Engineer

THE PROFESSIONAL BULLETIN FOR ARMY ENGINEERS

October 2000

Engineer Future

Headquarters, Department of the Army
PB 5-00-4 Approved for public release, distribution is unlimited.

CLEAR THE WAY

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

As I look back at the past 39 months, I realize that if I had had a choice of when to be Commandant of the Engineer School, this was the best time. But now it's time to say good-bye.

I've spent a good portion of my time as Commandant visiting engineer units all over the world. I've seen firsthand officers, NCOs, and soldiers at work and their pride in accomplishing the diverse missions of the Engineer Regiment. I am immensely proud of the enthusiasm and professionalism displayed by all of them. Sappers, both active duty and Reserve Component, are decisively engaged in every major deployment that the Army is involved in. The Engineer Regiment continues to lean more heavily on the Reserve Component with the increased number of deployments we are required to support.

The engineer future is bright, as we have major changes underway in materiel developments. We've led the Army's effort in the antipersonnel land mine alternatives program, which includes development of the new RADAM artillery-delivered antitank mine system and an alternative to our non-self-destructing antipersonnel mines.

We led the Maneuver Support Center efforts for keeping soldiers out of hazardous situations by giving them robotic equipment. The soldiers in Bosnia and Kosovo have been provided robotic countermine equipment and training, like the M60 Panther and the Miniflail. October should see the M1 Abrams Panther being issued to the contingency forces in the Balkans. The soldiers fighting in urban/tunnel environments have been introduced to small robots used in the JCF AWE at Fort Polk, Louisiana.

In October, we will field the Basic Hornet to the 82d Airborne Division. The Hornet changes the way we attack enemy schemes of maneuver and influences the commanders who work with mines at a higher echelon than we've ever addressed. In December, we will begin fielding the Wolverine to the 4th Mechanized Infantry Division, and in March, they will take those Wolverines to the division's Capstone Exercise. We have 26 Wolverines in the pipeline with a dozen more going on order next year.

We fielded an interim vehicle-mounted mine detector last year as part of planned countermine capability sets. We're developing ground-penetrating radar for those ten systems to detect nonmetallic mines. We'll add them in FY02 as part of the Ground Standoff Minefield-Detection System (GSTAMIDS) Program. In the meantime, we begin final development of the handheld STAMIDS (HSTAMIDS) next year. If test results continue to be encouraging, we may buy some early for contingencies.

Next year, we start two more major programs, the Raptor Intelligent Combat Outpost and the Mongoose Explosive Standoff Mine Clearer. Both are critical enablers for the Interim Brigade Combat Team. The Raptor will be pivotal to our ability to dominate terrain over the distances we have to cover with the interim and objective forces. And, we've made the Mongoose C-130 deployable and mobile enough to be the interim force's minefield clearer.

The Grizzly continues to be the centerpiece of our countermine capability and is recognized by TRADOC and DA as essential to the success of the heavy counterattack force. The two prototypes are performing splendidly. Keep reminding your maneuver bosses and brethren that we've got to automate and armor the complex obstacle-breaching task. It's the only way we can accomplish the mission without enormous penalties in casualties, tempo, and training time.

As the Army defines the substance of information dominance, the future of our Regiment is indelibly linked to digital terrain data. From the strategic level, the TRADOC Program Integration Office-Terrain Data (TPIO-TD) completed a two-year effort to define terrain-data requirements for the Army. The TPIO-TD now leads a robust Army team that is working with the National Imagery and Mapping Agency to develop an implementation strategy across the DoD. From a tactical and operational level, the Terrain-Visualization Center and the MANSCEN Directorate of Combat Developments lead the proponent effort to provide the tools to the field to ensure that the engineer is clearly established as the terrain-data expert in the digital force. Over the past three years, we have been able to get the terrain expertise and equipment in the digital division down to the maneuver-brigade level. We have also developed the ability to take this geospatial information and rapidly put it in the hands of the frontline soldiers with the prototype development of the high-volume digital printers. We are driving a fast train that is revolutionizing the way the Army sees the terrain. Every engineer must be a part of this exciting chapter in engineering.

With all that the Engineer Regiment is involved in, we must continue to focus and give priority to modernization. I encourage all of you to remain situationally aware by staying connected to your school and your Regiment. In these resource-constrained times, it is essential that the entire Regiment continues to speak with one voice. I am confident that our great engineer soldiers all want to be successful and will continue to do the right thing. All we as leaders must do is work to get them the resources they need and then point them in the right direction.

I know that our Regiment is in excellent hands as Major General Anders B. Aadland assumes his role as Commandant.

It has been an awesome 39 months. I am truly grateful for the support of everyone in the Fort Leonard Wood community and the entire Engineer Regiment. I am proud and honored to be part of the engineer heritage. Whether fighting fires on the home front, building roads for the people of Kosrae, or keeping the peace in Kosovo, engineers are always "on point."

Essayons!

Engineer

October 2000 Headquarters, Department of the Army **Volume 30 PB 5-00-4**

Front Cover: *The skid steer is shown with one of its seven attachments, the picket pounder. (Photo by PFC Matthew J. Jenkins.)*

Back Cover: *Engineers of the 8th New York State Militia during the Civil War.*

FEATURES

2 **Engineers, Where Do We Go From Here?**
By Lieutenant Colonel Kevin S. Lindsay

15 **The Army Facilities Components System**
By Edward Scott

16 **Updating the Army Facilities Components System**
By Lieutenant Colonel Robert C. Steiger

17 **Theater Construction Management System**
By Sergeant First Class Brian Nering

20 **Engineers Field the HYEX**
By Carolee Nisbet

21 **The Wolverine: An Update**
By Major J. Gary Hallinan

22 **Engineers Train With New, Advanced Equipment**
By Private First Class Matthew J. Jenkins

26 **OPFOR Engineer Platoon Leaders Learn Their Combined-Arms Trade**
By Captain Glenn Matlock, Jr.

29 **The Corps of Engineers**
By Dr. Larry Roberts

32 **Screaming Eagles Bridge the Gap**
By Captain James Handura

34 **The Junior Officer District Intern Program**
By Lieutenant Colonel Christopher J. Toomey, First Lieutenant Jeff Qualteri, and First Lieutenant Kevin Truesdell

36 **Costa Rican Ports Facilities: An Engineer Survey Mission**
By Captain Tim Scarbrough

38 **Enhanced Off-the-Shelf Technologies Help Engineers Prepare for Future Operations**
By Major Barrett W. Larwin

40 **The Thompson Bend Riparian-Corridor Project: An Innovative Environmental Solution to a Major Navigation and Flood-Control Concern**
By Terrie J. Hatfield

DEPARTMENTS

Inside front cover: Clear the Way
19 **Letters to the Editor**
25 **The Engineer Writer's Guide**
42 **Past in Review**
47 **PERSCOM Notes**
48 **CTC Notes**
50 **Engineer Update**
53 **Lead the Way**

ENGINEER (ISSN 0046-19890) is prepared quarterly by the U.S. Army Engineer School, 320 Engineer Loop, Suite 210, Fort Leonard Wood, MO 65473-8929. Second Class postage is paid at Fort Leonard Wood, MO, and additional mailing offices.

POSTMASTER: Send address changes to *Engineer Professional Bulletin*, 320 Engineer Loop, Suite 210, Fort Leonard Wood, MO 65473-8929.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to *Engineer* at the preceding address. Telephone (573) 563-4104, DSN 676-4104. *Engineer's* e-mail address is: bridgess@wood.army.mil. Our Internet home page is located at: http://www.wood.army.mil/engrmag/emag_hp.htm.

OFFICIAL DISTRIBUTION is targeted to all engineer and engineer-related units.

PERSONAL SUBSCRIPTIONS are available for $14.00 per year by contacting the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7950. Address changes for personal subscriptions should also be sent to the Superintendent of Documents.

Engineers, Where Do We Go From Here?

By Lieutenant Colonel Kevin S. Lindsay

This article is intended to stimulate thought and discussion on possible future directions for engineers. Although the article does not necessarily express an official Engineer School position or proposal, the author proposes some actions that might allow us to meet Chief of Staff of the Army General Eric K. Shinseki's vision. The author also illustrates possible future engineer organizations that would be more in line with that vision.

Although engineers remain respected and valuable members of the Army team, it seems we are continually losing key force structure and modernization battles. The armored combat earthmover (ACE) took so long to get fielded that even when it was new, it was already a generation behind other members of the mechanized team. We may still win the fight over the heavy engineer-brigade headquarters, the Wolverine (see article, page 21), and the Grizzly, but the fact that their future is uncertain tells us that many key people in the Army see higher priorities out there for people and dollars.

While we have been struggling to deal with long-standing equipment and organizational problems, Army downsizing has added a new set of problems. We've had to make tough decisions on which units to eliminate or move to the Reserve Component (RC), and we've suffered from the same "salami slicing" (taking a little away from all units to avoid cutting more units) as the rest of the Army. So we've reduced many engineer squads from ten to eight soldiers and steadily reduced support personnel. Units often respond to the latter by detailing soldiers from line platoons into support positions. Many units, even when they are at 100 percent strength, are not as capable as they were twenty years ago.

Review Roles and Missions

So what do we do? How can we not only maintain our current capabilities but actually increase our abilities to support the Army in an era of changing missions, shrinking budgets, and reduced personnel levels? We know that we can't simply dig our heels in to hold on to those systems and structures we've fought for based on the "Cold War Army." While we might win in the short term, in the long term, any system or structure that doesn't support post-Cold War realities will become a bill payer for those that do. It's just a matter of time. *What we must do is identify where the Army is going and what it needs its engineers to do.* We need a total review of our roles and missions and a top-to-bottom review of our units and our command-and-control (C2) structure.

The Army Vision

Realizing that we're not likely to get more money and more people, we have to ensure that we're focused on doing those things that the Army needs most from its engineers. General Shinseki's vision for the Army includes the following:

- **Strategic dominance**. Dominance at every point of the spectrum—from humanitarian assistance and disaster relief, to peacekeeping, to major theaters of war.
- **Responsive**. Quick deployment, over long distances, with sustained momentum.
- **Deployable**. Combat forces capable of going anywhere in the world—a brigade combat team (BCT) in 96 hours after liftoff and a division in 120 hours.
- **Agile**. Forces capable of transitioning quickly from stability support, to warfighting, and back.

- **Versatile**. Units able to fight at any point on the spectrum of operations with minimal adjustment.
- **Lethal**. Every element in the warfighting formation capable of generating combat power and contributing decisively to the fight.
- **Survivable**. Maximum protection at the individual-soldier level.
- **Sustainable**. Reduced logistics footprint and replenishment demand.

The Army's move to create "medium" maneuver forces and the discussions on making heavy forces more deployable and lighter forces more lethal are due to the recognition that we will likely have to move to the fight. Hopefully, if we can move fast enough, we can win the war before it starts by stabilizing a region or reinforcing a weaker ally to the point that an aggressor decides not to attack. If war does break out, then we want to deploy overwhelming combat power quickly to defeat an enemy with minimal loss of friendly forces. Once active combat ends, we must be able to transition to peacekeeping and stability operations. Key engineer considerations for these operations will include the following:

- Construction projects will support civil and military infrastructure to help deter aggression and strengthen a friendly government. Engineers are unique in their ability to provide highly visible assistance to a friendly nation and show U.S. support in a nonagressive manner. Active and reserve construction units have been successfully doing this for years. Airborne and light corps battalions (which are really medium battalions with a great deal of engineer equipment) give us the capability to deploy for these types of missions quickly by air.
- Engineers deployed for nation assistance may also assist in the buildup of U.S. combat power and play a key role in subsequent combat operations. *Versatility is a must.*
- Dynamic obstacles—such as the Volcano, Hornet/Raptor, and Modular-Pack Mine System (MOPMS)—and future scatterable mines will be key if enemy forces engage light and medium forces that arrive early. Dispersion of forces will hinder the emplacement of labor- and time-intensive conventional obstacles.
- Survivability support to light and medium forces could be key because they will not have the heavy armor of the Abrams tank and the Bradley fighting vehicle.
- Support to aerial ports and seaports of debarkation and road networks will be key to the rapid buildup of forces. As potential enemies learn to deliver chemical agents, mines, and conventional munitions deeper and more accurately, our ability to use established airfields and ports will be threatened. We must have the ability for airborne insertion and landing at small, austere airfields. We also must be able to bring in logistics over the shore.
- In-stride breaching (breaching obstacles without dismounting and stopping the maneuver force's momentum) will be key for forces on the attack.
- Air-assault operations will play a greater role as medium formations are created that can be rapidly moved by the joint tactical rotorcraft (JTR) and its planned 20-ton lift capability. These operations will allow engineers to provide rapid mobility support without having to move as part of the maneuver formation. This should be especially true for bridging and small earth-moving operations, where we've actually lost air-assault capability since Vietnam.
- Maneuver forces will still want well-maintained supply routes from the aerial ports or seaports of debarkation to the battalion trains. While future forces will make maximum use of the JTR, commanders will not want to be limited to aerial resupply. A force with such a limitation would be open to catastrophe if the JTR was grounded due to a new enemy air-defense system or some unforeseen weather condition.
- Enemy forces will rely more on their own dynamic obstacles and will gain improved capability to deliver scatterable mines and other munitions on our supply lines. Similarly, they will gain in their abilities to destroy point targets, such as bridges, along our supply lines.
- Dispersion of forces will lead enemy defenders to rely less on labor- and equipment-intensive obstacles such as tank ditches and conventional mines once combat is initiated. Instead, they will reinforce natural obstacles and make maximum use of rapidly delivered scatterable mines.
- We still will encounter heavy use of conventional mines and obstacles in peace enforcement and small-scale contingencies where factions have had months and years to place obstacles.

Recommended Changes

To better meet these future engineer requirements and to address the challenges brought on by aging equipment and the Army's downsizing, we should consider the following when developing our modernization plan:

1. Minimize our organic/normally associated footprint in maneuver formations (battalion task forces).

2. Focus on our unique capabilities to meet future maneuver-force requirements.

3. Simplify engineer C2.

4. Examine and redefine the role of the combat-engineer squad in support of mounted formations.

5. Ensure that we have robust (strong, healthy) engineer units at the execution level.

6. Integrate Active Component (AC) and RC engineers.

7. Improve equipment by going after high-payoff, low-cost developments and modifications.

The following paragraphs elaborate on each of these seven areas. The intent is to stimulate thought—not to criticize past efforts or to imply that these are the only ways to move forward. As anyone who has ever worked a decision-making process or other problem-solving technique knows, the best solution is usually one that emerges during the analysis of several distinctly different courses of action.

1. Minimize our organic/normally associated footprint in maneuver formations (battalion task forces).

As we look to the future, our first challenge is to define the engineer-support requirements for maneuver formations whose capabilities are still being developed. Many assumptions are being made about the mobility, countermobility, survivability, general-engineering, and topographic-support requirements of future forces. Most of these assumptions are toward minimizing engineer-support requirements through revolutionary weapons or logistics technologies.

The Army's goal is to minimize the need for specialized units such as engineer, air-defense, and fire-support teams that must move with the maneuver formation. The logic in this is simple and not really new: All of these specialized forces must be carefully maneuvered to be at the right place at the right time. Not only does this complicate the maneuver commander's job, but these forces also must be deployed in large numbers to ensure that they are there when needed. As a result, the normally associated mechanized engineer battalions that support each heavy maneuver brigade significantly increase the lift necessary to move the brigade. However, they often find themselves underemployed while moving with the brigade (for example, after the initial obstacles were breached in Desert Storm). And, they lack the versatility to support reception, staging, onward movement, and integration (RSOI), bases, and combat-support and combat-service-support (CS/CSS) operations. As a result, we often find ourselves with excess "assault engineers" and are forced to take up more critical lift to move echelon-above-division (EAD) engineers to support RSOI, bases, and CS/CSS operations.

In reality, the Army has already adopted this recommendation and currently plans to put only a small company in the medium interim brigade combat team (IBCT). While the exact size of the company may change, it seems unlikely that future divisions will have an engineer battalion to support each ground maneuver brigade. This may seem like a bad decision to some, but it probably is a reasonable one. If we can keep our normally associated footprint small, but capable, we can build more versatility into the division as a whole by creating a second divisional combat battalion that is not normally associated. This battalion could have the versatility to support a broad range of combat, RSOI, base support, and CS/CSS operations. As the remaining recommendations will point out, we can follow the Army's lead on this and create more versatile, agile, and deployable engineer organizations with companies instead of battalions as the normally associated engineer force supporting a maneuver brigade.

2. Focus on our unique capabilities to meet future maneuver-force requirements.

Currently, combat engineers spend a great deal of time performing labor-intensive tasks that others could do. Concertina obstacles and fences are general battlefield tasks that all soldiers should be able to do—just like digging a fighting position. If we spend great quantities of man-hours (which we are) erecting wire obstacles and fences (including fratricide fencing), then we are providing unskilled labor. Others could perform this labor, but they don't—because they have more important jobs to do. This puts us at a severe disadvantage in the prioritization fight. We also should avoid pursuing force structure for scouting and forward reconnaissance missions for maneuver forces. Instead, we should be able to attach experts to the scouts for engineer-specific reconnaissance. We should also continue pushing rapid topographic support and terrain analysis to units. These are unique engineer capabilities.

Other future requirements that we are uniquely capable of supporting include the following:

Maintenance and repair of main supply routes (MSRs). This mission will be even more important on a widely dispersed battlefield against future enemies that can attack our MSRs with long-range precision munitions and scatterable mines. While the future JTR promises reduced reliance on ground MSRs, few commanders will want to be totally reliant on air resupply for very long. Even in Vietnam (a classic light-infantry/air-assault war), MSR maintenance and repair were major engineer missions. Unfortunately, there is general confusion over whether MSR maintenance (to include bridging) is a mobility or general-engineering/sustainment task. Field Manual (FM) 5-101, *Mobility*, clearly focuses on mobility support to ground maneuver forces—infantry and armor. Bridging and road maintenance and repair, which could be key to a maneuver task force's mobility, are currently considered general-engineering tasks and are covered in FM 5-104, *General Engineering*. When senior leaders talk about mobility, they are often including mobility of unit supplies along the MSR. We have not done a good job of articulating the importance to the Army of maintaining supply routes in the task-force, brigade, and division areas. Articulating the importance of this mission, and fighting for equipment to perform it, will be key to getting the right engineer force to support it in the future. We should start by moving MSR maintenance and repair and bridging out of the "general-engineering" category and include them in "mobility."

Support outside of the maneuver brigades—brigade support areas (BSAs) and aviation, corps artillery, air-defense, and CSS units. As part of the Engineer Restructure Initiative, we put a battalion for each maneuver brigade in the heavy division. These battalions have little sustainment-engineering capability. They lack the versatility to support stability operations (which typically require general engineering) or to support force-buildup operations. This means that corps engineers must deploy early to support stability operations and force buildup. This lack of versatility in heavy-division engineers also means that there are no divisional engineers to support anyone outside the maneuver brigades. (In reality, there are very few engineers to support anyone outside the maneuver task force.) We currently rely on corps engineers to support BSAs, MSR maintenance and repair, aviation assembly areas, towed-artillery survivability, air-defense artillery, CSS units in the division support area, and bridging beyond the armored vehicle-launched bridge (AVLB). The units in question don't need just mechanized engineers—they also need equipment for survivability berms and trenches, leveling ground for support areas, dust control, and simple construction support for bunkers and basic quality-of-life projects. Future structures should correct this lack of versatility in the division's organic engineers. This would enable the division to execute a broader range of missions without corps engineer augmentation—making the division more responsive and deployable.

Minefield clearing and unexploded-ordnance (UXO) disposal. We have said loud and clear that demining and UXO removal are not our missions. We focus almost exclusively on assault breaching of minefields. We may have said this out of fear of becoming bogged down and exposing our troops to unnecessary danger. However, this is very shortsighted on our part. Minefield clearing and obstacle reduction (removal as opposed to breaching or bypassing) are engineer mobility tasks per FM 5-101. Artillery, air- and ground-delivered scatterable mines, and cluster bombs lead to a very dirty battlefield. Enemies increasingly will be able to place scatterable mines on MSRs, airfields, bases, and previously breached minefields. Even if they cannot place direct or indirect fires on these, they will pose a major obstacle on our supply lines if we cannot clear them quickly. Explosive-ordnance-disposal personnel cannot perform these missions alone. We should have the equipment and tactics, techniques, and procedures (TTP) to detonate large numbers of surface-laid or shallow mines/UXO. By taking advantage of our demolition skills and the systems already developed, we could greatly enhance our divisional and corps engineers' ability to safely detect and clear UXO along MSRs, within potential bases, and from assault and helicopter landing zones.

3. Simplify engineer C2.

We should simplify our C2 structure and align it better with supported maneuver units.

Discontinue either brigades or groups. Eliminate one level of C2 and produce a flatter organization that can take advantage of digital information systems. Each division (heavy, medium, and light) should have one brigade/group, and each corps should have one. There should also be some number of brigades/groups for the theater rear. These headquarters could be multicomponent with a mix of AC and RC subordinate units. This would allow a smooth transition from peacetime training, to deployment, to combat/peacekeeping, to redeployment. Each of these brigade/groups (including divisions) should have some type of construction-management section (most would be predominately RC) that would perform drills and annual training with the unit and go to war with them. The RC groups and brigades (15 groups and 4 brigades currently in the structure) could be combined with AC groups and brigades to provide each division and corps with a group. Construction-management sections could be fairly small, utilizing the U.S. Army Corps of Engineers to support any heavy design or highly technical requirements.

Use the same basic engineer C2 structure for heavy, medium, and light forces. Currently, we have heavy divisions with O-6 engineers (we may convert this to an O-6 staff engineer without a brigade headquarters), O-5 brigade engineers, and O-3 task-force engineers. Light, airborne, and air-assault divisions have O-5 engineers, O-3 brigade engineers, and light task-force engineers (one level lower than heavy divisions). The new medium brigade is expected to have an O-5/O-4 engineer with just one organic company. Currently, due to lack of sustainment engineers, all divisions would likely receive large corps augmentation (three to five battalion equivalents) depending on their priority. We try to assign a group to all types of divisions that receive significant corps augmentation.

To provide consistent engineer C2 and a smooth transition during contingencies, we should apply the following recommendations to all maneuver divisions and brigades:

- Assign an O-6 group engineer as the division engineer for all divisions.
- Provide a robust group staff to support division tactical (DTAC), division main (DMAIN), and division rear (DREAR) command posts with a minimum of a major, a captain, and two NCOs for each command post (DMAIN would be larger, of course) without pulling the group XO, S1, or S4. The DREAR should also have a construction-management section.
- Provide an O-4 staff engineer (supported by a captain or first lieutenant, and two NCOs) for each maneuver brigade and the aviation brigade.
- Provide liaison teams (staff sergeant and specialist) for engineer platoons to assist the task-force engineer platoon leader. If trained properly, these teams could assist platoon leaders during planning and then track scatterable mines, other obstacles, and mission status during execution. This would allow platoon leaders to focus on leading their platoons in combat.

Reduce the types of corps battalions. Corps battalions must be versatile—capable of both combat and construction missions. The current combat-heavy battalion with its six vertical-construction platoons is difficult to employ efficiently once combat starts (except in and around rear-area bases). The Army is attempting to reduce our deployed footprint by maximizing use of host-nation and contract engineers. This plan directly threatens the need for our current number of combat-heavy battalions (42 active and reserve). Similarly, corps mechanized battalions (14 active and reserve) have almost no capability to maintain and repair MSRs or to support rear-area bases.

A more efficient system would be to convert current combat-heavy, corps wheeled, and mechanized battalions to multifunctional combat/construction battalions. Separate horizontal, vertical, and bridge companies would then be attached to these multifunctional battalions based on the mission, enemy, terrain, troops, and time available (METT-T). Each battalion—consisting of three line companies with one horizontal platoon and two combat platoons each and a vertical platoon and construction management section in the headquarters and headquarters company (HHC)—could work anywhere from the brigade area to the theater rear. This would reduce the amount of task-organization changes to a bare minimum.

Note: The separate companies mentioned above must be able to break out platoons similar to the way prime-power platoons can be deployed from the company. In peacetime, these separate numbered companies would be assigned to a multfunctional battalion as a fourth company. (This is commonly done with current combat-support-equipment [CSE] and light-equipment companies.)

4. Examine and redefine the role of the combat-engineer squad in support of mounted formations.

Mounted maneuver commanders have been saying for years that they want their engineers to do two things: conduct in-stride breaches and create dynamic obstacles. This simple request poses several issues for engineers to consider:

- The need for organic or normally associated combat-engineer squads to meet these two needs will continue to diminish. Mounted maneuver units need breaching and mine-laying equipment with well-trained operators—not a squad that dismounts to breach or place obstacles by hand.
- We must continue to develop equipment and TTP that enable mounted engineers to perform required mobility tasks using the vehicles they operate (and that protect them).
- We are maintaining unnecessarily large engineer assault elements because of our desire to keep military occupational specialty (MOS) 12B (combat engineer) squads for mobility/countermobility support in mounted units.

Therefore, for mounted forces, we need to look at our assault engineers primarily as vehicles/equipment fighting as part of a mounted formation—not as transporters of dismounted engineers. Doctrine for medium forces is still being developed, but so far it seems that the medium brigade will be infantry-heavy and move in an armored personnel carrier. Again, it seems that equipment to allow rapid movement by these personnel carriers would be more important than the ability to dismount large numbers of engineers. Dismounted infantry can perform many of the same tasks that dismounted engineers would perform. What the infantry probably can't do is conduct in-stride breaches, create dynamic obstacles, and clear rubble/demolish buildings in military operations in urban terrain without engineer-equipment support. The objective force of 2020 to 2030 will rely on specialty units (such as engineer, fire-support, and air-defense) as little as possible. Rather, the capabilities that these elements currently bring to the task force will be built into the maneuver force's vehicles, equipment, and personnel to the maximum extent possible. This further underscores the need to focus on doing those things that only an engineer can reasonably do.

Future engineers who are organic or normally associated with a maneuver force should therefore be very equipment- focused. This equipment must have two operators per vehicle for 24-hour operations. (Why take critical air- or sea-lift space for a piece of equipment if we cannot operate and maintain it 24 hours a day?) The intent here is not to diminish the importance of combat-engineer squads; they remain critical because of their versatility. They allow the combat platoons to be versatile by conducting operations such as route-clearance, obstacle-reduction, and area-clearance after a breach; constructing culverts, bunkers, bridging, and lodgments; providing rear-area security; and fighting as infantry, when necessary. It does seem that 12Bs have lost some of their versatility over the past twenty years. We've significantly reduced the sets, kits, and outfits (SKO) that they carry. Perhaps this is due in part to the reduction to eight-man squads. This trend must be reversed because it clearly goes against General Shinseki's vision of more versatile units.

5. Ensure that we have robust engineer units at the execution level.

We should ensure that units are robust enough to complete missions even when they are short up to 20 percent of their personnel due to peacetime shortages (leaves, transitions, schools, special duties, support details) or combat losses.

Return to ten-man squads. In going to eight-man squads, we have assumed away too many real problems and reduced the squad's versatility (counter to General Shinseki's vision). When the squad dismounts, it must leave a driver (a "shotgun" is also required in many cases) with the vehicle. In peacetime, profiles, personnel transitions, leaves, schools, special duties, and support details (internal and external) mean that an eight-man squad will be short even if the unit is manned to 100 percent on paper. Also, with only five junior enlisted soldiers (including the vehicle driver), the squad has little opportunity to cross train soldiers on construction and the use of special equipment or tools. These same problems will continue in combat; plus, we may have battle casualties.

Man platoon, company, and higher headquarters with sufficient drivers and support personnel to avoid detailing them from squads. Another drain on our squads is that we have allowed modified tables of organization and equipment (MTOEs) to be made that do not provide sufficient drivers, mechanics, and support personnel. Every vehicle must have a dedicated driver; engineer equipment should have two drivers for a 24-hour operation. We need to look at each unit and put the positions on the MTOE to prevent squads and sections from being raided for drivers and mechanics. The same is true for other critical support personnel such as supply; communications; nuclear, biological, and chemical; and armorers.

6. Integrate AC and RC engineers.

We should truly integrate AC and RC units, taking advantage of each other's strengths, especially in headquarters, construction management, and sustainment engineering. The robust structure that we need to command and control organic and reinforcing corps engineers and maintain lines of communication can only be reached if we integrate RC engineers into active divisions.

Construction-management is a prime example of a function that could be performed as well or better by RC personnel. A small active-duty section would be augmented by RC soldiers on weekend drills, during annual training, and when deployed for combat. These RC soldiers often bring technical skills beyond what we can reasonably expect in the AC. Also, some of the units in the division could be RC. To be integrated, the AC will need to make some adjustments. For example, a multicomponent unit will have to designate one weekend a month for training, with two designated comp days shortly thereafter. This may sound silly, but it's a major issue when an RC unit wants to train with an AC unit. Often, the AC unit looks at the training as yet another weekend in the field and says no unless it was already planning to be in the field. AC units tend to expect RC units to adjust their schedule to meet the AC schedule. However, this isn't practical because RC units try to lock in their 39 training days a year out, versus six weeks in AC units. Multicomponent training should be routine and predictable; for example, AC units could plan that "the third weekend of every month, we will train with our RC units."

7. Improve equipment by going after high-payoff, low-cost developments and modifications.

The recent cuts in the Grizzly and Wolverine programs illustrate how difficult it is to get major systems fielded—even when they are fully justified. Maybe we can go for lower-cost systems that take advantage of commercial technology, make current systems (such as the Palletized Load System [PLS]) work for medium and light forces, and look at improvements to current systems.

Air-assault and air-transport capabilities. Air assaulting engineer equipment to where it is needed is a critical engineer force multiplier that was used very well in Vietnam in support of both light and mechanized forces. The JTR will be able to transport 20 tons. We should now start planning to procure equipment that will take advantage of this capability. For example, there are D6 dozers that weigh less than 20 tons. With D6s that compare favorably with current D7 capabilities, does it make sense to rebuild/replace the D7 fleet–or should we begin transitioning to a D6? The later would seem the obvious choice. Similar decisions can be made for most of our engineer equipment. The capabilities of the C-17 and JTR should allow our medium forces to possess capabilities that rival our current heavy engineers, thus enabling our heavy and light organizations to be merged into medium units in keeping with General Shinseki's vision for the objective force.

Future Combat System-Engineer (FCS-EN). Divisional and EAD combat engineers should move in the FCS for force protection. We should be working with the Army to ensure that the FCS has as much mobility capability as possible. The following options should be pursued for the FCS-EN (priority as listed):

- A small bulldozer blade. This blade could be used to dig in, breach, clear rubble, and receive attachments such as a mine roller or plow that rests on the ground to reduce stress on the blade arms.
- A demolition round fired by all FCSs or an FCS-EN.
- A simple heavy-duty grapnel hook that could be fired from the FCS and then mechanically retrieved to cut barbed wire and detonate trip wires.
- Hydraulic and electric tool connections similar to the capability of the current hydraulic-electric tool outfit (HETO) trailer.

These items should be included in all FCSs, as much as possible. If they cannot be, then an FCS-EN should be developed. The capabilities of FCSs versus an FCS-EN or other future combat-engineer vehicle will largely determine the requirements for engineers in the maneuver-task-force formation.

Integrated trailers. We need to take a hard look at our trailers. By upgrading them for use with standard Army prime movers, such as the interim fighting vehicle (IFV)/FCS and family of medium tactical vehicles (FMTVs), we can increase our capabilities at an economical cost. Items such as the new hydraulic tool trailer are a step in the right direction, but we can do more.

Mechanized engineers lost the earth-moving capability and versatility provided by a dump truck in order to improve their survivability. Current thinking is that there may be no engineer variant of the IFV and possibly none for the FCS. It would therefore be a tremendous asset to have a highly mobile trailer that could dump 3 to 5 tons of material. Mine/countermine sets, demolitions, and SKO could be stored in an insert that is easily dumped and retrieved using some type of mini-PLS. Additional features of this trailer should include the ability to "daisy chain" trailers so that one prime mover can pull more than one trailer and a quick disconnect system that allows drivers to disconnect trailers without leaving the cab. These two features, combined with the ability of the medium PLS (described later) to transport two trailers at a time, would allow trailers to "catch up" with elements that have dropped trailers based on METT-T. When combined with the following two inserts, this system would give us tremendous versatility and agility to perform both combat and construction tasks:

- **A mine/countermine insert.** It should contain a Ground Standoff Minefield-Detection System (GSTAMIDS) and other future detection and detonation equipment for use in conjunction with the dump trailer. Optimally, the dump trailer could be attached to the blade on the FCS-EN for mine-clearing operations. In this mode, weight (dirt) would be added to the trailer to make it heavy enough to stay on the ground when a mine is detonated. *Note: Many scatterable antitank (AT) mines are relatively small shaped charges that would do little damage to a trailer filled with dirt.* The GSTAMIDS or other future system could be mounted and suspected mines detonated.

Filled with dirt and equipped with proofing wheels, the trailer would then proof the cleared area in advance of the FCS.

- **An integrated skid steer with tools and attachments insert.** (See article, page 22). With special boxes for hydraulic tools and attachments, the skid steer can load dump trailers, FMTV dumps, and PLS dumps. While the skid steer's bucket is small, the loading speed on many smaller jobs is not critical. The skid steer can go places that small emplacement excavators (SEEs) and bucket loaders cannot go, and it is also easily air assaultable. This integrated piece of equipment, tools, and trailer could be deployed and pulled by anything from an IFV/FCS to a 5-ton truck. With the skid steer, combat engineers could efficiently perform a variety of combat tasks (such as obstacle and bunker construction) and sustainment tasks (such as road repair and vertical construction).

Medium combat-engineer vehicle (MCEV). This item is based on an assumption that we will be able to develop a more capable and survivable combat breacher than the FCS-EN if we limit the crew to three. The smaller crew should enable a lower silhouette, more armor, and a more capable breaching blade. This vehicle should have a blade on the front similar to the Grizzly, a demolition gun, and the same heavy-duty grapnel as described above for the FCS-EN. Deleting the Grizzly's bucket arm should reduce the weight and cost.

Bridge sets. We need a variety of bridge sets that can be rapidly deployed and placed by non-bridge units. With the IFV/ FCS being Class 20 or less, we should be able to produce an air-assaultable bridge that could be placed directly over small gaps (reducing requirements for future medium AVLBs) to cross the IFV/FCS. In fact, this was done in Vietnam with M4T6 dry spans. We should also have air-assaultable piers for these bridges to allow multiple sections to be air assaulted in to span larger gaps. This bridge system could be placed by any engineer unit (site prep by an air-assaultable blade would often be required) and greatly reduce the requirement for specialty bridge companies. *Note: A version of this bridge could be developed for launching from a PLS module.*

Automated fence and marking system. It currently takes more man-hours to mark scatterable minefields than to emplace them. We should be able to come up with some type of rapid marking system that can be attached to a high-mobility, multipurpose wheeled vehicle (HMMWV), a SEE, or a truck to eliminate having 12Bs hand-emplace fences. This system should also allow for some type of antipersonnel obstacle similar in effect to triple-standard concertina wire.

PLS for light and medium forces. Current PLS dump (12 cubic yards), water-distributor, and concrete-mixer modules appear to be easily modified for air deployment because they can be broken down from their prime mover. We need a lighter version of the PLS that can haul 20-ton engineer equipment–such as D6s, loaders, graders, and deployable universal combat earthmovers (DEUCEs)– Class IV, and current and future PLS modules. An example is a 5- or 10-ton tractor that could pull a trailer capable of loading and off-loading PLS racks and able to haul equipment/Class IV when no rack is loaded.While this seems like a lot, it should be doable with rollers and a wrecker-like system attached to the tractor. *Note: The current PLS can haul two racks–one on the prime mover and one on the trailer. This system would only haul one on the trailer.*

The main difference between light and heavy horizontal engineers is their earth-moving capabilities. A 12-cubic-yard (14 cubic yards with sideboards) dump truck would be a tremendous improvement. Light units' graders, loaders, and dozers/DEUCEs are already ideal for most MSR maintenance missions. Using PLS technology would also reduce development costs because heavy, medium, and light units could use many of the same systems. As later structure discussion will show, a medium PLS will provide tremendous capability, versatility, and agility to future forces.

An improved mine-clearing line charge (MICLIC). It should be survivable and simpler and capable of being pulled by a variety of vehicles. The currently planned Mongoose system should provide this capability.

Note: As we move to make ourselves more versatile, we will encounter significant training challenges. As a result, future systems should be designed to be as simple to operate and maintain as possible. This and ensuring that squads and platoons are properly sized are really the keys to versatility. We can also develop innovative training strategies, such as using civilian technical colleges and two-week courses at Fort Leonard Wood or other installations, to take some of the training burden off the units. It is typically the leaders' inability to train soldiers on a wide variety of equipment, rather than the soldiers' ability to learn, that limits what our units can do.

Possible Future Structures

The Army has developed its modernization strategy to reach its objective force as shown in Figure 1. While we sustain and recapitalize selected "legacy" forces, we will concurrently develop interim medium brigade combat teams and interim divisions. We will take advantage of current science and technology (S&T) for our interim forces and future research and development (R&D) to reach our objective force. This objective force will have the same or greater firepower and survivability as current heavy forces but will be much lighter and deployable, using 20-ton vehicles versus the 70 tons of today's M1 main battle tank. As the objective force is fielded, legacy and interim forces will be transformed into the objective design. Engineers can best support this plan by utilizing the seven recommendations previously described. Based on this, I recommend that we look at doing the following:

1. Field assault companies for the IBCTs (now to 2002). (See assault battalion in Figure 2.) While this organization is larger than the company currently proposed, the three assault and

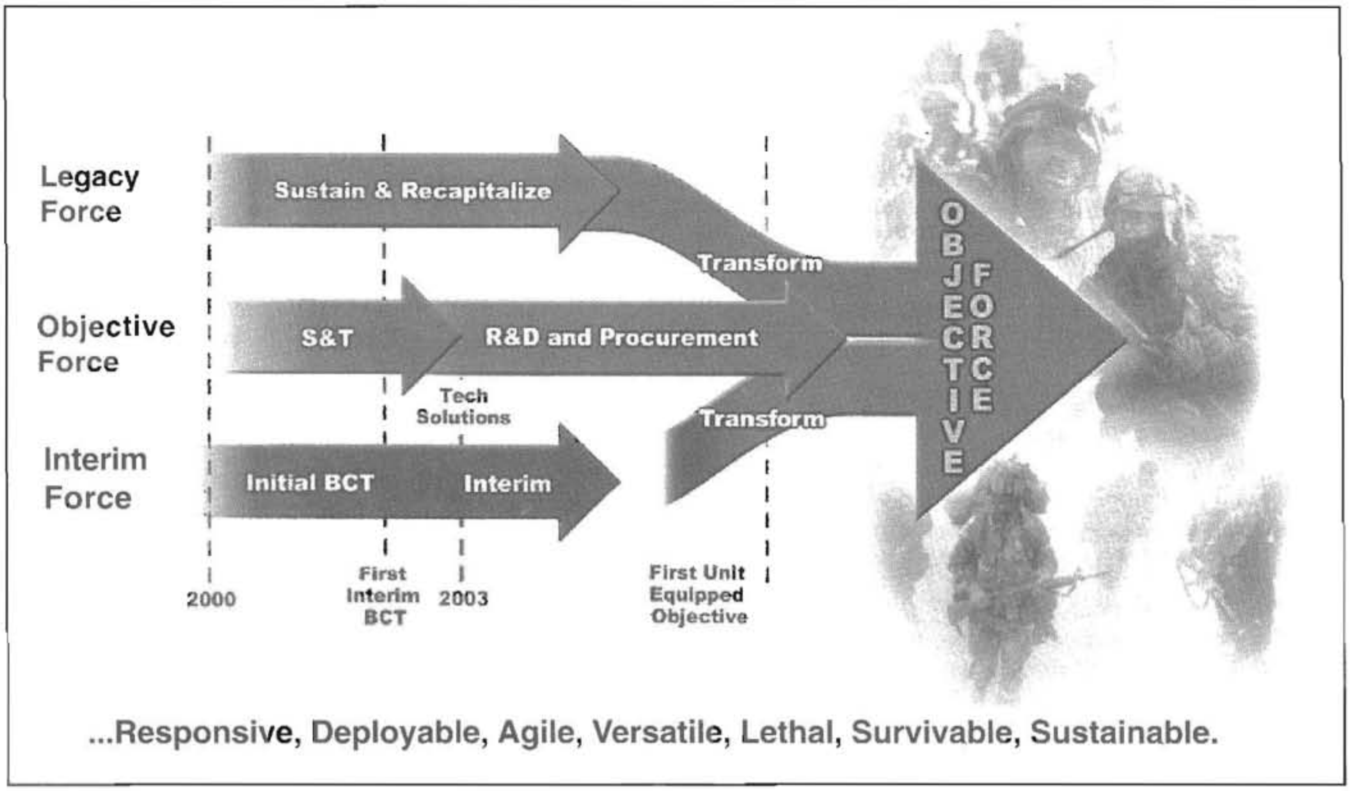


Figure 1. The Army Transformation

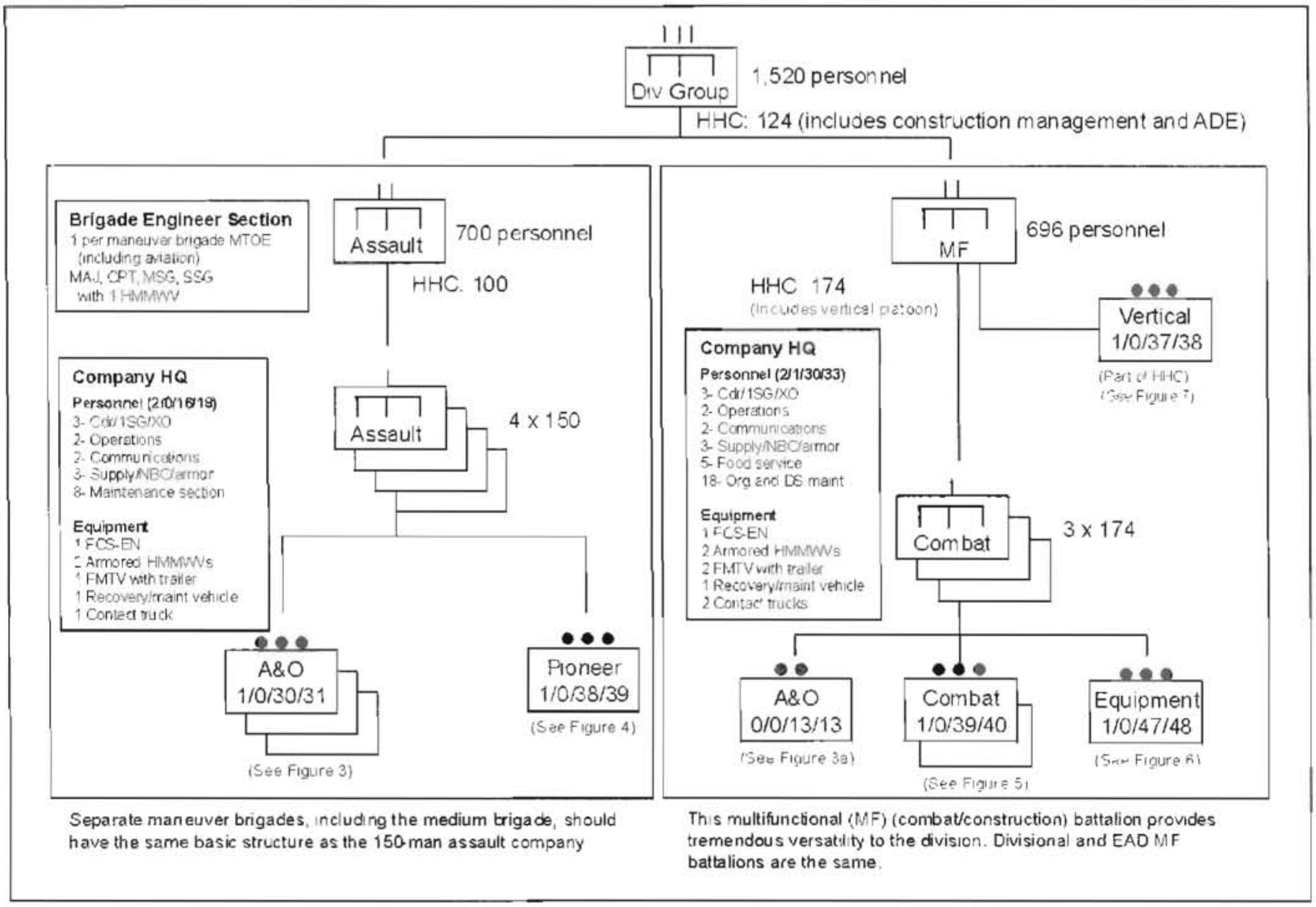


Figure 2. Standard Divisional Engineer Group Structure

obstacle (A&O) platoons (Figure 3) teamed with the pioneer platoon (Figure 4) provide the BCT with critical assault engineering support but are also versatile enough to support a broad range of missions. With this company, the BCT is more agile. It can go in early and support RSOI as well as stability, defensive, and offensive operations. Requiring less corps augmentation, it will be more deployable and sustainable than smaller, less versatile designs.

2. Field engineer groups with the interim divisions that have one assault battalion and one multifunctional (combat and construction) battalion (2003 to 2007). (See Figures 2 to 7, pages 9 and 11 to 13.)

- The assault battalion provides four small, yet capable, companies. Three of them can be normally associated with the three ground maneuver brigades. The fourth company can reinforce the main effort or support the aviation brigade.
- Figure 3a and Figures 5 and 6, page 12, respectively depict the A&O section, two combat-engineer platoons, and the equipment platoon found in the multifunctional battalion's line companies. Figure 7, page 13, depicts the vertical platoon found in the battalion HHC.

Figure 8, page 13, compares the current heavy divisional brigade with the proposed medium divisional group. The comparison shows that the proposed group has virtually the same assault capabilities as the divisional engineer brigade. (The loss of AVLBs is more than made up for by the ability to air assault Class 20 bridge sections that would be managed as a supply commodity.) However, the proposed group has far greater horizontal and vertical construction capabilities. The increase of 151 personnel is a result of making robust squads and platoons that are fully capable of operating and maintaining equipment 24 hours a day. In addition, the proposed group has most of the combat-engineer squads in the multifunctional battalion where their versatility can be fully utilized. This group is fully capable of supporting a broad range of missions without corps augmentation but can also command and control EAD assets without having to bring in a second O-6 group headquarters. The multifunctional battalion's HHC includes a construction-management section with design, survey, and materials-testing capabilities. As such, it can maintain and repair aerial ports and seaports of debarkation, MSRs, and lodgment areas with or without augmentation, depending on the amount of effort required.

The Army currently has two AC corps airborne battalions and three RC corps light battalions that are organized similarly to this design (including the A&O section—called a mobility/countermobility section). The design depicted here has larger squads and platoons; FCS-EN personnel carriers with dump trailers instead of 5-ton dumps as troop carriers; and a mixture of current equipment and new medium equipment such as a D6 dozer, a medium PLS, and an excavator (all less than 20 tons). The result is a fully air-deployable and air-assaultable force with excellent combat-engineering, force-protection, and firepower capabilities as well as horizontal construction capabilities similar to that of a combat-heavy battalion and a significant vertical capability from the vertical platoon and six combat platoons.

Note: Since interim divisional groups may not have a fielded IFV-EN dump trailer, a short-term solution would be to provide each combat-platoon headquarters an FMTV dump with a skid steer on a trailer. This vehicle could be hardened with ballistic glass and selected armor similar to a HMMWV's armor for improved survivability. It should also have a ring mount for MK19s or other automatic weapons (as should most of our trucks and HMMWVs).

If Army force developers balk at making the multifunctional battalion organic to the division, the multifunctional battalion could simply be assigned to the division for training purposes but remain an EAD asset. This is currently done with light equipment and CSE companies. It is key, however, that the division retain the C2 provided by the group headquarters in order to rapidly plan and conduct contingency operations.

3. Convert legacy light and heavy divisions to a similar two-battalion group (2003 to 2007). This would move the legacy organizations more in line with General Shinseki's vision of versatility and agility. The unit's current equipment and that found in current EAD battalions could be used for an interim organization. This would then be replaced by medium versions as the parent division was transformed into an objective division. This conversion would require equipment and personnel to be shifted from current EAD units such as corps airborne for light/airborne/air-assault divisions and combat-heavy for heavy divisions. Since so much of our active force currently resides in the heavy-division engineer brigades, standing up medium interim divisions with two-battalion groups will affect the entire force. Key decisions will have to be made on what units will be AC, RC, and multicomponent. That is why better integration of AC and RC structures is so important.

4. Convert corps combat-heavy, mechanized, and wheeled battalions to interim multifunctional battalions (same as the divisional group's multifunctional battalion) (2003 to 2007). Initially, an interim multifunctional battalion would be formed using current equipment (5-ton dumps as a squad vehicle and D7s). General-construction (vertical) platoons would be converted to combat platoons in the line companies. A vertical platoon would be added to the HHC in the combat-heavy battalions. Wheeled battalions would lose the third combat platoon per company but would gain horizontal and vertical capabilities. Mechanized battalions would retain most of their combat capabilities while gaining much greater horizontal and vertical capabilities. As current equipment is replaced, new equipment would be less than 20 tons (D6s replacing D7s). As mentioned above for the divisional combat battalion, these interim battalions would have to add a 5-ton dump with a skid steer on a trailer until a dump trailer with insert is developed. Before a medium CEV breacher is fielded to EAD units, an interim A&O section could be created using 5-ton dump trucks to haul MICLICs/Mongooses and Volcanos. Just as with the

Figure 3a. Assault & Obstacle Section
(In a multifunctional battalion line company)

Includes:
1 Assault section as shown below
1 Obstacle section as shown below

Personnel: 0/0/13/13

Equipment: 2 MCEVs, 1 medium assault bridge, 2 FCS-EN trailers towed by MCEVs

Mission: Move with maneuver battalions in the attack, breach obstacles, and support a hasty defense. They are reinforced by the pioneer platoon and multifunctional battalion for defense. The liaison officer (LO) team in the platoon HQ can move as part of the task-force HQ. The team tracks mobility/countermobility data for the task force and provides constant liaison with supporting engineers.

Typical attack: The platoon leader/assault sections move with the most critical assault elements. The obstacle section typically stays with the battalion trains until needed. The platoon sergeant may move with either section based on the METT-T.

••• 1-0-30-31

•• **Platoon HQ** 1-0-9-10

2 FCS-ENs
2 FCS-EN trailer

1 Platoon leader (PL)
1 Platoon sergeant (PS)
1 HQ squad leader/LO (SSG)
1 Asst LO (SPC)
4 Drivers/gunners
2 Combat engineers

Note: Attached medics, mechanics, or 12Bs would also ride in the back of the FCS.

•• **Assault** 2 x (0-0-8-8)

Per Section:

2 MCEVs
(include marking system and towing system
1 Medium assault bridge
(medium AVLB or towed and launched from trailer)
2 FCS-EN trailers with MICLIC/Mongoose inserts
(towed by MCEVs or PL/PS FCS-EN)

3-Man crew/CEV
2-Man crew/medium assault bridge

•• **Obstacle** (0-0-5-5)

1 Medium PLS with 2 Volcanos
(could also carry additional MICLIC/Mongoose)
1 SEE variant with fencing machine

3-Man crew for PLS with Volcanos
2-Man crew for SEE variant

2 x

Figure 3. Assault and Obstacle Platoon (Divisional Assault Battalion)

Mission: Reduce breached obstacles along key routes, maintain MSRs, provide survivability and general-engineering support to the BSA, and reinforce A&O platoons during the defense.

(Note: The 12Bs with route-clearing and lane-widening/area-clearance equipment are key to keeping MSRs open.)

••• 1-0-38-39

•• **Platoon HQ** 1-0-5-6

2 FCS-ENs
2 FCS-EN trailers with countermine inserts
(can also carry Volcano system in trailer)

1 Platoon leader (PL) (LT)
1 Platoon sergeant (PS)
4 Drivers/gunners

Notes: The two FCS-ENs with countermine inserts give the pioneer platoon its route-clearing and obstacle-reduction capabilities and provide excellent force protection and firepower.

The combat squad can assist with route clearance and support the equipment section with culverts and simple vertical construction.

The combat squad can also be air-assaulted for demolition/mine missions.

• **Combat** (0-0-10-10)

Moves in the PL/PS FCS-EN or with equipment platoon FMTVs

1 Squad leader
2 Team leaders
7 Combat engineers

•• **Equipment** (0-0-23-23)

3 DEUCE variants (mobile blades)
(armor kits/ballistic glass optional)
2 D6s (air-assaultable JTR)
2 Medium PLSs to haul D6s
(could also accept dump and other PLS modules)
2 FMTV dumps
2 Trailers with skid steers and attachments
(skid steers can load FMTV, PLS, and FCS-EN trailer dumps)
2 SEE variants with trailers for attachments

Figure 4. Pioneer Platoon (Divisional Assault Battalion)

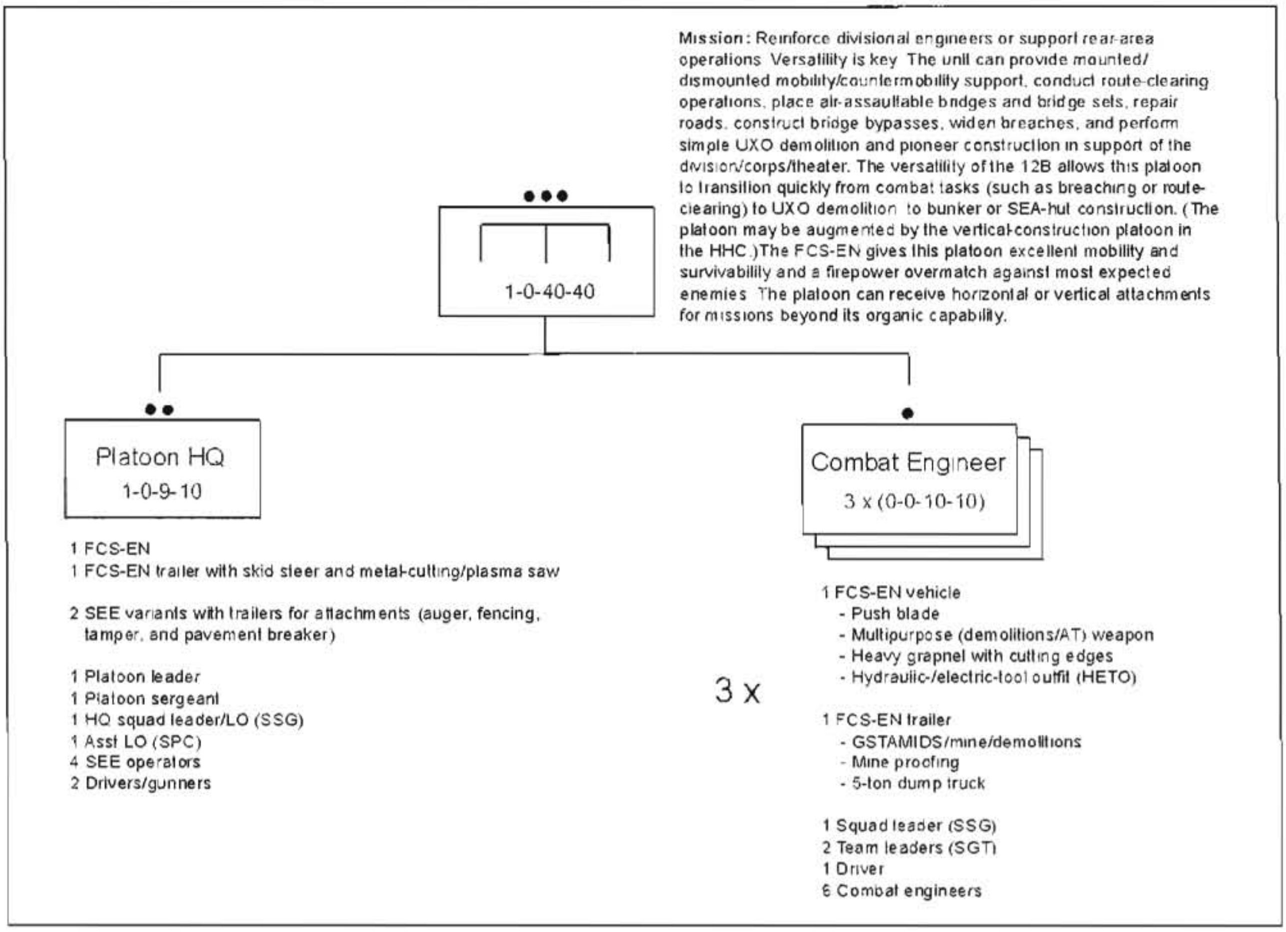


Figure 5. Combat-Engineer Platoon (Multifunctional Engineer Battalion)

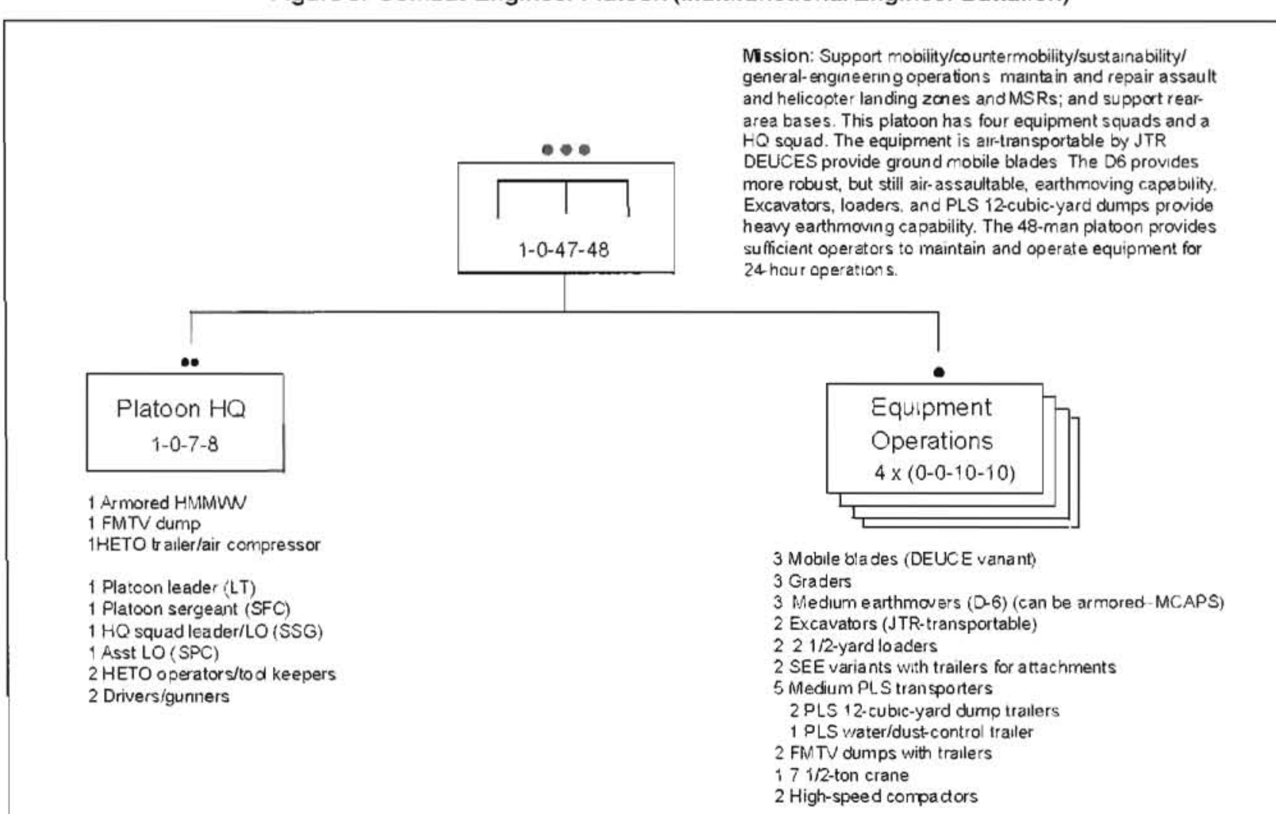


Figure 6. Equipment Platoon (Multifunctional Engineer Battalion)

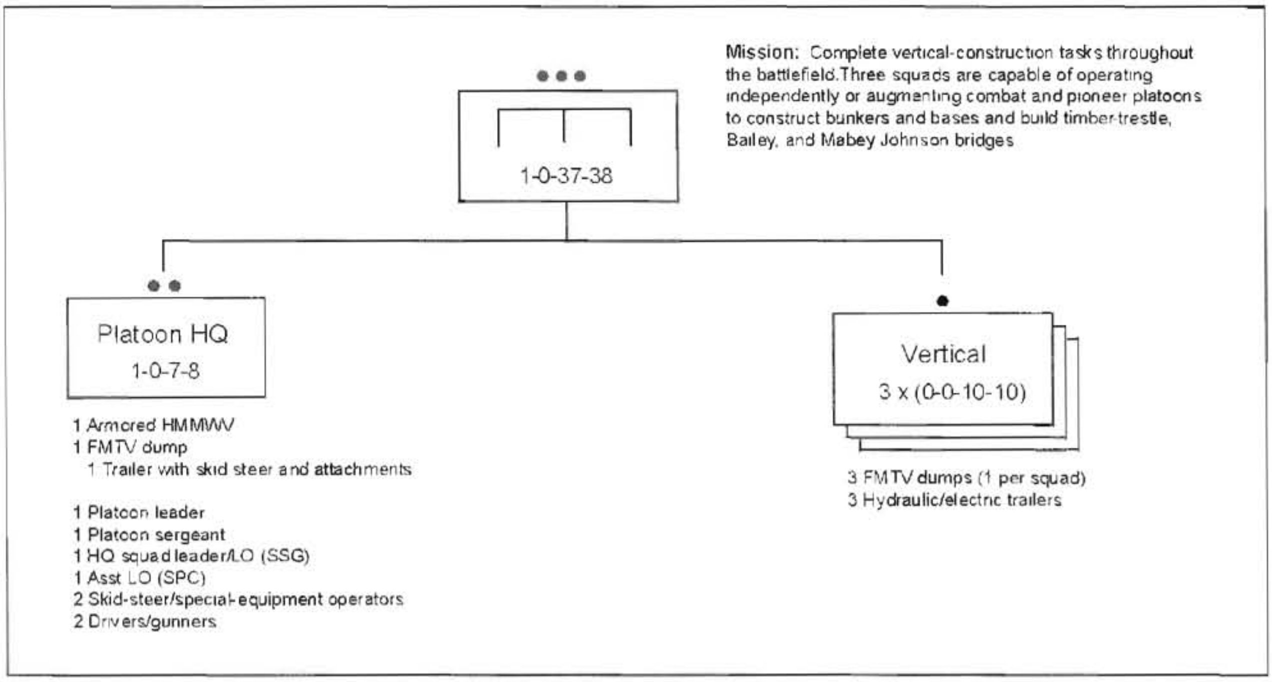


Figure 7. Vertical Platoon (Multifunctional Engineer Battalion)

Major Systems	Current Heavy Battalion	Current Heavy Div Engr Brigade	Proposed Assault Battalion	Proposed MF Battalion	Proposed Div Group (d+e+HHC)	Delta Current-Proposed (f-c)
(a)	(b)	(c)	(d)	(e)	(f)	(g)
ACE/DEUCE variants	21	63	0	9	9	-54
MCEVs	0	0	48	6	54	+54
APC/FCS-ENs	28	84	32	24	56	-28
FCS-EN dump trailers	0	0	32	24	56	+56
MICLICs/Mongooses	12	36	48	6	54	+18
Volcanos	6	18	24	6	30	+12
AVLBs/Med assault bridges	12	36	24	3	27	-9
Graders	0	0	0	9	9	+9
SEE variants	6	18	20	21	41	+23
D6 dozers	0	0	8	9	17	+17
High-speed excavators	0	0	0	6	6	+6
Med PLS equipment haulers	0	0	20	18	38	+38
PLS dump racks	0	0	0	6	6	+6
PLS water distributors	0	0	0	3	3	+3
FMTV dumps	0	0	8	13	21	+21
Cranes	0	0	0	3	3	+3
Skid steers	0	0	8	7	15	+15
Personnel	429	1,369	700	696	1,520	+151

Notes:

1. *All equipment for medium assault battalions and multifunctional battalions weighs less than 20 tons and is therefore air assaultable by JTR and transportable by C-17s and C-130s (newer versions). This not only allows the force to deploy by air but also gives it tremendous capability to move quickly to where it is needed by air assault.*
2. *The proposed divisional group has more personnel than the curent heavy divisional brigade because it has more robust squads, platoons, and headquarters. It is much more capable of 24-hour operations and has equipment to support combat operations; maintain and repair aerial ports of debarkation and MSRs; and support RSOI, force buildup, logistics, and other bases.*

Bottom line: It is a versatile and agile organization.

Figure 8. A Companion of Major Engineer Systems of the Current Heavy Divisional Engineer Brigade and the Proposed Two-Battalion Group

interim combat platoon. these 5-ton dumps could be hardened with ballistic glass, armored cabs, and applique bottom and side armor. With a ring-mounted MK19, this would be a vast improvement in survivability and firepower over current 5-ton dump trucks.

5. Create vertical companies and merge current CSE, dump, and CSC into one type of separate horizontal company (2003 to 2007). Separate paving and quarry detachments would also be retained. The vertical separate companies would work primarily in nation/humanitarian assistance and rear-area bases. They would become building experts similar to prime-power platoons. These separate companies—along with already existing bridge companies—could work independently but more often would work under the control of a multifunctional battalion for design, testing, management support, and security. They should be assigned to a multifunctional battalion in peacetime for the same support.

6. Replace interim equipment with objective-force equipment as technology and funds allow (2007 to 2030). It is important to restructure sooner than later. This will help us avoid replacing/maintaining overaged equipment and units that we no longer need. We will undoubtedly lose battalion and higher headquarters in order to build units that are more robust at the execution level. While painful, this is the right thing to do—the fewer units we have to deploy, the less unit C2 "overhead" will have to be deployed with them. Early conversion will then allow us to focus on developing the equipment and fine tuning interim organizations in order to reach the objective force. A reasonable goal would be to field the first objective force engineer units in 2010. Interim units would then receive objective equipment as funds allow from 2010 to 2030.

Note: While putting a bridge company back in the division is tempting, we should avoid doing so since bridge companies are primarily single-purpose units and would not be needed for many contingencies. Also, bridging does not require extensive combined-arms training with the supported maneuver unit. We would be better off keeping bridge companies (active and reserve) as EAD assets. We should also ensure that sufficient bridge sets (such as the Class 20 described above, the Bailey, and the Mabey Johnson) are available for rapid forward delivery and emplacement by the divisional assault and combat battalions, or multifunctional EAD battalions.

Seize the Initiative

The engineer organizations and changes described in this article clearly support General Shinseki's vision:

Responsive and deployable. The medium division with its engineer group can deploy and conduct a wide range of missions with less EAD augmentation than current structures. The robust squads and platoons will be fully capable of 24-hour operations and therefore ensure that we get the most out of our deployed equipment.

Agile. Medium divisional engineers and EAD multifunctional battalions will be able to rapidly change from construction to combat operations and back again. The simplified, but more robust, C2 structure in the division and corps would allow deploying forces to keep the same engineer C2 team that they have trained with.

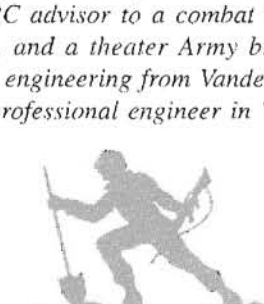
Versatile. Both divisional and corps engineers would be much more capable of supporting a full spectrum of operations. This versatility means that fewer types, and numbers, of engineers must be deployed. Integrating RC engineers into C2 headquarters at the division and corps levels allows us to take better advantage of the tremendous technical capabilities found in the RC. We can therefore provide better construction management, which is the key engineer mission in many low-intensity scenarios.

Lethal and Survivable. Multifunctional battalions (with IFV/FCSs) that replace combat-heavy and wheeled battalions will be much more capable of defending themselves and supporting combat operations, while still having excellent sustainment-engineering capabilities. The additional dig assets in the two-battalion group will also provide much greater survivability support to the division.

Sustainable. By making the divisional and corps engineers more versatile, and thereby reducing the number of corps engineers required, the deployed force is smaller and more easily sustained. The multifunctional battalions in the divisions and the EAD multifunctional battalions ensure that MSRs and aerial ports and seaports of debarkation remain open and keep logistics traffic flowing.

While our challenges may be great, so are our opportunities. If we seize the initiative by voluntarily reorganizing significant portions of the engineer corps to better support the Army's vision, we can control our own destiny and win future resource fights.

Lieutenant Colonel Lindsay is the Assistant Corps Engineer for the XVIII Airborne Corps. He has served with the 27th Engineer Battalion (Corps)(Airborne), the 13th Engineer Battalion/7th Infantry Division, the 36th Engineer Group (Construction) in Somalia, and the 20th Engineer Brigade (Combat)(Airborne Corps). LTC Lindsay also has served with the Nashville District, U.S. Army Corps of Engineers, as a facilities engineer in Hohenfels, Germany; and as an AC/RC advisor to a combat heavy battalion, an engineer group, and a theater Army brigade. He holds a master's in civil engineering from Vanderbilt University and is a registered professional engineer in Virginia.



The Army Facilities Components System

By Edward Scott

During World War II, it became apparent that the Army needed an improved emergency construction-support system to enhance planning and execution of the construction missions in the theater of operations. The goal was to develop standard designs and provide a common base for planning, logistics support, and construction.

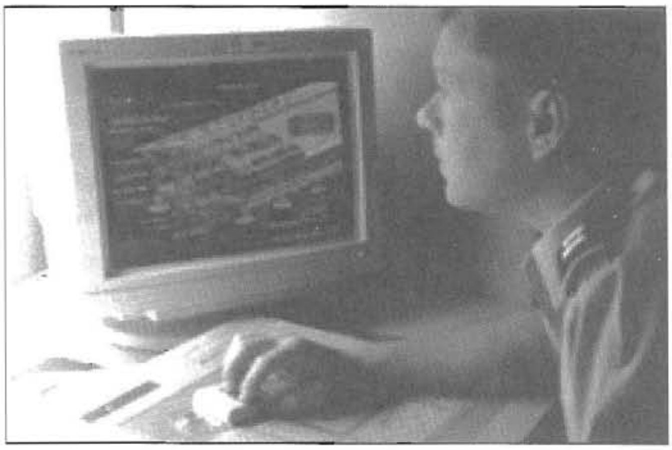
In 1951, the Office of the Chief of Engineers developed a system to facilitate planning and to serve as a construction guide to engineer field units. The system, the Engineer Functional Components System—later called the Army Facilities Components System (AFCS)—was established as a set of standard facility designs, managed and supported at the U.S. Army Corps of Engineers headquarters.

The AFCS design-and-support mission transferred to the U.S. Army Engineering and Support Center in Huntsville, Alabama, in 1978. Program management remains at the Corps's headquarters. The AFCS is an engineering construction-support program for Army mission construction in a theater of operations and for other OCONUS requirements. It also supports emergency construction during disaster relief in any area when required and also supports worldwide humanitarian-relief efforts.

The system was used in support of Operations Restore Hope in Somalia, Uphold Democracy in Haiti, Joint Endeavor/Joint Guard in Bosnia, and Allied Force in Kosovo. The AFCS provides planning guidance, construction drawings, bills of material, and labor and equipment estimates. The Huntsville Center's mission is to maintain and modernize the information contained in the system and to distribute it to all military engineer units on the distribution list or that request the system (see article, page 16). Although the AFCS is updated continuously, the system is sent to engineers annually.

Until 1995, a series of 11 Army technical manuals provided AFCS designs and related information to military engineers. All the information from these technical manuals is now available on a compact disk that can be used on common office computer equipment. This user system is the Theater Construction Management System (TCMS) (see sidebar, page 17).

In addition to the AFCS design drawings and related data, the TCMS includes commercial software and government-developed programming to facilitate planning, logistics coordination, design, site adaptation, communication, construction management, and reporting. The AFCS includes construction drawings and computerized information for about 4,400 facility designs and 750 installation designs. Some of the designs included in the system are troop camps, hospitals, bridges, marine terminals, and ammunition storage facilities.



A soldier uses the TCMS to locate plans for a construction project.

This system not only eliminates the time it normally would take to design a facility but also provides soldiers with a wealth of information.

Among the Huntsville Center's AFCS responsibilities are to—

- Develop budgets.
- Prepare and conduct industrial advancements in technology.
- Plan projects and programs.
- Arrange and monitor periodic exercises of the system.
- Develop and coordinate scopes of work.
- Negotiate and award design contracts.
- Prepare designs, bills of material, and labor and equipment estimates.
- Review designs for technical and functional adequacy.
- Provide automation support for AFCS and TCMS programs.
- Coordinate work with the Corps's labs.

For more information about the Army Facilities Components System, contact Edward Scott at (256) 895-1781.

Mr. Scott, a supervisory mechanical engineer, is the AFCS Branch Chief and project manager for the AFCS/TCMS program.

Updating the Army Facilities Components System

By Lieutenant Colonel Robert C. Steiger

While the World War II-era wooden theater-of-operations buildings are almost a thing of the past on Army bases today, the designs still live on in the Army Facilities Components System's (AFCS's) family of documents. However, the 416th Engineer Command (ENCOM), Darien, Illinois, is leading a project to modernize some of the AFCS designs. The AFCS is the military engineering construction-support system for planning and executing theater-of-operations construction. To the average engineer soldier, it is still a catalog of Army designs for facilities such as base camps and components such as guard towers.

The project to modernize some of the AFCS designs has two parts. First, add to the AFCS-specific designs for Southwest Asia facilities and components, such as sunshades, that are not found in the AFCS today. Second, modify some existing designs to use alternative construction materials that are more prevalent, are available faster, and cost less in the Southwest Asia area of operation. We are focusing on replacing lumber with materials such as concrete-masonry-unit block, plastic or steel pipe, and fabric.

The Beginning

This project originated in late 1998, when part of the 416th ENCOM's Forward Cell deployed to Kuwait to support Army Central Command (ARCENT)—the Army's component of Central Command (CENTCOM)—during Operation Desert Fox. This operation, the response to Iraq's threats toward Kuwait, involved the deployment of more than 4,000 soldiers to Kuwait to build a deterrence force. The Forward Cell was involved in providing facilities for the reception, staging, and onward integration (RSOI) of the soldiers.

We turned to the AFCS for already designed facilities and components but found them unable to meet the needs of the deterrence force. The AFCS designs for facilities to support troops in the field—such as field showers, latrines, guard towers, and administration buildings—were too lumber-intensive and too permanent. The designs were for "temporary" facilities, with a useful life of at least 24 months. What we needed were facilities that met the "initial" standard, with a useful life of 1 to 6 months.

The AFCS had not been updated to include the facility components designed and built during and after Operations Desert Shield and Desert Storm that were Southwest Asia-specific. We couldn't even find designs for some basic facilities that we needed. So ARCENT and the 416th ENCOM had to quickly redevelop designs, specifications, and scopes of work for initial standard facilities and components.

The Project

The after-action report for Operation Desert Fox recommended that designs for RSOI facilities applicable to the Southwest Asian environment be institutionalized. The report specified that designs for both initial and temporary facilities (as defined in Joint Chiefs of Staff Pamphlet 4-04, *Joint Doctrine for Civil Engineering Support*) be included.

In addition, the CENTCOM Engineer Working Group (composed of engineers from all of CENTCOM's subordinate services) also recommended that the AFCS designs be updated and modified to use alternative construction materials and techniques found in Southwest Asia and asked that force protection be included. We nicknamed the project the "Top 20 Project," because we focused on 20 generic facilities and components that are used most by all services (Army, Navy, Air Force, and Marines) in Southwest Asia. Examples are sunshades, showers, latrines, and maintenance hardstands.

Involved in this project are the U.S. Army Corps of Engineers (USACE) Transatlantic Program Center (TAC); the Engineering and Support Center at the Huntsville, Alabama, Division of the Corps of Engineers; the 416th ENCOM's Forward Cell; and the 416th ENCOM's facilities engineering design team. The TAC provides engineering, construction, and contracting services for the Army and Air Force in CENTCOM's area of responsibility and beyond. It is the best source of institutional knowledge of U.S. government-financed or -managed construction in the Middle East. Its forerunner, the Middle East/Africa Program Office, was a key element in the USACE's engineering and construction accomplishments before and during Operations Desert Shield and Desert Storm.

Huntsville's Engineering and Support Center developed and manages the PC-based Theater Construction Management System (TCMS) for construction planning, designing, managing, and reporting (see sidebar). The TCMS, which is used for contingency construction, has proven to be an important system for engineer brigades, groups, and battalions. To find the AFCS drawings and specifications, it is no longer necessary to leaf through the large paper Technical Manuals 5-301 and 5-302, *Army Facilities Components System–Designs;* and 5-303, *Army Facilities Components System–Logistics Data and Bills of Materiel.* Now, units can load the TCMS program and, with AutoCAD® LT, pull up the complete design packages and even issue construction directives from the program. The TCMS makes it easier to ensure faster distribution and use of the latest AFCS changes.

When the 416th ENCOM began the project to update the AFCS designs, the first step was to solicit input from each of the services as to its recommendations for the 20 most used generic facilities and components. We found that we really needed to expand the number beyond 20 to capture all of the most frequently used facilities (see chart, page 18).

The next step was to contact the TAC to see what designs existed for facilities or components constructed during or since Operations Desert Shield and Desert Storm, such as sunshades, that met our requirements. The TAC had a plethora of designs for temporary standard and permanent facilities but very few that could meet the austere design criteria for the initial standard. We contacted personnel at Huntsville's Engineering and Support Center to inform them of this project and find out how difficult it would be to modify the TCMS and the AFCS to add these Southwest Asia-specific facilities and components to the family of designs. Personnel at the center were very responsive and eager to add these facilities.

The project officer for the Top 20 Project then assigned a source of the design, specifications, and bill of materials (BOM) to each of the items. For some items, we could quickly procure the design from TAC because it had already been used in the area of operations to build a facility or component. All the 416th ENCOM had to do was produce the specifications and check the BOM. For many other items, we turned to our facilities engineering design team to either modify an existing design or complete the package for an existing design by developing the specifications and BOM.

A good example of this is the familiar "burnout latrine" from the Vietnam War. The design was modified to replace some wood structural members with plastic or steel pipe. The walls are no longer plywood but are fabric—whatever locally made fabric is available. Although we haven't totally eliminated wood in the projects, we have drastically reduced the amount of plywood needed.

As each design package is finished, engineers with area-of-operations experience review the package to ensure that it is complete and understandable. To date, the 416th ENCOM has completed three of the design packages and is staffing them. The next step is to electronically send each design package to Huntsville to be included in the next versions of TCMS software. So start looking for the first of the new Southwest Asia-specific design packages later this year.

The Results

By modernizing some of the AFCS designs with the Top 20 Project, the 416th ENCOM, the Transatlantic Program Center, and Huntsville's Engineering and Support Center are on the way to making it easier for engineers deploying to Southwest Asia to provide facilities and components to deployed soldiers much faster than before.

Lieutenant Colonel Steiger is a team leader in the 416th ENCOM Forward Cell, Atlanta, Georgia. He previously commanded the 391st Engineer Battalion, Greenville, South Carolina. A graduate of the Command and General Staff Course and the Armor and Engineer Officer Advanced Courses, LTC Steiger holds a master's degree in business administration from Duke University, Durham, North Carolina.

Theater Construction Management System

By Sergeant First Class Brian Nering

Modern Army engineers have a multitude of automated aids to make their job easier. The Theater Construction Management System (TCMS) is one of these aids. Used in conjunction with AutoCAD® LT, the TCMS is a computer-based system for planning construction projects. The system includes design, management, and reporting capabilities.

The TCMS was designed to replace Technical Manuals 5-301 and 5-302, *Army Facilities Components System – Designs;* and 5–303, *Army Facilities Components System – Logistics Data and Bills of Materiel.* These manuals include "blueprints" and schedules for projects ranging from latrines to base camps. The goal was to provide construction units with examples of projects that had already been used in the field. In other words, civil engineers would not have to design a base camp from scratch; they would simply copy the required drawings, make any necessary changes, and start building.

The primary military occupational specialty involved is 51T, technical engineer. The 51T course is taught at Fort Leonard Wood, Missouri, to members of all branches of the military. The 18-week, technically intense advanced-individual-training course is comprised of drafting, surveying, and materials-testing skills. At the beginner level (10), students are taught to search, modify, and print drawings properly. Considering the current inventory of 4,800 plans to choose from, proper search techniques are critical.

In the TCMS—under the "Facilities" pull-down menu—type either a "noun" or short "description" to search for like projects. After locating the desired project, open the drawing file in AutoCAD LT and save it as a separate file. Then changes can be made to the drawing for site conditions or other requirements specific to that project. Currently, personnel at the staff-sergeant level (30) are responsible for determining required changes. The next step is to generate a bill of materials (BOM) needed to build the structure.

It's easy to see how the TCMS has become a time and labor saver. Projects that once required cumbersome technical manuals and a chest of flat files are now on a CD. As always, time is a valuable asset to mission accomplishment, and the TCMS is now "time saved" for the military.

Sergeant First Class Nering is the Program of Instruction Manager for MOS 51T, Directorate of Training Development, U.S. Army Maneuver Support Center, Fort Leonard Wood, Missouri.

reporting (see sidebar). The TCMS, which is used for contingency construction, has proven to be an important system for engineer brigades, groups, and battalions. To find the AFCS drawings and specifications, it is no longer necessary to leaf through the large paper Technical Manuals 5-301 and 5-302, *Army Facilities Components System-Designs;* and 5-303, *Army Facilities Components System–Logistics Data and Bills of Materiel.* Now, units can load the TCMS program and, with AutoCAD® LT, pull up the complete design packages and even issue construction directives from the program. The TCMS makes it easier to ensure faster distribution and use of the latest AFCS changes.

When the 416th ENCOM began the project to update the AFCS designs, the first step was to solicit input from each of the services as to its recommendations for the 20 most used generic facilities and components. We found that we really needed to expand the number beyond 20 to capture all of the most frequently used facilities (see chart, page 18).

The next step was to contact the TAC to see what designs existed for facilities or components constructed during or since Operations Desert Shield and Desert Storm, such as sunshades, that met our requirements. The TAC had a plethora of designs for temporary standard and permanent facilities but very few that could meet the austere design criteria for the initial standard. We contacted personnel at Huntsville's Engineering and Support Center to inform them of this project and find out how difficult it would be to modify the TCMS and the AFCS to add these Southwest Asia-specific facilities and components to the family of designs. Personnel at the center were very responsive and eager to add these facilities.

The project officer for the Top 20 Project then assigned a source of the design, specifications, and bill of materials (BOM) to each of the items. For some items, we could quickly procure the design from TAC because it had already been used in the area of operations to build a facility or component. All the 416th ENCOM had to do was produce the specifications and check the BOM. For many other items, we turned to our facilities engineering design team to either modify an existing design or complete the package for an existing design by developing the specifications and BOM.

A good example of this is the familiar "burnout latrine" from the Vietnam War. The design was modified to replace some wood structural members with plastic or steel pipe. The walls are no longer plywood but are fabric—whatever locally made fabric is available. Although we haven't totally eliminated wood in the projects, we have drastically reduced the amount of plywood needed.

As each design package is finished, engineers with area-of-operations experience review the package to ensure that it is complete and understandable. To date, the 416th ENCOM has completed three of the design packages and is staffing them. The next step is to electronically send each design package to Huntsville to be included in the next versions of TCMS software. So start looking for the first of the new Southwest Asia-specific design packages later this year.

The Results

By modernizing some of the AFCS designs with the Top 20 Project, the 416th ENCOM, the Transatlantic Program Center, and Huntsville's Engineering and Support Center are on the way to making it easier for engineers deploying to Southwest Asia to provide facilities and components to deployed soldiers much faster than before.

Lieutenant Colonel Steiger is a team leader in the 416th ENCOM Forward Cell, Atlanta, Georgia. He previously commanded the 391st Engineer Battalion, Greenville, South Carolina. A graduate of the Command and General Staff Course and the Armor and Engineer Officer Advanced Courses, LTC Steiger holds a master's degree in business administration from Duke University, Durham, North Carolina.

Theater Construction Management System

By Sergeant First Class Brian Nering

Modern Army engineers have a multitude of automated aids to make their job easier. The Theater Construction Management System (TCMS) is one of these aids. Used in conjunction with AutoCAD® LT, the TCMS is a computer-based system for planning construction projects. The system includes design, management, and reporting capabilities.

The TCMS was designed to replace Technical Manuals 5-301 and 5-302, *Army Facilities Components System – Designs;* and 5–303, *Army Facilities Components System – Logistics Data and Bills of Materiel.* These manuals include "blueprints" and schedules for projects ranging from latrines to base camps. The goal was to provide construction units with examples of projects that had already been used in the field. In other words, civil engineers would not have to design a base camp from scratch; they would simply copy the required drawings, make any necessary changes, and start building.

The primary military occupational specialty involved is 51T, technical engineer. The 51T course is taught at Fort Leonard Wood, Missouri, to members of all branches of the military. The 18-week, technically intense advanced-individual-training course is comprised of drafting, surveying, and materials-testing skills. At the beginner level (10), students are taught to search, modify, and print drawings properly. Considering the current inventory of 4,800 plans to choose from, proper search techniques are critical.

In the TCMS—under the "Facilities" pull-down menu—type either a "noun" or short "description" to search for like projects. After locating the desired project, open the drawing file in AutoCAD LT and save it as a separate file. Then changes can be made to the drawing for site conditions or other requirements specific to that project. Currently, personnel at the staff-sergeant level (30) are responsible for determining required changes. The next step is to generate a bill of materials (BOM) needed to build the structure.

It's easy to see how the TCMS has become a time and labor saver. Projects that once required cumbersome technical manuals and a chest of flat files are now on a CD. As always, time is a valuable asset to mission accomplishment, and the TCMS is now "time saved" for the military.

Sergeant First Class Nering is the Program of Instruction Manager for MOS 51T, Directorate of Training Development, U.S. Army Maneuver Support Center, Fort Leonard Wood, Missouri.

Top "20" Projects
Southwest Asia Area of Operations

	Project	Description	Concept
1	Aircraft maintenance	An arch-span metal building	Various aircraft sizes
2	Ammunition supply point	An earth-barricaded ammunition-storage point	
3	Barriers	A concrete vehicle-barrier checkpoint	Placed at gate entrances; reinforced concrete; relocatable; "Jersey" and "Texas" sizes (3 feet and 6 feet high)
	Barriers	A 55-gallon drum vehicle-barrier checkpoint	Placed at gate entrances; filled with water; relocatable
4	Base-camp layout	A site-layout design for a 1,000-man Kaabal	Layout using the above facilities
5	Berms	Perimeter base-camp berms	Six-foot-high earth berms to provide blast protection and wheeled-vehicle barrier
	Berms	Aircraft, helicopter, and Patriot battery protection	Eight-foot-high, sand-grid walls or fabric-lined wire baskets (filled with sand and gravel)
6	Bulk fuel	A bulk-fuel storage and transfer point	Inland petroleum-distribution system (IPDS) feed and truck feed, with earth berms for spill protection; unit provides collapsible bags, piping, and pumps
7	Bunkers	Protective personnel bunkers	SCUD bunkers; reinforced-concrete box culvert, 5 feet high, 8 inches thick, sandbag sides and top, sandbagged Jersey barriers on the ends
8	Displaced-civilian camp	A 5,000-man camp	Layout using the above facilities
9	Electrical-power grid and lights	Electrical-power grid and lighting for a 1,000-man Kaabal	Power cables elevated on timber scissors, with relocatable exterior lights; electricity from 2- by 100-kilowatt generators (1,650 amperes at 120 volts)
10	Enemy-prisoner-of-war camp	A 5,000-man camp	Layout using the above facilities
11	Hardstand	Rough-terrain forklift capable	An area 100 by 100 meters; gravel surface, 6 inches thick; upgrade with 6 inches of concrete
12	Helicopter fueling point	A forward-area arming and refuel point (FAARP)	CH-47-capable, using dust palliatives for dust control
13	Helicopter landing pad	CH-47- and UH-60-capable versions	A concrete pad, 8 inches thick, with tie-downs; dust palliative around pad
14	Latrines	A three-hole field latrine	Wood frame; fabric siding; metal burnout barrels; relocatable
15	Latrines	A one-hole field latrine (foldable portatoilet)	Plastic siding, fabric hinges and snap construction for quick assembly; relocatable; requires sewage service
16	Latrines	A three-tube urinal	PVC pipe in gravel sump
17	Petroleum pipeline	An IPDS (pipeline)	
18	Shower/latrines	A shower/latrine trailer	Eight shower stalls and 8 toilet seats in a 40-foot trailer unit, with sinks and water heater; liftable; requires nonpotable running water, gray-water disposal, and sewage collection
	Showers	Two- and three-stall portable field showers	Wood frame; metal water storage; nonpotable water; relocatable; thermostat-controlled heating elements
19	Showers	Shower trailer	Sixteen shower stalls in a 40-foot trailer unit, with sinks, and water heater; liftable; requires nonpotable water and gray-water disposal
20	Sunscreens	Prefabricated metal building	Without walls; various sizes; capable of storing MILVANs stacked two high
21	Tent pads	A 4-inch gravel hardstand; upgrade with a 4-inch lean concrete slab for tent pads	Concrete pad kept thin and low strength to retain initial standard
22	Towers	Two-man guard/observation towers around perimeter and checkpoints	Steel frame preferred; 10-foot towers (from ground to top of floor); sandbagged sides and top
	Wash basins/shaving stands	Water tower	Steel frame preferred; for nonpotable water; unit provides a 3,000-gallon collapsible bladder; platform elevated to 10 feet

Letters To The Editor

U.S. Army Prime Power: A Tradition of Innovation and Excellence

I was very interested in an article in the July 2000 issue of *Engineer* by CW2 Andrew K. Potter ("U.S. Army Prime Power: A Tradition of Innovation and Excellence"), since it concerned the use of the nuclear power barge Sturgis during the period I worked at the Panama Canal.

Page 3 of the article indicates that the Sturgis was "... moored from 1968 to 1975 in the Panama Canal Zone, allowing the waters of Gatun Lake to be used for filling locks." Actually, the situation was much more complex. The Sturgis provided augmentation power-generation capacity to the entire Canal Zone, especially during the dry season, which allowed more of the water capacity of Gatun Lake to be used for navigation purposes rather than for hydroelectric power generation. Therefore, the lake could be kept at higher levels. This was critical during this period because of the emergence and growth of the "Panamax" container ship, which tested the draft and dimensional limits of the Canal.

The Sturgis provided a valuable service to the Canal operations but had no direct relationship to "filling the locks." Had the Sturgis not been in the Canal Zone during that time, more water would have been used for power generation. This would have lowered the level of Gatun Lake and reduced the allowable draft for transiting vessels, which would have resulted in fewer vessels transiting the Canal. The Sturgis was replaced by two 21-MW Hitachi turbines, one on the Pacific side of the Isthmus and one on the Atlantic side.

LaMar T. Sizemore, CPE
Deputy Director, Public Works
U.S. Army Aviation Center
Fort Rucker, Alabama

Maneuver Support Center's Reply

Thank you for your interest in Engineer *and the prime-power article. We appreciate your knowledge of the work in Panama and your taking time to comment on Gatun Lake and the Sturgis mission. We welcome the opportunity to learn more about the history of the prime-power battalion. It is a long and varied story, and contributions from people who have worked the mission are invaluable.*

CW2 Andrew K. Potter
Combat Developer

Route Reconnaissance: A Lost Art

An article entitled "Route Reconnaissance: A Lost Art" by Captain Matt Pasvogel in the April 2000 issue of Engineer instantly caught my eye.

As a retired NCO, who was a reconnaissance NCO for the 802d Engineer Battalion in Korea and the 11th Engineer Battalion at Fort Belvoir, Virginia, I was impressed with the list of recon equipment in Figure 2, page 16. I didn't have a digital camera or a Global Positioning System back then (I wish I had). My measuring tape in Korea was metric, and I had to convert the formulas or measurements to accommodate the numbers in the formulas in FM 5-170, Engineer Reconnaissance, and FM 5-34, Engineer Field Data.

I recommend adding a Philly rod to the list of recon equipment. Used by surveyors when running levels and finding elevations, this rod also can be used with photographs of bridges to give some reference as to size. A picture of a bridge is fine, but without some way of determining the bridge's size, it is just a pretty picture.

Another useful piece of equipment to have on a recon mission is a stopwatch. You can measure off a certain distance along the bank of a stream or river and then drop a stick into the water at the upstream end and time how long it takes for the stick to travel the measured distance. Using the formulas in FM 5-34, the flow rate of the stream can be calculated. This is critical for determining a bridge bypass.

Mr. Laurie R. Benke II, CCI
Construction Representative
U.S. Army Eastern District Facilities Engineer
Kunsan Project Office, Korea

Engineer School's Reply

We appreciate your comments. They have been noted by the personnel who are upgrading the Field Sketch Set. Meanwhile, positioning a soldier in the digital photo would lend a sense of scale to the structure. The recon form itself requires scaled and/or dimensional drawings along with other critical information. And the GPS—the Precision Lightweight GPS Receiver (PLGR)—has a chronometer feature that digitally displays the current time in an hour-minute-second arrangement.

As a former reconnaissance NCO, you realize the impossibility of carrying all the items necessary to meet every contingency. In the future, Land Warrior capabilities will link video and audio responses of the recon team members directly to the intelligence-gathering headquarters. For those not so equipped, the Field Sketch Set is being modernized with a laptop, a digital camera, a GPS, and laser range-finding devices for reconnaissance and construction use as well as facilities management and contracting.

Alan Schlie
Force Development Analyst

Engineers Field the HYEX

By Carolee Nisbet

On 17 June, the 77th Regional Support Command, Fort Dix, New Jersey, celebrated the first acquisition of commercial hydraulic excavators (HYEXs) for an Army Reserve unit. Five of the HYEXs were added to the inventory of mission, training, and emergency-support equipment used by the 77th's 854th Engineer Battalion.

The commander of the 77th termed the new equipment a combat multiplier that will let soldiers of the 854th complete more missions faster and better. The HYEX is deployable, and it replaces 12 to 15 pieces of equipment in the unit's inventory that are obsolete. It gives the unit the ability to accomplish tasks that they couldn't do before.

The Army opted to switch to the new equipment to save time and money. It would often take as much as half a day to change the extensions on their old equipment, but now it takes less than five minutes. This decreases time spent on projects, which decreases project costs.

The 854th received three types of HYEXs:

- Type I, weighing in at 52,410 pounds, comes equipped with a hydraulic quick-disconnect coupler; a hydraulic thumb clamp; and heavy and utility buckets for general digging, trenching, and lifting.
- Type II, a slightly heftier 62,000 pounds, is equipped with a hydraulic quick-disconnect coupler, a hydraulic rock drill, and a heavy-duty bucket for quarry operations.
- Type III, the heavyweight of the trio at 71,900 pounds, is equipped with a hydraulic quick-disconnect coupler, a heavy-duty bucket, a rock bucket, and an impact breaker for use in quarry operations.

Although the HYEX is not new to public industry, it is new to the Army inventory. It represents a critical step in expanding and improving the unit's ability to train soldiers while meeting its peace and wartime missions. In addition, the heavy-duty equipment will enhance the unit's capability to support the Federal Emergency Management Agency and other humanitarian missions.

A versatile type of construction equipment, the excavators were specifically adapted for military use. During the next year, other engineering units will receive the HYEX. Because of their interchangeable extensions, the three types of excavators can cover every needed job for land construction from drilling, hammering, breaking, lifting, and filling in.

According to the commander of the 77th Regional Support Command, fielding this equipment at Fort Dix is a testament to the post and to the U.S. Army Reserve forces.

Ms. Nisbet is the public affairs officer at Fort Dix, the U.S. Army Reserve Command's largest training installation, and the editor of the Fort Dix Post.

The photograph was provided by members of the 358th Mobile Public Affairs Detachment, Salt Lake City, Utah.

HYEX Type II

The Wolverine: An Update

By Major J. Gary Hallinan

The Wolverine is back for fiscal year 2001. While the Army is transforming to become lighter and more transportable, support to the legacy maneuver force continues. The Product Manager Wolverine, Deputy for Systems Acquisition (DSA), U.S. Army Tank-automotive and Armaments Command (USATACOM), Warren, Michigan, will field 12 Wolverines to the 588th Engineer Battalion, 4th Infantry Division, Fort Hood, Texas, by January 2001—just in time to participate in the First Digitized Division Capstone Exercise at the National Training Center, Fort Irwin, California, in March 2001.

The fielding of the Wolverines is the direct result of several things: restored fiscal year 2000 funding for low-rate initial production (LRIP) increment three, a congressional plus up in fiscal year 2001 to procure 12 additional Wolverines on the current LRIP contract with General Dynamics Land Systems, and the Wolverines' successful demonstration during the Limited User Test conducted earlier this year. Now, maneuver-brigade commanders will have a true military load class (MLC) 70 gap-crossing capability up to 24 meters that can keep pace with and is as sustainable as its supported force.

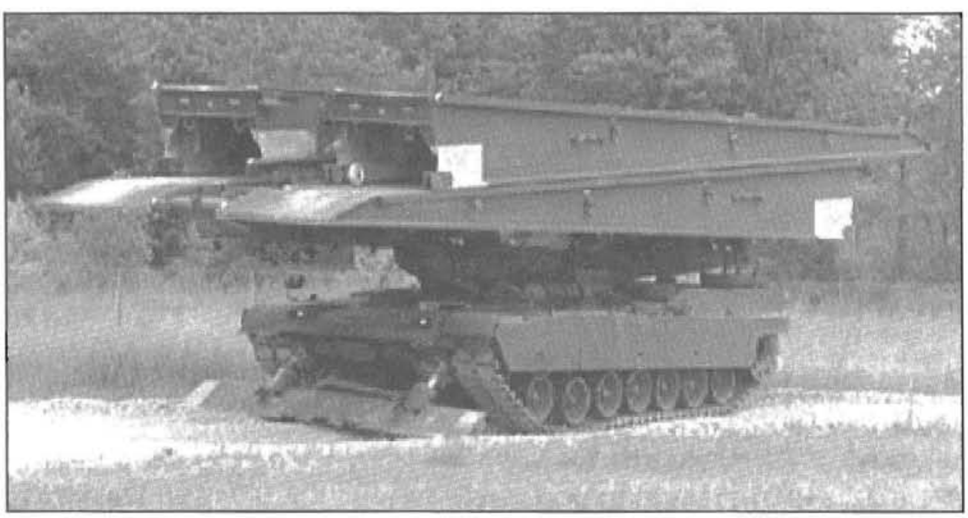
Several milestones still must be met in order to complete the production and fielding of the remaining Wolverines. The system must go through an initial operational test and evaluation in late 2001 at Fort Hood. This test will formally evaluate the entire system—its qualitative reliability, availability, and maintainability as well as the soldiers who interact directly with the Wolverine. Pending successful completion of this test, the Wolverine program will be scrutinized during the Milestone III decision, which is scheduled for the second quarter of fiscal year 2002. The deciding authority (DSA, USATACOM) will base its decision on several criteria to determine if the program is ready to move on to the next phase of its life cycle—full-rate production.

It is clear why the Army decided to restore the Wolverine after its near termination from Program Budget Decision 745. The Wolverine, the Engineer Regiment's only digitized platform, has commonality with the current legacy force since it is based on an M1A2 System Enhancement Program (SEP) chassis that has been modified to transport, launch, and retrieve an MLC 70 Leguan bridge across gaps up to 24 meters wide. The Wolverine will provide the Army with responsive assault-bridging capability, enabling freedom of maneuver on the digitized battlefield. The Wolverine is a one-for-one replacement for the armored vehicle-launched bridge (AVLB). A significant improvement over the older existing technology, the Wolverine brings the following capabilities to Force XXI engineers:

- Improved force readiness.
- Improved force mobility. The Wolverine is as mobile and as agile as the supported maneuver force, a key requirement for flexibility of maneuver.
- Improved gap crossing. The Wolverine can cross 73 percent of gaps theater-wide, compared to the AVLB's 54 percent.
- Caution-free MLC 70 crossing at 24 meters.
- Reduced logistics footprint. The Wolverine's chassis is 90 percent compatible with the M1A2SEP.

The path forward is clear. Although the First Digitized Division Capstone Exercise is not a formal test of the system, the performance of the Wolverine and how it interacts as part of the heavy maneuver, digitized brigade is critical to the future of the program and the role the Engineer Regiment will play in the first Digitized Division.

Major Hallinan is the Wolverine Assistant Product Manager, U. S. Army TACOM, Warren, Michigan.



Wolverine

Engineers Train With New, Advanced Equipment


The lightweight mobile obstacle breacher will clear a path 250 feet long and 18 inches wide.

By Private First Class Matthew J. Jenkins

During the recent Digital Mountain Peak exercise at Fort Drum, New York, sappers from A Company, 41st Engineer Battalion, 10th Mountain Division, trained with new equipment designed to increase the survivability and agility of the division. The training was in preparation for the Joint Contingency Force Army Warfighting Experiment that the 10th Mountain Division participated in at the Joint Readiness Training Center, Fort Polk, Louisiana, from 9 to 21 September 2000. Combat engineers are an integral part of the combined-arms team, and this new equipment will allow brigade engineers (engineer company commanders) to respond quicker to the brigade task-force commander's intent on the battlefield.

Lightweight Mobile Obstacle Breacher

To clear a path through a suspected minefield more quickly, light engineers now can turn to the lightweight mobile obstacle breacher (LMOB). The 55-pound, manpackable device is designed to eliminate surface-laid or buried antipersonnel mines. The LMOB contains a 250-foot, rocket-propelled detonation cord; a 30-foot spool of wire that attaches to the detonator; and a stake that secures the case to the ground.

The detonation cord contains 1,000 grains of explosive substance per foot, which will clear a 250-foot-long, 18-inch-wide path through an antipersonnel minefield. This is 20 times stronger than the old 50-grain-per-foot detonation cord. Attached to the front end of the detonation cord are two twisted metal cables about 3 feet long. These lightweight cables, which are attached to both sides of the rocket base, allow the rocket to successfully deploy without tearing away from the detonation cord. The LMOB, which comes with two reloads per kit, eventually will be employed by infantrymen if sappers are not readily available.

Mini-Mine Detector

One of the new tools that will increase the survivability of light fighters is the mini-mine detector (MIMID), which is about half the weight and one-fourth the size of the older conventional mine detector (the AN/PSS-12). A soldier can comfortably crawl on the ground with this new device to elude enemy fire. The small, collapsible frame of the MIMID makes it ideal for light engineers or light fighters to have readily accessible. Unfolding up to 4 feet in length, the 6-pound MIMID is powered by four AA batteries that are located in the handle.

To use the MIMID, a soldier sticks one hand through a hollow, rectangular frame and grips a handle located directly behind the top of the electronics control unit (ECU). The top of the frame rests against the bottom of the wrist to provide stability. A soldier can probe a 1-meter area 180 degrees in front of him with the MIMID's hollow, rectangular search head.

The ECU is the brains of the MIMID. There is a light-emitting diode (LED) on top of the ECU and an earpiece connection on the right side. A pair of knobs at the bottom of the ECU allows an operator to control the volume of the earpiece and the sensitivity of the search head. The ECU of the older mine detector was separate from the probing device.

The LED allows light fighters to tell if they are "hot" or "cold" when it comes to mine detection. The flashing red, six-level meter goes from top to bottom to inform a soldier of the presence of a metallic object. Then a "probe man" determines if the metallic object is a mine. If it is, a demolition team comes along and destroys the mine.

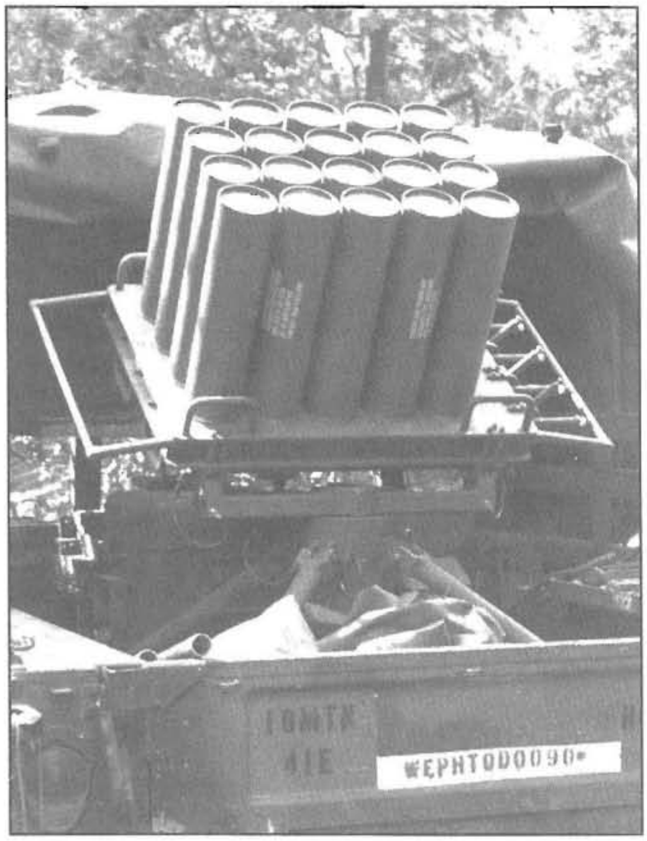
Volcano (Light)

In addition to new devices for defeating the enemy's land mines, light engineers are training with a new tool that will allow them to lay mines of their own. The Volcano (Light) is designed to lay a minefield about 900 feet long and more than 110 feet wide. Attached to the back of a high-mobility, multipurpose, wheeled vehicle (HMMWV), it allows more mobility than the larger Volcano, which is attached to a 5-ton truck.

The Volcano (Light), which is operated from where the back seat would normally be in a HMMWV, sits about 18 inches off the vehicle's floorboard on a stand that rotates 180 degrees. The Volcano (Light) has twenty 2-foot-long metal canisters, each containing five antitank mines and one antipersonnel mine. The canisters are braced by an inclined strip of metal. Once the canisters are armed, pressing a button expels the mines over the perimeter. When the mines hit the ground, trip wires spring out of each mine to prevent the enemy from passing safely.

M-Gator

Conserving soldiers' energy on today's up-tempo battlefield is always an issue, and a new device unveiled during Digital Mountain Peak helps conserve that energy. The newly modeled M-Gator is basically a military golf cart. It's a six-wheeled, topless vehicle that is able to travel through all types of terrain. About 3 feet tall, it is much more mobile than a HMMWV.



The Volcano (Light), scaled down to fit a HMMWV to match the mobility of a light fighter, creates a defensive minefield.

The two-seated vehicle can haul up to 1,400 pounds of equipment in two cargo trays. The smaller equipment tray on the hood holds about 2 cubic feet in volume, and the rear tray holds about 14 cubic feet. The 18-horsepower M-Gator, which runs on diesel fuel and can reach a speed of 17 miles per hour, can be sling-loaded by a UH-60 Black Hawk helicopter. The M-Gator can be used for ev-acuating casualties, laying communication lines, and transporting messages.

Skid Steer

In addition to helping clear obstacles, a new initiative—the skid steer—will also help light engineers construct some obstacles and field fortifications of their own (see *Engineer*, February 1998, page 18). The highly maneuverable skid steer, which resembles the combination of a small bulldozer and a small forklift, increases combat-engineer-squad capabilities and reduces physical fatigue. Two versions of the skid steer—both camouflage-painted and commercially available—are being evaluated. The Melroe Bobcat® Model 763 (see front cover) is a rubber-tired vehicle but, when needed, steel tracks can be manually installed over the tires to increase mobility. The Caterpillar® ASV Model MD-2810 has full-time rubber tracks for propulsion, which gives a reduced psi rating for traveling over wet and swampy terrain. Seven different attachments can be installed on either skid steer:

- Picket pounder—installs concertina wire, pickets, and post.
- Clamshell bucket—excavates or drops material in a designated spot. It is used for paving projects, such as filling in potholes.
- Auger (12-, 24- or 36-inch)—drills holes. One practical use for the 24- and 36-inch augers is to drill side-by-side holes up to 5 feet deep.
- Backhoe—excavates sand or gravel.
- Pavement breaker—breaks down pavement, concrete, or asphalt obstacles.
- Closed bucket—transports excavated materials.
- Fork lift—moves palletized equipment.

High-Mobility Engineer Excavator

The new high-mobility engineer excavator (HMEE) will phase out the older small emplacement excavator (SEE). The HMEE will provide better mobility, greater reliability, and a larger front-end loader than the SEE. The HMEE can reach a speed of 70 mph, as opposed to the SEE's top speed of 30 mph. The HMEE's front-end loader can be used for limited bulldozing. A backhoe attachment can excavate up to 14 cubic feet of dirt or gravel per scoop, 7 cubic feet more than the SEE. When the backhoe is not in use, it folds up, turns sideways, and leans in toward the HMEE's cab. The HMEE will be helpful to all soldiers on the battlefield, whether they need to dig a fighting position in a few seconds or construct a large berm to serve as a barrier from the enemy.

Robotic T-3 Dozer

Light engineers also will be using some new technological initiatives to tackle obstacles during military operations in urban terrain (MOUT). They can stay out of harm's way while clearing obstacles, thanks to the new Robotic T-3 Dozer, which is designed to clear away rubble and debris that obstructs the path of light fighters in MOUT settings. The diesel-fuel-operated dozer is about 12 feet long and 9 feet tall. Propelled by steel tracks, it weighs between 4 and 5 tons and has a top speed of about 10 mph. The remotely controlled bulldozer can be operated from up to 1,000 feet away. A camera placed on the ceiling of the dozer's cab projects onto a television screen and allows the operator to see as if he were sitting in the cab.

Urban Robot

Light engineers also trained with a new robotic reconnaissance tool that is small enough to recon sewers and tunnels in a MOUT setting. The urban robot (URBOT)—which has a camera on its front, rear, and top—can be operated from up to 1,000 feet away. A lithium battery powers the unit for up to 2 hours.

The black aluminum URBOT is a 65-pound, manpackable initiative that is about 2 feet long and 1 foot wide. It is rubber-tracked, can travel about 3 feet per second, and can climb stairs. The URBOT is a unique two-way reconnaissance device: the operator can speak through the device and also hear sounds. The URBOT can be guided to approach a person, shine a light

The HMEE is faster and more reliable and will do double the work of the SEE.

in his face, and speak directly to him to identify him as friend or foe. Another use the 41st Engineer Battalion found for the URBOT was to guide it under a HMMWV to find an oil leak with the robot's lighted camera.

Topographic Systems

In addition to those forms of reconnaissance, light engineers can also provide topographic maps to brigade task-force commanders. A three-part system for collecting topographic information will allow terrain detachments to disseminate information much faster. The system collects data from satellites orbiting the earth, sends it to a compact disc, prints it, and puts it into squad leaders' hands.

The first new initiative accessed in this chain of events is the Rapid Terrain Data Generation (RTDG) System. This set of compact discs contains data collected from aerial reconnaissance devices. Satellite dishes that orbit the earth and airplanes feed the computer data about terrain features. The technology on the compact disks turns the data into a high-resolution topographic map.

After the data is sent from the RTDG System, it hits the second new initiative on this information highway, the Digital Topographic Support System-Light (DTSS-L). The DTSS-L is mounted inside a shelter on the back of a HMMWV. In addition to the regular devices of a HMMWV, the DTSS-L has some commercial-off-the-shelf (COTS) technology—such as printers, scanners, and a computer workstation—to help topographers process the geographic data. Through a computer network link, the information goes to a third new initiative, the Rapid Hardcopy Reproduction (RHR) System. The RHR System has the capability to print up to 5,000 color maps a day. Because they are connected by a computer network, RHR Systems can be set up in many places on the battlefield. This will allow information to be distributed to a large group of people in a small amount of time. The brigade's tactical-operations center will be able to disseminate the topographic information all the way down to the squad leaders.

Conclusion

The 41st Engineer Battalion wants to build on these emerging technologies to increase the unit's versatility and mobility on the modern battlefield. With this new equipment, the battalion will be better prepared to maximize combat-engineer support to the division across a full spectrum of operations.

(All photographs by Private First Class Matthew J. Jenkins.)

Private First Class Jenkins, a staff writer for the Fort Drum Blizzard, is a graduate of the Department of Defense Information School's Basic Journalism Course 6-99, Fort Meade, Maryland.

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 are 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 of the subject being presented. Articles should be concise, straightforward, and in the active voice.

Length should range from 2,000 to 4,000 words, and text should be double-spaced. Generally, each such page should contain from 200 to 250 words. Manuscripts should be originals or clear copies. Provide a 3 1/2-inch disk in Microsoft Word, Rich Text Format, or ASCII (please indicate word-processing format on disk or cover letter). You also may send articles by e-mail to *bridgess@wood.army.mil.*

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

Contributors are encouraged to include black-and-white or color photos, artwork, and/or line diagrams that illustrate information in the article. Include captions for any photographs submitted. Hard-copy photos are preferred, but we will accept digital images originally saved at a resolution no lower than 200 dpi. Please do not include them in the text. If you use PowerPoint, save each illustration as a separate file and avoid excessive use of color and shading. Please do not send photos embedded in PowerPoint.

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 a fax number and commercial daytime phone number.

Reviews of books on engineer topics are also welcome.

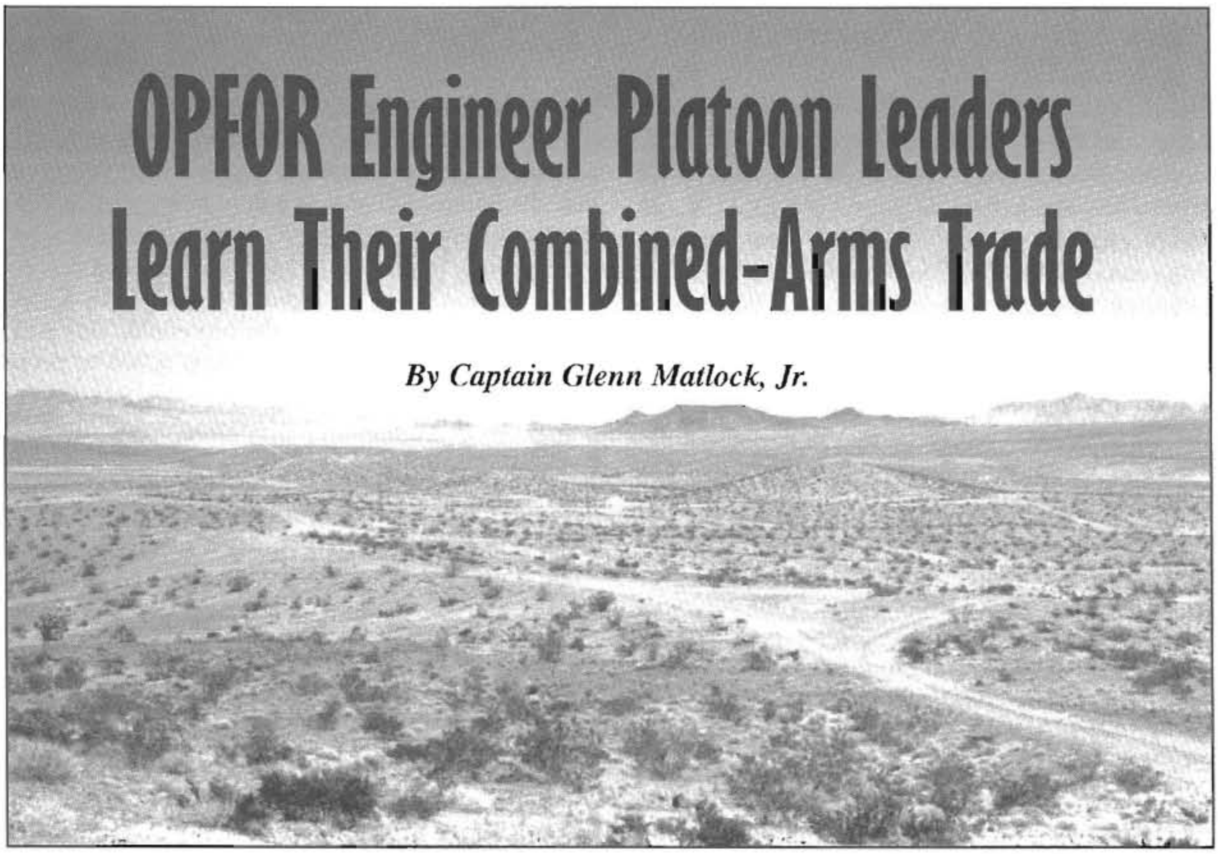
Articles or book reviews may be mailed to: Editor, Engineer Professional Bulletin, 320 Engineer Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

All submissions are subject to editing.

If you have questions about an article you're working on—or considering writing—call Shirley Bridges, at DSN 676-5266, or commercial (573) 596-0131 ext. 35266. We look forward to hearing from you.

Note: Due to the limited space per issue, we will not print articles that have been accepted for publication by other Army professional bulletins.

OPFOR Engineer Platoon Leaders Learn Their Combined-Arms Trade



By Captain Glenn Matlock, Jr.

By and large, junior officers who serve as combat supporters with the opposing force (OPFOR) at the National Training Center (NTC) at Fort Irwin, California, develop a firmer grasp of combined-arms operations than their peers who serve in different branches and/or duty locations. Engineer platoon leaders serving with the 58th Combat Engineer Company (CEC)—the separate company that supports the 11th Armored Cavalry Regiment (ACR) in its OPFOR mission at the NTC—learn and master their trade as combined-arms combat supporters. They practice multiechelon leadership, hone their skills as staff advisors, develop a higher degree of situational awareness, and repeatedly plan and conduct a combined-arms operation. Then, they put all the pieces of the combined-arms operation together in a large-scale-conflict scenario.

Serving in Multiechelon Leadership Positions

The learning curve for junior officers in the OPFOR is steep because they typically serve in positions that represent units one to two levels higher than their actual unit. For example, a platoon replicates a company and a company replicates a battalion. As such, the leadership also must rise to the occasion of the troop-leading duties that the replicated unit requires. Put simply, a platoon leader in garrison becomes a company commander on the battlefield.

When the 11th ACR takes on the role of the OPFOR, it fuses two maneuver squadrons together to replicate a motorized rifle regiment (MRR), consisting of four motorized rifle battalions (MRBs) and each implied headquarters element. In support of the OPFOR mission, the 58th CEC coordinates the efforts of a visiting engineer company with its internal capabilities to replicate the 46th Krasnovian Engineer Battalion.

To simplify the process of supporting the OPFOR in each of its dynamic missions on the NTC battlefield, the 58th CEC incorporates the duties of the three line platoon leaders into components of the OPFOR campaign. One platoon leader is responsible for coordinating the company's support for offensive operations, such as meeting battles, MRR penetration missions, counterattacks, raids, and decoy missions. Another platoon leader coordinates the company's support to defensive operations, including deliberate and hasty defenses, covering-zone operations, and security-zone operations. The third platoon leader either augments the executive officer as the operations officer in the field or manages sustainment projects tasked to the company. The assault-and-obstacle platoon leader advises maneuver commanders on all survivability operations.

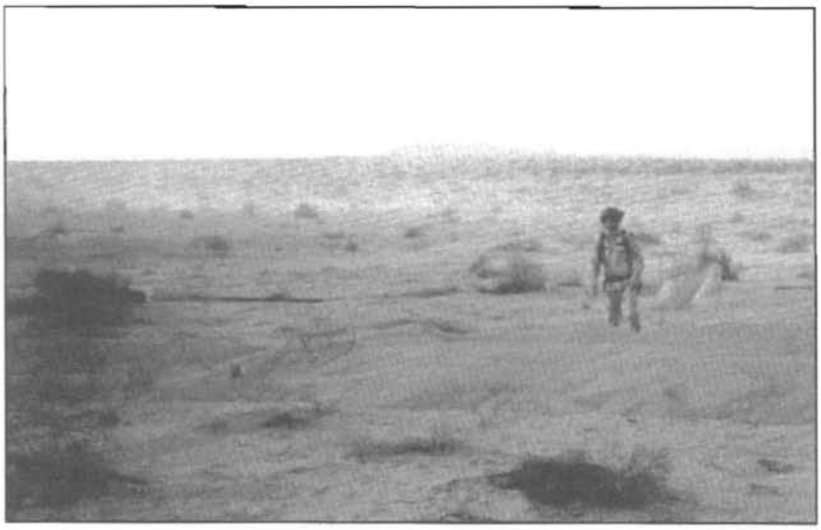
In defensive operations, such as MRB deliberate defenses or MRR security-zone defenses, the platoon leader responsible for defensive support coordinates not only the efforts of his platoon but also those of the other platoons in the company and an additional company of augmentee engineers. In terms of execution, the defensive platoon is responsible for the entire defensive operation, a planning and supervising task usually tackled by a company or battalion. Likewise, the offensive platoon leader is responsible for all engineer support to the MRR in offensive operations, usually a task for an engineer company or battalion commander.

Engineer platoon leaders have the opportunity to staff and plan the operation that they will support, develop the accompanying engineer overlays and estimates, and then execute and supervise that operation. Platoon leaders can observe their overlay becoming not just a complex obstacle belt but a full-blown engagement area. Their level of involvement stretches through the entire defensive operation as they overwatch the critical areas in the obstacle belts—supervising the execution of situational obstacles, reporting the enemy's positions and activities while conducting breaching operations, and calling for fire. Not only do the platoon leaders experience the magnitude of providing engineer support to a regiment-sized unit, but they also witness the effects of their mission on the higher unit's mission and on the enemy.

Serving As Unit Leaders and Staff Officers

Combat supporters who are with the OPFOR wear dual hats, serving both as their respective unit leader and as the regimental staff officer. In the OPFOR, there are no staff officers who are equivalent to assistant brigade engineers to serve as the link between the regimental staff and the 58th CEC. Instead, the platoon leader who supports offensive or defensive operations is the engineer advisor to the staff and commander. These platoon leaders, with varied assistance from the executive officer, attend the planning sessions for the war games, orders, and rehearsals that are pertinent to either the offensive or defensive operation.

Regimental and squadron staff officers and commanders depend on engineer platoon leaders to be experts in the mobility/countermobility/survivability Battlefield Operating System (BOS). Engineer lieutenants must be masters of their field craft because the success of the NTC operation depends on it. For example, the platoon leaders who support defensive operations advise MRB commanders on engagement-area development, situational-obstacle use, and engineer blade assets for all the defensive missions for a given rotation.



An OPFOR engineer helps his squad create a breach lane.

There are usually five battle scenarios for the force-on-force portion of the rotation, with at least two or three of them being defensive missions for the OPFOR. Therefore, the defensive platoon leader must coordinate with three separate MRB commanders to plan engagement-area development for each rotational scenario. Planning must include analysis of the enemy's possible courses of action, deception, flank security, mobility of the combined-arms reserve, and the location of fighting positions and obstacle belts in relation to system capabilities of both forces and terrain. In short, the engineer platoon leader must craft an engagement area that optimizes engineer assets and time, maximizes the use of terrain, protects friendly combat forces, and fully supports the MRB commander's intent and scheme of maneuver. These tasks normally are performed by an engineer-battalion staff or by an engineer-company commander. Platoon leaders in the 58th CEC perform the tasks with minimal supervision, in addition to performing their platoon-leader duties. As a result, junior lieutenants practice the higher-level planning and staffing process, which provides them exposure to the combined-arms planning process.

Learning Through Repetition

Junior officers who serve with the OPFOR practice combined-arms operations several times per month every month. At the NTC, there is always a next time. Leaders can take away lessons and apply what they have learned repeatedly throughout their tenure of leadership. Furthermore, since the OPFOR must be a freethinking opponent, the scheme of engineer operations must constantly adapt to the capabilities of the visiting brigade combat team, the regimental commander's intent, and the past lessons learned. Thus, combat-engineer platoon leaders can apply both the positives and negatives of lessons learned for the same type of operations (for example, security-zone defense) and apply them as they plan, staff, and execute engineer operations for future battles. As a former commander of the 58th CEC said, "You have a rare opportunity to make a plan and then see the execution of that plan."

The success or failure of the regiment provides instant feedback on the junior officers' decisions and actions before and during an operation. Unlike many of their maneuver companions, platoon leaders from the 58th CEC attend the regimental after-action reviews ("hot washes"). There they receive instant feedback not only on their unit's success or failure but also on how it affected the success or failure of the OPFOR.

Developing Situational Awareness

In general, combat supporters develop a high degree of situational awareness because they typically support echelons two and three levels higher than their own. Unlike their maneuver and engineer counterparts at other duty stations, OPFOR engineer platoon leaders must attend war games, staff synchronization drills, regimental operations orders, back briefs, and regimental rehearsals. Thus, they develop an understanding of the mission as a regimental operation as opposed to a sub-unit-level operation.

The mission itself requires that the platoon leaders operate at a higher level of situational awareness, because they must synchronize the transition of assets from unit to unit—sometimes several times in one operation. Although they may be task-organized to one MRB at the onset of a mission, they are regimental assets and must act to accomplish the regimental mission. For example, platoon leaders must anticipate encountering situational obstacles throughout the depth of the battlefield simultaneously and must advise the maneuver commander on how to employ engineer assets both before and during the mission.

The task organization of engineers changes from mission to mission in an offensive campaign with the OPFOR. Engineer platoon leaders play a crucial role in determining that task organization because they are ultimately the ones who advise the regimental staff and commander on how to best employ engineer capabilities based on intent, terrain, and enemy capabilities. The typical task organization of engineers during an offensive operation is to attach a mobility support detachment (MSD) with the forward security element and a mobile obstacle detachment (MOD) and a Volcano (UMZ) with the advanced guard main body; then, an MSD and an MOD travel with the main body. However, depending on a rotational brigade's propensity to use and proficiency in using situational obstacles. both MSDs may be "front-loaded" with the advanced guard. Likewise, the UMZ and the MODs may be task-organized as an independent situational-obstacle detachment traveling with the antitank battalion to seal assailable flanks autonomously of the main maneuver effort's ability to develop the situation. The engineer platoon leader, under the coaching of the 58th CEC commander, makes these determinations and recommendations in the planning processes that go into each mission.

"The vast training area of the NTC and the dynamic desert terrain give engineer platoon leaders the opportunity to develop a varied expertise in operations."

Engineers also learn about the other BOSs and how they all fit together. As a matter of routine, engineer platoon leaders advise peers in maneuver squadrons on employing internal and external assets to conduct an operation effectively—whether it is during an STX or a rotational scenario. Sometimes, an engineer may actually advise a peer on how to integrate all attached combat-support elements into the scheme of maneuver. or even shape the peer's scheme of maneuver. The reason engineers can do this is because they have more experience with the combined-arms concept and how each BOS fits in the picture. Integrating internal operations into a combined-arms team is essential to understanding the concept, and practicing that integration is the key to mastering it. OPFOR engineer platoon leaders practice this every month.

Putting It All Together

Officers at the NTC have the opportunity to participate in large-scale execution of exercises, putting together all the elements of maneuver and combined-arms operations. Leaders can practice their skills through train ups, rehearsals, and STXs. However, there is no substitute for putting all the pieces together. Every exercise within the OPFOR regiment is always a combined-arms operation.

Additionally, junior leaders and soldiers have the opportunity to focus on their specific tasks—whether it is emplacement of obstacles or maneuver support—because the higher-echelon leaders are very efficient in planning and coordination, which enables routine execution. The normal difficulties that hinder training in most units, such as availability of maneuver areas and training dollars, do not play a major role in shaping training for the OPFOR. While it places an unreasonable limitation on home-station training, ranges, and demolition qualification tables, the 58th CEC has the opportunity to conduct multiechelon maneuver and operations—be it in either the rotational scenario or in rotational train-up STXs. Thus, platoon leaders have the luxury of conducting essential engineer cornerstone missions and doing so at an incredibly high operational tempo.

The vast training area of the NTC and the dynamic desert terrain give engineer platoon leaders the opportunity to develop a varied expertise in operations. The NTC rotation is the end-all training event for which most other units train. It is the opportunity to put an operation together against a large force in a large training area. For the OPFOR, it occurs every month. The dynamics of supporting several headquarters and units simultaneously is a matter of routine for engineer platoon leaders who serve in the OPFOR. This allows junior officers to develop skills necessary to effectively advise and support units in multilevel operations.

The multiechelon operations encompassed in each rotational scenario

(continued on page 30)

The Corps of Engineers

By Dr. Larry Roberts

On 16 June 1775, the Continental Congress resolved "That there be one Chief Engineer at the Grand Army.... That two assistants be employed under him ...." This marked the beginning of the Corps of Engineers. In the following year, a number of individuals were given appointments as engineers or assistant engineers in the Continental Army. Three years later, the Congress authorized the recruitment of three companies of engineers, generally referred to as miners and sappers. The organization of these companies—and the officers having engineer responsibilities—into a "Corps of Engineers" came on 11 March 1779. During the Revolution, these miners and sappers worked on field fortifications and roads. At the Battle of Yorktown, they joined in the assault of Redoubt No. 10 in their secondary capacity as infantrymen. At the close of the Revolution, the Corps was mustered out of service.

Because of a recognized need for a regular military establishment, Congress took a number of steps in the early 1790s to reconstitute the American Army. One of these was the establishment of the Corps of Artillerists and Engineers in 1794. During the crisis with France four years later, an additional regiment of artillerists and engineers was formed. However, it was soon recognized that the duties and functions of the artillerists and engineers, while connected, were distinct. In 1800, a movement began to separate the two branches. On 16 March 1802, Congress authorized President Thomas Jefferson to establish a separate Corps of Engineers. The law also stated "That the said corps when so organized shall be stationed at West Point, in the State of New York, and shall constitute a military academy ...." By this action, the Congress recognized that military engineering was a science and therefore required formal education and training.

Initially, the Corps consisted primarily of officers and cadets. However, in 1803, the commanding officer of the Corps was authorized to enlist 18 men and 1 artificer to help conduct experiments at West Point and for other purposes. This constituted the first enlisted personnel in the Corps since its separation from the artillery several months before. During the War of 1812, a company of bombardiers, sappers, and miners served on the Northwest Frontiers. For the next 40 years, the Corps's responsibilities centered around the construction of coastal fortifications and the exploration of the American West.

In 1838, Congress authorized the creation of a separate Corps of Topographical Engineers. Individual topographical engineers had been serving under the Chief of Engineers since 1816, and the topographical-engineering mission dated from the appointment of Mr. Robert Erskine to be geographer and surveyor of the roads. Much of the effort on the nation's internal development, such as roads and waterways, was done by the "topogs."

During the Mexican War, engineer and topographical-engineer officers performed valuable services to the nation. Captain Robert E. Lee, Corps of Engineers, received several brevets for heroism and gallantry as General Winfield Scott's staff engineer. Significantly, Congress authorized the creation of a company of miners, sappers, and pontoneers for the Regular Army. Interestingly, these enlisted men were to be called engineer soldiers. Before this, the term engineer had generally been confined to officers. Following the Mexican War, the engineers returned to their civil works, fortifications, and exploration projects. In the 1850s, engineers surveyed several routes for the proposed transcontinental railroad.

In the first days of the American Civil War, Congress added three additional companies of engineers and one of topographical engineers. Formed into a battalion of engineers, they worked on field fortifications, conducted terrain reconnaissance, and built numerous fixed and floating bridges (see article, page 42). In 1864, the battalion built a floating bridge over the James River that exceeded 2,000 feet in length—a record that stood until 1945. The efforts of the regular battalion of engineers were supported by numerous volunteer engineer regiments, such as the 15th and 50th New York Volunteer Engineer Regiments.

Following the Civil War, the Corps returned to its peacetime missions. All of the work of the Topographical Engineers went to the Corps when the topogs merged with the Corps in 1863. Waterways, coastal fortifications, and lighthouses were the most important peacetime responsibilities. The structure of the Corps remained relatively constant until 1901, when the companies were enlarged and reorganized into three battalions of regular engineers. The Corps's experience with waterways was of great value when the Panama Canal Commission appointed engineer officers to direct the construction of the canal (see *Engineer*, February 2000, page 28).

In the years immediately preceding our entry into World War I, the Army and the Corps underwent expansion and reorganization. The Army adopted the divisional system, which constituted the combined-arms structure used today. Key to this was the creation of divisional engineer regiments that numbered almost 1,500 officers and men. When the country entered the war, additional engineer regiments appeared. Many of these worked on specific missions, such as railway construction, forestry, and harbor development.

The Corps's record of accomplishment during World War I established the general pattern of engineer operations during World War II. General service and combat regiments built every conceivable structure or facility in the various theaters of operation. Combat regiments and battalions supported the maneuver forces with roads, bridges, and mine warfare. At home, the Corps supervised the $15.2 billion defense-construction program. Included was the $2 billion Manhattan Project, which began the era of atomic warfare.

The end of the war against the Axis powers ushered in the Cold War between the free world and the communist states. The Corps responded with an intensive program of military construction that consisted of distant early-warning sites, military bases overseas, and missile installations. The Cold War turned hot in Korea between 1950 and 1954 and in Southeast Asia a decade later. For both of these conflicts, engineers not only fought alongside maneuver forces but also constructed countless support facilities. In the seesaw battles in Korea, combat engineers demolished, rebuilt, and destroyed the same bridges as the tide of war moved across the Korean landscape. Vietnam posed an even greater problem due to the nature of that insurgent conflict and the lack of support facilities for troops in the field. Firebases, airfields, heliports, harbor facilities, and major highways were among the tasks of builders and fighters. All of this occurred while the civil works side of the Corps continued with navigation, flood-control, hydroelectric, and military-construction projects in the United States.

The end of the Cold War did not bring the dividends of peace that so many Americans desired. Contingency operations in Granada, Panama, and Kuwait brought combat engineers into action. Humanitarian efforts such as Provide Comfort and Restore Hope constituted yet another mission for the Corps. Rebuilding Kuwait, providing for relief of displaced refugees, and supporting United Nations efforts in Somalia and the Balkans called for both combat and construction skills. Disaster assistance for victims of hurricanes, floods, and earthquakes continues to be a peacetime challenge of the Corps.

For more than 200 years, miners, sappers, pontoneers, and topogs-engineers have contributed to the development of this nation and of developing nations. In war, engineers have been fighters and builders of those things needed to sustain the battle. If the past is simply a prologue of the future, engineers must continue to hone their ability to build and, if necessary, to fight.

Dr. Roberts is the U.S. Army Engineer School historian at Fort Leonard Wood, Missouri.


Photo by C.J. Allen

Colonel Brian E. Osterndorf, commander of the Corps of Engineers' New England District, salutes Colonel Richard Gridley, the first Chief Engineer, during a wreath-laying ceremony at the Canton Corner Cemetery, Canton, Massachusetts, to mark the Corps's 225th birthday. The New England District's Ranger Color Guard accompanied Colonel Osterndorf to Colonel Gridley's grave site.

(continued from page 28)

provide junior officers with an end-state result in mind for each given mission. Platoon leaders know how they fit into the big picture and how the big picture fits into their training and performance.

Conclusion

While no one could win the argument that engineer platoon leaders at the NTC receive better overall training than their counterparts, it goes without saying that they develop and master the concept of their combined-arms role on the battlefield. The reason is simple: They do it the right way, all the way, all the time, every time. The Army depends on combat supporters to know and master their trade. When questioned about the use of engineers in the complex Force XXI Army during a visit he made to the NTC, Major General George Harmeyer (former commander of the Armor School) replied to the 58th CEC commander that "the onus would be on the maneuver commander to know how to use you."

The truth is that only knowledgeable and aggressive combat-support officers are going to get their assets integrated properly into the combined-arms fight. Those who have served with the 58th CEC have had a good taste of that concept. Lieutenants should seek out this assignment if they want to really learn their profession.

Captain Matlock, who is currently at Fort Carson, Colorado, spent three years at the National Training Center. A graduate of the U.S. Military Academy, he holds a master's in engineering management from the University of Missouri-Rolla. CPT Matlock recently completed the Engineer Captain's Career Course and the CAS3 Course.

Reference:

Law, Leonard J. and Ferdon, Keith R. "Red Devils! The 58th Combat Engineer Company." *Engineer,* November 1999, pp. 28-33.

Chiefs of Engineers

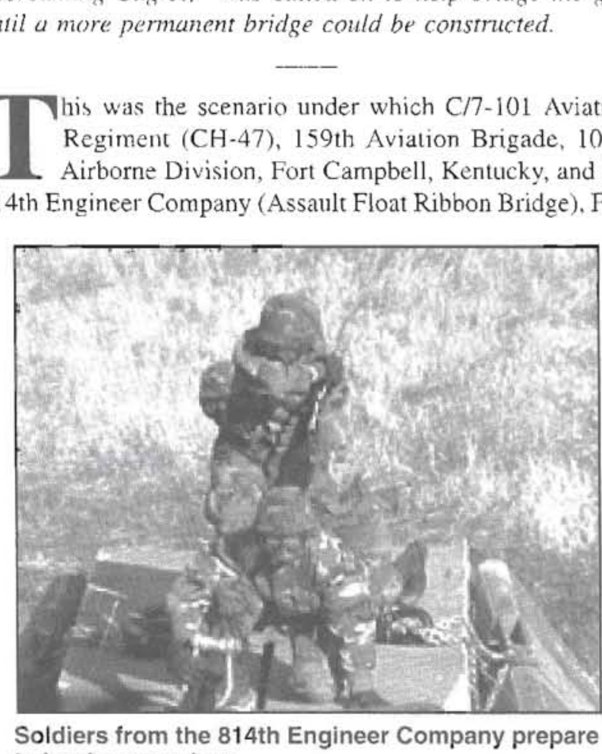
COL Richard Gridley	07 June 1775 - 05 April 1776
COL Rufus Putnam	05 April 1776 - 01 December 1776
MG L.L. Duportail	22 July 1777 - 10 October 1783
LTC Stephen Rochefontaine	26 February 1795 - 07 May 1798
LTC Henry Burbeck	07 May 1798 - 01 April 1802
COL Jonathan Williams	01 April 1802 - 20 June 1803
	19 April 1805 - 31 July 1812
COL J.G. Swift	31 July 1812 - 12 November 1818
COL W.K. Armistead	12 November 1818 - 01 June 1821
COL Alexander Macomb	01 June 1821 - 24 May 1828
COL Charles Gratiot	24 May 1828 - 06 December 1838
BG J.G. Totten	07 December 1838 - 22 April 1864
BG Richard Delafield	22 April 1864 - 08 August 1866
BG A.A. Humphreys	08 August 1866 - 30 June 1879
BG H.G. Wright	30 June 1879 - 06 March 1884
BG John Newton	06 March 1884 - 27 August 1886
BG J.C. Duane	11 October 1886 - 30 June 1888
BG T.L. Casey	06 July 1888 - 10 May 1895
LTG Raymond A. Wheeler	04 October 1945 - 28 February 1949
LTG Lewis A. Pick	01 March 1949 - 26 January 1953
LTG Samuel D. Sturgis Jr.	17 March 1953 - 30 September 1956
LTG Emerson C. Itschner	01 October 1956 - 27 March 1961
LTG Walter K. Wilson Jr.	19 May 1961 - 30 June 1965
LTG William F. Cassidy	01 July 1965 - 31 July 1969
LTG Frederick J. Clarke	01 August 1969 - 31 July 1973
LTG William C. Gribble Jr.	01 August 1973 - 30 June 1976
LTG John W. Morris	01 July 1976 - 30 September 1980
LTG Joseph K. Bratton	01 October 1980 - 14 September 1984
LTG Elvin R. Heiberg III	14 September 1984 - 05 May 1988
LTG Henry J. Hatch	17 June 1988 - 04 June 1992
LTG Arthur E. Williams	24 August 1992 - 30 June 1996
LTG Joe N. Ballard	01 October 1996 - 2 August 2000
LTG Robert B. Flowers	23 October 2000 - Present

Screaming Eagles Bridge the Gap

By Captain James Handura

Special-operations forces from Cortina destroyed the last remaining bridge over the Mississippi River. Their timing could not have been better, because they successfully stalled the joint task force's most critical logistics push of the operation. This bridge was a vital link in Main Supply Route Ford's ability to pass traffic. The nearest ribbon-bridge assets were almost 100 kilometers to the south. The joint-task-force commander knew there was only one unit that could move bridging equipment that far, over that terrain, that quickly. The 101st Airborne Division (Air Assault), known as the "Screaming Eagles," was called on to help bridge the gap until a more permanent bridge could be constructed.

This was the scenario under which C/7-101 Aviation Regiment (CH-47), 159th Aviation Brigade, 101st Airborne Division, Fort Campbell, Kentucky, and the 814th Engineer Company (Assault Float Ribbon Bridge), Fort Polk, Louisiana, recently conducted training. The genesis of this training event was derived from a corps-level simulation exercise in which the 101st Airborne Division had a "be-prepared" mission for just such a contingency. The training took place from 31 January to 4 February 2000, along the "old-river" portion of the Mississippi, with the help of the New Orleans District of the U.S. Army Corps of Engineers (see map, page 33).



Soldiers from the 814th Engineer Company prepare to hook a ramp bay.

The Training

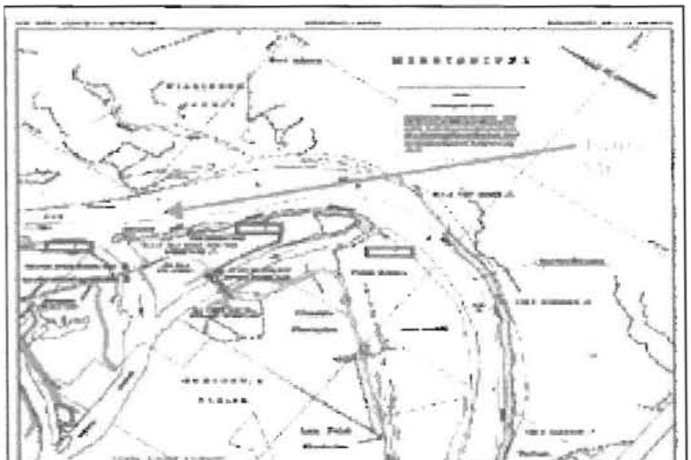
The stated training objectives were to train aircrews and engineers to sling load ribbon-bridge equipment and to construct a ribbon-bridge raft properly.

Day One

The 814th Engineer Company commander and the C/7-101 flight-operations officer held a meeting to discuss the location and layout of the pickup and landing zones, bridge components and characteristics, load-hook-up training, aircraft familiarization, daytime and nighttime pickup- and landing-zone operations, load inspections, proper rigging techniques, the situational training exercise (STX) and, most importantly, safety.

Day Two

Hooker training—the required process of maintaining proficiency in the perishable skill of hooking rigged loads to a hovering rotary-wing aircraft—was conducted. In the 101st Airborne Division, soldiers must have actually hooked a load under an aircraft within the past 90 days to be qualified, unless they are recent Air Assault School graduates. One CH-47D Chinook landed at the pickup zone at 1300 hours, where it was greeted by an enthusiastic crew and the unique pieces of equipment from the 814th Engineer Company—an interior bay, a ramp bay, and a bridge-erection boat. The Chinook company commander conducted a class with the engineers on aircraft



characteristics, aircraft safety, and actions of the hooker teams working underneath the aircraft. The daytime hooker training began at 1400 hours. Both bridge platoons had already rigged and positioned loads of all three types of equipment in the pickup zone and had rotated their personnel through the actual hooking of the loads under the aircraft. Many of the soldiers had never encountered the tremendous power and lift capability of the Chinook nor experienced its accompanying gale-force rotor wash.

When this training was completed, the Chinook picked up each load to verify the rigging, or the "link count," and then delivered it to the landing zone, which in this case was the Mississippi River. Nighttime hooker training began shortly after sundown, with the aircrews hooking the loads while wearing night-vision goggles (NVGs).

Day Three

This training consisted of slinging the bridge components and constructing a six-bay raft. The daytime portion began early, with both platoons rigging and positioning components of a six-bay raft along with one bridge-erection boat on the pickup zone. The plan was to sling bridge bays to the river (the landing zone), where the awaiting bridge crews in bridge-erection boats would assemble the sections into a six-bay-raft configuration. This raft is capable of transporting the heaviest vehicle in the 101st Airborne Division's inventory.

While engineers prepared the loads, the flight crews practiced their hovering position over the river and rehearsed ingress and egress from the pickup and landing zones. When rehearsals were completed, the individual training events were meshed and the collective training began. During this phase, the bridge crewmen assembling the rafts learned a valuable lesson: They must ensure that the sling legs were clear of the bay hinge points before the sections were unfolded or the section would remain in the folded position.

Once again, the nighttime training followed the same sequence as the daytime training, with the aircrews wearing NVGs. Aircrews are required to remain current and qualified while wearing NVGs, which is a challenging task. But flying with NVGs over water is even more challenging, especially when the landing zone must be shared with river barges that occasionally pass through the area.

The Exercise

The training event culminated with an STX, which began at 1100 hours. The flight-operations officer conducted the air-mission briefing, which included the overall enemy and friendly situation and the aircrew's role in the operation. After receiving the order, leaders finalized plans and conducted troop-leading procedures.

The STX focused solely on Phase II (Assault Across the River) of a deliberate river-crossing operation. According to Field Manual 90-13, *River-Crossing Operations*, the concept of this phase is to "rapidly place combat power on the far shore to eliminate the enemy's direct fire onto the crossing sites and secure terrain for attack positions."

The previous three days of training paid off when the operation began in earnest and the engineers rapidly and expertly constructed six-bay rafts, which—in an actual operation—would have been used to shuttle significant combat power to the far shore. The mission was clearly a success.

The Results

This unique training event, which coupled the mobility of Army aviation with the capability of the engineer float-bridge equipment, was significant in many ways. Perhaps most important was that the event proved that the 101st Airborne Division not only has the tactical mobility and lethality that sets it apart from other divisions, but it also has the flexibility to react to situations such as that in the opening scenario and quickly overcome it to accomplish the mission.

Although the stated training objectives were to train aircrews and engineers to sling load ribbon-bridge equipment and construct a ribbon-bridge raft properly, the engineer company also learned to set up and run pickup and landing zones properly. In addition, soldiers gained confidence working under the aircraft, and aviators were able to hone their over-water skills for both daytime and nighttime operations.

Captain Handura is a recent graduate of the Engineer Officers Advanced Course at Fort Leonard Wood, Missouri. He was previously assigned to the 326th Engineer Battalion, 101st Airborne Division, Fort Campbell, Kentucky.

The Junior Officer District Intern Program

By Lieutenant Colonel Christopher J. Toomey, First Lieutenant Jeff Qualteri, and First Lieutenant Kevin Truesdell

The 14th Combat Engineer Battalion's Officer Professional Development Program engages the unit's junior officers at multiple levels—from very specific, short-horizon, mission-essential-task-list (METL)-driven tasks to long-term exposure to the opportunities afforded through a career in the Army and the Engineer Regiment. One of the program's recurring components is visits to the neighboring Seattle and Portland U.S. Army Corps of Engineers (USACE) Districts, whose headquarters are close to Fort Lewis, Washington. These tours are always interesting, and most of the battalion's lieutenants and captains—particularly those with engineering and construction backgrounds—find work in the districts intriguing and a source of inspiration to remain on active duty. Recognizing the phenomenal diversity of the Regiment, many are excited about the prospect of serving in USACE Districts following successful company commands.

In an effort to enhance the breadth of junior officers' understanding of work within the USACE and develop construction management skills, the "Rugged" 14th Battalion developed a partnership with several of the districts in the USACE's Pacific Northwest Division. Modeled after the Cadet District Engineer Program sponsored by the United States Military Academy's Department of Civil and Mechanical Engineering, the Rugged Junior Officer District Intern Program (JODIP) places selected junior officers in local districts at the project-engineer level for two to four weeks.

Following the development of the initial concept with commanders of the Pacific Northwest Division and Fort Lewis' 555th Combat Engineer Group, the 14th Battalion approached the Seattle, Portland, and Walla Walla Districts with the idea and met positive responses. The ensuing process involved orchestration around four basic considerations.

- **Assignment**. The battalion asked the USACE Districts to place the officers in project-engineer positions on current construction projects. This does not preclude a district orientation, which is beneficial, but the intent is to place the junior officers in "muddy-boots" positions and expose them to construction and construction management in the field, to include quality assurance and safety.
- **Officer Selection**. The battalion looks for solid performers, typically first lieutenants and junior captains,

1LT Jeff Qualteri served his internship at the Portland District's Bonneville Lock and Dam. He is shown inspecting recently installed ductwork.

1LT Kevin Truesdell, while working in the Fort Lewis Resident Office, Seattle District, conducts quality-control and safety inspections at the McChord Air Force Base Medical Clinic.

with an interest in serving with the USACE. A desirable criterion is an academic background in engineering or construction management.

- **Timing**. A balance must be achieved between timing the officer's assignment with meaningful on-site construction and when the officer can be spared from the unit (normally during a post-support or "red" cycle). In addition, it is recommend that the duration be from two to four weeks with the latter being optimal.

- **Funding**. The unit must decide what it can fund and what the district can fund in terms of travel and per diem, particularly if the project site is far from the home station. Selecting USACE-managed construction projects on the installation can mitigate this cost. To date, USACE Districts absorb all TDY costs.

Two first lieutenants recently participated in the JODIP. One officer spent his assignment at the Portland District's Bonneville Dam. Following a briefing at the district office, he was assigned as a project engineer at the dam, where he completed a quality-assurance plan for rebuilding a 300-ton crane. He also attended a half-day course based on marine-construction cost estimating and learned about and worked with change orders and submittals from the contractor to the engineering department. While at the dam, he observed a final exciter test and an alignment test on a hydropowered generator before it was placed on-line for commercial use. The generator is part of the first powerhouse restoration being completed at the Bonneville Dam. From start to finish, the officer was actively employed, with each day's events scheduled for maximum opportunities. There was an equal balance of educational training and employment on various tasks.

For his internship, the second officer worked for the Seattle District Corps of Engineers at the Fort Lewis Area Office, which is primarily responsible for construction on Fort Lewis and nearby McChord Air Force Base. Assigned to the project site of a new medical clinic at McChord, the officer's responsibilities included processing requests for information and conducting quality-control and safety inspections. While processing requests for information, he worked with the superintendent and quality-assurance officer to determine ways to adjust the design of the building. The quality-assurance inspections were an excellent opportunity to observe the construction trades in action. The safety inspections consisted of daily walks through the project site to ensure that the subcontractors were following both Occupational Safety and Health Administration and USACE guidelines. The officer also had the opportunity to use his technical degree by designing a footing for the clinic's entrance sign.

The JODIP is making a positive impact on the participating officers and the sponsoring USACE Districts. For the officers, the program provides a valuable look at the remarkable diversity of assignments within the Regiment and the Army and allows the officers to get actual hands-on, project-engineer experience. The program also benefits the host district by providing it an opportunity to work and train future project engineers, deputy commanders, and commanders. The program is now broadened to all engineer units at Fort Lewis and is administered under the guidance of the 555th Combat Engineer Group. A third officer recently interned with the Walla Walla District.

At this time, it is difficult to gauge the long-term benefit of the intern program as a vehicle for officer retention. Yet, it clearly will contribute to further educating our junior officers to the vast assignment opportunities available and will serve as another "arrow in the quiver" in making the decision to remain a part of our Army.

Lieutenant Colonel Toomey, a graduate of the United States Military Academy, commanded the 14th Combat Engineer Battalion from 1998 to 2000.

First Lieutenant Qualteri, a graduate of Colorado State University with a degree in civil engineering, is a platoon leader in Charlie Company, 14th Combat Engineer Battalion.

First Lieutenant Truesdell, a graduate of the United States Military Academy with a degree in civil engineering, leads a platoon in Alpha Company, 14th Combat Engineer Battalion.

COSTA RICAN PORTS FACILITIES:
AN ENGINEER SURVEY MISSION

By Captain Tim Scarbrough

Since Hurricane Mitch devastated much of Central America nearly two years ago, the United States Southern Command (USSOUTHCOM) has continued to task United States Army Reserve (USAR) engineers with the assessment and management of theater engineering missions. The source of this collection of expertise is housed at the 416th Engineer Command (ENCOM) of Darien, Illinois, a suburb of Chicago. The 416th ENCOM specializes in technical engineering and engineering management, with areas of responsibility that include Southwest Asia and Central and South America. USSOUTHCOM relies heavily on the 416th's drilling reservists and its full-time staff to provide the best engineering expertise the USAR can muster.

Survey Background

Late in 1999, the 416th ENCOM was tasked to conduct several predeployment site surveys to assess future construction projects. Sites in Costa Rica came to the forefront for analysis in January 2000. An assessment of the cost regarding new construction versus renovation of existing facilities was needed according to bilateral agreements between the United States and Costa Rica. Also needed were detailed engineer surveys to help the Costa Rican Coast Guard combat drug smuggling.

The 416th ENCOM selected a team of three professionals from its reserve and active-duty staff months ahead. The team members' backgrounds collectively reflected a vast knowledge of architecture, building renovation and construction, pier analysis, soils suitability, and surveying. The team arrived in Costa Rica in late January to begin the extensive site surveys required by USSOUTHCOM's tasking.

Coordination with host-nation authorities is essential to any OCONUS mission. The 416th ENCOM's team met with general contractors the night before they left for the survey sites to determine short-term material issues and other related topics. Issues included Costa Rican building codes compared to those in the United States, joint usage of American Concrete Institute (ACI) manuals, and comparison of host-nation materials and construction practices to those used in CONUS. The team found that construction costs in Costa Rica were 20 percent higher than those in the United States and concluded that labor costs were 60 percent lower, including social security and taxes.

Survey Sites

The 416th ENCOM's team assessed six ports along the Pacific Coast: Golfito, Quepos, Puntarenas, Caldera, Flamingo, and Cuanjigil. The intent was to identify four of the six sites for use by the Costa Rican Coast Guard. One of these four sites was to be established as the main station, two sites were to be secondary sites, and one site was to be a substation.

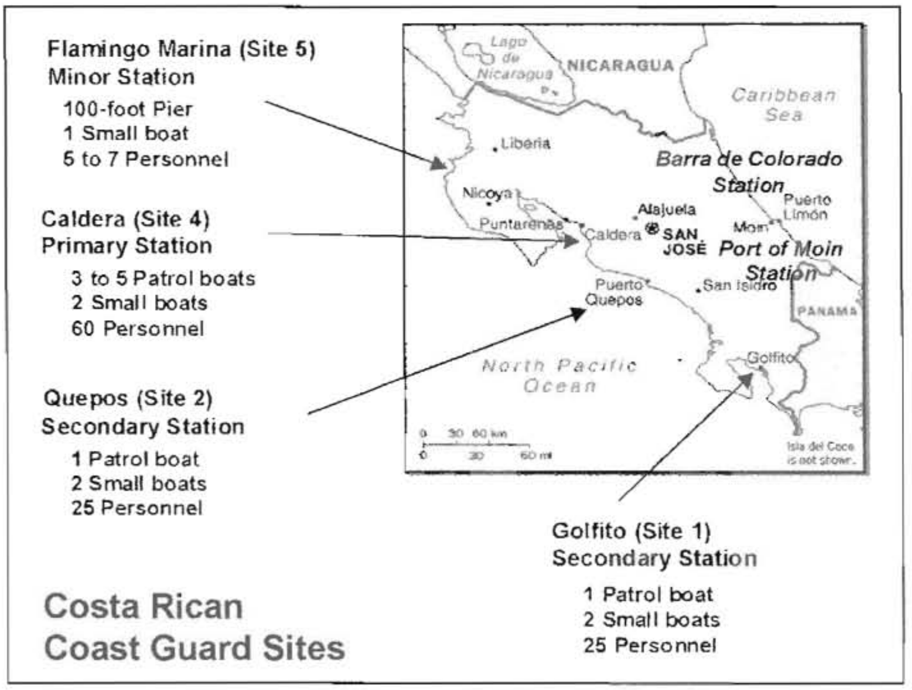
Golfito. For any predeployment site survey, an assessment of surroundings en route to the site is often more important than the proposed construction site itself. The survey team members realized this important fact when they arrived at Site 1, the port of Golfito. They noticed that the port took up a long, narrow area on the Pacific Coast and that there was very little space available for building or expansion. The team learned that Costa Rica had exported bananas through this central port approximately 60 years ago. Over time, the large export companies pulled out of the area and moved their operations to the Atlantic Coast at Limon. To keep the business at the port of Golfito, the Costa Rican government made all local products tax-free so that people would continue traveling there to shop.

This site encompasses a still-used, 60-year-old pier, which was being resurfaced by the National Port Authority for anticipated commercial traffic. A steel warehouse, in critical need of repairs, adjoined the pier and was being converted into administrative offices and living quarters. Collocated on this site were 50,000-gallon, gasoline-storage tanks and a boat-retrieval facility.

Quepos. One hundred miles north of Golfito is Quepos, a small community port used primarily for fishing, which was designated as Site 2. There, unlike at Golfito, a person must cross a peninsula to get to the Coast Guard facility. The 50-year-old facility, primarily made of wood, was unserviceable. The two-story structure, which had 500 square feet of space per story, had a separate latrine on each level. Next door to this facility was a structure, similar in design and age to the Coast Guard facility, that housed the National Port Authority. Accessibility to the pier from this area was a problem because it required crossing an aging steel-trestle bridge that was in very poor condition and heavily used by sport fishermen. At the pier, Coast Guard and commercial vessels shared mooring space, and the height of the fixed pier varied 12 feet between high tide and low tide. Attached to this pier were floating piers used to moor only the fishing boats.

Puntarenas. At Site 3, Puntarenas, it appeared that no land was available for construction, because every square inch was utilized in some way or another. Now, cruise ships dock there frequently, and tourists participate in inland tours, but there are plans to relocate such operations to Caldera.

The substructure of the wharf was in extremely poor condition and unsafe. Most of the facility was more than 70 years old and built on steel and concrete piers, which were more than 80 percent deteriorated. Structural failure seemed imminent unless extensive repairs were made to the undercarriage. Significant problems were noticed, such as ships being stuck in the mud for four hours a day due to the low tide.



Caldera. At Site 4, the port of Caldera, surveys showed that much detailed work would be required before relocating operations there from Puntarenas. Caldera is the largest commercial port on the Pacific Coast of Costa Rica. Each day, large, ocean-going ships handle vast quantities of import and export goods at this facility. Port authorities expressed a great interest and need for Coast Guard port security and protection.

The team assessed the main commercial pier, three large warehouses with offices, and the parking areas. The port is used for commercial fishing and tourism and would provide a good working platform for material storage and equipment staging. Well suited for maintenance, refueling, and construction operations, there was even room for offshore equipment mooring. Very accessible for engineering operations, this facility had all the amenities of an American port.

Flamingo. The team traveled from Caldera through the mountains to Flamingo (Site 5), which has the first marina built in Costa Rica. Used primarily by the sport-fishing industry, the area was being upgraded by a U.S. developer, who planned to more than double its size and include repair facilities. However, he still had to meet government requirements and obtain the necessary permits. Plans also were being made for a dry dock, a petroleum storage and issue area, and pier space for one hundred additional boats. Part of the expansion will include 100 feet of pier space devoted to Coast Guard vessels.

Cuanjigil. Four miles up the coast, the team reached Site 6. Cuanjigil, a very small fishing village about 20 miles from the Nicaraguan border, had constructed a 290-foot pier and a small fish-processing plant. Facilities included 440-volt electrical power, diesel fuel, and water. This was a small fishing-boat area with a low volume of sea traffic.

Survey Results

After touring all of the sites, the predeployment site survey team traveled to San Jose to summarize the data it had collected for a briefing to the U.S. Ambassador and the American Embassy staff. The team concluded that most of the "over-the-water" construction should consist of building the new facility in Caldera. All of the other sites were considered "secondary" and should have some type of simple, floating pier system. All existing structures, both on land and over the water, appeared to need major repairs or, in some cases, were beyond repair. However, with careful management, significant improvements could be made to the ports with a modest amount of funding.

At all of the sites, the survey team observed significant environmental problems, which included sewage systems being discharged directly into the ocean and vehicle batteries being dumped on bare soil, causing contamination.

In the most important part of the assessment—the bottom-line cost estimate—the team concluded that because of high costs, the projects should be prioritized and construction phased in over several years. If troop construction is considered, the availability of U.S. troop labor should be evaluated and properly coordinated. The initial estimated cost for the four sites selected for Costa Rican Coast Guard use ranged from $2 million for renovating the existing facilities to $5 million for new construction. At Caldera, the site selected for the main Coast Guard station, new construction—estimated at $1.9 million—will be required. Whether U.S. or Costa Rican design standards are used will also have an impact on the project's cost. Additionally, a detailed study of the underwater subsurface will be required before the final design of the piers is determined.

Captain Scarbrough is an active-duty project engineer for the 416th Engineer Command. Previously the 416th's Public Affairs Officer, he is the point of contact for issues on military water wells, alternative construction technology, theatre construction-management systems, and training management.

Enhanced Off-the-Shelf Technologies

Help Engineers Prepare for Future Operations

By Major Barrett W. Larwin

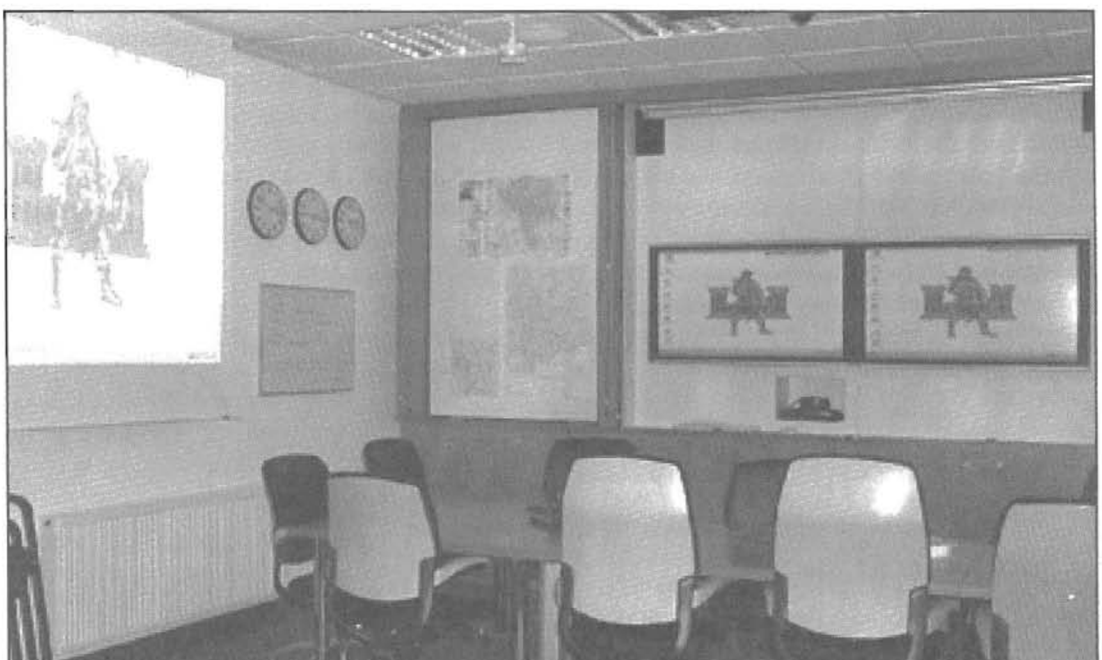
Never before in our nation's history have engineer missions in Europe been as complex, varied, and demanding as they are today. Facilitating operations throughout the Balkans, conducting Partnership for Peace and other support missions, facilitating exercises, entertaining and resolving readiness issues, and being actively engaged in contingency planning provide the ingredients for exciting times. While these missions offer us numerous challenges, we take great pride in knowing that we are directly linked to the role our nation is playing in helping shape the international environment where our national strategic interests are at stake.

A vexing issue that our United States Army-Europe (USAREUR) engineer staff recently entertained was how to improve the level of support we provide for current and future missions. While no one on the engineer staff would deny the importance of this issue, there was certainly debate over what we could possibly do while our OPTEMPO remains so high. After discounting a number of ideas, we decided to take on projects that we knew we could get approved and see through to completion.

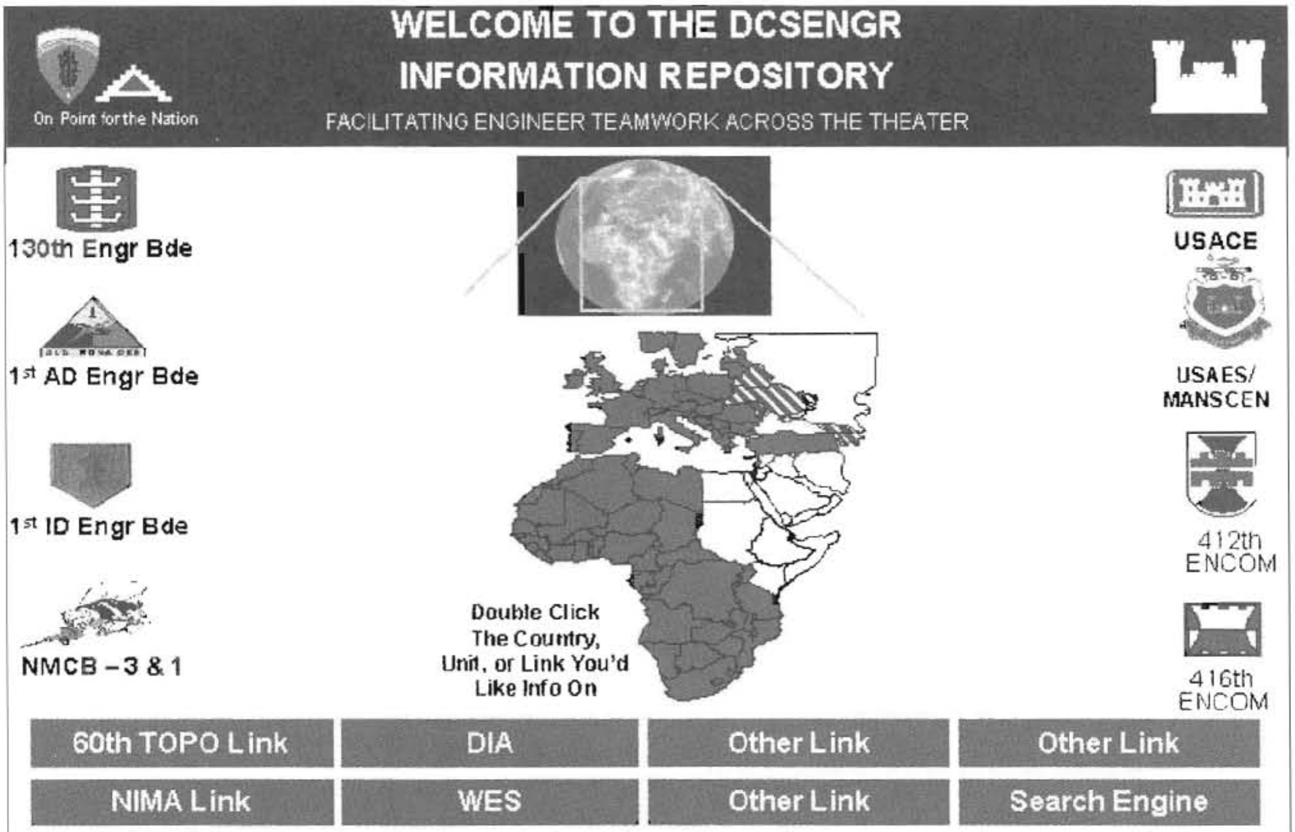
This article provides a retrospect of two projects that our Engineer Operations Division undertook to put its information and communications architecture on the right glide path for the twenty-first century. It describes the capabilities of our new Contingency Operations Center currently in use at our facility on Campbell Barracks, Heidelberg, as well as provide information on the new Engineer Information Repository which is currently available for your use.

Contingency Operations Center

After years of struggling to perform engineer operations in a facility with inadequate communications and a layout that didn't foster an efficient operating environment, the staff set out in July 1999 to give our facility a face-lift. Our goal was to complete a world-class engineer operations center in three months—before our next anticipated contingency operation.



An image of the front of the De Fleury Center. The two forward flat screens and multiple overhead screens give engineers the ability to present as many as four products at one time.



A model of the opening Engineer Information Repository screen. As you scroll your mouse over a country in the USAREUR area of responsibility, the country's name will pop up. Then follow the instructions on the screen.

We identified the location for the center and created a conceptual design using ideas from existing war rooms, local contractors, communication experts, and others with experience in developing similar projects. Like most unfinanced requirements that are pulled together near the end of the fiscal year, we scrambled to definitize the design requirements, acquire the funds, and get the contract awarded before the end of the fiscal year.

After considerable effort, the contract for the DeFleury Contingency Operations Center was awarded on 30 September 1999 with work starting on 10 October. Three months later, most of the construction was complete, and the center was officially opened. It is filled with the latest hardware and communications off-the-shelf technologies. Some of its noteworthy attributes are–

- A completely integrated worldwide architecture entailing voice, video, and data-communication links.
- Eight classified and unclassified workstations with a capability to surge to twenty.
- A TeleEngineering video teleconference (VTC) for point-to-point communications and a multisystem VTC for worldwide compatibility.
- A rotating overhead-projection system with three motorized screens for projecting digital maps and other geospatial imagery.
- Two 60-inch, flat-screen TVs and two multisystem TVs for displaying briefs, CNN, and numerous other products.

All of these features—including the lights, sound system, and ambient controls—are integrated into one touch panel, which gives the operator complete control over all the systems in the room. The operator can control and transfer data from any workstation to any one of the projection or display devices or VTC systems. Although this was an enormous challenge to pull together, we all agreed when it was complete that the headaches were worth the effort. We had effectively modified a twentieth-century structure and created the facilities we need to be an engineer multiplier in future operations.

Engineer Information Repository

Another project, which serves as a complementary initiative to the DeFleury Contingency Operations Center, is the Engineer Information Repository. The goal for this project was to develop a user-friendly information-management database that is capable of storing, linking, and

(continued on page 46)

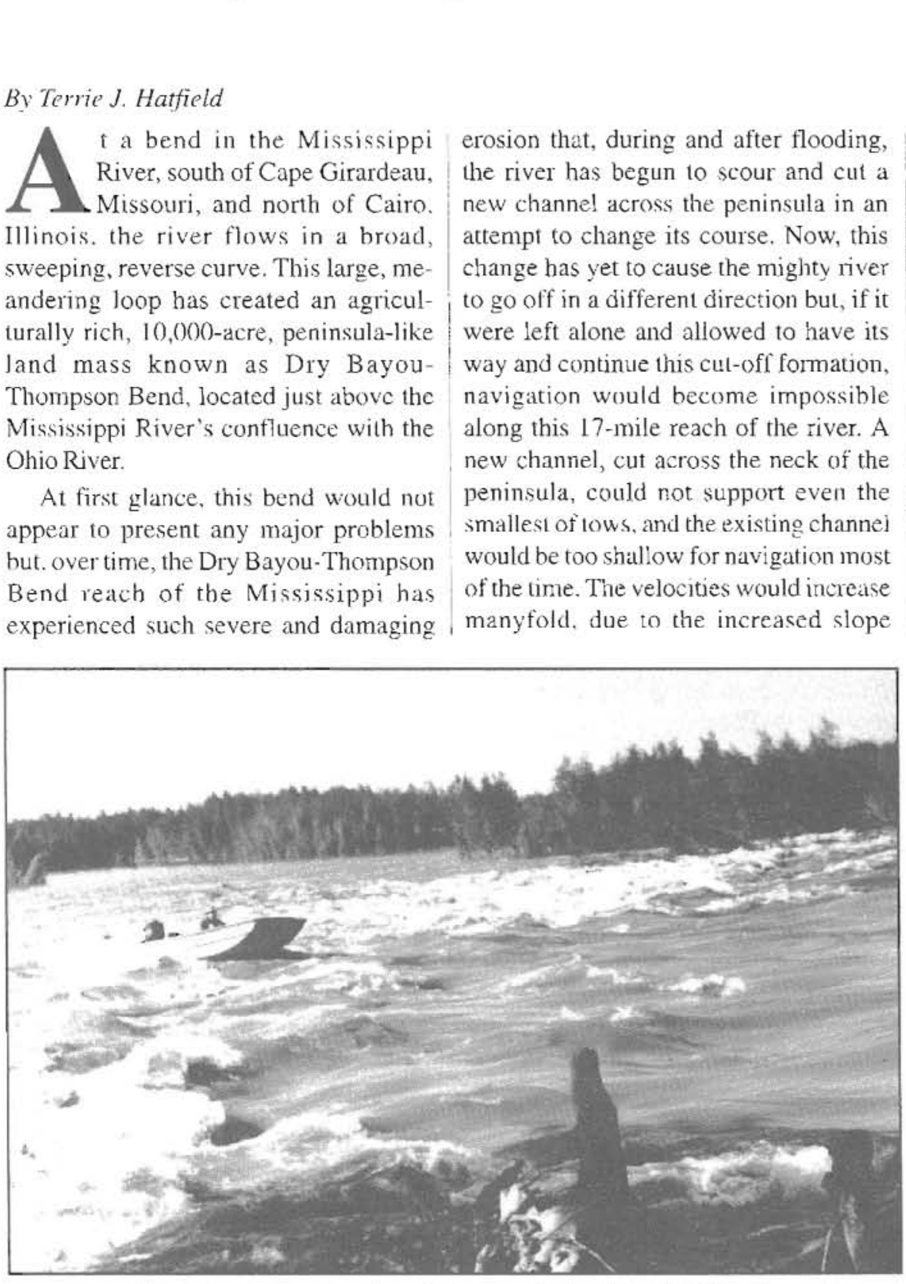
The Thompson Bend Riparian-Corridor Project:

An Innovative Environmental Solution to a Major Navigation and Flood-Control Concern

By Terrie J. Hatfield

At a bend in the Mississippi River, south of Cape Girardeau, Missouri, and north of Cairo, Illinois, the river flows in a broad, sweeping, reverse curve. This large, meandering loop has created an agriculturally rich, 10,000-acre, peninsula-like land mass known as Dry Bayou-Thompson Bend, located just above the Mississippi River's confluence with the Ohio River.

At first glance, this bend would not appear to present any major problems but, over time, the Dry Bayou-Thompson Bend reach of the Mississippi has experienced such severe and damaging erosion that, during and after flooding, the river has begun to scour and cut a new channel across the peninsula in an attempt to change its course. Now, this change has yet to cause the mighty river to go off in a different direction but, if it were left alone and allowed to have its way and continue this cut-off formation, navigation would become impossible along this 17-mile reach of the river. A new channel, cut across the neck of the peninsula, could not support even the smallest of tows, and the existing channel would be too shallow for navigation most of the time. The velocities would increase manyfold, due to the increased slope upstream and downstream of this reach of river, as the Mississippi would attempt to regain an equilibrium state.



The Thompson Bend project area during the 1995 flood

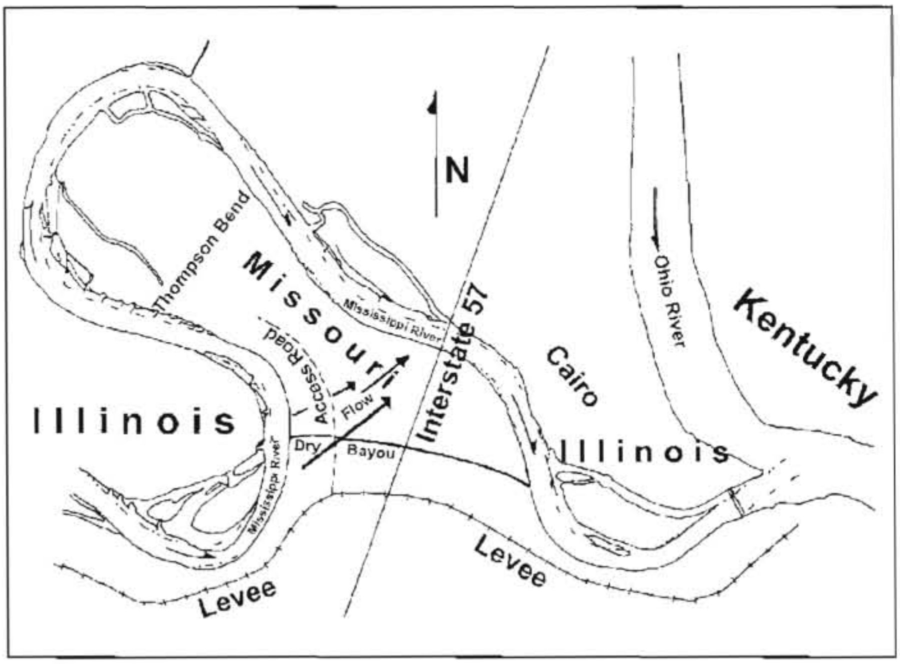
It was evident that if an efficient solution were not soon developed, a navigation crisis—potentially catastrophic to navigation, agricultural, and flood-control concerns—would occur. Southbound traffic would come to a halt at the beginning of the bend, and northbound traffic from New Orleans, Louisiana, could not progress north of Cairo. This midpoint 17-mile reach, if destroyed, would cause a break in the continuous 2,300-mile navigation channel. Navigation on the "Mighty Mississippi," the inland waterway system's busiest highway, would become nearly impossible for transporting a variety of products from the northern United States to the European market. Channel development would be an extremely time-consuming and very costly effort. The magnitude of the scour was such that it was also threatening the integrity of the mainline, Commerce to Birds Point Federal Levee, which protects hundreds of thousands of square miles of property.

A nonstructural, environmentally beneficial way to stop the erosion and repair the damage was needed, but the technology to resolve this kind of problem did not exist. So a 14-year period of trial and error and innumerable experiments began. During this time, the Great Flood of 1993 occurred, in addition to the major flood of 1995, plus many other high-water events of varying duration. Although these events caused setbacks, they also provided valuable opportunities to collect data and evaluate the work that is now known as the Thompson Bend Riparian-Corridor Project.

The result of these many years of hard work was the successful creation of the tree-screen/riparian-corridor concept, which consists of a buffer strip of trees planted between the riverbank and the floodplain. This methodology at this magnitude is a revolutionary and unprecedented blending of various sciences and technologies in an environmentally sensitive and friendly, cost-effective, and mission-essential manner. The project included obtaining permanent easements from the landowners; planting cottonwood clones and other hardwoods specifically bred for their fast growth and water-resistant attributes; and strategically placing various forms of other types of vegetation. The trees will be selectively harvested, in agreement with an arrangement with the landowners and local levee board, so they do not cause too much shade and prevent undergrowth. (A major side benefit of this part of the process is that it also provides timber as a cash crop for the landowners.) Consistent and continuing application of this technology, including ongoing tree planting, has maintained the river in its natural, original channel, and navigation has been sustained around Thompson Bend.

This erosion-control method has been so successful that it is considered by the Corps of Engineers' Mississippi Valley Division to be a prototype demonstration for the entire Corps. The concept is changing the way the Corps deals with severe erosion problems along the nation's waterways, while providing benefit to the environment.

The innovative concept was severely tested by the Great Flood of 1993. Even though approximately 40 percent of the trees were killed in the flood, they stayed anchored in place. The idea worked far beyond expectations. No one realized when they started that a 100-foot wide tree screen would cut flood velocities in half. However, when measured with a Global Positioning System and an Acoustic Doppler Current Profiler, flows measuring 8 to 8 1/2 feet per second going into the screens measured 4 to 4 1/2 feet per second coming out. This led to far less erosion and scour, increased deposition and, eventually, healing. The tree screens planted in the original Dry Bayou high bank in 1986 held even through the 1993 and 1995 floods.

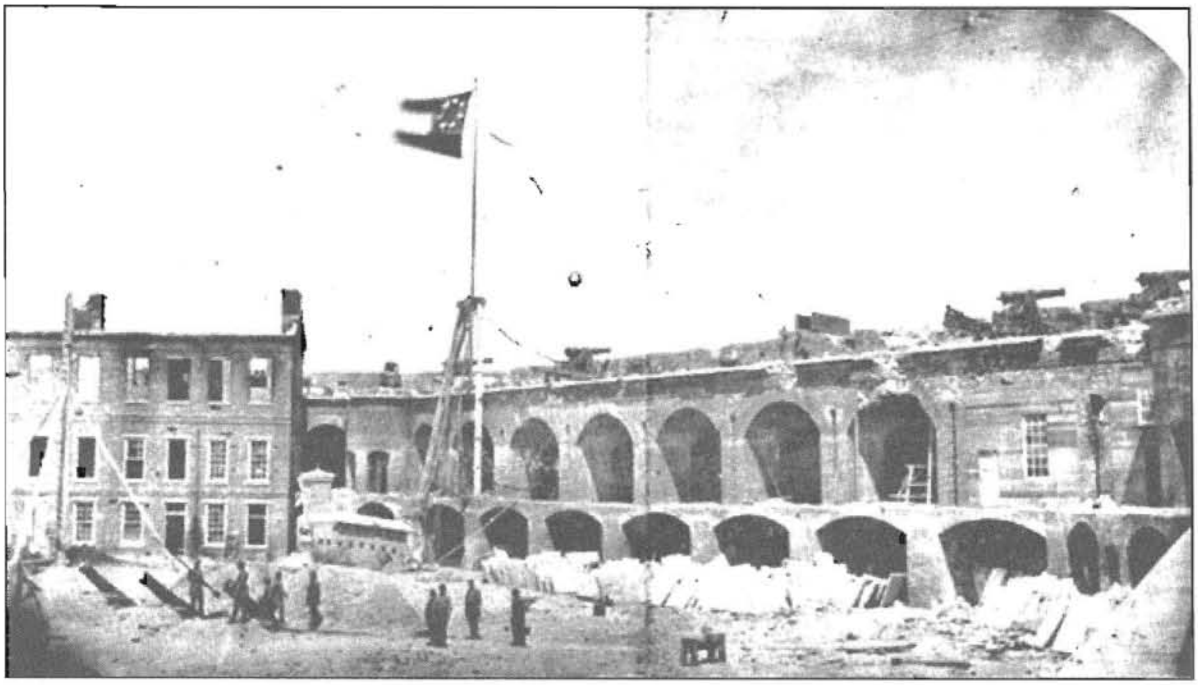


Map of Thompson Bend

Projects such as the Thompson Bend Riparian-Corridor Project are essential to continue the Corps of Engineers' mission of maintaining a safe and dependable navigation channel, while working with the environment in such a way that everyone benefits. The Mighty Mississippi has been around for a long time and will be around for a longer time than any of us can imagine. It is a very big river and, if we all work together to develop viable solutions to the problems it causes, everyone will benefit.

Ms. Hatfield has been with the Defense Department for more than 35 years, most of that time spent as a position classification specialist. She learned of the Thompson Bend Riparian-Corridor Project while conducting classification reviews in the Engineering Division's Hydraulics Branch. Currently serving as a public affairs specialist and editor of the district newsletter, Terrie now has the opportunity and the vehicle to translate some of the district's most outstanding engineering successes into feature stories as a very effective way to convey these achievements to both technical and nontechnical audiences.

Note: The hydraulic engineer who developed the innovative solution to this erosion problem was Jerry Rapp. His technical paper "Preventing a Cut-Off of a Mississippi River Bendway With Tree Screens" was a finalist in the Permanent International Association of Navigation Congress competition and was published in 1989. His technical expertise has become widely recognized in the development of various vegetative solutions for a wide range of overbank and bank-line erosion problems. His research and innovative and environmentally beneficial designs have earned him "expert" status throughout the Corps's Mississippi Valley Division and with other elements of the Corps and a number of environmental agencies and interests, including those in foreign countries.



Confederate Engineers in the American Civil War

By First Lieutenant Shaun Martin

On 16 March 1802, the Congress of the United States authorized President Thomas Jefferson to organize a Corps of Engineers, which "shall be stationed at West Point, New York," and "shall constitute a military academy," with classes beginning in April 1802.[1] The academy progressed from a disorganized and largely unknown institute to one with a record of high academic excellence, producing officers who would make a name for themselves in military and civil affairs. While the graduates of West Point distinguished themselves in different branches within the Army, attesting to the quality of their military education, the curriculum was designed to provide an engineering education to supply the United States with trained engineers.

Jefferson Davis summarized a widely held opinion of the value of West Point graduates in a report made to Congress:

Nearly all great public works of the country, the river and harbor works, the lighthouses, and even the public buildings, have been directed by its graduates; they were the pioneers in the construction of railroad, and among the teachers of that art; and the great scientific works of the government have been chiefly conducted by them. The military services of its graduates have been ever more conspicuous than those in engineering and science. The fortifications, the improvements in ordnance and small arms, the conduct of the geographical and other scientific labors carried on in connection with the operation of troops, equally attest the character of the instruction imparted at West Point. Ever since the organization of the government, perpetual Indian warfare has kept the larger part of the Army in active operation on the frontier and in the barren plains and mountains of the interior. The duties are harassing and entail great privation and exposure; they call for the exercise of all the best qualities of the soldier which, tried by this severe test, the graduates have been found to possess in an eminent degree.[2]

Choosing Sides

On 6 March 1861, after the South seceded from the United States, the Provisional Congress of the Confederate States of America passed "an act for the establishment and organization of the (Confederate) Army." Among other provisions, it called for the establishment of the Confederate Corps of Engineers.[3]

Since the primary source of men trained in the skills of artillery and engineering for the United States was West Point, those who attended classes together, as well as those who provided the instruction, chose sides when the Civil War began. (For example, in January 1861, the superintendent of West Point was Captain P.G.T. Beauregard. Four months later—as a newly promoted general—his troops opened fire on South Carolina's Fort Sumter (see photo at left), a Union fort commanded by Major R. Anderson, who years earlier had been the artillery instructor for cadet Beauregard at West Point.[4])

The Union Army received the greater share of these officers and the experience they brought with them. Of the 65 cadets who had resigned from West Point and accepted commissions in the Confederate Army by May 1861, only seven were in the Corps of Engineers. An additional 13 officers were inherited from the academy faculty, but seven of them were soon detached outside the Corps of Engineers.

With its limited cadre and without a source of training for new engineers, the Confederate Army, like the Union Army, would suffer from a critical shortage of engineer officers. The Confederate Army, however, did a better job of overcoming this shortage. Its establishment of an Engineer Corps and an improvised organization of dedicated engineer troops gained the Confederacy numeric superiority with regard to its engineers.

In 1863, the Confederate Congress passed legislation assigning a company of engineer troops to every division in the field. The troops were to be drawn from each division and selected based on their experience in the mining or construction trades. Each company consisted of 100 men commanded by a captain and three lieutenants. The newly formed companies (4,000 soldiers, who were dedicated to engineer operations) were superior to the Union Army's ad hoc system, which relied on employing soldiers as engineers as needed.[5]

By 1865, the Confederate Army had many more engineer officers in the field than the Union Army. The Confederate Engineer Corps had 13 regular officers, 115 provisional officers drawn mostly from civilian engineers, and an additional 188 nonengineer officers assigned to engineer troops. This compared to the Union's 86 engineers.[6]

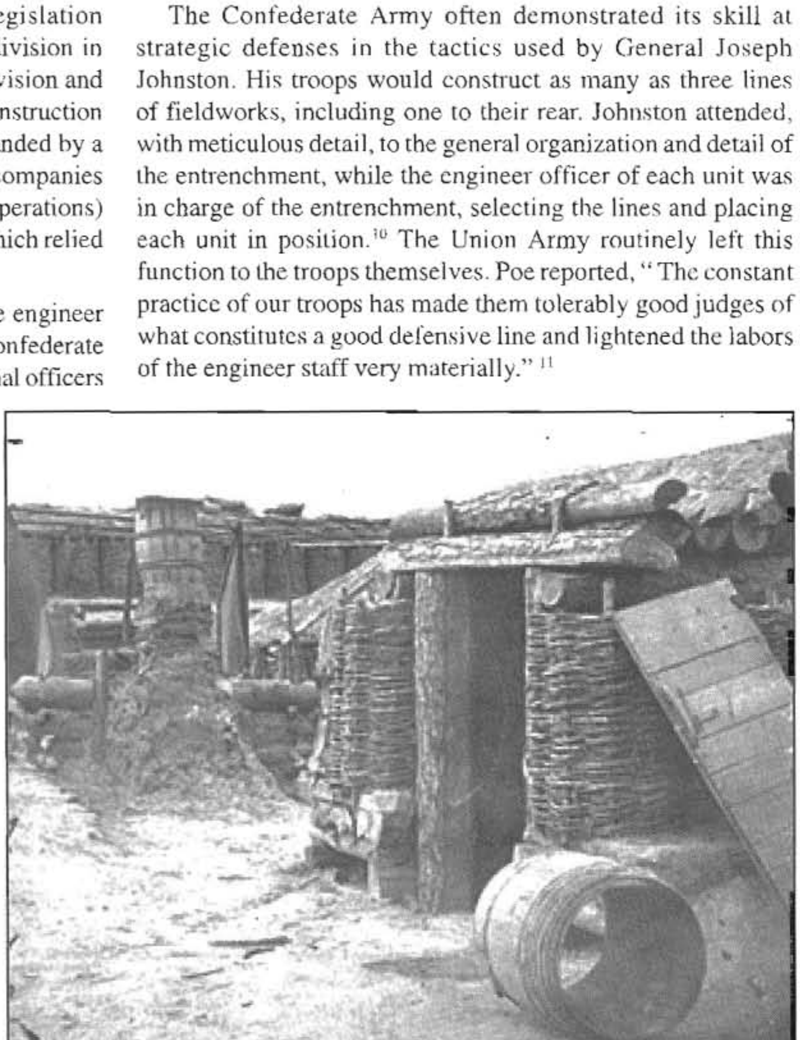
The engineer troops of the Confederacy were generally committed to constructing and improving field fortifications deployed to the coastal and interior defenses, and it was in this capacity that they were superior to their Union counterparts. At times, engineers were used to maintain and improve the Confederate rail system, but here the Union Army excelled, both in its utilization of the engineers and its logistical support of the rail system.[7] The creative use of the resources available was what set the Confederacy apart from the Union. Another lasting contribution of the Confederate engineers was the development of new weapons systems.

Field Fortifications

The innovations employed by the Confederate engineer units during the Civil War were remarkable. Field fortifications dominated the Confederate defensive operations and were extensively employed in their offensive operations. A zigzag system of trenches, which had never been used in field operations, protected the approach. Such entrenchment methods previously had been used exclusively for siege operations.[8]

Union Captain Orlando Poe, General William T. Sherman's chief engineer, admired one particular innovation he had observed—the "head log," which was invented to cope with the deadly accuracy of sharpshooters. The head log was described as "a stout log, of hardwood if possible, which is cut as long as possible and laid upon blocks placed on the superior slope for a foot or two outside the interior crest. The blocks supporting the head log raise it sufficiently from the parapet to allow the musket to pass through underneath it and steady aim to be taken, while the log covers the head from the enemy's fire. Frequently, the blocks are replaced by skids which rest on the ground in the rear of the trench so that if the head log is knocked off the parapet by artillery fire, it rolls along these skids to the rear without injuring anyone."[9]

The Confederate Army often demonstrated its skill at strategic defenses in the tactics used by General Joseph Johnston. His troops would construct as many as three lines of fieldworks, including one to their rear. Johnston attended, with meticulous detail, to the general organization and detail of the entrenchment, while the engineer officer of each unit was in charge of the entrenchment, selecting the lines and placing each unit in position.[10] The Union Army routinely left this function to the troops themselves. Poe reported, "The constant practice of our troops has made them tolerably good judges of what constitutes a good defensive line and lightened the labors of the engineer staff very materially." [11]



Interior view of Confederate works

Confederate fortifications at Petersburg

The Union was slow to appreciate the effectiveness of the Confederate defensive tactics. In June 1862, the defense of Vicksburg, Mississippi, under the command of General John Pemberton, was under way. The Confederates threw up two circular fieldworks that were connected by rifle trenches. The Union Army's General Ulysses S. Grant failed to entrench his offensive line or even to entrench his camps. The Union forces staged three assaults, the first on 29 December 1862 with forces commanded by General Sherman. The second and third assaults by Grant's forces were on 19 and 21 May 1863, this time after a six-hour artillery bombardment by land and from the river. Grant captured a few works but could not hold them. On 4 July1863, Pemberton, who was short of food and ammunition, surrendered after defending for 213 days. Grant had employed 220 artillery pieces, while the defenders hardly used any artillery. Pemberton had defended Vicksburg with a force of 18,500 men and lost about 800 during the siege. Grant had engaged about 30,000 men, and his force was almost decimated.[12]

In June 1864, near the end of Grant's Overland Campaign, the Confederate Army again demonstrated the power of its engineers at a crossroads in Virginia known as Cold Harbor. General Robert E. Lee had lost the crossroads while fighting General Grant's forces during the preceding days. Early on 2 June, Lee's soldiers began to erect a defensive works. Although Grant wanted to attack immediately and roll over Lee's forces before they could complete their efforts, his units were unable to complete necessary preparations in time for the sunrise assault. So Grant rescheduled the attack on Lee for dawn on 3 June.

Meanwhile, Lee's men dug frantically throughout the day on 2 June. Confederate engineers from Richmond used long cords marked with small strips of white cloth, expertly laying out the lines to maximize the fields of fire.[13] The earthworks were low-lying and did not look at all impressive. A Union officer recollected, "The country being generally level and only slightly undulating, the sharpest eye could perceive through the woods and fields nothing but faint lines of rifle trenches."[14]

A little before 0500 on 3 June, after a brief bombardment, Grant's forces began their assault on the Confederate positions. The mass charge of nearly 60,000 Union soldiers was shattered in less than an hour. Major General Andrew Humphreys, the Union Army's chief of staff, later tallied the Union losses for the day at 4,517 wounded and 1,100 dead.[15] After the war, Grant wrote, "I have always regretted that the last assault on Cold Harbor was ever made."[16] The Overland Campaign was finished and Grant now focused on taking Petersburg, Virginia, a siege that would last nine and a half months.

A new philosophy had emerged within the Union ranks. After Cold Harbor, General William F. Smith said, "It had become an axiom among both officers and men that a well-defended rifle trench could not be carried by a direct attack without the most careful preparation, nor even then without fearful loss."[17] On 18 June 1864, Union forces tried once more to storm an entrenched Confederate line at Petersburg. Within ten minutes, 241 Union soldiers were killed and 371 were wounded.[18] The message at last penetrated to the highest echelons of the Union command. Until 2 April 1865, when the war was almost over, the mere sight of Confederate field entrenchments ahead terminated many offensive operations at Petersburg.[19]

The Confederacy pursued a strategy of waging a defensive war[20] but, in the offense, its engineer forces were both innovative and highly effective. One especially successful technique involved creating a skirmish line that moved increasingly closer to the enemy's works. The line protected itself by digging individual rifle pits. Working parties then joined the chain of pits into an ordinary rifle trench, which they later strengthened. By this means, entire earthworks could end up within 200 feet of each other.[21]

A number of items for use in the offense were invented out of necessity. One such innovation was the sap roller, a large cylindrical basket that was closed at both ends and filled with rocks and soil. "Sappers" would roll the basket until they were directly in front of the Union positions. The advantage to this was that troops could move onto enemy defensive works while under fire and prepare a rifle trench almost on top of the enemy and be relatively free of the murderous fire the enemy could deliver.[22]

Rail Systems

Besides field fortifications and trench warfare, engineers were responsible for the rail systems that provided transportation for supplies needed by the armies. Dominance of both the rail and waterway transportation systems would contribute greatly to the ultimate victory of the Union forces, but the Confederate forces often made good use of the rail resources available to them throughout the duration of the war.

Like Grant, Lee understood the importance of the rail system during the war and had employed his engineers in the system's maintenance and expansion. Although Lee did not have the use of the waterways that the Union enjoyed, he still needed to move troops and materials. At his disposal, Lee had the Orange, the Alexandria, and the Virginia Central Railroads. The combined system extended from Richmond to within 40 miles of Washington, D.C. However, compared to the Union's Baltimore & Ohio Railroad, the Confederate rail system was very limited in the number of miles of track and the general quality.

The Union dominance of rail transportation was actually strengthened by the decisions of the Confederates regarding their existing system. First, the tracks for the southern rail systems were laid in a north-south direction and were not interconnected—a problem that could have been overcome by laying new tracks. But Congress was slow to respond to Lee's requests, and he expressed his concern in a letter written on 27 April 1861 just after assuming field command.[23] In addition, southern railroads were not subordinated to military needs, in contrast to the organization and administration of railroads in the North.[24] This was a continuous logistical hindrance as Lee anxiously waited for subsistence, fodder, animals, and wagons to arrive via an undependable rail system.

Another shortcoming in the southern rail system was the gauge of the rails. They were not a standard gauge, which meant that troops had to unload materials at junctions and reload them. As the Union Army captured these sections, it upgraded the track to the standards of the existing northern rails. This involved replacing rails with the standard gauge used by the northern rail system and laying new track to connect previously unconnected sections.

In spite of not developing their own rail system adequately, Confederate engineers contributed to pioneering uses of the railroad. For example, they adopted an effective railroad mobilization strategy. In the spring of 1862, Grant threatened the town of Corinth, Mississippi. A significant feature of this battle was the Confederacy's ability to quickly move troops to contest Grant's presence. In an unprecedented rapid concentration of troops, the rail system brought several armies to Corinth, plus newly mobilized regiments from other states. The Confederates lost the battle for Corinth, but they had shown the importance of the rail system in delivering troops to battle.[25] Grant was quick to see this importance and would use it effectively against the Confederates in the future.

Weapons Systems

Confederate engineers were also employed in developing new weapons in hopes of gaining an advantage on the battlefield. Among these was the introduction of a railroad artillery battery. During the Peninsular Campaign of 1862, General Lee suggested that a railroad battery be built for the Confederates. It would be used on the York River Railroad to halt the advance of General George B. McClellan along this line.

On 5 June 1862, Lee wrote his chief engineer, Major W. Stevens, and suggested that the Confederate engineers "construct a railroad … plated and protected with a heavy gun."[26] He also suggested that mortars be used in a similar manner. Lee hoped the gun would be in action by 6 June; however, it was not available until 22 June. The 32-pound gun was rifled and banded and weighed 5,700 pounds. Mounted on a railroad flatcar, it was protected in front by a sloping iron-plated shield through which a porthole had been cut for the muzzle of the gun. The sides of the car were protected with timbered walls that were lined with iron. The basic ammunition load consisted of 200 rounds, including a number of 15-inch solid bolt shot. The gun was first used at Savage's Station, Virginia, on 29 June during the Seven Day's Battles. The gun, under command of Lieutenant James E. Barry, was pushed near a rail bridge near the depot. He was to clear an obstruction emplaced by the Union troops and rake the infantry in the valley below with fire. He accomplished his mission with a terrible effect. The Union infantry's attempted assault on the gun was repulsed, and the Union suffered heavy losses.[27]

Conclusion

The Confederacy was never able to gain dominance in rail transportation, and the new breed of weapons and tactics introduced by the ill-fated nation's engineers did not provide the edge they needed to win the Civil War. However, the Confederate engineers' battlefield tactics changed the face of warfare, forever allowing commanders to mass and redeploy troops and transport supplies with previously unimagined rapidity and effectiveness. On the battlefield, the engineers demonstrated with gory clarity the contributions they could make. The innovations they introduced were the foundation of warfare of the future.

First Lieutenant Martin is a support platoon leader with the 162d Engineer Company, Oregon Army National Guard. A mechanical engineer, he is pursuing an advanced degree in design at Oregon State University.

Endnotes:

[1] Stephen Ambrose, *Duty, Honor, Country: History of West Point*, Baltimore: The Johns Hopkins Press, 1966, p. 22.

[2] Report of the Commission, Senate Document No. 3, 36th Congress, 2d Session, Washington, 1860, pp. 56-57.

[3] Richard P. Weinert, " The Confederate Regular Army," *Military Analysis of the Civil War*, ed. Military Affairs, New York: KTO Press, 1977, p. 17.

[4] Ambrose, p. 22.

[5] John H. Westervelt, *Diary of a Yankee Engineer*, ed. Anita Palladino, New York: Fordham University Press, 1997, pp. 47-59.

[6] Edward Hagerman, *The American Civil War and the Origins of Modern Warfare*, Bloomington and Indianapolis: Indiana University Press, 1988, pp. 236-239.

[7] John Prados, "How Many Roads to Richmond?" *The Quarterly Journal of Military History*, Vol. 12, No. 2, 2000, p. 55.

[8] Ibid., pp. 54-55.

[9] W.T. Sherman, *Memoirs*, Bloomington: Indiana University Press, 1957, pp. 117-118.

[10] Fitzhugh Lee, *General Lee*, New York: Greenberg D. Appleton and Co., 1894, p. 138.

[11] Sherman, pp. 38-39.

[12] Noah Andre Trudeau, "The Walls of 1864," *The Quarterly Journal of Military History, Vol.* 6, No. 2, 1994, pp. 24-26.

[13] Ibid., pp. 29-30.

[14] Barron Deaderick, *Strategy in the Civil War*, Harrisburg: The Military Service Publishing Company, 1946, p. 103.

[15] Trudeau, p. 30.

[16] Ulysses S. Grant, *Personal Memoirs*, New York: World Publishing Co., 1952, p. 96.

[17] Deaderick, p. 122.

[18] Ibid., p. 147.

[19] Trudeau, p. 31.

[20] James M. McPherson, "Failed Southern Strategies," *The Quarterly Journal of Military History*, Vol. 11, No. 4, 1999, p. 62.

[21] Hagerman, p. 199.

[22] Ibid., p. 330.

[23] Moxley G. Sorrel, *Recollections of a Confederate Staff Officer*, New York: Neal Publishing Co., 1905, p. 784.

[24] Hagerman, pp. 146-147.

[25] Prados, p. 55.

[26] Lee, p. 288.

[27] Stansbury Haydon, "Confederate Railroad Battery," *Military Analysis of the Civil War*, ed. Military Affairs, New York: KTO Press, 1977, pp. 291-294.

(continued from page 39)

retrieving a wide range of information products on both the secure and nonsecure Internet protocol routing (SIPR/NIPR) networks.The need for this project was identified after realizing that years of hard work had been electronically filed and boxed with little or no cataloging system for future retrieval. As a result, planners have spent hours digging through old boxes and scanning various disks and hard drives trying to locate good historical products they knew existed. When products weren't found, planners were forced to work from scratch and duplicate the efforts expended by their predecessors. This predicament served as a powerful motivator to get this engineer management system and repository designed and in place as rapidly as possible.

To assist in the development of this repository, we turned to the Waterways Experiment Station's (WES's) Tele-Engineering services in Vicksburg, Mississippi, for technical assistance. In short, our engineer planners developed the objective system and functional requirements, and WES successfully turned these requirements into a user-friendly engineer-information application.

The repository is designed with drag-and-drop functionality and drop-down menus, which will provide users a means to find and download various engineer products quickly and easily. It is being developed as a Web browser using Microsoft® Access 2000 and is organized by each country in the USAREUR area of operation.

The opening menu portrays a map of the European geographical region. Each country on the map has a trigger symbol linked to the primary table for that country. The primary tables have information organized into a minimum of 18 areas, to include military capabilities, U.S. military operations, topography, routes and bridges, ports, airports and airfields, power and water, useful Web sites, and other engineer-related topics. Subordinate tables have various forms of informational products, internal links to products in the database, or external links to Web sites where products you are interested in exist. The repository is also designed with a search engine to guide users directly to all its available products. This repository will be open for outside use in October 2000. The secure and nonsecure Web sites are available from the USAREUR ODCSENGR's home page.

Working Together

The DeFleury Contingency Operations Center and the Engineer Information Repository reflect two initiatives that the ODCSENGR personnel took on to supercharge their engineering capabilities and help them provide better and faster support to future operations. These projects illustrate what we, as individual staffs or units, can accomplish when we take the time to identify what's truly vital to our mission and then work together to make it happen.

Major Larwin is Chief of Plans and Exercises, DCSENGR, Heidelberg, Germany.

PERSCOM Notes

By Sergeant Major Theressa J. Fillmore

Communication

Communication is the key to working with the Engineer Branch on assignment and professional-development issues. It is critical to keep an active dialogue between you, your command, and this branch. Communication gives us advance notice of your concerns, such as readiness, pending operational deletions and deferments, commanding-general/general-officer interest, structure changes, personal wishes, and anything else that could have an impact on the assignment process.

There are many ways of communicating with your assignments branch: a telephone; personal letters; the Interactive Voice Response System (IVRS); branch field visits; e-mail, newsletters; a fax machine; personal visits; PERSGRAMs; PERSCOM Online; and the Department of the Army (DA) Form 4187, *Request for Personnel Action*. All of these methods help us stay in touch, but some are better than others.

The best way for a soldier to communicate with the Engineer Branch is to submit a DA Form 4187 with the recommendation or concurrence of the chain of command. We require that most 4187s be processed through the entire chain. While we appreciate courtesy copies, they only provide advance notice of a pending action and add to our paperwork. Although we do accept faxed requests when operating within a shortened timeframe, most personnel actions do not require faxing. Remember, faxed personnel requests must include the recommendations and concurrences from the required level of command, or we will not take final action.

The e-mail option, while often used, does not keep the chain of command informed of a soldier's actions. For this reason, we do not consider e-mail requests official except in certain cases, such as replies to Homebase/Advance Assignment Program (HAAP) changes generated by the branch. However, we do reply to e-mails as quickly as possible. These inquires must include your full name, rank, and primary military occupational specialty (PMOS), but do not include your social security number.

We welcome personal visits to PERSCOM. Although advance notice is not required, it is helpful to ensure that your assignments manager or professional-development noncommissioned officer (PDNCO) is available.

We also encourage telephone calls and personal letters. In the Engineer Branch, we believe that soldiers should have input in their future. When calling, we need your name, rank, and PMOS to quickly connect you with the correct assignments manager and/or PDNCO.

Soldiers primarily use the IVRS (1-800-FYI-EPMD [394-3763]) to determine if they are on assignment instructions. However, it also gives information on schools, retention management, and other enlisted topics. You need a touch-tone telephone to use the IVRS and must provide your social security number.

Branch field visits usually are scheduled at the request of the installation or major command. We conduct these visits to keep the field informed of engineer and Army issues and to conduct face-to-face interviews with the soldiers we serve.

PERSCOM Online (*http://www-.perscom.-army.mil*) is a PERSCOM Web site. The Engineer Branch maintains a portion of the site with assignments, promotions, and other data available for engineer soldiers. It is a good source of information on special assignment qualifications—such as drill sergeant, recruiter, Active Component/Reserve Component—and where engineer MOSs are authorized. The site also includes the telephone numbers and e-mail addresses of all branch personnel in the Enlisted Engineer Branch. The majority of PERSCOM Online has information relevant to all soldiers, not just engineers.

Last, but not least, is the HQDA PERSGRAM, which is used to notify soldiers of PERSCOM-generated actions such as assignments and schools.

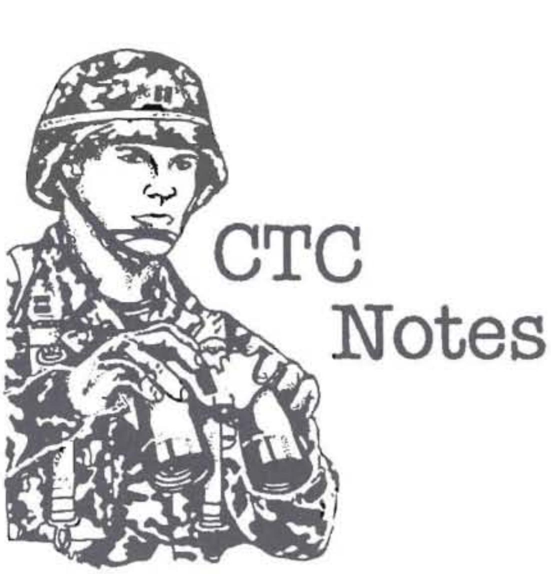
As you can see, there are many ways to communicate with your branch. These avenues are open to leaders and soldiers, and we highly encourage you to use them. We can't know everything that may impact on your next assignment or school unless you or your leaders tell us. The sooner we know, the better. You do not have to wait until you are on assignment instructions to get in touch with us.

MYTH: If you call DA, your next orders will be to Korea.

FACT: While Korea is a valuable assignment, we do not place soldiers on any particular assignment just because they called.

Your voice in the professional-development and assignment process is important to us. The following site on PERSCOM Online provides the telephone numbers and e-mail addresses to contact your branch assignment managers and PDNCOs: *http://www.-perscom.army.mil/EPeng/engdir.htm.*

Sergeant Major Fillmore is the sergeant major of the Engineer Branch.



Combat Maneuver Training Center

Product-Focused Planning

By Captain Ted Read and Major Tom Smith

During recent rotations to the Combat Maneuver Training Center (CMTC), engineer battalions have shared the training objective of "surging" the battalion staff during the brigade's military decision-making process (MDMP) and also improving its own MDMP. However, the battalions typically do not arrive with tactics, techniques, and procedures (TTP) on how to accomplish this goal. By the end of a rotation, the battalion staff reaches a norm on how to plan, but it may be inefficient and limit the positive impact of the engineer battalion staff. A technique to address this problem is for the battalion to arrive at the CMTC with an MDMP SOP. A simple way to develop this SOP is to use a product-focused matrix that identifies products required from each staff member by time/phase of the engineer- and maneuver-brigades' MDMPs. The matrix fixes the responsibility for specific products, by phase, and ensures that the staff acts within the brigade combat team's decision cycle.

The first step is for staff members to review tasks and responsibilities for each step of the MDMP. While Field Manual (FM) 101-5, *Staff Organization and Operations*, is the Army's capstone manual for MDMP, staff members should also review key manuals for engineer integration into the brigade combat team—FM 5-7-30, *Brigade Engineer and Engineer Company Combat Operations (Airborne, Air Assault, Light)*, and FM 5-71-3, *Brigade Engineer Combat Operations (Armored)*—as well as functional manuals such as FM 20-32, *Mine/Countermine Operations*; FM 90-7, *Combined-Arms Obstacle Integration;* and FM 3.34.2 (formerly FM 90-13-1), *Combined-Arms Breaching Operations*. The goal is for each staff member to answer five questions:

1. What products do I owe the engineer and maneuver commanders?

2. What products do I owe the engineer and maneuver staffs?

3. What products do I owe subordinate commands?

4. When do I owe these products?

5. Who synchronizes production and reviews the product before publication?

Note that FMs 5-71-3 and 5-7-30 crosswalk the maneuver-brigade and engineer-battalion actions during each step of the MDMP but do not fix responsibilities for products from specific staff members.

The second step is to synchronize tasks and responsibilities by time and staff member. The battalion executive officer is the key player in delineating the level of staff participation and the breakdown by phase. During this step, challenge the availability of staff personnel and the timing of products. As conflicts develop, weigh the criticality of the information or product and possible alternate staff members or means to provide the information. The end state is a matrix that lists critical tasks and products by staff section with a no-later-than (NLT) time of production. The matrix becomes a living document ready for execution, preferably at a command-post exercise before the rotation. More details can be added by increasing the specificity of tasks, increasing or further defining the staff participation to staff NCOs and below, and dividing the times/phases into smaller steps. Another level of refinement is possible if the matrix becomes mission-specific (for example, a different matrix for defend, movement-to-contact, or deliberate-attack missions).

Provided on page 49 is a simple example of the planning matrix, intentionally limited to three phases (receive mission, issue warning order (WARNO) #1, and brief the engineer mission analysis). It is not definitive! The unit matrix SOP should be the result of individual staff analysis by phases defined by the executive officer. It should account for your tactical-operations center's (TOC) organization and the brigade combat team's likely battle rhythm.

A primary benefit of this format for developing an MDMP SOP is flexibility. As the staff refines tasks and responsibilities, the matrix easily expands. It also trains a synchronization technique commonly used in tactical units. Used properly, it accomplishes the goal of surging the staff on the brigade's MDMP and improving the battalion's MDMP process.

Captain Read is the engineer observer/controller (O/C) for the Armor Task Force O/C Team at the CMTC in Hohenfels, Germany. He was previously assigned to the 9th Engineer Battalion, 1st Infantry Division.

Major Smith, the senior engineer O/C at the CMTC, was previously the executive officer for the 54th Engineer Battalion, Bamberg, Germany.

Product-Focused Planning Matrix

	Receive Mission	Issue WARNO #1	Brief Engineer Mission Analysis
CDR	• Analyze mission. • Provide initial guidance.		• Issue commander's guidance. • Direct focused precombat inspections on misson-critical equipment.
XO	• Develop timeline. • Prioritize planning assets. • Send a logistics planner to the assistant brigade engineer (ABE). • Focus rear-command-post planning tasks. • Verify current status.	• Issue WARNO #1. • Consolidate products for mission-analysis briefing.	• Coordinate the mission-analysis briefing to the commander. • Nest timeline within the brigade's timeline. • Receive commander's guidance. • Issue WARNO #2.
S3	• Verify initial guidance with the brigade S3/XO. • Identify operational tasks. • Identify operational shortfalls. • Identify critical tasks.	• Prepare operation portion of the mission-analysis briefing. • Prepare mission statement. • Approve ABE portion of the brigade's mission-analysis briefing.	• Brief operational piece of the mission-analysis briefing. • Be prepared to send a planner to the brigade's course-of-action (COA)-development meeting.
ABE	• Copy order for battalion. • Develop a friendly engineer estimate. • Identify engineer tasks. • Submit engineer-specific priority information requirements. • Update the Dirty Battlefield Overlay and have it available for mission-analysis briefing. • Pass specific verbal guidance from the brigade command group to the engineer battalion's TOC via the S3 or XO.	• Receive products from staff for brigade's mission-analysis briefing. • Work to get brigade-specific release authority of SCATMINEs. • Work with S2 on R&S routes. • Work with S2 on engineer-specific named areas of interest (NAIs).	• Attend engineer battalion's mission-analysis briefing. • Receive engineer commander's guidance. • Incorporate the commander's guidance into the brigade's mission-analysis briefing.
S1/S4	• Identify combat-service-support (CSS) tasks. • Identify CSS shortfalls. • Identify critical log task. • Update Class IV/V status. • Update equipment status and project the mission's NLT time.	• Prepare CSS portion of mission-analysis briefing. • Receive status from rear command post.	• Brief the CSS portion of the mission-analysis briefing (focus on mission-critical supplies and equipment). • Receive commander's guidance on priorities of supply and maintenance.
S2	• Develop TerraBase shots of key terrain and objectives. • Review and update the modified combined obstacle overlay (MCOO). • Conduct NAI analysis with the brigade S2. • Develop an enemy engineer estimate.	• Work with brigade S2 for NAI TerraBase products. • Prepare enemy engineer portion of the mission-analysis briefing.	• Brief enemy portion of mission-analysis briefing. • Receive TerraBase guidance.

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

Directorate of Training (DOT)

Active Duty Service Obligations (ADSO) Change to Partially Funded Degree Programs. If a proposed change to AR 350-100, *Officer Active Duty Service Obligations*, is approved, the ADSO will increase for UMR graduates for an additional 12 months after they receive tuition assistance. The change indicates that officers who participate in a partially funded program will incur a three-for-one ADSO for time spent in civilian education with a minimum ADSO of two years. Currently, the ADSO does not significantly extend an officer's commitment after degree completion. Of the officers polled who are current UMR students, 94 percent said they would still use tuition assistance if this change were in effect today. The effective date of the new policy is to be determined.

POC is CPT David Cushen, (573) 596-0131 ext. 3-7231, or DSN -7231, or e-mail *cushend@wood.army.mil.*

New Engineer Branch Video for ROTC/USMA Cadets. The Engineer Branch recently completed a new video, which is being distributed to ROTC detachments and the USMA. The updated video includes illustrations of our diverse missions and information concerning in-service and postservice benefits and portrays the current status of the Engineer Regiment.

POC is CPT David Cushen, (573) 596-0131 ext. 3-7231, or DSN -7231, or e-mail *cushend@wood.army.mil.*

Reserve Engineer TASS Battalion Instructors Needed. Resourcing of the TASS battalions by the institutional training divisions and brigades continues to be critical. Instructor strength is the primary challenge. All training battalions continue to need additional engineer instructors. If a quality engineer NCO (E6 or E7) is leaving active duty, he is needed as an instructor in the U.S. Army Reserve Engineer TASS Battalions.

POC is MAJ James Avants, -4114, or e-mail *avantsj@wood.army.mil.*

Engineer Officer Advanced Course. The construction module of the advanced course is being updated with a new capstone exercise based on the Bosnian theater of operations. Also, a quality-control/quality-assurance class is under development, which will be incorporated into the existing project-management lesson.

POC is CPT Tim Scholma, (573) 596-0131 ext. 3-5372, or DSN -5372, or e-mail *scholmat@wood.army.mil.*

Mine Awareness/Unit Mine-Advisor Train-the-Trainer Course. The Countermine Training Support Center (CTSC)/Humanitarian Demining Training Center (HDTC) projects that the pilot for this course will be in July 2001. The intent of the course is to teach senior NCOs and junior officers to develop and conduct unit mine-awareness training properly and to serve as unit mine advisors during deployments. Course graduates will be designated "trainers" from active and reserve engineer battalions and brigades throughout the force. The CTSC will teach this five-day course at Fort Leonard Wood on a cyclic basis, prioritizing instruction for those designated to deploy to mine-contaminated regions such as Bosnia and Kosovo. We anticipate space for up to 30 students, so please call to reserve positions. Units will be required to fund associated TDY costs. For more information, visit our Web site at *http://www.wood.army.mil/CTSC.*

POC is Dr. Steve Grzyb, -6199, or e-mail *grzybst@wood.army.mil.*

Directorate of Training Development (DOTD)

Field Manual Update. The following field manuals have recently been printed and distributed:

- FM 3-34.2 (formerly FM 90-13-1), *Combined-Arms Breaching Operations*, dated 31 August 2000.
- FM 3-34.230 (formerly FM 5-105), *Topographic Operations*, dated 3 August 2000.

These manuals also are available for viewing and downloading from the Reimer Training and Doctrine Digital Library. To access the library, go to *http://www.adtdl.army.mil/atdls.htm* and click on "Enter the Library." Select (highlight) "Field Manuals" on the left drop-down menu and "Engineer" on the right drop-down menu. Click on "Submit."

FM 3-34.331, *Topographic Surveying*, will be sent to print within the next 30 days. Look for it on the MANSCEN Publications Page at *http://www.wood.army.mil/PUBS/newpubs/htm*. This manual combines FM 5-232 and TMs 5-232 and 5-237 and is a guide for military occupational specialty (MOS) 82D (topographic surveyor). It provides techniques not found in any commercial text concerning the precise determination of position, azimuth, or elevation of a point. Additionally, this publication describes and standardizes procedures for performing recons, preparing station descriptions, and reporting and briefing survey projects.

POC is Sandra Gibson, -4100.

2000 Engineer Unit Directory. The directory, which is updated periodically, is available at *http://www.wood.army.mil/PUBS/dsd/dsd.htm*. Units may submit changes/corrections at any time via e-mail to Jennifer Morgan at *morganj@wood.army.mil*.

POC is Jennifer Morgan, (573) 596-0131 ext. 3-7644, or DSN -7644.

News and Notes

MOS 52E Prime Power Production Specialist. The U.S. Army Prime Power School is looking for self-motivated soldiers who meet the following prerequisites:

- Be an E-5 (nonpromotable) or an E-4 or E-4 (promotable) (subject to career-field requirements).
- Hold a high school or a General Education Development (GED) diploma.
- Score at least 110 on the Armed Services Vocational Aptitude Battery (ASVAB) in the electronics (EL), general technical (GT), and skilled technical (ST) areas.
- Score at least 70 percent on the Basic Mathematics and Science Proficiency Test (BMST).

Located at Fort Belvoir, Virginia, the school teaches the skills associated with installing, operating, and maintaining the Army's largest electrical-power plants. The one-year Prime Power Production Specialist Course is among the Army's most technically challenging training. The benefits include earned college credit, great assignments, promotion opportunities, and worldwide travel while conducting prime-power missions. The schedule for the course is as follows:

Class 01-1
Report date: 26 February 2001
Start/Class date: 12 March 2001
End date: 01 March 2002

Class 01-2
Report date: 27 August 2001
Start/Class date: 12 September 2001
End date: 30 August 2002

POC is Dennis Calamita or Nilia Kondratiuk, (703) 806-3904/3748, DSN 656-3904/3748, or e-mail *249PPSDEADMIN@EN249.usace.army.mil*.

Defense Mapping School Courses. The Defense Mapping School, located at Fort Belvoir, Virginia, is offering the following FY01 resident courses. More information about resident course offerings can be found at *http://www.nima.mil*.

Geospatial Information and Services Staff Officer Course

001	16 October 2000	20 October 2000
002	04 December 2000	08 December 2000
003	22 January 2001	26 January 2001
004	19 March 2001	23 March 2001

Geospatial Digital Data Users Course

001	23 October 2000	27 October 2000
002	13 November 2000	17 November 2000
003	29 January 2001	02 February 2001
004	09 April 2001	13 April 2001
005	07 May 2001	11 May 2001

Topographic Operations Management Course

001	26 February 2001	09 March 2001
002	13 August 2001	24 August 2001

Remote Sensing and Geographic Information Systems

001	06 November 2000	20 November 2000
002	12 March 2001	23 March 2001
003	18 June 2001	29 June 2001
004	20 August 2001	31 August 2001

POC is Ms. Lynn Keleher, (703) 805-3213, or DSN 655-3213. Alternate POC is at (703) 805-2237, DSN 655-2237.

Defense Technical Information Center (DTIC) 2000 Conference. The DTIC will host its annual users' meeting and training conference from 6 to 9 November 2000 at the DoubleTree Hotel, Rockville, Maryland. This year's theme is "Information Solutions for the Twenty-First Century."

DTIC 2000 provides a unique opportunity for attendees to explore in detail new developments not only at the DTIC but throughout the federal technical-information network. As in past years, the conference will feature a number of presentations and sessions that focus on the most current issues relative to the research, development, and acquisition communities. These sessions are designed to acquaint the participants with the latest policy and operational developments and will provide practical details on valuable and diverse domestic and foreign information resources. The sessions will also address security issues, the World Wide Web, copyright laws, and the storage and dissemination of electronic documents.

POC is Julia Foscue, (703) 767-8236, or e-mail *jfoscue@dtic.mil.* The DTIC home page is at *http://www.dtic.mil.*

22d Army Science Conference. Sponsored by the Assistant Secretary of the Army (Acquisition, Logistics, and Technology), the 22d Army Science Conference will be held at the Renaissance Harborplace Hotel, Baltimore, Maryland, 11 to 13 December 2000. The conference theme is "Accelerating the Pace of the Transformation to the Objective Force." The conference will feature presentations of papers and posters judged best among those submitted by Army scientists and engineers. Authors of the most outstanding papers will be selected to receive special recognition and awards.

POC is at (757) 357-4011 or e-mail *asc2000info@aol.com* or visit the conference Web site at *http://www.asc-2000.com.*

Web Site for Company Commanders. Eight Army officers have founded a Web site that is dedicated to improving company-level leadership in the Army. The site, *http://www.CompanyCommand.com,* is a user-driven forum in which former and current company commanders share their best ideas, products, and lessons learned to benefit current and future company commanders. The goal of the Web site is to improve institutional knowledge at the company level of Army leadership by improving the lateral flow of information.

The eight officers, who are assigned to the staff and faculty at the U.S. Military Academy, run the Web site during their off-duty hours without remuneration. Their sole focus is on helping leaders to grow great units and soldiers.

POC is CPT Peter G. Kilner, (845) 938-4764, or e-mail *cpkilner@aol.com.*

Lead the Way

Command Sergeant Major Arthur Laughlin
U.S. Army Engineer School

I recently went to a conference at Fort Monroe, Virginia, on the transition of TRADOC. The conference was a planning/brainstorming meeting. It dealt with everything in TRADOC from how the schools are organized to how the Army grows and trains leaders, what is taught during Initial Entry Training (IET), and what the school requirements will be for soldiers in their careers. There were a lot of ideas with no final decisions being made. Change, however, is not far off.

I consider this one of the most important times in our Army and our branch. Everything is on the verge of change, and not since the elimination of the horse has there been such dramatic turbulence in the structure of the Army. You may well have to serve in three types of force structure: the legacy force, the interim force, and the objective force. These are all going to be around at the same time until the transition is finished and, for many of you, that will take until the end of your career. Each structure may give you a different relationship with the maneuver force and the logistic chain and a different mix of soldiers and equipment. The training requirements will be different from unit to unit, and the OPTEMPO will vary.

The Chief of Staff of the Army tasked the EPMS XXI Task Force to conduct a comprehensive study of the Enlisted Personnel Management System and recommend changes to ensure continued readiness into the twenty-first century. The idea is to create better ways of managing the force so that soldiers are not stranded in their careers with no way to progress. The different force structures may require you to have different skills for the same MOS. The equipment will be different, the soldier mix will be different, and the support relationship will be different. Therefore, your skills will also have to be different. These changes mean that each of you has to be ready to change. These changes mean that you will have to learn new concepts and new ways of getting the mission accomplished. This will be an Army for people who are serious about soldiering and fearless in the face of the unknown. This will be an Army for engineers.

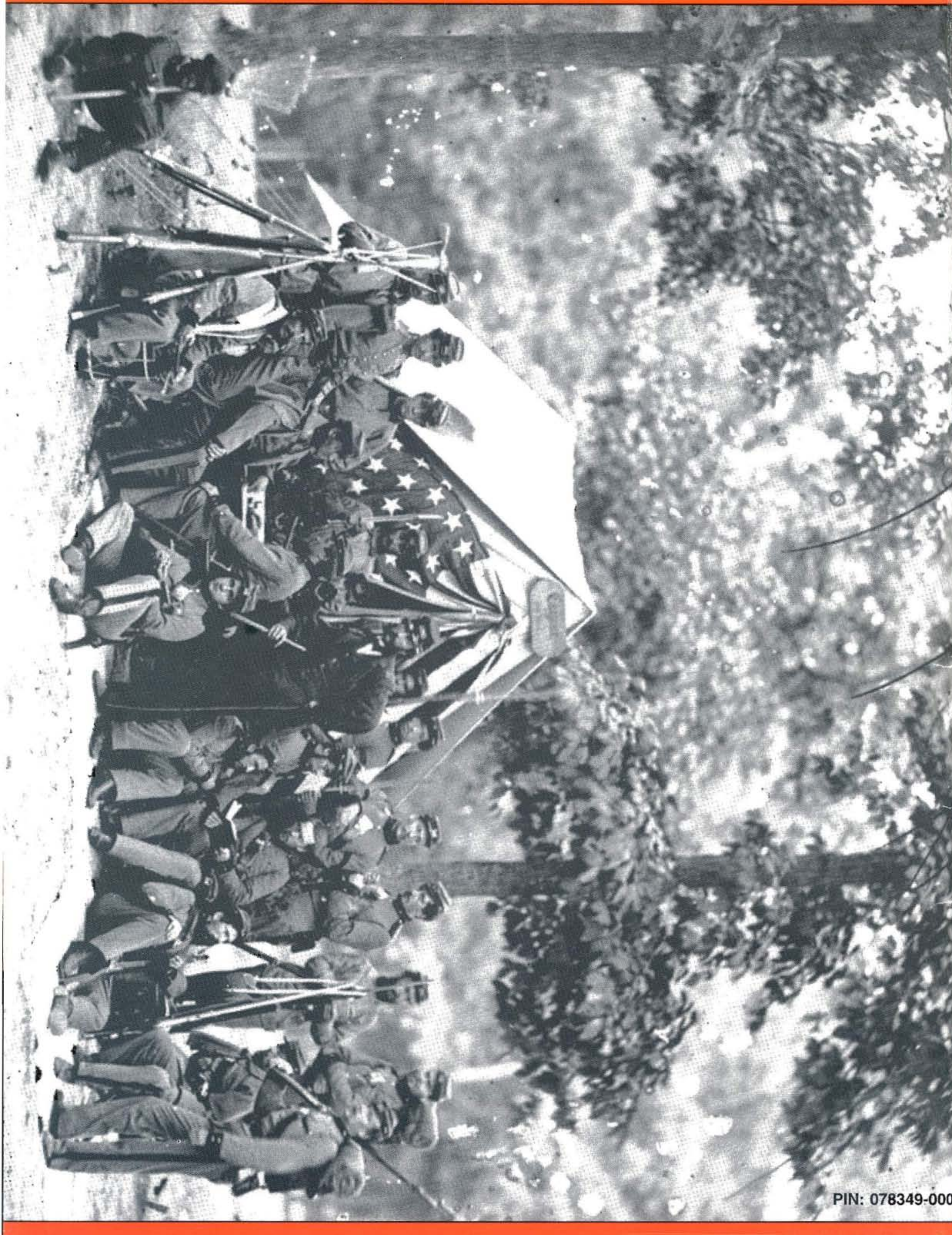
What will not change are the values that we live by and the requirement for leadership. The force will still be made of people expected to come together to accomplish the mission of defending the nation. Engineers will still be a vital part of that mission, and each one of you will be expected to carry more than your share of the load, just like engineers have always had to do when the Army was changing. I know that the easy thing to do is to say enough is enough and go do something else before the wave of change washes over you. But before you decide that enough is enough, remember that your leaders will stay and help mold this new force. Your leaders will embrace the change and make a difference.

This will be my last article to the Regiment and *Engineer*. I will be replaced by a very capable Command Sergeant Major–Robert R. Robinson II, who is coming from HHC 555th Combat Engineer Group, Fort Lewis, Washington. I know that you will provide the same outstanding support to him that I have experienced while serving as your Command Sergeant Major.

In leaving I would like to thank all of you, the soldiers and noncommissioned officers, for all you have done. By giving me your concerns and feedback, we have been able to continue doing something very important—making a difference.

NCOs, you must continue to lead and train our soldiers as we have done for so long. Do not be afraid of change; embrace and master it. You and your subordinates will be better for it. If called upon to assume a position of greater responsibility, do so gladly. Someone has faith in your abilities—be proud of that fact.

Take care; I will not soon forget the adventures so many of us have lived.



PIN: 078349-000