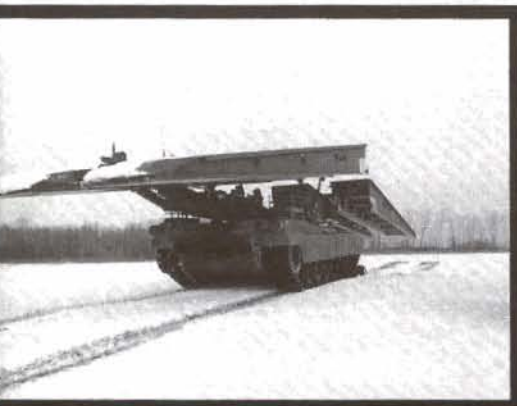
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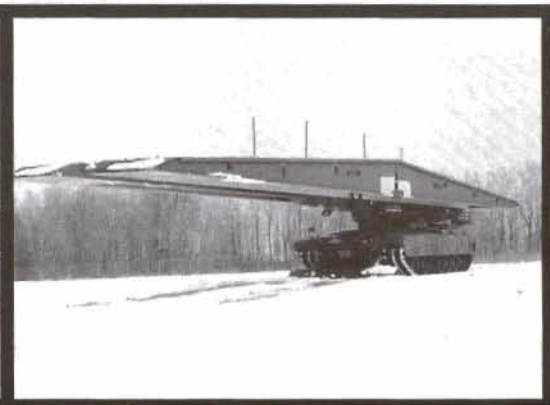
THE PROFESSIONAL BULLETIN FOR ARMY ENGINEERS

August 1996

THE WOLVERINE









25th Anniversary Issue

Headquarters, Deptartment of the Army

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CLEAR THE WAY

By Major General Clair F. Gill
Commandant, U.S. Army Engineer School

This year marks the 25th anniversary of *Engineer.* Since the first issue was published at Fort Belvoir in the spring of 1971, the format and content of our magazine have changed somewhat but the main purpose has remained the same—to provide an effective and responsive means of open communication between military and civilian engineers throughout the Corps of Engineers. In that first issue, Major General Robert R. Ploger, then Commandant of the U.S. Army Engineer School, clearly stated the reason for *Engineer's* existence:

"We of the Corps of Engineers have long been waiting for the advent of a forum to air our ideas on current engineering problems—military problems as well as those within the civilian domain.

We are optimistic that we now have such a vehicle, with the initial issue of The Engineer *making its debut on the engineering scene.*

Through this medium, we hope to trigger engineer thinking. We hope to stimulate controversial subjects; "cross-generate"—if you will—engineer viewpoints, with the objective in mind of progress in the profession. Certainly there are among us engineers who can rebut or reply to questions such as:

- *Should engineers be generalists or specialists...*
- *Can we attain trade union recognized proficiency for our MOS specialists...*
- *What is the best method of reducing response time...*

We would like to see such topics—and countless others—explored and we believe that this can be done effectively through future issues of The Engineer.

Controversy for controversy sake? No—that is not our objective. What we are after is progressive engineering thought, and we feel that we shall be successful in reaching that goal. We see The Engineer *as a reflection of contemporary thinking, engineering-wise. It will be edited with the aim of provoking the thought processes of the complete span of our personnel, from young enlisted men to career-oriented engineer officers. From them may well emanate new ideas, fresh approaches to existing problem areas—solutions perhaps, to many of the technical barricades facing us.*

With that in mind, an epigram occurs to us (and we are speaking in terms of engineering problems):

'Problems known by all are prevented from growing tall.'

In essence, this means that discussion invites solutions, and we want to stimulate discussion in The Engineer.

Remember, The Engineer *constitutes an open engineer forum. We hope that those who are in the business, will give us the business! Your help is solicited. Input is desired from all engineers who wish to serve the interest of our Army and nation.*

Let us hear from you!"

As we celebrate this silver anniversary, I reflect with pride that MG Ploger's far-sighted ideas have served us well for a quarter of a century and are still valid today. Our readership is expanding to engineers in other services as the shift toward joint training and more frequent joint operations continues, and we welcome those new readers. To them and to those in our traditional Army engineer family the *Engineer* staff and I extend a hearty "Thank you!" for supporting our magazine. *Engineer* will remain an effective forum for exchanging information within our engineering community as long as you submit your thoughts and ideas, so keep the manuscripts coming. This is your professional journal, and it will be as good as you want to make it.

On a more serious note, I will speak briefly about the impacts of the President's ban on antipersonnel land mines. President Clinton announced a unilateral U.S. policy on 16 May 1996 that immediately ends the use of non-self-destructing antipersonnel land mines by U.S. forces. The policy makes two narrow exceptions:

- We can continue to use the otherwise prohibited mines as "training aids" in countermine training and in humanitarian demining training.
- Because of the unique challenge of defending Korea, we can use and train with the otherwise prohibited mines in this theater.

While the policy is clear, the details and impacts are still being worked. Many issues, such as the "demilitarization" of prohibited mine inventories, are outside of Army engineer channels. Other issues, such as training the force in Korea and all other personnel and rewriting our mine-warfare doctrine, *do* involve Army engineers, and they are being discussed, coordinated, and resolved. Specific changes will be described in detail in future issues of *Engineer* and in other professional journals. Stay tuned for later developments!

Engineer

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Cover: The cornerstones of engineer modernization for the heavy force, the Wolverine heavy assault bridge and the Grizzly complex obstacle breacher, are featured on the front and back covers.

Photo credits: Wolverine photos courtesy of General Dynamics Land Systems Division. Grizzly photos courtesy of U.S. Army Test and Experiment Command.

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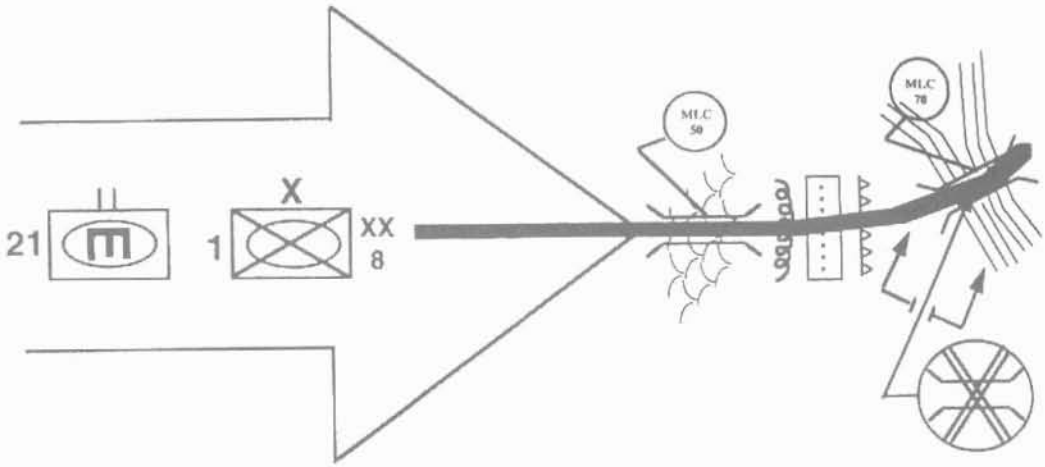
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The Grizzly and the Wolverine:

Alternatives to an Orchestrated Ballet of Farm Implements

By Major Harry Greene

The activities of engineers in the breach have been described as "an orchestrated ballet of farm implements."[1] The capability of engineers to provide responsive mobility support to the heavy division is a well-known area of concern. The Engineer Regiment's top two materiel development priorities, the Grizzly and the Wolverine, are designed to alleviate those concerns. The following scenario contrasts the "orchestrated ballet" of today to the future of the regiment with the Grizzly and the Wolverine.

Circa 2006

The 1st Brigade of the 8th Infantry Division (Mechanized), supported by the 21st Engineer Battalion, is conducting a deliberate attack. LTC Castle, commander of the 21st Engineers, begins to daydream as he watches the plan unfold on the digital display in his command vehicle. He is comparing today's plan with one he executed 10 years before as a captain.

Circa 1996

The brigade was conducting a deliberate attack followed by a pursuit. The initial penetration had gone well and the brigade was on the march. A Company, commanded by CPT Castle, was supporting one of the lead task forces. Two bridges were ahead, but one was only military load class (MLC) 50 and the other spanned a 20-meter gap. Bypasses of both bridges were not available. The plan called for an armored vehicle-launched bridge (AVLB) to replace the MLC 50 bridge and a medium-girder bridge (MGB) to replace the 20-meter bridge if it was damaged.

The AVLB. *As usual, the enemy didn't cooperate. He quickly disengaged and fell back to the far side of the first gap. The assault and obstacle platoon leader led the AVLB launcher forward. The platoon leader and the AVLB crew tried but could not keep up with the armored task force. The task force had to wait at the gap for the AVLB to catch up. Then they emplaced the bridge.*

Since the M1 tanks exceeded the rated capacity of the bridge, crossings were caution crossings and the lieutenant became a bridge inspector. Meanwhile, the enemy was busy developing a complex obstacle in the path of the brigade's advance, using mine layers, ditching machines, and wire. The breach would be a difficult mission resembling "an orchestrated ballet of farm implements."

Scouts quickly found the minefield, the wire, and the tank ditch. The lead task force organized to conduct an in-stride breach. The support team began to suppress the site, while artillery and tanks provided smoke. After the security was set, an M1 with a mine roller began the breach by moving forward. When the roller encountered a mine, the M1 stopped and backed out. A combat engineer vehicle (CEV), on one of its last missions before retirement, pulled a mine-clearing line charge (MICLIC) forward and fired it. Another M1 with a track-width mine plow proofed the lane created by the MICLIC and then moved aside. A squad of sappers in an M113 armored personnel carrier came forward to breach the wire. The M113 moved aside, and an armored combat earthmover (ACE) attacked the tank ditch. Meanwhile, the support force

was rapidly running out of direct-fire ammunition. Artillery continued to fire, but the fight was beginning to take its toll on the support force. The task force commander tried to see through the smoke to determine the progress of the various parts of the ballet. After the ACE cleared the tank ditch, the assault force began to pour through the obstacle. It hadn't been pretty, but good training and hard work got the task force through in true ESSAYONS spirit.

The MGB. *CPT Castle hoped the toughest part of his day was over, but it wasn't. The lead team radioed back that the 20-meter bridge was out. CPT Castle had planned for this eventuality, but the MGB company was still a few hours away. When the company arrived, the soldiers did their best, but the enemy rained artillery fire on the unprotected combat engineers building the bridge. They successfully completed the bridge but not without the loss of blood of some of the builders. The task force that followed CPT Castle passed lines, giving A Company a well-deserved rest.*

Circa 2006

LTC Castle's thoughts returned to the present. Conditions certainly had improved in the last 10 years. Although the mission today was nearly identical, the ease and speed of execution were much different.

The MLC 50 bridge was not a problem. The Wolverines in his battalion could easily maintain the pace of the armored task force. Better yet, lieutenants did not have to be dedicated to keep track of them. The Wolverine was fully digitized. Not only did the crew get the same directional information as the Bradley and Abrams crews, but the engineer and maneuver force leaders could track their progress on digital map screens without any effort by the crew. The Wolverine made it to the site, received a digital command to emplace the bridge, laid the bridge, and sent a digital report that caused the bridge to show up on the task force's digital maps.

The complex obstacle was much easier to breach, too. The Grizzlies were already task organized with the breach force. The support force set the necessary conditions for the breach and then digitally tasked the A Company commander to send the Grizzlies into action. With a few keystrokes, the company commander ordered the mission. The Grizzlies moved forward, plowed through the minefield, and breached the wire with their blades. Meanwhile, the task force commander was receiving real-time feedback on his screen on the location and progress of the breach. After a Grizzly attacked the tank ditch with its arm, the breach site was shown on digital maps throughout the task force. Quickly, the task force was through the complex obstacle and on the move again.

The 20-meter gap was not a problem because the Wolverines traveling with the lead task force were easily able to bridge the gap and pass the task force. Using the under-armor launch capability and the short 5-minute launch time, the crew and task force had minimal exposure at the gap.

This scenario may sound like a pipe dream from the Engineer School, but it isn't. Both the Grizzly and the Wolverine are in development with operational prototypes undergoing testing. When fielded, these two systems will accomplish complex obstacle breaches similar to the one that required CPT Castle to synchronize the use of many different systems. The first Wolverine will be fielded in 2000 and the first Grizzly in 2003. Both of them will be fielded to heavy division and corps mechanized battalions with a basis of issue of four Grizzlies and four Wolverines per company. These systems will greatly increase combat engineers' ability to provide responsive mobility support to Force XXI.

The Grizzly: A Heavy Force Complex Obstacle Breacher

The Grizzly is designed to breach simple and complex obstacles (see chart below). Mounted on a modified M1 chassis, the Grizzly features a mine-clearing blade equipped with an automatic depth control. It can clear mines at speeds up to 3 mph. The blade also cuts wire obstacles. It is complemented by an excavating arm that can attack antitank ditches, log cribs, and rubble. The system is required to clear a standard antitank ditch in 5 minutes or less.

The Grizzly will be a fully digitized member of the Army of the 21st century with a situational awareness similar to that of the supported M1 tanks

Grizzly Characteristics and Capabilities

- **M1 Abrams chassis**
- **Full-width (V-shaped) mine-clearing blade with automatic depth control**
- **Power-driven arm for digging, grappling, and lifting**
- **Commander's control station with communications, enhanced vision devices, and area suppression weapons**
- **Mobility/survivability equivalent to the supported force**
- **Requires a two-man crew**
- **Breaches antitank ditches and minefields**
- **Clears urban rubble**
- **Initial system clears mines to 12 inches in depth at 3 mph**
- **Objective system will clear mines to 16 inches in depth at 4.5 mph**

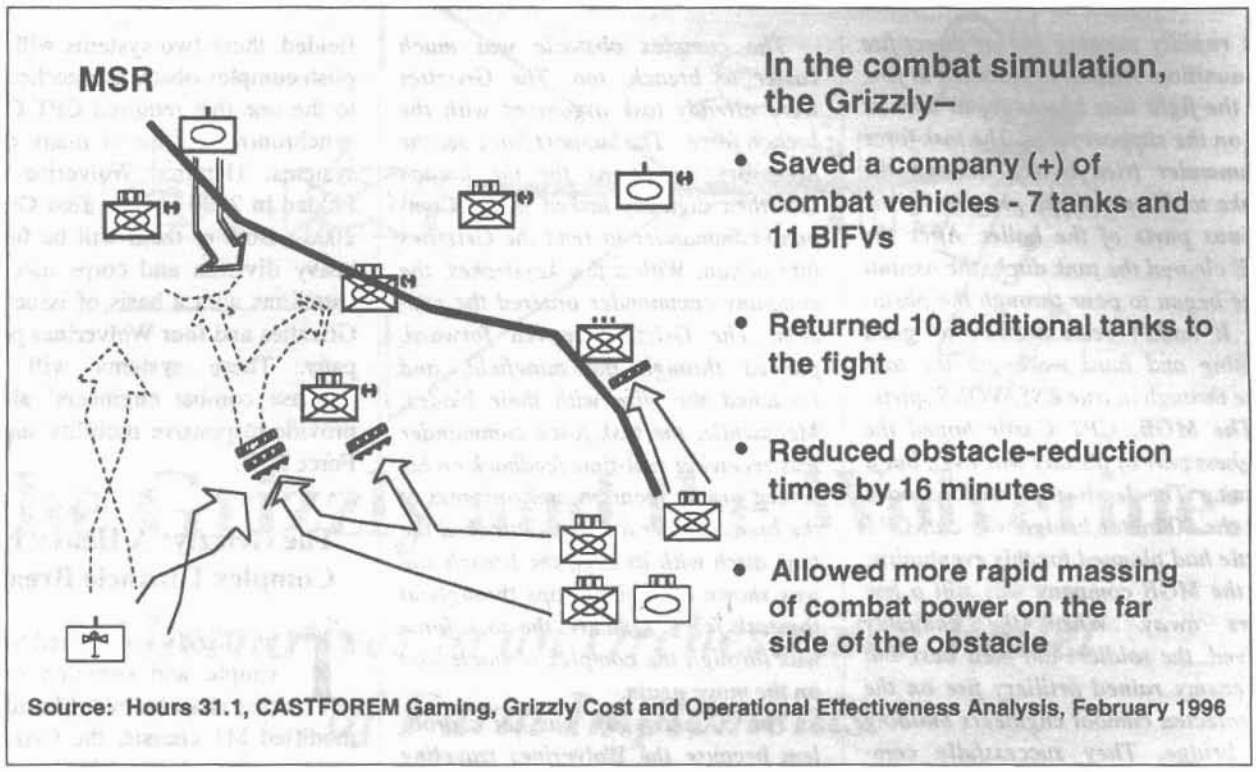


Figure 1. Grizzly Combat Effectiveness

and M2 Bradley fighting vehicles. The Grizzly promises to provide the maneuver task force with a robust, survivable, and mobile breaching platform to use against wire, mines, tank ditches, and log cribs.

The Grizzly's utility was highlighted by simulation results comparing it—operating alone—to the numerous systems we use today. The simulated mission involved a brigade clearing a main supply route (MSR) (Figure 1).

Using the Grizzly in this battle had a stunning impact. The main attack encountered a complex obstacle with mines, wire, and a tank ditch. The Grizzly breached this complex obstacle 16 minutes faster than the currently used equipment. As a result, the task force was able to mass combat power on the

Analysis Domains	Current Situation: *ACE, AVLB, MICLIC/M113, M1 with Roller*	Future Situation: *Grizzly*
Doctrine	- Complex obstacles require a deliberate breach	- Grizzly breaches in stride
Training	- Requires complex obstacle-reduction training	- Requires single-vehicle training
Leader Development	- Planning and execution difficult - Slow momentum of attack	- Focused command, control, and communications
Organization	- Combinations of AVLBs, M113s with MICLIC, and M1 Tanks	- 2 Grizzlies
Materiel	- Incompatible with M1 fleet - Low-density systems	- Compatible with M1 fleet
Soldiers	- Casualties due to lack of armor and slow breaches	- Reduced exposure time and M1 survivability yields fewer casualties

Figure 2. Analysis of Grizzly's Impacts on Engineer Operations.

Wolverine Characteristics and Capabilities

- MLC 70
- Carried on an M1 Abrams chassis
- Mobility and survivability equivalent to the supported force
- Spans gaps up to 24 meters
- Requires a two-man crew

far side of the obstacle in less time, which saved a company (+) of combat vehicles. In addition, the Grizzly allowed 10 tanks equipped with breaching equipment (rollers and plows) to return to the fight rather than be committed to breaching duties. The simulation results make a strong case for the Grizzly requirement.

The Grizzly will also have a dramatic impact on engineer doctrine, training, leader development, organization, materiel, and soldiers (DTLOMS) as shown in Figure 2. Using the Grizzly—instead of the M1 with roller and track-width mine plow, the MICLIC, the ACE, and the AVLB—will greatly simplify our doctrine, training, and planning and execution of complex obstacle breaches. The Grizzly should ease the logistics burden by replacing engineer-unique platforms with the common M1 chassis. Finally, soldier survivability for both the supported task force and the engineer force will increase due to the Grizzly's faster breach times.

The Wolverine: A Heavy Force Assault Bridge

The Wolverine is a heavy assault bridge designed to replace the AVLB on a one-for-one basis. It offers a substantial upgrade in capabilities compared to the AVLB. The Wolverine provides for a normal crossing of an MLC 70 vehicle over a 24-meter gap (see chart at left). The increased gap-crossing capability will allow the maneuver force to conduct assault breaches over gaps that require bridging to support lines of communications (Figure 3).

The Wolverine features a horizontally launched bridge, which offers a much lower profile than the vertically launched AVLB. Survivability of the force is enhanced and their momentum is maintained by the short 5-minute launch time and a 10-minute retrieval time. The Wolverine also provides the capability for launch from under armor, further increasing crew survivability. The Wolverine has a dual-purpose spade that stabilizes the chassis during launch and provides the crew a means

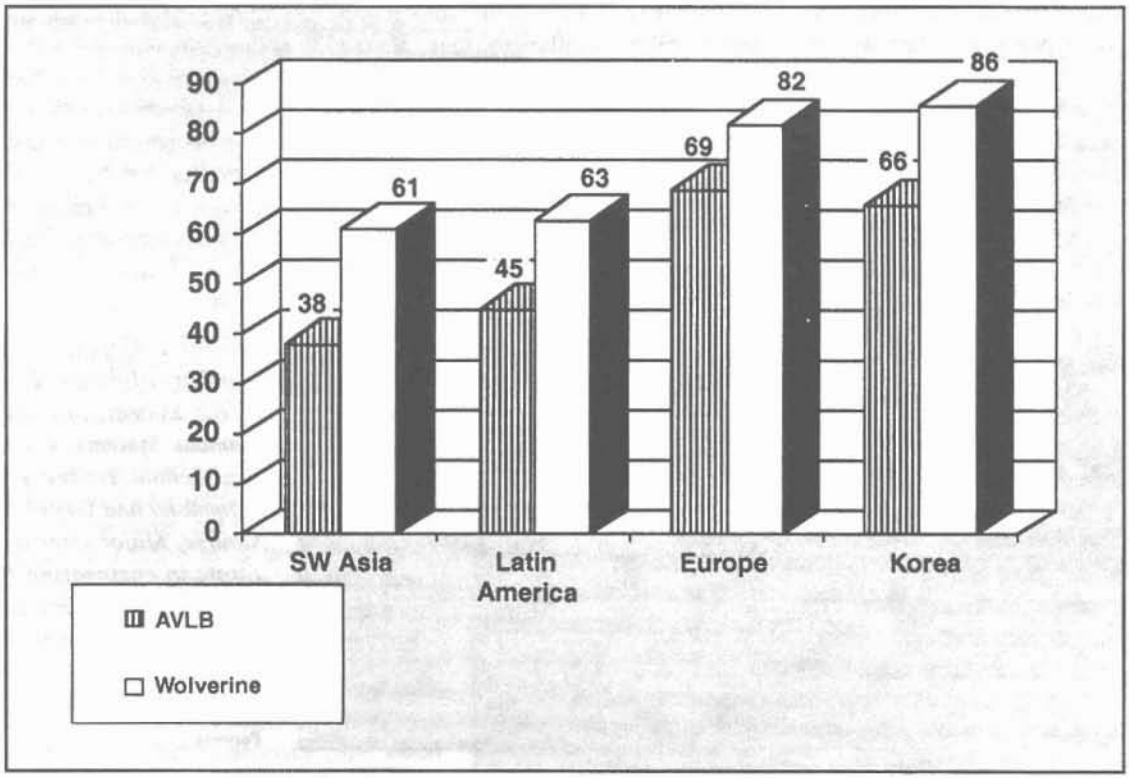


Figure 3. Analysis of Gap-crossing Capabilities of the AVLB and Wolverine for MLC-70. (Percent of Gaps Bridged)

Analysis Domains	Current Situation: *AVLB*	Future Situation: *Wolverine*
Doctrine	- Spans gaps to 15 meters; MGB spans gaps 15 to 24 meters - Travels at one-third the M1 speed (12 mph cross country)	- Spans gaps to 24 meters - Travels at M1 speed (35 mph cross country)
Training	- Requires three weeks for all systems	- Requires three weeks - Decreased costs using a combination of system and simulation training
Leader Development	- Planning and execution difficult for gaps greater than 15 meters: - Security - Fixed bridging assets - Command, control, and communications complicated	- Spans gaps up to 24 meters in less than 5 minutes
Organization	- Gaps less than 15 meters = 1 ALVB crew - Gaps 15 to 24 meters = 1 MGB platoon	- Gaps up to 24 meters = 1 Wolverine crew
Materiel	- Incompatible with current M1 fleet	- Compatible with current M1 fleet
Soldiers	- Crews suffer fatigue - Less survivable than the M1	- Reduced crew fatigue - As survivable as the M1

Figure 4. Analysis of Wolverine's Impacts on Engineer Operations.

of cleaning mud and snow off the bridge before retrieval.

Wolverine production will occur in conjunction with that of the M1A2 Systems Enhancement Package. By using the same production line as the newest tank, the Wolverine will have the same embedded digitization package as that provided to the tank and infantry fighting vehicle fleet. The Wolverine will have armor protection and mobility similar to that of the tank fleet (Figure 4). In the near future, the Wolverine will provide the Army with the world's premier assault bridge, one capable of providing responsive bridging support to the maneuver force of the 21st century.

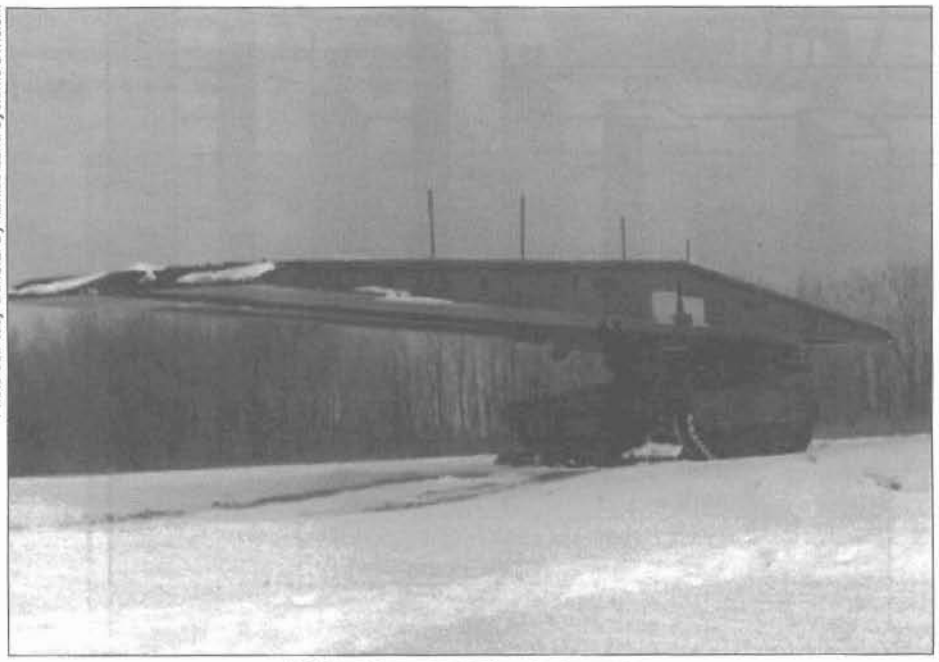


Photo courtesy General Dynamics Land Systems Division.

Wolverine preparing to launch.

[1] Description of engineer breaching operations by BG Scott Wallace, Commander, National Training Center, to BG Phillip R. Anderson, Deputy Commanding General, U.S. Army Engineer School, 16 April 1996.

Major Greene is chief of the Combat Mobility Division, TRADOC System Manager, Engineer Combat Systems, U.S. Army Engineer School. He is a graduate of the Command and General Staff Officer Course. Major Greene holds a doctorate in engineering from the University of Southern California and is a registered professional engineer in Virginia.

Grizzly logo courtesy of United Defense Limited Partners.

Photo-Essay From Operation Joint Endeavor

By Major Andrew Goetz

The following photo-essay concerns the author's experiences in Bosnia during the period March to May 1996. It will be published in two parts, with this portion including an overview and information about force protection, mine clearing, and mine-dog teams. The fall issue of Engineer *will include a discussion on base camps, the engineer construction effort, and heavy division engineer shortfalls. The photographs were taken by Major Goetz and the combat camera crews attached to Task Force Eagle.*

Overview

I was assigned as an engineer observer with Combined Arms Assessment Team (CAAT) II, Center for Army Lessons Learned (CALL), Operation Joint Endeavor, in Bosnia. The CALL operates out of Tuzla, with an office in the division tactical operations center. Observers go out for several days at a time to visit units, then return to Tuzla to write observations and push them through the lengthy approval process. My brief two months in Bosnia did not make me an expert but did give me an opportunity to get a snapshot of engineer operations there. This "briefing" is based on events I personally observed in Task Force Eagle and the 1st Armored Division Engineer Brigade. It provides an overview of engineer operations in Bosnia-Herzegovina, not a discussion on the political or military situation.

Observations and lessons learned concerning events in Bosnia are available through the Center for Army Lessons Learned at Fort Leavenworth, Kansas, and through the Center for Engineer Lessons Learned at Fort Leonard Wood, Missouri.



Force Protection

Force protection is a major consideration that requires extensive engineer planning for perimeter wire, bunkers, towers, lighting, and fighting positions. The engineer battalion manages all construction in the brigade combat team sectors. The mission of managing the staggering quantity of Class IV materials was given to the 1st Armored Division Engineer Brigade.

Photo (left)

Guard towers are a fixture at all base camps. They are constructed primarily by the vertical platoons of the 94th Engineer Battalion. Because of poor soil conditions, a stable surface must be created to set them on. Compacted gravel, sandbags, and wide timber bases solve the problem. The towers are constructed with double walls; sandbags fill the gap between the walls and cover the roof.

To ensure that the force protection structures are safe, engineers inspect every bunker and tower and post an inspection certificate on the facility. The task force engineer takes the certification process seriously and had several structures rebuilt that did not pass the quality-control check. The construction management section attached to the division engineers provides quality assurance.

Photo (right)

As the weather warmed, local citizens attempted to penetrate perimeter wire, apparently to steal material inside the base camps. To solve this problem, engineers placed tanglefoot wherever practical. In this photo, tanglefoot is placed between the inner and outer perimeter fences.

Perimeter lighting is used at some sites to keep locals out. Task Force Eagle wanted to light the entire perimeter of their base camp, but that was easier said than done. Power distribution for a large base camp requires up to 0000 wire, something even the prime power teams are not equipped to handle. Because portable light sets are too expensive for the entire perimeter lighting mission, most perimeters are not lit. Part of the challenge in figuring out how to provide perimeter lighting is determining what the commander wants. For example, is the desired effect to enhance night vision capability, illuminate wire, illuminate grazing fire, or prevent people from seeing inside the perimeter?

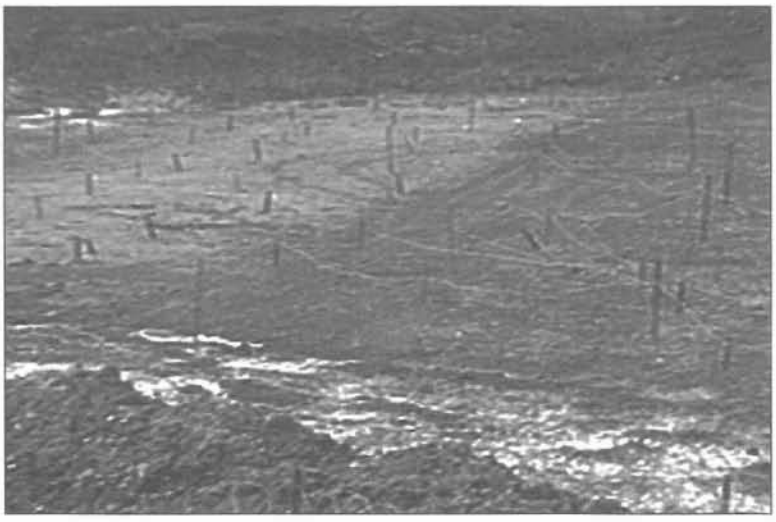






Photo (left)

Existing buildings at Tuzla Main are used for a wide range of purposes. This building is similar to many that are used as barracks. The double-decker hootches the U.N. constructed in the open bays are being removed because they pose a fire hazard. Fixed facilities at the old Yugoslavian air base are used for Task Force Eagle headquarters, the mess hall, and unit headquarters.

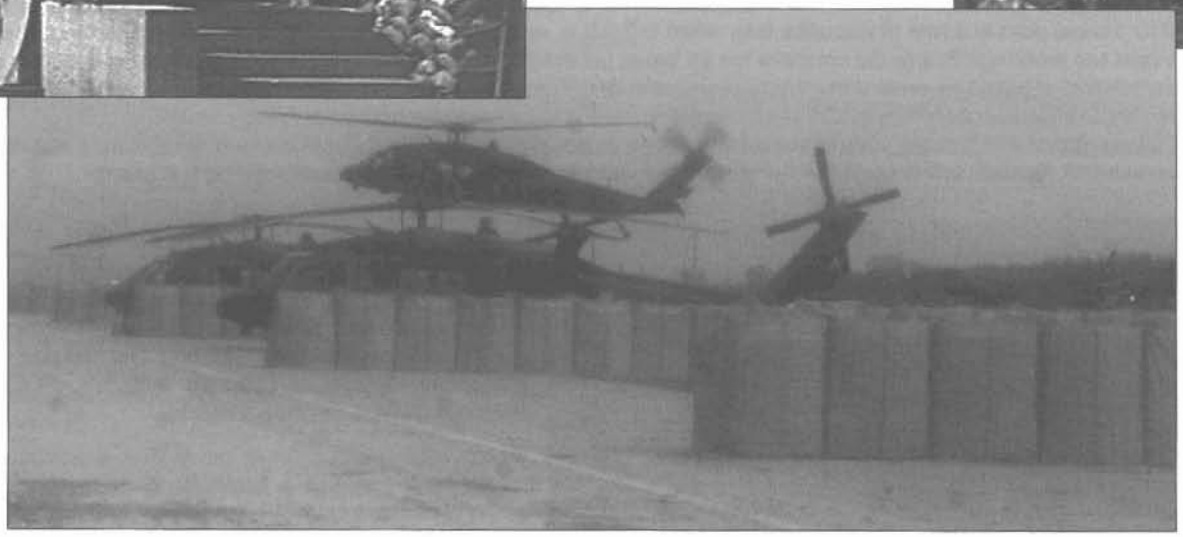


Photo (above)
Hesco Bastions are used as helicopter revetments at Comanche Base, Tuzla Main.



Mine Clearing in the Zone of Separation

One of the divisional engineer brigade's missions is to supervise the "demilitarization of the zone of separation (ZOS)." This includes blowing bunkers, filling trench lines, and clearing minefields. The former warring factions are primarily responsible for completing this work, but U.S. engineers provide supervision to ensure that the work is done. The U.S. engineers do some tasks themselves, such as destroying bunkers. This series of photos is from a mine-clearing mission performed by Serbian engineers and supervised by 1st Platoon, A Company, 40th Engineer Battalion.

Photo (left)

On this day, 1st Squad and 1st Platoon—with an interpreter, a medic, and two Bradleys—linked up with the Serbian engineers—a lieutenant, two soldiers, and a driver—near the edge of the ZOS. We followed the Serb's truck to their trench line. When we reached a point where the road along the trench line was too muddy and steep to drive on, we dismounted and walked.

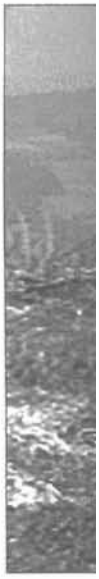




Photo (left)

The trench line runs along a crest. The Serbs led the way to the minefields we were to clear, which were about 2 kilometers from the dismount point. The platoon leader was very "situationally aware" of the mine threat. He knew that this section of trench line had never been occupied by anyone except the Serbs, so the mine threat on their side of the trench line was very low. On the far side, however, the threat was very high. The platoon leader instructed his soldiers to stay on the Serbian side of the trench line.





Photo (above)

A series of bunkers along the ridge links with the trenches. Fighting positions are spaced randomly along the trench line. Some bunkers are very basic, while others are completely enclosed with doors and windows. Pits behind the trench appear to have once held mortar and/or small-caliber artillery. The positions look across a large valley to the Muslim side of the line. At this point the Muslim trench line is several kilometers away; at other points it is as close as 30 meters.



Photo (above)

Minefields were recorded on Serbian mine data sheets, which show the location of the minefields, how many mines they contain, and whether any of them were detonated during the war. Here, the Serbian lieutenant and the 1st Platoon and 1st Squad leaders discuss the mine-clearing operation—how many minefields are here, how many will be cleared, and how the mines will be destroyed. The responsibility and coordination required to accomplish this mission are well above what we normally expect of a young platoon leader, much less a squad leader, but we ask them to do this type of mission every day.

Photo (left)

This Serbian mine-marking sign is written in Cyrillic. Part of the Dayton Accord requires the former warring factions to mark their minefields with a barbed-wire fence on all four sides. The Serbs frequently do not do this and can't be convinced it is necessary. First, there aren't enough Serbs to carry the marking materials to minefields in remote locations such as this. Second, since they are taking mines out of the minefields, they don't see a need to mark them. Finally, they are hesitant to mark the Muslim sides of minefields because they don't know if the Muslims have mined them.



Photo (left)

After reviewing the mine data sheets, this Serbian mine-clearing team went in front of the trenches to look for mines. When they found the PMR-2A mines, they cut the wire, pulled the mines out of the ground, and threw them up the hill to the Serbian lieutenant. They wore no protective armor and were very casual about the whole thing.



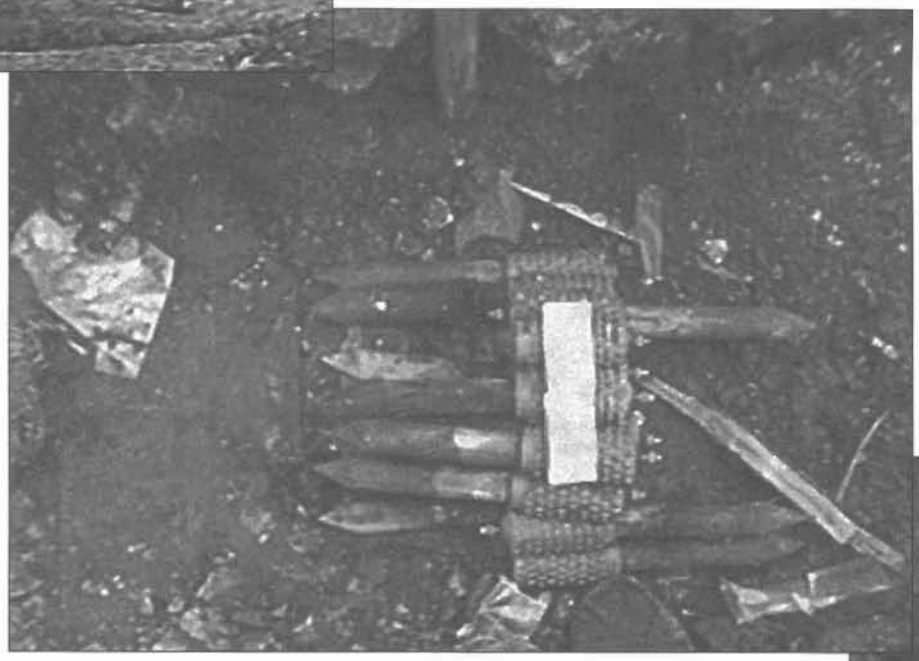


Photo (right)

Here, a batch of mines is rigged for demolitions. The mines were destroyed on-site by Serbian engineers. At this time, the Serbs were required to provide their own demolitions. Later Task Force Eagle allowed U.S. engineers to provide demolitions if the factions could not.



Photo (below)

On the first attempt to destroy the mines, the blasting cap fell out of the plastic explosives, causing a misfire. The platoon leader wanted the Serbs to wait 30 minutes before approaching the rigged mines but could convince them to wait only 15 minutes. The Serbian lieutenant then checked the demolitions, re-rigged them, and successfully destroyed the mines.



Photo (right)

At the end of the day, the Serbian lieutenant and the 1st Platoon and 1st Squad leaders reconciled the number of mines removed with the number shown on the mine data sheets. The sheets showed that 41 mines were originally placed in this sector. Seven of them were destroyed during the war. A Serbian engineer said that eight more mines were installed but not recorded on the data sheets. A total of 42 PRM-2A mines were removed from the sector on this day. The numbers conveniently added up, but it is impossible to determine if they are correct. This is why all minefields are considered active even though they have been "cleared."



Mine-Dog Teams

Both the Swedes and the Russians have mine dogs in theater, and in April 1996, our military police certified five mine dogs for use in Bosnia. They are the only mine dogs in the U.S. Army. These photos were taken at a mine-dog training site outside of Tuzla. The buried mines have been defuzed.

Photo (left)

This dog has located a buried mine, and the handler marked it with a mine bonnet. The team is now looking for a bypass. The second soldier marked the lane using a can of blue spray paint secured in long-handled holders. The lane marker sprays on both sides of the dog handler's boots. We should consider using this system for marking assault foot lanes through cleared minefields. (Utility companies use similar paint can holders to mark underground cables and pipes.)





Photo (above, right)

Here, the mine-dog team clears around a "casualty," and one soldier marks the cleared area with paint. After a lane to the casualty is cleared and the clearing team is out of the minefield, the rescue team moves along the lane to recover the casualty. The dog identified the mine next to the casualty; it is marked by a mine bonnet.



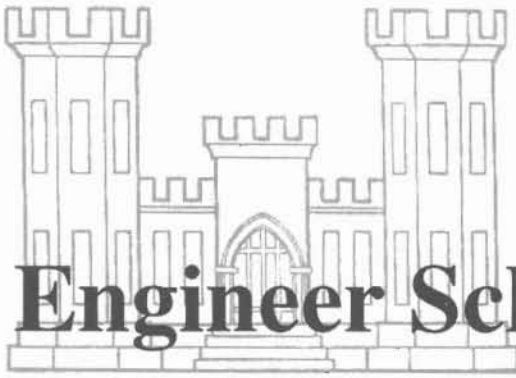
Photo (far right)

This U.S. mine-clearing dog is allowed to go forward on a long leash up to 20 feet in front of the handler. (The Swedish team keeps their dogs on very short leashes.) The second soldier marks the lane with engineer tape that is staked at the entrance to the lane and dragged along with the team. This is not a very effective system. In fact, if the training lane was not marked and the engineer tape already staked out, the team would not have used it. This dog successfully located the buried mines in the training lane.

Conclusion

I hope that this photo-essay helps you appreciate the vast scope of ongoing engineer operations in Bosnia-Herzegovina. The experience gained from this mission is producing skilled, confident young engineer leaders for tomorrow's Army.

Major Goetz is currently attending the Command and General Staff College at Fort Leavenworth. Previous assignments include construction branch chief, U.S. Army Engineer School, Fort Leonard Wood, Missouri; company commander, 82d Engineer Battalion, during Desert Storm; maintenance detachment commander, 3rd Engineer Brigade, 3rd Infantry Division; and military observer to the U.N. mission in the western Sahara.



The Engineer School:
Providing Lessons Learned to the Force

By Major David Brinkley

The U.S. Army Engineer School established a Lessons Learned Branch in the Department of Training and Doctrine in May 1995 to gather engineer lessons from ongoing operations and disseminate them to the field. The Lessons Learned Branch replaces a function formerly filled by the Directorate of Evaluation and Standardization, which was disbanded in 1995. This article highlights the critical mission of the Lessons Learned Branch within the engineer community by examining a few significant lessons gathered to date from Operation Joint Endeavor in Bosnia. The branch is tasked by MG Gill, Commandant, to gather information in three key areas: countermine operations, bridging, and sustainment engineering.

Countermine Operations

The Engineer School's involvement with countermine operations focuses on mine-awareness training and the collection of countermine lessons learned. Early in Operation Joint Endeavor, school personnel became heavily involved with mine-awareness training for units deploying to Bosnia. The Doctrine Development Division and the Department of Tactics, Leadership and Engineering jointly developed a comprehensive training program designed to "train the trainer." First we examined the existing doctrine, which was found to be sound.

"Operation Joint Endeavor is a veritable gold mine of engineer lessons learned."

Then we used FM 20-32, *Mine Countermine Operations;* FM 90-13-1, *Combined Arms Breaching*; and *The Engineer Contingency Handbook* to develop tactics, techniques, and procedures for the training program.

LESSON LEARNED: The doctrine used for high-intensity conflicts is sound and flexible enough to be useful in contingency operations. However, special publications, such as the Engineer Contingency Handbook, *are required for some areas of operations.*

The comprehensive training program was developed for the 16th Engineer Battalion, 130th Engineer Brigade. The training is based on doctrine for high-intensity conflicts and modified based on the situation in Bosnia. This training is intended for all soldiers. It focuses on the avoidance of minefields and unexploded ordnance (UXO) and extraction from minefields. The training is required for all civilian and military personnel deploying to Bosnia.

When the 16th Engineer Battalion was called to participate in Operation Joint Endeavor, the Engineer School assisted in training units deploying from the continental United States and the Southern European Task Force. A mobile training team from the school used the program to train deploying forces at Fort Bragg, North Carolina; Fort Riley, Kansas; and Vincenzia, Italy. Their efforts reduced the backlog of units requiring predeployment training in USAREUR. The newly formed Countermine Training Support Center at the Engineer School continues to provide this type of service to the Army.

LESSON LEARNED: *Maintain jointly prepared countermine training plans as an "off-the-shelf" resource to facilitate the rapid development of mobile training teams. Regardless of the source, the Engineer School should collect and store these plans for use in future contingency operations.*

The Lessons Learned Branch is aggressively collecting data from the 1st Armored Division. Direct links with the division's Mine Action Center, the Center for Army Lessons Learned, and the combined arms assessment teams allow us to acquire emerging doctrinal trends and critical information. In return, we serve as adjunct staff for the 1st Armored Division Engineer Brigade to assist with research, data collection, and analysis. School personnel also work extensively with private industry

and Army laboratories to develop new countermine systems.

LESSON LEARNED: *Both Engineer School personnel and deployed engineer soldiers benefit from close communications before, during, and after a deployment.*

Bridging

The world watched in awe as U.S. Army engineers bridged the Sava River under dismal conditions last winter. Their heroic efforts established one of the longest float bridges ever built—and it's still crossing Implementation Force (IFOR) traffic today.

In Operation Joint Endeavor, engineers successfully executed the largest military bridging mission since Vietnam. To date, U.S. engineers in Bosnia have built nonstandard fixed bridges, assault float bridges, a medium girder bridge, Bailey bridges, and a commercially available British Compact 200 bridge. To quote Colonel Steve Hawkins, Commander of the 1st Armored Division Engineer Brigade, "U.S. engineers built a British bridge to support a Russian brigade." This diverse capability characterizes much of the bridging expertise in Bosnia today. Engineer soldiers also have laid more than 20 AVLBs in support of the 1st Armored Division and, using techniques seldom required in today's Army, are repairing a railroad and a railroad bridge.

The Engineer School routinely provides experts to assist in bridge construction and has reaped benefits from this tremendous bridging effort. School personnel have collected lessons from bridging operations in Bosnia and are incorporating them in the latest version of FM 90-13, *River Crossing Operations*.

LESSON LEARNED. *School and field personnel should work together to update and revise doctrine. Experience gained in Bosnia has provided key lessons we are using to revise FM 90-13-1 and FM 20-32.*

Sustainment Engineering

Due to Bosnia's war-torn infrastructure, engineers in the 1st Armored Division are performing numerous construction missions to support the force. They continue to clear and repair mined and damaged roads. Housing, utilities, and water facilities are nonexistent or severely damaged almost everywhere and must be provided. All of this construction is accomplished through a combination of military troop construction, the Logistics Civil Augmentation Program (LOGCAP), and joint engineering.

Both Operation Joint Endeavor and Operation Uphold Democracy, in Haiti, have identified a serious deficiency—the lack of doctrine for joint engineer operations and combat heavy engineer operations. To meet this requirement, Engineer School personnel, in conjunction with the Army National Guard, will use the numerous lessons on infrastructure requirements, force protection, and joint engineering from these operations to write a capstone combat heavy engineer operations field manual. The school will also write a joint engineer capstone publication.

One concept that has emerged from Operation Joint Endeavor is *Force Provider*, a containerized base camp that allows rapid construction of long-term facilities. The Army organized Force Provider Companies in the Quartermaster Corps—Quartermaster personnel deliver a base camp as a commodity, and engineers assemble it. The camp sites require substantial preparation by engineers for site preparation, utility connections, and force protection. After a camp is assembled, the Quartermaster Company operates it and the associated facilities.

LOGCAP, another sustainment concept, is a tremendous force multiplier in Bosnia. It originated during Operation Desert Shield, when contractors were hired to perform most sustainment engineering and facilities services for the Army. LOGCAP was formalized in Haiti and has come to maturity in Bosnia. Both LOGCAP and Force Provider are examples of emerging concepts that the Engineer School has "captured" for use in contingency operations.

LESSON LEARNED: *Joint and civilian engineers will be part of most, if not all, future military engineer operations. We must become knowledgeable about the construction capabilities and limitations of other services and civilian contractors and fully integrate them in future operations.*

Operation Joint Endeavor is a veritable gold mine of engineer lessons learned. We are using the opportunity Bosnia provides to test the ability of the Lesson's Learned Branch to collect, analyze, and disseminate lessons to the field in a timely manner. For example, recently we received a lesson concerning the AVLB from the 2nd Infantry Division Engineer Brigade, in Korea, and immediately passed it to engineers in Bosnia. Our wish is to continue to provide that kind of service to the Engineer Regiment.

We invite you to share information with us. Send your good ideas or lessons to Mr. Bill Blackwell, at blackwew@wood-vines.army.mil. We also encourage you to browse through the latest lessons learned and doctrine on the Fort Leonard Wood Internet Home Page, at http:///www.wood.

LESSON LEARNED: *More than 25,000 people have used the Engineer Home Page service to date. Let us assist in your next training exercise or operation.*



Major David Brinkley served as Chief, Doctrine Development Division, Department of Training and Doctrine, U.S. Army Engineer School, from May 1995 to May 1996. He is currently attending the Command and General Staff College at Fort Leavenworth. Previous assignments include instructor/writer at the U.S. Army Engineer School and observer/controller at the National Training Center, Fort Irwin, California.

An Engineer Reconnaissance Platoon: *A Proposal*

By Major Douglas McNeese and Captain Steven Creighton

Too often during simulated combat, engineers must painstakingly "pull" critical information from maneuver channels, only to receive reports that lack important engineer-specific details regarding obstacles, enemy engineers, and terrain. To correct this shortfall, we propose that U.S. Army engineers implement a reconnaissance platoon that is organic to divisional engineer battalions.

The proposed platoon would consist of three engineer scout squads that could be either independently sliced to task force (TF) scout platoons or operate together as a brigade reconnaissance asset. In practice and by doctrine, TF engineers attach combat engineers to their TF scout platoons to enhance obstacle identification and terrain analysis. The engineer reconnaissance platoons would support this effort three ways:

- Provide tactically proficient engineers who are trained to operate forward of the forward edge of the battle area (FEBA).
- Promote habitual relationships between scout platoons and their engineers.
- Clearly define the role of engineer squads when they support scout platoons.

Current Engineer Reconnaissance: Practice and Doctrine

During most combat operations, combat engineers support scouts and provide technical expertise about terrain and obstacles—an asset usually welcomed by the scouts. However promising this arrangement may appear, the value added is usually minimal, and the shortcomings are no fault of the soldiers. Most combat engineers are not trained in scout tactics and thus lack the tactical expertise needed to integrate properly. Furthermore, no guidelines exist for engineers tasked to support scouts. Before we can expect top performance from our soldiers, we must determine–

- Who commands and controls the engineer scouts.
- If combat engineers should ride inside scout vehicles or operate their own.
- If habitual relationships between scouts and engineers are desirable.
- The tasks combat engineer scouts should focus on in offensive and defensive operations.

Maneuver doctrine describes the engineer augmentation of TF scouts in detail, but engineer doctrine on the issue is vague. For example, FM 17-98, *Scout Platoon,* page 6-32, states, *"In reconnaissance operations, an engineer squad may be placed in direct support of a scout platoon."* Six pages are dedicated to engineer capabilities and limitations and 32 pages in the appendix address obstacles. Similarly, FM 71-2, *The Tank and Mechanized Infantry Battalion Task Force,* page 3-47 (paragraph h), supports this by stating, *"Elements of the supporting engineer unit are employed with the [scout platoon] to reconnoiter obstacles."*

Unfortunately, the engineer response to these expectations is not strong. Both FM 5-71-100, *Division Engineer Combat Operations,* and FM 5-100, *Engineer Combat Operations,* repeatedly stress the importance of engineers in reconnaissance and the intelligence preparation of the battlefield (IPB) process, but they fail to address methods of employment and command and control. FM 5-100, page 44, states, *"Engineers identify specific reconnaissance requirements and augment dismounted patrols and scouts to identify obstacle characteristics."* It goes on to say, *"During the attack, engineer reconnaissance teams and engineer units provide continuous surveillance along the routes of advance."* Here, our doctrine clearly acknowledges the need to augment scouts and to establish engineer reconnaissance teams but says nothing more—leaving implementation a hodgepodge, makeshift element determined by the task force engineer.

Mission and Employment

The engineer reconnaissance platoon should have several intelligence-gathering missions, including:

- Terrain analysis.
- Determination of trafficability on proposed routes.
- Determination of soil suitability for digging.
- Route reconnaissance, road reconnaissance, and bridge classification.
- Reconnaissance of specific named areas of interest, targeted areas of interest, and decision points that may contain obstacles or be tied into obstacle plans.

- Identification of areas forward of the FEBA suitable for FASCAM minefields.
- Covert breaching and obstacle marking.
- Detailed reporting of enemy obstacles and overwatch positions.
- Identification of threat engineer equipment and capabilities.

Information on threat engineer capabilities assists commanders and planners in determining the enemy's main effort, forward security element, and flank; and in confirming assumptions made during the IPB and engineer battlefield assessment (EBA). Enemy minefield reports should include length of frontage, depth, orientation, density, composition, and bypass information. This detailed minefield information usually is not reported by TF scouts but is critical to engineers planning a breach.

Both scouts and engineers currently have too wide a spectrum of missions and tasks expected of them, which limits their ability to do any one mission well. For example, scouts are expected to be experts in all forms of reconnaissance, enemy identification, counterreconnaissance, and enemy obstacles. Similarly, combat engineers are expected to be experts in bridging, emplacement of friendly obstacles, enemy obstacles, and reconnaissance. The introduction of engineer recon units will produce more focused combat engineers and give both scouts and engineers a more attainable scope of mission requirements.

Equipment and Organization

The vehicles currently used in scout platoons are armored HMMWVs and off-road motorcycles. Of these, armored HMMWVs would best suit the engineer recon platoon. They are fast, maneuverable, quiet, and easily maintained; provide small arms protection; and have storage space and a turret. A recon squad might consist of eight men and two HMMWVs, with four soldiers per vehicle. Additional equipment for the squad may include an MK-19 grenade launcher, a .50 caliber machine gun, squad automatic weapons (SAW), AT-4s, AN-PSS 12 mine detectors, global positioning systems (GPS), SINCGARS radios, AN-PVS-7 night vision devices, hand-emplaced minefield-marking systems (HEMMS), VS-17 panels, demolition kits, and Polaroid cameras.

Command and Control

In a task force, the scout platoon serves as the commander's eyes and ears on the battlefield. The scout platoon leader takes orders and sends reports directly to the TF tactical operations center (TOC). Similarly, the engineer recon platoon leader should send reports directly to the engineer battalion TOC. This reporting procedure will provide brigade and TF engineers with direct links to engineer-specific intelligence forward of the FEBA. Currently, brigade and TF engineers obtain that intelligence, often by pulling it secondhand through maneuver S2 channels or by finding it the hard way—such as running into an enemy mine.

Engineer recon squads should be tied into brigade and TF reconnaissance and surveillance plans and employed in one of three ways:

- Sliced out, with each squad supporting a scout platoon.
- As a platoon, working for the brigade engineer.
- As a mixture.

In the last two scenarios, forward employment of an engineer reconnaissance element will require special measures for resupply, presumably by the same element that resupplies the scouts.

Threat Engineer Reconnaissance

Engineer battalions in the former Soviet pact forces have used engineer recon platoons for many years. Their platoons provide squad-sized engineer recon patrols (ERPs) that colocate with division and regimental recon patrols. The ERPs send engineer-specific intelligence to a director of engineers at both regimental and division levels. Although the recon companies of motorized rifle regiments and tank regiments consist of motorcycles and BMP and BRM armored vehicles, the engineer recon platoons have BTR armored vehicles. The platoons also have DIM truck-mounted mine detectors and VHF radios.

Engineer Reconnaissance Training

Training combat engineers to be qualified engineer reconnaissance scouts would neither be difficult nor require an additional military occupational specialty or time away from Fort Leonard Wood. The following program proposal is austere because combat engineers often are *tactically* deficient not *technically* deficient when operating forward of the FEBA.

The long classroom hours spent in basic and advanced courses for engineer officers and NCOs (EOBC, EOAC, BNCOC, and ANCOC) have produced well-schooled leaders. However, training in tactics such as noise and light disciplines, stealth movement, breaking contact, and reporting is lacking. Unfortunately, on-the-job training often leads to "the untrained leading the untrained" and specialty training in the Ranger and Scout Platoon Leader Schools is mainly for officers. Moreover, the Sapper Leader Course at Fort Leonard Wood focuses on light operations. The following tiers would establish a sound training program for engineer scouts.

1. Increase instruction for officers in EOBC to include task force scout operations (how they are employed and how engineer recon squads can assist scouts with gathering intelligence). Continue to send lieutenants to the Scout Platoon Leader Course at Fort Knox after they graduate from EOBC,

and add a combat engineer reconnaissance course to Fort Leonard Wood's program of instruction.

2. Train NCOs at the proposed combat engineer reconnaissance course at Fort Leonard Wood. As a branch of the Sapper Leader Course, it would be similar to the Scout Platoon Leader Course but tailored for engineers.

3. Provide motivated basic trainees desiring to be scouts with additional advanced individual training immediately after graduation. This special module would teach the basics of enemy obstacle identification and reconnaissance. Upon arrival at their units, these soldiers would receive additional training from NCOs trained at the combat engineer reconnaissance course.

Meet the Challenge!

The potential benefits of adding a combat engineer reconnaissance unit to our force structure is apparent at all echelons. Engineer recon platoons would assist scouts in gathering intelligence and significantly increase the level of combat engineer expertise throughout the Corps. Why not provide highly trained engineer soldiers tailored to meet the challenge! Implementing this platoon would be relatively simple, and soldiers from squad leader to division engineer would benefit. Essayons!

Note: Since this article was written, the Experimental Force at Fort Hood has added a reconnaissance section to the engineer battalion headquarters as part of their organization. In addition, the Engineer School is currently writing FM 5-170, *Engineer Reconnaissance,* which will addresss many of the concerns in this article. The authors' concerns, however, are still valid and are provided to stimulate discussion.

Major Douglas W. McNeese is assigned to the Headquarters, Engineer Brigade, 1st Armored Division, Bad Kreuznach, Germany. Previous assignments include tactics instructor at the Engineer School, Fort Leoanrd Wood, Missouri, and observer/controller at the Combat Maneuver Training Center, Hohenfels, Germany. Major McNeese is a graduate of the Command and General Staff College.

Captain Steven L. Creighton is commander of the 68th Engineer Company (CSE), Fort Hood, Texas. He previously served in the 1st Armored Division Assistant Division Engineer section during the 1AD BCTP Warfighter exercise, Baumholder, Germany (February 1994). CPT Creighton is a graduate of the Engineer Officer Advanced Course and the Armor Scout Platoon Leader Course. He was a sapper platoon leader in the 40th Engineer Battalion (Baumholder, Germany) during numerous rotations at CMTC.

The ENGINEER Writer's Guide

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

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

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

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

Articles should generally come from contributors with firsthand experience with the subject being presented. Avoid theatrical writing styles like: "It was a dark and stormy night...," or "...the soldier blazed through the jungle on his lumbering D7, providing a trail of freedom for the other vehicles..."

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

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

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

Manuscripts must be original, unpublished, and not under consideration by another publication.

All submissions are subject to editing.

Contributors are encouraged to include black-and-white or color photos, artwork, and/or line diagrams that illustrate information in the article.

Include your full name, rank, current unit and job title. Also include a list of your past assignments, experience and education; your mailing address; and commercial daytime phone number. Send articles to: Editor, *Engineer Professional Bulletin,* ATTN: ATSE-TD-D-EB, Fort Leonard Wood, Missouri 65473-6650.

If you have questions about an article you're working on—or considering writing—call Cathy Eubanks or Shirley Bridges, at DSN 676-4104, or commercial (573)563-4104. We look forward to hearing from you.

Marine Engineers:

Construction and Destruction on Demand

By Captain Thomas Pratt

With fewer resources and more missions, joint operations are now a way of life. To ensure the optimum use of assets and mission success in joint operations, all service members must become familiar with the capabilities that other services bring to the fight. The Marine engineer brings a unique contribution to present-day joint operations—expeditionary engineering, which supports the Marine Air-Ground Task Force (MAGTF) in combat support and combat service support missions. This article presents the history of Marine engineering through its evolution as the Marine component of joint engineering.

History

In the late 1800's, the Marine Corps mission expanded as America's status as a world power grew. The new mission to seize and defend advanced naval bases required that Marines have their own construction, maintenance, facilities operation, and general service capabilities. As a result, the initial mission of Marine engineers was primarily combat service support. Their objective was to construct, repair, or improve facilities in amphibious operation areas.

World War I. During World War I, the Marines relied on the Army to provide what we now call combat engineer support. In 1927, the Commandant of the Marine Corps, Major General Lejeune, further enhanced the role of the Marine engineer by publishing his vision of an organization within the Marine division that would operate captured or newly constructed advanced bases until relieved by their Army or Navy counterparts. That vision remained the mission of Marine engineers until the end of the 1930s. Today, these duties are mostly associated with landing support activities.

The development and organization of the Fleet Marine Force in 1935 gave birth to the Marine Corps' first force engineer companies. Engineers within these companies relied heavily on the Army for doctrine, training, and equipment. For military engineer schooling, Marine officers went to Fort Belvoir, Virginia, where they learned to apply civilian engineer knowledge in a military environment. In 1941, the Marine Corps established the Marine Corps Engineer School at Quantico, Virginia. A year later, the school was moved to Camp Lejeune, North Carolina. At this time, there were 58 military occupational specialties (MOSs) in the engineer field.

World War II. When World War II began, the Marine Corps grew immensely. For the first time, it began to think in terms of brigades and divisions and, along with this, the need for larger service units. By 1942, the Corps decided that each division would have an organic engineer battalion and an organic pioneer battalion. Normally these battalions went ashore in the second assault wave and set up the landing beaches. After the initial assault wave, they off-loaded materials and personnel. (The pioneer battalions are now called landing support battalions.) Later in the war, engineer regiments were formed with an engineer battalion, a pioneer battalion, and a Navy Seabee battalion. Since there was no



Marines from the 9th ESB pour a footing at Camp Foster, Okinawa.



Marines from MWSS-273 construct a temporary shelter in Jubail, Saudi Arabia.

standard table of organization and equipment at this time, all units were task organized to meet the division commander's specific needs during the island-hopping campaigns. The Marine "combat engineers" originated during World War II.

Assault engineer companies, created to breach the beach obstacles commonly found in the Pacific islands, were attached to regimental landing teams. These companies provided direct support to maneuver elements during landings and normally reverted to engineer battalion control when the battalion headquarters landed. Then they filled a general-support role for the regimental combat teams.

Except for the assault companies, employment of the engineer battalion in a purely combat support role was not considered. As a result, no combat-oriented doctrine or training was specifically developed for engineers. To compensate for this lack of training, infantry units normally received their engineer assets well in advance and trained them on assault techniques. On several occasions, Marine engineers applied their unique skills and equipment in assaults. Often an engineer or pioneer battalion was thrust into the defensive perimeter to free up an infantry unit.

Post-World War II. By the end of the war, the number of Marine engineers had increased more than 6,000 percent. Inevitably, they were hit hard by the postwar drawdown. In the late 1940s, the Marine Corps began a series of restructuring and reduction analyses to adopt a peacetime posture. In 1947, pioneer battalions were renamed "shore party battalions" to more accurately reflect their mission. Many of the engineer MOSs for Marine officers and enlisted personnel were combined or deleted. Between 1945 and 1950, the number of engineer MOSs dropped from 55 to 9; however, the number of missions did not drop. This lead to a "jack of all trades" phenomena that portrays Marine engineering today.

Korean War. During the Korean War, Marine engineer efforts focused on the mobility and survivability of the force. Constructing and maintaining main supply routes and airfields, clearing roads, and constructing bridges were common operations. Engineers also performed specialized demolition missions to disrupt the North Korean lines of communications. No significant changes occurred in the engineer community during the conflict, but it became evident that new, more advanced equipment was needed to perform their missions.

Post-Korean War. After the Korean War, the entire mission and structure of the Marine Corps was evaluated against the new threat—nuclear weapons. The popular thought at the time was that technology was becoming a more valuable resource than people. The engineer community did not suffer as badly as others, but significant changes occurred in the following years. The Navy Seabees were removed from the Marine engineer organization during the 1950s, although a strong link remained between the two services. To fill this void, a memorandum of understanding was written, and force engineer battalions were created.

The force engineer units had their roots in the aviation engineer battalions of World War II. Their mission was to support the entire landing force, including the aviation element, and to reinforce, augment, and expand the missions of

the division engineers. Therefore, the force engineer units were larger and more heavily equipped than the division engineer units. Bridge companies that were independent of both division and force engineers were created.

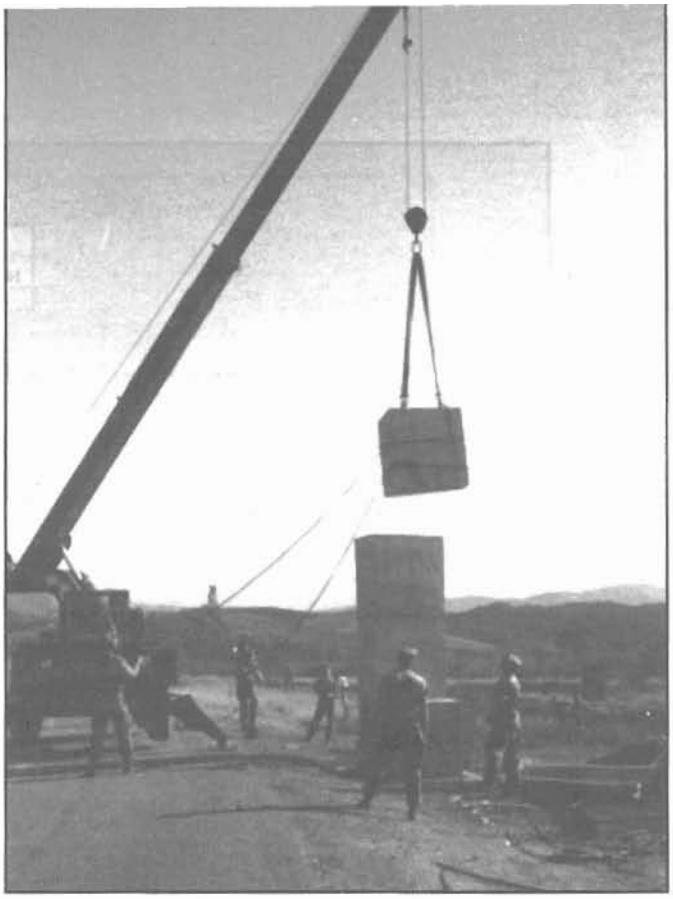
Vietnam War. In 1965, the U.S. military buildup in Vietnam began in earnest. The engineer effort there primarily involved humanitarian assistance. However, Marine engineers provided direct support in the actual fight, participating in practically every combat operation, search-and-destroy mission, roughrider convoy, and fire base preparation. Typically the engineers were a small, task-organized team—seldom more than three to four men—attached to an infantry unit.

Post-Vietnam War. Since the end of the Vietnam War, the Marine engineer community has undergone significant changes. In 1976, the division engineer battalion was renamed "combat engineer battalion" to more accurately reflect the combat nature of its mission. Once again, the Marine Corps responded to a postwar drawdown by restructuring the remaining active duty units. As a result, the force service support group (FSSG) was formed as the combat service support element of the MAGTF. Many of the division support units were moved into the newly created FSSG. The combat engineer battalion remained within the division, the force engineers were located in the FSSG, and the wing engineers were in Marine wing support squadrons (MWSS). When a MAGTF is organized, it pulls engineer assets from one or all of these three organizations, depending on the mission. This organization remains the same today. Because Marine Corps engineers lacked their own doctrine, they adopted the Army's doctrine when the FM 5-100 series was published in the mid-1980s. While the Marine Corps still uses Army doctrine, service-specific organizations are published in Fleet Marine Force Manual 13, *MAGTF Engineer Operations*.

Training

All Marine second lieutenants attend the Basic School at Quantico, where they are assigned an MOS. Assignments are based on their class standing, their staff platoon commander's evaluation, and their individual desires. Upon completion of the Basic School, lieutenants go to their respective MOS schools. Engineer officers attend a 13-week course at the Marine Corps Engineer School, where they learn the basic fundamentals that engineer platoon commanders need to know. However, engineer officers receive most of their training on the job. During fleet tours, engineer officers may be assigned to combat engineer battalions, engineer support battalions, or Marine wing support squadrons. Other assignments include the drill field, recruiting, facilities maintenance, Marine Corps headquarters, Marine Corps Engineer School, and professional and graduate studies.

Enlisted Marine Corps engineers are trained at several locations, depending on their specialty. They receive entry-level training and then return for two career-progression courses at the noncommissioned officer and staff noncommissioned officer levels. Combat engineers receive demolition, bridging, vertical construction, and mine/countermine warfare training at the Marine Corps Engineer School. Marines in the utilities fields of electrician, electrical equipment, and hygiene equipment receive all training at the Marine Corps Engineer School. Engineer equipment operators, mechanics, and engineer assistants (drafting and surveying) receive all levels of training at Fort Leonard Wood, Missouri. Metal workers and refrigeration mechanics train at Aberdeen Proving Ground, Maryland. Bulk fuel specialists train at Fort Lee, Virginia. Enlisted engineers are assigned to Marine divisions, force service support groups, and Marine aircraft wings for duty. They may also become part of the inspector instructor staff at one of the reserve centers throughout the United States. Career enlisted Marines may receive assignments as drill instructors, recruiters, or Marine security guards.



8th Engineer Support Battalion Marines construct a "falling block obstacle" (MONOLITH) at Guantanamo Bay, Cuba.

Present Structure

The engineer mission is based on the way the Marine Corps fights—as a task-organized MAGTF consisting of four elements:

- Command element (CE)
- Ground combat element (GCE)

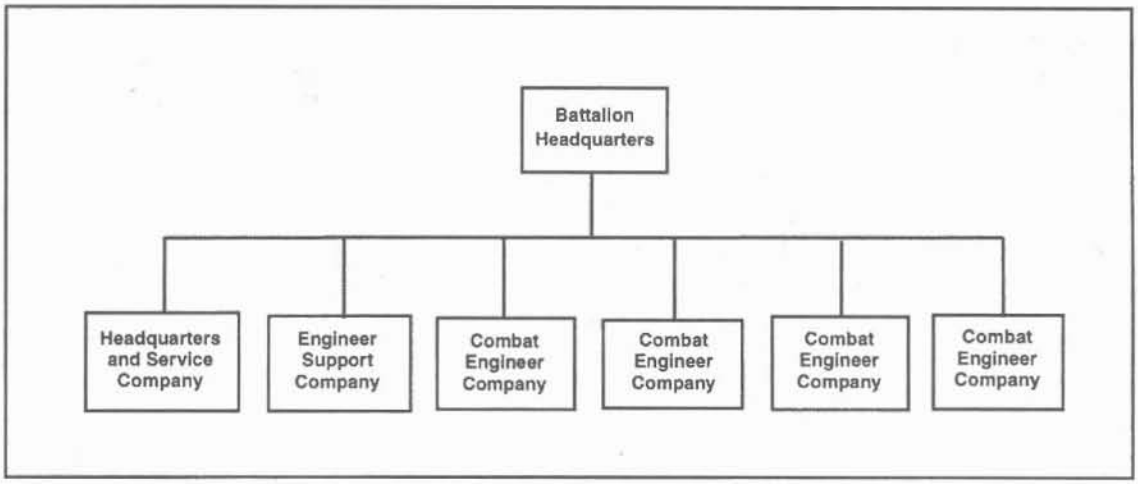


Figure 1. Marine Combat Engineer Battalion

- Aviation combat element (ACE)
- Combat service support element (CSSE)

If the mission dictates, Naval construction forces are attached to the MAGTF and become the fifth element. The Naval construction forces work directly for the MAGTF commander. Each element of the MAGTF has organic engineers. The Marine engineers' role is to support the MAGTF through operations in mobility, countermobility, survivability, and general engineering. However, Marine engineer support to the MAGTF is of an expeditionary nature and does not include the infrastructure building or theater-level construction provided by Naval construction forces and Army engineers. All engineer missions center on support to the MAGTF mission.

Command Element. The command element of a MAGTF includes the commander, the headquarters, and support required for command and control of the MAGTF. The MAGTF engineer serves as a special staff officer to the MAGTF commander. If the engineer position in the command element is not filled, the senior engineer in the MAGTF assumes the job as a secondary duty. The MAGTF engineer is responsible for coordination between the subordinate element engineer officers and, depending on the task organization and mission, Naval construction forces or other U.S., allied, or host-nation engineer assets.

Ground Combat Element. The ground combat element ranges in size from a battalion to one or more divisions. Engineers and their assets in the GCE are sourced from the combat engineer battalion (CEB) organic to the Marine division. The CEB consists of a headquarters and service company, an engineer support company, and four combat engineer companies (Figure 1). The size of the engineer complement varies with the size of the infantry unit to be supported. Normally a company supports a regiment, the platoons support the battalions in that regiment, and the company commander becomes the engineer staff officer for the regimental commander. The missions of the GCE engineers include:

- Performing engineer reconnaissance.
- Assault breaching of explosive and nonexplosive obstacles from the high-water mark inland.
- Employing assault bridge systems and, when augmented, other standard bridge systems.
- Repairing and reinforcing existing bridges.
- Constructing simple and compound explosive and nonexplosive obstacle systems.
- Performing demolition missions beyond the capability of other division units.

Additionally, Marines from the CEB provide mobile electric power to division organizations not authorized generators by their table of equipment and provide augmentation power to the division when required. Division engineers have limited resources in water purification and storage, field hygiene equipment, and vertical and horizontal construction. Division engineers primarily exist to support the maneuver of the ground combat element.

Aviation Combat Element. The structure of the aviation ground support is contingent upon the quantity and variety of aircraft to be supported. The ACE may vary in size from one aircraft squadron to one or more wings. Aircraft in the ACE are—

- Rotary-wing squadrons: UH-1N, AH-1W, CH-53D/E, and CH-46.
- Fixed-wing squadrons: F/A-18C/D Hornet, AV-8B Harrier, and C-130 Hercules.

The ACE may include one or all types of aircraft depending on the mission. Engineer assets organic to the ACE are located in four MWSS in the Marine wing support group. Two MWSS are dedicated to support fixed-wing aircraft and two are dedicated to rotary-wing aircraft (Figure 2, page 21). Normally, one MWSS is located in a Marine aircraft group. An MWSS detachment supports a composite squadron similar to those

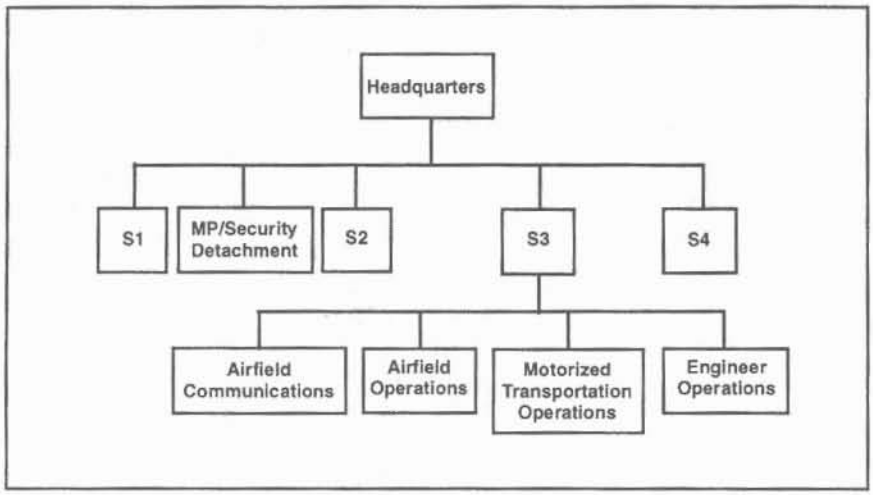


Figure 2. Marine Wing Support Squadron (V) or (R)

deployed with Marine expeditionary units (MEUs).

Wing engineers provide the ACE with limited vertical and horizontal construction capabilities. Airfield construction by elements of the MWSS normally is limited to 900 feet or less. Except for construction of forward area arming and refueling points, total engineer effort is focused on maintaining existing airfields rather than building new ones. When engineer requirements exceed the capabilities of the ACE, additional support may be obtained from the engineer support battalions and/or Naval construction forces. Wing engineer missions include:

- Performing engineer reconnaissance and survey.
- Repairing, improving, and maintaining existing road nets in the ACE tactical area of responsibility.
- Constructing and maintaining expeditionary roads.
- Constructing, maintaining, and improving vertical/short takeoff and landing sites.
- Constructing and maintaining mission-essential base camp requirements (temporary bunkers, aircraft revetments, and strongbacks).
- Providing essential utilities support (mobile electric power, water, potable water production, shower and laundry facilities, and refrigeration services).
- Developing, improving, and maintaining drainage systems.
- Assessing bomb damage and providing rapid runway repair.
- Supporting base material-handling operations.

Additionally, engineers are the bulk fuel commodity managers. They not only receive, handle, store, and operate bulk fuel assets during airfield operations but also set up expedient refueling systems at expeditionary airfields and helicopter landing zones. They are capable of all testing required for fixed-wing and rotary-wing fuels. Explosive ordnance disposal assets are located in the wing to support rapid runway repair and base recovery after attack missions.

Combat Service Support Element. The combat service support element of a MAGTF ranges in size from a small, task-organized combat service support detachment to one or more force service support groups. The CSSE draws its engineers from the engineer support battalion (ESB) organic to the force service support groups. The ESB provides expeditionary general engineering support and engineer combat service support to the MAGTF. An ESB consists of a bulk fuel company, a headquarters and service company, an engineer support company, a bridge company, and three engineer line companies (Figure 3, page 22). The bulk fuel company receives, stores, and dispenses all Class III bulk fuel products for the Marine expeditionary force. Responsibility for the fuel begins when it crosses the shoreline. The engineer support company holds the battalion motor transport, utilities, maintenance, and earth-moving and material-handling assets. Platoons and companies deploying or training receive attachments from the support company as the mission dictates. Combat engineers are located in the engineer line companies.

The missions of the engineer support battalion include:

- Performing engineer reconnaissance.
- Performing deliberate vertical and horizontal construction.
- Providing utilities support to the MAGTF to augment its organic capability.
- Performing demolition and obstacle removal.
- Receiving, storing, and dispensing Class III bulk fuel.
- Performing countermobility and survivability tasks during defensive operations.

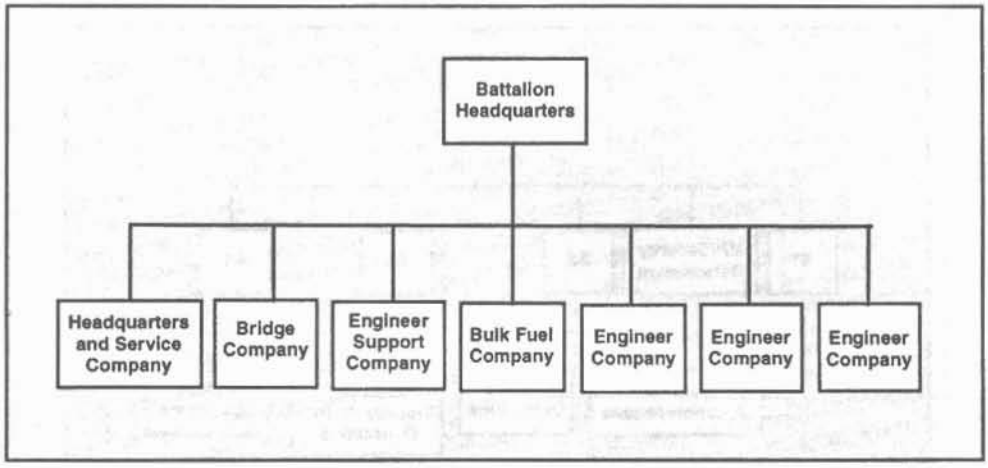


Figure 3. Marine Engineer Support Battalion

- Performing beach preparation and throughput to augment the landing force shore party.
- Reinforcing combat engineer battalions.
- Employing standard and nonstandard bridging.

Explosive ordinance disposal is also located with and managed by the engineer support battalions. However, it is a MAGTF asset and all taskings come from the command element.

Task Organizing a MAGTF. Task organizing for deployment is essentially the same for all MAGTFs smaller then a Marine expeditionary force. Typically, a Marine expeditionary unit is used. Engineers in the ground combat element are sourced from the combat engineer battalion. Engineers in the aviation combat element are from the MWSS engineer operations section, while those in the combat service support element come from the ESB. Each element's engineer section reflects the parent battalion. Often, the parent engineer battalion cannot fill their quotas for the MAGTF due to other operational commitments or shortfalls in staffing. Engineers from the landing support battalion, the maintenance battalion, and the medical battalion can be sourced to fill these quotas.

Recent and Current Operations

Marine engineers deploy year-round. They are found in every MAGTF and participate in every major Marine Corps exercise. Engineers most commonly deploy with a Marine expeditionary unit, as occurred in recent deployment operations to Lebanon, Grenada, Panama, Somalia, and Haiti. In Southwest Asia, Marine engineers played a tremendous role in the survivability, sustainability, and maneuverability of the MAGTF. Recent humanitarian assistance operations have taken engineers to places like the Philippines and Bangladesh to assist in recovery from natural disasters. In 1995, Marines from the 9th Engineer Support Battalion deployed to Sasebo, Japan, to relieve the drought-stricken Navy base. Marines from the East Coast assisted efforts during hurricane relief missions in Florida. Currently, engineers are deployed with three Marine expeditionary units. Other engineers are in Aviano, Italy, in support of the mission in Bosnia, while some are participating in training exercises.

Looking Forward

Every day there is something new that threatens to divert money, resources, and people away from our services. Many feel that each service must protect its own, or soon there will be nothing left to protect. We must overcome this fear and embrace the future of joint operations. Each service possesses skills and equipment that are decidedly unique. Awareness of the capabilities of each service and the proper use of these capabilities in a joint environment ultimately will save our nation's military engineers.

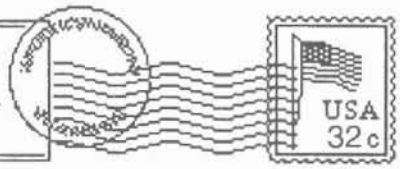
Captain Pratt is the engineer doctrine officer at the Marine Corps Combat Development Command, Quantico, Virginia. Previous assignments include Commander, Engineer Detachment, Marine Expeditionary Unit, Okinawa, Japan; and Commander, Alpha and Bravo Companies, 9th Engineer Support Battalion, Okinawa, Japan.

Reference:

Grelson, Captain J.D., USMC. "Up Front: The Evolution of the Marine Engineer," an unpublished research paper, 1987-88.

Note: This is the last in a series of articles on engineers of other services. See also "Navy Seabees and the Civil Engineer Corps: Providing Skills to the Joint Environment," Engineer, *December 1994, pages 11-17; and "Air Force Civil Engineers: Building Air Power's Foundation,"* Engineer, *August 1995, pages 30-35.*

Letters to the Editor



Techniques and Procedures for Route Clearance

I am the company commander of C/16 EN and have been in the former Republic of Yugoslavia since 27 December 1995. My battalion and company have spent many weeks clearing routes through the ZOS [zone of separation] and clearing bunkers and trenches with the former warring factions. I have worked with Mr. Green in theater and feel that the article he and Mr. Schneck wrote is informative and reflects many of the lessons learned that engineer units here in Bosnia have sent to the rear. [*Engineer*, March 1996, pages 3-10.] However, I take issue with the second survivability technique listed in Table 3 on page 9. The technique is a means of escape from a vehicular mine strike.

The article suggests survivors "dismount onto the road. Do not move onto the shoulders without first looking for AP mines." This suggestion will get people killed. The former warring factions often protect buried AT mines with a triangular pattern of buried AP mines surrounding each mine. Stepping out of a damaged vehicle is not advisable unless one is in ambush and must move quickly.

The mine awareness training my company developed for V Corps prior to deployment teaches survivors to wait for extraction by personnel and equipment in following vehicles or engineers called to extract. A path from the vehicle to safety must be cleared of mines first. Self-extraction is possible if probing equipment and/or mine detectors are on hand.

I am concerned about others following the article's suggestion because it goes against our current training. One lieutenant in 3/4 CAV lost a foot when he stepped on an AP mine within 2 feet of an AT mine that had blown the track off a Bradley.

CPT Robert Floersheim
C/16 EN BN

Authors' reply:

We wish to thank CPT Floersheim for his input to our article and for suggesting an effective countermeasure. As always, the situation dictates. Combat engineers must always be alert to the nature of the threats they face and respond accordingly. When U.S. soldiers encountered the situation he described in Vietnam, it was sometimes necessary to evacuate critically wounded personnel requiring immediate medical attention from mine-damaged vehicles. This was accomplished by passing the wounded to the rear of the vehicle, dismounting onto the track left by the vehicle, and following that track out to safety.

William C. Schneck
Brian M. Green

Engineer School's reply:

If a unit drives into a minefield in Bosnia, the Engineer School recommends that the soldiers remain in their vehicle, report the situation, and wait for mine-clearing assistance, unless they are under fire. If immediate self-extraction is required, they should exit from the rear of the vehicle and carefully walk in the tracks the vehicle made entering the minefield.

Engineers in Bosnia: An Overview

I finally received the March 1996 issue of your magazine and saw a photo on page 19 that really troubles me. The caption reads, "An Abrams M1 tank, with mine roller attached, searches for mines in a field along Route Ostrich in the zone of separation. The field will be used for a joint military mission."

The picture troubles me for several reasons. My main concern is with the soldiers in the picture. Two soldiers appear to be exposed from the waist up. Not only is this wrong because they should never expose that much of their bodies, it is especially wrong if they are searching for mines because, if they detonate a mine with the roller, it would instantly kill them. Another problem is that the cameraman is in front of the tank. Normally tanks clear forward, which would put the cameraman in the uncleared area. Unless he used a powerful zoom lens, the cameraman is probably in the blast radius of most antitank mines. That is not good for the life span of the cameraman. The entire magazine is devoted to mine awareness, which is probably a good idea. If that is the best picture we can find, we definitely need to greatly increase mine awareness in the region.

The only good point about the picture is that it is probably mislabeled. Although it is hazy, you can see where the belly of another tank had scraped the ground in the same place that the tank is going over, so he is not clearing the lane for the first time.

CPT Richard B. Stikkers
C Company, 2nd Engineer Battalion

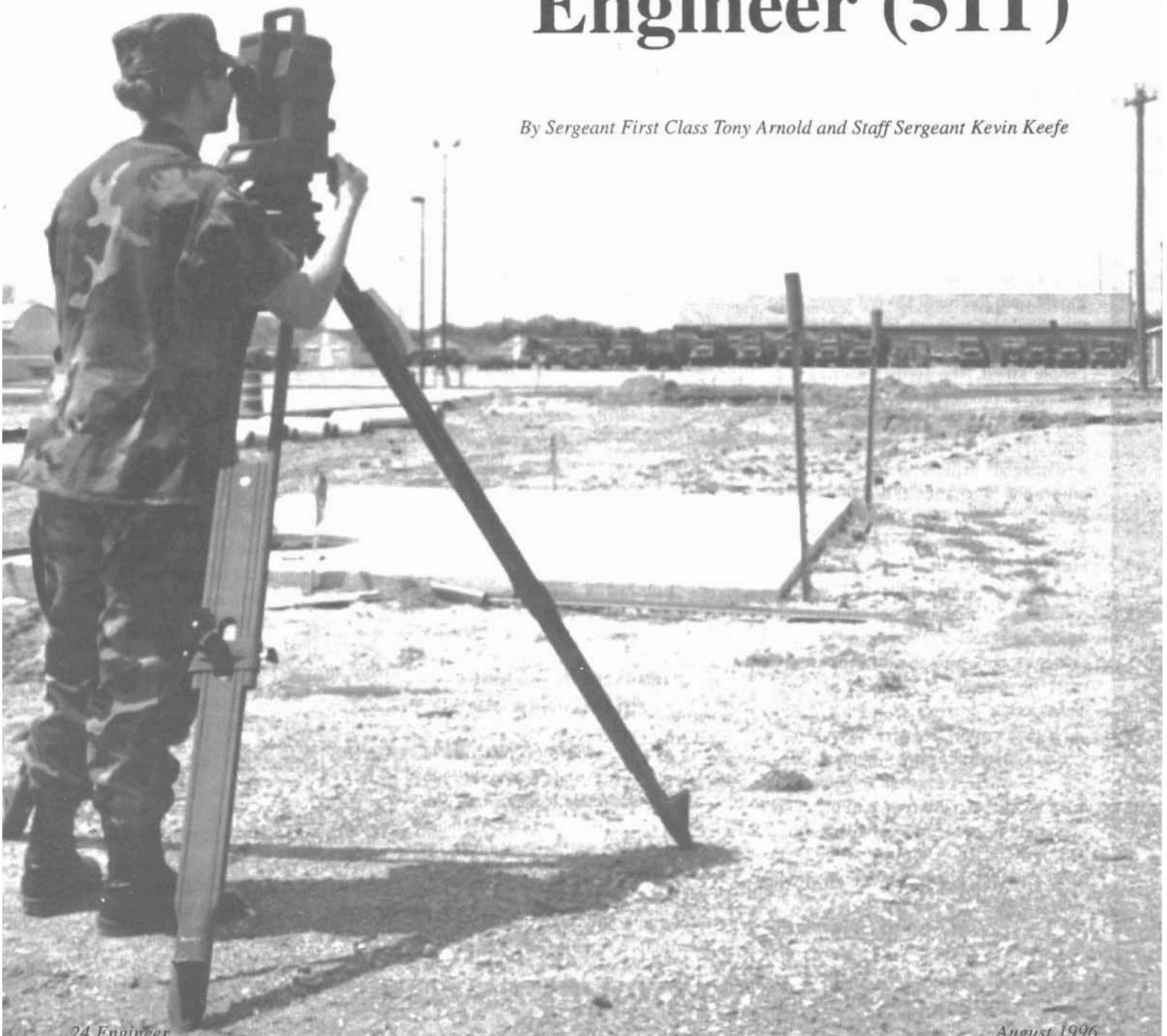
Author's reply:

I appreciate CPT Stikkers' sharp eyes. The picture was downloaded from the Public Affairs Office net on the Internet, and the caption was included with the picture. This is clearly a "photo opportunity." The photo does not depict a tank actively proofing a field for mines. The crew may have backed the tank up along a previously proofed area to take a break. The 'belly scrape' marks in front of the tank indicate the area has already been proofed. For whatever reason, the crew was exposed because the tank was not moving when the photo was taken.

MAJ David Treleaven

Transitioning the Technical Engineer (51T)

By Sergeant First Class Tony Arnold and Staff Sergeant Kevin Keefe



In September 1992, a Task Site Selection Board met to select critical tasks that would consolidate and streamline three military occupational specialties (MOSs): Materials Quality Specialist (51G), Technical Drafting Specialist (81B), and Construction Surveyor (82B). The board convened, voted, and released, and a new MOS—Technical Engineering Specialist (51T)—was born.

As with any new program, growing pains are to be expected, and the 51T MOS has experienced its share. Two problems identified by field personnel in both the active and reserve components are—

- How to train soldiers who held one of the three feeder MOSs and who have a Y2 identifier. The Y2 indicates that a soldier is not qualified in his/her current MOS.
- How to qualify soldiers who want to be reclassified into the new MOS.

Until recently there were no clear-cut procedures to accomplish either of these objectives. This article answers the questions concerning the removal of the Y2 identifier and qualifying the feeder MOS soldiers to 51T. Soldiers reclassifying into MOS 51T must follow guidelines outlined in AR 611-201, *Enlisted Career Management Fields and Military Occupational Specialties.*

Five options are available to remove the Y2 identifier from the 51T MOS:

- 51T Transition Training Course
- Active Component Basic NCO Course (BNCOC)
- On-the-job training program
- Civilian-acquired training/skills
- Wait until 30 June 97, when the identifier is withdrawn

51T Transition Training Course

The best option is the 51T Transition Training Course, which is taught at the Regional Training Institute-North Dakota (RTI-ND) at Camp Grafton, home of the 5th Engineer Training Battalion. The course has two phases:

Phase I consists of 120 hours of instruction in soils, concrete, and conventional surveying. It runs for 2 weeks—7 days a week, 8.5 hours a day. The course includes Campbell Pacific MC-1 Nuclear Densimeter training and operator certification.

Phase II also consists of 120 hours of instruction—84 hours of automated surveying, using the Geodimeter 444 automated integrated survey instrument (AISI), and 36 hours of computer-aided design and drafting (CADD), using AutoCad LT and the theater construction management system (TCMS).

Additionally, RTI-ND will offer separate TCMS training once each quarter beginning in FY97.

The following courses from the Army Correspondence Course Program (ACCP) are prerequisites for Phase II:

- EN0591, *Surveying I*
- EN0592, *Surveying II*
- EN0594, *Surveying IV*

Soldiers who held the 81B or 82B MOS must attend both phases of the transition course to acquire the automation training. The Commander, RTI-ND may waive the ACCP subcourse requirement for the 82Bs. Soldiers who held the 51G MOS are exempt from Phase I but must attend Phase II. Completion of these requirements qualifies a soldier in the 51T MOS and removes the Y2 identifier.

51T Basic NCO Course

For qualified soldiers, the second option is to attend the active component BNCOC for MOS 51T. Upon successful completion of this course, the soldier's Y2 identifier will be withdrawn.

On-the-Job Training Program

The third option is an on-the-job training program. The only requirement is that the program be approved by the soldier's chain of command and the U.S. Army Engineer School's Directorate of Training and



A student performs automated drafting in the RTI-ND computer lab.

Doctrine (DOTD). This option was difficult to accomplish until the recent release of the Skill Levels 1 and 2 Soldier's Training Publication (STP) and Trainer's Guide (TG). This manual serves as a guide to develop the unit training plan.

To enroll a soldier in this program, the chain of command must submit a memorandum to the 51T senior training developer at DOTD. The memorandum should include:

- Tasks on which the soldier is to be trained.
- Tasks for which the soldier already meets the requirements (include all supporting documents).
- Estimated time needed to meet the requirements.

After DOTD approves the plan, it is returned to the requesting unit. When the soldier meets the requirements of the STP, the unit will submit the soldier's name and social security number to remove the Y2 identifier. With this method, several soldiers can be trained at the same time.

One drawback to the on-the-job training program is that it does not include certification with the Campbell Pacific MC-1 Nuclear Densometer. All soldiers must complete the required training for the MC-1, which currently must be conducted by a qualified instructor or operator.

In addition to the Transition Training Course, three options are available to personnel to meet the requirement for certification on the MC-1. The training plan should include one of the options listed below if the soldier has not attended the training previously. This certification is only required once during a soldier's career. An operator's certificate will be issued by the Engineer School or RTI-ND, and it is the only certificate authorized to represent validation as a certified operator on the MC-1.

- A mobile training team from the Engineer School or RTI-ND may be sent to the unit at the unit's expense. The unit must submit a request for training to the school or RTI-ND for this option.
- An interactive CD-ROM training course developed by the Engineer School will be available in late August 1996. This training must be conducted at the unit by a previously certified operator. No cost to the unit is anticipated.
- A 14-hour block of instruction conducted during the 51T10 course at Fort Leonard Wood. The unit must coordinate with the 1st Engineer Training Brigade at Fort Leonard Wood to attend this instruction.

Civilian-Acquired Training

The fourth option available for training personnel is civilian-acquired skills. Six credit hours of CADD training at a college or technical school meets the requirements for the drafting training. Materials testing training is available through the Corps of Engineers Waterways Experiment Station at Vicksburg, Mississippi. Survey training on the Geodimeter 444 is more difficult to obtain in the civilian sector. However, a new equipment training team contracted by the U.S. Army is providing the training to units Armywide. Soldiers who complete this training meet the STP requirements for tasks using the Geodimeter 444. Certification on the MC-1 must be completed as described in the OJT program.

Waiting Until June '97

Army Regulation 611-201 establishes the termination date for the Y2 identifier for MOS 51T as 30 June 1997.

Conclusion

While waiting for the termination date to remove the Y2 identifier from a soldier's MOS is an option, it is not recommended by the Engineer School. This method will not produce well-trained and motivated soldiers. A combination of the other options may be approved by the school and, in many cases, completion of these options will qualify a soldier for MOS reclassification. It is important for leaders to remember that whatever option(s) are chosen, prior coordination with the Engineer School will speed the process and streamline the approval process..

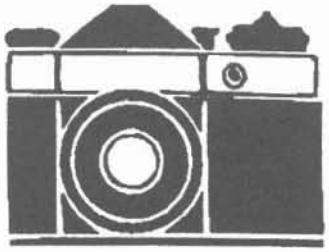
Address questions concerning the Transition Training Course to: Commander, Regional Training Institute-North Dakota, 5th Engineer Training Battalion, ATTN: SSG Kevin Keefe, RR 5, Box 278A, Devil's Lake, North Dakota 58237. SSG Keefe may be reached at (701) 662-0400 or DSN 344-5226, extension 400.

The point of contact concerning MC-1 Nuclear Densometer training at the 1st Engineer Training Brigade, Fort Leonard Wood, is Mr. Ron Winrich, (573) 596-5410.

For other information, contact SFC Walter Mortimer at (573) 596-0131, extension 37593, or DSN 676-7593; or SSG Tom Hylsky, (573) 596-0131, extension 37511, or DSN 676-7511.

SFC Arnold served as the 51T senior training developer at the U.S. Army Engineer School, Fort Leonard Wood, Missouri, from 1992 to 1996. Previous assignments include 51G senior instructor, Fort Belvoir, Virginia; combat construction NCO, 44th Engineer Battalion, Korea; technical engineer, 84th Engineer Battalion, Hawaii. He is a graduate of the 51T Basic NCO Course and the CMF 51 Advanced NCO Course and holds an associate degree in construction management from Park College, Parkville, Missouri.

SSG Keefe, the 51T NCOIC at the 5th Engineer Training Battalion, assisted in the design and development of the 51T Transition Course. Previous assignments include squad leader, B Company, 397th Engineer Battalion, LaCrosse, Wisconsin. SSG Keefe was an instructor for 51B10 and 51K10 Courses, Phase II of the 12 CMF Basic and Advanced NCO Courses, and Phase II of the 51H Basic NCO Course. He is a graduate of the 51T10 Advanced Individual Training Course.



Snapshots From a Liaison Officer

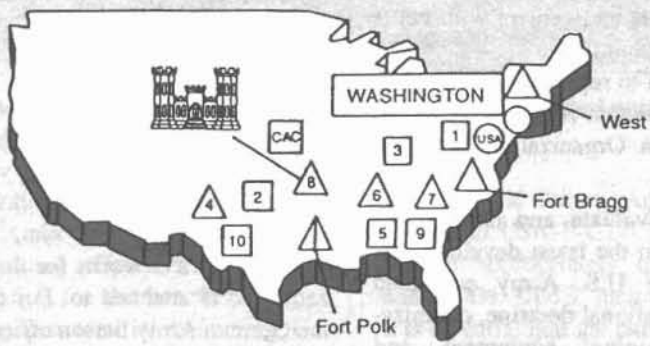
By Lieutenant Colonel Reinhold Hocke

Observations from the German Army Liaison Officer concerning the U.S. Army Corps of Engineers and his four-year tour at the U.S. Army Engineer School.

Throughout my military career, I have enjoyed many contacts with U.S. Army engineers in Germany. As a company commander I shared a unit citation with the U.S. partnership unit, Delta Company of the First Infantry Division (Forward), at that time stationed in Neu-Ulm, later in Goeppingen, Germany. The award was presented by CINC USAREUR, General Kroesen. I share many memories with engineer officers and soldiers of the U.S. Army Corps of Engineers who served tours in Germany. Cooperation with U.S. and allied army engineers has always been part of my life in the German military.

During recent discussions, the Commanding General of the Engineer Center, Major General Gill, encouraged me to share some "snapshots" of my tour here with the readers of *Engineer.* Information flow includes both receiving and giving. Having received so much from U.S. Army engineers in the last four years, it is a pleasure to give a little information back. First I will explain the mission and organization of the German Army liaison organization (see chart). In conversations with Americans, I am often asked to describe the German Army liaison officer's job.

German Army Liaison Organization in the U.S.



Army Main Liaison Staff	Army Liaison Staff
Army Liaison Officer	Observer/Controller (O/C)
HHptVStab (USA) Fort Monroe*	U.S. Army Training and Doctrine Cmd (TRADOC)
HVStab USA CAC Fort Leavenworth*	U.S. Army Combined Arms Center
HVStab USA 1, Fort Lee*	Combined Army Spt Cmd
HVStab USA 2, Fort Sill*	Field Artillery Center and School
HVStab USA 3, Fort Knox*	Armor School
HVStab USA 5, Fort Rucker	Aviation School
HVStab USA 9, Fort Benning*	Infantry School
HVStab USA 10, Fort Bliss	Air Defense Artillery Center and School/USASMA
HVO USA 4, Fort Huachuca	Intelligence Center
HVO USA 6, Fort McClellan	Chemical School
HVO USA 7, Fort Gordon	Signal School
HVO USA 8, Fort Leonard Wood	Engineer Center
HVO USMA, West Point	U.S. Military Academy
HVO XVIII, Fort Bragg	XVIII (US) Airborne Corps
O/C JRTC, Fort Polk	Joint Readiness Training Center

* Installations with a battle lab.

The Commander of the German Armed Forces Command, United States and Canada, is the superior for all German soldiers in the United States, excluding military attachè personnnel. He is headquartered in Reston, Virginia. The German Army Liaison Organization, USA, is a subordinate element that is colocated with Headquarters TRADOC, at Fort Monroe, Virginia. It provides a direct means of liaison between the German Ministry of Defense's Army staff with its subordinate elements and selected U.S. Army agencies and facilities. These include TRADOC, the Combined Arms Center (CAC), the National Training Center, the United States Military Academy at West Point, and the service schools and centers with battle laboratories.

In addition to representing the interests of the German Army, the German Army Liaison Organization is tasked to—

- Obtain, evaluate, and assess information on the latest developments regarding U.S. Army command and operational doctrine, organization, training, equipment, and logistics, and to report pertinent recommendations to the German Army Office.
- When invited, inform and brief U.S. agencies and officer and NCO course students on the German armed forces in general or any particular combat engineer subject.
- Attend and report on authorized field exercises and trials.
- Carry out assignments in response to specific requests for information.

While at Fort Leonard Wood I have written more than 100 reports to the German Ministry of Defense. Numerous letters, phone calls in country and to Germany, meetings, and TDY travel activities are also part of the job.

The liaison mission essentially is about communication between our respective armies. At Headquarters TRADOC, CAC, and those U.S. Army centers owning a battle lab, the German Army is represented by a main liaison staff or by a liaison staff consisting of at least a senior lieutenant colonel and a sergeant major. Since TRADOC is scheduled to stand up the "Maneuver Support Battle Lab" at Fort Leonard Wood in October 1996, the German Army will keep the sergeant major's position here.

"The mentality and thinking of Americans differ from those of Germans or other Europeans because the United States and its armed forces have never really suffered from a lack of natural resources."

To many, the difference between a liaison officer and an exchange officer seems unclear. However it is very simple: The liaison officer works for the organization that sent him, and the exchange officer works for the organization he is attached to. For example, the German Army liaison officer works for the German Army, while the British exchange officer in the Directorate of Training at the U.S. Army Engineer Center works for the Engineer School's Director of Training.

Let me now provide some impressions. I have enjoyed my appointment at the U.S. Army Engineer Center very much and have seen and learned a lot about the world's only remaining military superpower, the U.S. Army, and the Army Corps of Engineers. Since 1967, the German Army liaison staff at Fort Leonard Wood has always enjoyed working with open-minded people who are aware of the importance of sound allied relations. I have met very few people who were not interested in NATO, allied, and U.S.-German interoperability issues. I have always enjoyed open discussions where I could pass on information about the German Army that is relevant to U.S.-German Army engineer interoperability.

I have a lot of admiration for the U.S. Army. But I would not be frank if I did not admit to some concerns acquired during my dealings with U.S. Army personnel over the last few years.

Doctrine

Military doctrine is subject to many influences and parameters. Today's high technology obviously has a major influence on it. However, it was most interesting for me to learn and understand to what extent resources influence military thinking and doctrine. In this assignment it was important for me not only to get acquainted with the U.S. armed forces but also to learn about American culture by traveling around the country and learning some of your history. I am deeply impressed to what extent the availability or lack of resources influences a nation's mentality and thinking. The mentality and thinking of Americans differ from those of Germans or other Europeans because the United States and its armed forces have never really suffered from a lack of natural resources. Think about that.

Training

The U.S. and German Armies are starting a cross-training program for engineer officers. This program will be relevant for career development and assignments such as liaison officers. The program's payoff will be a broader and better understanding of the capabilities and limitations of both our armies. As a result of this program, the effectiveness of bi- and multinational operations will increase.

Germany sent the first students to the Engineer Precommand Course and the Engineer Officer Advanced Course (EOAC) at Fort Leonard Wood in 1996 to gain a better understanding of U.S. Army engineer operations. On a reciprocal basis, the first U.S. Army engineer officers recently attended the German EOAC at Munich. I do not believe an inability to speak German is



Photo courtesy MaK System Gesellschaft

The mine-clearing vehicle Keiler (or"Wild Boar") in action. The Keiler successfully clears both buried and surface-laid land mines. It is employed with the German Army engineer contingent in Bosnia.

an obstacle for this program. Many U.S. Army engineer officers are fluent enough in German and would have no difficulty attending courses at the German Army Engineer School.

Training is a main key to success. Learning about training in the U.S. Army and on Fort Leonard Wood makes me think about the influence of a nation's educational system in general, and vocational training in particular, in providing relevant and useful trade skills. Most of the recruits joining the German armed forces (both regular soldiers and conscripts) are well trained in trade skills. So a plumber, mason, electrician, or carpenter has three or more years of vocational training when he joins the German Army Corps of Engineers. Because the German Army takes advantage of the soldier's civilian trade skills, it must provide training only for his military skills.

I was frankly impressed by the efforts U.S. armed forces must take to provide well-trained soldiers with appropriate trade skills to complete their missions. The engineer Interservice Training Review Organization, recently established on Fort Leonard Wood and various Air Force and Navy bases, is the evidence. By realizing your training efforts, I have gained appreciation for the benefits that conscription provides in resourcing Germany's armed forces with well-skilled tradesmen.

Army engineers cooperate with coalition forces sometimes down to the company level. This creates a demand for engineer officers and NCOs to have some knowledge of the capabilities and limitations of attached foreign formations. The Euro-NATO Engineer Training Center, hosted by the German Army Engineer School in Munich, has the mission to train military leaders from squad level up to battalion commander in engineer interoperability and standard NATO procedures. Many allied engineer NCOs and officers have attended these courses and should continue to do so.

Sending students to allied nations for training is not just a question of diplomatic relations. Today, joint, combined, and multinational military operations are common. The success of these operations is closely related to the quality of cooperation within the multinational forces. At least the two binational US/GE-GE/US Army Corps require appropriately trained officers and NCOs. Under such circumstances, it is essential that the participating military forces understand the capabilities and limitations of the national military forces being committed to these special task forces.

Leadership

What is *leadership* all about? Millions of words have been written about leadership, motivation, and counseling. For years scientists have tried to penetrate the human psyche to find more ways of getting the job done.

A leader needs—

- Realism and imagination.
- Receptiveness and strength of character.
- Self-assurance and adaptability.
- Modesty and moral firmness.
- Patience and a sense of justice.
- Inward composure and excellent professional skills.

- Stamina and outstanding physical fitness.

Leaders must decide quickly, courageously, and prudently; promote comradeship; strengthen the sense of responsibility in their soldiers; take resolute action; and set an example.

All of these pearls of wisdom are from just two pages of the German Army Field Manual 100/100, which is equivalent to the U.S. Army's FM 100-5. Had I continued to turn pages, I would have found much more. Do you fulfill all those requirements? I don't! Nor did Frederick the Great, Blucher, Clausewitz, or Rommel. Did George Washington, Patton or MacArthur fulfill them all?

Leadership means the ability to get other people to do what you want them to do. But there are two sides of that coin: First you must know what is to be done; then you must make your soldiers do the job. That involves more than simply issuing orders according to NATO and STANAG regulations. It is more, also, than the ability to inspire or force your will upon others. Hitler, Stalin, Saddam Hussein, and other scoundrels of world history had those qualities. We lead free men and women who think and know their rights. They will fight for a just cause, but we must prove it is a just cause. They will not fight for justice if we treat them unfairly or fight for freedom if we put them down. They will follow us if we prove our honesty and integrity, and if they experience our compassion and morality.

How do we prove that? One simple four-letter word clearly describes what real leaders must do: *care*. We must care about our soldiers and care for them, because anyone who wants to lead people must like people.

If you care, you listen to your soldiers. I don't mean the stilted baloney that some superiors ask: "How old are you, son? Where are you from? Thank you, next man." I'm talking about real listening—because a soldier probably will not tell you when everything is all wrong. He'll be a little hesitant. If you ask a soldier how he's doing and he just nods or shrugs, you know he's doing poorly and you need to dig a little deeper.

You care if you really wonder what your soldiers do both on and off duty. If PFC Miller does not go to the movies with the rest of the squad, you care if you wonder why. You care if you wonder why PFC Jones has flunked weapons inspection for the third time in a row. And you care if you stand up and tell the commander that your men were not slow but your plan was faulty.

You care if you share their problems, their hardships, and their jokes. Your soldiers are as lousy as you let them be, and they are as good as you make them be.

You care if you make them proud and don't humiliate them. Your soldiers won't be brave if you abuse and cower them—and they won't be strong if you break them. You know they won't be respectful and obedient if you haven't treated them with the respect and dignity that fosters personal pride.

There is a very fine line between firmness and harshness, between strong leadership and bullying, between discipline and "chicken". We must find that line and we will—if we care!

I'm not sure that the following observation is correct, but I've noticed over the past few years that some military leaders act more "boss-oriented" than "mission-oriented." If we get the mission done properly, our boss will be happy. But keeping the boss happy does not always mean getting the job done. Think about that. In my estimation, good leaders focus first on the mission.

Organization

The U.S. Army is focused on Force XXI. In this scenario, we digitize the battlefield using high-tech, state-of-the-art electronic equipment to improve the combat power of the force. Force XXI will consume a lot of energy and resources. But we Army engineers should not forget that most of the physical and mechanical missions will not be done by computers.

For the foreseeable future, we will still need an adequate number of well-trained "damned engineers" to deal with mud, snow, land mines, river-crossing sites, etc. Planners sometimes forget that future wars, just like those in the past, will be determined by the adequately equipped combat engineer working side-by-side with his fellow soldiers of the combat arms. Reducing the number of combat engineers may lead to a loss in combat power.

Materiel

Today, the U.S. Army's credo is to fight and win the war by first fighting and winning the information war. This vision of "Army XXI" is focused on digitizing the battlefield. In this arena the U.S. Army is second to none. A huge research and development (R&D) world is pushing this issue forward. While visiting U.S. Army, Air Force, Navy, and Marine Corps R&D installations, I noticed some duplication and redundancy of efforts, which is nothing new for a super-sized organization. On the other hand, it may be prudent to focus R&D efforts more on users' needs. Let me explain.

While visiting U.S. Army combat engineer units, I saw aging and worn-out engineer equipment that needs to be replaced. The U.S. Army Corps of Engineers has struggled with this problem during all the years of my assignment at the Engineer Center. I sincerely hope that urgently needed new equipment will be fielded within the next few years. If you need help in the interim, ask your fellow German Army engineers for support. We have engineer equipment, such as the new mine-clearing vehicle Keiler, that may meet your requirements (see photo, page 29).

Soldiers

A resource all armies must handle very carefully is the soldiers. Belonging to an army that recruits female soldiers only to a limited extent, it was a new experience for me to learn about gender-integrated training and equal promotion opportunities for female officers and NCOs. I have followed with interest the ongoing discussions about which positions should be opened to females or kept closed.

I admire the willingness and good morale of young American soldiers—they show pride in what they do. Recently I had an opportunity to visit U.S. engineer units in Bosnia. Even though I spent only a few hours with the Task Force Eagle engineers, I was deeply impressed by their discipline, confidence, and commitment.

I am very grateful to the fine soldiers and officers I served with in the United States. I would go to war with American soldiers any time because I know that I can trust them. They are committed to readiness and dedicated to victory. Many things are done differently over here, but I got reaffirmance again and again that we can rely on our U.S. allies. It has been a privilege to serve a four-year tour with the U.S. Army Corps of Engineers. I thank all of you who I had the chance to meet for your support and friendship. Auf Wiedersehen and Essayons!

Lieutenant Colonel Hocke served as German liaison officer to the U.S. Army Engineer School and Center, Fort Leonard Wood, from August 1992 to September 1996. He previously served as commander of the German 61st Engineer Battalion, 6th Armored Infantry Division; and staff officer engineer and senior combat engineer officer, Headquarters Allied Forces Central Europe. LTC Hocke is a graduate of the German General Staff Officers Course at the Federal Armed Forces Command and General Staff College in Hamburg.

Book Review



Breaching Fortress Europe: The Story of U.S. Engineers in Normandy on D-Day, by Sid Berger. Kendall/Hunt Publishing Co., Dubuque, Iowa, 1994, 272 pages.

By Lieutenant General Daniel W. Christman, Superintendent, United States Military Academy.

Assault landing on a fortified coastline, arguably an army's greatest challenge and an engineer's greatest nightmare, has been masterfully captured by Sid Berger with insight, detail, and thoroughness honed through firsthand experience and in-depth research. A veteran of amphibious operations in Sicily, Italy, and Normandy, the author has written one of the most compelling and comprehensive accounts of Operation Overlord. His focus on engineer units and their tactics and techniques, so crucial to the success of this complex operation, is unique and long overdue.

Breaching Fortress Europe is a definitive and accurate account of the planning and execution of the D-Day assault on Omaha and Utah beaches. Sid Berger has produced a readable story that strikes an excellent balance between a narrative that is easily understood by nonengineers and one that is technically useful to combat engineers and military historians. The significance of the book has been recognized in several independent reviews, one of which was highlighted in the March/April 1995 issue of *Military Review.* One quote from that review captures the essence: "Berger's book should be combined with S.L.A. Marshall's *Night Drop* and Cornelius Ryan's *The Longest Day* for the background and framework upon which these build."

Although other works have portrayed in detail the activities of 6 June 1944, the author's focus on engineer cross-channel planning and engineer support to landing-force preparation and invasion-force marshaling and embarkation is unique and refreshing. His description of the enemy's prepared positions, stretching 2,400 miles with more than 15,000 fortified positions laced with extensive mines and wire obstacles, provides a rich picture of unique engineer factors affecting the operation. By highlighting the engineer units' participation, he leaves no doubt as to the importance of their effort and sacrifice to the successful outcome of the entire operation.

The inclusion of four 18" x 22" full-color, top-secret Bigot maps of Omaha and Utah beaches, one of which the author personally used during his landing on Utah beach, is especially noteworthy. Also of interest are the many original drawings, illustrations, maps, and photographs that depict the varied and complex nature of the operations. A "must read" for the serious student of military history; pure intellectual enjoyment for the rest of us. And for combat engineers, it is a particularly moving, emotional account of heroism that has rarely been equaled in the annals of warfare.

Proceeds from the sale of this book, which was produced by the Society of Military Engineers, will be used to repair and maintain five engineer battle monuments on Omaha and Utah beaches. These monuments are fully described in an appendix to the book.

Note: Engineer *is seeking insightful reviews of books of special interest to military engineers. Contributions are welcome.*

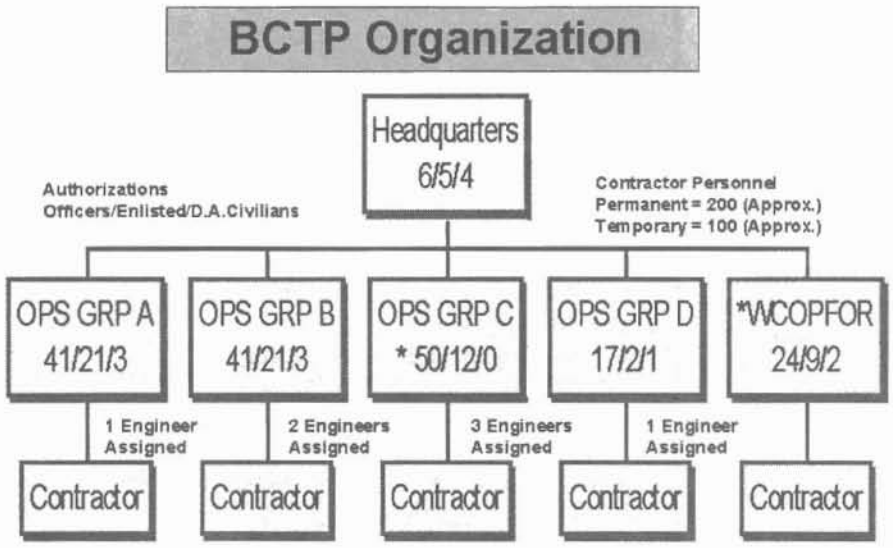
BCTP: Warfighter Exercises Strengthen Battlefield Performance

By Lieutenant Colonel Gregory Stanley and Lieutenant Colonel David Snodgrass

The Battle Command Training Program (BCTP) is the Army's capstone combat training center. Initially formed to conduct realistic, stressful exercises for division- and corps-level commanders and staffs, it has expanded over the last three years to include exercises for National Guard brigades and the Army component of joint exercises. The following information describes recent changes in the BCTP and some perceptions (current trends) of the senior observers and observer/controllers based on recent corps and division exercises.

BCTP Missions

The BCTP consists of four lettered operations groups (teams). Operations groups A and B are responsible for the traditional division and corps BCTP rotations. These groups conduct a seminar for the commander, primary staff, major subordinate commanders, and associated battle staff, ideally within the first 3 to 6 months of a new command. The seminar is normally held at Fort Leavenworth. It offers a unique opportunity for a new commander to divorce himself from the daily peacetime activities of command and to focus specifically on warfighting, team building, and relating his warfighting philosophies to those of his staff and subordinate leaders. Using an order similar to one to be issued during a subsequent warfighter exercise (WFX), the staff conducts portions of a deliberate tactical decision-making exercise. This exercise is a vehicle for initiating professional discussions and information exchanges between unit personnel, observer/controllers, and senior observers. The senior observers are retired three- and four-star general officers who contribute their experience by mentoring the process. (Currently they are GEN(R) Cavazos, GEN(R) Lindsay, GEN(R) Burba, GEN(R) Franks and LTG (R)



Grange.) The actual WFX is conducted at the unit's home station 3 to 6 months after the seminar and pits the unit against a world-class opposing force that fights from the National Simulation Center at Fort Leavenworth. A corps battle simulation (CBS) drives the WFX. (See box for recent improvements to CBS.)

Another operations group, Team C, was added in the summer of 1993. It conducts two phases of realistic and challenging training for Army National Guard brigade and battalion commanders and their battle staffs. In the first phase, the brigade commander, his subordinate commanders, and the brigade staff attend a five-day decision-making seminar at Fort Leavenworth. Observer-trainers lead the staff through the deliberate decision-making process and conduct workshops, a JANUS exercise with the battalions, and an after-action review (AAR). Approximately 3 months later the rest of the brigade command and control cells participate in a 30-hour brigade battle exercise using a brigade/battle simulation that is based on the plan developed during the seminar. Two AARs are conducted during this phase. The same group of senior observers mentor the brigade commander and staff during both the seminar and the brigade/battle simulation.

The fourth operations group, Team D, was formed in 1994. It participates in joint exercises and provides assistance during real-world contingencies. While the other operations groups set up and control exercises, this team focuses on exercises developed and organized by major Army commands and joint commands. Recent examples include Ulchi Focus Lens, in Korea; Frontera Libre, in Panama; and Unified Endeavor, with the Atlantic Command. Team D has also provided assistance with real-world contingency operations in Bosnia, Somalia, and Haiti and for the Southern European Task Force in Italy and the Allied Command Europe's Rapid Reaction Corps. In existence for less than two years, Team D has provided assistance for 22 exercises and contingency operations. No other service has an equivalent organization, making this operations group highly sought after for its expertise in joint operations.

1996 Perceptions

Each year BCTP publishes perceptions of observations from WFXs. These generally are common trends collected from recent rotations that identify areas in which the Army should collectively improve. The following engineer-related observations are from 1995-96 division and corps operations.

Integrate engineer effort into the entire battlefield framework.

Perception: Develop situational obstacles for the deep fight.

Discussion: Scatterable minefields emplaced to support the deep fight often lack a detailed plan for execution and synchronization with other operating systems to achieve a specific effect. As a result, helicopters and Air Force aircraft

CBS Improvements

CBS is constantly changing, and the Engineer School recently made several enhancements to improve the fidelity of engineer play. For those who have not participated in a WFX recently, a summary of those improvements follows:

- Engineers now show up as separate icons and can be task organized. They used to be invisible and conducted work as engineer task teams (ETTs). Because engineer units and equipment now can be seen by opposing forces, intelligence simulation with engineers is greatly improved. This change also allows engineers to continue functions such as breaching while in contact. Formerly, the ETTs would abort work upon any contact with the enemy.
- The number of engineer tasks that can be performed is expanded. Previous versions allowed only one type of minefield. Now the simulation discriminates between surface-laid, buried, antitank, antipersonnel, and scatterable mines. Breaching can be done by various means, such as MICLICs or tanks with rollers and plows, which the operator selects. The time required to complete tasks is based on the resources on hand; the more forces available, the less time required. Multiple breach lanes can be established through all minefields.
- Operations previously done by "work around" now are performed as integral parts of the simulation. (A "work around" is an action taken outside of the simulation through a specific set of rules.) For example, tactical bridges now can be constructed, removed, or destroyed. Fixed bridges can be destroyed or repaired, and runways can be cut and repaired. Point obstacles can be detonated on command.
- Survivability improvements allow specific units to be dug in, according to the survivability levels described in FM 5-103. In previous versions, engineers fortified a piece of terrain, and all units received additional protection by occupying terrain close to the dug-in unit. The simulation now calculates how much earth must be moved to dig in a piece of equipment and applies earth-moving rates to the pieces of engineer equipment allocated to the task. The time required depends on the assets available and what is dug in. The protection is directional and applies only to the equipment, personnel or unit supported.
- Work-arounds have been added to allow for future engineer equipment tested during EXFOR warfighter rotations and Prairie Warrior. These include wide-area munitions, intelligent minefields, the Grizzly, and stand-off-minefield detection systems.
- Efforts are ongoing to drastically improve the corps battle simulation of terrain. Conceptually, rates of movement will vary depending on the slope, condition of the route, and vegetation. The flat terrain board of the current system will be replaced with a three-dimensional model that will affect both aviation and artillery.

"The planning requirement for situational obstacles is the same as that for all obstacles; scatterable minefield delivery systems are just a faster method for emplacement."

are placed at risk emplacing obstacles that have little impact on the enemy, and direct and indirect fires are not planned to take advantage of obstacle effects. Division and corps staffs should identify the named areas of interest (NAI), decision points (DP), and targeted areas of interest (TAI) to support scatterable minefields in the deep fight. The planning requirement for situational obstacles is the same as that for all obstacles; scatterable minefield delivery systems are just a faster method for emplacement.

Perception: Anticipate the transition to the defense.

Discussion: Division and corps staffs seldom plan for battle culmination. Additionally, they do not use the reverse planning sequence, starting with actions on the objective and working back toward actions in the assembly area. As a result, engineers have a difficult time successfully planning and conducting the transition to the defense. Changes to task organizations often are made without considering their potential impacts on current activities or the status of engineer units. During the planning process, units should identify the best terrain to defend throughout the offensive zone and the Class IV and Class V requirements for each potential line of defense. Engineers need that information to determine the task organization changes needed to support the transition.

Perception: Allocate resources to conduct general engineering tasks.

Discussion: Many units sacrifice general engineering requirements in order to support close operations. This may not cause problems during a relatively short WFX conducted in a computer-simulated environment, but it does not replicate the engineer support that maneuver units will expect over a long duration in a deployment. To train as we will fight, units must balance the requirements of the close fight with the general engineering tasks required to sustain units over an extended time period.

Exploit engineer expertise in the intelligence preparation of the battlefield process.

Perception: Engineers seldom "think red."

Discussion: Friendly engineers must be "experts" on enemy engineers. We must know the enemy engineer structure, how they are organized, their equipment, and how enemy engineers are employed in various situations. Engineer planners and S2s use that knowledge to predict enemy engineer actions and the effort required for each identified course of action. We provide that information to commanders, intelligence staff officers, and subordinate engineers. To provide useful tips on probable enemy actions, we must evaluate how, when, and where the enemy uses engineer reconnaissance teams, mobile obstacle detachments, movement support detachments, and bridge units. Ultimately we want to predict the enemy's main effort and deception efforts. Prediction is the bottom line, not regurgitation of information.

Perception: Continuously estimate enemy engineer capabilities based on the battle damage assessment.

Discussion: Engineer planners should allocate resources based on actual and anticipated requirements derived from enemy capabilities. Many units initially assess enemy capabilities based on known strengths and time available. They often fail to track enemy losses or update their probable capabilities based on the passage of time and changes in strength. As a result, friendly units often find themselves facing more (or occasionally less) engineer effort than anticipated and templated. Many units allow the enemy to construct or improve his defense. They tend to ignore enemy engineer targets in favor of enemy air defense, artillery, and command and control targets. Enemy engineers should be considered in the division and corps high-payoff target lists.

Perception: Template and disseminate enemy engineer effort based on their known capabilities.

Discussion: Engineers should apply their knowledge of terrain and enemy engineers to template enemy engineer efforts. This template, derived from known enemy engineer capabilities, should be revised and updated frequently to reflect new data gathered in a focused and integrated information-collection effort. Units should devise a system to disseminate the template when it is revised. The All Source Analysis System (ASAS) is a great option for disseminating information. The engineer S2 can also use ASAS to search for reports of enemy engineer activities the G2 might not otherwise disseminate. Unfortunately, not all divisions resource their engineers with ASAS.

Perception: Coordinate efforts of the engineer S2 and the G2 to take advantage of their individual strengths.

Discussion: Units must delineate intelligence responsibilities for products based on the skills each intelligence officer brings to the collective table. Many units duplicate efforts on enemy obstacle tracking, with both the G2 and the engineer S2 following reports and tracking obstacles. Often, neither of them uses confirmed obstacle reports or their knowledge of terrain, enemy capabilities, and enemy doctrine to template additional obstacles. Coordinating their efforts will focus data-collection activities and enhance the picture of the enemy defense. The engineer S2 offers the unit a tremendous capability when he maintains and updates the obstacle database for the entire unit because he can ensure that all subordinates have

access to a common picture of the battlefield. With that database and his unique knowledge of terrain, defense construction techniques, and enemy engineer capabilities, the engineer S2 is the ideal person to assign obstacle templating responsibilities. Updated obstacle status and templates based on dynamic enemy engineer capabilities give commanders (including subordinate unit commanders) and their staffs valuable clues to identify the enemy defensive array. Division engineers should get an ASAS terminal for their S2 and exploit ASAS to assist in this function.

Integrate obstacles to enhance other battlefield operating systems.

Perception: Develop an obstacle plan that supports the scheme of maneuver.

Discussion: Divisions often decentralize obstacle plans down to the brigade level but fail to synchronize brigade efforts to ensure a coherent division defense. As a result, one brigade may plan and construct a belt that turns the enemy into the flank of another brigade. Some plans lack a concept for obstacles. Units should ensure that obstacle intents match the maneuver intent and concept of operation. One option to ensure compatibility is to use intent graphics at the division level. Another option is to review the obstacle plan and intents during each division backbrief and rehearsal.

Perception: Refine obstacle-control measures to focus engineer effort and materials.

Discussion: Divisions often do not want to restrict maneuver brigade commanders, so they design zones that cover entire brigade sectors. As a result, each brigade fights a separate fight not a division fight. Failing to focus obstacle-control measures to specific enemy avenues makes it difficult to determine obstacle resource requirements.

Perception: Provide meaningful information on friendly and enemy obstacles.

Discussion: Dissemination of obstacle information is extremely weak. Units lacking a staff engineer (field artillery, air defense artillery, signal, and corps units) either do not get obstacle information or fail to use it. Units, especially those with several types of communications systems, must develop a method that is easy to use and facilitates dissemination. Generally, the DIVEN S2 cell is the ideal group to develop a single, common database and disseminate it over a tactical local area network or via TACFAX. The cell also must maintain an overlay that identifies cleared lanes and obstacle-control measures. Engineers must be involved with movement control, and maneuver units must enforce procedures to ensure that all movement within their sector is coordinated with their engineer representatives.

Perception: Address obstacles during rehearsals.

Discussion: Discuss the intent for obstacles during rehearsals. This practice will reduce the chance of diverting engineers for lower priority missions and ensure that obstacle plans support the commander's intent and the unit scheme of maneuver.

Perception: Plan obstacles that support offensive operations.

Discussion: Obstacle-control measures are rarely discussed in plans for offensive operations. FM 90-7 describes techniques for obstacle planning in the offense. Obstacles are an engineer weapons system that, when properly employed and integrated with other operating systems, can wrest the initiative from the enemy. Many commanders hesitate to delegate emplacement authority for FASCAM during offensive operations but rarely restrict the use of other obstacles. As a result, a unit is guaranteed not to face a "temporary" obstacle that will self-destruct in another hour or two but potentially runs the risk of dealing with such "semipermanent" obstacles as road craters or conventional minefields. When defining delegation authority, commanders must consider differences in sighting accuracy and marking methods between aerial- and ground-delivered FASCAM as well as potential areas of employment.

Perception: Synchronize FASCAM to maximize effects.

Discussion: FASCAM capabilities are not understood by all, so they are rarely exploited during combat operations. Many commanders tend to consider field artillery (FA) delivered ADAM and RAAM only. When FA-delivered FASCAM is used, it tends to be a "Call 911" approach. In that situation, nobody can maintain a clear picture of all of the FASCAM self-destruct times or safety zones. Once again, the planning requirement for FASCAM obstacles is the same as that for all obstacles; scatterable minefield delivery systems are just a more rapid method for emplacement. The bottom line is that obstacles must be emplaced for a specific effect and be targeted with direct and indirect weapons systems to take advantage of enemy delays at the obstacles. If the timing of an obstacle is critical to mission success, units must identify the NAIs, DPs, TAIs, and observation required to support the scatterable minefields.

Lieutenant Colonel Greg Stanley served as an engineer observer/controller with the BCTP from July 1993 to May 1996. He currently serves as the executive officer for the Assistant Deputy Chief of Staff-Training at Fort Leavenworth. Previous assignments include assistant division engineer for the 6th Infantry Division (Light) and executive officer of the 6th Engineer Battalion, Fort Wainwright, Alaska.

Lieutenant Colonel David Snodgrass is the BCTP engineer observer/controller. Previous assignments include commander, Bravo Company, 17th Engineer Battalion; assistant division engineer in 2d Armored Division, Fort Hood, Texas; and light and armor team engineer observer/controller at the National Training Center, Fort Irwin, California.



CTC Notes

NATIONAL TRAINING CENTER

National Training Center (NTC)

Engineer Platoon Critical in Defense Planning and Execution

By Major Tom Buning

Engineer battalions and staffs are not using the time and resources available to them to sufficiently prepare detailed plans for countermobility and survivability efforts for their subordinate commanders. Poor adherence to the principle of parallel planning between the engineer battalion staff and the brigade staff results in the issuance of incomplete and poorly staffed orders to engineer company commanders. This problem often increases in magnitude as similarly incomplete orders are issued to platoon leaders. As a result, platoons are left with an overwhelming responsibility to complete obstacle plans, coordinate for and haul Class IV and Class V barrier material, and execute the plans. Since platoon leaders are trained and manned only to *execute* obstacle plans, platoon productivity takes a drastic nosedive.

Philosophically, the engineer battalion and company headquarters staffs must realize that there are only six line platoons capable of emplacing barrier obstacle plans in the battalion. Commanders, staff officers, and noncommissioned officers must work together to maximize the platoons' outputs and to ensure the outputs are properly synchronized. All planning functions must be accomplished by the higher headquarters in direct proportion to the size of the staff available. The only acceptable end results are the issuance of an execution order to a platoon leader that requires obstacle siting as part of engagement area development (as outlined in FM 90-7) and disciplined compliance with executing squad and platoon obstacle-emplacement drills.

Standard planning factors for platoon efforts, in terms of minefield frontage emplaced over time, are based on the understanding that an engineer platoon is responsible only for emplacing obstacles. It is no wonder that battalion staffs, as they trace the execution glide paths for the brigade and engineer battalion commanders, often see the platoons' performance fall behind more than 50 percent. Units must take several steps to fix this situation. They include but are not limited to the following:

- Brigade operation orders (OPORDs) must include directed obstacle and survivability efforts to be executed before the battalion task force orders are issued. To start smart, task organize engineers and issue detailed warning orders early. The brigade obstacle plan must include all directed obstacles (with sufficient details to execute) and brigade obstacle belts, including intent graphics, priorities, and resources to be provided. The assistant brigade engineer must use these resource planning factors to determine the Class IV and Class V requirements to support the belt intents.
- Brigade orders must direct Class IV/V point locations and amounts to be delivered from Corps. Details on Class IV/V point management responsibilities and augmentee manual labor must be directed in the main body of the brigade OPORD. Class IV/V point locations must have the following essentials: someone in charge with engineer expertise, copies of the obstacle plan and orders, communications requirements, materiel handling equipment, and labor.
- The brigade OPORD must direct the earliest possible time and place for maneuver commanders and supporting engineer leaders to link up and site battle and fighting positions, site-engagement areas, and target reference points.
- Units must consider a unit basic load of Class IV/V materials to resource early emplacement efforts by engineer platoons as mission loads are brought forward. The engineer company and battalion support platoon's heavy expanded mobility tactical trucks (HEMTTs) must be ready to support the distribution of Class IV/V materials forward to the mine dumps. The key is to reduce the time engineer squads need to travel and load Class IV/V materials into their trailers.
- Staff discipline and practice orders drills, led by the executive officer in his role as the chief of staff, are critical to engineer success in owning the mobility and survivability battlefield operating systems for the brigade combat team. Brigades must take ownership of the fight and

rid themselves of the notion that task forces and engineer companies should have the planning freedom to "fight their own fight."

- Engineer commanders must plan for the use of FASCAM both situationally and conventionally. The best planning considerations for VOLCANO are to complete conventional obstacles that were planned but not executed prior to the defend time or to reinforce the conventional effort, as described in Chapter 7, FM 90-7.

Platoons that do not emplace obstacles because they are coordinating unclear plans, running down materials, responding to faulty intelligence, or "Black" on water are not adequately supported by their higher level commanders and staffs. The platoon "lane" is to site and emplace obstacles. The battalion and company lane is to take care of all else so the platoons can do their work.

The most important qualifier for successful engineer countermobility and survivability operations is to properly synchronize obstacle effects where the brigade wants to kill the enemy and from what location. This task is critical! Failure to properly synchronize obstacle effects with maneuver and fire may not only render thousands of engineer countermobility man-hours useless but, more importantly, jeopardize the success of the mission.

By addressing the above steps, units can maximize the use of their available time, forces, and materials to produce the most effective obstacles.



Joint Readiness Training Center (JRTC)

Engineer Command and Control at Brigade Level

By Major Jim Brooks

Recent improvements are noted in the integration of brigade engineers into the brigade tactical operations center (TOC) and the brigade decision-making process. The brigade main engineer cell (BMEC) is typically manned by a brigade engineer or assistant brigade engineer (usually a first lieutenant who formerly served as a platoon leader or a captain just out of the Engineer Officer Advanced Course), a borrowed vehicle with radios and a driver (not authorized on the modified table of organization and equipment [MTOE]), a few noncommissioned officers (operations, communications, or NBC), a digital nonsecure voice telephone (DNVT) for connectivity to the mobile subscriber equipment network, a tactical fax machine, and a notebook computer with a printer. Most brigade TOCs now allocate sufficient space for the brigade engineer to effectively set up appropriate map boards and overlays and to display current engineer battle-tracking charts. This personnel and equipment support is critical to sustained battle tracking, staff integration, and 24-hour operations.

Options. FM 5-7-30, Chapter 2, shows a sample organization for supporting engineer cells. When followed, this organization has proven to be more successful than others observed at the JRTC. Engineer companies on rotation here typically use one of two organizations for engineer command and control. Some units position a brigade engineer in the brigade TOC, while the rest of the company headquarters section operates in a separate company command post (CP) within the brigade support area. Under this organization, the company CP tracks the current engineer situation and the brigade engineer plans future operations. Because challenges exist in communicating current and future operations between the BMEC and the company CP, the brigade engineer is usually unable to keep the brigade commander and staff accurately informed on the current status of engineer operations. Also, task force engineers frequently are overtasked to report the same mission status to three nodes: the engineer company CP, the brigade engineer cell, and the maneuver commander.

Other, more successful, engineer companies divide the company headquarters to integrate engineers into both the BMEC in the brigade TOC and the brigade rear engineer cell (BREC) in the forward support battalion TOC. The company first sergeant establishes company trains in the brigade support area. The BMEC is manned and equipped with assets from the company CP and can track battles accurately and quickly. As a result, the brigade engineer can keep the brigade commander and his staff informed on the current status of engineer operations, and he is available for better integration into the planning process and sustainment of 24-hour operations. This organization also reduces the reporting requirement nodes for battalion task force engineers.

Bottom Line. Determine the command, control, and staff integration requirements of the brigade task force, then adjust the task organization of the available engineer assets. For long-term solutions, submit MTOE changes for additional equipment and personnel in the brigade engineer cell. For the short term, given the current MTOE of light, airborne, and air assault engineer companies, it is more efficient to take personnel and equipment formerly used to conduct current operations within the company CP and use them to strengthen the BMEC and the BREC in the brigade main and rear CPs.

Shaping the Electronic Battlespace: The HEXJAM

By Captain Dale A. Kornuta and First Lieutenant Brian R. Dunmire

Engineers fight obstacles! Webster defines obstacles as something, material or non-material, that stands in the way of literal or figurative progress. For engineers, obstacles are the task force defense—mines and wire. While not very exciting, they are very effective when properly integrated. They were responsible for 20 percent of tank losses in World War II.

Now engineers have discovered a new obstacle: the hand-emplaced expendable jammer (HEXJAM). It can jam the complete spectrum of frequency-modulated (FM) radios, both single-channel and frequency-hopping!

The HEXJAM is known in the military intelligence (MI) community as a barrage jammer. Since the MI branch is no longer the proponent for hand-emplaced jammers, MI battalions may transfer these devices to engineer units.[1]

History

FORSCOM fielded the HEXJAM as an electronic warfare communications device to divisional and corps MI units about 10 years ago. As a one-time issue, Class IX expendable item, accountability for the HEXJAM is maintained at the company level. This means that many MI S4s or property book officers may not know they exist.

There are two problems concerning ground-based jammers:

- To overpower enemy radios, friendly jammers must create a huge radio signature that is easily detected by enemy direction-finding equipment. The large signature makes them artillery magnets, since no enemy commander will tolerate disruptions in his communications.
- To jam an enemy's communications, we must know his radio frequency. We must determine when to jam and then reacquire



Photo by Jennifer Morgan

The hand-emplaced expendable jammer (HEXJAM) is a lunch-box-sized broad-band communications mine.

HEXJAM Characteristics

- Can be set up in 3 minutes.
- Jams all former Soviet bloc radio frequencies; severely restricts radios used by U.S. and NATO forces.
- Operates when buried up to, but not over, the top of the system.
- Range (classified information).
- **WARNING:** A nonhazardous, nonreversible, self-disabling capability prevents unauthorized reuse. Use only the training setting; the operational setting activates the self-destruct feature.
- Activated by a timer, with up to 29.9 hours delay.
- Jams continuously for 2 hours with one SINCGARS battery or for 4 hours with an external adapter and two SINCGARS batteries.
- Can be command activated by shunting wires attached to mounting posts (does not require a blasting machine).
- Has a shelf life of more than 10 years without batteries installed.
- Operates in blackout conditions; has no visual or audio signature.
- Smaller and lighter than an M21 mine, it is made by Fairfield Weston/Schlumberger, Model No. 4286-031. It uses a BA-5590 battery.
- No maintenance actions are authorized. A built-in test check, which includes battery installation, may be exercised at any level; however, it is performed primarily by deployment forces (engineers).
- Requires minimal training to operate (instructions are printed on the device).

the target after jamming. This limits the number of nets that a unit can attack.

Because the MI jamming mission is operational and strategic, a vacuum is created at the tactical level. The HEXJAM fills that vacuum, but the MI community does not have—and does not intend to have—personnel operating where tactical operations occur. Engineers do, and can fill that gap.

Future

We must train young engineers to attack the battlefield—not just the ground—by making them aware of new technologies in our arsenal, such as the wide area mine (WAM), the hush flare, and the HEXJAM. The WAM destroys low-flying aircraft and helicopters. The hush flare (a directional ground flare) prevents the enemy from using thermal and passive night sights. The HEXJAM denies the enemy the FM portion of the electromagnetic spectrum.

Obstacles in the electromagnetic spectrum (such as radios; microwaves; global positioning system receivers; and laser, visual, and thermal sights) must be part of the ground that we shape. We engineers must not restrict ourselves to destroying vehicles and personnel but concentrate on achieving the commander's intent. Disrupting the enemy's command and control slows or desynchronizes his maneuver, thereby supporting the killing systems of the task force. Disrupting the enemy's motorized rifle company or battalion while it conducts breaching operations can have a ripple effect reaching all the way up to regimental headquarters. Such disruptions may force him to commit follow-on forces early to make up for the forces destroyed in the breach.

Jam Field

A jam field is any HEXJAM or group of HEXJAMs that deny the enemy effective communications on a particular piece of terrain. A jam field is difficult to detect. The enemy hears no static while his equipment is being jammed but clearly hears friendly vehicles nearby. Since jamming only affects reception, everyone outside the jam field can hear vehicles within the field. Therefore, enemy units do not realize they are being jammed even though they cannot communicate with elements of their force at the most critical juncture in their operation.

If the enemy's direction-finding systems find the jammers, they can only report that fact, because the standard opposing force (OPFOR) tactic is to use heavy artillery or rocket launchers to destroy jammers. His problem now is that the jammers are "in the wire" with his forces.

The HEXJAM's small size and delayed activation make it a flexible munition. Its disrupting effect is truly nondiscriminatory, affecting engineer, artillery, and maneuver personnel. Engineers in the breach—or one terrain feature short of the obstacle—lose their communications. Forward observers supporting the breach experience disruptions. The assault force awaiting the breach and the support-by-fire team that never gets the call to mass or shift fires are also affected.

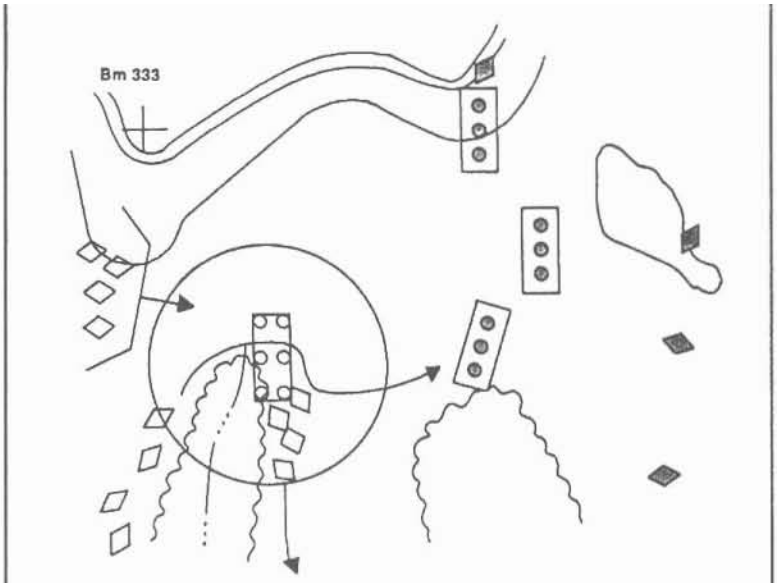


Figure 1. OPFOR Deliberate Breach Deployment

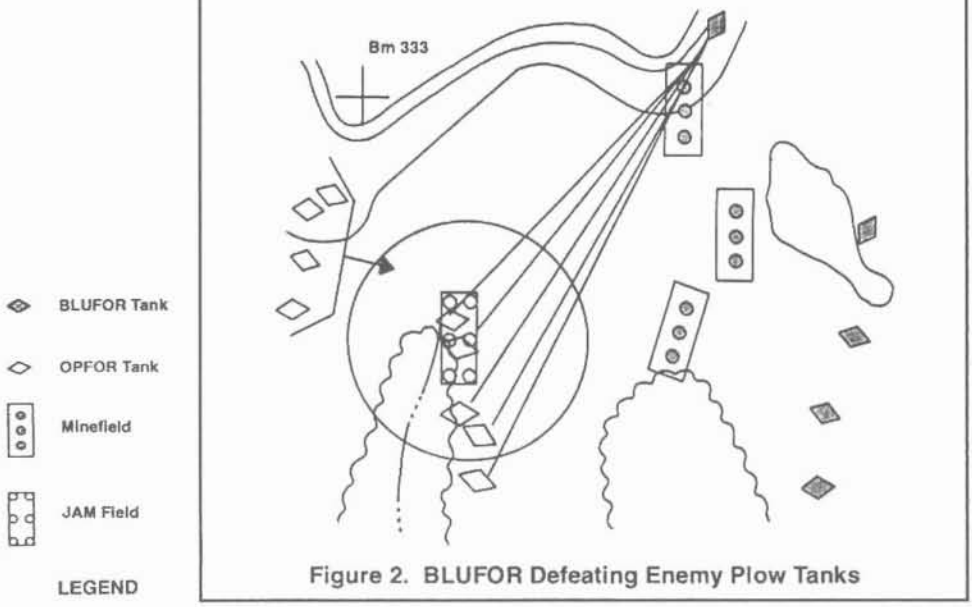


Figure 2. BLUFOR Defeating Enemy Plow Tanks

When the enemy is in the defense, HEXJAMs pushed forward with the scouts isolate security forces, thereby disrupting the entire enemy security zone.

Operations

Alpha Company, 588th Engineer Battalion, Fort Hood, Texas, used the HEXJAM during recent training. The following examples typify the effects the HEXJAM produced on the battlefield.

Action. Company/team lanes were conducted in the 1-kilometer-wide avenue of approach south of Bench Mark 333 (Figure 1). The ground the maneuver commander chose for his defense was bound by a steep, wooded mesa on the north and forested, low ground on the south. The jam field was placed forward of the main defensive belt in the low ground and covered by the keyhole tank on the extreme north of the main defensive position.

The OPFOR tank company maneuvered to conduct a deliberate breach. The support force deployed on the intervisibility line south of Bench Mark 333 and established a support-by-fire position. The jam field was activated using the time-delay function, which allowed the engineers to clear the battlefield before the direct-fire engagement.

The support force skirted the low, vegetated ground in the south and the OPFOR commander moved with his breach force of four plow tanks into an attack position within the jam field. The attack stalled for 10 minutes while the OPFOR commander attempted to regain communication with his platoons. In the absence of orders, the security force worked the low ground to the south, off the map and out of the battle. The blue force (BLUEFOR) keyhole tank then annihilated all the plow tanks in a short, one-sided fire fight (Figure 2). Eventually, based on the platoon leader's understanding of the commander's intent, the security force conducted a desynchronized platoon attack (Figure 3, page 41).

Effects. The OPFOR commander and plow tanks were effectively removed from the fight, desynchronizing the attack. The commander never realized he was being jammed because he maintained constant communication with his wing tank even though he lost communication with all of his

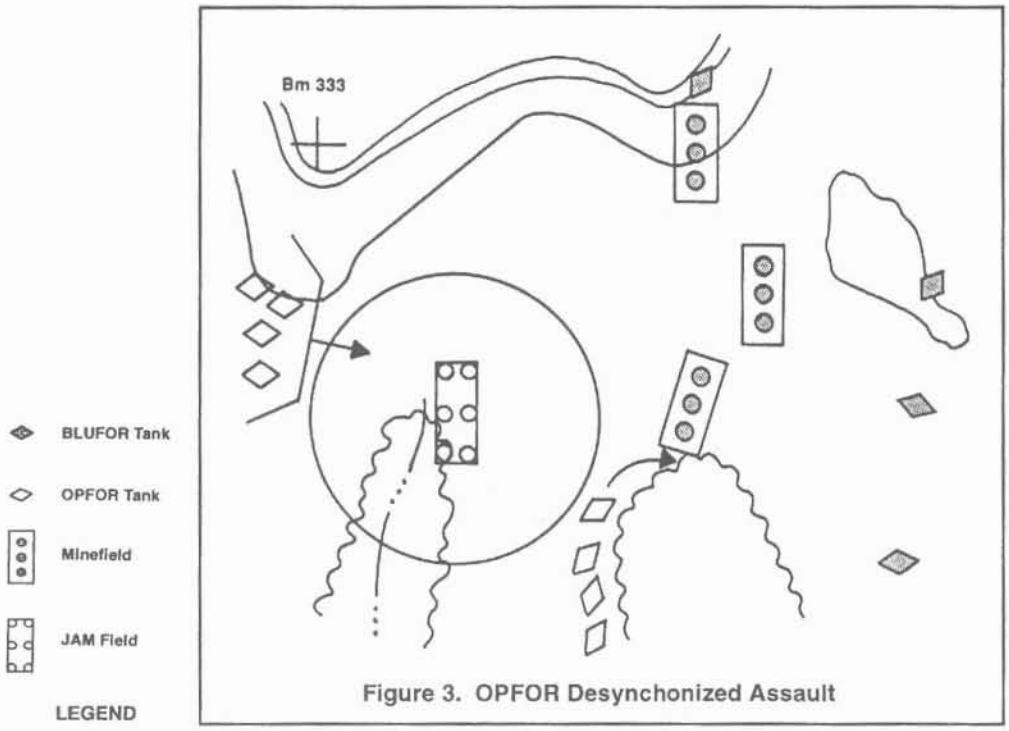


Figure 3. OPFOR Desynchonized Assault

platoons. The security force passed through the jam field with little effect, because it was not assigned a critical mission at the location of the jam field. The jam field was covered with fires, allowing it to produce the maximum effect.

Action. During Task Force Lane's offensive operations, scouts from the 3-67 Armored Battalion, Fort Hood, placed HEXJAMs near vacant enemy fighting positions before the positions were occupied. With less than 10 minutes of instruction, the scouts effectively employed the HEXJAMs. The devices were activated using the time-delay function based on line of departure plus movement time.

Effects. Tank commanders were observed dismounting to develop hasty hand and arm signals, which became their only means of communication during the battle. Lacking radio communications, the tanks could not coordinate direct fires. Their higher headquarters could not effectively control them nor could they carry out the plan for indirect fires, since they could not hear their fire support officer. This led to destruction of the tanks and desynchronization of the OPFOR defensive fight.

Strengths

The HEXJAM is an inexpensive, simple, and effective tool that has a tremendous effect during training exercises. Because there are no open frequencies to jump to, the broad-band jamming makes conventional antijam techniques ineffective. It can be set up in 3 minutes, requires minimal training, and is capable of continuous jamming operations for a period of 2 hours with one single-channel, ground-to-air radio system (SINCGARS) battery. The HEXJAM is nonhazardous and nonreversible and has a self-disabling capability which prevents unauthorized reuse by the enemy. It can be activated by a timer with up to 29.9 hours of delay (see chart on page 39). The command activation system is accomplished by shunting ordinary wire. Many HEXJAMs can be "daisy chained" together. The effective area of the HEXJAM indicates the capabilities of the next generation of mines being fielded.

Limitations

Like any minefield, the HEXJAM must be integrated into the scheme of maneuver. Most importantly, the jam field must be placed where the enemy needs to communicate via FM radio. Integrating engineers into the S2's intelligence preparation of the battlefield (showing the enemy's decision points) is critical to the successful emplacement of the HEXJAM.

Communications minefields will require special rules of engagement or obstacle restrictions, such as in observer/controller locations. Its short operational time requires excellent intelligence on the enemy time line or command detonation. The batteries required for the HEXJAM must be requested through the task force several months before a training exercise. The new rechargeable SINCGARS batteries will mitigate this drawback somewhat.

The HEXJAM was designed to target potential enemy radios. As a possible friendly antijam TTP (tactic, technique, and procedure), single-channel antijam frequencies are available at the top of the FM radio spectrum.

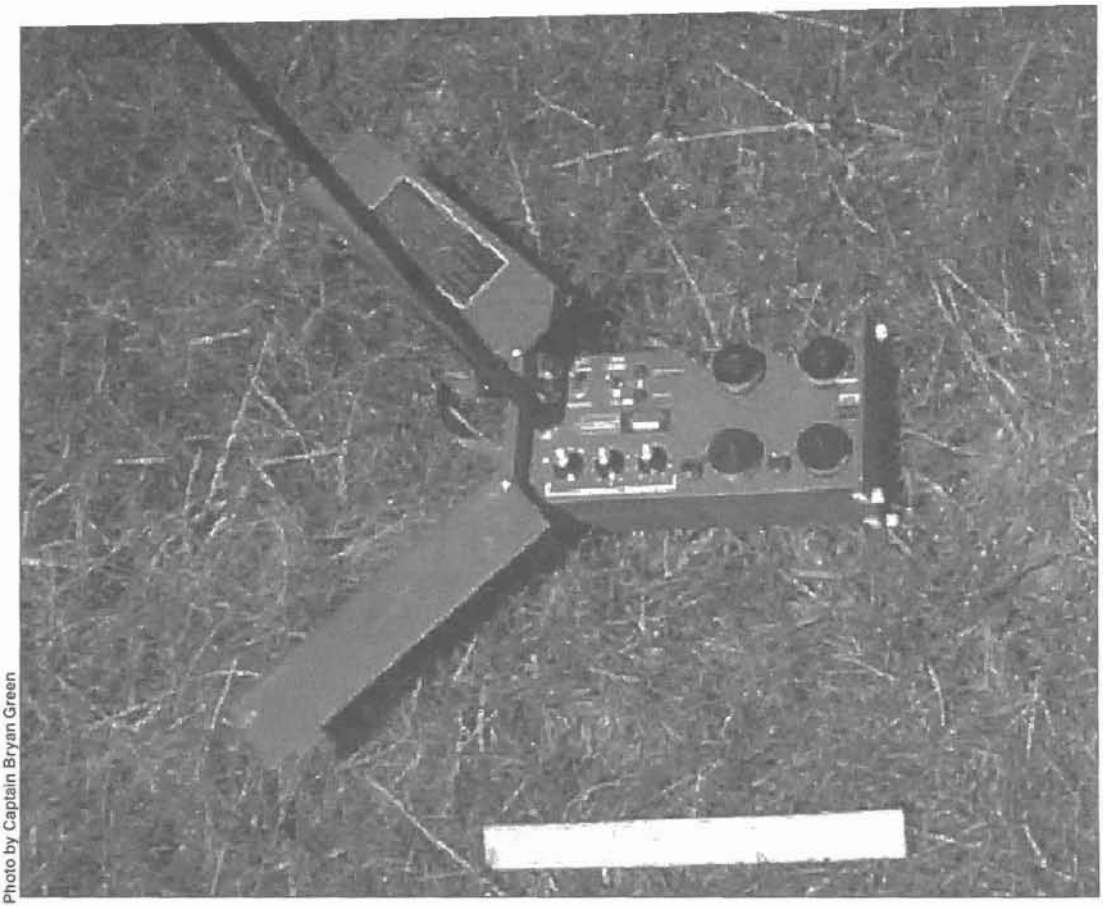


Photo by Captain Bryan Green

The HEXJAM works by denying the enemy the FM portion of the electromagnetic spectrum.

The HEXJAM is no longer in the supply system. It is available from the Delta Company (General Support) or the Long Range Surveillance Company of any military intelligence battalion that has had continuous service since 1985. This device is out of the system but not "out of supply." The 588th Engineer Battalion has obtained 22 HEXJAMs. Now each line company can deny the enemy significant portions of the engagement area.

The hand-emplaced jammer is not a sensitive item or a classified device, but its range and power output are classified "confidential." The exact specifications are published in Training Circular 34-98, *Expendable Jammers* (U), 29 May 1984 (a confidential document). This pamphlet, which offers excellent TTPs for engineers, is available at the same units where the HEXJAMs are obtained.

Conclusion

The effect of denying the enemy communications on a particular piece of ground is similar to blowing a track to disrupt his formation. The usefulness of this weapon is limited only by the imagination of the commander, the S2 who knows the location of the enemy's decision points, and the engineer or scout who emplaces the device.

The HEXJAM must be added to the task force engineer's equipment. Although current supplies of HEXJAMs are adequate for training units in peacetime, they are not adequate for wartime needs.

The strengths and limitations of the HEXJAM must be developed through the normal training cycle so we can employ them to better defend ourselves from similar devices fielded by adversaries. In the Force XXI era, this simple, inexpensive combat multiplier will help ensure that the Army achieves success on the modern battlefield.

Endnote:

[1] The memorandum authorizing engineers to obtain HEXJAMs from MI units is on file at the Directorates of Battle Lab Support and Combat Developments, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

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First Lieutenant Brian R. Dunmire is the S2, 1-10 Cavalry Squadron, 4th Infantry Division (M), Fort Hood, Texas. Previous assignments include XO of D/104th Military Intelligence Battalion; collection and jamming platoon leader, D/522d Military Intelligence Battalion; assistant S2, 1st Brigade, 2d Armored Division, all at Fort Hood. He is a graduate of the Military Intelligence Officer Basic Course and the Airborne School and holds a degree from Pennsylvania State University.

Send your ideas about shaping tactics and techniques of future engineers to CPT Bryan Green, the Battle Lab Integration Officer, (573) 563-7355 or DSN 676-7355.

This article builds on the information contained in "Avoiding an Engineer's Nightmare: The Mine-Clearing Line Charge (MICLIC)," Engineer, December 1994, pages 18-24.

Maintaining the MICLIC

By Captain Joe Birchmeier, Sergeant First Class Terry Purdin, and Sergeant First Class Ted Roberts

The Mine-Clearing Line Charge (MICLIC) is a critical mobility asset—even with its limitations. Engineers use it to clear a path through obstacles without having to dismount.

The following information will help engineer units reduce or eliminate some common problems associated with the MICLIC. Units should follow these techniques and procedures in conjunction with those in Technical Manual (TM) 9-1375-215-14&P when performing maintenance or training on the MICLIC system.

Most of the MICLIC problems observed at the National Training Center (NTC) are attributed to—

- Poor unit maintenance.
- A lack of system knowledge at both the soldier and the leader level.

Poor readiness rates occur in units that do not maintain the complete system. Units have arrived at the NTC with launchers or trailers that were "up" to -10 standards; however, the system was "down" due to a faulty firing cable. A weakness of TM 9-1375-215-14&P is that it does not require a check of the complete system during the preventive maintenance checks and services (PMCS).

Deficiencies in leader/soldier knowledge of the system result from insufficient training. Because most units do not fire the line charge often and lack a complete training aid, they arrive at the NTC improperly trained in MICLIC operations. The end result is long MICLIC preparation times and high misfire rates.

PMCS of Launcher

Problem. TM 9-1375-215-14&P does not provide enough detail about the U-bolts that attach the launcher to the trailer or the armored vehicle-launched MICLIC (AVLM) mount. Many units arrive at the NTC to fire live line charges with U-bolts missing from the launcher.

Solution. The launcher must be secured with four U-bolts. If any U-bolts are missing or loose, consider the system nonmission capable.

Problem. Some units conduct a PMCS of the MICLIC system without checking the M34 blasting machine. Some units arrive at the NTC with only one operational M34.

Solution. Two M34 blasting machines should be available when the MICLIC is operated. Check the M34s with a multimeter. To be used with the MICLIC, the M34s must produce at least 222 volts DC.

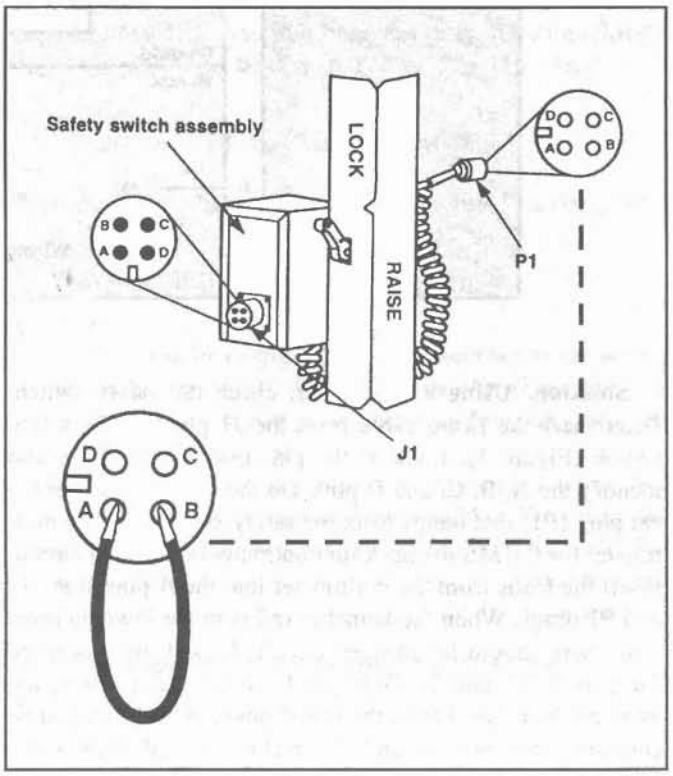


Figure 1

Problem. Units do not check the firing cable and safety switch for continuity when they conduct a PMCS of the MICLIC without a line charge or rocket.

Solution. Use the M51 test set and a 3-inch piece of communications wire with the ends stripped. Connect the firing cable to the J1 plug (Figure 1) on the safety switch. Attach the selector switch to the other end of the firing cable. Taking the 3-inch piece of communications wire and the P1 cable, jump the pin marked "A" and the pin marked "B" (Figure 1). This check replicates a line charge and will check both the firing cable and the safety switch.

Note: If a light does not come on when the launcher arm is in the raised position, test the safety switch. If the safety switch is operational, the firing cable is defective.

Problem. When checking the firing cable, a light appears when the launcher arm is in the lowered position; or there is no light when the launcher arm is in the raised position.

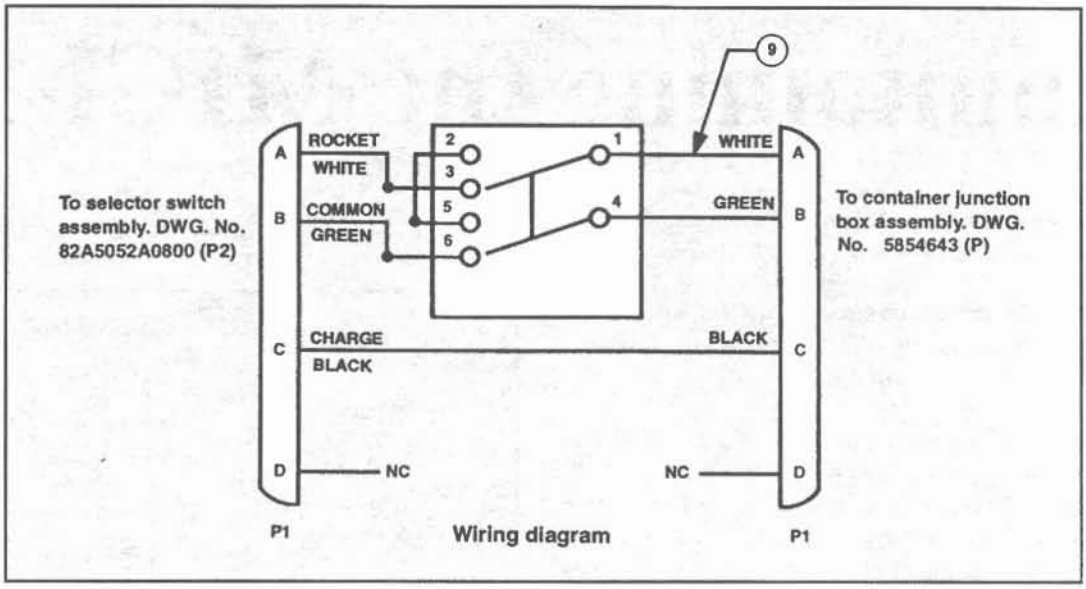


Figure 2

Solution. Using a multimeter, check the safety switch. Disconnect the firing cable from the J1 plug on the safety switch (Figure 1). Look at the pin inside the J1 plug and identify the A, B, C, and D pins. Do the same on the electrical plug (P1) that hangs from the safety switch. Set the multimeter for OHMS to check for continuity or a closed circuit. Insert the leads from the multimeter into the A pins at the J1 and P1 plugs. When the launcher rail is in the lowered position, there should be an open circuit. Repeat the procedure for pins B, C, and D. Only pin C should have continuity. With the launcher arm in the raised position, there should be continuity in pins A, B, and C. Pin D is not used (Figure 2).

Note: If there is continuity in pins A and B in the lowered position, or if there is no continuity in pins A and B in the raised position, refer to TM 9-1375-215-14&P (pages 5-8) and adjust the roller switch lever. If the safety switch checks out after adjustment, recheck the firing cable for continuity.

Problem. The line charge is not properly secured to the trailer or the AVLM.

Solution. For the trailer-mounted MICLIC, the line charge must be connected to the trailer with four turnbuckles and locking nuts. Tighten the turnbuckles, but allow threads to show on the inside of each end. Then tighten the locking nuts to ensure that the turnbuckle will not unthread itself. Use two chains and binders for the AVLM. Pull the hook and chain through the rear line charge tie-down and attach the hook to the chain approximately 6 to 8 inches from the charge tie-down (Figure 3). Route the chain through the rear launcher tie-down to the front launcher tie-down, up through the front line charge tie-down, and attach the hook approximately 6 to 8 inches from the charge tie-down. Install the binder under the center and ensure that the binder handle is facing rearward. After the binder is locked, secure the binder handle with tape. Repeat these steps for the other side of the charge.

Setting Up the Line Charge and Rocket

Problem. The MICLIC line charges sink due to settling, which may cause them to deploy erratically and/or misfire.

Solution. Inspect the line charge as soon as it is opened. The line charge should be flush with the sides of the container. If it sinks more than 1 1/2 inches, do not use it. Return the line charge to the ammunition supply point for inspection.

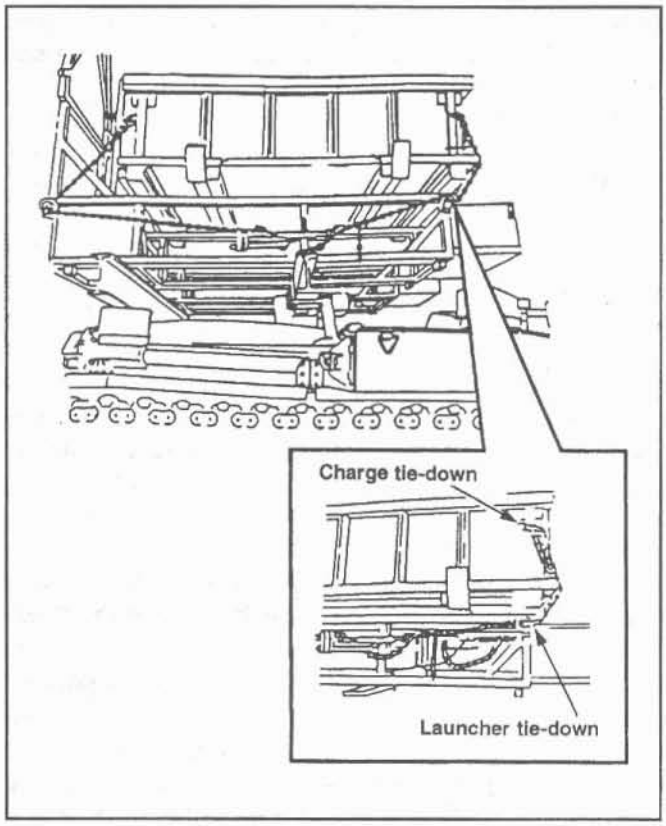


Figure 3

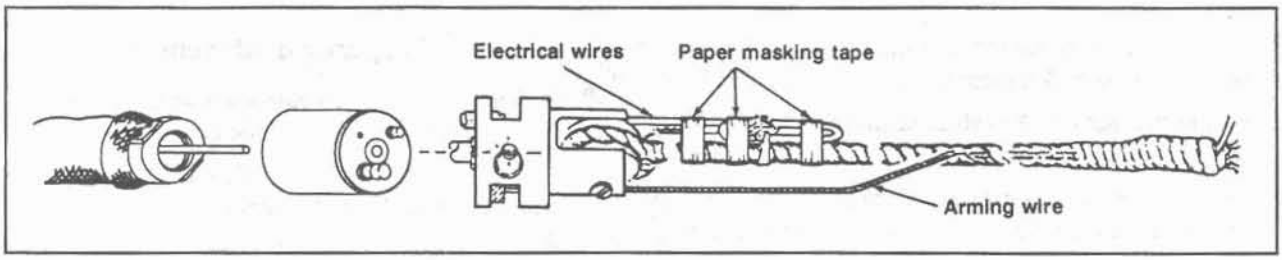


Figure 4

Problem. TM 9-1375-215-14&P does not describe how to ensure that the arming cable will not cut the firing wire at the base of the fuze.

Solution. As part of each MICLIC preparation, pull back the nylon sock from the arming cable side of the fuze connector. Align the electrical wires on the side opposite the arming wire and neatly tape them with paper masking tape (Figure 4). Return the nylon sock to its original position.

Problem. The rocket bridle cable slips out of the cable sheath.

Solution. The improved method of taping the rocket bridle cable to the launcher rail is to tape the bridle in two places—just to the front and just to the rear of the cable sheath. Use electrical tape (Figure 5) to keep the bridle cable from moving back and forth. Ensure that the bridle forms an "S" shape when it is laid on top of the charge and connected.

Problem. Some rockets come unlocked, due to excessive stress on the launcher rail, while traveling across rough terrain with the rocket attached to the MICLIC launcher.

Solution. Ensure that the rocket locking mechanism locks the rocket in place. Always travel with the ball-lock pins in the LOCK position. To keep the rocket secure, put some packing material from the rocket shipping container under the head of the rocket. Use a ratchet strap to secure the launcher rail with the rocket to the launcher.

Note: The strap must go over the top of the launcher rail, not just over the rocket, to prevent undue stress on the rocket.

Problem. Units travel at excessive speeds over rough terrain. Several line charge misfires at the NTC may have been caused when the charges shifted in the container before they were fired.

Solution. For trailer-mounted MICLICs, maintain speeds of 15 mph or less on improved trails and 10 mph or less when traveling cross-country; the top speed for the AVLM is 30 mph. Leaders must plan for the low speeds and coordinate with their supported maneuver units.

Checking the System

The following checklists for precombat checks (PCCs) and precombat inspections (PCIs) were developed to help leaders ensure that the complete MICLIC system is combat-ready. The checklists do not replace the PMCS in TM 9-1375-215-14&P.

PCC/PCI Checklist

- Perform PMCS on the armored personnel carrier (APC) or the AVLM.
- Perform PMCS on the launcher.

Notes:

(1) On a trailer configuration, the launcher is connected to the trailer with four U-bolts. The line charge container is fastened with two 6-inch turnbuckles in front and two 12-inch turnbuckles in the rear.

(2) On the AVLM configuration, the launcher is connected with two U-bolts in the rear and two modified U-bolts on the center I-beam. Chain and binders are used to secure the line charge container. The binders must face rearward when closed; secure the binder to the chain with 100-mph tape.

Start the inspection at the top of the line charge:

- Ensure that the rocket is tied down properly and locked into position.

Note: The tie-down straps must be attached to all four hand knobs on the rocket rail guide.

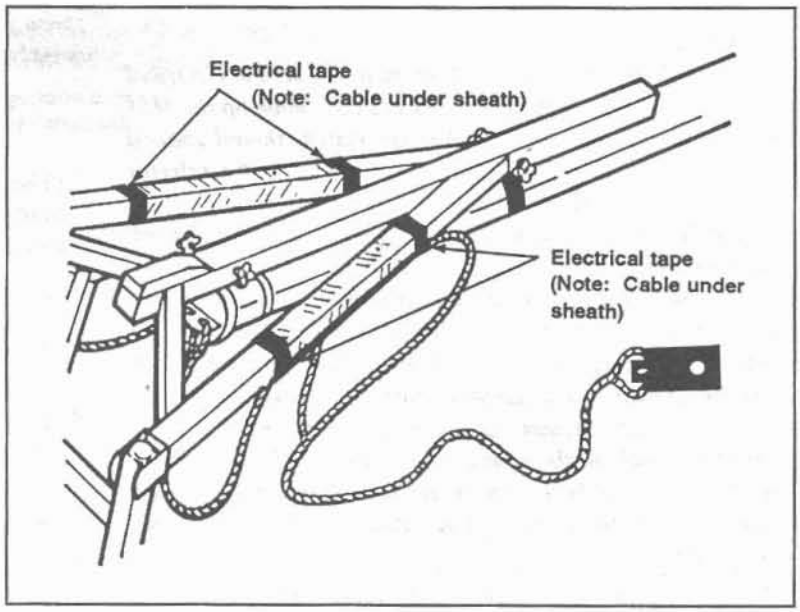


Figure 5

- Give the ball-lock pin for the rocket motor to the crew or secure it to the rocket motor.
- Ensure that both bridle cables behind the sheath have an 18-inch loop in place.
- Lay the bridle cables forward of the sheath on top of the line charge and configure them in an S-curve pattern.
- Place the bridle cables in the sheaths on both sides of the launcher and secure the cables with electrical tape.
- Pull back the nylon sock from the arresting cable fuze connector and inspect the connector.

Note: *The electrical firing wire must be secured to the nylon rope opposite the arming wire using ONLY paper masking tape. Do not tape the arming wire.*

Move to the rear of the MICLIC launcher :

- Connect the safety switch cable to the tub of the line charge.

Note: *Before beginning the continuity check, shunt the rocket receptacle with either a shunt plug or a jump receptacle with a 3-inch piece of communications wire.*

- Verify that the hydraulic cylinder will hold from 3200 to 3500 psi and that the control valve is set to the pressure accumulator.
- Engage the detents.
- Ensure that the two ball-lock pins are in place on the rail.

Note: *The ball-lock pins must be placed in the RAISE position; however, when traveling, the pins must be in the LOCK position.*

- Mount and connect all cables.
- Move to the location where the control box will be fired.
- Verify the continuity check.

Notes:

(1) With the rocket in the down position, set the electrical control box selector switch to SAFE/TEST; hook up the M51 test set and depress the handle; the system should show a light. The system should not show a light when the selector switch is set on ROCKET or CHARGE. If a light is observed on the ROCKET or CHARGE setting, stop and notify the unit maintenance section.

(2) Raise the rocket from the control box and observe if it locks into position. Ensure that white marks on the inner launcher rail supports are visible but have not risen high enough for the vertical white marks (T-strips) to be seen above the outer lower launcher rail supports. Move the selector switch on the control box to ROCKET, and depress the handle of the M51. You should see a light on the test set. Move the selector switch to CHARGE and again you should see a light.

- Place the protective cover on the line charge.
- Rehearse the misfire and evacuation drills.

Prepare for Movement

- Position the electrical control box so that it receives maximum protection yet affords quick access.
- Secure the cable for travel. This is especially important when using APCs with trailers.

Note: *The 60-foot cable frequently is damaged when it falls between the APC and the trailer. Run the cable so that it does not interfere with troop reaction to enemy contact. For example, ensure that the cable will not be severed when troop hatches are closed during an indirect-fire attack.*

- Place packing material from the rocket shipping container between the line charge and the rocket. Secure with a cargo strap.

Note: *The strap will extend from one side of the launcher over the rocket and guide rail. Secure the strap to the other side of the launcher.*

- Put the protective cover in place and check the line charge once more.

Notes:

(1) The bridle cable must be in the S-curve pattern; the protective cover must not interfere with the firing operation.

(2) The bridle cables must be secured properly.

(3) The rocket ball-lock pin must be attached to the rocket or be in the hands of the crew.

- Insert the launcher rail ball-lock pins in the lock position.
- If towing the MICLIC, secure the trailer to the APC.
- When towing the MICLIC, maintain speeds of 15 mph or less on improved trails and 10 mph or less when traveling cross-country. The speed for an AVLM should be no greater than 30 mph.

Note: *Excessive speed may require that the MICLIC spend more time at the assault position rather than moving quickly forward to fire.*

Prepare for Firing

The MICLIC must be prepared for firing before it is moved forward for deployment. This preparation time will minimize soldiers' exposure to enemy contact.

- Remove the ratchet strap and packing material.
- Remove the ball-lock pins from the LOCK position and insert them in the RAISE position slots.
- Pump the hydraulic cylinder until the pressure gauge indicates between 3200 and 3500 psi. Then set the control valve to the PRESSURE ACCUMULATOR position.
- Attach the rocket receptacle cable to the tub.
- Ensure that the detents are in the down position.
- Place the ball-lock pin in the rocket head.
- Move the system forward to fire.

Table 1. Recommended BOM for MICLIC Operations

NSN	Nomenclature	Quantity
6625-01-131-8586	Digital multimeter (fluke)	1
7510-00-198-5831	Tape, masking (roll)	1
5975-00-074-2072	Strap, tie-down	50
5970-00-686-9151	Tape, electrical (roll)	1
4925-00-999-3454	Test set (blasting cap) M51	1
1375-00-567-0223	Blasting machine, M34	2
1670-00-725-1437	Tie-down, cargo	1
	(AVLM Only)	
Steel Pole	Cheater pole (for binders)	1
	(Do not use an aluminum pole!)	
	Tape, 100 mph (for binders) (roll)	1

NOTE: The AVLM is considered one system.

References : TM 9-2320-205-14&P M200A1 Trailer
TM 9-1375-215-14&P w/change #1 MICLIC
TB 43-0001-36-5 *Equipment Improvement Report*

Table 2. Recommended PLL Stockage

NSN	Nomenclature	Quantity
5306-01-226-8720	Bolt, U-	4
5310-00-491-5895	- Washer, flat	8
5310-00-937-0453	- Washer, lock	8
5310-00-764-6609	- Nut, hex	8
6150-01-348-4036	Cable assembly, power: W5	1
6150-01-347-8428	Cable assembly, power: W3 60-foot	1
4320-01-072-4918	Pumping unit, hydraulic, hand	1
1055-01-316-7764	- Handle, pump	2
3040-01-218-6145	Accumulator, hydraulic	1
5340-01-230-0093	Pin, quick release	2
5930-01-218-4673	Switch, safety, firing	1
4730-01-342-0587	Cover, protective, rocket launcher	1
4730-01-345-4083	- Shock cord	8
5340-01-248-7962	Turnbuckle: 1.00 x 6	2 *
5340-01-249-0589	Turnbuckle: 1.00 x 12	2 *
5305-00-947-4354	Bolt, hex (Grade 8)	4 **
3990-00-171-9775	Load binder	4 **
4010-00-171-4426	Chain, 14-foot	4 **
5310-01-284-6395	Beveled washer, 1-inch diameter	6 **
5310-01-317-0480	Beveled washer, 3/4 -inch diameter	8 **
5310-01-373-6951	Beveled washer, 5/8-inch diameter	8 **
5310-00-499-3333	Nut, hex, self-locking	24 **

NOTE: * For trailer configuration only.
** For AVLM configuration only.

- Simultaneously give the authority to fire both the rocket and the line charge.

Notes:

(1) Valuable time is taken from, or added to, breach time by units trying to make firing the rocket and firing the charge a two-part command. Recommend that commanders give authority to fire both the rocket and the line charge when they order the emplacing engineer to move forward from an assault position.

(2) All supporting units in the battlefield must be prepared for the safety standoff when the line charge detonates.

Table 1 gives a suggested bill of materials (BOM) for MICLIC setup. Table 2 provides a suggested prescribed load list (PLL) for MICLIC operations.

Commander's Challenge

With the information in this article and the applicable technical manual, the commander can ensure that his MICLICs are always ready for employment in a combat environment. (Refer also to *Engineer,* December 1994, page 18.) Your challenge is to instill this knowledge in the leaders and soldiers responsible for this weapon system. Stay abreast of all current guidance involving the MICLIC and conduct appropriate inspections to ensure the maintenance status and mission capability of this valuable combined arms breaching asset.

CPT Birchmeier, SFC Purdin, and SFC Roberts are assigned to Operations Group at the National Training Center, Fort Irwin, California. They are members of the Sidewinder 12 Team, working as company/platoon trainers.

ENGINEER UPDATE

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

Department of Training and Doctrine (DOTD)

Director Welcomed. We welcomed our new director, Lieutenant Colonel Robert Kirsch, in May 1996. He previously served as executive officer for the U.S. Army Engineer Center. LTC Kirsch may be reached at -4111.

Professional Reading List Revised. The Engineer Center's recently revised Professional Reading List provides a short description of almost 100 books on leadership, the operational level of war, and combat operations at the tactical level. There is a separate listing of books on the history of Army engineers. To receive copies of these lists or to suggest changes to them, write to Dr. Larry Roberts, U.S. Army Engineer Center, ATTN: ATZT-H, Fort Leonard Wood, Missouri 65473. POC is Larry Roberts, -6109.

MOSs 12B and 12F Basic Noncommissioned Officer Courses (BNCOCs) Consolidated. On 16 July, TRADOC approved a plan to consolidate the separate 12B and 12F BNCOCs. NCOs who previously were selected to attend the two courses now will attend a single 9-week course that integrates skills from both MOSs. Effective 1 October 1996, only promotable sergeants will be permitted to attend. Class starts for FY97 are: Class 1-97, 16 October 1996; Class 2-97, 6 January 1997; Class 3-97, 17 March 1997; Class 501-97, 22 May 1997; and Class 4-97, 1 August 1997. POC is SFC Lawrence B. Marks, -4125.

Department of Tactics, Leadership, and Engineering

Engineer Officer Advanced Course (EOAC). The EOAC curriculum and student handbook are available on the Internet. Information also is available about the University of Missouri-Rolla master's degree program and the Engineer in Training and Professional Engineer examinations. The EOAC page is linked to Fort Leonard Wood's Home Page. Direct links in these documents connect the user with an instructor at the Engineer School who can answer questions. POC is CPT Kurt Norem, -5764.

Engineer Personnel Proponency Office (EPPO)

Consolidation of MOSs 81C and 81Q Approved. On 14 May 1996, the Office of the Deputy Chief of Staff for Personnel approved consolidation of MOS 81C (Cartographer) and 81Q (Terrain Analyst) into MOS 81T (Topographic Analyst). Consolidated BNCOC training will begin in January 1997; consolidated advanced individual training (AIT) will begin in July 1997.

To facilitate reclassification, the Engineer School is finalizing a transition plan that identifies all tasks in which soldiers must demonstrate proficiency. The approved plan will be distributed by September 1996. Soldiers will have until August 2000 to complete transition training through supervised on-the-job training or attendance at either the consolidated AIT or BNCOC. POC is SFC Theodore Mohn, -4087

Directorate of Combat Developments (DCD)

Polygonal-Based Terrain in the Corps Battle Simulator (CBS). The Jet Propulsion Lab is testing a new version of the CBS. The new CBS leaps from the hexagonal-based terrain grid to a more robust and flexible polygonal terrain grid. A major drawback to the hex-based terrain was that players could only emplace obstacles on the hex edge, and the obstacles had to extend the length of the edge. The new terrain model allows players to emplace obstacles at doctrinal lengths anywhere on the map. An operational test will be conducted at Fort Leavenworth in August. The first planned exercise using the new technology is Prairie Warrior 97, scheduled for May 1997. POC is CPT Bill Davidson, -4084.

Engineer Branch Safety Office

Demolitions Accidents. Serious demolitions accidents to soldiers during the period September 1991 through June 1996 resulted in three fatalities and three permanent disabilities. All of these accidents resulted from a failure to follow procedures or a failure to maintain a minimum safe distance, as described in AR 385-63 and FM 5-250. Failure to follow procedures for steel-cutting charges (AR 385-63 and FM 5-250) contributed to two of the engineer accidents (one fatality and one permanent disability). A training packet called "Demolitions Certification" is available from the Engineer School. To receive copies, call SFC Francisco at (573) 596-0071 or DSN 581-0071. POC is Paul Rusinko, -4025.

News and Notes

60-Kilowatt (kw) Generator Operation and Repair Video. A team effort between Headquarters, U.S. Army Combined Arms Support Command Training Directorate (Fort Lee, Virginia) and the Ordnance Center and School (Aberdeen Proving Ground, Maryland) has produced the video "Operation and Setup of the 60-kw Tactical Quiet Generator." The video is intended to help reduce damage to the generator sets. The video, TVT 9-312, PIN No. 710844DA, is available through local Training Support Centers (TSCs). POC is Ed Starnes, (410) 278-2415.



BRIDGE THE GAP

By Command Sergeant Major Julius B. Nutter
U.S. Army Engineer School

Engineer Force Protection

Our regiment has come a long way in its ability to successfully integrate risk management into training and battlefield operating systems. The number of accidents in fiscal year 1995, shown below, reflects our success.

Engineer Accident Summary

Fiscal Year	No. Accidents	No. Fatalities	Cost (Millions)
93	479	9	$9.7
94	358	11	5.5
95	239	8	6.4

Despite the overall improvement, however, a review of recent training accidents shows a common factor: ineffective risk management.

Risk management is a logic-based, common-sense approach to making calculated decisions regarding human, materiel, and environmental factors before, during, and after every training mission. It enables leaders to maximize their training and operational capabilities while minimizing the risks to soldiers. Risk management is a five-step process that requires all leaders to—

- Identify hazards.
- Assess the risk of each hazard.
- Make decisions and develop controls.
- Implement controls.
- Supervise.

A recent accident involving an M21 antitank mine seriously injured two engineer soldiers. The following information is provided to remind engineer leaders about the restrictions for live-mine training:

- Training is allowed using M15, M16, M19 and M21 mines.
- No training is allowed with live M14 mines.
- All approved mines will be armed/disarmed no more than 25 iterations per mine.
- No trip wires or booby traps will be used.
- Use of tilt rods with live mines is prohibited.
- Training with M16 antipersonnel mines must be conducted with the positive safety pin remaining in the M605 fuze.
- No pre-1957 fuzes are allowed in training with the M16 antipersonnel mine.
- All arming and disarming will be conducted in the prone position.
- Live-mine training and simulator training will not take place concurrently at the same location to preclude a live mine from being mistaken for an inert mine.

Restrictions for live-mine training are contained in the following messages and DA Pamphlet: HQDA, DAMO-TR/DACS-SF, 141237, Dec 90, subject: Live Mine Training; HQDA, DAMO-TRO, 151835Z, Apr 96, subject: Ammunition Prohibited From Use During Training; and in DA PAM 350-38, *Standards in Weapons Training.* FM 20-32, *Mine/Countermine Operations,* provides additional guidance. A basic risk assessment for each of the above mines is in Appendix E of FM 20-32. Units must adapt these risk assessments to account for local conditions.

Human error is responsible for 80 percent of all accidents to Army personnel, including both ground and aviation operations. Accident-causing mistakes occur for a number of reasons. Sometimes the individual who makes the mistake is at fault, and sometimes it is the individual's unit or higher command that is at fault because they failed to provide adequate training, guidance, or supervision.

The "Next Accident Assessment" is a good tool all leaders should use to promote accident prevention. It is included in two booklets available at your local safety office and at the U.S. Army Safety Center at Fort Leonard Wood (*Risk Management Reference Guide & Coursebook,* July 1993; and *Leader's Guide to Force Protection Through Risk Management,* October 1995.) The risk assessment is based on the top five reasons for human-error accidents in both ground and aviation operations over the last 10 years. These reasons involve self-discipline, leadership, training, standards, and support.

Safety begins with every soldier. Training safely does not mean unrealistic training. Units can execute realistic training to standards that is challenging and fun. But to train safely, leaders must be aware of the potential hazards and take sensible precautions.

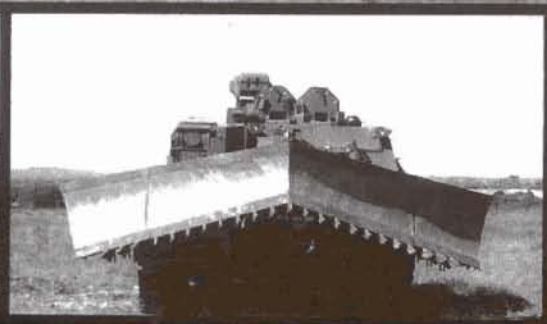
Remember, no single tool or technique can completely protect the regiment. Additionally, tactics, techniques, and procedures applied without disciplined execution will not work. I challenge all noncommissioned officers to protect the force by using risk management in their daily operations and training.

The Grizzly

The Future of Army Engineers









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