Engineer

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March 1999

Support Operations

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CLEAR THE WAY

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

These are exciting times for engineers as we approach the new millennium. This year has been designated the "Year of the Maneuver Support Center" (MANSCEN) here at Fort Leonard Wood. During the next eight months, the Military Police and Chemical Schools will complete their moves from Fort McClellan to Fort Leonard Wood. The collocation of the Engineer, Military Police, and Chemical Schools under MANSCEN creates a world-class joint training facility for soldiers, sailors, airmen, and marines. MANSCEN maximizes resources, establishes a framework for integrated training, creates synergy among the branches, and promotes joint service training. Approximately $220 million worth of new buildings and ranges, which will increase both the quality and quantity of training conducted here on post, are nearing completion. We continue to serve as a showcase for TRADOC's base realignment initiative. In an era that requires cohesive joint operations among the services in response to crises around the world, we continue to define TRADOC's slogan "Where tomorrow's victories begin."

General Reimer's visit to Fort Leonard Wood in January went very well. He viewed Initial Entry Training activities and ongoing construction in support of MANSCEN, and he received a briefing covering TRADOC's support to Homeland Defense. At the conclusion of that briefing, General Reimer approved Fort Leonard Wood as TRADOC's Center of Excellence for Homeland Defense. The center will "stand up" on 1 October 1999 and take advantage of the synergy created by the collocation of the three schools under MANSCEN.

Why establish this center at MANSCEN? Because—

- It is ideally located and organized to support DTLOMS (doctrine, training, leader development, organization, materiel, and soldiers) integration requirements.
- No other installation brings subject matter experts, training, and battle lab facilities together as well as Fort Leonard Wood.
- It exemplifies the kind of synergy we sought when MANSCEN was formed.

The Homeland Defense mission is to develop and integrate doctrine, training, and materiel requirements in support of the newly formed Rapid Assessment and Initial Detection (RAID) teams, which were authorized and funded in the FY99 defense bill. These teams will operate in direct support of civilian first responders, and each falls under the command and control of the adjutant general of the state in which the team resides. The ten teams being fielded across the United States are aligned with the Federal Emergency Management Agency (FEMA) regions. In addition, the 7th Military Support Detachment RAID team is being activated and will reside at Fort Leonard Wood. It was designated a pilot program by the Army Chief of Staff and must be fully mission capable no later than January 2000. An article describing the Homeland Defense mission and the RAID teams will be published in the April 1999 issue of *Engineer.*

The regiment continues to work on redistributing Bradley fighting vehicles (BFVs) to engineer battalions that support mechanized and armored divisions. It is desirable to have engineers in armored vehicles that provide the same degree of mobility, protection, and survivability as that provided on the maneuver platforms they support in the close fight. Currently we are attempting to retain BFVs in the 588th Engineer Battalion, 4th Infantry Division. The retention of BFVs in the 588th will provide an experimental baseline to further refine doctrine, tactics, techniques, procedures, and organizational designs in the future. A white paper justifying the need for BFVs appears on page 11.

This year's ENFORCE Conference is scheduled for 25 April-1 May. The 1st Brigade is planning to present another outstanding tactical twilight tattoo in celebration of our engineer history. I'm sure it will be a highlight of the conference. The theme for this year is "Joint Engineers: America's Total Engineer Force for the Next Millennium." Mark your calendars; we hope to see you here at Fort Leonard Wood.

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Front Cover: *Engineers from A Companies, 20th and 40th Engineer Battalions, 1st Cavalry Division, reinforce a damaged timber trestle bridge with an AVLB at Base Camp Demi, Bosnia-Herzegovina. Photo by Captain Dan Dolwick, U.S. Army Engineer School.*

Back Cover: *Historical example of the Army value "Selfless Service."*

FEATURES

DEPARTMENTS

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Mine Warfare and Counterinsurgency: The Russian View

By Lieutenant Colonel (Retired) Lester W. Grau

The Soviet Army trained and prepared for a "Third World War." This war would involve large-scale nuclear exchange and/or conventional maneuver, where modern, fast-moving armored forces probe for enemy weak spots, break through enemy defenses using massed or nuclear artillery strikes and the shock action of armor, and then drive deep into the enemy rear area to fight the deep operation. While this vision may still apply to a future war, military theorists in the Russian Ground Forces are considering their last two large-scale conflicts—in Afghanistan and Chechnya—and drawing some conclusions about other possible types of future war.[1]

Soviet military theorists envisioned war on the rolling plains of northern Europe or in the high Manchurian plains near China. Instead, their last two conflicts were fought in rugged mountainous terrain against irregular forces. One conflict occurred on the soil of a neighboring country, and the other was fought on Russia's own territory. Instead of swift wars of maneuver and massed combat power, those conflicts were protracted civil wars that were fought in mountains, forests, and cities.

While armies must train and prepare for the most dangerous future conflict, they should also train and prepare for the more likely future conflicts. Some Russian military theorists think their armed forces are more likely to fight guerrilla or local wars than world wars. The force structure, weapons, equipment, tactics, training, and military theory required to counter an insurgency or fight a local war differ from those required for a world war. As Russian military theorists gather data and develop tactics and methodologies to fight local wars and counter insurgencies, one of their interests is to prepare sappers and other forces to deal with land mines in these conflicts.[2] The applications of land mines in world wars, local wars, and guerrilla wars are distinct and different. The following discusses the Soviet/Russian experience with land mines in Afghanistan and Chechnya and lessons they learned from those conflicts.

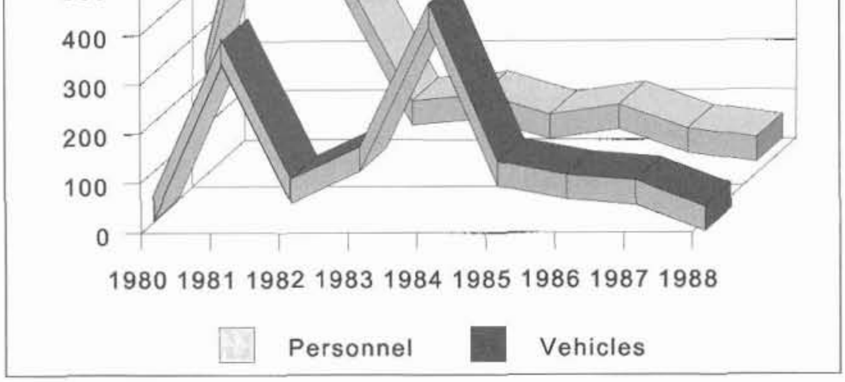


Table 1. Soviet 40th Army losses to mines—personnel killed in action and vehicles destroyed[5]

Afghanistan

Mines are used differently in guerrilla wars than in conventional wars. Whereas the Soviet 40th Army used millions of land mines in Afghanistan to protect communist installations and deny the mujahideen use of their lines of communication, the mujahideen used their limited number of mines more selectively and probably more effectively. The mujahideen antitank mines ranged from homemade to a variety of foreign-designed and -manufactured mines. These designs included the Soviet TM-46, the Italian TC-2.5 and TC-6.1, the U.S. M19, the British Mark 5 and Mark 7, and the Belgian H55 and M3 antitank mines. Their antipersonnel mine inventory was primarily Soviet PMN, POMZ-2, and MON-50 mines but also included the Italian TS-50, the U.S. M18A1, and the British P5 MK1. Many of these mines were manufactured in Pakistan, Iran, Egypt, and China.[3]

Mine Effects

Table 1 shows the Soviet 40th Army's personnel and vehicle losses to mines during their war in Afghanistan. As shown, the mujahideen did not have many mines when the war started but soon obtained them. Soviet deaths to mines initially were high until they developed countermeasures to cut their losses. Their countermeasures included issuing flak jackets, sandbagging and reinforcing vehicle floors, and riding on top of armored vehicles. Dissemination of these countermeasures was part of the in-country training conducted by the 45th Separate Engineer Regiment.[4] After these countermeasures were implemented, the number of deaths from mines fell but the number wounded by mines rose. Vehicle losses spiked in 1984 and 1985 during the heaviest fighting in the war and fell as the Soviets prepared to withdraw.

Table 2 shows the number of mines captured by the Soviet 40th Army as well as the number detected and disarmed or destroyed. The Soviets captured far more mines before the mujahideen could deploy them than they found during mine-clearing activities.

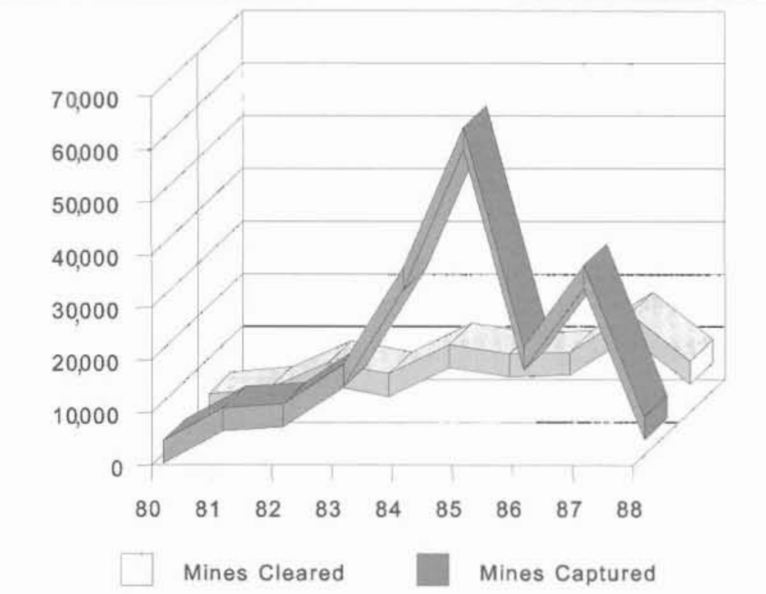


Table 2. Number of mujahideen mines cleared and captured by the Soviet 40th Army, 1980-1988.[6]

Soviet Wounded

Of the 620,000 Soviet personnel who served in Afghanistan, 14,453 were killed or died from wounds, accidents, or disease. That is 2.33 percent of those who served. An additional 53,753 (8.67 percent) were wounded or injured.[7] In the early part of the war, twice as many Soviet soldiers were wounded by bullets as by shrapnel, but by the end of the war, 2.5 times as many were wounded by shrapnel as by bullets. The percentage of multiple and combination wounds increased about four times over the course of the war, while the percentage of serious and critical wounds increased two times. Land mines were the primary reason for the increase in serious and critical wounds. The number of soldiers wounded by land mines increased 25-30 percent over the course of the war.[8] Table 3 reflects this change. The first two lines of the table total 100 percent. For the percentage of single wounds, subtract the percentage of multiple and combination wounds (line 3) from 100 percent. For the percentage of light and moderate wounds, subtract the percentage of serious and critical wounds (line 4) from 100 percent.

During the early years of the war, the mujahideen guerrillas had rifles but few mortars or land mines. As the war progressed, guerrillas captured or re-ceived these weapons and, consequently, the type and nature of wounds changed. Soviet medical evacuation techniques improved during the war, enabling more critically wounded soldiers to survive. The figures in Table 4, which show the number of war dead and wounded for the Soviet 40th Army by year, reflect their improved evacuation techniques.

As the table indicates, the ratio of dead to wounded Soviet soldiers

Type of Wound	1980	1981	1982	1983	1984	1985	1986	1987	1988
Percent from bullets	62.2	54.7	50.4	46.0	34.1	36.6	31.8	26.5	28.1
Percent from shrapnel	37.2	45.3	49.6	54.0	65.9	63.4	68.2	73.5	71.9
Percent of multiple and combination wounds	16.0	21.1	29.5	47.6	65.4	72.8	68.8	65.8	59.4
Percent of serious and critical wounds	23.1	27.7	31.1	47.1	52.4	51.4	50.2	50.1	45.2

Table 3. Type and severity of wounds as a percentage of total hostile fire and mine wounds[15]

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Dead	86	1484	1298	1948	1446	2343	1868	1333	1215	759	53
Wounded	-	3813	3898	6024	4219	7786	8356	7823	5008	3663	144

Table 4. Soviet 40th Army war dead and wounded in Afghanistan, 1979-1989[15]

Location of Wound	1980 (percent)	1988 (percent)
Cranium and brain	4.9	8.5
Backbone and spinal cord	0.1	0.9
Face and jaw	1.4	1.9
Eyes	1.3	3.2
Otolaryngologic (ear, nose, and throat)	1.8	3.4
Chest	11.6	6.3
Stomach and pelvis	7.8	4.6

Table 5. Location of wounds by percentage over time[15]

improved over time from roughly 1:3 to 1:5, with an overall ratio of 1:3.6. By comparison, the Russians state that the ratio of dead to wounded U.S. soldiers during the Vietnam War was 1:5.[9] Despite the increased severity of wounds, more wounded Soviet soldiers survived. Changes in medical procedures apparently improved the soldiers' survivability rate.[10]

Changes in the location of wounds reflect the acquisition of modern armaments by the guerrillas. Table 5 shows the location of the wounds and their percentage of frequency for the first and last full years of the war. The increase in head and neck injuries is consistent with shrapnel injuries from mines and mortars and matches the increase of these types of weapons in the mujahideen's arsenal. The table is incomplete—the source provided general figures of wounds to upper extremities of 25.4 percent, to lower extremities of 37.9 percent, and for thoracic and abdominal wounds of 1.7 percent, without reference to any change over time. Still, figures in the table reflect an increase in injuries that is consistent with those caused by shrapnel from mines and a decrease in wounds to the chest, stomach, and pelvis. The decrease probably is due to enforced wearing of flak jackets and the issue of some improved flak jackets.

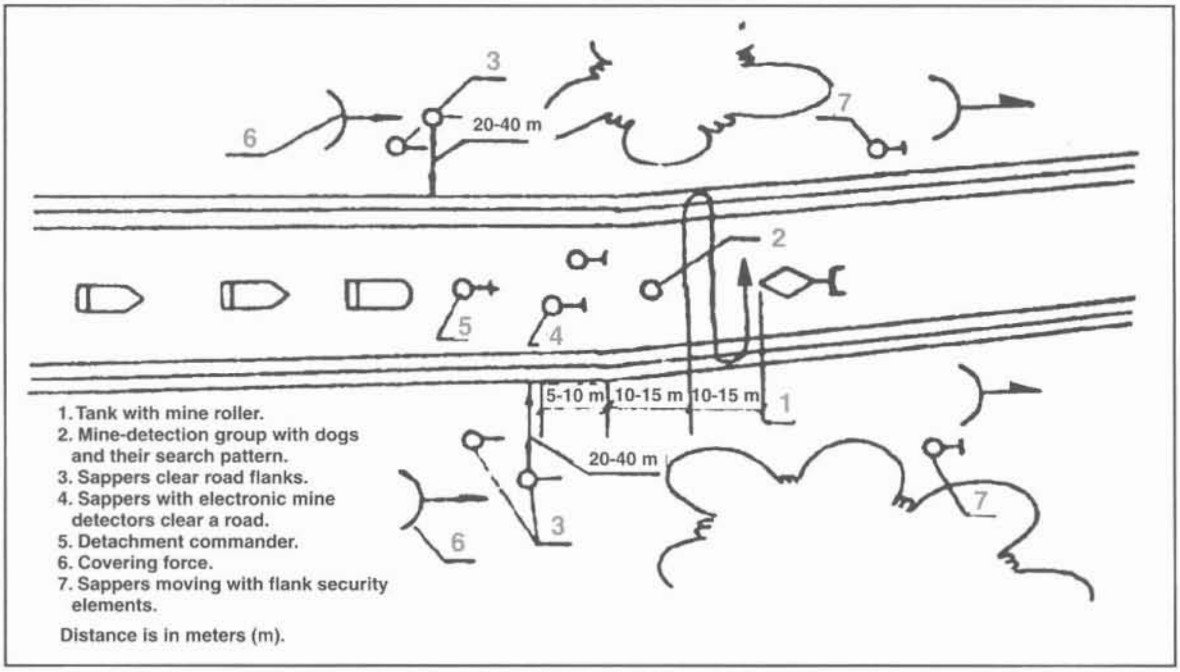
Table 6 compares the percentage of wounds by location for the Great Patriotic War (Soviet soldiers wounded in their war with Germany during World War II), Vietnam (U.S. wounded), Afghanistan (Soviet wounded), and the fighting in Chechnya (Russian wounded). Differences in the percentage of wounds by location partly reflect the type of terrain on which each war was fought, the training and skill of the combatants, and the type and degree of individual protection available.

Chechnya

From the beginning of the conflict in December 1994 until the summer of 1995, Chechen forces seldom used mines against the Russian forces. In July or August 1995, Chechen forces began using mines regularly and they continued to use them until the end of the conflict in 1996. The Chechens did not employ many conventional mines but improvised them using artillery rounds, aviation munitions, grenades, and other explosives. They also employed captured Russian mines, including directional mines, which they mounted off the ground to explode on the flanks or above vehicles and personnel. Most of the Chechen mines were laid on or

Location of Wound	Great Patriotic War (Russian)	Vietnam (United States)	Afghanistan (Russian)	Chechnya-1995 (Russian)
Head and Neck	19	21	15.7	24.4
Chest	9	5	12.2	8.6
Stomach	5	18	7.1	2.3
Pelvis	-	-	3.8	1.6
Arms	30	20	26.3	27.3
Legs	37	36	34.9	35.8

Table 6: Percentage of wounds by location in various wars[15]



Contemporary Russian formation for clearing roads

adjacent to roads and highways.[11] As a result of their experiences in Afghanistan and Chechnya, the Russian sappers have developed new techniques for clearing roads in a counterinsurgency. Descriptions of some techniques follow.

Russian Road-Clearing Techniques

A Russian motorized rifle regiment normally is given responsibility for clearing roads. If the entire regiment will physically move on the road, the regiment constitutes a movement support detachment (OOD—*otryad obespecheniya dvizheniya*), which includes a tank with a mine roller, a sapper squad mounted on a BTR (wheeled personnel carrier), and scouts and mine-clearing personnel. The OOD moves in front of the regiment and clears the road. If the regiment is responsible for clearing and securing a portion of a road on a long-term basis (such as protecting lines of communication in Afghanistan or Chechnya), the Russians deploy a mine reconnaissance detachment to check the section of road that the regiment maintains. The mine reconnaissance detachment normally consists of a tank with a mine roller, a sapper squad mounted on its BTR, and a covering force mounted on two or three BMPs (tracked armored personnel carriers). As they move, the tank uses its main gun to blast any suspicious objects, such as piles of trash or burned-out vehicles. The sappers must be particularly alert in areas where the enemy might employ command-detonated mines. After the regiment's section of road is cleared, the regimental commander reports this fact to his higher headquarters. No convoy movement is allowed on the road until all commanders have reported that their sections are cleared.[12]

So-called "green zones" were a constant source of trouble in Afghanistan. A green zone is an agricultural area of gardens and vineyards that is bisected by a network of irrigation ditches. In Afghanistan, green zones provided concealment for guerrilla forces and were practically impassible for vehicles. The green zones in many parts of the country bordered highways and provided optimum sites for ambush. Antitank mines, antipersonnel mines, and command-detonated mines were easily concealed in the edges of green zones, where ambush parties and snipers preyed on dismounted scouts and sappers.

The Russians now recommend the formation shown in the figure above for clearing roads. A tank or BMP pushing a mine roller moves in front of the formation. On its flanks and slightly ahead move dismounted motorized riflemen and sappers with electronic mine detectors, who clear snipers and ambushes. The mine detection group, equipped with mine-detection dogs, follows some 40 or 50 meters behind the tank. They carefully look for mines on the road and road shoulders. Sappers with electronic mine detectors move on the road about 15-20 meters behind the mine-detection group. Walking on the right and left sides of the road, two or three sappers with electronic mine detectors and mine probes clear an area about 20-40 meters on the flanks of the road. A covering force of dismounted motorized riflemen follow the sappers who clear the flanks. The BTR and BMPs follow the dismounted party and the mine reconnaissance detachment commander (usually a platoon leader), who controls the activity from the middle of the formation. The average clearing speed of such a formation is about two kilometers per hour.[13] The vulnerability of the sappers to snipers and ambush in Afghanistan and Chechnya was a problem for the Soviets/Russians. This formation protects the sappers with both dismounted infantry and vehicle-mounted direct-fire weapons.

In addition to using dogs, electronic mine detectors, and probes, Russian sappers are taught to look for signs of soil disturbance, soil discoloration, dents or depressions on the earth's surface, and other signals. Such signals include tunneling, broken branches and debris, trash associated with mines or demolitions, trip wires, wire leading away from the site, patches in road work, loose cobblestones, or other indications of mining.

When a member of the detachment finds a mine, the detachment stops and the finder marks the mine's location with a small red flag. The detachment commander and an experienced sapper move to the site and examine the mine. If the commander decides to destroy it, every member of the group draws a circle on the ground where he is standing and marks it with the first letter of his last name and whatever else is necessary to find it again. All the members except the one-man demolition party then move behind the armored vehicles or into a ditch for protection. The demolition party places an electrically primed charge on the mine, moves to a safe location, and detonates the charge. After the mine blows up, group members return to their last location and resume the search.[14]

If the commander decides to disarm the mine, a single sapper is given the mission. He carefully examines the area within a radius of at least 1.5 meters around the mine for other mines, trip wires, or detonator wires. Then he carefully scrapes the concealing layer off the mine; exposes the sides of the mine; and looks for antilift devices, other mines underneath the first, and booby traps. He removes the mine fuze and uses a grappling hook and rope to pull the mine from the hole. He then examines the hole to check for additional mines. Disarmed mines are collected for destruction or evacuation.[15]

The Dangerous Road Ahead

Although international efforts are underway to ban the use of mines in future conflicts, they will remain a constant feature of insurgencies. Mines are cheap, easy to manufacture and deploy, and provide an effective countermeasure to a modern, mechanized force. Guerrilla forces often operate outside the parameters and without the protection of international law. Thus, a guerrilla force may find that the efficacy of mines outweighs their prohibition by international treaty—particularly if the guerrilla force does not represent the state and is not signatory to the treaty.

Countering mines increases the logistics burden on a force—from the necessity to carry additional equipment and clearing personnel to the need for additional medical and mortuary services. Mines that wound rather than kill are more efficacious since every wounded soldier ties up many support and medical personnel. Mines also rob a modern mechanized force of its high-speed mobility and reduce the rate of movement to the speed of a cautious sapper. For these reasons, the problem of countering mines will remain a constant for armed forces well into the next century.

Consequently, modern armies should train to deal expeditiously with mines placed by irregular combatants. If a modern army is not trained to deal with this form of mine warfare, it may, like the Soviets and Russians, find its tempo reduced to that of a cautious dismounted sapper picking his way through rough country controlled by indigenous guerrillas.

Mr. Grau is a military analyst at the Foreign Military Studies Office at Fort Leavenworth, Kansas. He is a Vietnam combat veteran, retired infantry lieutenant colonel, and Soviet Foreign Area Officer. Mr. Grau holds a master's degree from Kent State University.

Endnotes:

[1] This article follows the convention that "Soviet" refers to the period before the breakup of the Soviet Union in 1991 and "Russian" refers to the period after the breakup.

[2] Adam Nizhalovskiy, "Na dorogakh Chechni" [On Chechnya's roads], *Armeiskiy sbornik* [Army Digest], January 1997, page 27.

[3] Russian General Staff material currently being translated for a book by the author.

[4] Petr Antonov, "Chemu uchit opyt" [What does experience teach?], *Armeyskiy sbornik* [Army Digest], January 1997, page 35.

[5] Aleksandr Lyakhovskiy, *Tragediya I doblest' Afgana* [The tragedy and valor of the Afghanistan veteran], Moscow: Iskona, 1995, Appendix.

[6] Ibid.

[7] G. F. Krivosheev, *Grif sekretnosti snyat* [The secret seal is removed], Moscow: Voyenizdat, 1993, pages 401-405. A portion of this article is taken from "Handling the Wounded in a Counter-Guerrilla War: The Soviet/Russian Experience in Afghanistan and Chechnya" by Lester W. Grau and William A. Jorgensen, published in *U.S Army Medical Department Journal, January-February 1998.*

[8] E. A. Nechaev, A. K. Tutokhel, A. I. Gritsanov, and I. D. Kosachev, "Meditsinskoe obespechenie 40-I armii: Tsifry I fakty" [Medical support of the 40th Army: Facts and Figures], *Voenno-meditsinskiy zhurnal* [Military medical journal, hereafter *VMZ*], August 1991, page 4.

[9] P. G. Brusov and V. I. Khrupkin, "Sovremennaya ognestrel'naya travma" [Modern bullet- and shrapnel-induced trauma], *VMZ*, February 1996, page 26. The Russian source of U.S. statistics is unknown.

[10] Readers interested in the medical treatment of mine casualties are directed to "Guerrilla Warfare and Land Mine Casualties Remain Inseparable" by Lester W. Grau, William A. Jorgensen and Robert R. Love, *Army Medical Department Journal,* October-December 1998, pages 10-16.

[11] Nizhalovskiy, pages 27-29.

[12] Mikhail Firsov, "Nepisanye pravila" [Unwritten rules], *Armeyskiy sbornik* [Army digest], January 1997, page 30.

[13] Firsov, page 30.

[14] Ibid., pages 30-31.

[15] Ibid.

Engineer/Civil Affairs Teams Enhance Peace Support Operations

By Lieutenant Colonel Christopher J. Toomey and Major William R. Buckley Jr.

Whether the mission is to deliver humanitarian aid in Somalia, foster development of democratic institutions in Haiti with the United Nations force, or ensure peace and stability in Bosnia as part of the NATO Implementation Force/Stabilization Force (IFOR/SFOR) engineer and civil affairs (CA) units are necessary for successful peace support operations.

This article describes how engineer and CA units can develop positive working relationships and enhance their contributions to any mission. Included are examples of successful operations and some guidelines to maximize these units' combined capabilities.

The Challenge

A significant challenge in many peace support operations is that they occur in areas with an immature or destroyed infrastructure. Transportation networks are either rudimentary, as in Somalia or Haiti, or destroyed, as in Bosnia. Utilities often are disrupted or deficient. The lack of a supportable infrastructure limits sustainment of the peace support force and hinders humanitarian aid, economic regeneration, and the development of democratic institutions.

Another challenge is that military forces within peace support operations normally operate in conjunction with the host nation; with governmental agencies, such as the Department of State; or with nongovernmental organizations, such as the World Bank and the European Union. These organizations often are not affiliated with the United States and may have objectives and time lines that are not in synch with military forces. Therefore, fostering stability is a continual and complex challenge during peace support operations. In nations with shattered economic and democratic institutions, the peace support force is often charged with encouraging stability and restoring democratic-based "normalcy."

Complementary Capabilities

To counter these challenges, engineer and CA units bring complementary capabilities to the peace support "battlefield."

The Bosnian rail situation in January 1996

Engineer forces perform valuable service during peace support operations.

Engineer Units

Engineers are infrastructure experts. They provide military forces with mobility and survivability support, particularly during early stages of an operation. Engineers open and construct roads; restore bridges, airfields, and heliports; and open lines of communication. Depending on the force package, specialized well-drilling, quarrying, and other units are included.

Engineer units have design and project management capabilities that are valuable to civil organizations. Engineers can take the lead in demining programs. Depending on the situation, they may remove mines to support military forces and assist civilian demining programs.

Civil Affairs Units

Civil affairs units also bring a wealth of expertise to the theater. These units are concentrated within the U.S. Army Reserves. CA units have personnel skilled in a myriad of professions, skills, and occupations, some of which are not available within the Active Component. Civil and electrical engineers, telecommunications specialists, doctors, veterinarians, farmers, and lawyers are some of the skills that CA units bring to the force.

CA units typically are task organized to support specific mission requirements. Their mission and force structure depend on the degree to which military forces are required to operate in-country institutions. Support can range from a complete "hands-on" approach, similar to that required in Germany and Japan after World War II, to liaison and coordination with existing governments, similar to operations in Bosnia. CA units in Bosnia provide military forces with essential coordination with host nation governments, government organizations, and non-government organizations. Liaison officers are stationed with key players, such as the host nation, U.N. organizations, and the World Bank. Where appropriate, these soldiers provide NATO and the organizations to which they are attached with information on one another's operations, goals, and objectives. They are conduits for information flow in both directions and can build interpersonal relationships needed to coordinate between organizations with no formal connections and that may answer to national authorities with differing goals and priorities.

Mutual Support

Engineer and CA units should support each other during peace support operations and execute combined initiatives. Military engineer resources and efforts normally are focused on direct support to the combined/joint team and have a distinctly military flavor. CA personnel can serve as a lubricant to facilitate this engineer work. Engineers seldom work in a vacuum during peace support operations, so it is necessary to establish and foster relationships with local contractors, host nation governments, and various international organizations working in the area. The CA personnel serve as liaison officers, open lines of dialogue, and represent the command's position. Their liaison skills may be especially helpful when establishing long-term rapport with host governments to facilitate military engineers' access to real estate and locally controlled resources.

CA personnel can also provide economic and political analyses. As engineers develop courses of action, CA forces can provide assessments and projections that facilitate the military decision-making process. Country studies and infrastructure assessments can be very helpful and should be considered valuable resources.

Engineers can support CA operations. Direct support may take many forms but normally is in terms of engineer assessments and design work. A good practice is to include engineers as part of CA assessment teams for infrastructure surveys. These engineers contribute technical expertise and ensure that the surveys support engineer efforts. When resources are scarce, engineers may also provide physical support. A small amount of engineer effort, such as grading a road or rebuilding a wooden bridge, can pay great dividends. CA teams can maximize the use of such residual engineer effort by identifying low-cost, high-payoff targets.

Examples

The authors acquired firsthand experience in exercising engineer/civil-affairs cooperation while serving with the SFOR, NATO Headquarters, in Sarajevo, Bosnia-Herzegovina. The Combined Joint Engineer (CJENGR) and the Civil-Military Commission (CIMIC) Task Force routinely cooperated to facilitate engineer support to SFOR military operations and CA reconstruction objectives as a means of promoting economic regeneration.

Operating in teams, CJENGR and CIMIC personnel established strong liaisons with each other and coordinated both plans and operations. The CJENGR was a multinational organization, while the CIMIC Task Force was a U.S. organization that worked through the multinational CJ9 (the staff section responsible for civil-military operations). For numerous reasons, it was not practical to simply integrate a CIMIC brigade into the NATO headquarters. This was a potential problem, because U.S. civil-military doctrine is much more defined than that of most of our NATO allies. To enhance cooperation, the chief of CJ9 allowed the CIMIC Task Force to pursue missions within the overall SFOR and civil-military campaign plans. For the most part, CJENGR worked directly with the CIMIC Task Force's Joint Civil Commission (JCC). The JCC comprised the bulk of engineer and infrastructure expertise within the CIMIC Task Force.

A primary component of success was ensuring that the engineer and civil-military campaign plans were synchronized with the theater campaign plan and with each other. The engineer campaign plan listed three primary goals:

- Support military operations.
- Promote effective demining.
- Improve civil infrastructure.

The last two goals correlated directly with CA actions. Engineers were major contributors to the CA planning process, while CA personnel participated as members of the CJENGR-led SFOR Infrastructure Steering Group. The steering group brought many agencies together to establish theater-wide engineer policies and construction priorities.

A Hungarian engineer works on the bridge at Basci.

Within the steering group, the CIMIC Task Force provided the civil perspective to an organization that had no civilian component. The task force also provided the NATO engineer officers, who had minimal contact with civil-military operations, with resources they could access through their CIMIC teams.

Of major importance to the success of operations in Bosnia was the network of liaison officers the CIMIC Task Force established with the host nation and various international organizations such as the World Bank. The liaison officers helped facilitate engineer initiatives, identify potential high-payoff projects, gain access to resources, and promote engineer activities.

The CJENGR staff routinely consulted with the CIMIC Task Force and appointed a liaison officer to serve as the primary point of contact for CA actions. Working through the Engineer Plans Office, this officer oversaw coordination of engineer support to CA initiatives.

Three initiatives portray the outstanding mutual support fostered at theater level and illustrate the varied scope of engineer/CA actions undertaken: the bridge replacement program, the strategic rail program, and the Basci village construction.

Bridge Replacement Program

Situation: From 1995 to 1997, to promote freedom of movement for military forces, SFOR and its predecessor, IFOR, installed numerous NATO-owned military equipment bridges to replace bridges destroyed on main supply and movement routes throughout the country. In late 1996 and early 1997, international organizations began funding the repair or replacement of damaged or destroyed bridges to replace the NATO military equipment bridges. The challenge was to facilitate bridge repair and replacement—a major move toward economic regeneration—while maintaining full freedom of movement for SFOR. The CIMIC Task Force, which focused on developing civil institutions, un-hesitatingly endorsed the proposal. However, CJENGR, ever mindful of military requirements to keep routes open for military traffic, insisted that all routes remained open. The solution exemplifies the cooperative approach between the two organizations.

Solution: Convinced that civilian-led bridge repair was the eventual long-term solution, the CJENGR considered bypasses for each of the bridges, which would ensure full freedom of movement for SFOR once the military equipment bridges were removed. Since no NATO funding existed to upgrade bypass routes, the CIMIC Task Force coordinated with international donors to incorporate bypass upgrades in their funding. The CIMIC Task Force and the CJENGR worked closely with local transportation directorates to ensure that construction schedules meshed with the CJENGR's ability to remove the equipment bridges and provide site clearance. By working together, the CJENGR and the CIMIC Task Force took this process a step further. They worked together to select sites to place bridges displaced by new construction. Most of these sites had great civil benefits and helped enhance SFOR's image as a positive force within the country.

Strategic Rail Program

Situation: Before the conflict, rail was the primary mode of long-distance transportation in the Balkans. The conflict destroyed much of the rail system (*Engineer*, July 1998, pages 2-6) however, and by 1996 rail traffic was only 15 percent of prewar levels. Large stretches of the network were literally torn apart. In particular, there was no rail access to the mineral-rich Tuzla Valley. Before the war, this area was linked to the Sava River port of Brcko and to ports along the Danube in Croatia and Hungary. In a region with an estimated 70-percent un-employment rate at the start of 1997, the CIMIC Task Force estimated that restoring the link between the Tuzla Valley and Europe would immediately create 1,200 jobs and inject a minimum of $4.6 million per annum into the depressed area. Restoring regional economic vitality is a key component of developing stability and fostering democratic institutions. Encouraging rail traffic across the Bosnian-Croatian border was a positive step in normalizing relations within the divided region.

Solution: Over the course of several months, the CJENGR-CIMIC team worked closely with SFOR's political advisor to develop a program to repair most of the main rail line. Following the CJENGR's technical assessment of the line between Tuzla and the Hungarian border, the CJENGR-CIMIC team developed initiatives to repair it. A key element was using the U.S. Agency for International Development (USAID) as a funding source for materials and construction contractors. As a healthy investor in the region, USAID provided funds for the $2.5 million rail-highway bridge at Brcko and pledged more than $2 million for additional work along the line. With the CJENGR's encouragement, the Italian government deployed the Italian Railway Engineer Regiment to construct the line between Tuzla and Brcko using materials provided by USAID. In Croatia, a series of negotiations chaired by the CJENGR-CIMIC team led to Croatian Rail and the Hungarian government repairing much of the line between the Croatian border and Hungary. By late 1997, a serviceable rail line existed from the Dalmatian Coast to the main European line in Hungary. Although some political obstacles still restrict full traffic, the necessary infrastructure is in place.

Basci Village Construction

Situation: The village of Basci, located southeast of Sarajevo near the International Entity Boundary Line, was ravaged and abandoned during the fighting. Due to its proximity to the boundary and the willingness of its residents to return, the United Nations High Commission for Refugees (UNHCR) considered Basci an ideal place to spearhead the refugee-return program. Funding was available from various sources to purchase modular buildings as housing for returning residents. However, routes into the area needed repair, and two small bridges on the road leading to the village were destroyed. Although local contractor support was not costly, it was limited. Using military engineers to do the work was an attractive option.

Solution: Working as a team, CJENGR and CIMIC Task Force representatives, via the CIMIC Task Force's UNHCR liaison officer, scheduled NATO military engineers to repair the 2,100-meter road and construct two military load class 40 bridges of 6.5 and 6.9 meters, respectively. The troops assigned to complete the mission were members of the Hungarian Engineer Contingent. Because NATO funding did not cover the cost of materials (about $8,000), the CIMIC liaison officer obtained funds from the United Nations.

Guidelines

The following guidelines will help maximize engineer/CA cooperative capabilities.

- **Recognize complementary capabilities.** Engineer and CA personnel must be familiar with each other's capabilities and organizations. Since engineer and CA

(Continued on page 38)

Why Engineers Need the Bradley Fighting Vehicle

On July 28, 1997, the U.S. Army Engineer School submitted an operational concept to Training and Doctrine Command to replace the M113A3 Engineer Squad Vehicle with the Bradley – the Engineer Bradley Fighting Vehicle. In October 1998, Major General Flowers asked the school to develop a white paper articulating why engineers need to be mounted in a Bradley, so the entire regiment can speak with one voice. ***Major Darrell Strother,*** *then chief of the Collective Analysis Branch, took the lead in developing the following white paper.*

The world has entered a period of radical and often-violent change. The threats are more diverse and less predictable. Today's threat vehicles and weapons are more lethal than those available during any other period in our history. Army combat engineers require a modernized squad vehicle to enhance their speed, versatility, and survivability as they provide necessary mobility and countermobility support to maneuver forces during the close fight. The leading contender to assume this modernization role is the Bradley fighting vehicle (BFV). The long-term solution is to codevelop a future engineer squad variant of the future infantry vehicle.

The Army and the methods by which we conduct warfare are constantly changing. Army Warfighting Experiments (AWE), the development of Force XXI, continuing force reductions, and the combat service support (CSS) redesign effort reflect these changes. To support them, the Engineer Regiment has adopted a strategy that shifts from mechanized to armored warfare. The M1-based Grizzly and the Wolverine are the first two examples of implementing this strategy. Both platforms are designed to accomplish their respective breaching and bridging missions while the soldiers on them remain under armor protection.

The Maneuver Support Battle Lab (MSBL) conducted an experiment under the Concept Experimentation Program (CEP) in 1998 to evaluate the BFV. Results from the CEP experiment clearly demonstrate the requirement to find a more mobile and survivable platform for combat engineers than the M113. While the M113 will continue to have a place in the Engineer Regiment, divisional combat engineers must be mounted in the most survivable platform available if they are to ensure the mobility of the offensively oriented Brigade Combat Team (BCT). Today that platform is the BFV.

The Infantry School has already demonstrated improvements the BFV offers in the areas of cross-country mobility, target acquisition, weapons ranges, night operations, and the potential for technology enhancements. The MSBL Bradley CEP demonstrated how the speed, increased armor, and firepower of the BFV allowed combat engineers to work, maneuver, and protect themselves simultaneously. The turret and main gun have proven extremely valuable to combat engineers, and the BFV provides increased commonality, lethality, and versatility to the BCT.

Analysis reinforces the commonality available to the BCT from the engineers' transition to the BFV. Engineer and infantry soldiers are intermixed on the battlefield and often rely on one another for CSS. The nature of Force XXI and the CSS redesign require us to reduce the logistical demand of the force. It is not unthinkable that the ongoing CSS redesign will lead to consolidated support for infantry, armor, and engineer forces. Efficiencies created by equipment interoperability and commonality can markedly enhance the CSS force's ability to sustain the BCT. Just the reductions in the Prescribed Load List and Authorized Stockage List and the increases in BFV mechanics within the BCT will significantly ease the sustainment challenge.

A high degree of lethality is a key requirement of the current and future force, and it involves more than maneuver and the application of firepower. Lethality is obtained from the synergism of force agility, technologically superior weapons, sound doctrine, and realistic training that emphasizes the integration and synchronization of the BCT.

Engineers cannot afford to be the weak link in the combined arms team. New and readily available weapon advancements combined with the vulnerabilities of the M113 exposed during Operation Desert Storm mean that combat engineers are mounted in the most easily defeated vehicle used to conduct the close fight. When engineers are mounted in BFVs, the situation changes completely. The advantages offered by the BFV allow engineers to move as an integrated, survivable member of the BCT and have all the assets necessary for success. Retention of three additional battalions of BFVs in the division during this time of force reduction increases the overall lethality of the force.

The engineer M113 has become distinguishable on the battlefield as a result of fielding such systems as the Bradley linebacker, the command and control vehicle, and the fire support team vehicle. The enemy can easily target our engineers, while friendly forces

(Continued on page 35)

Force-Protection Measures in Bosnia

By Captain Frederic A. Drummond

The lethality of modern and Third World weapon systems makes the future battlefield an increasingly hostile environment, whether during peacekeeping, peace enforcement, or war. For this reason protecting the force should be a commander's number one priority. Have you ever heard or used these excuses when instituting force protection: "I don't have time for force protection," "I don't have enough money or materials for force protection," "I don't have enough personnel to fill sandbags," or "I don't need to worry about force protection, the engineers take care of it." Our soldiers are our most precious asset; we must provide them the best equipment, technical guidance, and leadership when establishing force-protection measures.

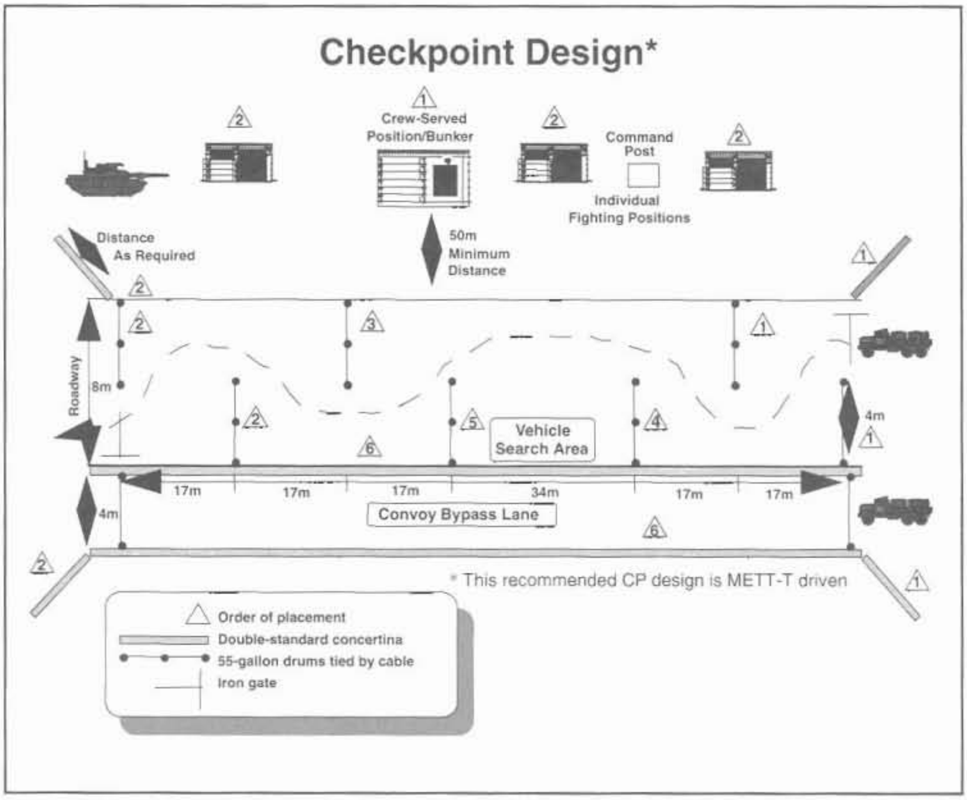


Figure 1

An effective force-protection program consists of both individual skills and collective tasks. Soldiers should be trained continually on force-protection techniques. Since these critical tasks are perishable, they must be sustained through realistic training and evaluated routinely. Leaders should learn force-protection techniques while attending basic and advanced institutional training courses. Understanding the basic fundamentals of survivability and general engineering in peacekeeping, peace enforcement, and war scenarios is essential for all combat arms and combat service support leaders.

This article describes a systematic way to protect soldiers and equipment. It challenges leaders to understand the fundamentals of general engineering as it applies to force protection. We must keep an open mind and be creative when working with force protection.

Force-Protection Measures

Force protection of troop living areas, headquarters elements, weapon storage areas, and communication assets must be considered when planning any operation. Developing force-protection measures begins by educating everyone in the chain of command from the highest to the lowest level. Understanding fundamental procedures—such as requirements for overhead cover, proper emplacement of sandbag revetments, and capabilities of individual and crew protective systems—is essential to ensuring system safety. In most cases, combat engineers do not have the time or the soldiers to construct a base camp and implement force-protection measures for other units. They normally assist maneuver commanders or base camp mayors in formulating force-protection plans. Engineers provide technical and tactical advice and quality control for emplacement of force-protection structures, including earth revetments, wire obstacles, and fighting positions.

A Systematic Approach

During Operation Joint Endeavor, a systematic approach was developed and implemented to monitor force protection in Bosnia. When the operation began, force protection was first on every commander's mind. After the initial thrust of U.S. combat forces into Bosnia, however, it became apparent that most units had changed their focus to completing missions that supported the peace plan.

Task Force Eagle mandated that each unit use three tiers when constructing force-protection systems. The three tiers were part of 1st Armored Division's tactical SOP and were used during several field exercises before Operation Joint Endeavor began. Part of Tier II includes the checkpoint design established by the 1st Armored Division Engineer Brigade (Figure 1). The guidelines were briefed and each unit was expected to meet these standards (METT-T dependent).

Tier I - consists of triple-standard concertina around the base camp, prefabricated fighting positions in place and sandbagged, and established checkpoints.

Tier II - consists of Tier I plus sandbagged protective bunkers.

Tier III - consists of Tiers I and II plus trip flares, guard towers, perimeter lighting, and ballistic protection (fuel farms and helipads).

The Base Camp Coordination Team monitored the force-protection tiers. This team worked directly for the Assistant Division Commander for Support and reported its findings monthly. Each engineer battalion reported force protection in its assigned sector to the Engineer Brigade, which then reported to Task Force Eagle. This is a very systematic way to approach and monitor a complex mission.

This protective bunker collapsed due to improper sandbagging.

Bunkers

During the Persian Gulf War, some soldiers were killed when improperly designed bunkers collapsed. The photo above shows a fighting position that collapsed next to a prefabricated constructed fighting position. The fighting position in the background was sandbagged by the tenant unit. When engineers inspected it, they found that it was unsafe. Engineers directed the tenant unit to reconstruct the sandbags, labor that could have been used elsewhere had the bunker been constructed properly initially.

A collapsed protective bunker is a command problem. Before a soldier steps into a bunker system, the chain of command must protect troops by ensuring that the following requirements are met:

- Plan and select sites for fighting positions.
- Properly design, construct, and certify bunkers according to FM 5-103, *Survivability.*
- Provide the correct quality and quantity of construction materials (sandbags, lumber, etc).
- Plan for maintenance and inspect the bunkers periodically.
- Constantly supervise the construction.
- Get technical advice from engineers as required.

During Operation Joint Endeavor, the Army invested considerable money in force protection. Commanders were held accountable for their force-protection status and were required to brief force protection daily. In spite of this command attention, some units installed unsafe fighting positions, checkpoints, and protective bunkers.

Standard Design

When several types of protective systems appeared throughout the Task Force Eagle sector, the Engineer Brigade commander decided to enforce a single standard. Various designs were sent to engineer units and maneuver commanders. Base camp mayors were asked to disassemble all questionable protective systems. The 16th Engineer Battalion was tasked to develop an aboveground fighting position, guard bunker, and protective bunker. Combat engineers, assisted by maneuver commanders and base camp mayors, ordered these protective systems based on their security plan. Engineers delivered protective systems to each base camp and provided technical guidance on the proper subgrade and emplacement. The base camps provided manpower to fill, lay, and tamp sandbags.

Using the "one team, one fight" concept, engineers built safe prefabricated fighting positions, protective bunkers, and guard bunkers and supervised quality control. Engineers inspected each protective system periodically to ensure that the system remained structurally sound and was maintained by the tenant unit. Based on my experience during Operations Desert Shield/Desert Storm and Joint Endeavor, most soldiers are not trained to properly construct fighting positions with sandbag revetments. Failing to tamp the sandbags or laying them incorrectly presents a safety hazard.

Pros and Cons of Consolidated Assembly

Pros

- Unity of command and control, with one person in charge (OIC).
- Continuity and experience improve production.
- Simplifies supply and logistics coordination.
- One standard for all products, since each company has force-protection experience.
- Experienced soldiers increase productivity.
- Safety, quality control, and quality assurance ensured safe positions.
- Masses both soldier support and vehicle support (Support Platoon), so no one company suffers the loss of 30 soldiers. This allows companies to continue with other missions.
- Increases the availability of serviceable tools and equipment.
- Battalion sets priorities, so there is no question as to where assets go.

Cons

- Not all companies can provide the same soldiers all the time.
- Depletes resources more quickly.
- Transportation may not be available to meet production times, and production may stop due to lack of space.

Figure 2

Sandbags

Every leader should use FM 5-103. They must understand the basic fundamentals of sandbagging, which is a key component of the bunker system. The manual describes six steps in sandbagging revetments:

- Turn sandbags inside out. If not turned inside out, they lose strength.
- Fill sandbags three-fourths full with an earth or dry soil-cement mixture and tie the choke ends.
- Tuck in the bottom corners of the bags after they are filled.
- Construct the bottom row of sandbags by placing all bags as headers. Build the sandbag wall using alternate rows of stretchers and headers with joints broken between courses. The top row of the sandbag wall has only headers (FM 5-103).
- Uniformly tamp each sandbag with a flat object (such as a 6x6 board) to force out all air pockets and make the wall more stable.
- Replace sandbags if they are punctured.

The Task Force Eagle commander made force-protection construction the priority for all units because of the underlying threat of terrorism. Task Force Volturno was tasked with the construction and prefabrication of force-protection systems for 12 base camps in the Tuzla Valley and other sites throughout Bosnia-Herzegovina. Each company was responsible for four base camps. It soon became clear that several base camps required large quantities of fighting positions and bunkers. Initially each company constructed its own positions, but with some base camps requiring more than 50 fighting positions, a consolidated production site was needed (Figure 2).

The task of planning, organizing, and constructing this facility was given to Alpha Company, 16th Engineer Battalion. The Assault and Obstacle Platoon established a prefabricated

Poor Bunker Construction

This bunker was not built using the basic fundamentals of sandbagging. Sandbags were laid incorrectly, which presents a safety hazard.

Good Bunker Construction

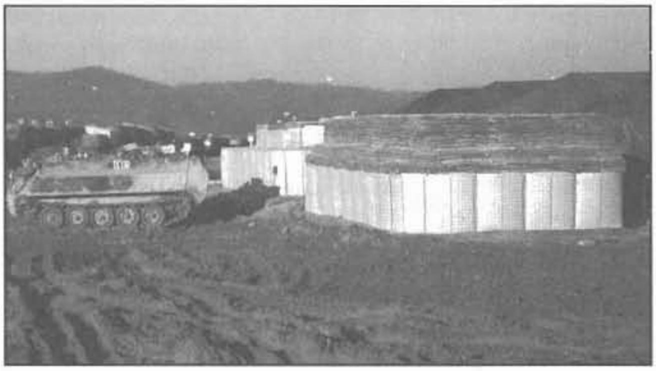
Protective bunkers located behind the 16th Engineer Battalion tactical operations center at Camp Bedrock. These bunkers present a neat and uniform appearance, and load bearing is equally distributed.

Hesco-Bastion Concertainer Defense

During Operation Joint Endeavor, a new force-protection system was introduced to combat engineers in Bosnia: the British-developed Hesco-Bastion concertainer defense wall system. The concertainer wall sections are constructed from geotextile-lined galvanized wire mesh panels that are connected with a spiral of galvanized wire mesh hinges. When the wall expands, it forms an array of linked, self-supporting cells. When the cells are filled with earth, sand, snow, etc., they provide ballistic and blast protection. Once erected and filled, the cells can withstand a 155-millimeter high-explosive blast detonated from a distance of five feet. To provide flexibility, the wall sections are designed in several sizes. The sections we used were 10 meters long by 1 meter wide by 1.37 meters high.

Applications. Concertainer wall sections can be used to construct—

- Protective bunkers
- Aircraft and headquarters revetments
- Shelter and observation posts
- Fuel points

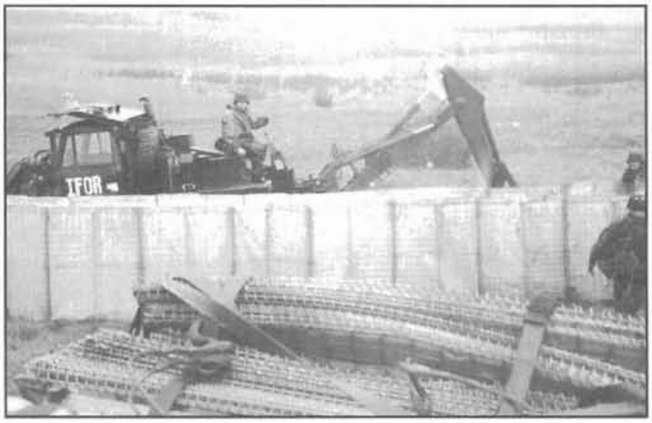


Advantages. Concertainer wall sections offer the following advantages:

- They require less construction time than sandbags.
- They can be stacked higher than sandbags.
- They can withstand stronger blasts than comparable amounts of sandbags.
- They provide immediate visual protection.
- The containerized system is easy to stack and haul.

Disadvantages. Concertainer wall sections have some disadvantages:

- They are not in the supply system.
- They are hard to recover once used.
- Heavy engineer equipment, such as a bucket loader or a small emplacement excavator, is required to fill the bastions.



Availability. The company can produce 2,100 10-meter sections per week. They are shipped on NATO pallets, five to a pallet.

The Hesco-Bastion concertainer wall system saved engineers a considerable amount of time when implementing force protection in Bosnia. Units deploying on peacekeeping or peace-enforcement missions need a system that is easily deployable and provides sufficient protection for soldiers. The Hesco-Bastion is an outstanding system with many applications.

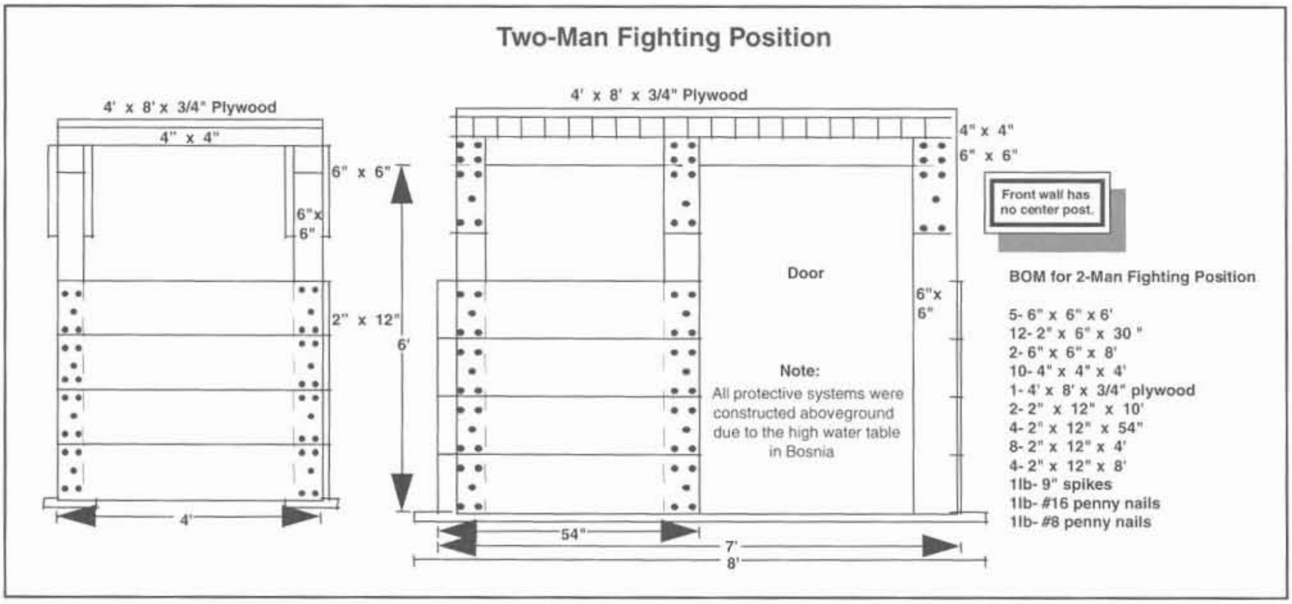


Figure 3

construction yard known as "Slate" on Camp Bedrock, and it began mass producing force-protection systems. The first phase in the building process was to develop the work site. Due to limited resources, two medium tents were used. The construction site was divided into four areas:

- Download and storage
- Ripping and cutting
- Prefabrication
- Assembly and rough cutting

Each area was run independently and simultaneously. With the building area construction complete, "Slate Construction" was born, and the next phase began. The need for rapidly available, quality force protection required 24-hour operations. Each company in the task force supplied five soldiers, who worked in two 12-hour shifts with 15 soldiers per shift. We established four teams, each run by the same NCOIC to ensure continuity. Alpha Company supplied the NCO foreman for each team, and the other companies rotated soldiers through due to their mission requirements. The teams were—

Haul team—one NCO and two soldiers with one or two HEMTTs with forklifts. The team hauled wood from the S4 yard to the assembly area, coordinated with the S4 to obtain materials, and delivered fighting positions to the site or helped the support platoon load them.

Ripping/cutting team—consisted of two NCOs to operate saws and two soldiers to carry wood. The team had two circular saws, but a radial arm or table saw would have been helpful. The team cut wood for the prefabrication operations, ensured that the standard template for cutting was followed, provided quality control for cutting operations, and determined the cutting order and overall control operations.

Prefabrication team—consisted of one NCO and three soldiers. The team assembled fighting position components, constructed walls and roofs, and moved prefabricated parts to the assembly area.

Assembly team—consisted of one NCO and two soldiers. The team assembled the fighting positions and packaged them for shipment.

The materials used to construct the fighting positions and bunkers varied significantly. The battalion S4 requested the required lumber, but dimensions often varied due to the many suppliers. Most of the cutting and assembly was done in the cutting and prefabrication tents. Because of their size, bunkers were assembled outside in the assembly area. Initially the priority went to fighting positions (Figure 3), but as base camps became more secure, personnel bunkers became more important.

Do It Right

Before any protective system is constructed, officers and NCOs should attend a class given by the engineer team supporting their base camp on proper emplacement procedures. During Operation Joint Endeavor, we found that most leaders had no idea there is a systematic way to lay sandbags, build bunkers, or use Hesco-Bastions (see page 15) to augment sandbagging. After officer and NCO training, there was a noticeable improvement in the placement, uniform appearance, and structural soundness of the sandbag revetments. Teach leaders first, then the soldiers, and never accept a substandard sandbag wall. The lives of our soldiers depend on it.

Captain Drummond is the assistant engineer battalion operations trainer at the National Training Center, Fort Irwin, California. His e-mail address is: sw03a@irwin.army.mil. He previously served as commander of Company A, 16th Engineer Battalion, 130th Engineer Brigade, in support of the 1st Armored Division during Operation Joint Endeavor. CPT Drummond is a graduate of the University of Nebraska at Kearney.

Engineers, Army After Next, and Military Operations in Urban Terrain

By Jeb Stewart

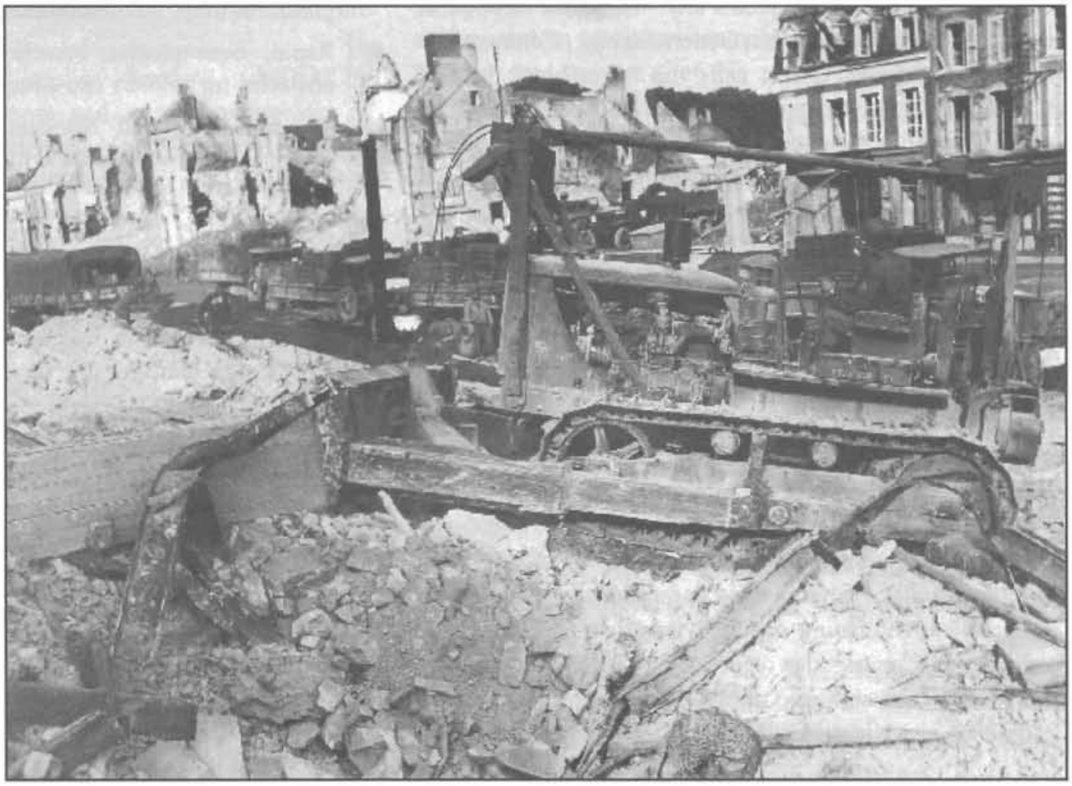
The Army After Next (AAN) project is a series of studies on future warfare that frame issues vital to the development of the U.S. Army. The studies are in formats suitable for integration into TRADOC combat developments programs.[1] With a 30-year focus, the AAN process begins about 2025 and describes requirements beyond the current Force XXI development. When executing the 1998 AAN campaign plan, futurists focused the force design on "mechanized airmobility." This particular concept was an area of concern for engineers.

Engineers and AAN

The concept of mechanized airmobility envisioned the convergence of air and armor attacks on an objective. The concept described a very fast operational tempo to disrupt enemy coherence. The critical materiel part of mechanized airmobility was a single ground/air combat system, the Aerial Infantry Fighting Vehicle. In this idealized AAN vision, enemy obstacles, inundated areas with low trafficability, and conflict-induced rubble were of little concern because the futurists assumed mechanized airmobility would free maneuver forces from the ground approach to the objective. In this concept, AAN strike forces would simply cross deadly zones by flying over them.[2]

Since their work in articulating the initial concept, the AAN community has determined that the Aerial Infantry Fighting Vehicle was "neither technologically nor operationally feasible."[3] Consequently, the mechanized airmobility concept has been put on the shelf while other organizational structures are examined. This action was a lucky break for Army engineers because, when engineer leaders saw the first papers and briefings, they were appalled at the dismissive intent toward terrain and ground mobility.

For engineers, this aspect of the initial AAN project clearly seemed to be "a stretch" that denied laws of physics. The air mechanization concept could have had a pernicious effect if applied to midterm mobility doctrine, training, leader development, organization, materiel, and soldiers. Since AAN was designed to mesh with TRADOC's requirements determination process, there was ample cause for concern.



Pushing rubble in France in 1944—old-fashioned MOUT.

> **"Future land combat units will exploit terrain by maneuvering for tactical advantage within the folds and undulations of the earth's surface without suffering the restrictions imposed on speed and mobility by contact with the ground when conducting movement or being inserted into a battlespace."**
>
> **"Forging Possibilities into Reality" by BG Buckley, LTC Franke, and A. Fenner Milton *Military Review,* Mar-Apr 1998**

Fortunately, the AAN concept is young and has much room for development. The 1998 Army After Next Report to the Army Chief of Staff indirectly shows that ground mobility concerns have replaced some of the early enthusiasm for mechanized airmobility. From the engineers' perspective, this change is a step in the right direction.

Engineers and MOUT

During AAN war games, one phenomenon emerged time after time and in war game after war game: To avoid certain defeat by the AAN Strike Force, the enemy went into and occupied a city. When that happened, the battle tempo became what General Krulak, Commandant of the U.S. Marine Corps, calls the "three-block battle." AAN operational tempos promptly collapsed, and the initiative went to the enemy. Engineers have always been a key component of the military operations in urban terrain (MOUT) force, and this seemingly unsolvable MOUT dilemma calls for an engineer solution. MOUT situations present a succession of mixed civil engineering and close combat problems. Therefore, the engineer component of AAN looks like a good "mission fit."

Armies traditionally have tried to avoid combat in cities, but in the 21st century we *will* operate in built-up areas. To do so effectively and with minimum casualties and collateral damage, we must enhance our means to apply modern Army XXI engineering skills to a full spectrum of urban situations. Military forces in urban areas may be applied toward a wide variety of missions, including peacekeeping and peace enforcement, combating domestic terrorism and the use of weapons of mass destruction, and evacuating noncombatants. The ability to apply appropriate military force in built-up areas is difficult—a politically astute adversary can rather easily thwart a sophisticated heavy force that is trained and equipped for high-speed maneuver warfare. AAN war games have confirmed this dilemma. To resolve it, engineer operations must be a key element of the decisive military force in urban areas.

The lead for MOUT will remain the purview of the U.S. Army Infantry Center and School, and engineers will support them. Future MOUT operations are likely to include many of the same deliberate, slow, and painstaking tasks performed historically. In past operations, as when U.S. Army forces cleared Japanese troops from Manila in World War II, engineers in combined arms task forces concentrated on mobility and countermobility missions. The engineer component primarily reacted to the immediate needs of the task force. In those operations, engineers were called upon to clear rubble, perform demolition work, create breaches in structures, and repair infrastructure to support military uses. Those same tasks are likely to be important in future operations.

Engineers can and should increase their role in MOUT. By expanding the doctrinal focus to include MOUT, many critical elements of future operations are easily envisioned. Some potential engineer contributions are—

- Applying information technologies, specifically three-dimensional terrain visualization of above- and below-ground structures and infrastructures. Examples include database storage and displays of city streets, power grids, water and sewage systems, manholes, subways, etc.
- Predictive modeling of materials' strengths for precise and measured weapons effects and to establish mobility platforms , i.e., rooftop landing zones.
- Rapid, nonexplosive breaching of walls and similar obstacles for soldiers and equipment.
- Teleoperations and semiautonomous or autonomous clearing of booby traps and mines/munitions using small robots.
- Acquiring and providing targeting information for smart weapons designed to penetrate a designated point within a structure.
- Preparing templates of enemy weapons effects that include predictive structural strengths for friendly survivability.
- Ensuring the use of infrastructure services, such as electricity, water, and transportation hubs, for friendly forces and denying them to the enemy.
- Developing a "tool kit" for combat in cities.

An increased role for Army engineers in MOUT will enhance the convergence of combat, construction, and topographic engineer units and missions. For example, the capability to prepare three-dimensional urban terrain visualization products requires such skills as combat soldiering, civil engineering, city planning, architecture, and the ability to create graphic information systems. A strengthened engineer role in MOUT seems especially well suited for light engineer forces.

Suggested tasks to support an increased role for Army engineers in MOUT follow:

Doctrine. Engineer School personnel develop MOUT-specific tactics, techniques, and procedures for mobility, countermobility, general engineering, and topographic engineering, and provide input to FM 90-10-1, *An Infantryman's Guide to Urban Combat.*

Training. Engineer School personnel identify MOUT-related tasks for unit Mission Training Plans and add MOUT instruction to One-Station Unit Training courses. School personnel develop training to fully utilize Fort Leonard Wood's MOUT facility, which is being constructed for both military police and engineer requirements.

Leader Development. Determine MOUT training needs for engineer officer basic and advanced courses.

Organization. No immediate or direct impacts on organizational structure are identified, but units will consider MOUT training when preparing their Mission Essential Task Lists.

Materiel. The development of equipment specifically for MOUT represents something of a problem. Specialized equipment can save lives, but more equipment leads to higher training and maintenance requirements and, if we are not careful, to heavier burdens for soldiers to carry. We must consider these factors when building our MOUT tool kit. We should examine equipment used by police and fire departments.

Soldiers. Evaluate the "soldier's burden" in MOUT by testing extremity body armor and an appropriate mix of ammunition items. Consider physical factors as well as training overload factors when designing equipment. Think about the old Army joke, "100 pounds of ultra-lightweight equipment."

The following MOUT lessons learned, prepared following the mission to Panama during Operation Just Cause, apply to engineers:

- Engineers should have scheduled opportunities to practice live-fire demolitions and breaching techniques in realistic training situations.
- Engineers should have employed obstacle systems in sewers to hamper enemy use of underground passageways.
- Engineers could have employed claymore mines more effectively in urban situations.
- Engineers should have removed stairways to hamper enemy use.
- Engineers should have reinforced ground floor areas to provide for increased blast protection.

Photograph by Sarah Underhill

Soldiers in a four-man stack outside a building at Fort Benning's McKenna MOUT Training Site.

Looking Ahead

Enhancing the capabilities of Army engineers for MOUT is fully warranted and justified. The trend toward MOUT seems irreversible—the U.S. military's next conflict probably will resemble past conflicts in Hue, Beirut, Belfast, Sarajevo, Mogadishu, and Chechnya more closely than Operation Desert Storm.[4] The Army *must* continue to develop future MOUT capabilities to sustain its reputation as the "world's finest sustained fighting-in-cities force." It is not because we seek decisive engagements in complex urban terrain or want to fight in cities. The reason for developing this capability is simply to deny advantages to and influence the perceptions of a potential adversary. When an adversary realizes that an urban environment offers no benefits and will become the graveyard of his military power, the enemy commander will be inclined to avoid urban areas. Our capability to defeat him in the city must be so overwhelming that we influence his tactical choices. The advantage must be ours. The U.S. Army vitally needs these capabilities, and engineers are a major contributor to this fight.

Jeb Stewart is a military engineer development analyst with the Directorate of Combat Developments, U.S. Army Enginer School.

Endnotes:

[1] "Knowledge and Speed," July 1997 report to the Army Chief of Staff.

[2] Suggested by the article, "Tomorrow's Army: The Challenge of Nonlinear Change," by LTC Antulio Echevarria II, *Parameters*, fall 1998.

[3] Summary Report, Integrated Idea Team on Operational and Tactical Mobility, December, 1997.

[4] From remarks by Secretary of Defense Cohen, cited in *MOUT: the Showstopper,* Proceedings, February 1998.

Bridging Shortfall: Lines of Communication Bridging

By Captain Kevin A. Brooks

"... the U.S. Army is not as well equipped as it might be to construct follow-on, long-span fixed bridging. More emphasis is clearly needed in this area to help overcome what could, in a different scenario, be a serious shortcoming."

Dr. Martin J. Falk
Science Advisor to CinC USAREUR & Seventh Army
"The Ribbon Bridge in Peacekeeping Operations"
The Army Engineer, August 1997

During the past 20 years, the U.S. Army has changed from a forward-deployed, defense-oriented force structured around the old NATO general defense plans to a force-projection-based force capable of tremendous strategic and tactical agility. We have endorsed the theory of *maneuver warfare*—the domination of our opponents by obtaining positional advantage and conducting sequential operations at a pace faster than they can implement counteractions. This evolution has been accompanied by development of a wide range of combat systems that make such fast-paced operations possible, including the M1A1/A2 Abrams tank and the M2/M3 Bradley infantry fighting vehicle/cavalry fighting vehicle. The battlefield mobility these systems offer can be decisive on the modern battlefield...*if we can deliver them to, and sustain them on, that battlefield*. Our ability to meet this key requirement is currently deficient in terms of our capability to conduct river- and dry-gap-crossing operations.

This situation is reminiscent of one faced by another generation of engineers in 1939. During the months preceding World War II, new tanks were developed that weighed up to 35 tons, such as the M3 Grant and M4 Sherman tanks. This heavy equipment posed problems for an engineer force that had just replaced its Civil War-era 7 1/2-ton ponton bridges with 10- and 20-ton-capacity bridges.[1] By 1944, increasingly heavy tanks required a 50-ton-capacity structure, which was satisfied by a combination of modified steel treadway floating bridges and Bailey fixed bridges.[2]

The observation in 1939 that "...engineers ...were aware of the inadequacy of their own bridging equipage and acknowledged that they were unprepared..."[3] is as true today as it was then. Engineers know that current tactical bridging systems cannot handle the increased loads of our newest equipment, such as the M1A1/A2, except under "caution" or "risk" category crossings that decrease the crossing rate. None of our systems can handle the M1A1/heavy equipment transporter (HET) combination at military load class (MLC) 96W over any but the shortest of gaps or, for float bridging, at low-stream velocities. We can marginally support a heavy-force river or gap assault crossing, even though it is under restrictions that affect the crossing rate. However, we cannot provide appropriate bridging support to establish and maintain lines of communication (LOC) for continued operations.

Current Status

Doctrine concerning river- and gap-crossing operations is scarce except for information provided for assault crossings in FM 90-13, *River-Crossing Operations*. Rear-area bridging operations are not well explained in any doctrinal publication, although ARTEP 5-145-32-MTP, *Mission Training Plan for the Engineer Bridge Company*, includes a partial doctrinal framework for conducting such operations. Based on this information, gap- and river-crossing operations can be divided into three broad, and sometimes overlapping, categories:

- Assault crossings conducted under close combat conditions maintain the momentum of maneuver forces or initiate offensive operations. The ribbon bridge/raft and the armored vehicle-launched bridge (AVLB) are used to conduct these operations. Beginning in 2000, the AVLB is scheduled for replacement by the Wolverine heavy assault bridge, which has an increased capacity and a longer span.
- Whenever possible, temporary forward fixed bridging (sometimes called "follow-on bridging") replaces assault-crossing equipment remaining in the brigade and division rear areas as maneuver forces advance. The temporary bridging frees the assault assets for future operations. The medium girder bridge (MGB) is our only forward fixed-bridging system.
- Within the corps rear area and communications zone, long-term LOC bridging is installed to support the sustainment effort. The MGB and ribbon bridges are replaced where possible to free assets for use in forward areas. The current LOC bridge, the M2 Bailey, is a widened derivative of the original Bailey bridge procured by the U.S. Army in 1941.[4] The ribbon bridge also can be used. However, its usefulness as a LOC bridge is limited because LOC traffic is predominantly nontactical, the bridge requires extensive anchoring systems and maintenance, and this asset should remain available for assault requirements.

Engineers supporting Task Force Eagle executed the Sava River crossing in Bosnia in December 1995. This operation illustrates the Engineer Regiment's ability to conduct and maintain a crossing on a long-term basis. The maneuver force could cross on the ribbon bridge, although movement was slow due to the bridge's limited capacity to handle the M1A1 (MLC 70T). However, the increased logistical support traffic that followed caused problems because much of it was nontactical and included heavy, multiaxle wheeled equipment. Significant effort was required to modify and maintain the structure to support the increased loads until a second bridge, which allowed two-way traffic, was completed on 17 January 1996.

As the science advisor to the Commander in Chief U.S. Army Europe and Seventh Army stated, "The ribbon bridge was designed to provide a quick means of crossing wet gaps. It was not conceived as a permanent bridge on a main supply route."[5] It would have been desirable to quickly replace the ribbon bridges with fixed bridges, but the MGB and Bailey bridges in our inventory could not replace the destroyed spans. The only solution was to obtain a commercial bridge. The Army procured an advanced panel bridge, a Bailey bridge derivative manufactured by a British firm (Mabey & Johnson). Allowing for the time required to procure this bridge was acceptable in Bosnia, but such a delay could be catastrophic in a high-intensity combat environment.

New Initiatives

The engineer community is aware of our shortfall in bridging capabilities. The ribbon bridge was not designed to handle MLC 70T tanks, much less MLC 96W wheeled traffic. The MGB is limited by its capacity, in terms of span and loading, and its exotic alloy construction. The alloy prohibits significant field maintenance and contributes to metal fatigue problems that require frequent inspections and management of the total volume crossing over structures. The current M2 Bailey system is unchanged from its World War II design and is too narrow to support modern traffic, especially the M1A2/HET combination. Its span and load capabilities are deficient (the almost universally mistrusted cable reinforcement system is unavailable), and the lack of available M3 conversion sets and reinforcing chords precludes panel-pier or multispan construction.

The U.S. Army Engineer School has initiated several programs to remedy our bridging shortfalls. Programs that will impact LOC bridging include the following:

Heavy Dry Support Bridge (HDSB). Currently under development, this $177 million program will provide 32 mechanically erected bridge sets capable of crossing MLC 70T and MLC 96W traffic over gaps of 40 meters. Originally described as a LOC bridge, it has steep ramps and no guardrail, which makes it more suitable for tactical rather than logistical traffic. Depending on funding, initial fielding is projected for the year 2002, with procurement completed in 2010.[6]

Multirole Bridge Company (MRBC). This program involves replacing current MGB and ribbon bridge companies with new, dual-role bridge companies. The interim structure provides each MRBC with MGB and ribbon bridge sets. In the final configuration, these units will be equipped with the HDSB and improved ribbon bridge, with transportation provided by the new common bridge transporter (CBT), a derivative of the HEMTT (heavy, expanded-mobility, tactical truck). Of the 16 MRBCs scheduled for our Total Force, seven will be allocated to the National Guard, five to the Reserve Component, and four to the Active Component. Transition to the interim structure has been hampered by a lack of equipment, especially in the Reserve Components.

Improved Ribbon Bridge. This modified ribbon bridge has an increased capacity (MLC 70T normal, MLC 96W caution) and articulated ramp bays that accommodate bank heights up to 2 meters. This program is still in the feasibility analysis stage of development. It is not optimized for LOC traffic.

Comparison of the HDSB to an Advanced Panel Bridge

DTLOMS	Heavy Dry Support Bridge	Advanced Panel Bridge
Doctrine	Handles M1/HET, MLC 100W/70T at 40 meters; simple span, single lane only.	Handles M1/HET, MLC 100W/70T at 49 meters; multispan/lane capable.
Training	Simplified crew training.	Minimum training required, if familiar with M2 Bailey.
Leader Development	Simplified leader requirements; no construction calculations.	Experienced leaders required; tabular design system.
Organization	Requires 14 personnel.	Requires 60 to 80 personnel, but no more than 30 working at one time.
Materiel	Support required for 9 loads (6 CBTs, 3 palletized load system transporters (PLSTs); mechanical erection.	Requires 12 CBTs or PLSTs or current TOE 05463L MGB/Bailey Company (32 5-ton dump trucks); manual erection.
Soldiers	Requires 1.5 hours to emplace; mechanical erection.	Requires 8 to 12 hours to emplace; manual erection.

When teamed with the pending procurement of the Wolverine heavy assault bridge, these proposed programs eventually will satisfy our assault and forward fixed-bridge requirements. The HDSB, once considered the solution for all our fixed-bridge needs, will replace the now-inadequate MGB system. The question is, how will we meet our forward fixed-bridge requirements until the HDSB is fielded in the 2002-2010 time frame? What happens if the HDSB procurement plan is delayed or cancelled?

Even with the HDSB, our LOC bridging capabilities will remain seriously deficient. The HDSB design is not optimized for the LOC role, and its relatively high cost prohibits purchase in sufficient quantities to meet war stockage requirements. So, how will we address our LOC bridging requirements now and in the future? The Engineer School is preparing an Operational Requirements Document to identify specific needs in this area. But there is an affordable, feasible alternative to a time-consuming and expensive new LOC bridge system development program.

An Interim Solution

U.S. Army engineers need a solution to the bridging shortfall that can be implemented in a timely manner and that does not depend on outside support. Because of procurement time, it took more than three months for the Army to replace the Sava River float bridges with the commercial fixed bridge we were forced to use, and vendor support was required to erect it. One possible solution is to purchase a limited quantity of proven, commercial-off-the-shelf advanced panel bridging to replace the old M2 Bailey systems retained in Reserve Component panel bridge companies. This solution will ensure our ability to conduct limited fixed and LOC bridging operations on short notice without depending on external support.

Army engineers also need to maximize the use of available fixed-bridge assets. There is no need to "reinvent the wheel" to solve this problem when available systems will meet our needs. The proposed solution is economical and makes the best use of limited assets. Commercial-off-the-shelf panel bridge systems that are based on modified Bailey designs and that use modern alloy steels are available from various manufacturers. They have increased roadway widths and longer span lengths at a greater load capacity than the old M2 Bailey bridge systems. NATO and multinational forces in Bosnia have installed 25 advanced panel bridges when the Bailey systems proved to be inadequate. The durability of advanced panel bridges has been proven repeatedly, and they are often used as permanent replacement bridges in the civil sector. Adding these new systems to our four panel bridge companies will provide a source of "in house" LOC bridging expertise that can be used in contingency operations. It will avoid reliance on support from vendors or the Engineer School.

Required Capabilities. A new LOC bridge system requires the following capabilities:

- Sufficient width and load capacity to handle logistical traffic. The defining system should be the M1A2/HET combination, which requires a roadway that is 3.7 meters wide and an MLC 96W.
- Ability to span at least 40 meters at design load capacity (MLC 96W) without using a multistory design. This capability is based on the HDSB requirement. Since NATO requires a capacity of MLC 105W (apparently based on the old British Chieftan MBT and HET), the structure should be capable of supporting this requirement under a "caution" category crossing.
- Minimal specialized training requirements for soldiers experienced in standard Bailey bridge erection.
- Low procurement, operation, and maintenance costs.
- Immediate availability.
- Packaging configuration that supports rapid strategic deployment.

Advanced Panel Bridge. Advanced panel bridge systems meet all of these requirements. Using the Army's standard DTLOMS (doctrine, training, leader development, organiza-

Double story MLC 70T Bailey bridge erected in June 1998 as a temporary replacement bridge at Fort Pickett, Virginia, by the 1031st Engineer Company (Panel Bridge), Virginia Army National Guard.

tion, materiel, and soldiers) model, a comparison of a sample advanced panel bridge system and the HDSB is shown in the table on page 24.[7]

Army engineers must be prepared to support maneuver forces across the entire conflict spectrum, from domestic support to high-intensity conflict. Purchasing a limited quantity of advanced panel bridge sets and providing them to the Reserve Component panel bridge companies ensures an *immediate* interim fixed-bridging capability until the HDSB is fielded. It provides some degree of insurance against delays to that program and a viable LOC bridging capability to complement the HDSB in its forward fixed-bridge role. Because other high-priority engineer systems may compete for very limited funding, program delays are possible (the engineer portion of the Army's research, development, and acquisition budget through FY 2006 is estimated to be only 0.06 percent).[8] For an estimated cost of $8 million, we could equip the four remaining panel bridge companies with advanced panel bridge systems and pre-position 12 additional sets overseas as contingency stockage. This is approximately the same cost as 1 1/2 sets of HDSB.

Reserve Component panel bridge companies are our primary LOC bridging asset. The bridging mission can be trained during weekend drills and, except for individual specialists at the Engineer School, these units are our last source of panel bridging expertise. These units have proved their ability to successfully accomplish this mission during numerous local disaster response and operational support missions. And since they are already our initial response force for domestic disasters, advanced panel bridging will enhance our capabilities in this important area as well. The companies—already manned, trained, and ready—are a potential asset that is being largely wasted because their bridges are inadequate. Revitalizing this asset by acquiring advanced panel bridging offers an economical, practical, timely, and effective solution to our LOC bridging problem.

Repeating History

The bridging dilemma we faced in 1939 was solved in part by procuring the Bailey bridge. It would be a fitting tribute to Sir Donald Bailey and his timeless vision of an efficient, portable bridging system if the solution to our current LOC bridging problem repeats history in the form of an advanced, modernized Bailey system that allows us to accomplish our mobility support mission into the next millennium.

Captain Brooks is the S3, Engineer Brigade, 28th Infantry Division (Mech), Virginia Army National Guard. Previous assignments include S3, 1030th Engineer Battalion, and Commander, 1031st Engineer Company (Panel Bridge), Virginia Army National Guard; and active duty platoon leader and company XO, 13th Engineer Company (CS) and 19th Engineer Battalion (Cbt). CPT Brooks holds a bachelor's degree in civil engineering from Virginia Military Institute.

Endnotes:

[1] Falk, Dr. Martin J., "The Ribbon Bridge in Peacekeeping Operations," *The Army Engineer*, August 1997, p. 38.

[2] Hearings on Military Establishment Appropriation Bill, 1940, HR, 76th Congress, 1st Session, 1 February 1939, p. 393, as cited in *United States Army in World War II: The Corps of Engineers:Troops and Equipment*, by Coll, Blanche D.; Keith, Jean E.; and Rosenthal, Herbert H., USGPO, Washington, D.C., 1975, pp. 36-49.

[3] Coll, et al, pp. 486-497.

[4] Ibid, p. 37.

[5] Ibid, p. 51.

[6] Falk, p. 38.

[6] HDSB data obtained from U.S. Army Engineer School slide presentation on bridging developments provided to the author on 20 December 1996.

[7] See note 6 regarding HDSB data. Compact 200 data courtesy of the manufacturer, Mabey & Johnson.

[8] Allen, James L., "Engineers in the Future Army," *Engineer*, November 1997, p.44.

Army Performance Improvement Criteria Strengthen OSUT and AIT Engineer Battalions

By Lieutenant Colonel Allen C. Estes and First Lieutenant Ricky J. Scott

The Army Performance Improvement Criteria (APIC) process is a method of self-assessment that is an integral part of the Army Communities of Excellence program. APIC is based primarily on Malcolm Baldrige National Quality Award criteria, which are commonly used by America's best corporations to achieve a competitive advantage. The goal of APIC is to establish and maintain a systematic process to review and analyze relevant performance measures against established standards. The focus is on continuous improvement and customer satisfaction. The 35th and 169th Engineer Battalions, from the 1st Engineer Brigade at Fort Leonard Wood, have embraced the APIC process to improve one-station unit training (OSUT) and advanced individual training (AIT) for engineer soldiers.

Mission

The 35th and 169th simultaneously conduct two separate training missions. Each battalion is comprised of three OSUT companies and one AIT company. OSUT companies conduct basic combat training and advanced individual training in a combined 14-week cycle to produce high-quality Career Management Field (CMF) 12 soldiers (12B Combat Engineers and 12C Bridge Crewmembers). AIT companies conduct training for seven engineer military occupational specialties (MOSs) and one ordnance MOS (62B Construction Equipment Mechanic) in CMFs 51 and 63. The engineer MOSs are 51R Interior Electrician, 51T Technical Engineer Specialist, 62E Heavy Construction Equipment Operator, 62F Crane Operator, 62G Quarrying Specialist, 62H Concrete and Asphalt Equipment Specialist, and 62J General Construction Equipment Operator. AIT cycles range from six to 18 weeks.

The APIC Process

Using the APIC process to improve performance, training, and quality required that we answer the following questions:

- How do we know when we have provided adequate initial entry training (IET) to soldiers?
- What core processes determine this baseline, and how can they be measured?
- How do our results compare with those of other Army units that perform the same or similar missions?
- Who are our customers, and are they satisfied with the soldiers we send them?

The APIC process starts with identifying a unit's core processes—those tasks that soldiers must perform well for the organization to be successful. Core processes for OSUT companies are soldier performance in basic rifle marksmanship (BRM), hand grenades, the Army Physical Fitness Test (APFT), attrition, safety, End-of-Cycle Test (EOCT), End-of-Cycle Comprehensive Test (EOCCT), weight control, discipline and motivation, and Army values training. Core processes for AIT companies are soldier performance in the APFT, attrition, safety, weight control, discipline and motivation, Army values training, and MOS course performance. Some of these processes are measured more easily than others.

Many variables other than core processes indicate a unit's performance, including the number of Articles 15 per cycle, barracks quality, field training exercise performance, drill and ceremony scores, cadre APFT results, drill sergeant certification, trainee abuse allegations, post inspection results, sports programs, and award competitions. While these are important, the APIC process focuses on variables that determine if soldiers are trained, disciplined, physically fit, motivated, and ready to make an immediate contribution to their new units.

Several periodic internal assessment mechanisms enable the 35th and 169th Engineer Battalions to continually monitor performance. At the battalion level, cadre after-action reviews, weekly command and staff meetings, weekly training meetings, quarterly training briefs, quarterly reviews and analyses, safety council meetings, and quarterly training status reports play a crucial role in the

APIC process. The 1st Engineer Brigade helps battalions monitor performance by using similar mechanisms at a higher level.

Performance Assessment

Core processes are measured and tracked over time to assess performance, improvement, and trends. Figure 1 shows BRM hit averages from the first quarter of 1997 through the fourth quarter of 1998. A soldier must hit 23 out of 40 targets during record fire to qualify on the M16 rifle. The brigade and battalion goals of 26 and 28 hits, respectively, form a band of excellence that we try to maintain. An average above 28 hits indicates a tremendously successful cycle. First-time "go" and end-of-day "go" rates are tracked as additional performance measures.

Figure 2 shows the final APFT averages over a three-year period. Again, the battalion and brigade goals provide a band of excellence where any average above 240 points is outstanding. The final APFT average tells only half the story. We recently tracked the initial diagnostic APFT averages, which indicate consistent improvement of more than 100 points during the 14-week cycle. Some trends tend to be cyclical. For example, winter classes do not perform as well on the APFT as summer classes, which are filled with recent high school graduates. Winter trainees often shoot better, because classes are smaller and drill sergeants can provide more individual attention. We measure other core processes in a similar manner.

To prevent isolated self-evaluation, APIC requires that units compare their results against other units that perform the same or similar missions. In comparison with armor OSUT units at Fort Knox and infantry OSUT units at Fort Benning, Fort Leonard Wood engineer soldiers attain roughly the same or better results. Comparisons of some mission results are difficult to make, because ranges are different or tests are conducted in a different manner, but the approach is to determine which units perform best and adopt their good ideas.

Figure 1

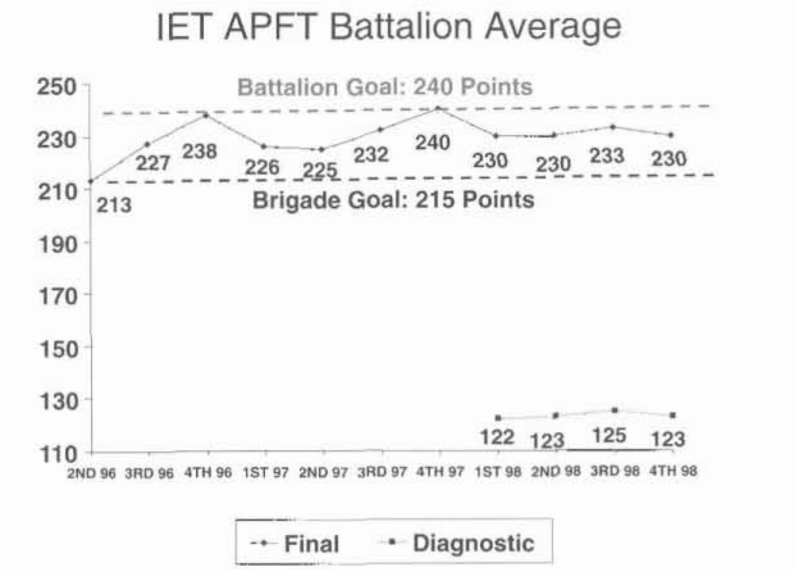


Figure 2

Customer Satisfaction

Since customer satisfaction is an integral part of APIC, customer feedback is very important. The battalions' internal customers are the IET soldiers they train; their external customers are the active, reserve and National Guard engineer units that receive these soldiers. Internal feedback is provided through trainee sensing sessions, after-action reviews, trainee letters to the commander, and surveys.

Trainee surveys provide the most objective and systematic feedback. Soldiers respond to questions regarding quality of life, the soldierization process, and training. The surveys are organized in question and Likert Scale formats. Figure 3, page 26, summarizes the soldiers' response to quality-of-life issues from the second through the fourth quarters of 1998. Out of 10

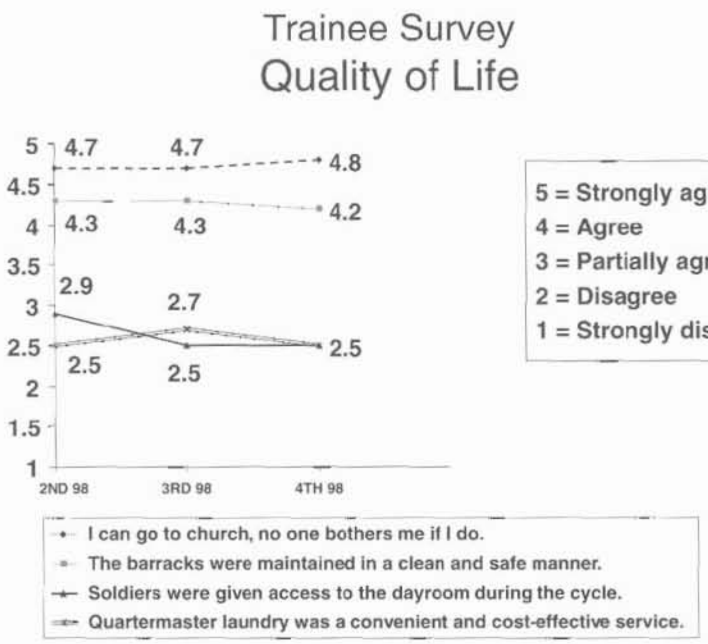


Figure 3

Field Unit Feedback

Quality Indicators	1 Active Engineer Units FY97 Score	2 Active Engineer Units FY98 Score	3 Total Army Force FY98 Score
Adapting well	2.07	2.32	1.88
Team oriented	2.27	2.67	2.34
Neat appearance	2.44	2.26	1.95
Disciplined	2.48	2.57	1.98
Motivated	2.50	2.17	1.84
Mentally tough	3.04	2.84	2.36
Know combat skills	3.26	2.47	1.94
Physically fit	3.48	3.21	2.60

Physical Fitness #1 Training Priority

1-Excellent 2-Good 3-Above average
4-Below average 5-Poor

Figure 4

quality-of-life questions, Figure 3 shows the two questions that yielded the best and worst responses over time. The numbers ranging from 5 (good) to 1 (poor) mean little by themselves. Comparing the numbers to various other quality-of-life issues over time provides leaders with valuable input on where to focus more effort. Trainee surveys also address areas such as the quality of dining facilities and field chow, quality of medical treatment, quality and quantity of training aids, assessment of safety precautions, training that soldiers like most and least, availability of cleaning supplies, and quality of physical training.

The primary method of obtaining external feedback is through surveys sent to engineer units throughout the Total Army Force that receive our IET soldiers. In 1997, we sent surveys to commanders of all active duty engineer units that receive 12B and 12C soldiers. In 1998, we distributed surveys to all commanders and command sergeants major in the Total Army Force who receive 12B and 12C soldiers. More than 40 percent responded to the surveys each year, and Figure 4 shows the results. Our conclusion is that physical fitness must remain our top training priority.

In 1999, all engineer units with CMF 12 and CMF 51 soldiers will receive surveys. Survey results will be available at the ENFORCE Conference at Fort Leonard Wood in April.

Conclusion

APIC has helped the 35th and 169th Engineer Battalions more accurately measure and improve their performance, but much work remains to be done in this process of continuous improvement. Initiatives for FY99 include additional systematic coordination with other OSUT units for benchmarking; more MOS-related performance indicators for AIT students; including off-site AIT companies in Gulfport, Mississippi, and Shepard Air Force Base, Texas, in the APIC process; and incorporating performance measures for values training and weight control. The APIC process, which incorporates management techniques used by America's top-performing companies, helps engineer training units provide the force with the best possible new soldiers.

Lieutenant Colonel Estes commands the 169th Engineer Battalion at Fort Leonard Wood. Previous assignments include S3, 36th Engineer Group; and S3, 43rd Engineer Battalion. LTC Estes is a graduate of the United States Military Academy and holds a doctorate in civil engineering from the University of Colorado.

Lieutenant Scott is the operations officer for the 169th Engineer Battalion. He is a graduate of the Engineer Officer Basic Course and holds a master's degree in management from Webster University.

Ammunition Forecasting for Task Force Operations

By Captain Jared Ware

At 0130 hours, the task force support platoon leader drives toward the brigade support area. Following chemlights between the concertina wire into the area, he asks the gate guard for directions to the Class IV/ Class V pickup point for the task force. The guard points to the south and says, "That way, sir, about 150 meters, right next to the covered HEMTT."

After finding the site, the platoon leader discovers that the Class IV/Class V point does not have the right ammunition. There are no MICLIC reloads on hand and only a few AT4s and Dragons. There are too many high-explosive mortar rounds and not enough smoke rounds. The platoon leader asks the Class IV/Class V NCO why the ammunition count is not what he needs for the upcoming mission, and the NCO replies, "Sir, each task force gets an equal amount of ammunition."

"But our task force is the main effort for tomorrow's attack, sergeant," answers the platoon leader.

"Sorry, lieutenant, but the Brigade S4 gave me the logistics plan, and this is what you get. Besides, you never sent in an ammunition status report."

As the support platoon personnel load the ammunition, the platoon leader wonders why Task Force Eagle received so much ammunition if they are in reserve. He also wonders how he's going to explain the improper mix of ammunition to the task force commander at the morning operations brief.

This article provides information to fix task-force-level ammunition forecasting problems. It defines ammunition terms and describes how planners can accurately forecast ammunition requirements for combat operations.

Terminology

Ammunition consists of bullets, rockets, demolitions, mines, and associated munitions. Ammunition supply is based on a *required supply rate* (RSR) and a *controlled supply rate* (CSR). According to FM 5-71-3, *Brigade Engineer Combat Operations (Armored)*, page 6-8, the RSR is the estimated amount of ammunition required to sustain operations, without restrictions, for a specific period. The rate is determined by forecasting ammunition requirements based on the mission, enemy, troops, terrain, and time available (METT-T). RSRs are based on weapon density for a given unit. RSRs can be developed by several methods, but the accuracy of the calculations varies from method to method. The CSR is the rate of ammunition that can be supported for a given period based on ammunition availability. If a support unit cannot supply a specific type of ammunition based on the forecasted RSR, then it imposes a CSR to limit the distribution of that type of ammunition. The CSR may be less than the RSR; the optimum situation is when the RSR equals the CSR.

Combat load is the ammunition required by each combat system and the individuals assigned to that system. Also called the *minimum initial issue quantity*, a combat load is a standard measure used throughout the Army and provides the baseline upon which units develop their basic loads. Class V loads can be calculated per system, per individual, or per unit.

Basic load is the command-determined quantity and type of munitions carried by an individual, unit, or combat system. A *unit basic load* is the amount of ammunition needed to initiate combat operations and can be moved in a single load by a designated unit.

Responsibility

In a task force environment, the S3 should forecast and determine ammunition requirements. Slice elements, such as engineer, military police, and chemical units, should provide input to the task force S3 for their specific requirements. The S4 then sources these requirements, which normally are based on the mission, its duration, weapon systems used, and the number of personnel in the task force. The task force S3 often allows the S4 to determine and source ammunition requirements without input from slice elements. When that happens, the elements may not receive the ammunition needed to complete their combat missions. For example, engineers need mine-clearing line charge (MICLIC) rockets and reloads for mobility missions and Volcano munitions for countermobility missions. Field artillery units use 155-millimeter smoke rounds for breaching operations, and they need scatterable mines for defensive missions.

Both FM 5-71-2 and 5-71-3 describe a general concept of Class V consumption but don't provide enough information to actually develop a thorough Class V forecast. FM 5-71-2, *Armored Task Force Engineer Combat Operations*, page 6-4, states that "Class V material is based on reported expenditures submitted to the field trains by the first sergeant." This manual discusses ammunition expenditures, but it only addresses replacing Class V expenditures rather than forecasting mission requirements. FM 5-71-3 is the only engineer manual that discusses forecasting requirements for engineers.

Problems

The problems that planners encounter when forecasting ammunition requirements stem from a number of sources.

- Some planners at the task-force level misunderstand ammunition forecasting. Establishing a unit basic load from a tactical SOP is a good start, but that provides only enough ammunition to initiate a mission, not sustain it.
- Establishing an RSR is difficult due to the forecasting tools available. RSRs often are a "best guess," based on the task force planners' experience.
- Units must prioritize ammunition requirements because the haul capacity at the company level and below is limited. Most ammunition is carried on vehicles organic to the company, such as M1A2 tanks, M2A3 Bradley fighting vehicles, M113 armored personnel carriers, HMMWVs, and cargo trailers.

OPLOG Planner

FM 9-6, *Munitions Support in Theater Operations*, chapter 3, page 1-3, states, "An automated tool called the Operational Logistics (OPLOG) Planner is the authorized method for determining munitions planning data at all levels." It is a good tool for forecasting engineer-specific ammunition requirements and can be used to establish an RSR for engineer ammunition. Based on the mission, the OPLOG Planner creates an ammunition consumption report that shows the type of ammunition required for a specific type of operation, battle intensity, and duration. From this report, engineer planners can forecast ammunition requirements. A simplified version of the process follows:

1. Determine the engineer unit by source reference code (SRC), unit identification code, type, size, and name.
2. Assign the engineer unit a "task force" name such as "203_EN_ BN."
3. Assign the unit to the "task force" by SRC and quantity (type a "1" next to the SRC).
4. Determine the use of mission parameters or custom parameters and modify them.
5. Create an order, such as "Order 1-1," and assign the engineer unit to it.
6. Determine the type of operation, intensity, and number of days for the operation.
7. Select the data according to the area of operation (mission, duration, and posture).
8. Prepare the consumption report and the ammunition report.
9. Print the reports (to a file, screen, etc.) and analyze them according to the mission.
10. Divide by the quantity of weapon systems in the unit (ignore line item numbers [LINs] that are not in the unit).

Mission parameters are based on a number of factors specific to the mission and area of operation. The figure on page 29 shows various parameters for combat operations.

Table 1, page 29, is an estimated ammunition consumption report for an engineer battalion, heavy division. The document lists data such as the mission, intensity, duration, LINs and quantity of weapon systems, and Department of Defense identification codes (DODICs) for associated ammunition. It also lists weights associated with each DODIC as a planning factor for transportation. Table 2, page 30, shows the total ammunition consumption for an engineer battalion in the attack phase. (OPLOG Planner also calculates for defensive and reserve missions.) Although not shown in Table 2, the ammunition report includes the DODIC Summary Report for the engineer battalion, the Phase DODIC Summary Report, the Phase Total Report, and the Order DODIC Summary. These reports are useful if an operation has more than one phase or if more than one unit provides input to the ammunition forecast. The reports also contain information needed to forecast initial ammunition requirements for engineer units in a task force.

OPLOG Planner allows the user to build task force models, which add multiple units to the report. However, planners should analyze the information carefully, because the calculations often produce extremely high consumption rates for units that do not use the amount of ammunition estimated for their combat mission. For example, the program recognizes that all M16A2 rifles in a task force fire at the same rate. This is equivalent to putting an entire task force's M16A2s on line and firing the rifles at maximum rate. To forecast accurately, planners should run the program for individual units and their specific missions rather than "grouping" the units as a task force.

Drawbacks

Although OPLOG Planner is a good planning tool, it has some drawbacks. It—

- Does not forecast for most engineer units below the battalion level. Engineer planners must perform an extra "allocation" step to forecast Class V requirements for an engineer company by separating the company's forecast from the battalion's.
- Does not account for certain types of Class V supplies. Engineer Class V munitions not accounted for in OPLOG Planner include the Modular Pack Mine System (DODIC K022).
- Does not calculate consumption rates for the MICLIC or the MK19 grenade machine gun. It lists the basic loads for these systems but does not calculate additional ammunition requirements for these situation-dependent munitions.
- Generates Volcano consumption rates but lists the individual mine consumption rate instead of the canister consumption rate.

Parameter Set: -> Defense-Succeeding Days-Light	
Description->	Defense: Combat Posture; Succeeding Days; Intensity: Light
Class I->	A: 1, B: 0, T: 1, MRE: 1, LRP-I: N, HCP1: Y, HCP2: Y, R/CW: N
Class II->	Theater: NEA
Class III->	Profile: CONUS
Class IV->	Barrier: Y, Construction: Y
Class V->	Rate: NEA DIV
	Posture: Defense;Succeeding Days; Intensity: Light
Class VI->	Use [Y/N]: N, Climate:
Class VIII->	Echelon: ECH 1 & 2 (DIV), Theater: MRC-W
Water->	Echelon: Division, Climate: Temperate
Parameter Set: -> Protracted-Reserve	
Description->	Combat Posture: Protracted; Intensity: Reserve
Class I->	A: 1, B: 0, T: 1, MRE: 1, LRP-I: N, HCP1: Y, HCP2: Y, R/CW: N
ClassII->	Theater: NEA
Class III->	Profile: Europe EAC
Class IV->	Barrier: Y, Construction: Y
Class V->	Rate: NEA DIV
	Posture: Protracted Period; Intensity: Reserve
Class VI->	Use [Y/N]: N, Climate:
Class VIII->	Echelon: ECH 1 & 2 (DIV), Theater: MRC-W
Water->	Echelon: Division, Climate: Temperate

Combat mission parameter sets. (Note the change in parameter set ->)

Phase: 1 Phase Length: 1.00 Days
Task Organization: Engineer
Parameter Set: Attack; Succeeding Days; Moderate
Rate: NEA DIV

Posture: Attack; Succeeding Days
Intensity: Moderate; Strength: 100 percent
Unit: 05335L000 Engr Bn, Hvy Div
Qty: 1, Str: 444

LIN	QTY	Weapon Nomenclature	DODIC	DODIC Nomenclature	CBT Load	Rounds	Weight	Cube
C18234	28	Carrier Personnel Full TR	A576	CTG CAL .50 M8	50,400	1,786	696.60	8.93
1049	6	Carrier Cargo: Tracked 6	A576	CTG CAL .50 M8	5,400	383	149.27	1.91
D11538	4	Carrier Command Post: LIG	A576	CTG CAL .50 M8	3,600	255	99.51	1.28
D30897	6	Dispenser Mine: M139 (HTL)	K045	Mine, XM87, Volcano	960	1,018	44,797.72	2,514.78
E56578	6	CEV FT 165 mm Cannon M728	A131	7.62 mm 4 Ball, 1 TRA	21,600	1,112	111.21	2.22

Table 1. OPLOG Planner estimated ammunition consumption report for an engineer battalion, heavy division

Unit Total for Engr Bn, Hvy Div	DODIC	DODIC Nomenclature	Rounds	Weight (lb)	Cube
Weight (lbs): 52,560.34					
Short tons: 26.28	A059	5.56 mm Ball M855 10	9,797	489.83	9.80
Pounds/Man-day: 118.38	A063	5.56 mm Tracer M856	3,740	149.40	3.74
	A064	5.56 mm Ball-1TRL	0	0	0

Table 2. Total ammunition consumption for an engineer battalion in the attack (OPLOG Planner).

Solution

These problems can be corrected by using OPLOG Planner ammunition factors with a spreadsheet program, such as Microsoft Excel, to forecast ammunition requirements. After downloading OPLOG Planner text files to a disk, the files can be reopened in the spreadsheet program. The user can "manually" separate the amount of ammunition forecasted for an engineer battalion and express it as an engineer company forecast in the spreadsheet format. The user can then input DODICs into the spreadsheet that are not accounted for by OPLOG Planner. Engineer planners can use OPLOG Planner consumption rates from the spreadsheet to determine ammunition forecasts for MICLICs and MK19s. For example, OPLOG Planner determines Volcano consumption in terms of individual mines. Volcano reloads can be accurately forecasted by dividing the OPLOG Planner consumption rate by a factor of 6, which is the number of canisters in each Volcano DODIC.

Engineer Forecasting

Forecasting ammunition requirements for combat operations is an integral part of the engineer planning process and should be included in the Engineer Estimate. After receiving a mission, engineer planners know the type of operation the unit will perform. During the battlefield assessment and intelligence preparation of the battlefield, engineer planners determine the enemy's capabilities. These analyses indicate the types of targets to expect and the battlefield conditions. From this information, the planner develops a tentative list of ammunition the unit will need for a mission. In analyzing engineer missions, planners further determine which parameters impact the mission (figure, page 29).

While developing the scheme of engineer operations (SOEO), planners determine which engineer assets to use in the mission. FM 5-71-2, pages 3-10 and 3-11, states that "There are some specific considerations that the engineer staff officer should consider as he develops his SOEO." These include task force breaching capabilities and adequate fire-control measures to support breaching. Engineer planners should coordinate with the fire-support officer for artillery fire as related to the task force mission. If the mission requires scatterable mines, engineer planners forecast the ammunition needed to achieve the desired obstacle effect. Field artillery munitions that are important to engineers include the area denial artillery munition (long duration) (DODIC D501), the area denial artillery munition (short duration) (DODIC D502) and the remote antiarmor mine-(long duration) (DODIC D503).

After developing the SOEO, engineer planners determine the types and quantities of ammunition the unit needs to accomplish the mission. They use OPLOG Planner and a spreadsheet program during the wargaming and refining phase of the Engineer Estimate. After engineer planners run OPLOG Planner for each possible course of action (COA) and analyze the results, they forecast ammunition requirements for each COA. The forecasted requirements are used as criteria to determine which COA to recommend to the commander. After he decides on a COA, the OPLOG Planner results for that COA are used as the engineer ammunition forecast for the mission. Give a copy of the results to the task force S4 and the support platoon leader to ensure that the engineer-specific ammunition forecast is included in the task force logistics plan.

Tools

Forecasting engineer ammunition requirements for combat missions is an important job for planners who work in a task force environment, where engineer companies may use a variety of Class V items depending on the mission. It is the task force engineer officer's responsibility to forecast, determine, and source engineer ammunition requirements. By understanding the basic ammunition terms and definitions, engineer planners can formulate a plan to accurately forecast Class V requirements. The Engineer Estimate will alleviate some forecasting uncertainties. Using OPLOG Planner to forecast initial ammunition requirements and a spreadsheet program for additional requirements lead to an accurate engineer ammunition forecast. This forecasting process provides engineer planners the fundamental tools to forecast the proper type and amount of ammunition needed to complete their assigned combat missions.

Captain Ware is commander of A Company, 249th Engineer Battalion (Prime Power), Fort Lewis, Washington. Previous assignments include Joint Operation Planning and Execution System (JOPES) Officer, G3, Eighth U.S. Army, Korea; and platoon leader and executive officer, 70th Engineer Battalion, Fort Riley, Kansas. CPT Ware is a graduate of the U.S. Military Academy and holds a master's degree in engineering management from the University of Missouri-Rolla.

PERSCOM Notes

By Sergeant Major Jay Florance

When the command sergeant major/sergeant major list was released in December 1998, many non-commissioned officers (NCOs) had their day brightened, as they became the new senior enlisted leadership for our Army. They deserve our congratulations. Army promotion boards always try to promote the best NCOs, and they usually do. But we know that some excellent soldiers are not promoted simply because their Noncommissioned Officer Evaluation Reports (NCOERs) are weak or unclear. During my two years of duty at PERSCOM, I have reviewed the records of every engineer NCO. I am taking this opportunity to pass along my thoughts about what results in promotion selection.

On the whole, most NCOERs don't paint a picture that helps the promotion board select the best candidates. There usually are three or four NCOs who have had stellar careers or unique events that clearly place them in the upper percentile of their grade and military occupational specialty. Such events include being selected Drill Sergeant of the Year or Soldier of the Year. But only a few soldiers achieve those high standards, and there is a huge bubble of soldiers grouped in the middle who compete for promotion.

The NCOER is the key to who gets promoted, but many of them don't say anything substantial. The words may be there, but they lack significance. Phrases such as "Leads from the front," "Places unit goals above his own," or "Consistently demonstrates sound judgment" do not relate to promotion. Nor do they say anything significant about the soldier's performance over the past 9 to 12 months. If promotion board members read those or similar comments on 50 NCOs and only 30 NCOs can get promoted, which 30 should they select? The following recommendations will help rating officials prepare strong NCOERs that send the intended message.

Raters: Part IIId, *Area of Special Emphasis,* should relate to *the* event that occurs during the rating period. It may be a rotation at the National Training Center or the Joint Readiness Training Center, a deployment, or a field training exercise, etc. Since this is the most important event of the rating period, gear the first comment in each rated area on the back of the NCOER to it. If a rater includes *the* event on the front of the NCOER but does not add comments about it on the back, the reader may assume that the soldier's performance was less than successful. Excellence and success, or lack of success, should be clearly identifiable based on this key event. Describe day-to-day events or performance in the second and following bullets.

Raters should also consider other factors. When listing three positions for future duty, don't forget about observer/controller (OC) duty at a combat training center. We need to know which NCOs to place in these key positions and don't want to guess! Recommend only your best NCO for an OC position. Also, staff sergeants should rate other staff sergeants only when absolutely necessary! They normally do not provide a strong description of duty performance and generally rate the soldier lower than a more experienced NCO would. Finally, understand that if you rate a soldier "fully capable" rather than "among the best," that soldier probably will not get promoted. If your NCO is not the best, why isn't he? Have you counseled the NCO on what is needed to become the best? Do you have a best?

Senior Raters. Weigh in with your comments! Whether you realize it or not, senior raters really drive the train. Platoon leaders: Who is your best squad leader? Company commanders: Who is your best platoon sergeant? Battalion commanders: Take a bow—you do a great job stating who your best first sergeant is. Prepare a bullet for each area, performance and potential. Too many NCOERs have conflicting messages. For example, if the comment "Ready to perform duties as first sergeant" is paired with a potential rating of "2," the NCO will not be selected. That combination raises the question of how an NCO can be ready without a potential of "1." When company commanders do not indicate who their best platoon sergeant is, that soldier probably will not get promoted. Don't shortchange your best NCO! If you don't identify your best NCO, his chance for promotion is about one in 50.

This is my last PERSCOM Note, since I am preparing to move to Germany. It has been an honor to be the Engineer Branch sergeant major for the past two years. Sergeant Major Fillmore will arrive in May, and I'm sure she will continue to take care of the Engineer Corps.

Sergeant Major Florance serves as the Engineer Branch sergeant major at PERSCOM. His e-mail address is florancj@hoffman.army.mil.

Civil Disturbance Operations for Mechanized Engineer Battalions

By Captain Mark A. Geraldi

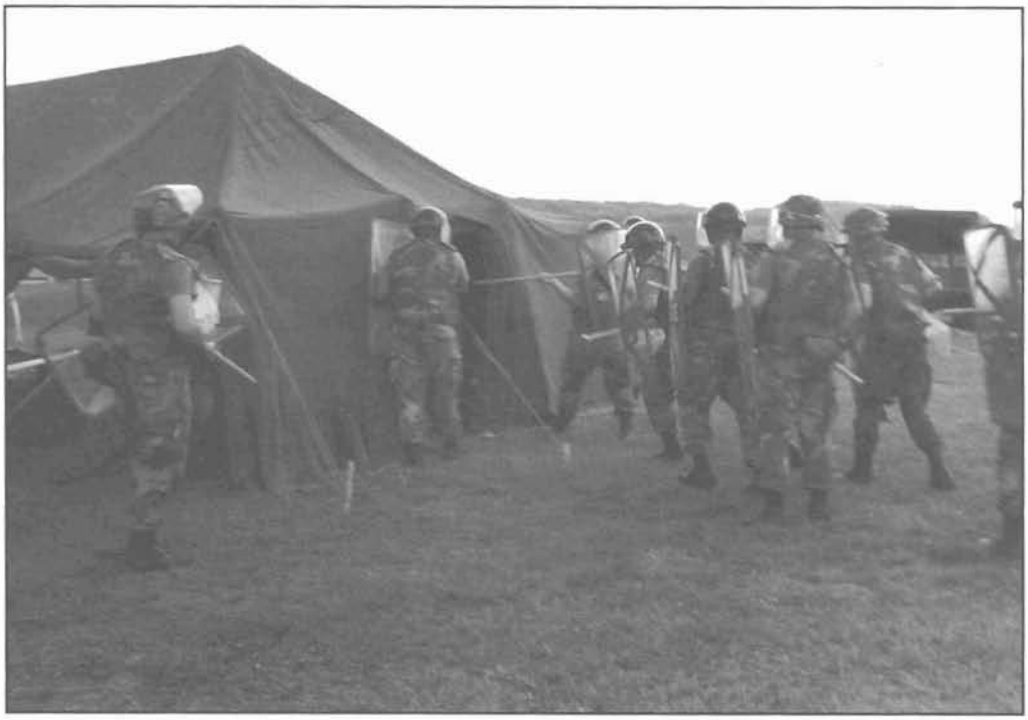
With the proliferation of operations other than war (OOTW), civil disturbance missions are no longer owned solely by light infantry battalions. Correctly employed, mechanized combat engineers can be major players in future OOTW deployments. For example, units currently deployed to Bosnia have faced and probably will continue to face civil disturbance scenarios in that theater.

The 1st Cavalry Division's 8th Engineer Battalion at Fort Hood, Texas, demonstrated the effectiveness of a mechanized engineer battalion in such a role when it deployed to Panama for Operation Safe Haven/Safe Passage during 1994 and 1995. As a line platoon leader, I was an active participant in this innovative role for combat engineers. This article details the task organization and deployment, the specialized equipment, and the training and tactics that a mechanized engineer battalion must employ to conduct effective civil disturbance operations.

Task Organization and Deployment

The United States constructed four camps in Panama to house Cuban refugees while they awaited entry into the United States. On 7 and 8 December, 1,000 of more than 8,000 refugees escaped during an extremely violent riot. More than 200 U.S. military personnel were injured, with 18 of them hospitalized. The 8th Engineer Battalion's role was to reinforce the severely outnumbered and underequipped joint task force soldiers, marines, and airmen guarding the camps.

The battalion began its notification sequence at 1600 hours on 11 December 1994. My company held its first muster formation for this "Drawn Saber" alert (a muster in field uniform with the remainder of the gear packed in duffel bags) two hours later, which is the division standard. The company had participated in a brigade-level sea deployment readiness exercise six months earlier, so the squad leaders had



Sappers from the 2nd Platoon, Alpha Company, 8th Engineer Battalion, conduct tent-clearing operations as part of their civil disturbance training during Operation Safe Haven/Safe Passage. The soldiers are in a modified uniform (no blouse) for this training due to the extremely hot and humid weather.

little difficulty in directing the initial steps of the deployment preparation while the commander briefed senior leaders.

To support Operation Safe Haven/ Safe Passage, we modified our basic task organization. The two line platoons in each company were the focus of the battalion's effort. Soldiers from the assault and obstacle platoon augmented the line platoons to bring them up to their full 29-man strength. Each line platoon also deployed all four of its M113 armored personnel carriers (APCs), a HMMWV, and all other modified table of organization equipment. The commander attached the remaining soldiers from the assault and obstacle platoon to the company headquarters section to form a small transportation section. The assault and obstacle platoon leader served as liaison to the local U.S. infantry battalion (5-87th Infantry) after we arrived. The headquarters section deployed the remaining three HMMWVs, a 5-ton cargo truck, and a HEMMT (a heavy, expanded-mobility tactical truck). The combat engineer vehicles (CEVs), armored vehicle-launched bridges (AVLBs), and armored combat earthmovers (ACEs) remained at the home station.

The company loaded its vehicles and equipment onto C-5 Galaxies and C-141 Starlifters and left Fort Hood by 2200 on 12 December. The main body of the battalion, with full field gear and personal sensitive items, departed later that evening. This was the largest airlift of mechanized forces since Operation Desert Shield.

We arrived at Howard Air Force Base, Panama, on the morning of 13 December. The joint task force headquarters, known as Joint Task Force Safe Haven, informed us that the riots had ceased and all but 10 of the escapees had been apprehended. Initially we were to serve as a mechanized quick-reaction force that could project from our jungle base camp to quell any new flare-ups by the Cuban refugees.

Based on the clarified mission and situation, the commander directed both line platoon leaders to conduct a reconnaissance of the four refugee camps and the one confinement facility known as "Camp 5." Our recons focused on the standard military aspects of terrain—OCOKA (observation and fire, cover and concealment, obstacles, key terrain, and avenues of approach). We noted such things as fields of fire (the rioters inflicted most of the injuries by throwing jagged stones found along this part of the canal), areas in which our troops could take cover from such projectiles, and concealed areas that refugees could pass through or ambush from. We also recorded locations of natural obstacles and potential man-made barriers that rioters could hastily erect, key terrain such as choke points (one camp entrance was through a constricted canyon), and avenues of approach for dismounted troops and APCs. Since we were the only mechanized unit in Panama, we conducted several bridge classifications and constructed an improvised bridge over aboveground plumbing for one camp.

Specialized Equipment and Modifications

Civil disturbance operations required us to either modify existing equipment or acquire new equipment. At Howard Air Force Base, our supply sergeant issued each soldier a complete set of riot gear that included shin guards (the same type that baseball catchers use), a Plexiglas shield, a Plexiglas face visor that attached to the kevlar, and a 3-foot wood baton. The main purpose of this gear was to protect against projectiles such as rocks or tent poles that the rioters sharpened and used as spears. We donned the gear when we moved large numbers of refugees from one camp to another or were alerted.

We also wore a stripped-down pistol belt with a 2-quart canteen on our backs and had protective masks that hung on our front sides over the groin. The position of the masks served two purposes: protection and accessibility in case we employed riot-control agents. Soldiers wore flak jackets and leather gloves for additional protection. We reinforced our shields with 100-mile-an-hour tape along the edges and placed two strips in an "X" pattern across the front. The entire ensemble was hot but offered excellent protection.

We removed the lanyards on the batons because our soldiers were not experts in their use and risked being pulled into a rioting crowd if the lanyard was attached to their wrist and refugees grabbed the baton. We also carried four flexicuffs on the elastic snap loops of our flak jacket shoulder pads. The cuffs were prethreaded so we could quickly take them off to restrain a rioter. The ammunition pouch on our pistol belt held additional flexicuffs. Each of the two grenade pouches of the ammunition pouch contained a pepper spray bottle (with a 10-foot range). Soldiers at team leader level and above, track commanders, and drivers also had night vision goggles, which usually were stored in the squad APC.

Since we did not know how volatile the situation was, soldiers deployed with an M16 and bayonet, but we left the M249 squad automatic weapons behind. As soon as a forward base camp was established along the Panama Canal, we permanently stored our rifles in the field arms room. Once in country, we drew one riot shotgun per squad. We used birdshot in these weapons, which could be fatal at close range (10 meters or less) but not at longer distances. Platoon leaders carried 9-millimeter pistols. Local military police conducted ranges for both pistols and shotguns to improve our proficiency on these weapons. They remained in the arms room except when we deployed to a camp.

Other platoon equipment included mine detectors, which were used when searching the camps for buried caches of homemade weapons. Each platoon also brought five single-channel, ground-to-air radio systems (SINCGARS), which were taken from home station ACEs and CEVs. We configured them as manpacks so each leader

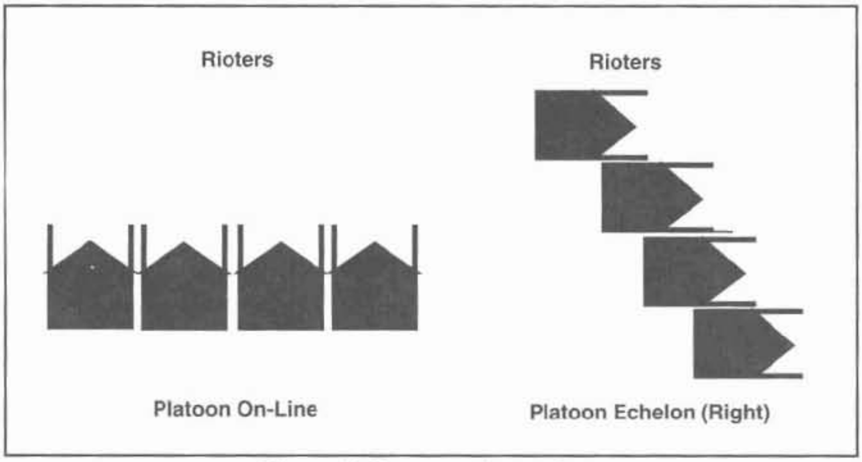


Figure 1. Dismount formations

in the platoon could maintain communications with the tracked vehicles while dismounted.

We also modified the APCs to better support the mission. Since it was a riot-control mission, we did not deploy our M2 machine guns from Fort Hood. We removed all external attachments from the APCs—such as pioneer boxes, tow cables, and oil cans—so rioters could not swarm the vehicle and use them as weapons. We also taped over the external handle of the onboard fire extinguisher. Some of the refugees had prior military service and could try to disable an APC. (During the initial riot, a rioter turned off the ignition of a passing HMMWV.) Drivers kept both the engine compartment and fuel cap combat locked at all times. We also mounted two rolls of concertina around the exhaust stack of each APC and stored pickets inside the vehicle. We used this barrier material for hasty roadblocks. Inside each tracked vehicle we stockpiled two cases of MREs (meals, ready-to-eat) and a 5-gallon water cooler.

Training and Tactics

Upon arriving in Panama, we initiated individual and squad-level training for such areas as squad formations and use of the baton and shield. A military police lieutenant deployed with our battalion to serve as a subject matter expert in civil disturbance operations. After a few days, the battalion and company adopted a more formal civil disturbance operations mission essential task list (METL), which focused our training. It followed the natural progression from individual and squad tasks to platoon and company formations and included rules-of-engagement training at all levels.

We practiced quick-reaction force alerts several times a day. The company standard was to roll out of camp fully geared within 20 minutes of notification. To accomplish this, each squad laid their gear on sheets of plywood outside their tents, and we parked the APCs next to the bivouac area.

Joint Task Force Safe Haven constructed two mock-up camps for training, and we conducted an exercise at one site using other joint task force soldiers as opposing forces. This beneficial exercise exposed us to some of the frustrations typical of civil disturbance operations, especially the incessant jeering of rioters and continuous barrage of projectiles.

We developed a series of tactics to use when dismounting troops near rock-throwing rioters. These formations allowed us to dismount and assemble into riot-control formations out of direct fire (Figure 1). Drivers drove buttoned up so they were fully protected from threats such as gasoline fire bombs.

Another mission was to serve as a mobile roadblock if the refugees broke out. The tactic we developed involved tying into the impenetrable vegetation that grew on either side of every road. Two squads pulled into a predesignated site and strung triple-standard concertina across the road. Dismounted troops stood behind the wire to prevent escapees from creating a breach, and we positioned APCs behind the soldiers as a final backstop.

The APCs were positioned in a Vee formation to create a gate effect on the road (Figure 2, page 35). If the wire did not hold the rioters, the soldiers could retrograde through the gap between the tracks, and the APC would reseal the hole. This allowed soldiers to make a second stand from the top or behind the vehicles or remount the APCs and button up if the crowd was too large. We also developed an obstacle plan for key avenues of approach. At critical choke points, we erected tanglefoot on the shoulders of the road and 11-row wire obstacles. For the 11-row obstacles, we secured concertina on only one side and kept it coiled so the road remained open but could be rapidly sealed off. The only difficulty with the obstacles in remote areas was that they soon fell prey to scavengers.

To relieve monotony after several weeks of continuous civil disturbance operations training, we conducted jungle survival training and dismounted patrolling with the 5-87th Infantry Battalion "Light Fighters." We also ran an M16 range and a 50-foot rappelling tower for the company. These training events were critical in maintaining and improving esprit de corps.

Unit Success

Throughout the three-month deployment to Panama, our company had no Cuban refugees escape and no riots erupt. The deployment concluded with Operation Safe Passage, which entailed moving the refugees from our camps to Guantanamo Bay, Cuba. This phase of the deployment also was without incident.

The unit's successes were largely due to the adaptation of our mechanized engineer battalion to conduct effective

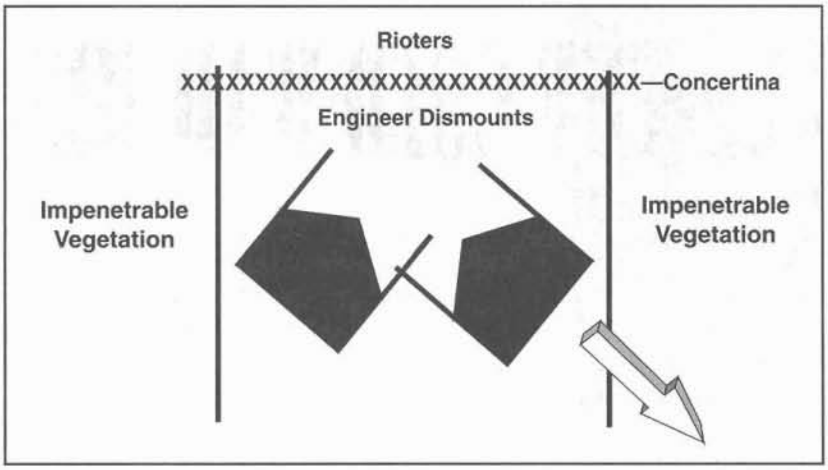


Figure 2. Hasty roadblock

civil disturbance operations. For example, the focus on the line platoons was critical in building a highly mobile, quick-reaction force. The APCs offered a level of protection that light forces do not have and permitted us to dismount close to rioters without facing a hail of stones. The protective equipment and array of weapons provided the flexibility to respond to varying levels of violence by rioters. The tiered training plan and realistic training events rapidly built up the soldiers' ability and confidence in this otherwise foreign mission. Finally, occasional adventure training provided the variety necessary to maintain the soldiers' morale during this extended deployment.

Honing in on these basics is an effective way for a mechanized engineer battalion to adapt to civil disturbance operations. Correctly employed, combat engineers can be major players in future OOTW deployments in any environment, whether it is the jungles of Panama or the rugged terrain of Bosnia.

Captain Geraldi is the 1st Brigade engineer, 101st Airborne Division (Air Assault), 326th Engineer Battalion, Fort Campbell, Kentucky. He previously served as a platoon leader and a company XO, 8th Engineer Battalion, 1st Cavalry Division, Fort Hood, Texas. CPT Geraldi holds a master's degree in engineering management from the University of Missouri-Rolla.

(Continued from page 11)

may have difficulty recognizing the M113 as friendly. This dilemma is evidenced by the consistently high losses of engineers to enemy contact at the combat training centers, the fratricide of engineers from the 82nd Engineer Battalion during Operation Desert Storm, and the recent training death of M113-mounted engineers at the National Training Center. The vulnerability of the M113 to most weapons on the battlefield, its lack of firepower, the difficulty friendly forces have in recognizing the M113 as friendly, and the fact that our mission places engineers forward of friendly defensive positions and in the gauntlet of fires during breaching operations create a deadly combination. It leaves engineers with a recipe for mission failure and fratricide.

Engineers mounted in BFVs offer the BCT increased versatility. When mounted in M113s, engineers command and control mobility and countermobility assets but must rely on maneuver forces for protection. This requirement often drains the already-stretched firepower of infantry and armored forces. As the structure of the division is reduced, this burden will increase. Engineers in BFVs can protect themselves during movement and can provide their own protection during obstacle reduction. In the defense, engineers in BFVs can relieve infantry and armored forces from the need to escort the Volcano because they will have the firepower needed to accomplish the mission.

The transition from the M113 to the Bradley fighting vehicle will dramatically improve the survivability, lethality, and versatility of combat engineers during the close fight. It also will create the commonality required to effectively streamline the CSS system and provide a platform to launch combat engineers into the future. Clearly, combat engineers must rapidly transition to the Bradley fighting vehicle to support overall mission accomplishment now and well into the 21st century.

ROBOTS CLEAN UP THE COLD WAR MESS

By Mark D. Kessinger

Fearful that Hitler's Germany might invent the world's first atomic bomb, the United States began the Manhattan Project in 1942 to secretly build the bomb before the Germans. In less than three years, we successfully built both uranium and plutonium bombs. During that time, the U.S. Army Corps of Engineers managed the construction of monumental plants to enrich uranium, production reactors to make plutonium, and reprocessing plants to extract plutonium from the reactor fuel. On 6 August 1945, the United States dropped a uranium bomb (called Little Boy) on Hiroshima, Japan, and on 9 August we dropped a plutonium bomb (called Fat Man) on Nagasaki. Japan surrendered 23 days later.

Following World War II, relations between the United States and Russia were strained, and with an impending threat from the Soviets, the Cold War began. Over the next five decades, the United States spent an estimated $300 billion manufacturing nuclear weapons. This ended in 1991, when the sudden collapse of the Soviet Union brought an abrupt end to the nuclear arms race and the Cold War.

Now, the Corps of Engineers is assisting the Department of Energy (DOE) in decontaminating and decommissioning portions of the nation's vast nuclear weapons sites with the help of robots.

The Cold War Legacy

Like most industrial and manufacturing operations, the production of nuclear weapons has generated wastes. But unlike other wastes, these have unique radiation hazards. In the late 1980s, all major facilities in the nation's nuclear weapons complex were shut down temporarily. Because the end of the Cold War was so sudden, many facilities were not closed properly. Much of their wastes remain in temporary storage and pose environmental and health risks. The DOE currently owns and maintains more than 2,000 contaminated buildings that will require decontamination and decommissioning. It also must remediate about 2,700 metric tons of spent fuel, 100 million gallons of high-level waste (enough to fill 10,000 tanker trucks), 100 metric tons of plutonium, and 550,000 metric tons of contaminated metal.

In its 1995 Baseline Environmental Management Report, the DOE estimated that it would take 75 years and $227 billion to clean up the nuclear weapons complex. Because of this enormous price tag, in June 1997 the DOE introduced its "2006 Plan." Formerly called the "Ten Year Plan," it urges the use of innovative technologies, processes, and thinking to clean up many of the sites by the year 2006 at a cost of about $120 billion.

Interagency Agreement

The DOE's Federal Energy Technology Center (FETC), located in Morgantown, West Virginia, and Pittsburgh, Pennsylvania, has the lead for developing innovative technology to decontaminate and decommission the nation's nuclear weapons complex. In 1995, the FETC executed an interagency agreement with the Army that allows the Corps of Engineers to assist the DOE in a variety of areas, including cleanup of the nuclear weapons complex. The Corps Huntington, West Virginia, district serves as the Army's program director for the agreement. It assigns work to the Corps district that is nearest to the DOE project, if that district has the necessary expertise and resources.

Projects

The Corps played a major role in building the nuclear weapons complex in the 1940s, and now it is a vital part of the team that is decontaminating and decommissioning these facilities. Currently, the Corps is helping the FETC decontaminate and decommission a portion of three sites: the Chicago Pile 5 Reactor at the Argonne National Laboratory; Fernald's Plant 1 near Cincinnati; and Hanford Reservation's C-Reactor near Richland, Washington.

Chicago Pile 5 Reactor. This heavy-water, uranium-fueled, thermal reactor operated for 25 years before shutting down in 1979. Decontaminating and decommissioning the reactor includes removing the reactor core and the biological shield structure, decontaminating the rod storage area, and dismantling the structure.

Fernald. At this plant, uranium ore was milled for distribution to other nuclear weapons sites. The work generated low-level radioactive dust, which settled over much of the 1,000-acre site.

C-Reactor. This full-scale surplus production reactor was constructed rapidly in 1951 to respond to increased tensions in the Cold War. The reactor started up in November 1952 and operated until April 1969. The C-Reactor was scheduled to be the first of eight reactors at Hanford to be dismantled.

However, due to site priorities and limited resources, the DOE is exercising the option to maintain the reactor in safe storage for 75 to 100 years before final disposition.

New Projects. Four new cleanup projects are getting underway: at Mound, Ohio; the Los Alamos National Laboratory in New Mexico; the Savannah River National Laboratory in South Carolina; and the Idaho National Laboratory.

Technology

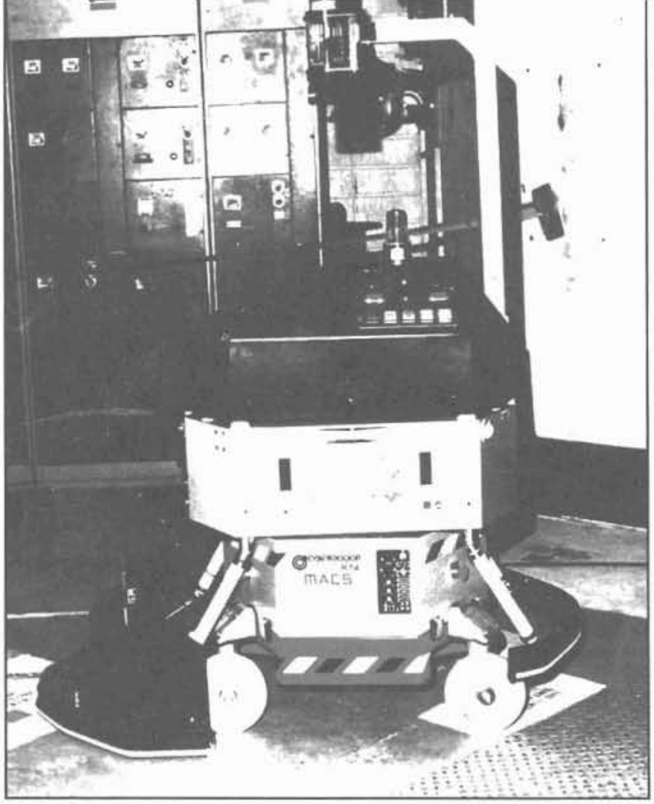
FETC's ultimate goal is to demonstrate innovative technologies and processes and facilitate their acceptance and deployment for repetitive and reliable uses across the nuclear weapons complex. The Corps provides management support and cost engineering services to determine the performance and cost effectiveness of these technologies and processes.

Robots are an example of innovative technology that is used successfully to clean up nuclear weapons sites. This equipment includes the following:

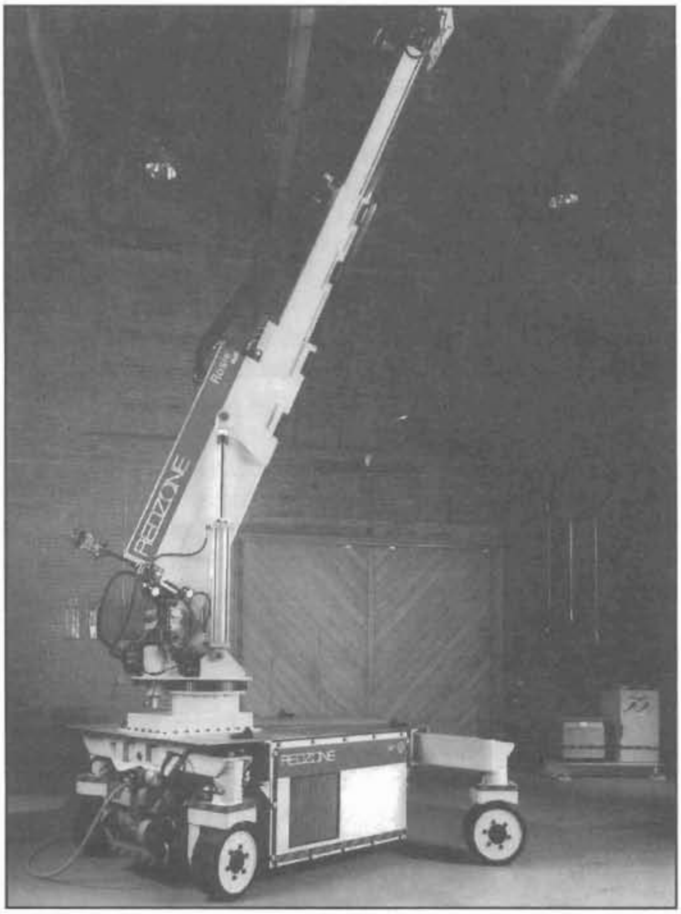
Mobile Automated Characterization System (MACS). The MACS is a battery-powered, autonomous robot with a laser positioning system. It can detect alpha and beta contamination on floors and perform long-term surveillance and maintenance tasks. Because it is operated from a remote location, the MACS reduces worker exposure and provides accurate characterization data. (See top photo.)

Rosie Remote Work System. A remote mobile work system called *Rosie* provides a telerobotic, mobile platform from which other robotic tools can be deployed for a variety of demolition and decon-tamination tasks. At the Chicago Pile 5 Reactor Project, Rosie broke up high-density concrete in an hour. In comparison, it would take several days for workers using jackhammers to complete this task. (See bottom photo.)

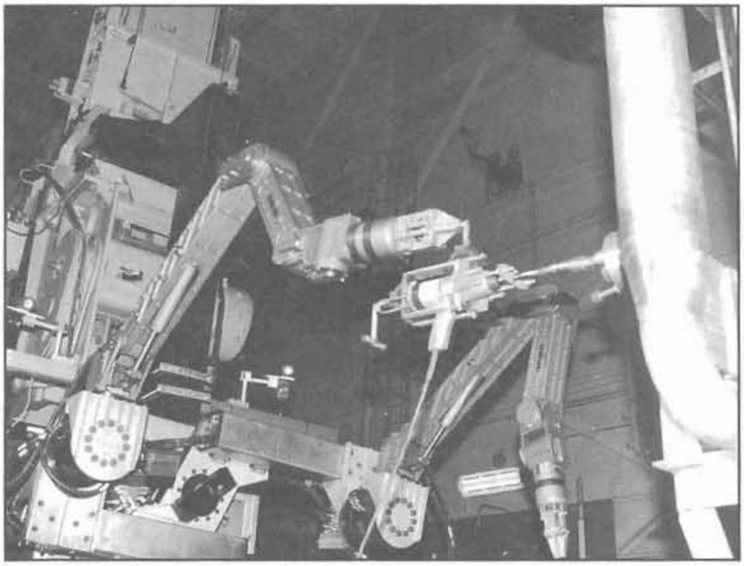
Dual-Arm Work Platform (DAWP). The DAWP has two hydraulic manipulator arms that are mounted on a hydraulic positioning base. Equipped with a circular saw, it cut up large sections of the Chicago Pile 5 Reactor, removed contaminated lead



The Mobile Automated Characterization System can detect alpha and beta contamination on floors.



"Rosie" performs manual dismantlement, waste handling, and packaging using standard handheld tools.



The Dual-Arm Work Platform can be mounted on deployment devices such as Rosie-C, overhead cranes, telescoping booms, and remote vehicles.

panels, and dismantled graphite bricks. This equipment can accept a variety of tooling configurations, and its remote operation removes workers from high-radiation environments. (See photo above.)

Lessons Learned

The United States' unleashing of the fundamental power of the universe with the atomic bomb is one of the greatest accomplishments of our time. Although it was an enormous challenge to build the nuclear weapons complex, to safely and effectively decontaminate and dismantle these facilities may be an even greater challenge. This endeavor will require an enormous level of commitment and cooperation from governmental agencies, federal and state regulators, industry, academia, and the public. We must safely accomplish the enormous undertaking of cleaning up the aftermath of the Cold War. To do so, we must use ingenuity to develop and modify robots that can work effectively on delicate and heavy decontamination and dismantling tasks in highly radioactive environments.

For more information, contact Mark D. Kessinger, the Army's National Program Manager, at (304) 529-5083 or at *markk@mail.orh.usace.army.mil.*

Mr. Kessinger is the Corps of Engineers National Program Manager for support to the Department of Energy's Federal Energy Technology Center. Previous assignments include Corps liaison to the Department of Energy and engineering staff specialist with the Great Lakes and Ohio River Division in Cincinnati. Mr. Kessinger holds a master's degree in engineering management from West Virginia University.

Reference:

Closing the Circle on the Splitting of the Atom, U.S. Department of Energy, Office of Environmental Management, Second Printing, January 1996.

All photos courtesy Department of Energy.

(Continued from page 10)

task organizations are mission-specific, knowledge beyond generic capabilities is required. This knowledge is critical when forecasting the support available from each organization.

- **Encourage cooperation at the lowest level.** In peace support operations, people on the ground are closest to the problem, usually have the greatest insight, and often make the greatest contributions. They should not be hindered by unnecessary bureaucracy and should have the flexibility to create ad hoc relationships.
- **Carefully assess resources.** Specify "who will provide what" in an operation. Military engineers often have more manpower and equipment resources than discretionary funding, while CA teams have access to funding sources. To avoid half-finished projects that may be viewed negatively, assess all resources when developing a plan. Close coordination with logistics and transportation personnel is very important.
- **Link with the information campaign.** The success of both engineer and CA activities is magnified when woven into an information campaign. During peace support operations, the perception of the force—by the host nation, the international community, and at home—as a contributor to peace and stability is advanced by publicizing CA and engineer contributions.

A Final Word

As our Army becomes engaged in more and more peace support operations, we will continue to face unforeseen challenges and seek to solve complex issues that go beyond the realm of traditional military solutions. Engineer and civil affairs leaders must recognize that they have mutually supporting capabilities and look to forge a cooperative spirit. Through cooperation, these two organizations can magnify their separate contributions toward achieving the force's objectives.

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Major Buckley is a reserve civil affairs officer and president of Bay Colony Engineering, based in Foxboro, Massachusetts. He recently served as a leading member of the Joint Civil Commission in Sarajevo, Bosnia-Herzegovina. MAJ Buckley is a graduate of the U.S. Military Academy.

Gaining Distance Education

By Captain Tim Wallace

Earning college credits is a challenge for most soldiers. Finishing a degree or just earning promotion points is a difficult goal for several reasons. Many soldiers do not have a flexible schedule that allows them to attend classes for a 16-week semester. Schools that are located near military posts and that cater to soldiers often have a limited number of academic programs. Constantly moving around the world makes it hard to earn enough credits from one institution to graduate, and transferring credits may be impossible because of different academic standards among colleges and universities.

Soldiers can overcome these challenges by enrolling in distance learning programs that let students earn credits without attending on-campus classes. Before taking my first multimedia-based distance education class from the University of Missouri-Rolla, I was skeptical of nontraditional education. I have since become a proponent of this new alternative to classroom learning.

Changes

Distance education has come a long way in the past few years. There are still advertisements on TV or the backs of magazines for correspondence schools that are not accredited or approved for tuition assistance and offer classes that lead only to a diploma or certificate. Now, however, many state universities and private colleges offer fully accredited associate's, bachelor's, and master's degrees with no on-campus attendance required. As the economy changes and education becomes more expensive, colleges and universities are changing their methods and policies to accommodate busy people who work and continue their education simultaneously. Even some of the most exclusive schools, such as Stanford University, Massachusetts Institute of Technology, and Duke University, recognize the importance of serving nontraditional students. Peterson's Education and Career Center lists hundreds of schools on its web site that offer associate degrees in 65 areas of study, bachelor's degrees in 73 areas, master's degrees in 74 areas, and doctorate degrees in three areas. There is a degree program to fit almost everyone's interests.

In addition to individual schools, several consortiums are forming around the country. The National University Degree Consortium consists of 13 accredited state universities that offer more than 1,000 courses, 16 bachelor's degrees, and 31 graduate degrees. In the summer of 1998, Western Governors University, a consortium of universities from 15 western states and Guam, opened its virtual doors to offer numerous degree programs to students "by focusing only on the skills and knowledge areas that they need." They call this "competency-based education." National Technological University, which offers advanced degrees to engineers, scientists, and technical managers, currently has 14 Master of Science degree programs taught by faculty from 48 leading engineering schools. National Technological University demonstrates its commitment to the busy working professional by offering its courses continuously rather than adhering to a semester or quarter calendar. For this convenience, students can expect to pay more than $600 per credit hour. This is expensive; however, the university is approved by the Veterans Administration for tuition assistance.

Communication Technologies

Off-campus students use a variety of communication technologies for course delivery, such as videotapes, videoconferencing, the Internet, teleconferencing, and correspondence. School administrators understand the benefits of student-teacher interaction and use a variety of means to maximize the time students have to interact with instructors and classmates.

Videotape

The most common delivery system for distance learning is videotape. Classes are videotaped during a normal on-campus class, and copies of the tape are sent to off-campus students. Many schools guarantee shipment the day after the class to ensure that distant students have adequate time to complete assignments. For most classes, completion requirements are identical to those for on-campus students.

Videoconference

Many schools set up remote sites so they can use videoconferencing for classes. The University of Kentucky and Old Dominion University in Norfolk, Virginia, offer classes by satellite to many off-campus locations throughout the country. These are the same classes that are taught at the main campuses, and students have the opportunity to ask questions and participate in class discussions just as on-campus students do. Off-campus locations are at community colleges, libraries, hospitals, military bases, and corporate sites. The University of Kentucky has 13 off-campus sites throughout the state and offers programs of study in seven undergraduate and graduate disciplines. Old Dominion University has 40 sites across the country and offers 11 degree programs.

Internet

The Internet is the fastest growing media used by schools to deliver classes. The Career and Education Editor of Peterson's says that 92 percent of colleges with distance education programs say they plan to use the Internet to a greater extent in their programs. City University in Bellevue, Washington, offers several electronic distance learning programs on the Internet using the university's online instructional center. City University currently offers more than 50 programs ranging from associate's to master's degrees in a wide variety of fields.

Nova Southeastern University in Fort Lauderdale, Florida, uses several communication technologies to deliver classes to their distance education students, but the Internet is the core to most of their classes and degree programs. In addition to communication among students in chat rooms and real-time electronic classroom online forums, students in advanced degree programs attend quarterly weekend conferences at the Fort Lauderdale campus. Nova Southeastern University's distance education offerings are almost exclusively for master's and doctorate degrees, and they have numerous programs in different areas of computer and information sciences.

Schools use varying levels of advertising to generate interest in their distance learning programs. Some advertise extensively, have a dedicated staff to assist students, and have detailed web sites packed with information. For other schools, distance education is not a priority, and the information that is available may be difficult to find.

The University of Phoenix has an informative web site geared toward assisting military members. Currently 40 percent of full-time students in its Center for Distance Education are military personnel. The university offers six undergraduate and five graduate degrees. Tuition is $365 per credit for undergraduate classes and $460 for graduate classes. Other schools with easy-to-follow web sites, such as Brigham Young University and the University of North Dakota, offer degrees but require students to attend one- to three-week seminars or labs during the summer. Brigham Young University offers a broad-based, flexible Bachelor of Independent Studies degree and charges $79 per credit hour. Walden University of Boca Raton, Florida, offers flexible master's and doctorate degree programs in management, education, and psychology geared toward working professionals and allows students to complete programs at their own pace.

Engineering Degrees

The University of North Dakota is the only school I have found that offers undergraduate engineering degrees that are fully accredited by the Accreditation Board of Engineering and Technology.

Of particular interest to Army engineer officers are programs that offer advanced engineering degrees. The University of Alabama's College of Continuing Studies offers graduate degrees in seven engineering disciplines, such as aerospace engineering and environmental engineering. During the spring term of 1999, the university will offer 41 graduate engineering courses. Another university with extensive graduate engineering programs is the University of Idaho, which offers 10 Master of Science and Master of Engineering degrees and more than 80 courses each semester. Both the University of Alabama and the University of Idaho offer thesis and nonthesis options to their graduate degrees and require no on-campus classes.

Auburn University offers master's degrees in eight engineering fields but requires students to pass on-campus oral examinations at the completion of their studies. Auburn also offers a program that culminates in a Master of Business Administration degree.

Getting Started

With all these opportunities available, it may be difficult to decide where and how to get more information. I started with commercial search engines like Yahoo and Alta Vista on the Internet. They offer so much information that its difficult to search through it. A more help-

Resources

University	Web Site
Stanford University	*http://www-scpd.stanford.edu/*
Massachusetts Institute of Technology	*http://web.mit.edu/sdm/www*
Duke University	*http://www.fuqua.duke.edu/programs/gemba*
Peterson's Education and Career Center	*http://www.petersons.com*
National University Degree Consortium	*http://sc.edu/deis/NUDC*
Western Governors University	*http://www.wgu.edu*
National Technological University	*http://www.ntu.edu*
University of Kentucky	*http://www.uky.edu/DistanceLearning/*
Old Dominion University	*http://www.odu.edu/~sbh/ttn*
University of Alabama's College of Continuing Studies	*http://bama.ua.edu/~disted/*
University of Idaho	*http://www.uidaho.edu/evo/*
Auburn University	*http://www.eng.auburn.edu/department/eop/*
International Association for Continuing Engineering Education	*http://www.dipoli.hut.fi/org/IACEE*
Nova Southeastern University	*http://www.nova.edu/cwis/disted*
Walden University	*http://wwwwaldenu.edu*

ful site is Peterson's Career and Education Center, which has information on available programs but does not have links to the various universities.

The International Association for Continuing Engineering Education is a nonprofit organization with the objective of "supporting and enhancing lifelong technical education and training and advanced engineering education worldwide." It has dozens of links to universities and related sites in several countries. The home pages of the consortiums mentioned above offer links to their supporting universities and can usually take you directly to the distance education department.

The most helpful and comprehensive site that I have found is at *http://www.disted.com*. It contains an enormous amount of information from other nontraditional students, professional educators, and authors. Almost any topic in the distance education sphere is discussed on this site.

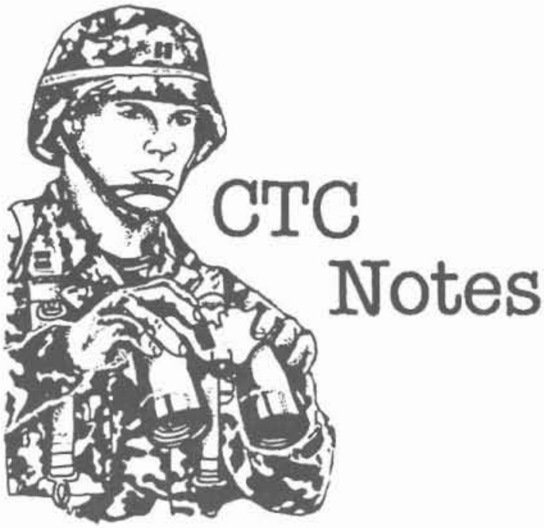
Several books offer suggestions and information. *Campus-Free College Degrees* by Marcie Kinser Thorson covers many programs in depth and only discusses legitimately accredited programs. An overview of John Bear's book *Bear's Guide to Earning College Degrees Nontraditionally* can be found at *http://www.degree.net*. The complete text of Steve Levicoff's book *Name It and Frame It* is at *http://training.loyola.edu/cdld/nifi.html*.

These Internet sites show the abundance of information available on distance learning. The difficult part is deciding which programs are most applicable to your situation. "The Consumers Guide to Choosing College Courses on the Internet" (*http://www.drake.edu/iaicu/consumer_guide.html*) can help make that decision. It also offers other links and postal addresses that may be useful.

Finding and enrolling in a distance education program may seem overwhelming. However, by using resources on the Worldwide Web and at military education centers, prospective students should find an option that fits their needs. Students may also find that distance education is not merely an acceptable alternative for traditional schooling, but the best means available anywhere to meet the needs of today's growing population of nontraditional students.

For more information, e-mail CPT Wallace at wallaceg@wood.army.mil.

Captain Wallace is a small-group instructor for the Engineer Officer Advanced Course, U.S. Army Engineer School. Previous assignments include Commander, B Company, 23rd Engineer Battalion, 1st Armored Division; plans officer, JTF-B DCSENG, Honduras; and platoon leader, executive officer, and battalion staff in the 27th Engineer Battalion, Fort Bragg, North Carolina.



Battle Command Training Program (BCTP)

Synchronizing the Plan: The Orders Crosswalk

By Lieutenant Colonel Ron Light

According to FM 101-5, *Staff Organization and Operations*, the chief of staff/executive officer (XO) bears the responsibility to ensure that war-fighting plans are integrated and synchronized. The XO also ensures that the staff "integrates and coordinates its activities *internally, vertically* (with higher headquarters and subordinate units), and *horizontally* (with adjacent units)."

The XO can significantly affect the synchronization of staff plans and orders during the conduct of the military decision-making process (MDMP). The *orders crosswalk* is a tool to do this. The methodology is simple, and the results usually are startling. Units that conduct their own orders crosswalks can dramatically improve battlefield synchronization of the engineer effort. In effect, the orders crosswalk is a tool to incorporate discipline in the MDMP.

While preparing an orders crosswalk is relatively straightforward, it requires time and an experienced eye. Whoever prepares the crosswalk must have both the experience to understand the "big picture" and the tenacity to ferret out the details of the scheme of engineer operations. Doctrine suggests that the person for this task is the XO. Others can be trained to perform the orders crosswalk, however, and it may be preferable if someone not involved with the orders preparation conducts the crosswalk. The important point is that the crosswalk is performed. Moreover, the earlier the orders crosswalk is performed the better. It is best to completes the crosswalk before the order is published.

During the orders crosswalk, look for two things. First, does your base order mirror the direction, guidance, restrictions, constraints, and tasks presented in your higher headquarters' base order, especially the commander's intent? Second, is your operations order synchronized throughout all battlefield oper-ating systems (BOS) areas and annexes? As you review the orders, list any disconnects you find.

The first step in conducting the crosswalk is to thoroughly read the higher headquarters' order. Starting with the base order, highlight or tab anything to do with engineers. Look for both implied and specified tasks. You must clearly understand what your higher headquarters will do and what it wants your unit to do. Next read your unit's base order. It should nest with the higher headquarters' intent and scheme of maneuver. After reviewing the two base orders for nesting and consistency, go to the annexes in your order.

The XO frequently directs a unit to "reduce the size of its order," but most orders remain fairly hefty. While a review of all annexes is not required, a thorough crosswalk requires that at least the following annexes in both the higher headquarters' order and your order be reviewed:

1. Start the review with Annex A, *Task Organization*. Note all engineer units and prepare a "mass balance" worksheet of them. This is merely an accounting of all engineer units. For example, if the 123 Engineer Battalion is listed in the task organization as "123 En BN (-)," locate the detached units. After you have located all allocated assets, move on. During this and all succeeding steps, correct disconnects as you go. If you wait to perform the orders crosswalk after the order is published, you will have to issue a fragmentary order to correct disconnects.

2. Annex B, *Intelligence*. Focus on terrain analysis and the effects of terrain. What your intelligence officer and the higher headquarters' intelligence officer say about terrain must complement each other, if not match. Next check to see what the enemy capabilities are, especially with respect to engineers. Again, the analyses should be similar. You can improve the likelihood of this if your S2 volunteers to work with the G2 staff in developing the division intelligence annex and borrows liberally from their work. As before, seek to resolve all disconnects. Note what you read in this annex and in the others that follow and compare that information with information in Annex F, *Engineer*, later.

3. Annex D, *Fire Support*. By now you should begin to see how well the staffs have synchronized the orders, both within your unit and with your higher headquarters. Key things to focus on are the allocation of ADAM/RAAM and, more importantly, authority for these and all other scatterable mine systems and special-purpose munitions. You should see some annotations regarding the use of GATOR mines and smoke.

4. Annex E, *Rules of Engagement*. This annex frequently is not synchronized with the subordinate unit's order. Key disconnects often include the authority and approval process for scatterable mines, the use of antipersonnel mines, the destruction of key roads and bridges, and restrictions on the use of obstacles. Crosswalk this annex with Appendix 4 (*Legal*) of Annex I, *Service Support*.

5. Annex F, *Engineer*. If you have reviewed the annexes listed above, you know how well the staff has synchronized engineer operations by the time you read Annex F. Key areas include the effects of terrain and weather, enemy engineer capabilities, scatterable mine authority and use (including all scatterable mines!), priority of support and effort (this should match with the base order), the controlled supply rate and required supply rate (CSR/RSR) of key munitions, the designation of obstacle zones and effects, and the use of host nation assets. The engineer overlay (Appendix 1) should have the same graphics as the operations overlay. Also, environmental considerations in Appendix 2 should be synchronized with Appendix 4 (*Legal*) of Annex I, *Service Support*.

6. Annex G, *Air Defense*. Review this annex for appropriate air defense support, especially during large-scale breaching or bridging operations. If air defense artillery (ADA) units are task organized to engineers in Annex A, make sure this information is in Annex G.

7. Annex I, *Service Support*. Apart from Annex E, this annex usually has the most synchronization problems. Cross check the CSR/RSR for critical munitions (for example, scatterable mines, MICLIC rockets, etc.). Note which main supply routes (MSRs) are "priority" MSRs. Engineers maintain them, but other units (ADA, military police, and combat service support) both support and complicate this maintenance effort, so a well-synchronized plan is essential. If Class IV/V (obstacle) supply points are established in Annex F, *Engineer*, make sure the locations match. Next, consider the engineer mission and assets needed to accomplish it. Is there a plan for Class IV/V (obstacle) distribution? Do engineers have any priority for maintenance? These and other questions will occur to you if the overall mission is clearly understood. Look for answers! For example, during a river-crossing operation, you would expect to see some priority of maintenance for bridge erection boats and assault float bridges. If you don't see any priority for that maintenance, now is the time to fix it—not after you cross the line of departure. Before leaving Annex I, crosswalk it with Annex N, *Rear Operations*, and look for disconnects regarding the priorities for MSRs.

8. Annex J, *Nuclear, Biological, and Chemical (NBC)*. A quick review of this annex should indicate if the engineer and chemical staffs are talking. Look for integrated smoke plans (especially during breaching operations and river crossings), locations of decontamination sites (where engineers typically are tasked to dig sumps), and so on. We must take the lead in synchronizing our plans with the chemical staff as we establish the maneuver support concept.

Depending on the operation, you will check the remaining annexes by exception. In all cases, review them for tasks specified or implied for engineers. Although all tasks for units should be listed in the base order, you may be surprised at how many appear only in the annexes. Work with the appropriate staffs to list all tasks in one place—this is an important step to synchronize operations.

After completing the above review, analyze your notes. You probably found some minor disconnects, and you may have found some that could lead to fratricide, wasted effort, or a failed mission. Resolve all disconnects.

This completes the orders crosswalk process. It always takes effort...but it is always worth the effort.

Lieutenant Colonel Light is an observer/controller for the Battle Command Training Program at Fort Leavenworth, Kansas. He previously served as the S3 and XO of the 168th Engineer Battalion, 3rd Brigade, 2d Infantry Division, Fort Lewis, Washington.

National Training Center (NTC)

48-Hour Volcano Mines on the NTC Battlefield

By Lieutenant Colonel David Hansen and Major Fred Erst

Current Army doctrine does not provide the Brigade Combat Team (BCT) commander authority to execute scatterable munitions. This authority is retained at corps and division levels but may be delegated. Both levels usually delegate responsibility for conventional minefield emplacement to the BCT. When this aspect is combined with the world's current attitude against the use of conventional "dumb" mines (those without self-destructing capability), it is clear that the expanding use of special purpose "smart" munitions and scatterable mines with self-destructing or command-detonating capability will change the way engineers shape the battlefield.

Units training at NTC previously used 4-hour scatterable mines such as Volcano, MOPMs, and ADAM/RAAM with approval authority from the division and corps. The focus of that training was to develop tactics, techniques and procedures (TTPs) for employing 4-hour scatterable mines as situational obstacles. In 1998, NTC began training brigades to employ 48-hour Volcano minefields. Since then, brigades have begun to improve the integration of this lethal weapons system into the BCT military decision-making process (MDMP). Now it is essential that engineers drive the development of TTPs to expand the use of 48-hour Volcano and other scatterable assets at the brigade level.

Using 48-Hour Scatterable Mines to Support the Brigade Fight

Recent rotations have shown that brigades have difficulty employing 48-hour Volcano minefields as tactical obstacles on the NTC battlefield. Unfortunately, this problem is compounded by decreased productivity in the conventional obstacle effort. While Force XXI is driving changes in Army doctrine and organizations, war fighters must transition their countermobility efforts from reliance on conventional minefields to significant use of special purpose munitions and scatterable mines to shape the brigade fight. Engineers are expected to be dynamic and lethal. Their ability to plan, prepare, and execute 48-hour scatterable mines and special purpose munitions is essential in supporting the BCT. To effectively plan and execute those mines and munitions, engineer and maneuver units must train together to optimize their capabilities and minimize their limitations.

To better develop the use of 48-hour scatterable mines and special purpose munitions, engineers need to focus their efforts in the following areas:

- Command and control (C2) and emplacement authority.
- 48-hour Volcano minefield procedures.
- Scatterable minefield integration in brigade planning, preparation, and execution.

C2 and Emplacement Authority

FM 20-32, *Mine/Countermine Operations,* states that the corps commander has emplacement authority for all scatterable minefields within his area of operations. Current doctrine also states that for ground- and artillery-delivered scatterable mines with a self-destruct time of 48 hours or less, the corps commander may "...delegate emplacement authority to division level, who may further delegate to brigade level, who may then further delegate to task force level." There is a perception within the force, however, that the corps commander will retain rather than delegate emplacement authority for scatterable mines with a self-destruct time greater than 4 hours. As a result, while divisions may use 48-hour scatterable minefields during command post exercises and computer simulations, most brigades typically execute only 4-hour scatterable minefields during field training exercises at home station.

As engineers become more reliant on scatterable mine systems to achieve intended obstacle effects on the Force XXI battlefield, scatterable mine C2 and emplacement authority must change. While theater and corps commanders should maintain overall obstacle emplacement authority, division and brigade commanders need the flexibility and lethality that 48-hour scatterable mines provide. A recommended solution is to provide 48-hour scatterable mine C2 and employment authority to the division commander and provide 4-hour scatterable mine employment authority to the brigade commander, based on the theater and corps commanders' obstacle plans. These changes allow maneuver commanders to more rapidly use their scatterable mine capabilities and engineers to maximize their obstacle effort.

48-Hour Volcano Minefield Procedures

At NTC, the operations order (OPORD) for the 52nd Infantry Division (Mechanized) states that the division retains emplacement authority for all 4-hour scatterable mine systems and corps retains authority for all others. It also states that the BCT may request authorization to emplace 48-hour Volcano minefields by exception. The technique NTC uses to train brigades to synchronize the execution of 48-hour Volcano minefields with the corps and division fight is simple. In addition to obstacle-control graphics, the division OPORD also specifies a no-later-than (NLT) execution date-time-group (DTG) for the maneuver brigade to emplace all 48-hour scatterable minefields. This method ensures that the brigade's 48-hour scatterable minefields do not interfere with future corps and division operations. It also drives obstacle siting and integration as an issue for BCT and task force commanders early in defensive preparations.

During force-on-force operations at NTC, brigades are authorized one Volcano load (160 canisters) per ground or air Volcano system per mission. During the live-fire defense, the allocation is doubled to two loads per Volcano system up to a maximum of eight loads. This allocation provides the brigade the opportunity to employ several air and ground Volcano loads in the 48-hour mode. However, the brigade must comply with the following approval procedures and doctrinal requirements before executing any 48-hour Volcano minefield:

- Submit a request and receive approval for planning all scatterable minefields through the G3, 52nd ID, to the assistant division engineer (ADE).
- Emplace 48-hour Volcano minefields *before* the NLT execution DTG.
- Complete a four-sided fratricide fence before executing any 48-hour Volcano minefield that is emplaced behind the forward line of own troops (FLOT), according to FM 20-32. This typically is either a single-coil concertina or two-strand cattle fence. Units have the option to fence the obstacle group or fence each 48-hour Volcano minefield separately.
- After receiving approval to plan and complete the fratricide fence, the brigade may execute 48-hour Volcano minefields subject to final division notification and the scatterable mine warning (SCATMINWARN) procedure.

Scatterable Minefield Integration in Brigade Planning, Preparation, and Execution

During defensive operations, brigade personnel have difficulty synchronizing the execution of 48-hour Volcano minefields. This is because they do not adequately understand the amount of manpower, materiel, and time needed to site and build the fratricide fence and emplace the 48-hour Volcano minefields *before* the NLT execution DTG. Inadequate detailed reverse planning, ineffective time management, and the late arrival of Class IV/V materials needed for fratricide fence construction usually cause most brigades to execute only a fraction of the 48-hour Volcano minefields possible. This shortfall often is compounded by the brigade's struggle to conduct task force Class IV/V point operations, Class IV/V haul, and manpower management, which typically consume many hours of obstacle production time. Late in the rotation, during the live-fire defense in sector, the BCT finally will commit enough additional manpower to emplace fratricide fences for the 48-hour Volcano minefields. Ironically, on the few occasions when engineer companies receive manpower augmentation from the task forces (usually infantry or tank loaders), the augmentees do not come with the company/team small-unit leadership needed for effective supervision. Then the engineer company leadership has the additional responsibility to manage the attached manpower as well as provide life support, security, and transportation. This added responsibility often hampers 48-hour Volcano execution before the NLT DTG, because the required amount of fratricide fencing is not constructed.

Planning and Preparation. Improvements to the MDMP must begin at the brigade mission analysis briefing. The assistant brigade engineer (ABE) should identify potential targeted areas of interest as part of his terrain analysis and discuss obstacle requirements versus shortfalls as part of the friendly capabilities portion of his engineer battlefield assessment brief. At the mission analysis brief, the ABE should provide the brigade commander a written "Commander's Card" that describes friendly engineer capabilities and requirements. During the commander's guidance, the ABE must ask the brigade commander to discuss his intent for employing scatterable mines and special purpose munitions. The brigade commander should discuss intended obstacle effects on enemy maneuver, the allocation of scatterable mines/special purpose munitions to support both the brigade's deep fight and the close fight, and the priority of emplacement of scatterable mines for 4-hour and 48-hour duration.

To improve integration with the BCT scheme of maneuver, the ABE must ensure that planning for scatterable mines is an integral part of developing the brigade's course of action. During the war-gaming step of the MDMP, targets for scatterable mines are integrated with direct and indirect fires throughout the depth and width of the battlefield for each enemy and friendly course of action. Engineer staffs can use a sketch to assist the commander in effectively visualizing the scheme of obstacles and the location of observers, triggers, named areas of interest, targeted areas of interest, emplacement assets, and units covering the obstacle with direct or indirect fires. The ABE must develop and brief a detailed brigade countermobility time line that includes the brigade commander's critical information requests (CCIR), which serve to synchronize 48-hour Volcano execution.

Finally, engineers must improve task force ownership of brigade-directed 48-hour scatterable minefields by stating specified tasks for subordinate maneuver units in the main body of the brigade OPORD and in the Engineer Annex. Specified tasks include execution and overwatch responsibilities and manpower and Class IV/V requirements.

Execution. To improve scatterable mine execution, task forces may refine the brigade plan. They may submit requests for additional scatterable minefields through the brigade to the division. During engagement area development, obstacle integration for both conventional and scatterable minefields begins during obstacle siting. However, obstacle siting of 48-hour Volcano minefields by engineers, the maneuver company team, and the fire support officer *must* be the commander's priority due to their NLT execution times. The company team and engineer platoon must work together to position each scatterable minefield in the obstacle group using the direct fire plan and the initial obstacle group design. Based on the terrain, the company team commander and the engineer platoon leader should adjust obstacle locations to ensure that the obstacle group is covered by direct fires and the obstacle design is consistent with the task force commander's intent. The obstacle siting procedure described in FM 90-7, *Combined Arms Obstacle Integration*, serves as an effective guide.

Similarly, "ownership" of an obstacle group by the company team begins with obstacle siting and continues through obstacle turnover. While an obstacle group is emplaced by the engineer platoon, the actual "owner" is the company team overwatching the obstacles. The company team should provide security and manpower for fratricide fence construction and reload or mine-dump operations. This technique allows the engineer platoon to focus on its primary mission of emplacing minefields. It also allows the company team to account for, equip, transport, and supervise its personnel. It enables the company team to better prepare for obstacle turnover and lane closure during the battle and to recover fratricide fencing after the fight, when the scatterable mines self-destruct. Ownership ensures that the company team remains involved in obstacle construction and results in better integration of the direct and indirect fires needed to achieve the intended obstacle effect on enemy maneuver.

Specific actions for the successful integration of 48-hour Volcano minefields follow.

Commander provides guidance

- Allocate and prioritize resources for conventional and scatterable mines and special purpose munitions.
- Shape the brigade fight and the task-force fight.
- Determine employment requirements for 4-hour and 48-hour scatterable mines.

- Specify 48-hour scatterable minefields as brigade-directed obstacles or allocate them to an obstacle belt to achieve a specific effect.
- Discuss the effects that scatterable mines have on the brigade's repositioning and counterattack plans.

Brigade staff allocates and prioritizes resources

- Array maneuver companies and tenative obstacle groups against enemy battalion-sized mobility corridors.
- Establish priorities for countermobility efforts.
- Allocate resources for—

- Firepower (direct and indirect).

-Manpower (engineers and dismounts for fratricide fence).

-Materiel (Class IV/V, scatterable mines/special purpose munitions, Volcano).

- Time.

Brigade staff establishes ownership of obstacles in the OPORD

- Establish ownership of obstacles in the subunit instructions
- of the OPORD. Specify the brigade or task force responsible for obstacle emplacement and overwatch for obstacle belts, brigade-directed obstacles, and situational obstacles.
- Direct task forces to submit their obstacle plans so the brigade can prepare and disseminate a consolidated obstacle overlay.
- Direct task force manpower support for fratricide fence construction.
- Establish task force responsibilities for obstacle turnover, security, and lane closure.
- Specify task force responsibilities for obstacle recovery and battlefield restoration.

Brigade staff establishes and tracks CCIRs

- Submit the task force obstacle plan to the brigade NLT DTG. Include the obstacle group overlay, the obstacle execution matrix, and countermobility/survivability time lines.
- Track the status of Class IV/V materiel, the palletized load system (PLS) racks, material handling of equipment, haul assets, and manpower support.
- Establish 48-hour Volcano NLT emplacement times for—

-Approval for planning, execution, and SCATMINWARNs.

-Equipment and material on hand (Volcano, Volcano loads, and fratricide fencing).

-Obstacle siting completion.

-Fratricide fence completion.

-Volcano minefield execution.

Future Requirements. The current Volcano system provides the engineer force only 4-hour, 48-hour, and 15-day self-destruct times. These self-destruct times often limit the engineers' ability to achieve the maneuver commander's intent. On the fluid battlefield of the 21st century, the need for intermediate self-destruct times would significantly enhance the effectiveness of scatterable mines in support of the BCT fight. Current battle rhythm and our improved ability to solidify operational plans at the brigade and task force levels support the creation of 12- and 24-hour self-destruct options. Scatterable mines and special-purpose munitions should be developed with 12-and 24-hour durations and an immediate self-destruct capability to provide that flexibility to the brigade. Engineer trainers at NTC also recommend that authorization for the employment of 12-hour scatterable mines and special purpose munitions reside with the BCT commander.

Conclusion

To successfully shape the Force XXI battlefield, engineers must drive the transition from conventional minefields to the employment of 48-hour scatterable minefields and special purpose munitions at the brigade level. When integrated with direct and indirect fires, scatterable mines and special purpose munitions provide the BCT the lethality and time needed to acquire and destroy enemy targets. As Force XXI engineer battalions are reduced in size, these mines and munitions provide the rapid emplacement capability needed to accelerate obstacle production. The self-destruction capabilities of scatterable mines and special purpose munitions reduce the long-term impacts of these minefields.

At NTC, the Sidewinder Team remains committed to maintaining conventional minefield skills and developing tactics, techniques, and procedures for planning, preparing, and executing scatterable mines. Through these efforts we will improve the brigade combat team's ability to conduct successful combat operations.

Lieutenant Colonel Hansen is the senior engineer trainer at the National Training Center, Fort Irwin, California. He previously served as commander of the 20th Engineer Battalion, 1st Cavalry Division, Fort Hood, Texas.

Major Erst is the assistant brigade engineer trainer at the National Training Center, Fort Irwin, California. He previously served as a company commander of the 10th Engineer Battalion, 3rd Infantry Division, Fort Stewart, Georgia.

ENGINEER UPDATE

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

ENFORCE XXI-99. The theme for this year's conference is "Joint Engineers: America's Total Engineer Force for the Next Millennium." Scheduled for the week of 26 April through 1 May, the conference will include numerous breakout sessions, tactical demonstrations, and dynamic displays. Registration information will be mailed in March. POC is CPT Elita Perusek, -7015.

Directorate of Combat Developments (DCD)

Tables of Organization and Equipment (TOE) Cyclic Review. The following TOE will undergo cyclic review for the Consolidation TOE Update (CTU). Request appropriate units review their TOE and submit comments regarding their concerns by the dates shown. Comments not in line with the mission of the review (minimum mission-essential wartime requirements) will not be considered.

TOE No.	October 1999 CTU Consolidated Unit
05413L000	Engineer Company, Construction Support
05423L000	Engineer Company, Combat Support Equipment
05424L000	Engineer Company, Dump Truck
05434L000	Engineer Company, Pipeline Construction
05473L000	Multirole Bridge Company

Comments due by 15 July 1999.

	April 2000 CTU
05500LA00	Headquarters and Headquarters Detachment, Engineer Battalion
05520LC00	Quarry Team
05520LD00	Headquarters Well-Drilling Team
05520LE00	Well-Drilling Team
05530LA00	Engineer Heavy Diving Team
05530LC00	Engineer Light Diving Team
05530LF00	Real Estate Team
05530LH00	Utilities (4000) Team
05540LA00	Topographic Planning/Control Team
05540LF00	Terrain Analysis Team (Heavy)
05540LI00	Command and Control Team (DS) (Heavy)
05540LN00	Terrain Analysis Team (Light Infantry Division)

Comments due by 15 December 1999.

To obtain a copy of a TOE undergoing review, send an e-mail request to Tom Knotts (knottst@wood.army.mil) or Garry Hamlet (hamletg@wood.army.mil). POC is Tom Knotts, -6139.

M917A1 Dump Truck. Fielding for the M917A1 dump truck began in April 1998 with Reserve Component units leading the way. The M917A1 is a nondevelopmental item for U.S. Army, Army Reserve, and National Guard units. The commercially designed 6x6 truck has a conventional cab, diesel engine, automatic transmission, two-speed transfer assembly, and antilock brakes. With a curb weight of 29,454 pounds (lb) and a gross vehicle weight rating (GVWR) of 68,000 lb, the truck operates on both JP-8 and standard Army diesel fuel. The M917A1 shares the same basic chassis as the type-classified M916A1 truck tractor. However, component upgrades to the transmission, transfer, and suspension systems accommodate production changes and an engine change to comply with current U.S. Environmental Protection Agency regulations. Added subsystems include a cab air-conditioner and central tire-inflation system. The heavy-duty steel body holds 14 cubic yards of material and has an 18.5-ton rating. Its double-action hoist system can be powered up and down from inside the cab. Other key features are—

M917A1 Dump Truck

- Air-transportable on C-17 and C-5 aircraft.
- 20-inch fording capability.
- 300-mile range at 40 mph at GVWR.
- Air-actuated tailgate.
- Material control system (on selected vehicles).
- Chemical-agent-resistant coating painted in a camouflage pattern.

POC is CW4 Bobby Russell, - 4074.

Engineer Personnel Proponency Office (EPPO)

Accession Board for MOS 215D, Terrain Analysis Technician. Eligible applicants are needed for an accession board scheduled to convene in July 1999 to access two vacancies. To date, no applicants meet the minimum requirements for this board. EPPO's home page was updated in December 1998 to reflect the need for eligible non-commissioned officers (NCOs) (grade E-5 or above) to apply for this MOS. Minimum requirements follow:

- General Technical (GT) score of 110 or higher.
- Sergeant (P) or higher.
- 81T MOS (previously 81Q).
- 4 years of experience in 81Q MOS.
- 1 year of experience at division level.
- 1 year of supervisory experience.
- Successfully completed the Basic Terrain/Topographic Analysis Course.
- Successfully completed the Advanced Terrain/Topographic Analysis Course.
- Current background investigation (within 5 years) required if appointed.

The Recruiting Command at Fort Knox has sent a letter to eligible 81T NCOs encouraging them to consider a career as a Terrain Analysis Technician. POC is CW4 Fred Tressler, -4088.

Lead the Way

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

One Corps, One Regiment, One Team

Over the last year and one-half, I have had the pleasure and the honor of serving as your proponent command sergeant major (CSM). During this time, CSM Ed Lugo, U.S. Army Corps of Engineers, and I have built a solid team with our organizations. CSM Lugo has been a valuable advisor and supporter, and together we have initiated many new programs and ideas. We have traveled together many times to visit units and meet with soldiers and noncommissioned officers (NCOs). We have demonstrated to our regiment that we are one team and have worked hard to improve the Engineer Regiment's relationship with Active and Reserve Component units and soldiers. CSM Lugo represents us well as an engineer soldier and Major Army Command (MACOM) command sergeant major. He is dedicated to making our regiment more effective and to improving the quality of life of our soldiers, civilians, and families. I appreciate our teamwork and look forward to a great year as we resolve the many challenges before us.

ENFORCE XXI - 99

The 1999 ENFORCE Conference is just around the corner—it is scheduled for 25 April-1 May. All of us at the U.S. Army Engineer Center and Fort Leonard Wood are working hard to make it the best ENFORCE Conference ever. The soldiers of the 1st Engineer Brigade are busy practicing and rehearsing their tattoo, which will be superb. Command sergeants major who come to the conference will be housed in the new Maneuver Support Center Noncommissioned Officers Academy billets. These billets are state-of-the art and very impressive. Packets for the conference will be mailed in March. For more information and the proposed CSM conference itinerary, visit the ECCSM's home page (http://www.wood.army.mil). Send us your key issues now, and we will present responses at the conference. Your feedback can help us improve the force structure, equipment, doctrine, and training that we provide for engineer soldiers.

Recruitment

The Army and the Engineer Regiment need your help. The effort to recruit soldiers for our Army is currently experiencing some rough times. The economy is doing very well, the United States has close to full employment, recruiting standards are at an all-time high, and many citizens perceive that America currently has no enemies—the reasons go on and on. U.S. Army recruiters are doing all they can to enlist high-quality, fully qualified soldiers into the Active and Reserve Components. Last year's delayed entry program account is almost zeroed out, and citizens who want to enlist and ship to training immediately are not signing up. As a result, Army training seats are not being filled and Army units are feeling personnel shortages. These shortages will continue to grow if we do not help. It is our responsibility, because it is our Army and our units that will be hurt. Here are some things you can do:

- Encourage high-quality young Americans you know to consider military service in a component of the U.S. Army. The benefits and cash and educational bonuses offered to enlistees have never been higher.
- Visit your local Army Recruiting Office. Offer encouragement and tell the recruiters how valuable they are. Offer your support and your unit's support.
- Call or visit your local U. S. Army Recruiting Company or Battalion Headquarters and offer your support and your unit's support.
- Support the local high school's Junior Reserve Officer Training Corps (JROTC) program. Visit them and help all you can.
- Encourage your best NCOs to serve a tour as an Army recruiter. Recruiters work hard, but the work is very rewarding. The service recruiters provide to our Army cannot be overemphasized.

Thank you for helping with this very important issue. We are one team.

NCOES Standards

Recently we have seen an increase in the number of unqualified NCOs who arrive at the Sergeant George D. Libby NCO Academy for Noncommissioned Officer Education System (NCOES) courses and the Drill Sergeant School. Some are overweight, cannot pass the Army Physical Fitness Test, and have "temporary" profiles. Out of 380 soldiers who came in January to attend the Primary Leadership Development Course, Basic and Advanced NCO Courses, and Drill Sergeant School classes, we had to send 50 home. This action results in wasted funds, demoralized NCOs, and vacant school seats that could have been used by fully qualified soldiers. Properly prepare your NCOs for school and check their qualifications thoroughly. We appreciate your support for this critical issue.

Great News on the Wolverine

Production of several M1A2 chassis for the Wolverine is ongoing in Lima, Ohio. In addition, bridges for these Wolverines are enroute to the factory. This critical engineer combat system is a great success story. The Wolverine's success is due to the hard work of Engineer School staff, numerous Army staff organizations, industry, and field units. Thanks to you all for a job well done.

ARMY VALUES

Selfless Service

"What you have chosen to do for your country by devoting your life to the service of your country is the greatest contribution any man could make."

President John F. Kennedy - 1961

Operation Snowbound

During the winter of 1949, the upper Plains states were hit by a blizzard of historic proportions. Snow ranged in depth from 30 to 70 inches and, driven by high winds, drifted to depths of 20 to 30 feet. The hard-hit area encompassed more than 190,000 square miles. More than 1,000,000 people and 10,000,000 head of livestock were threatened. The Missouri Division of the Corps of Engineers led the Fifth Army's "Disaster Force Snowbound." In conjunction with state and federal agencies, other services, and the National Guard, the engineers sought to clear major transportation routes, rescue trapped motorists, bring emergency supplies to isolated homes, and deliver forage for starving livestock. Battling high winds and temperatures of 35 degrees below zero, equipment operators and other staff worked 15- and 24-hour shifts. More than 2,200 bulldozers were used to clear 115,048 miles of road. Property and countless lives were saved from destruction by the deadly, frigid assault by nature.

History Office, U.S. Army Engineer School

PIN: 077050-000