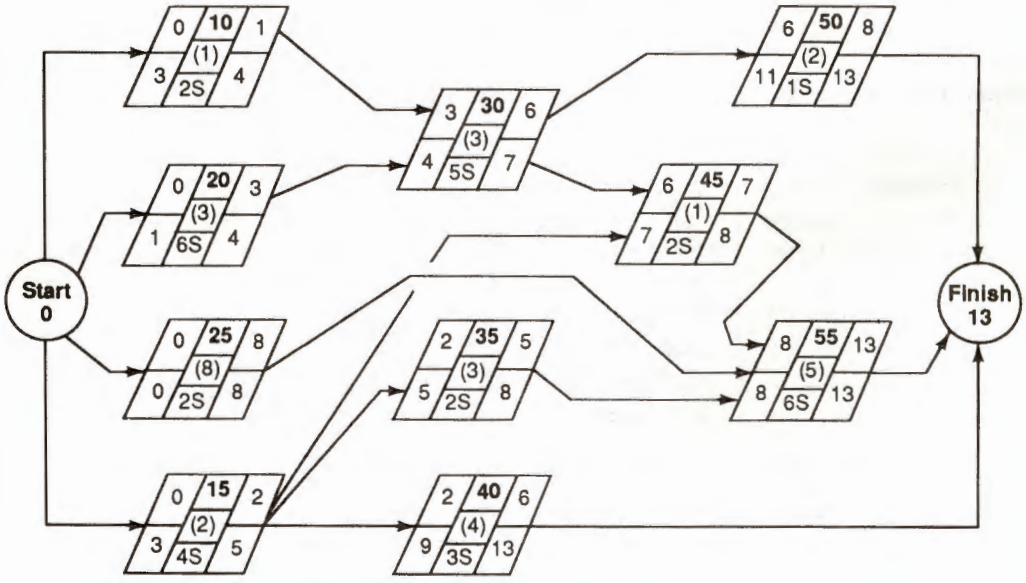
Problem: As a project supervisor, you developed the logic diagram and early start schedule shown below. During initial planning, the number of available squads (14) was the only critical resource. Later you were tasked to provide three squads to support post clean up during the same time period. This has reduced the number of squads available for the project to 11. You must resource constrain the project to 11 squads by completing the following tasks:

a. Resource constrain the early start schedule. (PART I of procedure)

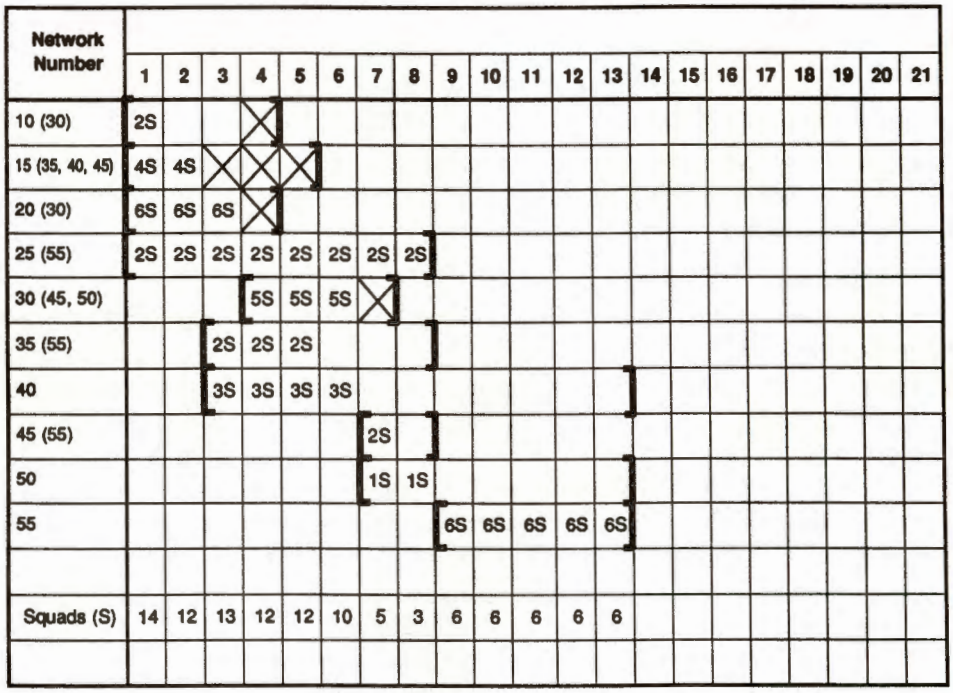
b. Update the logic network. (PART II of procedure)

c. Update the early start schedule. (PART III of procedure)

d. Determine if the reduced number of squads affects the project duration.



Engineer Problem



The following step-by-step procedure is one way to solve this problem. Although a procedure to constrain resources is not presently included in FM 5-333, this procedure will be used during future instruction at the Engineer School. Your comments and recommendations for changes are welcome and should be addressed to: U.S. Army Engineer School, ATTN: ATSE-DI-CC, Fort Leonard Wood, MO 65473.

Procedure To Constrain Resources (AON)

PART I: Resource Constrain The Early Start Schedule

Step 1. *Find the first time period where resource requirements exceed the resources allocated.*

Step 2. *Choose an activity(s) to delay.* Review the activities that begin in the time period identified in Step 1 and that provide sufficient resources. Choose the activity that has the largest amount of total float (the amount of time an activity can be delayed without delaying the project). Delay that activity one time unit.

- If one activity will not provide enough resources, choose a combination of activities that meets the resource requirement.
- If more than one activity qualifies as having the most total float, delay the one with the most free float (the amount of time an activity can be delayed without delaying any other activity).
- If there are no activities with float, choose one on the critical path to delay.

Step 3. *Follow the delay through the schedule.* If an activity is delayed into interfering float or past its right bracket (late finish), follow the delay through the schedule. (An activity delayed into interfering float will delay an activity but not delay project duration.)

Engineer Problem

- To accomplish Step 3, you must identify all activities that logically follow the delayed activity. These activity numbers are shown in parenthesis behind the delayed activity. For example: Activity 25(30,40) indicates that activities 30 and 40 logically follow activity 25.
- Check each activity shown in parenthesis (Step 3a) to see if its early start (ES) comes before the early finish (EF) of the activity delayed for insufficient resource. If so, delay that activity's start until the first time period after the early finish of the activity delayed for insufficient resource.
- Repeat Steps 3a and 3b for all activities that are delayed into interfering float.

Step 4. *Sum resources.* After following the delay through the schedule, determine the total resource requirement for each time period.

Step 5. *Move to the next time period.* Go to the next time period where required resources exceed the resources available. Repeat Steps 2 through 4 until the entire schedule has been adjusted to meet the resource limitations.

Step 6. *Identify reason for the delays.* If insufficient resources caused an activity to be delayed, place an "R" at the right of its late finish (LF) bracket (see example). If logic caused an activity to be delayed (it follows an activity delayed because of resources or logic), place an "L" at the right of its late finish bracket.

Step 7. *Draw the resource flow arrow(s).* Each resource-delayed activity is immediately preceded by an activity(s) that uses the same resource and has an early finish one time period before the resource-delayed activity begins. If two or more preceding activities use the same resource, you must choose one. Normally you will choose the one that provides the least, but sufficient, resources. Find the source of the resource and draw a resource flow arrow(s) from the end of the preceding activity(s) to the beginning of the resource-delayed activity.

In the following example, activity 30 is resource delayed and will begin on time period 10. Look at the preceding time period (9) for activities that end on it and that use the same resource. Activity 20 is the only one that ends on time period 9. Therefore, activity 20 must be completed before activity 30 can begin. In this example, you would draw the resource flow arrow from the end of activity 20 to the beginning of activity 30.

	6	7	8	9	10	11	12	13
5 (30)	2c	2c	2c					
20 (50)	4c	4c	4c	4c				
30 (50)					3c	3c		
45 (50)				6c	6c			R

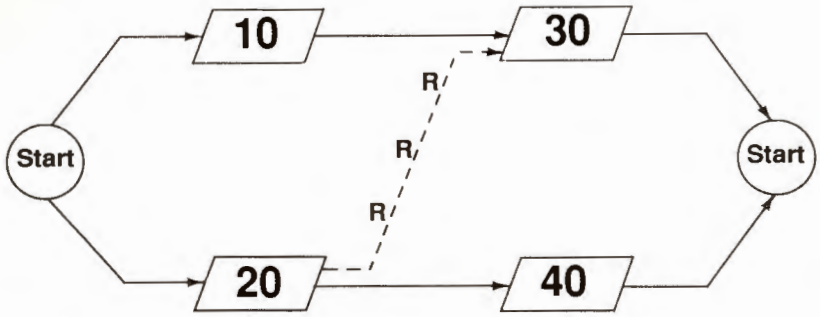
Note: One activity may require assets from two or more activities, or one activity may provide assets for two or more activities. In the following example, activities 5 and 20 provide resources to activity 45.

	6	7	8	9	10	11	12	13
5 (30)	2c	2c	2c					
20 (50)	4c	4c	4c					
30 (50)					3c	3c		
45 (50)				6c	6c			R

Engineer Problem

PART II: Update The Logic Network

Step 8. *Draw the resource dummy arrow.* A resource dummy arrow must be added to the logic network for every resource flow arrow on the early start schedule. Draw the resource dummy arrow from the activity(s) that provide the resource to the activity(s) that receive it. In the following example, activity 20 provides a resource to activity 30.



Step 9. *Conduct a new time analysis.* The addition of resource dummy arrows to the network changes the time analysis for the network and may change the critical path.

PART III: Update The Early Start Schedule

Step 10. *List activities.* Activities that provided resources will gain new follow-on activity numbers (numbers in parenthesis). Adjust the activity numbers on the early start schedule.

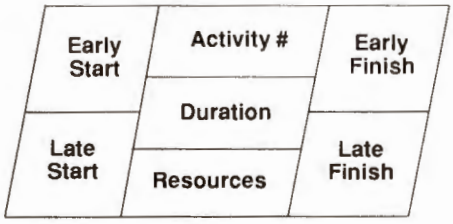
Step 11: *Mark time frames.* Check the early start (ES) and late finish (LF) times for all activities. If an activity's ES or LF changed, adjust the left and right brackets accordingly.

Step 12: *Identify float.* Recalculate interfering float for each activity based on the new ES and LF times. Update the interfering float "XX" on the early start schedule.

The node shown below is from Appendix B of FM 5-333.

Activity on the Node Time Analysis

Early Start (ES) + Duration = Early Finish (EF)



Late Finish (LF) - Duration = Late Start (LS)

Reference: FM 5-333, Chapter 2 and Appendix B.

ENGINEER Solution begins on page 49.

Engineers As Part of the Combined Arms Reconnaissance Team

By Captain Bob Wray

The success of an offensive or defensive operation often depends directly on the success of the reconnaissance effort. This effort enables the maneuver commander to see the battlefield. Likewise, the ability of engineers to support maneuver units depends on the success of the engineer reconnaissance effort. This article describes two types of reconnaissance, and provides an overview of the combined arms planning process.

There are two basic types of engineer reconnaissance: technical and tactical. The reconnaissance missions are conducted under different threat environments, focus on different engineer-specific information requirements, and are executed and organized differently (Figure 1).

General Types of Engineer Recon Missions

Technical Recon:
- Collect engineer specific technical data on a point, area target, or route
- Normally a specified task from higher headquarters
- Conducted in a Level 1 threat environment
- May involve only engineer forces

Tactical Recon:
- Collect engineer specific information requirements on an enemy point, area target, or attack axis/route
- Implied task to support maneuver plan
- Conducted in Level 3 threat environment
- Combined arms effort: Engineer force is just part of total intelligence collection effort

Figure 1

Technical Reconnaissance

Technical reconnaissance missions focus on collecting engineer information about a target, area or route. This type of reconnaissance gathers engineer information about the target without regard to the enemy. It is usually conducted under a low level of threat and in areas physically controlled by friendly forces. The mission is normally a specified task from higher headquarters or is derived from mission analysis, and can be conducted by a pure engineer unit. A technical reconnaissance is typically conducted rear of the forward line of troops (FLOT). A combat engineer company could anticipate the following technical reconnaissance missions:

- River (unopposed river crossing)
- Engineer resource
- Bridge
- Route and road
- Landing area
- Tunnel
- Ford and ferry (unopposed)
- Water resource

The basic references for technical reconnaissance are Field Manual (FM) 5-36, *Route Reconnaissance and Classification*, FM 5-34, *Engineer Field Data*, FM 90-13, *River Crossing Operations, Technical Manual* (TM) 5-312, *Military Fixed Bridges*, TM 5-330, *Planning and Design of Roads, Airbases, and Heliports in the Theater of Operations*, and TM 5-700, *Field Water Supply*.

Tactical Reconnaissance

Tactical reconnaissance is conducted against a target in areas where enemy contact is likely, and the reconnaissance mission is an integral part of confirming or denying the intelligence preparation of the battlefield (IPB) and developing a scheme of maneuver. These missions normally are not specified, but fall out as an implied task. Engineer forces participate in tactical reconnaissance as part of a combined arms team consisting of scouts, infantry or cavalry patrols. Tactical

reconnaissance is typically performed forward of a task force rear boundary. The combat engineer company could anticipate the following tactical reconnaissance missions:

- Enemy obstacle
- River
- Landing/pick-up zone (PZ/LZ)
- Terrain
- Choke points
- Friendly situational obstacle
- Friendly reserve obstacle (bridge demolitions, road craters, etc..)
- MOUT (building evaluations, utility facility recons)

The basic references for tactical reconnaissance are FM 5-34, *Engineer Field Data*, FM 20-32, *Mine/Countermine Operations*, FM 90-13-1, *Combined Arms Breaching Operations*, FM 5-25, *Explosives and Demolitions*, FM 7-7, *The Mechanized Infantry Platoon and Squad*, and FM 7-70, *Light Infantry Platoon/Squad*.

These two categories of engineer reconnaissance are critical to developing and training engineer squads. They provide the baseline for the tactics, techniques and procedures for each reconnaissance mission, and will help focus training and squad reconnaissance drills. The new FM 5-36, *Engineer Reconnaissance*, will reflect the two categories. The remainder of this article concentrates on tactical reconnaissance.

Engineer Tactical Recon Planning and the Estimate Process

Engineer Estimate	*Recon Planning*
Mission	Specified region tasks
Engineer battlefield assessment	Identify possible NAIs Identify recon assets available in adjacent recon efforts
Participate in IPB	Establish IRs and integrate into collection plan
Commander's guidance	Establish PIR
Mission analysis	Identify specified/implied recon missions
Develop scheme of engineer operations	Allocate recon assets to accomplish recon missions and develop tentative recon plan
Wargame and compare	Deconflict recon plan with other staff/manuever plans
Finalize plan	Integrate recon plan into order, and complete coordination

Note: Recon assets may have to deploy before estimate process is complete based on tentative NAIs and PIRs.

Figure 2

Recon Planning

Combined arms engineer reconnaissance planning is conducted as an integral part of the engineer estimate. Figure 2 shows the reconnaissance planning steps and how they integrate with the engineer estimate process. The estimate process provides the foundation for developing a reconnaissance plan. However, an engineer reconnaissance mission may require engineer forces to deploy with scouts prior to completion of the estimate process. When engineer reconnaissance forces deploy early, the task force engineer must consider how he will shift the reconnaissance effort as the planning process matures.

Mission. Knowledge of the mission should automatically start to focus intelligence requirements. Deliberate attack, hasty attack, hasty defense, or movement to contact missions generally call for general intelligence targets. For example, in the offense, obstacle intelligence, mobile obstacle detachment location, terrain data, enemy survivability effort, enemy countermobility and mobility asset location, and engineer low density equipment location are intelligence requirements which can help confirm or deny the situational template.

In the subunit instructions, an engineer company could receive a specified reconnaissance mission. Characteristically, the engineer subunit mission will be a technical reconnaissance. The task force engineer needs to be aware of the maneuver unit's specified reconnaissance task, and higher headquarter's priority intelligence requirements. This article uses the deliberate attack as an example.

Engineer Battlefield Assessment. The engineer battlefield assessment [EBA] is the basis of the engineer's input into the IPB and, therefore, becomes the foundation for reconnaissance planning. During terrain analyses, the engineer and S-2 identify key and decisive terrain features whose engineer characteristics are important to the maneuver plan. The S-2 uses the higher headquarter's situational template and refines it (Figure 3). The task force engineer uses the S-2's template of the enemy location, along with other

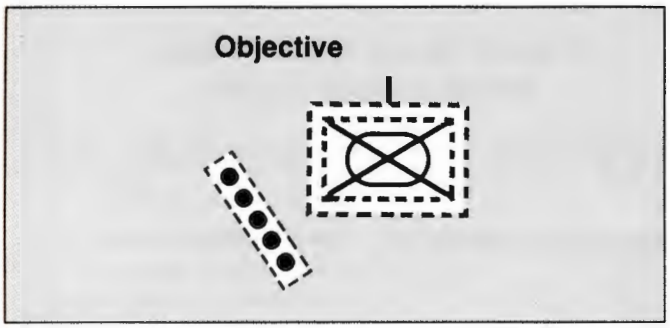


Figure 3

Recon Planning and Engineer Battlefield Assessment

Terrain and weather analyses:
- Identify key terrain features requiring engineer recon (technical or tactical)
- Focus on existing obstacles that impact on maneuver forces

Enemy M/CM/S capability and employment
- Template enemy engineer activities
- Identify possible NAI's/information requirements
- Begin to establish priorities

Friendly M/CM/S capability
- Identify friendly recon assets available
- Include engineer, maneuver, and intelligence assets
- Coordinate with adjacent engineer recon efforts
- Identify necessary recon equipment

Figure 4

Recon Planning Input to the IPB

Provide input into S-2's terrain analysis
- Determine impact existing obstacles have on avenues of approach and mobility corridors
- *Prioritize* engineer recon to confirm terrain analysis and begin recon early

Provide input into the S-2's doctrinal and situation template
- Base your input on enemy M/CM/S assessment
- Identify tentative NAI's and information requirements

Provide input into the S-2's collection plan
- S-2 and engineer develop coordinated list of NAI's and information requirements
- Ensure mutual support is planned

Figure 5

facts and assumptions, in order to template enemy mobility/countermobility/survivability capabilities (Figure 4). This procedure assists the engineer and S-2 in focusing tactical reconnaissance on specific named areas of interest (NAIs) to collect the information requirements/priority information requirements (IRs/PIRs) (Figure 5). Figure 6 shows a refined situation template with NAIs annotated. Mission-critical NAIs and PIRs can now be prioritized.

The S-2 and engineer also look at adjacent reconnaissance efforts which impact on the area of operations. Last, the engineer considers the friendly engineer capability and reviews the combined arms assets available for collecting engineer intelligence. Those usually include:

- **Scouts** - Used to recon areas in close proximity to the enemy. Scouts reconnoiter to determine enemy locations, orientations, and dispositions. Before, during, and after the battle, they report their observations and significant changes in enemy activity.
- **Ground Surveillance Radars (GSRs)** - A GSR can detect moving vehicles and personnel in open terrain at long ranges, and it can provide information on the number, location, disposition, and types of targets. Normally, GSRs are placed to cover open, high-speed approaches where early detection is critical.
- **Remote Sensor Teams (REMS)** - Like GSRs, REMS are division assets attached or placed in direct support. The REMS should be placed as far forward as possible. They are useful in covering dead space and broken terrain where observation would require more observation posts (OPs) or patrols than are available. They can also assist in detecting attempts to breach friendly obstacles and in keeping track of enemy movements after security force withdrawal.
- **Maneuver Listening/Observation Posts (LP/OPs)** - LP/OPs are used to observe or listen to the front, or in gaps between friendly positions. They provide early warning of the enemy's advance.
- **Patrols** - Patrols are conducted to cover unoccupied gaps between defensive positions. On occasion, patrols also may cover the terrain between OPs to the front. This is normally accomplished by the occupying unit during a defensive operation.
- **Engineers** - Engineers are used specifically to gain intelligence on the enemy's mobility/countermobility/ survivability operations and friendly OCOKA requirements.

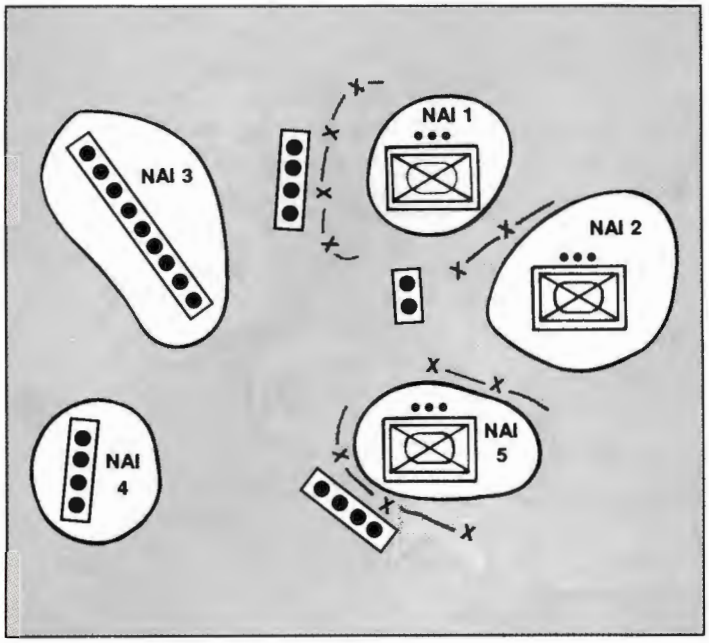


Figure 6

Recon Planning and Mission Analysis/Commander's Guidance

Identify all specified recon missions
- Based on higher's basic OPORDER
- Intelligence annex
- Engineer annex
- Higher engineer OPORDER

Identify implied engineer recon missions
- Based on EBA and IPB input
- Prioritize recon missions
- Identify recon missions that are essential tasks

Recon missions and priorities may change as maneuver plans are developed

Establish PIR based on commander's guidance

Figure 7

■ **Aerial Reconnaissance** - You must coordinate for these assets—if they are available at the battalion task force level. Imagery and photography products can compliment your intelligence collection plan. Ensure the requests for these products are submitted. On numerous occasions, the products are not "pushed" through the system. Aviation assets can be task organized to the battalion task force for specific missions. OH-58s can be requested to cover specific areas, routes or targets (Refer to FM 17-95 *Cavalry Operations*). Be sure to consider SEAD (suppression of enemy air defenses) and air superiority when planning and requesting these assets.

Commander's Guidance. The commander's guidance is given after the restated mission of the command estimate. The restated mission confirms the essential tasks expressed in the mission statement. This aids in determining and recommending PIRs to the commander. He confirms the PIRs, and the staff engineer ensures that intelligence requirements are included in his recommendation.

Mission Analysis. Recon tasks identified in the IPB process and R&S (reconnaissance and surveillance) planning are included in the mission analysis. The engineer considers all engineer recon missions given by higher headquarters as specified tasks. These tasks are usually technical recon missions. The engineer also identifies implied technical and tactical recon missions as implied missions. Mission-critical technical and tactical engineer recon missions are identified as essential tasks and become the main effort in recon planning and force allocation.

A word of caution: engineer recon mission priorities may change as maneuver plans are developed and refined, or they may change as the situation changes (Figure 7). Time analysis of the command estimate might drive specific NAIs to be more important than others. Mission analysis provides the framework for a reconnaissance and surveillance plan with NAIs, targeted areas of interests (TAIs) and PIRs.

Develop Scheme of Engineer Operations. The scheme of engineer operations is developed concurrently with the maneuver course of action. Figure 8 shows a generic offensive scheme of maneuver. Engineer recon efforts are included in the development of a scheme of engineer operations. The engineer analyzes the recon tasks that have been identified and looks at where they occur on the battlefield. He knows the assets available from his EBA analysis, and so allocates the engineer forces necessary to accomplish the recon task. Normally, an engineer squad is capable of reconnoitering one target at a time. Large targets may require an entire platoon.

In some cases, using non-engineer intelligence collection assets is more appropriate. Scouts, patrols, GSRs and aviation recon efforts may be tasked to collect engineer IRs in coordination with the S-2. The engineer will then task organize engineer assets allocated to the recon effort based on the type reconnaissance and the type of force commanding and controlling the recon effort. As a rule of thumb, engineer forces conducting technical recons remain task organized under engineer

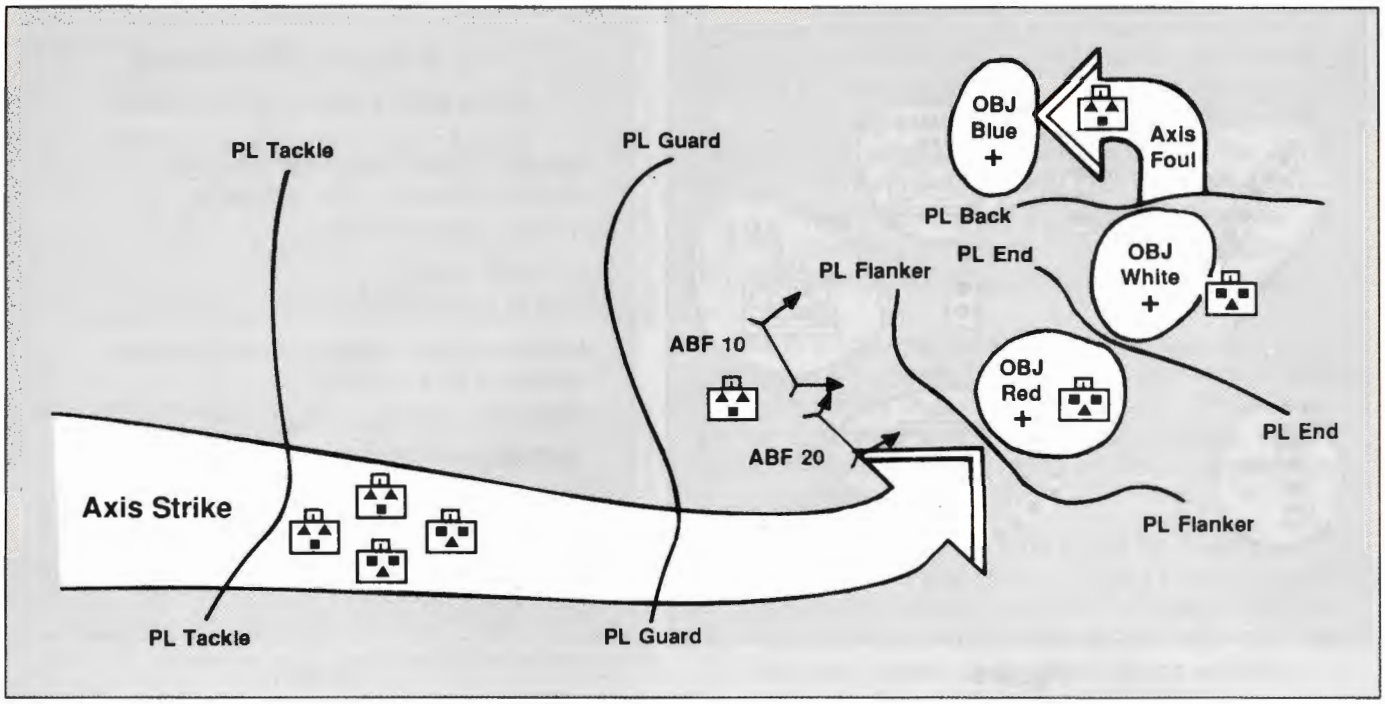


Figure 8

headquarters. Engineer forces conducting tactical recons are task organized as attached to a maneuver headquarters—usually the task force or battalion scouts. The engineer integrates engineer recon forces, missions, and priorities into the total scheme of engineer operations.

Engineers are trained to conduct obstacle and fortification reconnaissance to evaluate the technical nature of these works. Scouts and infantry also conduct obstacle reconnaissance, and are experts in tactical maneuver and reconnaissance. Maneuver unit recon assets are normally better than an engineer squad at collecting information in NAIs that are close to the enemy location. However, increasing engineer recon training can compensate for this. For example, in support of an offense operation, engineers would focus on the NAIs covering the enemy's tactical obstacles, while the scouts would focus on the NAIs covering the enemy's weapon systems and protective obstacles.

Finalize The Engineer Recon Plan

Assign specific NAIs, IR/PIR to subordinate units

Integrate engineer recon effort into BDE/TF OPORDER (R&S plan)

Coordinate recon routes with other staff members and unit commanders

Brief engineer recon effort at the OPORDER

Develop engineer recon tracking/command and control systems

Specify how hard intelligence will be disseminated

- By whom
- To whom
- Where
- When
- Using what means (radio, FAX, courier)

Figure 9

Wargame and Refine. The engineer always participates in the wargaming process. Wargaming offers the engineer an excellent opportunity to look at his recon effort in the context of the maneuver plan and other recon efforts. It helps him identify weaknesses in his recon plan. As the maneuver plan is wargamed, the engineer should consider how well his recon plan has provided the information needed to successfully execute the maneuver plan. As a result, the engineer may identify the need for additional NAIs and IRs. He also looks for conflicts such as recon assets that are operating in an area of indirect preparatory fires.

Finalize Plan. In coordination with the TF S-3, S-2, and commander, the engineer finalizes his recon plan. Engineer forces participating in the recon effort are given specific NAIs and IRs as sub unit instructions in the engineer company OPORD (Figure 9). If the reconnaissance assets have already moved out, their plan must be updated and the commander's intent given to the recon elements. This critical point is often overlooked. If the reconnaissance units know the commander's intent,

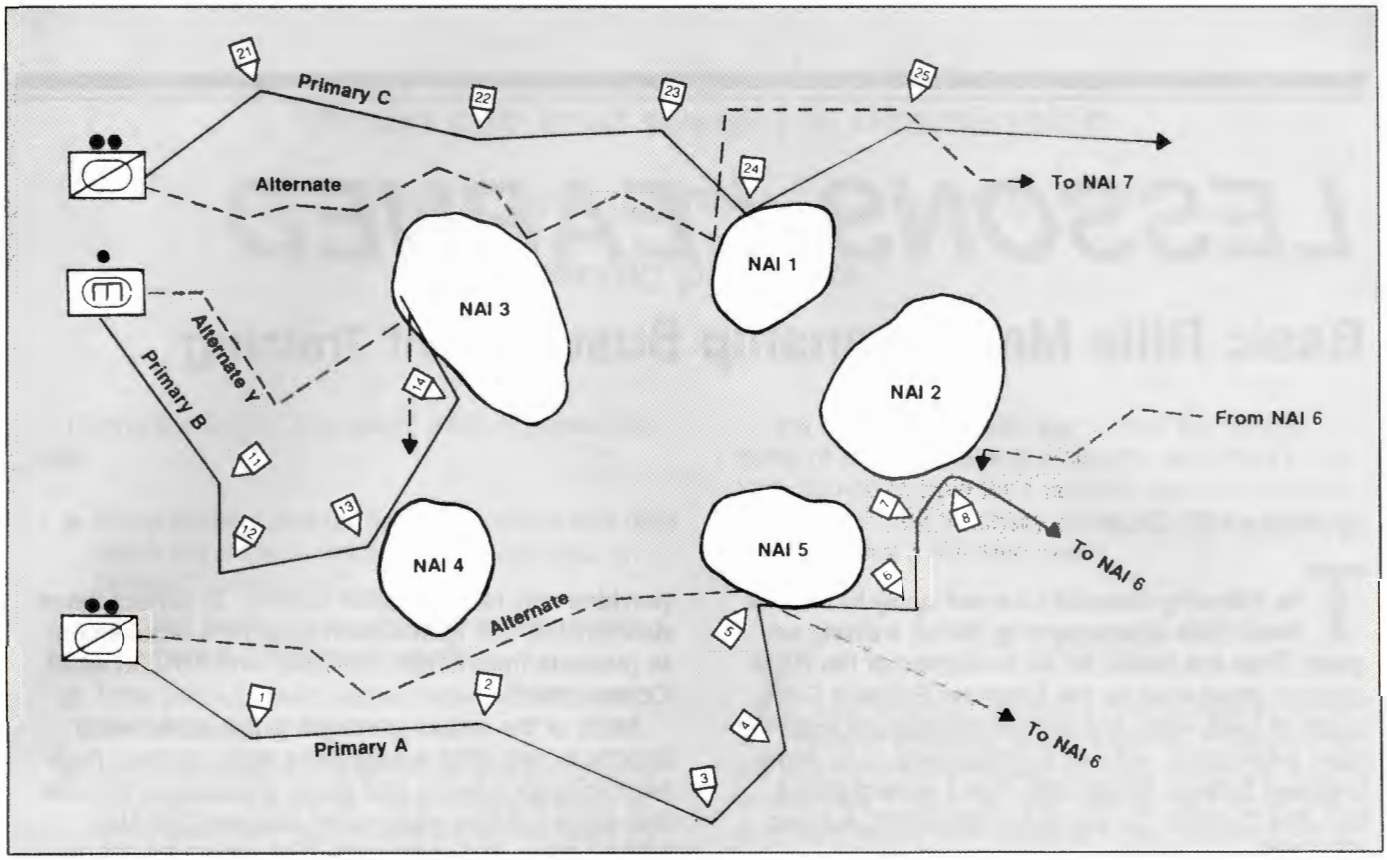


Figure 10

they will be better prepared to demonstrate the appropriate initiative to help the commander.

The staff engineer makes every effort to coordinate with other TF staff members and maneuver commanders. He ensures that engineer reconnaissance assets are given the appropriate NAIs, command and control, and logistics. It's important that the engineer brief his recon plan (as part of the TF plan) at the TF operations order (OPORD) to ensure that the plan is disseminated. As the engineer recon plan is finalized, the engineer must consider how he will track the progress of the recon effort, receive reports, and, if necessary, shift the recon focus. He must not only focus on his engineers, but on the total combined arms reconnaissance effort as well. The scout platoon leader integrates the engineers into his movement and develops his own movement plan (Figure 10).

Summary

This article has been limited to the engineer's planning process and his responsibilities as part of a combined arms staff. Combined arms reconnaissance planning should not be viewed as a check to block activity—the R&S plan confirms or denies the situation template. After the intelligence reports are received, the template is updated and refined and the S-2 and engineer develop new NAIs. As for all staff engineer planning, the engineer estimate provides the basic framework for engineer reconnaissance operations. After staff planning, engineer reconnaissance leaders must conduct standard troop leading procedures.

Engineers are a critical part of the combined arms reconnaissance effort, and must be proficient in recon operations and planning. Engineer leaders should take note, and make sure their units are trained up to the mission.

Captain Wray is an instructor/writer in the Engineer School's Tactics, Training and Doctrine Division. He previously served as a company commander and assistant S-3 with the 7th Engineer Battalion. He is a graduate of Command and General Staff College and the University of Louisville.

LESSONS LEARNED

Basic Rifle Marksmanship Sustainment Training

By Robert C. Clark

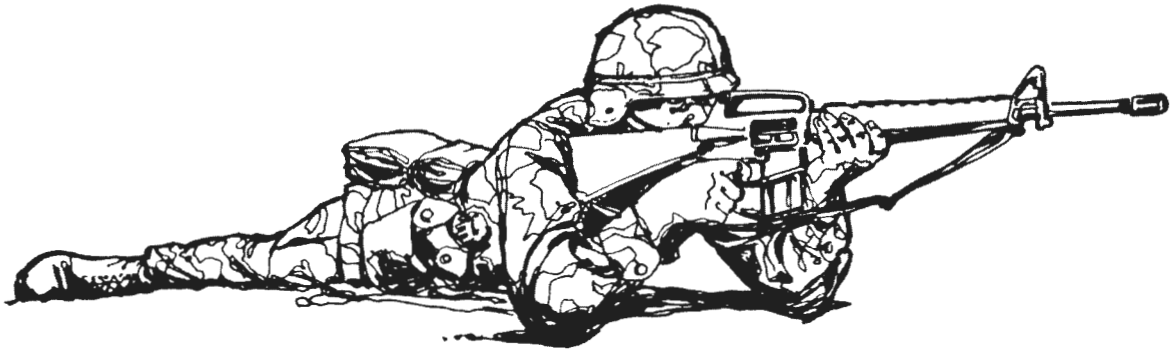
The following Lessons Learned apply to the unit Basic Rifle Marksmanship (BRM) training program. They are based on an evaluation of the BRM program conducted by the Engineer School's Directorate of Evaluation and Standardization (DOES). For more information, write to Commandant, U.S. Army Engineer School, ATSE-ESE, Fort Leonard Wood, MO, 65473-6630. Or, call (314) 563-5320, Autovon 676-5320.

ISSUE: Many soldiers who attend the Noncommissioned Officer's Basic and Advanced Courses (BNCOC and ANCOC) or the Engineer Officer's Basic Course (EOBC) are not prepared to learn the train-the-trainer skills taught in these professional development courses. Instead, they require training in the basic skills needed to qualify with a weapon. Students comment that their unit training programs are not designed to sustain BRM skills, as required in FM 23-9, *M16A1 Rifle* and M16A2 *Rifle Marksmanship.*

DISCUSSION: Analysis of the BRM program taught in NCO and officer courses at the Engineer Center revealed that the basic officer and NCO courses (EOBC and BNCOC) provided no training in BRM skills, and the advanced course (ANCOC) provided only familiarization training. To correct these deficiencies, rifle qualification became a requirement to graduate from EOBC, BNCOC, and ANCOC as of October 1990.

Many of the issues identified in this study relate directly to unit BRM sustainment skills. Student feedback through surveys and group discussions indicate that some soldiers were never assigned MI6AI or M16A2 rifles. And many unit BRM programs did not include a unit sustainment program, as required FM 23-9. Other key points—

- Basic rifle marksmanship training for BNCOC, ANCOC and EOBC provides instruction to leaders on how to plan, conduct, and evaluate rifle marksmanship sustainment training. It is not designed to train soldiers in basic BRM skills.
- While the intent of the BRM program in professional development courses is to train-the-trainer, soldiers report to them with skill deficiencies. They must be trained in the basic skills required to qualify with an individual weapon before they can learn the advanced tasks. Thus, instruction cannot focus on train-the-trainer skills. Instead, it focuses on ensuring soldiers qualify with the weapon so they can meet graduation requirements.



"A unit can best sustain marksmanship proficiency by implementing a quality unit training program."

During the DOES' evaluation, soldiers pointed out that:

- Many soldiers had not fired or qualified with their individual weapon since leaving Advanced Individual Training (AIT).
- Soldiers had not been exposed to pop-up targets (target detection) since AIT.
- Long periods often elapse between initial and sustainment training.
- Unit sustainment training often is not in accordance with FM 23-9. In many units emphasis is on qualification, not on sustaining individual soldier skills.

What Needs To Happen

To ensure soldier proficiency in BRM skills, commanders and trainers must first understand the Army's training goal and the standards and strategies for marksmanship training.

Training Goal: The Army's goal for training is to develop a combat-ready force that is prepared to mobilize and deploy on short notice and to fight and defeat enemies. DA Pam 350-38, *Standards in Weapons Training*, can help units attain this goal. It provides commanders and unit trainers with:

- A common set of weapon and weapon qualification standards
- Suggested weapon training strategies that will lead to the attainment and sustainment of measurable standards, and a model for resource requirements

Standards and Strategies: Commanders must design training strategies that will allow their soldiers to attain the BRM standards. DA Pam 350-38 provides models for training and the resources needed to attain the standards. The models provide generic, not specific, requirements and are one way to attain and sustain the standard.

Unit commanders can select from the generic menu of weapon training programs described in DA Pam 350-38 to train for a specific assigned mission or unit goal. This flexibility allows trainers to design programs that meet their needs.

For Example

As an engineer company commander in an engineer battalion, you are tasked to determine the requirements for qualifying your company on the M16A2 rifle. Using DA PAM 350-38, you determine that the soldiers are Category II (not members of a rifle or scout squad). Thus, 90 percent of the soldiers assigned an M16 rifle or M203 Grenade Launcher must have met the individual requirements for the M16 rifle to standard within the past 6 months. Individual requirements for Category II soldiers include qualifying on a day record fire course, firing in mission oriented protection posture (MOPP) 4 protective clothing to standard, and firing a night record course to standard.

Table 5-31 (DA PAM 350-38) recommends training strategies (firing events) that will enable soldiers to maintain and sustain proficiency with the M16 rifle. The table also lists ammunition allocation requirements for each weapon per firing event, which makes it easy for trainers to order the correct type and amount of ammunition.

Now you know the firing events, standards, and ammunition requirements for your unit. The next steps are to review the suggested training strategies in FM 23-9, plan the training, program the events into long-range training calendars, and then conduct the training to standard. You should use both DA Pam 350-38 and FM 23-9 to be sure the training and BRM qualification are conducted to standard.

Year-round Marksmanship Training

A year-round marksmanship training program will help units meet the Army's training goal.

An effective unit marksmanship program reflects the commander's and trainer's priority of interest and emphasis. Appendix A of FM 23-9 proposes a strategy to guide units in establishing and conducting an effective program. It includes a list of tools for individual and leader refresher training that can help soldiers maintain the basic skills learned during initial entry training (IET).

Unit sustainment training is a critical part of year-round marksmanship training. Studies show that soldier skills and marksmanship fundamentals deteriorate within two months, and mechanical skills weaken even sooner. Therefore, units should provide short periods of training throughout the year to maintain these skills.

A year-round marksmanship sustainment program enables units to attain and maintain their individual and collective firing proficiency skills. Many non-firing tasks can be accomplished as opportunities develop or concurrent with other training. Dry-fire training can strengthen marksmanship skills and assess training needs. The key is to make marksmanship training an on-going event.

Back To The Study

The DOES survey of students in BNCOC and ANCOC produced the following information:

- Of students surveyed, 66 percent indicated that BRM training in their units did not include target detection. This is a key element of BRM training and is a major reason why soldiers fail to qualify in their professional development courses. Appendix B of FM 23-9 provides tips to improve training in this area.
- Many units do not use training devices such as the M15A1 aiming card, riddle sight device, M16 sighting device, or the weaponeer. Several marksmanship training devices can enhance sustainment training when they are used with appropriate training strategies (see Appendix C, FM 23-9). These devices are especially useful when ammunition is limited. While some are complex, costly, and in limited supply, others are relatively simple, inexpensive, and in large supply. Devices can be used individually or in combinations.

  Individuals or squads should use these devices to practice and sustain basic marksmanship skills and fundamentals. The old philosophy that training can't be conducted because bullets and a range are lacking is no longer valid.

RECOMMENDATION: The Engineer Center recommends that commanders at every level ensure their unit sustainment training program conforms with FM 23-9, and that soldiers meet BRM standards at least semi-annually.

Soldiers are taught how to detect and hit a target, and how to maintain their weapons during IET. They must maintain these skills throughout their Army careers. Commanders at all levels are responsible for developing programs that enable soldiers to sustain these skills.

A year-round program is the best way to maintain the basic skills learned in IET. In these days of force reductions, only top quality soldiers are selected to attend professional development courses. If a student is not prepared to learn the train-the-trainer tasks there, his military career may be in jeopardy.

The following suggestions may help you develop a sound BRM program:

1. Use the training strategy chart (Figure 1-1) on page 1-2 of FM 23-9 as a guide when developing a sustainment program.

2. Know the standard. Review Chapter 5 and Tables 5-30 and 5-31 in DA PAM 350-38.

3. Integrate sufficient time for marksmanship training in the unit's mission essential task list (METL).

4. Assess your soldiers' proficiency.

5. Train the trainers.

6. Conduct refresher training.

7. Use training devices.

8. Ensure standards are met.

As we begin a new fiscal year, let me challenge you to include BRM in your overall training program. Commanders, examine each strategy as it applies to your unit's modified table of organization and equipment (MTOE), METL, training level, time available, and unique training needs. Implement a year-round marksmanship training program that will allow soldiers to sustain BRM skills and contribute to your unit's overall proficiency.

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The Evolution of River Crossing Doctrine, 1918 to 1944

By Captain Robert Toguchi

Italy's Rapido River was shrouded in heavy fog as darkness fell shortly before 6 p.m. January 20, 1944. The soldiers of the 141st Infantry Regiment, 36th (US) Infantry Division, anxiously awaited movement to the water's edge for an assault river crossing. The regiment's commander, Lieutenant Colonel Aaron A. Wyatt, Jr., moved among his men as they made final preparations for the crossing.[1]

The first group of troops took their assault boats from a nearby depot, and departed for the river at 7 p.m. Pathways thick with mud made it a difficult journey. Barely 30 minutes later, more than sixteen battalions of friendly artillery began firing on defending German positions of the 15th Panzer Grenadier Division. German batteries replied, raining down shells on the Americans trying to make their way to the riverbank. Within minutes, one company lost 30 men.

The situation got worse as engineer guides lost their way in the artillery fire, and the advancing Americans entered friendly minefields. By 8 p.m., 25 percent of the boats and footbridges needed for the assault were lost. Radio and landline communications broke down. Some of the troops that managed to reach the river found that their boats had been pierced by shrapnel and sank when placed in the water. Other boats were swept away by the swift current before they could be loaded, and some sank because the crews paddled improperly. Of four footbridges designated for the crossing, one was destroyed in a minefield enroute to the riverbank, one was defective, and the remaining two were destroyed by artillery fire. By salvaging bits and pieces from each bridge, engineers managed to construct a single footbridge by 4 a.m., nearly seven hours after the designated crossing time.[2] By 6:30 a.m. on the 21st, only half a battalion of a three-battalion force had managed to get across the river.

With the approach of dawn, LTC Wyatt tried to put together a daylight operation to sustain the small force across the river. He considered using of smoke to conceal continued crossing operations. But much to his chagrin, Wyatt discovered that no smoke-generating equipment was available. Six hundred smoke pots were available at a rear depot, but the 141st was not notified of their availability until it was too late.[3]

Without concealment, the small foothold on the far shore of the



River crossing failures in the early days of World War Two cannot be laid entirely at the feet of the soldiers on the line. Institutional flaws in doctrine were a significant factor (U.S. Army photo).

Rapido was doomed. Consequently, Wyatt ordered the evacuation of the soldiers who had already crossed. Subsequent assaults the following day by the 141st and an adjoining regiment also failed. The 36th Division suffered 1,681 casualties and was forced to cancel the river crossing operation.[4]

The Rapido operation was one of the earliest attempts by the Army to conduct a river crossing in World War II—and it was a fiasco. Combat engineers had a critical role in support of the crossing, and—as a whole—they performed poorly. Prior to the operation, the regimental engineer had developed a crossing plan without consulting the infantry regiments. Pre-paratory bridging drills were not conducted. Pre-liminary roadwork was not accomplished. Bridging equipment was not adequately inspected. Coordination measures had not been established with the infantry. And these were just a few of the problems that led to one of the worst military disasters in American military history.[5]

Military doctrine provides the foundation and framework for commanders to build successful operations. The absence of river crossing doctrine was a key factor in the poor performance of the 141st Regiment and the 36th Division. In an attempt to analyze the state of U.S. Army Corps of Engineers' doctrine at the start of World War II, this article will focus on the evolution of river crossing doctrine during the pre-war period and during the war itself, during the years 1918 to 1944.

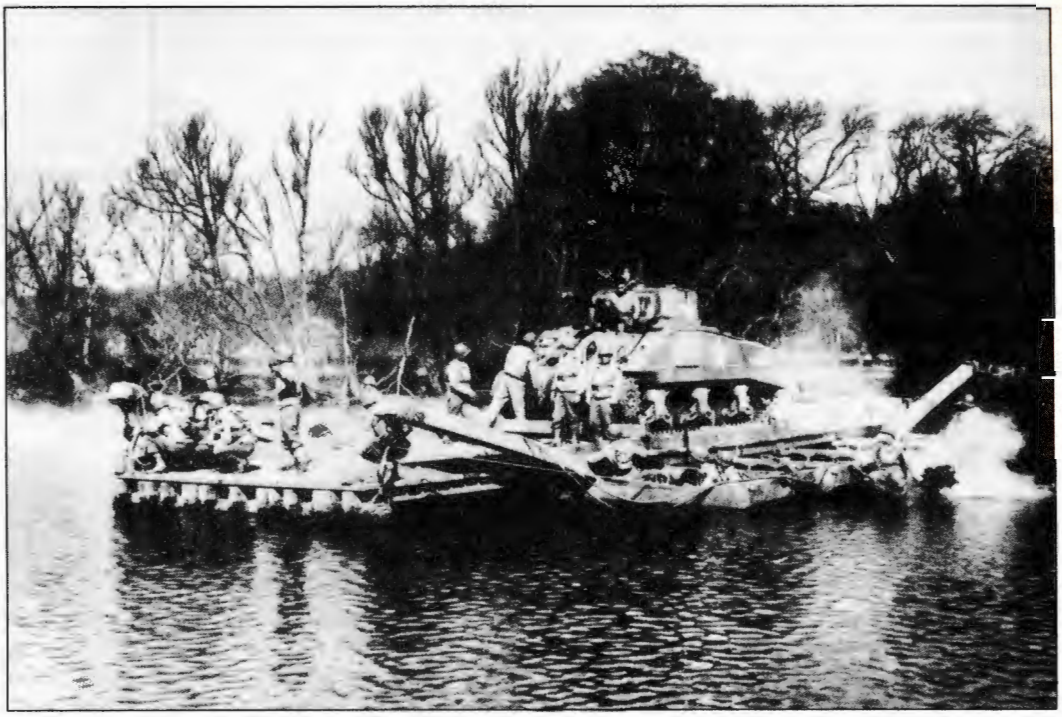
Traditional histories of the Rapido river crossing have placed the overwhelming burden of responsibility squarely on the shoulders of senior commanders. I believe the factors influencing the operations's failure are far more complex than merely pointing the finger of culpability at local battle captains. To a certain degree, operational historians have a penchant for emphasizing the obvious while ignoring that Army systems can affect individual battles. This has resulted in traditional studies that have not always revealed the institutional flaws that doom certain battles before the first shot is fired. I contend that the Rapido river crossing operation was just such a battle, and that fundamental flaws existed in the Army's ability to produce viable crossing doctrine before World War II.

Doctrine, in military usage, is a word of fairly recent origin.[6] During the 14th century, the word "doctrine" was used to describe fundamental truths concerning a special field of knowledge. The term "military doctrine" does not appear to have entered American military jargon until the early 20th century. *The Dictionary of United States Army Terms* defines it as the: "compilation of principles and policies, applicable to a subject, which have been developed through experience or by theory, that represent the best available thought, and indicate and guide but do not bind in practice..."[7]

Official doctrine for the Corps of Engineers was provided primarily in the form of published field manuals or field service regulations that instructed soldiers and leaders on how to fight on the battlefield.[8] Subjects were diverse, ranging from basic survival techniques, to unit logistics, to combined arms operations. The field manual was the normal authority on the specific techniques or tactics to be used in a given battlefield situation.[9] So, to understand doctrine development

during this period, we must look at the progressive changes made in those manuals.

The Corps first addressed the subject of river crossing doctrine in the 1862 *Manual for Engineer Troops*, a compilation of doctrinal instructions adopted from British, Austrian, and French manuals.[10] Since the Army had not developed such related doctrinal instructions prior to this time, the Corps translated and adopted the procedures then in use by foreign armies. This practice of copying the doctrinal instructions of the major European powers was quite common for developing military establishments of the period.



Despite the advent of highly mechanized maneuver forces, river crossing doctrine did not keep pace—often limiting the usefulness of those forces (U.S. Army photo).

Only one of the five chapters within the manual was devoted to river crossings. This chapter provided 27 pages of instruction that focused primarily on the technical aspects of pontoon bridge construction. It discussed construction materials, river conditions, bank preparations, fording, ferrying operations, and basic pontoon drills. While the manual provided valuable advice on methods of streamlining speed of construction, it did not provide instruction on tactics or coordination with the infantry.[11]

A revised version, *The Engineer Field Manual*, was published in 1904. This manual provided river crossing doctrine under a section devoted to floating bridges.[12] Again, instruction focused largely on the technical aspects of construction, and dealt only briefly with military tactics. The manual provided technical details on American bridging equipment, incorporating changes in bridge design since the 1862 manual.

This basic manual was popular, undergoing four revisions by 1917.[13] Interestingly, the floating bridge portion of the manual remained virtually the same. Basic pontoon bridge design did not experience significant change between the Civil War and World War I. As a result of the satisfactory results experienced during the Civil War, the Engineer Corps decided in 1869 to retain the Civil War pontoon bridge designs.[14]

In the years between the wars, engineer offices that played a key role in the development of river crossing doctrine included the Office of the Chief of Engineers, the Engineer Board, and the Engineer School. The Chief of Engineers was the primary authority for the formulation of engineer policy, and was responsible for the technical performance of all officers and enlisted men within the Corps.[15] The office was divided into two divisions, Civil Works and Military. The Military Division was responsible for personnel, intelligence, operations and training, construction, railways, and supply. The division also directed the activities of the two field agencies, the Engineer Board and Engineer School.[16]

The Engineer Board served as the Corps' proponent agency for research and development on all Army engineer equipment. The board also developed procedures that covered the technical aspects of construction, maintenance, handling, and storage of engineer equipment. The Engineer School, on the other hand, was responsible for the training of Army engineers, and for the development of engineer tactical doctrine. Both agencies submitted their concepts of doctrine and equipment to the Office of the Chief of Engineers for review.[17]

A contributing factor to the slow development of river crossing doctrine was the Engineer School's concentration on individual training for soldiers. Concerns other than engineer instruction received limited attention, and suffered considerably.

The school simply did not provide any formal provisions or institutional structure to ensure the consistent review and generation of river crossing doctrine. Similarly, the Office of the Chief of Engineers failed to ensure that the school updated and formulated the Army's river crossing doctrine.

Interestingly enough, many of the doctrinal concepts during the interwar period were developed by individual soldiers—independent of any support from the engineer hierarchy. Following World I, a number of after-action reports were written about the Army's European river crossing experiences. A young engineer, Captain William M. Hoge, completed a book in 1918 that provided frank after-action comments about the 5th Infantry Division's crossing of the Meuse River.

Despite the success of the operation, the soldiers of the 7th Engineer Regiment had to overcome several difficulties. The Meuse valley, about 600 meters in width, consisted of marshy flats that made ingress and egress difficult on both sides of the river. The hills overlooking the valley provided commanding fields of observation and fire for enemy artillery. The necessary use of French bridging equipment, which the Americans were not familiar with, compounded the regiment's problems.[18]

The engineers were able to overcome these obstacles through meticulous planning. Prior to the crossing, one engineer company received the dedicated mission for road preparation, infantry guides were designated, fascines were constructed to facilitate passage over mud, ramps were constructed over high banks, wagon loads were prioritized, and assault engineers were attached to the infantry brigades.[19] All of these measures were planned and executed prior to the crossing. While Hoge's book covered seemingly simple tactical procedures, it was the combination of all these techniques that paved the way for the success of the Meuse crossing.

From his review of the operation, it is evident that Captain Hoge captured valuable insights into the difficulties of organizing engineer assets for river crossing operations. He presented these ideas in a well-written book entitled *Engineers in the Crossing of the Meuse*. Unfortunately for the Army, none of this material was incorporated as approved doctrine into the engineer manual. The next revised version of the manual, which was published in 1932, did not include Captain Hoge's well-reasoned and coherent thoughts on river crossing.[20]

Other veterans of the war provided similar grass roots doctrinal material based on practical experience. In early 1920, Colonel R.R. Ralston, the Fourth Corps Engineer of the American Expeditionary Force, published an article in *The Military Engineer* that included discussions on World War I river crossings. The work titled "Engineers' Duties in the Field of War" was a compilation of senior officer comments on engineer doctrine.[21] While the article presented several perceptive insights from highly experienced senior officers, none were used for the formulation of crossing doctrine during that period.

In the article, Colonel John C. Lee, chief of staff for the 89th Division, stressed the importance of traffic control. He recommended prioritizing traffic, controlling local traffic with engineers, and having military police provide general traffic control.[22]

Colonel John Kingman, chief of staff for the 90th Division, recommended a three-phase approach for river crossings: (1) an infantry footbridge, (2) standard pontoon bridge, and (3) a timber trestle structure.[23] Kingman believed that a phased approach would preclude increasing the load capacity of the standard pontoon bridge.

During the period between the wars, traditional concepts of war slowed development of the Army's mechanized forces, further delaying the development of river crossing doctrine and equipment. The attitude among some Army planners was "the next war should be fought like the last one."[24] For example, the infantry branch was initially given responsibility for the organization and development of the tank corps. As perhaps an expected consequence, their concept of tank employment called for armor to play an infantry support role—rather than take its place as a large, mechanized maneuver force. This attitude, though not pervasive, limited the development of a mechanized force which would have forced planners to rethink river crossing operations.

Despite a reduced interest in warfighting concerns, the Corps updated the *Engineer Field Manual* in 1932, incorporating new material on modernized bridging equipment. The manual added technical details on the M1926 light bridge and the M1869 heavy bridge. The new instructions focused primarily on bridge construction techniques, bridge specifications, transportation, maintenance, and load capacities. Some tactical instruction was provided, with a recommendation that bridging operations be divided into four phases:

- pontoons to ferry infantry
- light pontoons to cross combat wagons
- heavy pontoons to cross heavy trains
- fixed bridging

While the manual was an improvement over earlier versions in many respects, tactical procedures filled no more than one page of instruction.[25]



While many valuable field reports were available from experienced combat engineers, doctrine writers often failed to use the information (U.S. Army photo).

As early as January 1941, the Office of the Chief of Engineers was aware of the extreme complexity of river crossing operations.[26] German crossing operations in May 1940 were reported in German publications and translated by Captain Paul W. Thompson, an American military observer stationed in Germany prior to our entry into World War II. Complete accounts of step-by-step crossing sequences, timetables, operational diagrams, fire support, equipment characteristics, bridge sites, and orders issued by the participating German units were available to the American engineers.[28] These materials were published in 1941 in several articles appearing in *The Military Engineer*. Later that year, Captain Thompson published a book, *Modern Battles*, that depicted modern German doctrine for assault river crossings.[29] In 1942, now-Lieutenant Colonel Thompson published two more books, the *Army Engineer* and *Engineers in Battle*, which provided material superior to doctrinal literature then available on river crossing.[30]

While detailed reports on successful river crossing operations were flowing out of Europe, where were the doctrinal writers in the Engineer Corps? Thompson's publications were a valuable and cost-free opportunity for the Corps to update existing crossing doctrine. Engineers in the field needed more definitive guidance than the general overview of crossing operations officially available at the time. But strangely enough, comparable changes to the existing river crossing doctrine did not occur until 1943.

In 1941, the river crossing doctrine contained in FM 5-5, *Engineer Field Manual: Troops and Operations*, was an improvement over previously available literature, but did not provide enough detail at the tactical level. The manual included general instructions on planning, command and control responsibilities, equipment characteristics, reconnaissance, and site selection. However, doctrinal writers made no attempt to flesh out the problems encountered in the support of tactical river crossings.

The prescribed doctrine viewed a crossing as an end in itself, rather than as a means to accomplish a definite wartime objective.

No plans were made to continue the attack once the crossing was achieved. Was the whole operation supposed to grind to a halt once the river was crossed, leaving a complacent bridgehead vulnerable to counterattack? To the detriment of soldiers in the field, plans for securing initial, intermediate and final objectives were not included in the 1941 doctrine.[31]

Combined arms coordination is critical to the success of

military operations, a fact not unrecognized in 1941. But the 1941 manual scarcely addressed instructions on how engineers should fit into the combined arms team. For example, the preparation of engineer estimates, the allocation of assembly areas within the division's sector, the incorporation of engineer units into the communications net, and the use of a deception plan were just a few of the techniques that were absent from engineer doctrine in 1941.[32]

The same manual also lacked detailed instructions for the assault phase of a crossing, whereby the infantry secured the far shore prior to the construction of rafts and bridges. Probably the most difficult phase of a crossing operation, the assault is normally conducted under direct enemy fire. Timing, speed, and organization are critical to the operation's success. Hence, extremely detailed engineer planning in shore party organization, timetables, boat crew breakdowns, far shore objectives, ferry round-trip times, marked routes, and other techniques were expected to be addressed in tactical manuals. In 1941, two pages of general instructions addressed the assault phase, whereas ten pages were used in the 1943 manual.[33]

Further, details on control and coordination measures to direct the actions of the crossing units were practically nonexistent in the 1941 text.[34] Interestingly, these measures were discussed in Captain Hoge's after-action reports in 1918, but were not incorporated in later texts. Coordination measures are necessary to ensure that the maneuver force knows the plan for linking up with the engineers, the location of key crossing assets, assembly areas, and routes to and from the crossing sites. Without these procedures, the probability of disorganization and mission failure increases considerably—even for the simplest operation.

The lack of doctrinal coordination measures was a sure sign that both engineer and maneuver units were operating with the cards stacked against them. In 1941, a mere thirteen pages were used to describe an extremely complex operation that had already been described earlier in voluminous detail by American and German engineers with combat experience.

In 1943, finally, the Corps of Engineers developed viable river crossing doctrine. The new manual, FM 5-6, *Engineer Field Manual: Troops and Operations*, fully incorporated many of the detailed tactical procedures that were missing from the 1941 publication. For the first time, the manual differentiated between conducting hasty and deliberate river crossing operations.[35] It also outlined initial, intermediate, and final objective phases of a crossing. Unfortunately, it was made available to the field only after American forces had been deployed. Had the manual been published earlier, units—both engineer and infantry—could have familiarized their soldiers with these techniques under training conditions. As it was, most had to learn the hard way—under enemy fire.

The 1943 manual also provided detailed instructions for conducting the assault phase of river crossings. Initial assembly areas were added to assist in the control of traffic movement to the crossing sites. Traffic control plans were assigned with specific routes of march, a time sequence for group assembly areas, and specific frontages designated for boat groups. Specific boat battle drills were added to the doctrine specifying boat crew conduct, boat navigation, paddling techniques, and loading/unloading procedures. The techniques of successive trips were discussed, and concentrated on the responsibilities of engineer guides for the return boat trips.[36]

In addition to specific tactical instructions, the manual also provided engineer planning data for river crossing operations at the division and corps levels. It specified the quantity of bridge equipment and the number of engineer units required to support different types of infantry and armor units. It also included construction and crossing times to assist the maneuver commander in planning his operation.[37]

The manual was refined in 1944 with the addition of instructions for the use of heavy weapons companies in lead battalions to provide supporting fires at the river.[38] It also addressed the use of specialized equipment, like bangalore torpedoes, to facilitate the passage of obstacles during the assault wave. It also continued to update the engineer time tables for bridge construction, equipment use, and ferrying operations.

A historical review of official doctrine clearly reveals that the Corps of Engineers did not develop effective or timely river crossing doctrine during the period 1918 to 1944. While many tactical insights were readily available from both American and German engineers with significant combat experience, none gave birth to badly-needed initiative or forethought among those responsible for such doctrine.

While those insights were available in many informal forms—magazines, after-action-reports, and books—this did not ensure that the knowledge would be incorporated into the Army mainstream. Such experience was often gained at a great cost in human lives, and the loss of such experience weighed heavily on the combat readiness of Army engineers.

Have we developed viable river crossing doctrine to meet the

demands of modern tactical operations? Indeed, a hard look at the doctrine in FM 90-13, TC 90-13-1, and FC 90-13 reveals areas that could be addressed in greater detail. For example, the current concept of conducting the assault phase solely with armored personnel carriers (APCs) presents itself well on paper, but cannot be the rule for all river crossings. Far shore bank conditions can often preclude or seriously hamper the use of APCs. Too, dismounted infantry is often needed to breach obstacles and secure difficult terrain prior to the movement of APCs. Moreover, in a full mobilization, many combat units may find themselves short of their full complement of APCs.

So, before we become complacent in our satisfaction with current doctrine, let's take a lesson from the past. I submit that we need to consistently review a wide variety of writings—including foreign publications—on engineer operations, promptly process experiences from the field, and rapidly produce draft doctrinal publications for review. In addition, greater institutionalization of combined arms tasks can be accomplished by assigning doctrinal proponency to specific combat units. Only through painstaking effort and consistent command emphasis can we ensure that there will never be another Rapido.



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Notes:

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[2]Ibid. 82-85.

[3]Ibid. 87.

[4]Ibid. 110.

[5]Ibid. 71-111.

[6]Jay Luvaas, "Some Vagrant Thoughts on Doctrine," (March 1986): 56.

[7]Department of the Army, *Dictionary of United States Army Terms* (Washington, D.C.: Government Printing Office, 1950), p. 78, as quoted in Jay Luvaas, "Some Vagrant Thoughts On Doctrine," (March 1986): 56.

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[11]Ibid. 7-33.

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[13]Office of the Chief of Engineers, *Engineer Field Manual*, Parts I-IV. Professional Papers No. 29. 4th revised edition, with addenda. (Washington D.C.: Government Printing Office, 1917).

[14]Kohloss, "The Status of Pontoon Bridge Development," p. 1.

[15]War Department, *Corps of Engineers, General Provisions*. AR 100-5. (Washington D.C.: Government Printing Office, 1942), pp. 1-3.

[16]War Department, *Report of the Chief of Engineers*. Office of the Chief of Engineers (Washington D.C.: Government Printing Office, 1921), p. 3-4.

[17]Blanche D. Coll, Jean E. Keith, and Herbert H. Rosenthal, Report of the Chief of Engineers, Office of the Chief of Engineers (Washington, D.C.: Government Printing Office, 1921), p. 3-4.

[17]Blanche D. Coll, Jean E. Keith, and Herbert H. Rosenthal, *The Corps of Engineers: Troops and Equipment* (Washington D.C.: Office of the Chief of Military History, 1958) p. 4.

[18]William M. Hoge, *Engineers in the Crossing of the Meuse River* (Ft. Leavenworth, KS: Command and General Staff School, 1918), pp. 1, 5-6.

[19]Ibid. 1-18.

[20]Colonel R.R. Ralston, "Engineer Duties in the Field in War," *The Military Engineer* 12 (January-February 1920): 67-80.

[21]Colonel R.R. Ralston, "Engineer Duties in the Field of War," The Military Engineer 12 (January-February 1920): 67-80.

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[23]Ibid. 73.

[24]Mark Skinner Watson, *Chief of Staff: Prewar Plans and Preparations* (Washington D.C.: Historical Division, 1950), pp. 23-25, 35.

[25]Office of the Chief of Engineers, *Engineer Field Manual*, Military Engineering, Volume II. (Washington D.C.: Government Printing Office, 1932)

[26]Captain Paul W. Thompson, "Engineers in Battle," The Military Engineer 33 (January-February 1941): 1-5.

[27]Ibid. 1-5.

[28]Ibid. 1-5.

[29]Major Paul W. Thompson, *Modern Battle* (Richmond, Virginia: Infantry Journal, 1941), p. 1-209.

[30]Major Paul W. Thompson, *The Army Engineers*, (New York, N.Y.: W.W. Norton, 1942); *Engineers in Battle*, (Harrisburg, P.A.: Military Service Publishing Company, 1942).

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[32]Ibid. 252-261.

[33]Ibid. 252-261.

[34]Ibid. 252-261.

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Initial Observations By Engineers in the Gulf War

By Vernon Lowrey

The Desert Storm victory depended heavily on massive engineer support. Engineers constructed hundreds of miles of main supply routes (MSRs), logistics facilities and base camps, airfields, landing pads and aviation maintenance facilities, combined arms training facilities for maneuver units, and several prisoner-of-war camps.

They also played a critical role in general defense planning to thwart incursion of Iraqi forces into Saudi Arabia. Engineers dug in maneuver units, and provided force protection and camouflage. They provided updated maps and topographic imagery for fighting forces, trained units in breaching Iraqi defenses, and accomplished countless other preparatory tasks for both American and allied forces.

And just before Desert Storm forces crossed Iraqi lines, engineers cleared gaps in the enemy's complex obstacle belts. When the attack began, engineer soldiers were well forward with covering force and scout units.



Engineers fire a MICLIC (mine clearing line charge) during Operation Desert Storm. The MICLIC appeared to suffer from several shortfalls during the Gulf War (U.S. Army photo).

Following the allied victory, engineers cleared MSRs deep into Iraqi territory, allowing supplies to keep up with maneuver units. Sappers cleared wide areas of unexploded mines and other ordnance, and destroyed vast quantities of captured Iraqi facilities, vehicles, weapons and munitions.

After the cease fire, engineers constructed redeployment bases, and assisted in the initial reconstruction of Kuwait. Engineer forces continue today to assist war refugees, and are working to restore Saudi facilities and roads.

Observations

The Gulf War clearly showed that certain engineer problems, identified since World War II, continue to be a source of concern, including countermine/counterobstacle operations, and the engineer force structure for the heavy divisions. The operation also showed that the recent procurement of new engineer equipment, like the M9 armored combat earthmover (ACE), the small emplacement excavator (SEE), and the full-width combat engineer vehicle mine rake (CEV), were wise choices—and invaluable to the success of the operation.

Nothing "new" has really been gleaned from the operation, and the engineer community seems to be on track with the refinement of current engineer doctrine, training, organization, materiel and leader development.

The following are ten major engineer observations from Operations Desert Shield and Desert Storm. The commandant of the Engineer School has passed them on to the Center for Army Lessons Learned to be used for further study and development. These are only observations, and will become official "lessons learned" only after they have been analyzed. There are many observations currently under study, and these are some of the more important ones.

1. *OBSERVATION:* Formation of "regimental engineer" organizations in heavy divisions.

"The regimental engineer organization... allowed the regimental engineer staff to be an integral part of the decision cycle, rather than just reacting to it."

DISCUSSION: Regimental engineer force structures were created in four of the five heavy divisions deployed to Saudi Arabia. The regimental engineer organization consisted of a headquarters detachment and three engineer combat battalions—one associated with each maneuver brigade. Engineer planning took place inside the maneuver commander's decision cycle. This allowed the regimental engineer staff to be an integral part of the decision cycle, rather than just reacting to it. The time freed up by efficient engineer planning and operations allowed maximum use of mobility, countermobility, and survivability operating systems. For the first time, maneuver commanders were able to mass engineers at the point of application.

RECOMMENDATION: Continue to form regimental engineer organizations in each heavy division, as approved by the Army chief of staff in April 1991.

2. ***OBSERVATION:*** The M9 ACE worked well.

DISCUSSION: Desert Storm provided the first hard evaluation of the M9 ACE. Though not intended as an assault breaching vehicle —hence its light armor protection—the ACE proved to be a success in breaching obstacles that were not covered by fire. The ACE remained well forward, and was available for task force operations when required. ACE missions included knocking down Iraqi berms, constructing friendly survivability positions, and digging trenches for the destruction of captured munitions. Its mobility was also a key factor, because it did not require the additional transport vehicles normally associated with bulldozers. Commanders commented that the ACE needs an additional crewman and a weapons system such as the .50 caliber machine gun, or the Mark 19 automatic grenade launcher.

RECOMMENDATION: The M9 ACE should continue to be fielded in sufficient quantities in all combat engineer companies. ACE training needs to be emphasized in the future. The concepts of a weapons station, blade design, engine improvement, and two-man crew need further study.

3. ***OBSERVATION:*** The overall breaching capabilities of engineer forces must be improved in order to provide effective mobility support.

DISCUSSION: Iraq developed formidable, complex obstacle systems to blunt penetrations into Kuwait by allied forces. The U.S. Army and its allies responded with several existing systems, and quickly developed other, mechanical obstacle-reduction methods. In addition, a combined arms breaching doctrine, described in Field Manual (FM) 90-13-1, was implemented, rehearsed, and successfully executed.

On the whole, complex obstacle breaching was not conducted under fire. If this had been the case, the breaches would have been more difficult because of the numerous systems and methods in use. Desert Storm revealed that the current (essentially World War II vintage) breaching and clearing capabilities—along with a lack of demolition expertise—severely limited our ability to breach modern mine fields.

The modern conventional mines now employed by Third World countries are more sophisticated than our own. They contain magnetic, double impulse, and seismic fuses, along with anti-disturbance devices. They also contain little or no metal, and most mine detectors are ineffective in locating them.

The sophistication of these mines also makes the use of grappling hooks, bangalore torpedoes, and mine probes a very hazardous proposition. Other mechanical and explosive breaching methods proved slightly faster, but were limited in numbers and success. The mechanical systems lacked the mobility and protection required to provide responsive support to maneuver forces, and only managed a cursory obstacle reduction capability.



An Iraqi minefield on the Kuwaiti coast. While Iraq built formidable obstacles on both the southern and coastal borders of Kuwait, Desert Storm engineers successfully breached them using current combined arms breaching doctrine (U.S. Army photo).

Breaching by Air Force bombing was ineffective. Bombing patterns did not provide a straight lane, and made proofing with plows and rollers difficult and ineffective. Such bombing also left metal fragments which interfered with mine detection, and left dud bombs which had to be cleared.

Once a breach was established, breach lane marking was ineffective. There were no standard marking systems identified in the theater. The cleared lane marking system (CLAMS), and the hand-emplaced minefield marking system (HEMMS) proved ineffective for most units, and were seldom used. Both systems proved difficult to see at night. The HEMMS could not be easily deployed from the rear of lead vehicles in breach lanes, and the CLAMS was often covered by sand from passing vehicles.

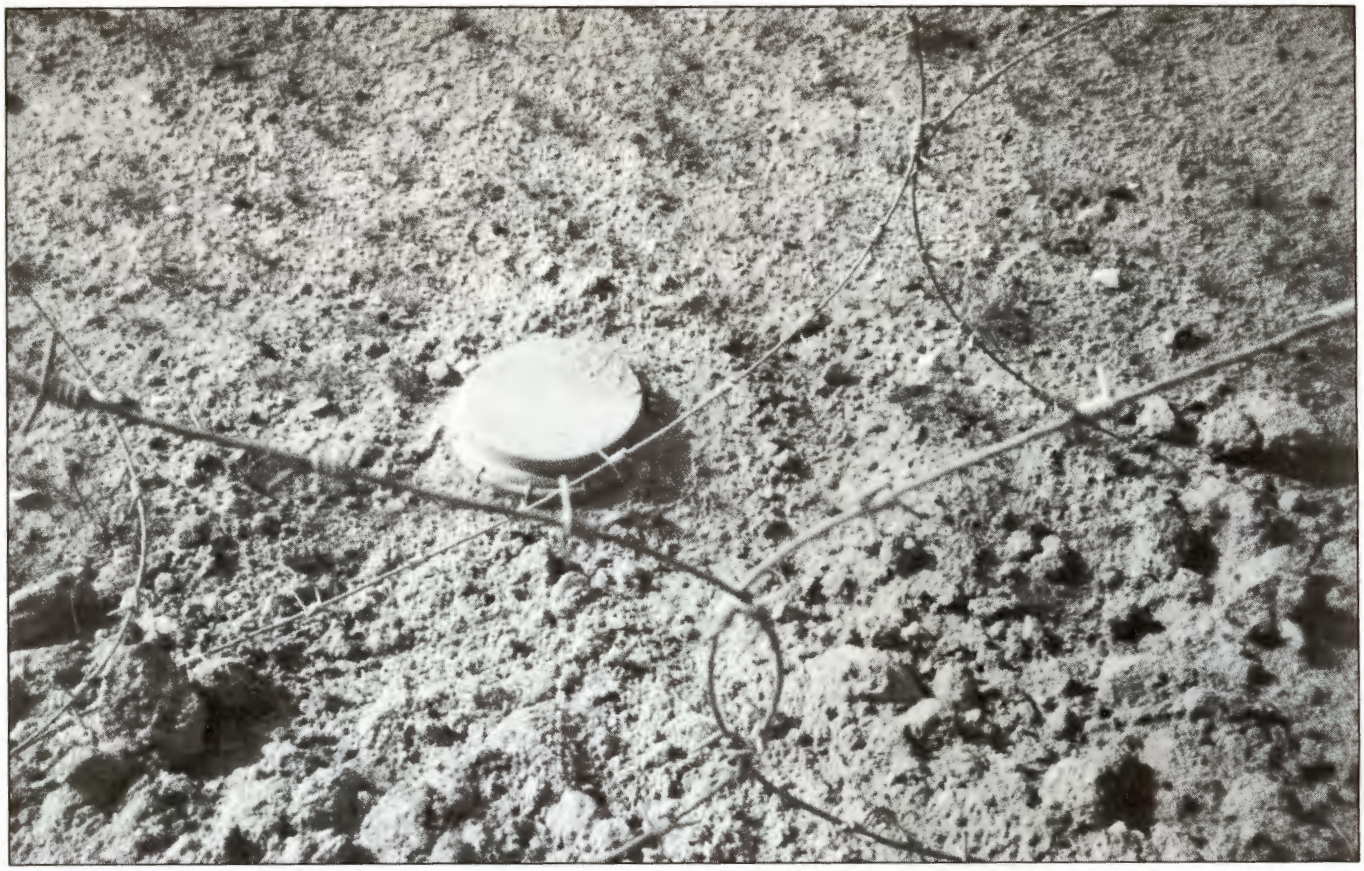
Descriptions of several mechanical obstacle reduction systems and comments on their effectiveness follow:

Mine Clearing Line Charge (MICLIC). The MICLIC had several shortfalls. Numerous firing failures occurred during live fire training, involving both the trailer firing circuits and rocket/line charge circuits. Test firings prior to the start of hostilities resulted in a 50 percent failure rate (primarily due to unfamiliarity with the system, inadequate training prior to arrival in theater, and production quality control).

Additionally, the MICLIC only attacks the mine fuse—not the mine itself. As a result, it was only effective against single, short-impulse, pressure-fuzed mines that were surface-laid, or buried 10 inches or less below the surface. The system also left "skip zones" (0.75 meter (m) to 1.5m) on both sides of the centerline, where mines escaped destruction from overpressure blast. Mines with other types of fuzes were not affected by the MICLIC.

The unarmored MICLIC trailer, towed by armored vehicles, suffers from a lack of survivability and mobility that hinder the usefulness of the system.

Mounting the MICLIC on an armored vehicle launched MICLIC (AVLM) provided more survivability, but did little to help other operational problems. The AVLM is a modified AVLB (armored vehicle launched bridge) chassis with two MICLICs on the rear deck. Commanders planned for their use as part of deliberate breaching operations, but left them behind once the initial breach and pursuit were initiated. Simply put, the older M48/M60 chassis was unable to keep up with the M1s and M2s of the maneuver forces.



An Iraqi mine in southern Kuwait. These mines are much more sophisticated and versatile than our own, and contain magnetic, double impulse, and seismic fuses—along with anti-disturbance devices (U.S. Army photo).

Another logistical limitation was imposed by the 100m length, or effective range of the system. Commanders found that several MICLICs were required for breaching complex obstacles.

The Combat Engineer Vehicle (CEV). Engineer forces conducting breaching operations with the CEV found that the vehicle was unable to keep up with maneuver forces—diminishing its value to the operation. The CEV also had maintenance delays because it is built on the M48/M60 chassis and spare parts were not readily available in a theater where most U.S. tanks were M1s.

The CEV Full-Width Mine Rake. This rake is a non-developmental item developed and fielded specifically for use in Desert Storm. The rake is suited only to a dry sand environment, giving it a very narrow usefulness. The rake was normally employed after a MICLIC firing to proof and clear a lane. Because the rake was designed to remove only antitank mines, antipersonnel devices slipped through the tines. Once the deliberate breaching operation was completed, commanders left them behind. Overall, the rake worked well during Desert Storm.

Countermine Sets (Mine Rollers and Mine Plows). Extensive training and rehearsal with mine rollers and mine plows took place during Desert Storm. Prior to this, countermine sets received little more than "lip service" from the maneuver community.

The use of tank-mounted mine plows for lane clearing or breaching proved to be very effective against surface-laid and scatterable mines. The plows were effective at punching through the Iraqi sand berms and clearing minefield lanes for the tanks.

Mine rollers, however, were judged by armored forces to be ineffective and cumbersome.

Overall, Desert Storm validated the value of mine breaching systems mounted on fast, survivable vehicles. The most effective system will depend on the tactical situation, but the need for the capability is clear.

Others. Other means of reduction not addressed here included the ACE, the AVLB, and manual techniques (grappling hooks, probes, and bangalore torpedoes).

RECOMMENDATION: The mechanical reduction methods now in use need to be replaced by a system that will provide the AirLand Battlefield maneuver commander with a highly mobile and effective obstacle reduction capability. That system is the

combat mobility vehicle (CMV). The CMV is highly mobile, survivable, and can be very effective in the reduction and clearing of complex obstacles—without the aid of other mechanical or manual reduction means.

The CEV should be replaced by the CMV. There must be four CMVs per company, supporting a maneuver task force (two per breached lane). The CMV needs a crew of at least two soldiers in order to conduct 24-hour operations.

Current countermine sets should remain with armored forces as a self-extraction capability. Mine rollers should remain in the force for use in terrain other than that found in the Persian Gulf region.

Additionally, we need an improved or modified MICLIC to correct the identified deficiencies. The MICLIC must be mounted on a survivable vehicle that can keep up with the supported maneuver units. Live fire exercises for the MICLIC must be included in the Combined Arms Training Strategy (CATS). Adequate resources must be provided by the Standards in Training Commission (STRAC) to support live firing by engineer forces. Live fire training sites must be identified for the MICLIC and similar systems.

Standoff minefield detection systems, remotely operated breaching devices, and a standardized, simple, and durable minefield marking system need to be developed. Live mine training must be emphasized in order for soldiers and leaders to gain sufficient skill and confidence.

4. *OBSERVATION:* Gap crossing with the AVLB-M48/M60 chassis.

DISCUSSION: The AVLB continues to be a viable means of crossing gaps of 18 meters or less. However, there are major mobility and survivability concerns. The AVLB is mounted on an outdated M48 or M60 chassis that cannot keep up with main battle tanks or infantry vehicles, and can't offer the same degree of protection.

RECOMMENDATION: As we continue to rely on AVLBs for crossing short gaps, we must begin to mount the system on the M1 chassis. This will give the AVLB the mobility it needs to support rapidly advancing maneuver units.

5. *OBSERVATION:* Combat engineers mounted in M113s or 5-ton dump trucks could not keep pace with maneuver forces.

DISCUSSION: Once maneuver forces broke through initial Iraqi defenses and advanced rapidly to the north, combat engineers in outdated and slow vehicles were left lagging behind. Engineer units require mobility and protection commensurate with that of supported maneuver forces. They must be agile enough to respond to the needs of maneuver units as the situation develops—not afterwards. This lack of mobility degraded the capability of engineers to respond to missions during the attack. The required level of engineer protection was not adequately assessed in this operation.

RECOMMENDATION: The current divisional mechanized combat engineer squad M113 should be replaced with a modified version of the M2 infantry fighting vehicle—making it a "sapper vehicle." Since the M2 turret is not required for the engineer mission, it should be replaced with a commander's machine gun station. Removing the turret also allows increased internal storage for squad equipment and munitions.

M2s and M113s could be transferred from deactivated divisions for use as sapper vehicles. Not all mechanized engineers would be able to receive M2s, so M113s should be allocated to lower priority units. Corps combat engineer squads that support mechanized forces should also receive M113s.

6. *OBSERVATION:* The M548 tracked ammunition carrier could not keep up with heavy forces.

DISCUSSION: The M548 is the prime mover for ground emplaced mine scattering systems (GEMSS) and the upcoming VOLCANO mine system. Because of its relative slowness, the carrier normally moves with combat trains instead of maneuver elements.

RECOMMENDATION: Replace the M548 with a vehicle providing enhanced speed and survivability for the GEMSS and VOLCANO.

7. *OBSERVATION:* Before the start of gulf operations, realistic training on complex obstacle breaching was not conducted at the combat training centers (CTCs).

DISCUSSION: When it became apparent that allied forces would have to breach a complex obstacle system in order to retake Kuwait, a serious deficiency in unit training was discovered. Units traveling to the CTCs had not practiced complex obstacle breaching. In fact, units at the NTC did not have rollers or plows, and MICLIC trainers were not being used.

This resulted in a last-minute effort to train units in the complicated breaching operation, along with the organization and equipment necessary to support it. If the CTC program had operated as planned, realistic threat training would have been in place.

RECOMMENDATION: Units training at the CTCs should train to standards. The threat should be accurately portrayed and breaching operations should

be conducted in accordance with FM 90-13-1. Because breaching, like bridging, is an extremely complex task, units must keep their skills current so they will be better prepared to conduct this operation.

8. *OBSERVATION:* Current conventional mine stocks need to be modernized. Inventories of scatterable mines must be expanded to meet contingency requirements.

DISCUSSION: Foreign conventional mines are complex, yet highly effective and versatile, highlighting the obsolete nature of our own mine stocks. Had the roles been reversed, it would have been far easier for the enemy to breach our obstacles. Overpressure protection, advanced fuzing, and anti-handling features make foreign mines an attractive alternative to our current stock of conventional mines.

Existing stocks of scatterable mines did not meet theater requirements. Europe-based battalions were the only units with GEMSS equipment. Artillery-delivered scatterable mines have not been produced in sufficient quantities to meet anti-personnel and anti-tank requirements. Marine requirements also put a strain on the limited availability of these mines. Only two Air Force scatterable minefields were employed.

RECOMMENDATION: Replace current conventional mine stocks with modern models. Adopt a common-fuzed mine which has the flexibility of performing any of the current mine functions. Provide a capability for remotely arming/disarming/self-destructing these mines. Increase production and fielding of scatterable mines and their delivery systems to meet future contingency requirements.

9. *OBSERVATION:* Engineers need a hardened ambulance for casualty evacuation on the battlefield.

DISCUSSION: Currently, the mechanized engineer battalion is authorized only one soft-skinned ambulance. Mechanized engineer companies must have an armored, tracked ambulance in order to evacuate casualties from the battlefield. Area evacuation doesn't work because of the size of the battlefield and the number of casualties. Maneuver units were forced to give up their own M113 ambulances in support of engineers conducting breaching operations.

RECOMMENDATION: Authorize an M113 ambulance in each mechanized engineer company.

10. *OBSERVATION:* Topographic survey support and map production failed to meet the requirements of units at corps level and below.

DISCUSSION: Gulf operations showed the need for new and updated topographic capabilities. Existing control points for corps artillery were of questionable accuracy, since they were established from local datums or by unknown procedures. The nature of the gulf region emphasized the need for automated, integrated survey instruments (AISI) and the global positioning system (GPS) to provide positioning and navigation for engineers.

Rapid, down-sized, and tailored map production capabilities are also needed to support tactical commanders at division level and below. This capability is currently available with non-developmental items of equipment, but these systems are not tactically feasible because of special handling and power requirements.

RECOMMENDATION: Topographic survey capabilities should be retained in the force structure to allow engineers to map and update potential contingency theaters. Geodetic-quality GPS systems should be fielded to topographic units for survey purposes. Compact, rugged equipment needed at the division level includes a down-sized digital topographic support system (DTSS), digital cartographic integrated information system (DCIIS), and quick response multi-color printer (QRMP). This equipment should be mounted on a high mobility, multi-purpose, wheeled vehicle (HMMWV) to provide better support to the maneuver commander.

Mr. Lowrey is chief of the Engineer School's Analysis Division, Directorate of Evaluation and Standardization. He previously served as primary action officer for the E-Force and Engineer Restructure Initiative for the directorate. As an Army National Guard major, he also serves as S-3 of Missouri's 1138th Engineer Combat Battalion. Previous military assignments include company commander, platoon leader and S-1. He holds a bachelors degree from Colorado State University.

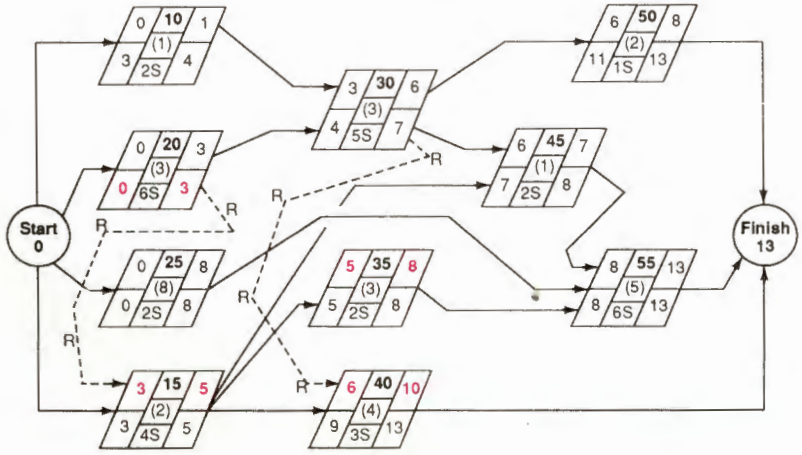
PART I: Resource Constrain The Early Start Schedule

After constraining the early start schedule, we find there are two resource delays (R) and one logic delay (L). Activity 15 cannot start until the resource from activity 20 becomes available. When delayed, activity 15 moves into interfering float. This causes a logic delay of three days for activities 35 and 40. When time period 6 is constrained, we find that activity 40 must be delayed one additional day for insufficient resource. The resource needed for activity 40 must come from activity 30.

Network Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
10 (30)	2S																				
15 (35, 40, 45)				4S	4S	R															
20 (30)	6S	6S	6S																		
25 (55)	2S	2S	2S	2S	2S	2S	2S	2S													
30 (45, 50)				5S	5S	5S															
35 (55)						2S	2S	2S	L												
40							3S	3S	3S	3S				R							
45 (55)							2S														
50							1S	1S													
55									6S	6S	6S	6S	6S								
Squads (S)	~~14~~	~~13~~	~~13~~	~~12~~	~~12~~	~~10~~	~~5~~	~~3~~	~~6~~	~~6~~	6	6	6								
	10	8	8	11	11	9	10	8	9	9											

PART II: Update The Logic Network

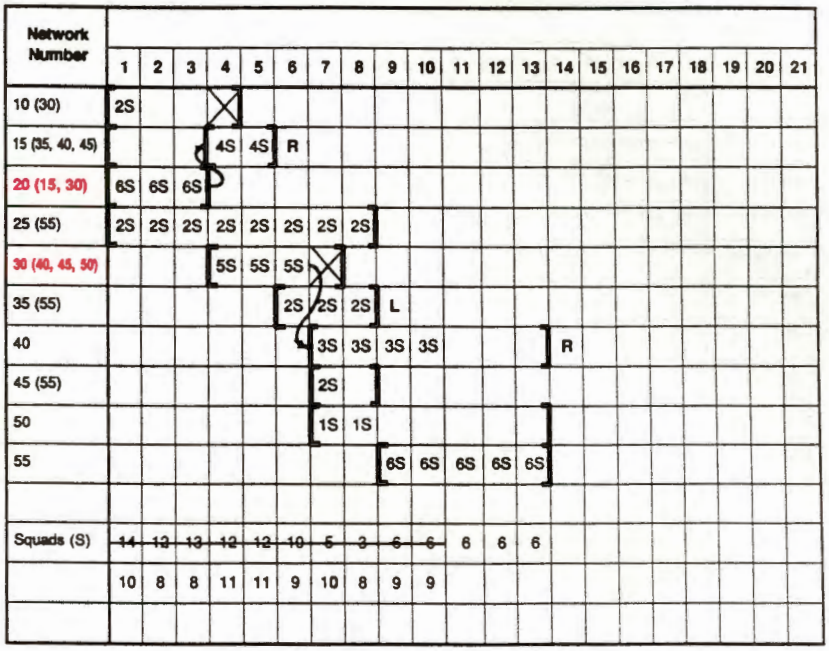
We incorporated the two resource flow arrows into the logic network by drawing dashed arrows and a superimposed "R". This established two new paths in the network and changed the time analysis. The updated network and time analysis are shown below. Changes in the time analysis are annotated in red.



Engineer Solution

PART III: Update The Early Start Schedule

The changes made in the logic network must be incorporated into the early start schedule. After updating the activity numbers (Step 10), time frames (Step 11) and float calculations (Step 12), we prepared the following early start schedule. Activity numbers that changed are shown in red. Time frames (early start and/or late finish) changed for activities 15, 20, 35 and 40. Interfering float calculations did not change for the activities with float (activities 10, 30, 40, 45, and 55).



Summary. At this point we have constrained the resources for the project. Three additional activities (20, 15 and 35) have become part of the critical path. Critical activities are defined as activities with zero float. None of the changes resulted in any activity being delayed beyond its late finish (right bracket). Therefore, the project duration will not change.

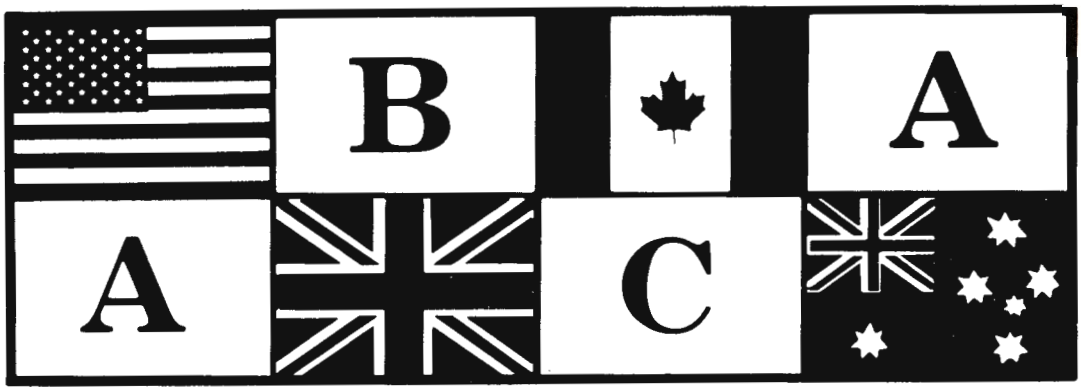
Notes: The step-by-step procedure described in this problem will produce a solution to the resource problem. If this technique results in project delays that are unacceptable, there are two variations the manager can use to select activities to delay (Step 2).

The first variation is to delay the early start of an activity that is ongoing, but does not begin, during the time frame identified in Step 1. In some cases this option provides a better solution to the resource problem. The procedure used is the same, except that the first activity delay will be greater than one time period.

The second variation is to delay part of an activity (splitting an activity). This option requires that you redefine the logic network and make two activities out of one. You must add the new activity to the early start schedule.

A project manager can use these techniques after he or she fully understands the basic technique described in Step 2. For any project with insufficient resources, the project manager must ultimately decide which activities to delay. An understanding of the intricate interaction between each activity will enable the manager to make informed decisions and successfully complete the project.

This problem was submitted by Captain Earl Hooper, an instructor in the Combat Construction Division, Department of Instruction, U.S. Army Engineer School.



The Quadripartite Working Group:

Honing Engineer Standardization

By Captain Kathryn M. Ohmann

Operation Desert Storm engineers are still sifting through the lessons of the Gulf War, but one thing they know for sure: The standardization of allied engineer equipment, tactics and procedures was critical to the swift victory over Iraq.

That's the word from engineer officers from four coalition nations—the United States, United Kingdom, Canada and Australia—who recently met at Fort Leonard Wood for the 10th Quadripartite Working Group on Engineers (QWG Engr).

Background

The QWG is part of the American-British-Canadian-Australian (ABCA) Armies Standardization Program, initiated shortly after the end of World War II. Its origins can be traced directly to the close working relationship of the Allies during World War II. Within two years after the war's end, General Eisenhower and Field Marshall Montgomery sought to maintain the hard-earned interoperability between British and American forces by implementing the "Plan to Effect Standardization" in 1947. The plan, supported by Canada as well, had two basic purposes: minimize materiel or technical obstacles to full wartime cooperation among the armies concerned, and maximize economy of resources and effort. In the following years, equipment began to appear in the three armies with the designation ABC preceding the model and nomenclature of the item, indicating an operational commonality.

By 1963 Australia joined the effort, and the program was ratified by the current agreement, called the Basic Standardization Agreement 1964 (BSA 1964). New Zealand initiated cooperation with the ABCA in 1965 and, though not a signatory to the BSA, maintains close ties with the organization.

Working under the authority of BSA 1964, the aims of the ABCA are to:

- Ensure cooperation and collaboration among the ABCA armies
- Achieve the highest possible degree of interoperability among the signatory armies through materiel and nonmateriel standardization
- Obtain operational economies through the use of combined resources and effort

To achieve those ends, the ABCA strives to:

- Keep each army fully informed of research and development (R&D) taking place in the other armies
- Guide R&D so that it meets the requirements of all four armies
- Record and maintain formal agreements on materiel and nonmateriel items or concepts



A team of Canadian Army engineers lifts a section of bridge during a training exercise. Commonality of equipment was a significant contributing factor to the success of Operation Desert Storm .

meeting the needs of two or more armies

- Ensure that such formal agreements are not modified without consultation

At the senior level, each army gives direction to the program through quadripartite standardization discussions known as TEAL (tactics, equipment and logistics). These discussions are held in rotation among the four member countries approximately every 18 months. They are attended by officers at the vice/deputy chief of staff level—or equivalent—and their delegations. At the action level, the policy-making body is the Washington Standardization Officers (WSO). This group is composed of senior officers on duty in Washington D.C. They represent each of the member armies and collectively provide management guidance to the program by discussing policies, programs and procedures.

The WSO is supported by the Primary Standardization Office (PSO), which is composed of military representatives from each of the armies. The PSO provides the secretariat for the WSO, reviews the progress of the ABCA Program, and monitors the activities of the QWGs. This office is led by a director (colonel), provided by each of the participating countries on a rotational basis, and lieutenant colonels from each country. The lieutenant colonels are designated as the Primary Standardization Officer (PSO) for their country.

In addition to these ABCA elements, each army designates a National Standardization Officer (NSO) and appoints three Standardization Representatives (StanReps) to each of the other three armies. The StanReps' duties include liaison with the staff agencies to which they are accredited, and relaying information and reports to their own army.

QWGs

The key working elements of the program are the QWGs. Currently, 18 QWGs exist to exchange information, develop concepts, recommend areas for cooperation and standardization, develop Quadripartite Standardization Agreements (QSTAGs) and assist the WSOs to maintain the standardization progress. QSTAGs are formal agreements ultimately incorporated into "how to fight" manuals. They define the level of standardization to be achieved in materiel and non-materiel fields.

The current QWGs are: Engineers, Engineering Standardization, Air Defense, Infantry, Armor, Intelligence, Army Operational Research, Logistics; Aviation, Nuclear-Biological-Chemical Defense, Combat Developments, Command and Control, Proofing, Inspection, and Quality Assurance, Communications and Information Systems, Surface-to-Surface Artillery, Electronic Warfare, Surveillance, Target Acquisition, Night Observation, and Health Service Support.

Most of the detailed work of standardization is conducted in the QWG forum. Experts in the appropriate fields represent their army at QWG meetings. Meeting time is used principally to resolve issues that cannot be settled by correspondence, and redirect the work of the QWG in accordance with TEAL guidance. In the time between such meetings, correspondence between national points of contact (NPOCs) carries the QWG workload.

Each QWG has a standing chairman, appointed by the WSO, who coordinates QWG business and chairs meetings. The QWG Engineer standing chairman is always provided by Australia.

In general, the role of each QWG is to:



Australian engineers conduct river crossing training using a British Class 30 aluminum bridge. Crossing the bridge is an Australian cavalry fire support vehicle, a modified version of the American M113 armored personnel carrier.

- Exchange information
- Develop concepts
- Influence requirements
- Identify areas for cooperation and standardization
- Develop standardization agreements
- Participate in the validation of standardization agreements
- Maintain the standardization level that has already been achieved
- Review appropriate sections of the standardization list (STANLIST) to ensure that it remains current in both content and application, and recommend additional items for the list

On a QWG's recommendation, special working parties (SWP) and information exchange groups (IEG) may be established to achieve, through correspondence, tasks requiring expert examination beyond the QWG's capability, and to explore other areas of potential standardization. QWG Engineer has two associate SWPs: Field Electrical Power Systems, and Mapping, Charting and Geodesy. QWG Engineer also has an IEG on Engineer Command, Control and Information Systems. These SWPs perform valuable work in their specialist areas of concern, though interoperability in both of these areas is still some way off.

10th QWG Summary

The 10th QWG Engineer was held 5-11 June 1991, at the Engineer Center, Fort Leonard Wood. Attendees included:

Standing Chairman - LTCOL K.J. Gillespie (AUS)
WSO Representative - LTCOL A.W. Ayerbe (AUS)
NSO Representative - Dr. R. Wiltshire (US)
StanRep - LTCOL E.W. Challis (AUS)
US Delegation - COL F.J. Charles III, LTC R.J. Somerville, Mr. C.F. Wassan, MAJ W.D. Johnson (USMC)
UK Delegation - Col P.B. Page, Lt Col (R) D. Silver, Maj J.P.J. O'Sullivan
CAN Delegation - LCOL D.A. Grice, Maj R. B. Nageleisen, Maj J. Hamel
AUS Delegation - COL P.C. Cooper, LTCOL P. Newman, MAJ G.O. Fenton
NEW ZL Observer - LTCOL A.T. Beaver

A special working group, composed of the QWG NPOCs, met for two days before the meeting began to discuss interoperability gaps and a plan of action. This meeting identified and prioritized areas for the QWG agenda. In many cases, the priorities were changed from the original agenda because of recent engineer developments.

Discussions continued to center on low and mid-intensity conflicts, with particular emphasis on priority tasks identified in the QWG Engineer Plan of Action. Interoperability aims were directed toward ensuring that an ABCA engineer squadron/company would be able to operate effectively as a subunit of any member nation's brigade or engineer regiment. Integration of units below squadron/company level was not considered feasible.

Concentration of work for mid- and low-intensity conflicts will probably be centered on general

engineer support and engineer command, control and information systems (ECCIS). Work on ECCIS is particularly important because it's a key factor in achieving interoperability. Before the 11th QWG Engineer meets, the WSO will probably be asked to approve the formation of a Special Working Group ECCIS.

The reorganization and down-sizing now taking place in each army may well have a detrimental effect on the ABCA program. QWG Engineer decided that the current program of work should continue without amendment. However, dates for the execution of individual tasks, and perhaps the whole program, may have to be slipped as reorganizational changes take effect.

The major achievements of the 10th QWG Engineer meeting were:

- A review of the assessment of interoperability gaps and preparation of a revised plan of action
- A revision of concept papers, reference and working papers, and QSTAGs
- A major discussion of ECCIS and its role as a key factor in future interoperability
- Reconfirmation of ECCIS and general engineer support as priority areas for future work
- Confirmation of the structural changes and developments undertaken at previous QWGs
- An exchange of information and ideas

The 11th QWG Engineer is scheduled to be held in the United Kingdom in October 1992.

Achieving true interoperability between allied forces is a daunting objective. But the accomplishments of the ABCA Program proved their worth in the Gulf War, and the QWG Engineer will continue to be a vital part of those efforts.

Captain Ohmann is the information management coordinator for the Engineer School's Directorate of Combat Developments. She served as the administrative officer in charge of planning and organizing the 10th QWG Engr meeting. Captain Ohmann's previous assignments include platoon leader, adjutant and S-2 for the 29th Engineer Battalion (TOPO). She is a graduate of the Engineer Officer Advanced Course, Combined Arms and Services Staff School, and North Dakota State University.

The ENGINEER Writer's Guide

We think engineers take a special pride in their profession, and *ENGINEER* is always looking for articles from readers who want to share their expertise, experience and ideas.

If you're a potential contributing writer, here are a few "writer's guide" tips that should help steer you in the right direction:

Articles can cover engineer training, operations or doctrine, engineer equipment, history or other areas of general interest to an engineer readership.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers—that's what we need.

Articles should generally come from contributors with first-hand experience with the subject being presented.

Avoid theatrical writing styles like: "It was a dark and stormy night...," or "...the soldier blazed through the jungle on his lumbering D7, providing a trail of freedom for the other vehicles..."

Articles should be concise, straightforward, and in the active voice.

Length should range between 2,000 and 4,000 words, and the text should be typewritten and double-spaced. Generally, each such page will contain from 200 to 250 words.

Articles containing attributable information or quotations not referenced within the story should carry appropriate footnotes.

Manuscripts must be original, unpublished, and not under consideration by another publication. Normally, you can expect a reply to your submission within two weeks after we receive it.

All submissions are subject to editing.

Contributors are encouraged to include black-and-white photos, artwork, and/or line diagrams to help illustrate your article.

Include your full name, rank, current unit and job title. Also include a list of your past assignments, experience and education, your mailing address, and daytime phone number—preferable Autovon. Send your articles to: Editor, *ENGINEER* Professional Bulletin, ATTN: ATSE-TDM-PB, Fort Leonard Wood, MO 65473-6650.

If you have any questions about an article you're working on—or considering writing—give our features editor, Phil Howell, a call at Autovon 676-7643, or commercial (314) 563-7643.

We look forward to hearing from you.

P.S.* ENGINEER *is planning to start a Letters to the Editor column soon, and correspondence from our readers is welcome.

ENGINEER UPDATE

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

Directorate of Training and Doctrine (DOTD)

Topographic Division Welcomed. The Department of Topographic Engineering is reorganized as a division under the Directorate of Training and Doctrine. Office telephone numbers are the same: -5433/5435. LTC Mark Schnable, the chief, came to us from Fort Shafter, Hawaii, where he was commander, 29th Engineer Battalion (Topographic). POC is Robert Valska, -7505.

Combined Arms Training Strategy. Proposed training strategies for the combined arms training strategy (CATS) will be distributed to the field for comments by April 1992. POC is CPT Frank Barry, -7594.

DA Pam 350-38 Revision. The review process for DA-PAM 350-38, Standards in Weapons Training, has been accelerated due to issues arising from Desert Storm operations. Plans are to review field comments and produce an updated DA PAM 350-38 by the 4th quarter of fiscal year (FY) 92. POC is Rayburn Toy, -7591.

Directorate of Combat Developments (DCD)

Explosive Malfunctions. Units returning from Saudi Arabia report numerous malfunctions with demolitions, particularly with the M180 Demolition Cratering Charge. If your unit experienced problems with explosives in the Persian Gulf or in normal training, call the Engineer Hotline, AV 676-7324 or (314) 563-7324. When recording your message, include a POC (name, unit, and phone number), and the ammunition type and lot number. If possible, do not destroy the evidence. POC is SFC Leatherman or Eric McGrath -7337/7256.

Engineer Restructure Initiative (ERI). Implementation of ERI has been approved in the FY 92 FORSCOM Command Plan. This conversion will affect 11 CONUS installations. The redistribution of engineer assets within FORSCOM includes heavy divisional battalions, corps mechanized battalions, and separate engineer companies. POC is Pete Malley, -7243.

Engineer Center Welcome Packets. Students scheduled to attend professional development courses at the Engineer Center should receive welcome packets before they come to Fort Leonard Wood. Students who do not receive a welcome packet 30 days prior to their scheduled report date should request one by calling the appropriate office:

▶ Engineer Officer Basic or Advanced Course (EOBC/EOAC) - AV 581-4367, (314) 596-4367.

▶ Primary Leadership Development Course (PLDC), Basic or Advanced Noncommissioned Officer Courses (BNCOC and ANCOC) - AV 581-2419/6334, (314) 596-2419/6334.

POC is Bob Clark, -5320.

Directorate of Evaluation and Standardization (DOES)

Desert Shield/Storm Oral History Program. Units returning from the Persian Gulf area will participate in an oral history program conducted by DOES. The program is designed to collect information about soldiers' experiences, opinions of the value and importance of equipment, and solutions to issues. Key unit personnel, recorded on tape, will discuss topics

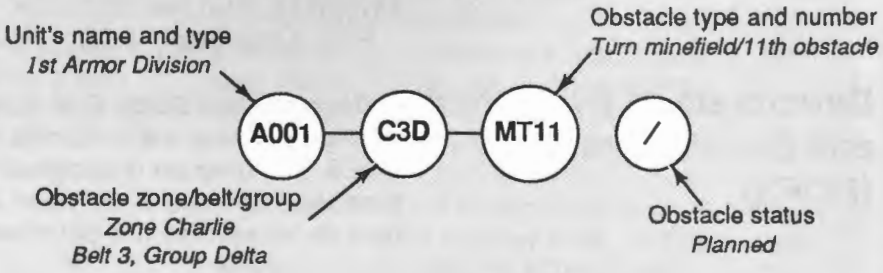
such as deployment, combat, administration, and logistical operations.Initial analysis of transcripts and other related documents will be used to determine impacts on engineer doctrine, training, organizations, materiel, and leader development.

Every engineer unit that was in the Persian Gulf will participate. If your unit participated but has not been contacted by DOES, call Vern Lowrey, -5304.

Department of Instruction (DOI)

Obstacle Numbering System. The standard numbering system for obstacles described in Appendix 2 of FM 5-102, *Countermobility*, is obsolete. The new, revised obstacle numbering system shown below will consist of 11 characters and an obstacle status symbol. It will show the type of obstacle, the belt and zone in which it is located, and the headquarters that established the zone. POC is CPT Bob Wray, -5808.

Character	Description
1 through 4	Alphanumeric descriptions of the headquarters type and numerical designation that established the obstacle zone. Character 1 designates the unit type with a letter (A, Armor Division/Brigade; I, Infantry Division/Brigade; C, Cavalry Division; R, Cavalry Regiment; and Z, Corps).
5	Letter indicating obstacle zone.
6	Number indicating belt number in obstacle zone.
7	Letter indicating group in obstacle belt.
8 and 9	Letters indicating obstacle type.
10 and 11	Two numbers indicating obstacle number in the group.
12	One of four characters indicating obstacle status: / (slash = planned obstacle. – (dash) = obstacle being prepared. + (plus) = prepared obstacle. The + is for reserve demolition targets and may indicate a readiness state of safe or armed. X ((X) = completed obstacle.



Obstacle type abbreviations:

B - Bridge demolition (demo)
- BA - bridge demo, abutment
- BS - bridge demo, span
- BC - bridge demo, combination of abutment and span

M - Minefields
- MD - minefield, disrupt
- MT - minefield, turn
- MF - minefield, fix
- MB - minefield, block
- MN - minefield, nonstandard
- MP - minefield, protective
- MQ - minefield, nuisance
- MS - minefield, standard pattern

R - Road crater
- RH - road crater, hasty
- RD - road crater, deliberate
- RM - road crater, mined

W - Wire obstacles
- WA - wire, double apron
- WB - wire, obstacle with booby traps
- WF - wire, tangle foot
- WG - wire, GPBT
- WN - wire, nonstandard
- WR - wire, road block
- WT - wire, triple standard

S - Scatterable minefields
- SA - FASCAM, ADAMS
- SP - FASCAM, PDM
- SG - FASCAM, GEMSS
- SB - FASCAM, GATOR
- SR - FASCAM, RAAMS
- SF - FASCAM, ADAMS and RAAMS
- SM - FASCAM, MOPMS
- SV - FASCAM, VOLCANO
- SW - FASCAM, WAM

Miscellaneous
- AD - antitank ditch
- AR - rubble by CEV gun
- AB - rubble by blade
- AT - abatis
- AE - rubble by explosives
- AM - movable MOUT obstacle (car, bus, etc)
- AN - expedient nonstandard
- AL - log crib
- AP - post obstacles (hedgehog, tetrahedron)
- AH - log hurdles

Example: Obstacle number I005-A2A-SM21/ indicates the 5th Infantry Division planned the obstacle in zone A. It is the 21st obstacle in group A, belt 2, and has not been executed. The obstacle is a MOPMS.

Engineer Personnel Proponency Office (EPPO)

Civilian Proponency. EPPO has assumed proponency for employees in engineer wage grade career fields. The proponent will serve as an advocate for personnel management issues and life-cycle activities. An article explaining the program will appear in a future issue of *ENGINEER.* POC is Cynthia Matthews, -6341.

Functional Area Designation Process. The functional area (FA) designation process is underway for all year group (YG) 86 officers. By now, YG 86 officers should have returned an FA preference marksense form to Engineer Branch, PERSCOM. EPPO has provided a desired FA designation plan to Department of Army. Nominally, about 50 percent of YG 86 engineer officers will receive FA designations; the rest will be single-tracked as engineers. Results are expected by January 1992. POC is Rita Price, -5351.

Rear Guard at Kunu-Ri

By Dr. James W. Dunn

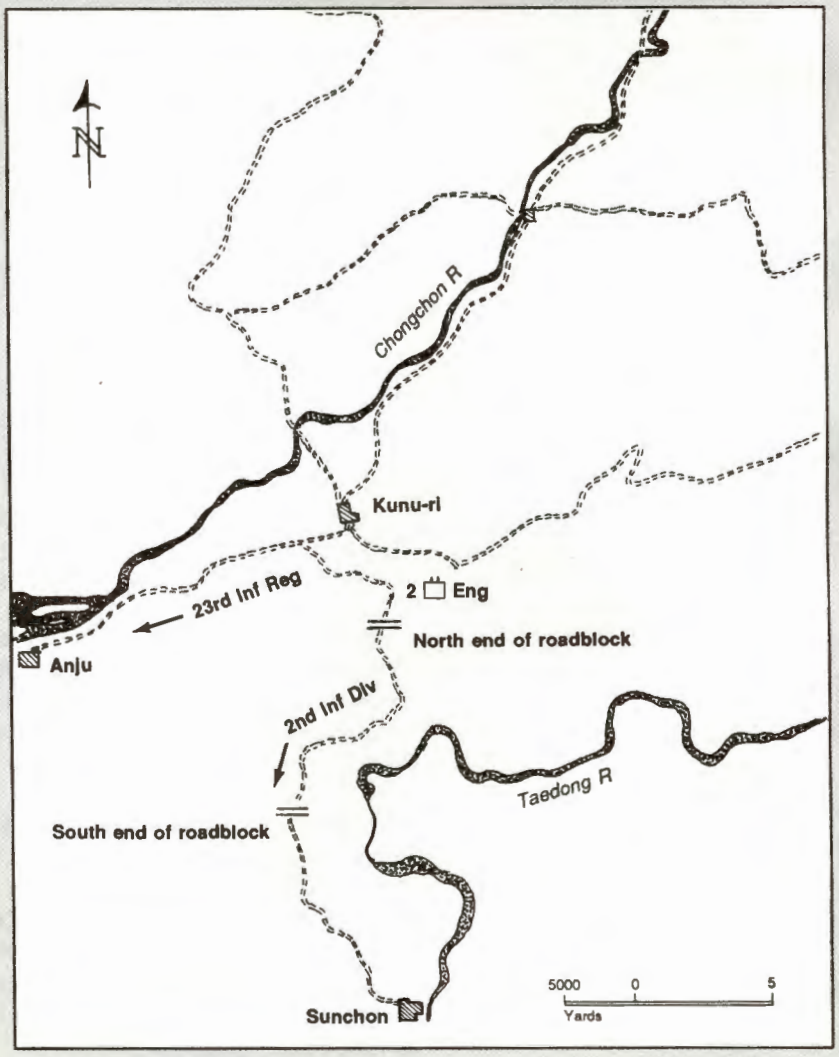
In late November 1950 the American Eighth Army, and the 2nd Infantry Division in particular, suffered a resounding defeat when Chinese forces attacked south across the Chongchon River in North Korea. Most accounts of that action credit either infantry or artillery elements of the 2nd Infantry Division with carrying out the missions of a rear guard during the critical November 30 withdrawal from Kunu-ri. In reality the rear guard at Kunu-ri was the 2nd Engineer Combat Battalion. How that came to be and what happened to the 2nd Engineers is the thrust of this article.

In the fall of 1950, the United Nations Command moved north across the 38th parallel to complete the destruction of the North Korean Army and to unify the country under the government of South Korea. The offensive carried the Eighth Army deep into North Korea. On October 25, Chinese forces attacked forward elements and forced a withdrawal south to positions astride the Chongchon River, some 50 miles north of Pyongyang, North Korea's capital. After a period of recovery, Lieutenant General Walton Walker, commander of the Eighth Army, determined they were ready to resume the offensive on November 24, the day after Thanksgiving.

The mountainous terrain of North Korea made movement and coordination difficult for a mechanized force such as the Eighth Army. Roads were narrow and gravel-surfaced, and had steep grades. In late November the first snows fell, and a brisk northern wind made it bitterly cold. As temperatures dropped, vehicles and weapons failed to function, and the troops suffered from frostbite.

While the North Korean Army had been all but destroyed, the Chinese Peoples Liberation Army posed an unknown threat to the attacking Eighth Army. Estimated at about 50,000, the Chinese opposite the Eighth Army actually numbered more than 200,000 men. They were poised to conduct a mobile defense geared to invite penetration, and then to counterattack with an aim of complete destruction.

The Eighth Army planned to conduct a phase-line controlled, corps-in-zone advance to the northern border, with I Corps on



Map of the Kunu-Ri, Sunchon area, Korea

the left, IX Corps in the center, and the Republic of Korea II Corps on the right. In the IX Corps zone, the 2nd Infantry Division was to attack north in the Chongchon river valley toward Kunu-ri. This kind of methodical advance usually assured close coordination among major units. However, the mountainous terrain made communications difficult, and the campaign developed into a series of battalion-level actions.

Kicking off the attack on November 24, the 2nd Division had the 9th Infantry Regiment on the left, the 38th Infantry Regiment on the right, and the 23rd Infantry Regiment in reserve. They reached a line 20 miles north of Kunu-ri by late afternoon on the 25th. The 2nd Engineer Combat Battalion had a company with each of the two attacking infantry regiments, while the rest of the battalion remained under division control. The engineers were busy keeping roads open and constructing fords across the Chongchon River.

In an attack that night, the Chinese virtually destroyed a battalion of the 9th Infantry and a company of the 38th Infantry. The next morning, the division commander attached Company C of the 2nd Engineers to the 38th Infantry and the rest of the battalion to the 9th Infantry for use as infantry.

As Chinese pressure mounted, the 2nd Infantry Division gradually withdrew toward Kunu-ri. In a strong attack against the 9th Infantry on November 27, the Chinese overran the 2nd Engineers' command post. They moved to Company D's position to continue the fight.

By November 29 the Chinese had stymied the entire American-led offensive, and Eighth Army ordered a withdrawal south to Sunchon. It detailed the 2nd Division as a rear guard to hold at Kunu-ri until November 30. In preparation for the withdrawal, the division relieved its engineers from attachment to the infantry regiments, and the battalion moved to a position near the division command post, just south of Kunu-ri.



Combat engineers place satchel charges on a bridge near Pyongyang, Korea, during the winter of 1950 (U.S. Army photo).

That same day the command post received reports that Chinese were on the road to Sunchon, threatening to cut the withdrawal route. Attempts by company-sized units to clear the road were unsuccessful, so Division Headquarters ordered the 9th Infantry to attack on the following morning. The 2nd Engineers were ordered to occupy a ridge just south of the command post. They were to hold it until all elements of the division, except the rear guard of the 23rd Infantry, had cleared south on the road to Sunchon.

The division withdrawal plan for November 30 had the attacking 9th Infantry in front, followed in turn by the 38th Infantry, Division Headquarters, artillery battalions, 2nd Engineers and, finally, the 23rd Infantry as rear guard. But when the 9th Infantry attack failed to clear the road and the 23rd Infantry reported increasing Chinese pressure, Division ordered the 38th Infantry to lead a fighting withdrawal and blast open the road south to Sunchon.

At 1300 the 38th Infantry started south along the road. It passed through the Chinese block position, but following units had



Combat engineers serving as infantry in Korea in the winter of 1950. Snow and bitter cold caused vehicles and weapons to malfunction (U.S. Army photo).

trouble. By mid-afternoon the Chinese had closed the road again, blocking the withdrawal of division headquarters and the leading artillery battalions. Air strikes helped clear the way, and as darkness fell the stalled units began to move south.

At 1500 the Chief of Staff authorized the engineer battalion to assemble and follow the artillery in the withdrawal column. This proved to be Division Command's final contact with the 2nd Engineers. Headquarters personnel began to move off the ridge in preparation for the move south, but the remainder of the battalion stayed in the defensive position. At the same time the 23rd Infantry, feeling pressure from the Chinese and increasingly concerned about the security of the withdrawal route, asked the assistant division commander for permission to begin withdrawing. They proposed using an alternate route west through Anju. Their withdrawal was approved, but nobody told the 2nd Engineers. When the 23rd Infantry pulled out, the engineers were the northernmost troops in position between the withdrawing 2nd Division and the attacking Chinese. As darkness fell, they stood alone as the rear guard.

By the time engineer headquarters personnel got in the withdrawal column behind the last artillery units, about 1930, all three infantry regiments, division headquarters, and some of the artillery battalions had successfully withdrawn. Darkness and the Chinese caught the engineers and artillerymen on the road. They took to the hills and walked south to Sunchon.

The rest of the 2nd Engineers stayed on the ridge to hold it, as ordered, until all elements of the division had cleared south on the road to Sunchon. They were still there when the Chinese overran the position about 2000. Their story is incomplete because all records were lost during the withdrawal. Division artillery staff officers confirmed that, as the artillery was withdrawing, the engineers were still there as the rear guard.

These engineers paid a heavy price, suffering one of the highest casualty rates in all of the Eighth Army during the Chinese offensive. At Sunchon on December 1, the 2nd Engineers, which had an authorized strength of 977, counted an actual strength of 266. The S-2 was in command of the battalion. The battalion commander, executive officer, S-1, S-3, S-4, and four company commanders had been lost in the fighting, as had almost all of the battalion's equipment. The 2nd Engineer Combat Battalion merits recognition for the sacrifices it made in November 1950, when it served as the rear guard at Kunu-ri.

Additional Reading:

Mossman, Billy, *Ebb and Flow*, November 1950-July 1951, *U.S. Army in the Korean War*, U.S. Government Printing Office, 1990.

Appleman, Roy E., *Disaster in Korea*, Texas A&M University Press, College Station, 1989.

Dr. James Dunn is chief, Studies and Analysis Division, Office of History, USACE.



BRIDGE THE GAP

By Command Sergeant Major Richard N. Wilson
U.S. Army Engineer School

"Training is the Army's top priority. It prepares us to fight. As leaders our sacred responsibility is to ensure that no soldier ever dies in combat because that soldier was not properly trained."

This introduction to FM 25-101 by General Vuono, our former Chief of Staff, captures the essence of noncommissioned officer (NCO) responsibility. Our first and foremost responsibility is to train soldiers in all aspects of their military occupational specialty (MOS) skills and to further develop them in the whole soldier concept.

The NCO Corps is responsible for training the individual tasks and most of the collective tasks in unit training plans. To do this effectively, NCOs must first provide input to their unit's training schedule. After the training schedules and plans are developed, NCOs in each organization must be allowed time to train. A plan that looks good on paper, but which doesn't provide enough resources or protected time to train, has little chance of succeeding.

"Sergeant's time" is a great tool when it is properly used. In many units, however, sergeant's time is simply placed on the schedule. If left there, it provides little to that organization's training posture. Sergeant's time becomes a beneficial tool only when an NCO uses the time for planned, quality training needed by the squad or section.

The NCO is the principal person responsible for making sergeant's time a success. He or she must ensure that training is planned, rehearsed, conducted to standard, and retrained as necessary. But he cannot work alone. The chain of command must back the program by providing the resources and emphasis that will allow the NCO to perform his principal mission as a trainer.

The fielding of new equipment and organizational changes challenge Engineer Corps NCOs to continually revise their training plans. For example, when complex equipment like the M9 ACE is fielded, NCOs must develop and provide training on how to operate and maintain it. Changes in organization, such as the development of engineer brigades in heavy divisions or the manner in which we will fight in a new organization, require that we teach these unfamiliar concepts at the unit level and in the Noncommissioned Officer Education System.

In addition to these changes, several MOS restructuring initiatives now underway will affect how we develop and train engineer soldiers. An example is the 12-series MOS. Upon implementation of this initiative, we will no longer have 12B (combat engineer) and 12C (bridge crewman) as separate MOS. The two will be consolidated into a 12A (sapper) MOS, and 12A soldiers will become responsible for all aspects of the 12B and 12C MOS tasks through all skill levels. This consolidation is tentatively set for fiscal year (FY) 1994.

The 12F (engineer tracked vehicle crewman) series MOS was restructured when the M9 ACE was fielded. ACE operators are now part of the 12F MOS, as are operators of the CEV and the AVLB for skill levels 1, 2, and 3. At skill level 4, 12F MOS soldiers are programmed to merge into the 12A (sapper) MOS.

This means that, starting in FY 94, a 12A sapper platoon sergeant must be knowledgeable in all aspects of what are currently 12B, 12C, and 12F skills. This will be quite a challenge.

Other MOS are being evaluated for possible consolidation. For example, portions of Career Managment Field 51 (general engineering) may be combined.

Initiatives such as these will require that soldiers in the NCO Corps become more knowledgeable and better trained over a wider spectrum of engineer tasks than they are now. In addition, much of the training currently done in one station unit training and advanced individual training will shift to the soldier's individual unit. Thus, NCOs can expect assignments with great diversity.

As the Army's engineer corps shrinks, we must ensure our NCOs are the highest caliber trainers we can develop. We must select only the best soldiers to become NCOs, and then expend great effort and time developing the skills and attitudes they will need for retention and advancement in the NCO Corps. We must train these soldiers so they are prepared to replace us senior NCOs, and can continue to meet Corps' missions with confidence and pride.

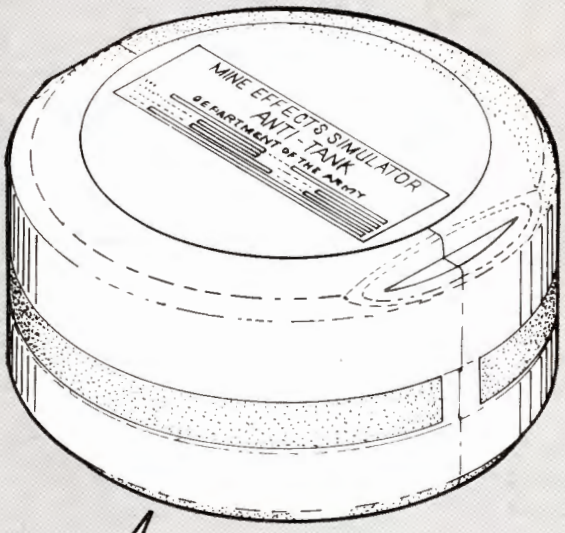
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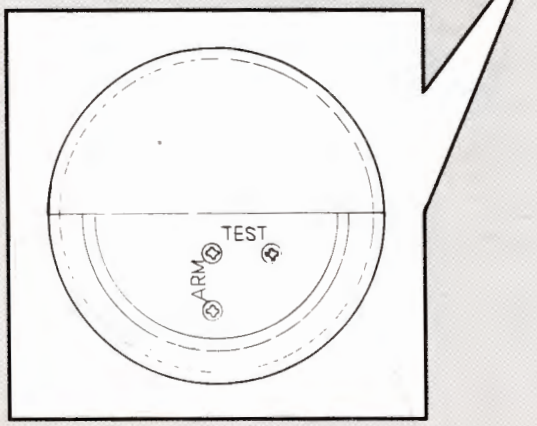
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