ENGINEER

The Professional Bulletin of Army Engineers

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FORGING OUR FUTURE

REGIMENTAL TRANSFORMATION

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ENFORCE 03

CANCELED

By Captain Mark A. Winkler

In light of current world events, MG Van Antwerp, in consultation with the Chief of Engineers, decided to cancel ENFORCE 03. The Engineer School is focusing, instead, on providing the very best support possible to the Army in the field, the Regiment, and the soldiers training here during this period of increased worldwide tension. It was definitely not an easy decision because of the critical nature of ENFORCE to the Regiment's leadership and future. However, this will allow increased focus on near-term missions and requirements that will set the stage for ENFORCE 04.

Although ENFORCE 03 was cancelled, the focus on transformation is too important not to be covered in *Engineer*, our professional bulletin. The articles in this issue focus on the areas that were planned for breakout sessions at ENFORCE 03—the Objective Force, the Officer Education System, Regimental Transformation – How to Fight, Operationalizing Assured Mobility, the Countermine Center, FM 3-34, Geospatial Engineering, Terrain Visualization, and Environmental Ethics.

The Commandant will look for an opportunity later this year to host a two-day Regimental Warfighter Conference that will focus on the Objective Engineer Force, Officer Education System transformation, and lessons learned from current operations.

ENFORCE Background

The ENFORCE Conference, hosted by the U.S. Army Engineer School, is an opportunity for senior engineer leaders to come back to the home of the Regiment once a year to attend professional development seminars, receive Army institutional updates, and participate in informational exchanges—and then take this information back to the sappers on the ground.

ENFORCE, as we know it, began as the Engineer Commanders' Conference (ECC) before the school's move from Fort Belvoir, Virginia, in 1989. Soon after the move here to Fort Leonard Wood, the name of the conference changed to the Senior Engineer Leader's Training Conference (SELTC), to signify the change in focus from only engineer commanders to all senior engineer leaders. In 1995, the name changed again to the Engineer Force Conference (ENFORCE), to signify the Regiment's move into the future and its focus on what that future would hold for engineers.

Typical ENFORCE attendees are commanders and command sergeants major at the battalion, brigade, and group levels of Active and Reserve Component engineer units; senior engineer advisors to the Reserve Component units and the Readiness Groups; engineers from Corps/Major Commands; senior engineers from the Engineer School, 310th Theater Army Area Command, 98th Division (Training), U.S. Army Corps of Engineers, and Directorates of Public Works; members of the Army Engineer Association; and selected senior staff engineers.

Captain Winkler is an operations officer in Headquarters, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

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Back Cover: *WWI and WWII U.S. Army engineer posters*

FEATURES

DEPARTMENTS

Clear The Way

By Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School

In October, we here at the Engineer School began active support for Operation Iraqi Freedom. It wasn't called that then, but our involvement was an important factor in the decision to cancel ENFORCE 03. It wasn't an easy decision, and we held off on until the last possible moment. We think it was the right thing to do in many ways, but the work that was to be accomplished was to have important impacts on the future of our Regiment. That work must continue, so this issue of the bulletin remains devoted to opening the discussion on critical transformational ideas. In it we lay out some of the key conceptual, informational, and material ideas that form the basis of our overall theme: *Regimental Transformation – Forging Our Future*.

In the last two issues, I began to describe to you some of the underlying ideas behind the transformation of our Regiment. Those were some of the ideas behind assured mobility and some of the impacts of information superiority. In the following pages, more ideas—such as operationalizing assured mobility, a description of many aspects of how we will fight in the Objective Engineer Force, and ideas in the areas of the Officer Education System transformation—are explored. Each of these in turn was to form the basis for breakout sessions where you, the regimental leadership, would come together to discuss, debate, hopefully engage, and explore. That is part of what I am talking about when I say that people are our strength. People and leadership—woven together—are what will carry the Regiment into the future.

We were looking forward to the discussions at ENFORCE 03, the feedback you would provide, and the ideas you would carry away, which are vital in that effort to reach the future. These things are important, because I believe we are at the crux on transformation. We have been talking it, briefing it, writing about it, and—perhaps most painful—resourcing and funding it for more than three years.

There has been progress in a variety of areas within the overall goals of transformation, but much of that progress is not apparent, not even to those who work it every day. I assess that we, the Army, are very close to what the Chief of Staff calls sustainable momentum. I take that to mean that we are close to having a coherent concept—tied to achievable resourcing and solid science and technology—that will allow us to achieve the goal of fielding the Objective Force.

That's a remarkable thing to say, and it has some specific impacts that you, the leadership, need to understand. For example, in some ways this affects the Legacy Force. Although I think everyone will agree that every engineer leader remains deeply committed to taking care of the legacy portion of our Regiment, everyone must understand that the new force is coming, and the process of reaching that force has deep impacts on the Legacy Force. Further, it has come to the point where we must commit to the Objective Engineer Force. It is our path to ensuring that we can support the Objective Force in the future operational environment. Without the Objective Engineer Force, we will simply watch our portion of the Legacy Force fade and will see the risk inherent in future operations rise to truly unacceptable levels.

Now you notice that I have used the term leadership in several contexts within this article. In that usage comes my challenge to you. If this discussion seems difficult to understand—new ideas, new terminology, complex approaches, difficult decisions—then you are right, but your effort to understand them is an example of one of the aspects of transformed leadership that we must incorporate: lifelong dedication to learning. It simply isn't enough to say "I have mastered that skill." That's no more appropriate than an ophthalmologist saying "I am competent on the concept of contact lenses" and then never going on to grasp the idea of laser surgery. Such an inability to keep on learning simply dooms that type of leader to obsolescence in the march of new ideas. We aren't, can't be, and won't be that kind of leader. That's my first challenge to you—lifelong learning.

My second challenge to you is the other half of the leadership team—the led. I think that while many great ideas about leader development come and go, there is one enduring aspect for transformation. We must develop agile and adaptive leaders. Agile (fast on their feet, fast in their thoughts, fast in their analytical and assessment skills and make it happen, get it done, do it right) and adaptive (come out on top, work together to overcome, ensure teamwork, learn and grow) leaders can and will overcome the challenges that we and the future environment are building for them. I know that many of you have given quite a bit of attention to these types of thoughts, and I look forward to your feedback.

I know, just from the type of leaders you are, that we will get it. And even more importantly, you can count on us to use that feedback as we continue to work toward the Objective Engineer Force and toward ENFORCE 04.

Essayons!

Lead The Way

By Command Sergeant Major William D. McDaniel, Jr.
U.S. Army Engineer School

I would like to use this article to reach out to all of you and highlight my travels around the Regiment. Since my message to you in the last issue of the bulletin, I attended the Sergeant Major of the Army (SMA) Nominative Command Sergeant Major (CSM) Conference in January at the U.S. Army Sergeants Major Academy at Fort Bliss, Texas. We had a week with the senior Army leaders, to include the Secretary of the Army, Chief of Staff of the Army, Army G1, Army G3, Director of the Army National Guard, Chief of the Army Reserve, TRADOC Commander, and past SMAs. Many others provided briefings and insight into our future. This was a very informative week for all attendees.

I also briefed TRADOC Commander General Brynes, the SMA, and all the Nominative CSMs on our Engineer Branch Key Initiatives. CSM Balch and myself visited and had dinner with our future sergeants major (SGMs) and their spouses who were attending the SGM Course at the Sergeants Major Academy.

Here at Fort Leonard Wood, I visited the 1st Engineer Brigade, 5th Engineer Battalion, 35th Engineer Battalion, 169th Engineer Battalion, 544th Engineer Battalion, and 577th Engineer Battalion. The 1st Engineer Brigade is a diverse organization that does remarkable work with limited manpower. The brigade produces professional, confident, and competent leaders and soldiers through the Advanced Individual Training, One-Station Unit Training, B-6 Additional Skill Identifier, and Sapper Leader Courses. In addition, the brigade provides support to the Engineer School and Noncommissioned Officer (NCO) Academy in conducting the Officer Education System, Noncommissioned Officer Education System, and Warrant Officer Candidate School.

I had the privilege of carrying the 18th Engineer Brigade unit colors from the U.S. Army Engineer Museum at Fort Leonard Wood, Missouri, to Heidelberg, Germany, and then participated in the activation ceremony of the 18th Engineer Brigade (see article on page 37.) I was the NCO of the Year for this brigade in 1983. To participate in the activation twenty years later, as the Regimental CSM, made it a very special event. This brigade is not the same as in the old days, because it is redesignated as a Theater Army Brigade. The commander, designated as a brigadier general, is COL (P) William H. McCoy.

I spent ten days in Europe, visiting the leaders and soldiers of the 130th Engineer Brigade, 94th Engineer Battalion, 54th Engineer Battalion, 1st Armored Division Engineer Brigade, 16th Engineer Battalion, 40th Engineer Battalion, 1st Infantry Division Engineer Brigade, and 9th Engineer Battalion. Then, in Kosovo, I spent a couple of days with the 82d Engineer Battalion "Blue Babes" and watched the Super Bowl with them. The leaders and soldiers from all these organizations were heavily engaged in future operations, and the morale was high. They were confident in their abilities and were prepared for any mission.

I visited the Caterpillar® plant in Peoria, Illinois, where we had soldiers training on CAT® equipment. The leadership there was doing a superb job of supporting the Regiment's needs in a professional and expedient matter. It is a great team effort, and the support cast at CAT was doing it right in every facet of the requirements. My special thanks go out to Mr. Frank Weinburger, Mr. David Haney, Mr. Rick Sharp, and Mr. Thomas Brady.

I continually spread the word about our engineers at the U.S. Army Engineer School. They are a great team of dedicated professionals who strive to provide key information and solutions to the many issues that our leaders identify and inquire about. These important issues come in daily, and our engineers here always provide quick response to the field.

We continue to support the Regiment through a host of different means. One example of excellence is our mobile training teams (MTTs) that are providing countermine training throughout CONUS and OCONUS (Germany, Kuwait, and Afghanistan). They are doing a great job, and I have received positive feedback from leaders throughout the Regiment. As BG Castro says, we are a "Team of Teams"—always supporting and reaching out to each other.

I realize that as a Regiment we are extremely busy and engaged in a multitude of ongoing missions. I will continue to encourage you to keep safety on the forefront when performing our missions. Continue to take care of the soldiers and their families, because this is one of our most important missions, and if done right, everything else will be accomplished easily. Remember that we can only be effective if we take care of ourselves; if we don't, then we can't focus on taking care of our soldiers and the mission at hand.

I want to congratulate CSM Rodney Craddock as the new 18th Engineer Brigade CSM and CSM Gerald Jones as the new 1st Engineer Brigade CSM. I also want to thank CSM Dave (and Rosie) Delgado for their professionalism and dedication to the Regiment as they transition into retirement. They have been a superb command team and family. We bid them farewell and wish them the very best in the future.

In closing, let me say thanks for your dedicated support to our great Regiment. It is held in high esteem, and that is due largely to all our efforts. We are a Regiment that takes great pride in producing superior results. We are always on the cutting edge of full-spectrum engineering with the energy of taking care of each other, our soldiers, and their families—while giving our total support to mission accomplishment. Be proud of whom you are, and always let those around you know that you are a proud member of the best Regiment in our Army. God bless you all.

Essayons!!

Objective Force 101

By Captain Mark A. Winkler

Most of us have heard the term Objective Force. For many, this conjures up images of an Army that has done away with the very combat forces that have made us the premier military in the world. For some, it causes a sense of excitement, knowing they will be leaders in cutting-edge technology. For a few, it causes a glazed-over look of confusion and boredom. This Objective Force tutorial is written in an effort to clarify some misconceptions, introduce some new terminology, and lay a foundation of understanding concerning the intent of the Objective Force and the Army Vision. It is imperative that officers and noncommissioned officers have a basic understanding of the concepts, doctrine, and terminology so they can support the Army Vision and Transformation process.

Army Transformation

The Army regularly undergoes transformation to meet current and future national military requirements. In the emerging asymmetrical combat environment, the Army—and the Corps of Engineers—are once again rethinking our strategies, equipment, and training doctrine to meet current and future national security contingencies. The environment has changed; therefore, we must change. Our current structure is a Cold War relic not designed to support the full spectrum of operations. Engineer units are not sufficiently responsive, deployable, and agile to meet the realities of the Objective Force.

The Army Transformation Plan is based on Army Chief of Staff General Eric K. Shinseki's Vision for the Army: "Soldiers on Point for the Nation…Persuasive in Peace, Invincible in War." The vision includes three primary components starting with an overriding requirement, key principle, and primary objective statement. Readiness continues to be the Army's top priority requirement. The principle recognizes that the Army's people are the centerpiece of Army capabilities and represent the most important element of change. The objective statement sets the tone for Army Transformation. It calls on the Army to create "strategic dominance across the entire spectrum of operations" with seven broad goals. They are to make the Army more *responsive*, *deployable*, *agile*, *versatile*, *lethal*, *survivable*, and *sustainable*. These goals underscore everything.

Army leaders contend that Army Transformation is one of the most sweeping institutional changes ever designed. It involves more than new equipment, vehicles, uniforms, basing, doctrine, tactics, training, or any other single or coupled aspects. Army Transformation is a complete paradigm shift in training, doctrine, equipment, and institutional thinking. Army Transformation has three key elements: the Legacy Force, the Interim Force, and the Objective Force. These will be separate initiatives for the first decade of the 21st century but will merge during the second decade to create the final product, which is envisioned as a whole new Army.

The term *Legacy Force* centers on current major weapons systems, principally combat maneuver vehicles and armored fire support and combat support vehicles. Known as the heavy force, it comprises the Army's mechanized infantry and armored divisions. The Army will continue upgrading the heavy force while developing other paths. The Legacy Force will still be the Army's primary warfighting maneuver force for the foreseeable future.

The plan for the *Interim Force* is to use available technology to reequip brigade-sized units to adapt them to meet many of the Army's missions. This will enable them to deploy more quickly than the heavy forces but have greater lethality, speed of mobility, and soldier protection than the Army's light forces. Although Interim Force units will handle conventional missions, they will also be used to develop much of the doctrine and training aspects of the Objective Force.

The *Objective Force*, currently in the development phase, represents the vision of the future Army: what can be done to equip, organize, and train units to integrate the best aspects of the heavy, light, and interim forces. For example, the Army is conducting core research to create a new family of lighter armored fighting vehicles, called the Future Combat System, that offers equal or better protection for soldiers who will use them.

Objective Force: The Big Picture

The Objective Force Model consists of two primary echelonments: units of employment (UEs) and units of action (UAs). UEs function primarily at the operational and strategic level of war and are concerned with the prosecution of campaigns and major operations. UEs have the headquarters structure to perform as a joint task force and are highly tailorable to mission requirements. UAs function primarily at the tactical level of war and are concerned with planning and fighting engagements and battles. They are semifixed organizations, capable of training and operating across the full spectrum of operations, and are inherently combined arms.

Misconceptions

There are three major misconceptions about Army Transformation:

- *Misconception No. 1:* The plan is for the Army to divest its tanks and mechanized infantry fighting vehicles quickly in favor of lightly armored, wheeled vehicles. That is wrong. Abrams tanks and Bradley fighting vehicles will remain in the Army's inventory for decades.
- *Misconception No. 2:* Interim Brigade Combat Teams will replace light forces. That is not right either. Airborne, air assault, light infantry, and special operations forces will continue to be the Army's forced-entry team. The Initial Brigade Combat Teams are not being organized to be the tip of the spear.
- *Misconception No. 3:* The Interim Brigade Combat Teams are just peacekeeping forces. Wrong again. They will have major wartime missions in addition to being able to handle operations other than war. They are combat formations first and foremost and will have a substantial amount of firepower. There are a number of roles for them on the battlefield.

Machines That Perform; Soldiers Who Think

Objective Force equipment will have vastly increased capabilities, but soldiers will have a larger responsibility to interpret information that the systems provide. The Stryker Brigade Combat Teams at Fort Lewis, Washington, are focusing on training individual soldiers to maximize the use of the information they receive. Meanwhile, leadership training that emphasizes flexibility and adaptability starts at the lowest level and continues up the chain of command. The goal is to prepare soldiers to assume a leadership role at one or two echelons above their own and to be better prepared for those jobs when they are promoted to them. Soldiers will utilize live-virtual-constructive training venues in both classroom and field environments. Simulations and enhanced situational training exercises will develop their leadership potential and technical capabilities.

Captain Winkler is an operations officer in Headquarters, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

Engineer Objective Force Concept: "How to Fight"

By Mr. Mike Fowler

As everyone knows, the environment of our world has changed, and the Army is transforming to adapt to this new environment. The Army's goal, referred to as the Objective Force, has led us to look at the Engineer Regiment to examine how engineers will fight in the future.

Objective Force

Before discussing the overarching Objective Force engineer concept, it is imperative that we review how the Objective Force maneuver unit of action (UA) is designed to fight. The Objective Force is a full-spectrum force, capable against an adaptive, learning enemy in all terrain conditions (see Figure 1). It operates with greater effectiveness and versatility and achieves greater empowerment in small-unit tactical operations through improvements in the—

- Development of the situation out of contact.
- Information dominance that allows unprecedented situational awareness and situational understanding.
- Ability to know and use terrain and weather to a degree that removes the enemy's "home court" advantage.
- Standoff destruction of enemy systems.
- Assured mobility that creates a significant mobility differential relative to the adversary.
- Embedded, robust, all-weather, 24/7 intelligence, surveillance, and reconnaissance.
- Ability to achieve assured lethality with a very high probability of hit—and assured kill with an equally high probability of kill given a hit—all beyond the range of the enemy's weapons.
- Ability to achieve three-dimensional mutual support between units on parallel axes while on the move.
- Ability to plan collaboratively and rehearse virtually while on the move, arriving at the objective on parallel axes.
- Precision fire control and distribution when conducting tactical engagements at the small-unit level.

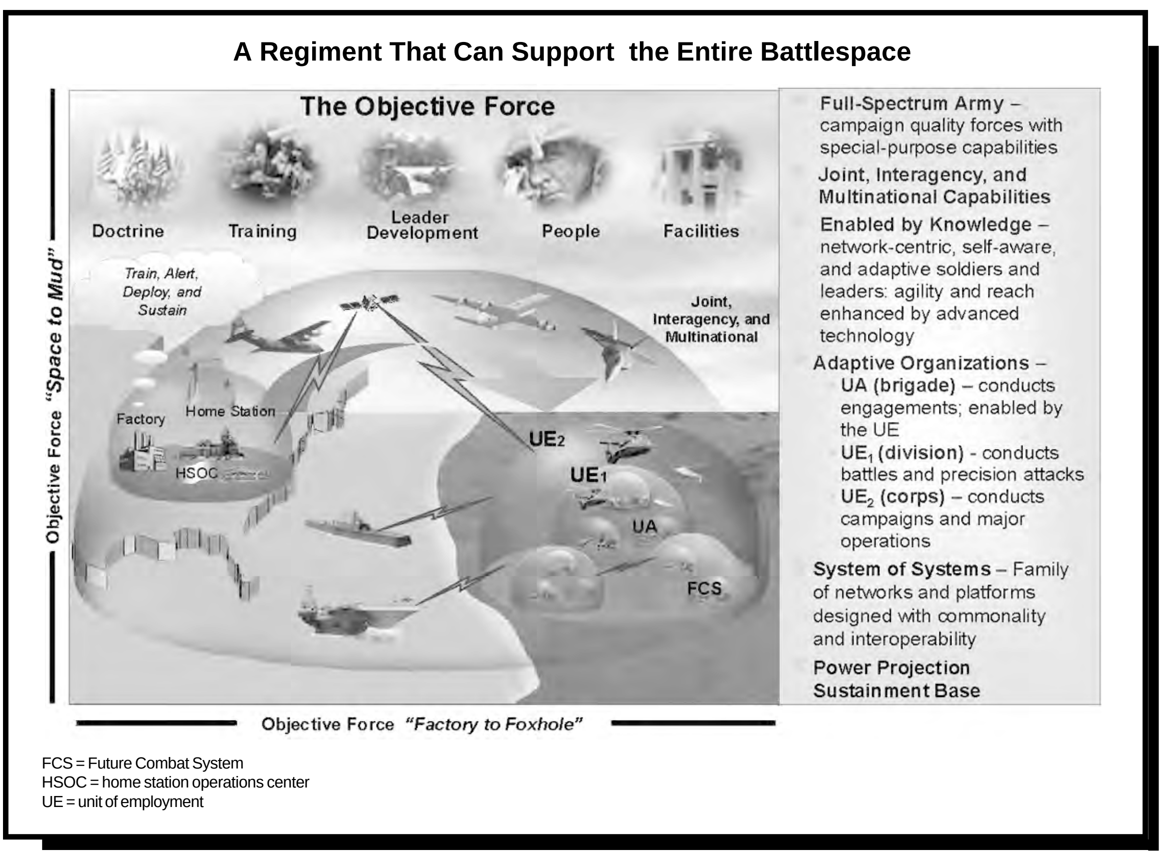


Figure 1

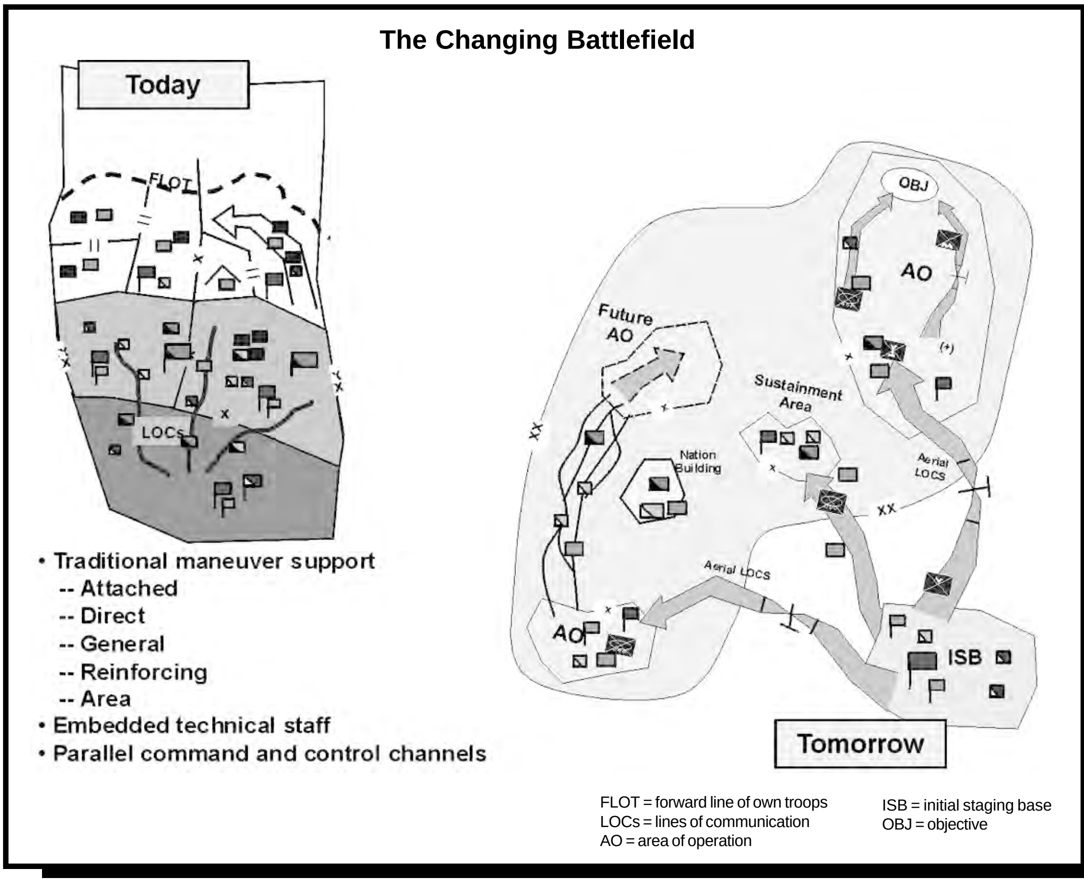


Figure 2

- Standoff detection and neutralization of mines; booby traps; improvised explosive devices; and chemical, biological, radiological, nuclear, and explosive threats.
- Inherent air-ground integration.
- Manned-unmanned teaming with organic unmanned systems.
- Reliability of combat power.
- Seamless transition while in contact.

Ultimately, decisive operations require tactical success in close combat—the capability to seize and control key terrain and to close with and destroy enemy forces. In this sense, close combat actions are the fundamental building blocks for operational success and strategic victory. The Objective Force executes decisive combat operations by denying the enemy freedom of action and destroying him through a series of rapid, violent actions. Future engagements will be characterized by new tactical principles based on the development of the situation out of contact and the balanced combination of standoff capabilities, skillful maneuver, and tactical assault to achieve simultaneous decisions at multiple locations. Continuous integration of powerful, small tactical units—moving along multiple, noncontiguous lines of operation to objective areas that are force-oriented—is the foundation underlying the success (see Figure 2).

Objective Force Engineers

One of the challenges that the Engineer Regiment must address is that under our current structure, engineer units are not responsive, deployable, agile, versatile, or sustainable in the context of the Objective Force. Some overarching concepts have been developed to help eliminate these shortfalls:

- Foundation forces and force pools
- Command and control cells
- Early-deployable detachments (EDDs)
- Construction modules

Foundation Forces and Force Pools

One of the underlying concepts in the Objective Force engineers is the design of foundation forces and force pools. Foundation forces are the building blocks for projecting engineer capabilities into tactical units. They are made up of engineer effects modules (EEMs) and engineer mission teams (EMTs) with a broad baseline capability. The foundation force relies on the force pool to provide mission-specific capabilities. The force pool is the primary force provider, comprised of a modular base structure with a fixed organization of discrete sets of capabilities. This enables rapid force tailoring and a scalable robustness to allow for maximum operational flexibility.

Both organizations have an inherent design for small-unit excellence. In both the foundation force and the force pool, organizations are based on engineer mission forces (EMFs), which are compatible with the engineer battalion of today.

Command and Control Cells

Developing a command and control structure that is projectable and scalable to support the foundation force and force pool concept will be a challenge. This concept breaks out command and control headquarters (HQ) into four cells that vary among the standing (regiment/brigade), foundation force, or force pool HQ. The command and integration cells are the bulk of the standing and foundation force HQ.

- *Command cell*—contains the command group and is responsible for issuing orders, executing current operations, providing the vision for future operations, and providing a command presence.
- *Integration cell*—provides control for current operations and battle tracking, participates in combined arms planning, and produces orders.
- *Technical cell*—provides a specific engineer expertise that analyzes the engineer's common operational picture (COP) and provides technical advice and design to help produce solution sets. This cell, which is also responsible for the reachback for technical assistance, is more robust in the force pool HQ.
- *Sustainment cell*—tracks readiness, plans and coordinates sustainment operations, and anticipates logistical requirements. Engineer regiment and brigade HQ have a larger sustainment cell.

As EMFs are task-organized, the modularity of these cells form together to provide the right HQ structure to support the mission requirements.

Early-Deployable Detachments

A new capability embedded in engineer organizations is an EDD. This capability is a small, rapidly deployed team that enables engineer solutions out of contact and allows precise employment of engineers. The EDD would be organic to organizations with an EMF role and, in some cases, may have duty in a Corps of Engineers role to enhance its professional engineer skills. Once deployed, an EDD begins to build/update the engineer COP for the specific mission, identifies problems, and initiates reach to get the expert centers to develop solutions and shape the engineer battle through identifying contracts and resources available.

Construction Modules

There are several aspects of the construction battalion concept. The first is designing modules that can be easily deployed that will allow the battalion to phase in its capabilities with the maneuver force. The construction EDD is made up of technically trained soldiers who can begin to identify and prioritize the required engineer missions that must be accomplished and begin to reconnoiter possible contract support. The next step is a skid steer-type platoon. This platoon is equipped with commercial skid steers and a variety of attachments that allow it to begin some limited work. The skid steer operators are trained on heavy construction equipment, so if more robust requirements exist, they can use commercial construction equipment. The primary role of this platoon is to support the first-deployed maneuver forces with unmanned aerial vehicle landing areas, rotary wing sights, forward area rearming and refueling points, and limited airfield repair. As deployment continues, these limited teams are followed by a light air-transportable construction company, which gives additional capability in a deployable package. The company will provide increased airfield repair and main supply route maintenance. The rest of the battalion is comprised of heavier construction equipment that is capable of supporting a sustained military operation.

There are some additional changes that must be addressed to fully embrace the Objective Force. As we look at the current level of construction equipment and the Army dollars that are available to update this fleet, we find that there is a considerable shortfall. This initiative looks at reducing the number of construction equipment items while maintaining the operators, allowing for 24-hour operations. Reduced equipment strengths would then be augmented with rental equipment for surge capability. This would also find efficiencies in deployment and maintenance. This concept will require some major changes. Standing lease/rental agreements must be developed which would require changes to the current acquisition laws. Additional analysis needs to be conducted to determine the optimized amount of equipment for current operations and training. As we rely on industry to support us abroad with equipment, our operators must be readily adaptable to the differences of equipment by manufacturer. One way to help this and to stay proficient with operator skills is to field configurable construction equipment simulators.

Conclusion

The Army is changing. The enemy is changing. The way we fight will change. Engineers in the future will have greater demands forced upon them. Developing solutions out of contact over noncontiguous operations, with a greater reliance on support to future maneuver, are just some of these demands. Engineers may not be organic at all echelons in the future, but engineer requirements will still exist. The Engineer Regiment must be a relevant option for the maneuver commander. It will take the efforts of the entire Regiment to get this change right. The Engineer School must receive your support and feedback to accomplish this challenging task.

Mr. Fowler, a military engineer development analyst, has worked in the Directorate of Combat Developments, U.S. Army Engineer School, and more recently, the U.S. Army Maneuver Support Center, at Fort Leonard Wood, Missouri, for fourteen years. During the past ten years, he has been involved in developing engineer concepts, to include those for Force XXI, the Stryker Brigade, and the Objective Force.

Stryker Brigade Combat Team: A Window to the Future

By Lieutenant Colonel Robin Selk and Major Ted Read

We are often admonished to "improve your foxhole every day, because you never know how bad you might need it tomorrow." The foxhole and the defense allow us time to prepare for an offensive operation.[1] Army Transformation calls for a similar effort, to get better every day while preparing for future operations. To that end, the Stryker Brigade Combat Team (SBCT) is an existing formation, an organization that is optimized for mobility, and a lens through which we can glimpse the future.[2]

With one organic engineer company supporting the SBCT, the mobility capability of the formation has been questioned. When we look at the strategic, operational, and tactical mobility of any organization, there are always trade-offs. A light organization has excellent strategic mobility but does not have the organic transportation assets that give it operational and tactical mobility. Likewise, the heavy forces have unmatched tactical mobility and speed in many environments at the expense of strategic mobility. The operational mobility of the heavy force is very dependent on local infrastructure and a large logistics and engineering tail. In the SBCT, the three forms of mobility are optimized for high-end, small-scale contingencies. According to the SBCT operational and organizational (O&O) concept, augmentation of the engineer company will be necessary when the brigade undertakes special operations support element or movement control office missions.[3] Looking through our lens to the future, it is clear that the situational understanding of the SBCT and future forces will be a fundamental mobility enabler. Proactive use of situational understanding through emerging doctrine will help to prioritize the use of SBCT engineer assets to provide mobility to the decisive force. In the Objective Force, we will see other units designed to exploit the information gained through situational understanding. Prudence dictates that we invest thought and resources into the SBCT's development and doctrine.

The concept and organization of the SBCT's engineer companies has changed little since the report published in the May 2001 issue of *Engineer*.[4] One can see the mobility focus in the organization of these companies as shown in Figure 1, page 10. A rough estimate of the unit's mobility capability is as follows: the three combat mobility platoons have a combined mobility capability of 400 to 900 kilometers of level 1 route clearance and 540 meters of mine-clearing line charge (MICLIC) lane reduction, plus rollers and plows. The mobility support platoon will have the capability to cross four gaps simultaneously with the rapidly emplaced bridge system. The bottom line is that by design, the organic engineer company is optimized for the mobility requirements of the SBCT.

To address the augmentation of the SBCT, the commander of the 555th Engineer Group presented a series of initiatives, known as the Engineer Augmentation Package (EAP), to the Engineer Council of Colonels in October 2002. The EAP concept provides the SBCT with a set of tailored modules to address operational and tactical missions outside of the SBCT's current capabilities (see Figure 2, page 10).

The EAP is designed to augment all of the operational requirements of the SBCT. It will provide the SBCT with greater mobility, countermobility, and survivability options in theater, to enhance the maneuver force's ability to conduct combat operations. This is done through the organization of five EAP modules:

- *Sapper module*—provides assets for route reconnaissance, local security, conventional mine emplacement, scatterable mine emplacement, obstacle reduction,

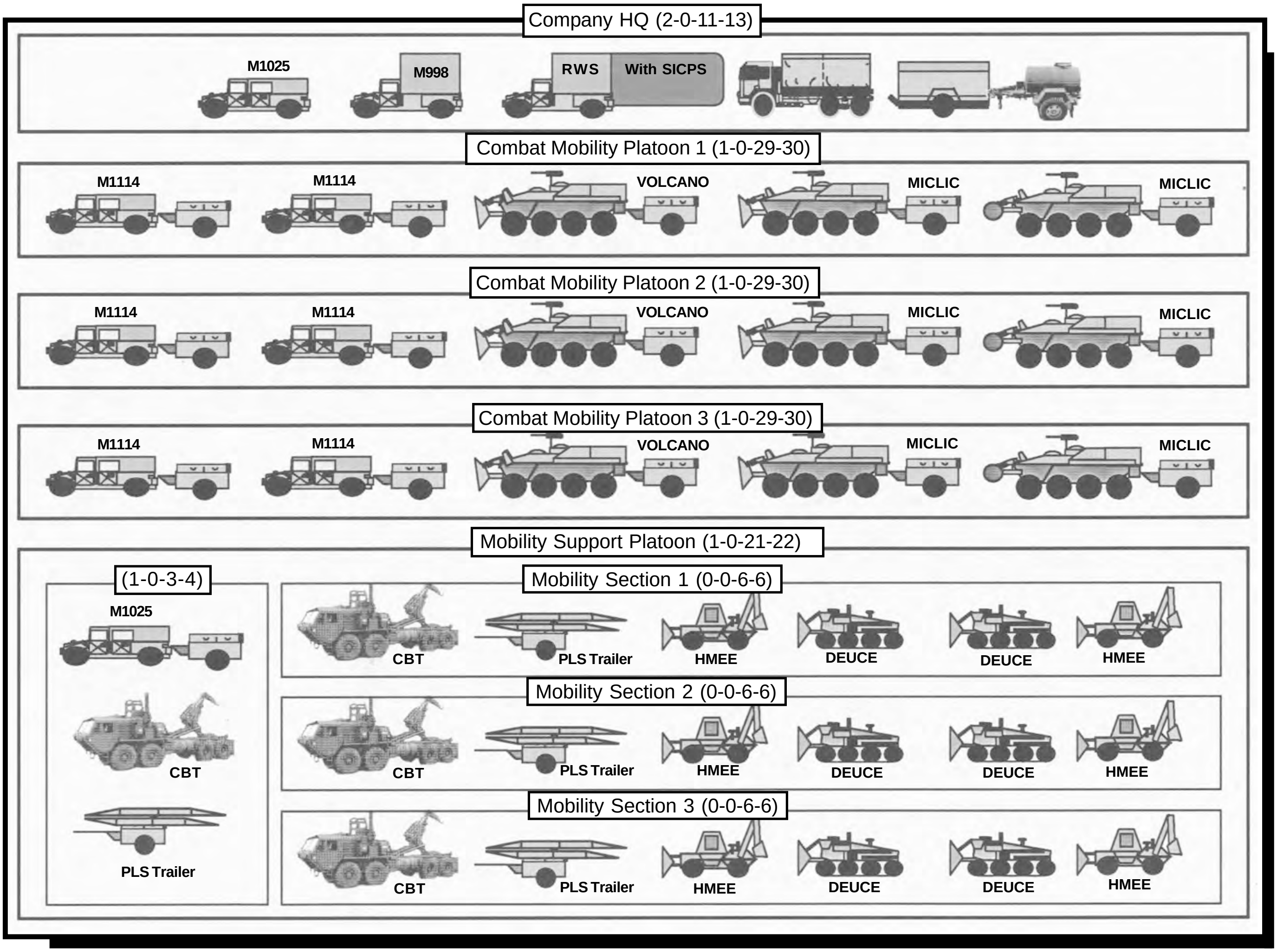


Figure 1. SBCT Engineer Company Objective TOE

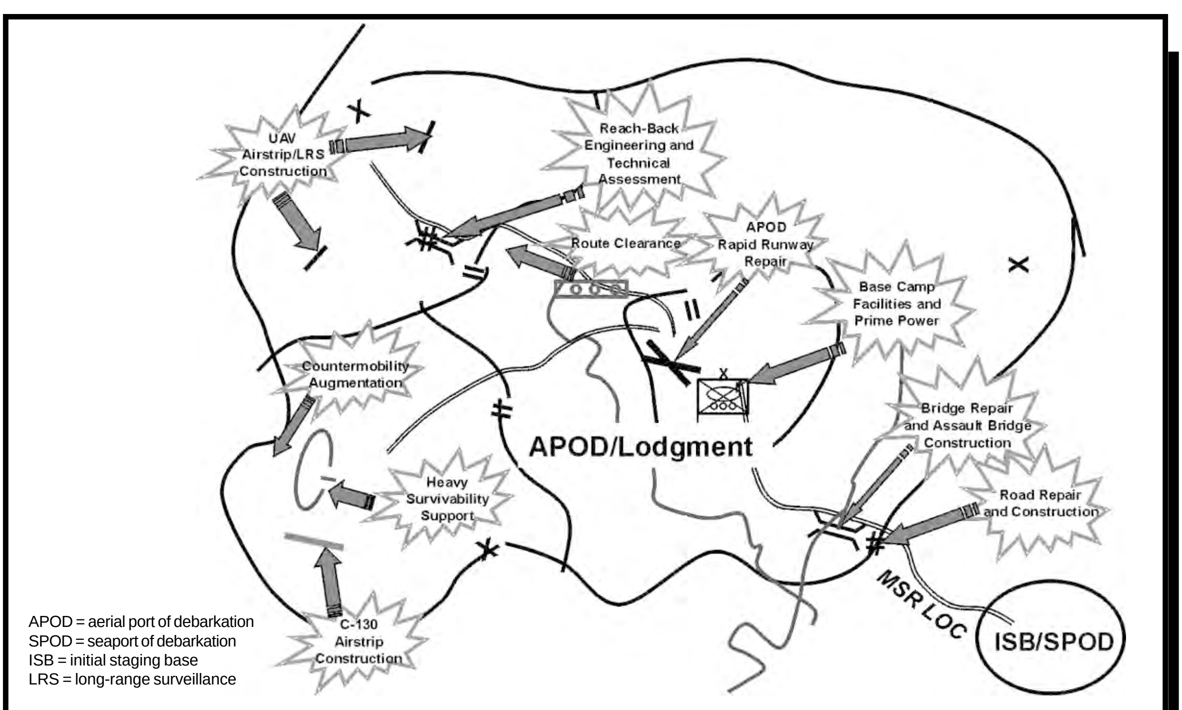


Figure 2. SBCT Support Missions (Combat Engineer Task Force [Corps Wheel Company/Battalion])

route and area clearance, stability and support operations, and mine-clearing operations support.

- *Horizontal module*—provides assets for main supply route (MSR) construction from unimproved trails or combat trails to gravel roadways, unmanned aerial vehicle (UAV) airstrip construction, rapid runway repair, MSR repair, road crater repair, survivability positions, and Hesco Bastion fortifications.
- *Vertical module*—provides for temporary base camp construction, to include the tactical operations center (TOC), guard towers, living areas, a dining facility administration center, and shower and lavatory facilities.
- *Bridge module*—provides additional bridging assets to the SBCT to include the medium girder bridge, the assault float bridge, the Mabey-Johnson bridge, and crossing-area engineer support.
- *Heavy module*—further augments the horizontal module, allowing it to provide complete survivability support, high-traffic roadway construction, new roadway construction, and increased productivity in all other horizontal operations. The heavy EAP module is not C-130 mobile.

The EAP modules will be organized with a command and control design that can be tailored to meet the needs of the mission (see Figure 3).

The engineer company mission in the SBCT O&O specifies that augmentation may be required "… on order, with augmentation, provides additional mobility (lines of communication [LOCs]), countermobility, survivability, and sustainment engineering support to the Interim Brigade Combat Team …"[5] Today's challenge is to ensure that there is robust, deliberate, and perhaps contentious dialogue to refine the augmentation and organizational packages that will ensure the survivability and sustainment of the SBCT in future operations.

The U.S. Army Engineer School has worked closely with SBCT leadership to improve the mobility of the force with organic enablers in the nonlinear, noncontiguous battlefield of a small-scale contingency. In July 2002, during the Senior Leaders Course, assured mobility was introduced to the 1st Brigade, 25th Division (SBCT #2), to give unit leaders the tools to optimize their mobility by using situational understanding as a fundamental enabler. The instruction at the Senior Leaders Course, and the following Tactical Leaders Course in September 2002, was well received by the 1st Brigade commander and his subordinate commanders. The confidence they had in the concept was such that the brigade requested that the agenda of a second Tactical Leader Course, scheduled in November 2002, be modified to include discussion of assured mobility.

The central theme of the training was to help the SBCT leadership realize and use their unique enablers to answer the following commander's focus question: What must I do to sustain my ability to maneuver, to prevent enemy interference, and to protect the force in order to accomplish my mission?

The assured mobility framework seems most successful in providing an answer in the proactive, enabling perspective of warfare. The SBCT leadership addressed the six assured mobility fundamentals—predict, detect, prevent, avoid, neutralize, and protect—through an analysis of the four imperatives: develop the mobility common operational picture (COP), establish and maintain operating areas, attack the enemy's ability to influence, and maintain mobility and momentum. Analysis should be conducted from both friendly and enemy points of view, using three perspectives: en route to, on, and beyond the objective. The use of these perspectives is critical to success. The end result of the training was leaders looking at the battlefield from a new, proactive perspective

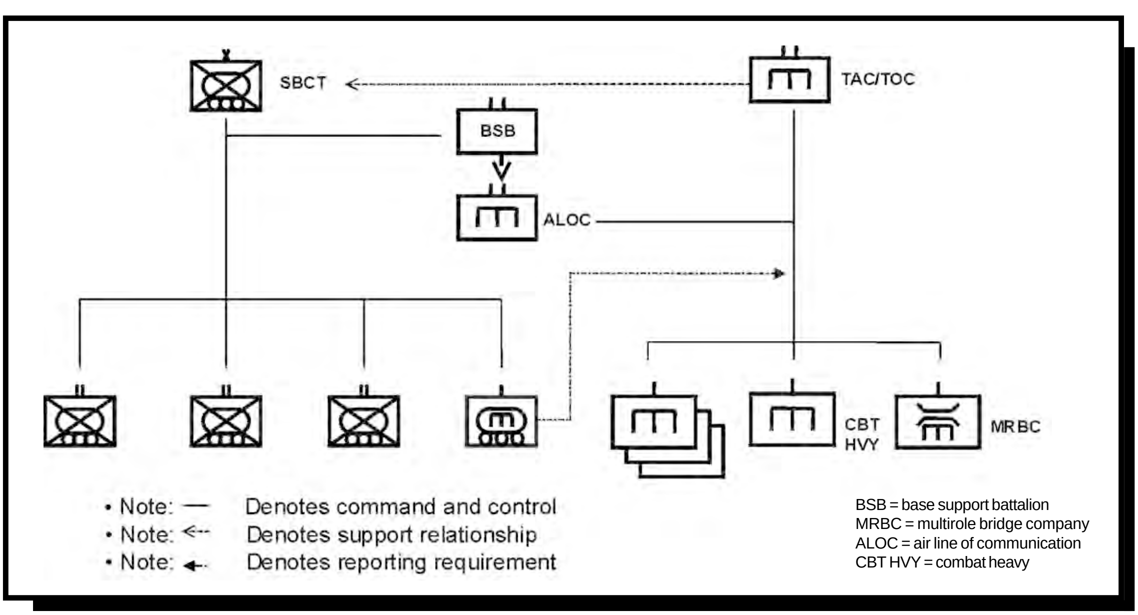


Figure 3. EAP and SBCT Support/Command and Control Relationship

Providing Assured Mobility in the Unit of Action

By Major Ted Read and Major Nelson "Glenn" Kerley, Jr.

"Convinced that the general advance in the weaponry of the world's armies was introducing a tactical revolution in land combat which rendered the organization of the ROAD [Reorganization Objective Army Divisions] …obsolete, the TRADOC commander, General DePuy, set in train in 1976 a restructuring study of the heavy division."[1] General DePuy was concerned that the Army would miss the opportunity to build organizations around the newest technology of the time. From this beginning, the Army of Excellence and its doctrine, AirLand Battle, were born.

Concept

The concept is not much different today. The Army is working hard to define success in the future battlefield with the technology and doctrine of the future. The Army is reaching for flatter organizations and processes with enduring doctrine, as U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Military Operations Force XXI Operations*,[2] described almost ten years ago. The Engineer Regiment has contributed heavily to the description of the future battlefield and its systems and doctrine by providing assured mobility within the maneuver support battlefield function.

Providing assured mobility is a critical imperative of the maneuver support battlefield functional area for Objective Force operations. Maneuver support is thoroughly discussed in *The United States Army Objective Force Maneuver Support Operational Concept, Coordinating Draft*, [3] and incorporated in TRADOC Pamphlet 525-3-90, *The United States Army Objective Force Operational and Organizational Plan Unit of Action*.[4] It concentrates on two interrelated components: freedom of maneuver and force protection. The figure on page 13 displays the seven maneuver support imperatives, although the dependencies are more complicated than the simple model depicts.

Evolving an assured mobility framework to meet the needs of the Objective Force begins with the definition: "Actions that guarantee the force commander the ability to deploy, move, and maneuver where and when he desires, without interruption or delay, to achieve his intent. This includes maneuver in all types of terrain and weather, including urban terrain."[5]

Assured mobility will create a mobility differential relative to the adversary, significantly contributing to the unit of actions's (UA's) greater empowerment in small-unit tactical operations.[6] When applied near the objective, the UA forces will avoid enemy kill zones, increasing their ability to close with and destroy the enemy.[7]

The most notable automation/technology change is our ability to move from focusing on the mobility perspective of the common operational picture (COP) as an imperative to a more holistic approach in developing the situation. The key is still a proactive-centric method that establishes predict-to-prevent linkages that will allow commanders to leverage analysis and collection capabilities, predict enemy actions to hinder his mobility, and then take proactive measures to prevent the enemy from impeding our maneuver. A commander may make or alter his maneuver plan to avoid known impediments. If required, he will neutralize, reduce, or overcome the impediments to his mobility that cannot be prevented or avoided. Through a structure of systems and improved processes, we will provide assured mobility to the future commander.

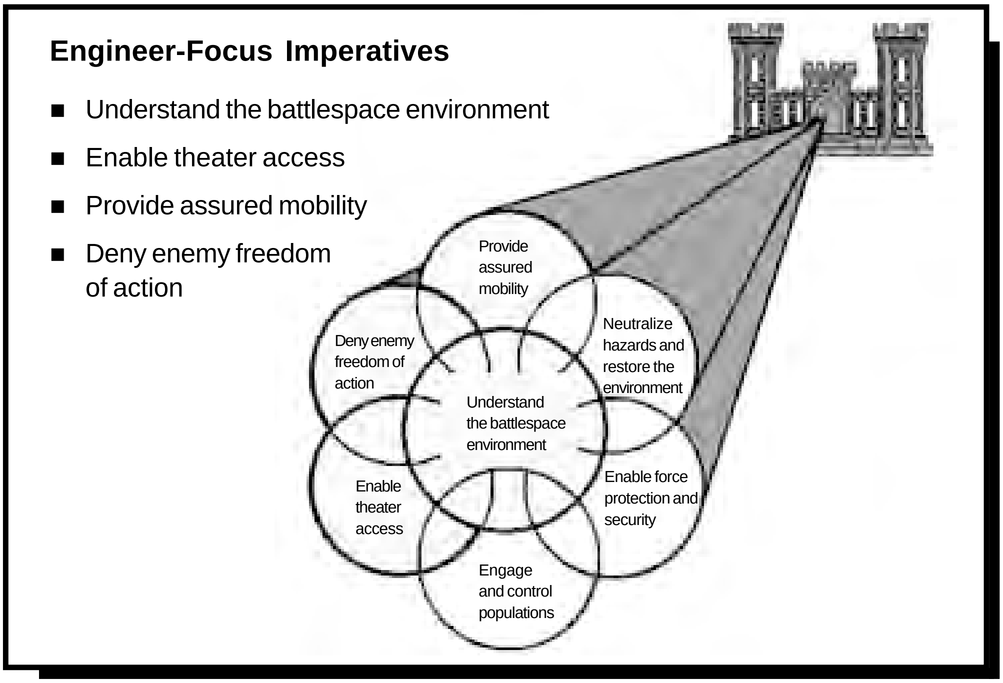
The imperatives—as defined in the article on page 15, "Operationalizing Assured Mobility"—change in scope and become four nested and overlapping tasks that require providing assured mobility: develop the situation; select, establish, and maintain operating areas; attack the enemy's ability to influence operating areas; and maintain mobility and momentum from standoff to greatly reduce the likelihood of traditional breaching or neutralization.

Develop the Situation

"This is the collection and integration of imagery and geospatial, cultural, and enemy information—aided by automated mobility planning tools—to establish the mobility COP for the operating area."[8] Automated terrain products and dissemination will allow commanders at all levels to understand the total implications of the terrain and how to leverage it to a tactical advantage. Potential capabilities include a tool that quickly produces a modified combined-obstacle overlay and publishes mobility courses of action. The overlay would be dynamically updated as refinement and alterations of the terrain are reported.

Select, Establish, and Maintain Operating Areas

"With the aid of automated tools, critical mobility choke points, operating areas, and airspace are identified, and a



shaping plan is developed en route to the area of operation (AO). Operating areas are designated portions within the AOs that the maneuver commander has identified as relevant to the scheme of the maneuver. This plan includes prediction of enemy actions and required sensor coverage to fill any information voids within the operating area. Through this proactive process, sensors 'stare' at critical areas to fill the voids or improve our situational awareness. In coordination with sensor-effects packages, the ability to predict, detect, prevent, avoid, and neutralize the enemy's ability to emplace or use mines and booby traps from stand-off positions sets the conditions for mobility situational understanding. For critical choke points such as bridges, sensor packages linked with brilliant munitions form an active protective system to eliminate the enemy's attempt to influence or degrade these critical points. The ability to control and monitor critical mobility areas are essential to coordinating a mobility plan in conjunction with the scheme of maneuver."[9]

Attack the Enemy's Ability to Influence Operating Areas

"This task includes the specific actions to be taken to preclude, deny, or prevent enemy maneuver and facilitate the UA's movement. The commander proactively attacks those enemy systems capable of directly or indirectly impeding friendly maneuver, thus destroying route interdiction capability before it occurs. This includes precision fires and munitions, obstacles, and attack by aircraft. Precision munitions (all types) and dynamic obstacles (Intelligent Munitions Systems [IMS]) are effective and important methods of hindering the enemy's freedom of movement. Sensor suites tied to point munitions and networked fires are also employed to protect freedom of maneuver once it is established in key operating areas or along key routes."[10]

The operational employment and utility of the IMS is discussed in the *IMS Operational Employment Concept*[11] and the *UA O&O Plan*.[12] The IMS operational requirements are outlined in the *Future Combat System (FCS) Operational Requirements Document*,[13] and the IMS is being developed within the FCS. More information on the IMS is provided at the TRADOC System Manager–Engineer Combat Systems Web site at *http://www.wood.army.mil/TSM/*.

Maintain Mobility and Momentum

"Most mobility impediments will be mitigated through prediction, detection, and prevention. Obviously, if operationally feasible, impediments to maneuver will simply be avoided. There will be situations in which operational requirements dictate negotiation of impeded routes. Based on FCS survivability to antipersonnel mines and some chemical, biological, radiological, and nuclear (CBRN) hazards, the commander may choose to simply detect and move through the area."[14]

Summary

As a doctrinal framework, assured mobility truly achieves General Sullivan's vision of "a doctrine today and tomorrow"[15] that he had while the Army's leadership was laying the post-Cold War foundations for doctrine we are using today. The proof of the product is that doctrine as written in FM 3-34, *Engineer Operations*, (see article on page 20) has been accepted throughout the Army as a standard for constructing operational thought. And as an imperative to the future maneuver support battlefield functional area, it has been accepted as hard requirements for tomorrow's Objective Force.

Endnotes

[1] Romjue, John L. (1997) *The Army of Excellence: The Development of the 1980s Army,* Washington, D.C.: Center of Military History, p. 8.

[2] TRADOC Pamphlet 525-5, *Military Operations Force XXI Operations,* August 1994.

[3] *The United States Army Objective Force Maneuver Support Operational Concept, Coordinating Draft,* Volume 3, 6 November 2002, Chapter 6, p. 32.

[4] TRADOC Pamphlet 525-3-90, *O&O Change 1, The United States Army Objective Force Operational and Organizational Plan Unit of Action,* 25 November 2002, p. 4-68.

[5] *Maneuver Support Operational Concept,* p. 32.

[6] TRADOC Pamplet 525-3-90, p. 4-2.

[7] TRADOC Pamplet 525-3-90, p. 4-5.

[8] *Maneuver Support Operational Concept,* p. 33.

[9] Ibid., pp. 33-34.

[10] Ibid., p. 34.

[11] *Intelligent Munitions System Operational Employment Concept Paper and Briefing,* Final Draft, U.S. Army Engineer School, Fort Leonard Wood, Missouri 65473, 23 October 2002.

[12] TRADOC Pamphlet 525-3-90, pp. 4-15, 4-38, 4-68, 4-73, 4-74, F-8, F-32, F-37, F-43, F-62.

[13] *Operational Requirements Document for the Future Combat Systems, Change 2 (Army Requirements Oversight Council Approved),* Unit of Action Maneuver Battle Lab, Fort Knox, Kentucky 40121, 22 January 2003, p. 39.

[14] *Maneuver Support Operational Concept,* p. 34.

[15] John L. Romjue, *American Army Doctrine for the Post-Cold War,* Washington D.C.: Center of Military History, 1997, p. 35.

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("Stryker Brigade," continued from page 11)

focused on attacking the enemy—not reacting to the enemy's impediments.

The SBCT provides a window for us to see the future of organizations and mobility. Its design is a balance between responsiveness and capability.[6] The focus of balance and mobility on the design is evident in the embedded engineer company. While smaller than the current mechanized formation, the embedded engineer company has significant mobility enablers. In some missions, the SBCT—like any organization—will need engineer augmentation. The challenge is to design scalable augmentation forces that can precisely meet the unit's need for those specific missions. A doctrinal approach that recognizes situational understanding as a fundamental enabler will help define those packages. This approach will leverage the design and doctrine of the SBCT and augmenting forces to successfully shape future organizations.

The SBCT is an organization that is preparing for tomorrow's operations, which provides us with insight to the tools that will be used in future organizations. The Engineer School will use the lessons and emerging doctrine of the Stryker Brigades to help shape the dialogue of the future, while capitalizing on their presence to improve our Regiment today and in the days and years to come.

Endnotes

[1] FM 3-0, *Operations,* 14 June 2001, Chapter 7.

[2] *Organizational and Operational [O&O] Concept for the Interim Brigade Combat Team [IBCT]*, 30 June 2000, Chapter 1.6.

[3] Ibid., Chapter 9.1.

[4] Major Anthony O. Wright, C*oncept and Organization of the IBCT Engineer Company,* Engineer, May 2001, pp. 6-9.

[5] *O&O Concept for the IBCT*, Chapter 9.1, 1.

[6] Ibid., Chapter 1.8.

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Operationalizing Assured Mobility

By Lieutenant Colonel Jeffrey A. Bedey and Major Ted Read

The assured mobility framework enables increased situational understanding to yield increased freedom of maneuver as it ties together the elements of combat power for existing and future formations. The framework is a proactive thought process that is not tied to equipment capability, but rather is a way to systematically refine the combined arms assets available to assure maneuverability of the decisive force. Essentially, the framework enables Legacy, Interim, and Objective Force units to harness situational understanding as a fundamental enabler to attack the threat before he impedes our ability to maneuver.

To recap, the assured mobility framework was originally developed to leverage information and the other elements of combat power to determine mobility requirements for the Objective Force (see Figure 1). As an analysis tool, it is very successful in ensuring that mobility requirements are adequately defined in the Objective Force Organizational and Operational Plan for the unit of action. Essentially, it is an exemplar that enables units to proactively identify "predict-to-detect," "detect-to-prevent," and "predict-to-prevent" linkages to generate superior situational understanding and focus on the maneuverability of the decisive force. The key is to build these linkages to prevent the threat from affecting our ability to maneuver and protect ourselves from the threat's effects.

The current Legacy/Interim Force assured mobility framework definition is "actions that give the force commander the ability to deploy, move, or maneuver where and when he desires, without interruption or delay, to achieve his intent." The framework of assured mobility entails four imperatives (see Figure 2, page 16):

- *Develop the mobility common operational picture (COP).* Gain improved situational understanding geographically by using geospatial tools to combine improved intelligence, surveillance, and reconnaissance (ISR) capabilities with terrain data and an integrated reconnaissance and surveillance to help the commander visualize the battlefield.
- *Establish and maintain operating areas.* Identify enemy engagement areas (EAs), named areas of interest (NAIs), targeted areas of interest (TAIs), choke points, operating areas, and lines of communication (LOCs) connecting those areas in order to determine enemy capability and intentions.
- *Attack the enemy's ability to influence operating areas.* Allocate combat power and sensors to negate the threat's efforts to impede maneuverability. In addition, secure our ability to maneuver where needed (operating areas, LOCS, TAIs, and EAs),
- *Maintain mobility and momentum.* Synchronize all Battlefield Operating System (BOS) capabilities to protect and sustain our established ability to maneuver when and where we wish, enabling us to maintain pressure and lethality despite the threat.

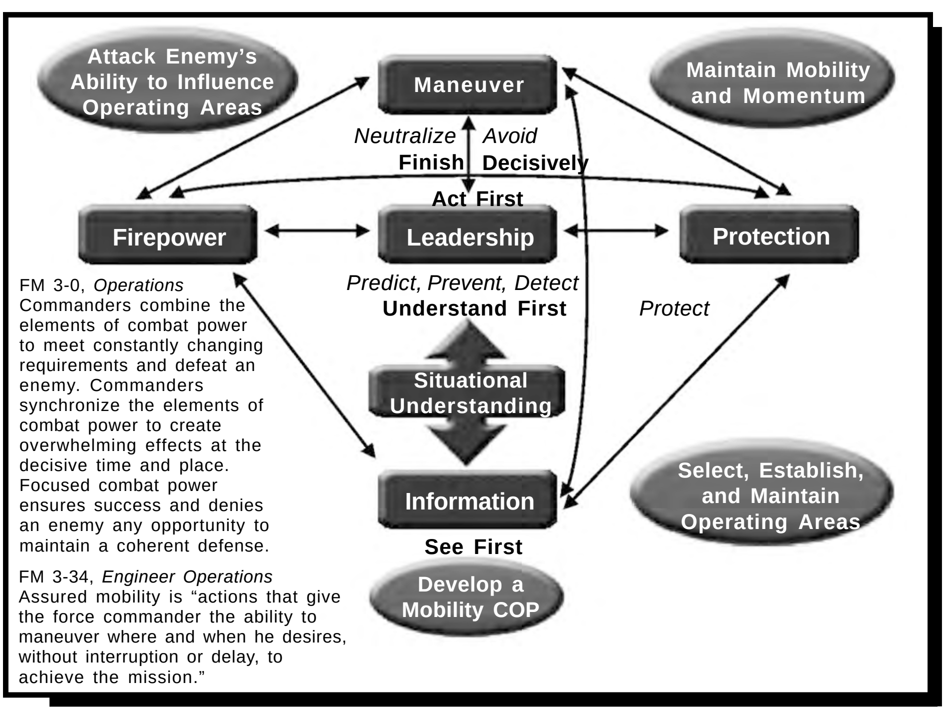

Figure 1. Assured Mobility Framework

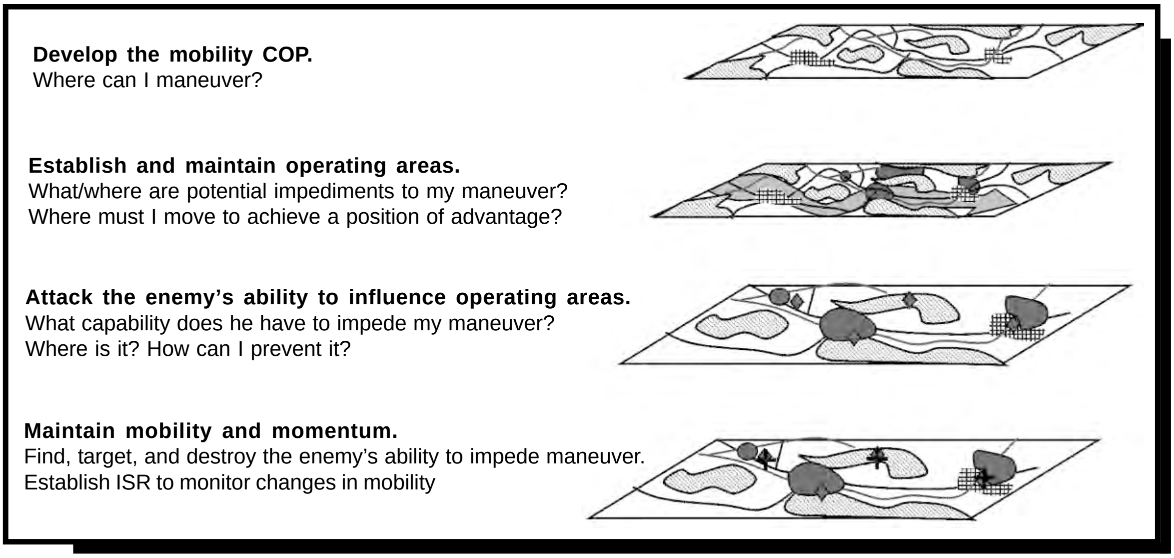

Figure 2. Assured Mobility Imperatives

The assured mobility fundamentals tie the imperatives together and must be proactively viewed from two perspectives (see Figure 3). The six fundamentals are:

- *Predict* actions and circumstances that could affect maneuverability.
- *Detect* early indicators of impediments to battlefield mobility.
- *Prevent* potential impediments to maneuverability from affecting battlefield mobility of the force. A key is to develop predict-to-prevent linkages to detect impediments and identify alternative mobility corridors needed to . . .
- *Avoid* battlefield impediments.
- *Neutralize*, reduce, or overcome impediments (from traditional mines to industrial chemicals) that cannot be prevented or avoided.
- *Protect* against the effects of enemy impediments. Successful application of assured mobility analysis is gained through a sequential and continuous application of the fundamentals throughout the imperatives en route to, on, and beyond the objective.

The linkage of assured mobility to FM 3-0 begins with information—the newest element of combat power. FM 3-0 refers to information as an element that "…enhances leadership and magnifies the effects of maneuver, firepower, and protection."[1] Later, the manual describes information superiority as the "…force being able to *see first*, *understand first*, and *act first*."[2] These additions to FM 3-0 were a concrete start to enabling the information edge within the operational art as foreseen by Generals Frederick Franks, William Hartzog, and Gordon Sullivan in the U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Force XXI Operations*.[3]

Assured mobility is a model that enables commanders to see first, understand first, act first, and finish decisively from a mobility perspective. Furthermore, when used as a layered system of proactive refinement in complex environments, it can provide a way to enumerate the amount of combined arms assets required to assure freedom of maneuver of the decisive force. The definition of "provide assured mobility" in the Objective Force shifts to "…actions that guarantee …" from "…actions that give…," and it becomes an imperative to our future BOS as "provide assured mobility."[4] (See article on page 12.) In the Objective Force, we will *guarantee* freedom to maneuver through a system-of-systems approach that capitalizes on embedded standoff capabilities. Until the assured mobility system of systems is built, proofed, fielded, and embedded, the Army must maximize existing combined arms capabilities to *give* mobility to the maneuver commander. To that end, assured mobility

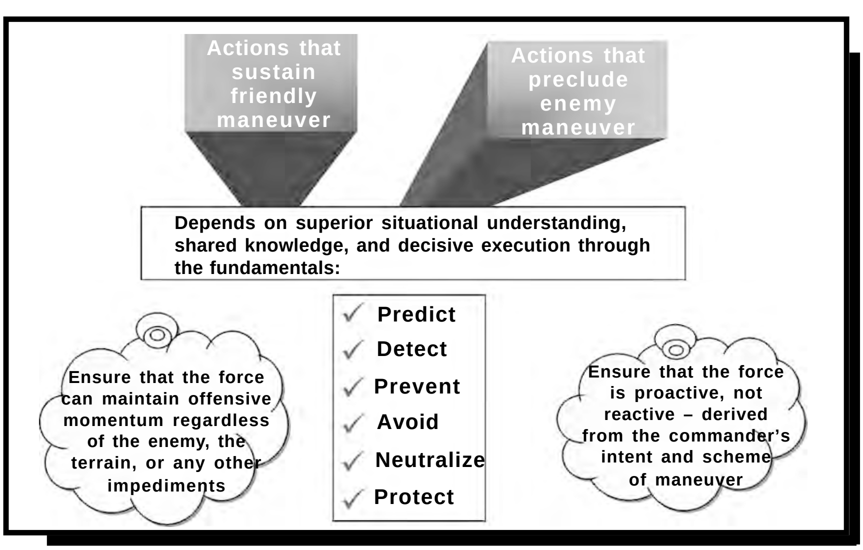

Figure 3. Assured Mobility Perspectives

provides a framework that helps transform increased situational understanding into decisive maneuver. Essentially, the assured mobility framework is the transmission that transfers power from the elements of combat power to the wheels of time, space, and purpose within the operational framework.

An example of doctrinal application today is how the U.S. Army Engineer School is helping the Stryker Brigade Combat Team (SBCT) leadership maximize its capabilities to provide mobility to the decisive force. Assured mobility was the centerpiece of an interactive practical exercise that proactively used enhanced situational understanding and situational awareness to build linkages among the assured mobility fundamentals to enable maneuverability. Assured mobility provides the SBCT leaders a framework to mobility solutions by addressing a few considerations (listed below) to help focus their analysis of the fundamentals against each imperative. The analysis was shaped to ensure that both an enemy and friendly perspective were accounted for en route to, on, and beyond the objective.

- *Develop the mobility COP.*
  - √ Leverage terrain and reconnaissance technology to determine mobility corridors, defensible terrain, and choke points.
  - √ Determine who is using what mobility corridor and why.
  - √ Predict when, where, and why the enemy will maneuver.
  - √ Develop a sensor web and reconnaissance plan to confirm enemy maneuver.
- *Establish and maintain operating areas.*
  - √ Determine friendly operating-area needs.
  - √ Identify key terrain, and implement an ISR plan to support mobility.
- *Attack the enemy's ability to influence operating areas.*
  - √ Allocate combat power to attack the enemy's ability to influence the maneuverability of the decisive force.
- *Maintain mobility and momentum.*
  - √ Predict, detect, and then prevent the enemy from using situational obstacles, and when prevention fails, avoid or breach/bridge obstacles as necessary.
  - √ Maintain multiple routes to enable maneuver flexibility.
  - √ Anticipate and allocate assets to reduce civil/cultural impacts.
  - √ Anticipate and prevent the use of toxic industrial chemicals and weapons of mass destruction.
  - √ Counter enemy reinforcement attempts.

The SBCT leadership used the considerations to focus the discussion within a continuous and sequential analysis of the assured mobility fundamentals to successfully tie FM 3-0's see first, understand first, act first, and finish decisively to physical assets owned by the maneuver commander. The result was an innovative and proactive application of information enablers and combat units to ensure the mobility of the decisive force in complex and urban terrain specific to that mission.

Assured mobility is a framework leaders can use to envision the elements of combat power in allocation of assets to multiple engagements in time, space, and purpose. The SBCT leadership has proven that the assured mobility framework contributes to the freedom to maneuver for existing Legacy and Interim Force formations—not just the Objective Force. The key to implementing assured mobility is altering thought processes from reactive-centric to proactive-centric methods that build decisive maneuver linkages with the assets available.

The hard part may have been said best by Sir Basil Liddell Hart in *Thoughts on War, 1944* "…that the real challenge is not to put a new idea into the military mind but to put the old one out…."[5] Assured mobility provides a new idea to help the commander maximize information, in conjunction with the other elements of combat power, to achieve decisive results within an operational framework. Assured mobility is how a maneuver commander can, as envisioned in FM 3-0, enhance the elements of combat power and build successful engagements within time, space, and purpose.

Endnotes

[1] Department of the Army, FM 3-0, *Operations,* Washington, D.C., 14 June 2001, p. 4-10.

[2] Ibid., p.11-2

[3] Department of the Army, TRADOC Pamphlet 525-5, *Force XXI Operations, A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century*, Washington, D.C., 1 August 1994, p. 1-3.

[4] TRADOC Pamphlet 525-3-25, *The United States Army Objective Force Maneuver Support Operational Concept, Coordinating Draft*, v1.3, 6 November 2002, Chapter 6, p. 32.

[5] TRADOC Pamphlet 525-5.

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Engineer Officer Education Transformation

By Lieutenant Colonel Jeffrey A. Bedey and Major Storm E. Reynolds

On 4 February 2003, the Army announced significant changes to the Officer Education System (OES). These changes seek to provide the right education, in the right medium, to the right leader at the right time and place. Just as the Army transforms to the Objective Force to meet the challenges of the 21st century security environment, so too must the Army transform its education system to train and educate the leaders who will command and control that force.

The U. S. Army Engineer School at Fort Leonard Wood, Missouri, has been a leader in every facet of OES transformation. One of the keys to our success has been the many ideas, comments, and concerns from the field. Much of the feedback is incorporated into the Engineer School's transformation strategy. The latest initiatives and changes to the way we will train our engineer officers are captured in the following paragraphs.

After the Basic Officer Leader Course (BOLC), junior officers will no longer move through broad-based educational gates based solely on a time frame. But, when officers move into a new staff job or into command, they will receive specific institutional training that is tailored to the skill sets necessary to succeed in that position (see Figure 1).

The current Officer Basic Course will transform into BOLC. This course will ensure a tough, standardized, small-unit leadership experience that flows progressively from precommissioning (BOLC I) to initial-entry field leadership experience, a 6-week training experience held at a centralized location (BOLC II). The final component of the course will be branch technical/tactical training, an 11-week program held in residence at the proponent school (BOLC III). Current plans are for BOLC to be fully implemented in the 3d quarter fiscal year (FY) 06.

Training beyond BOLC will consist of the Combined Arms Staff Course (CASC) and the Combined Arms Battle Command Course (CABCC). These two courses will replace the existing Captain's Career Course and the Combined Arms and Services Staff School. The changes in the OES will provide institutional training that is tailored to a specific job in a way that is expertly packaged and provides more frequent training for shorter periods. This will allow the mind to better absorb and understand concepts and thus increase overall retention and depth of knowledge. Exposure to multiple and diverse jobs will provide breadth to an officer's knowledge.

The CASC is designed to train staff officer skills. The diversity of the Engineer Regiment requires multiple assignment-oriented training opportunities for its officers. With that concept in mind, the Engineer School developed a modular concept for the CASC built around six engineer staff/technical courses:

- Assistant Brigade Engineer
- Assistant Division/Corps Engineer
- Task Force Engineer
- Geospatial Manager
- Construction Engineer
- U.S. Army Corps of Engineers (USACE) Engineer

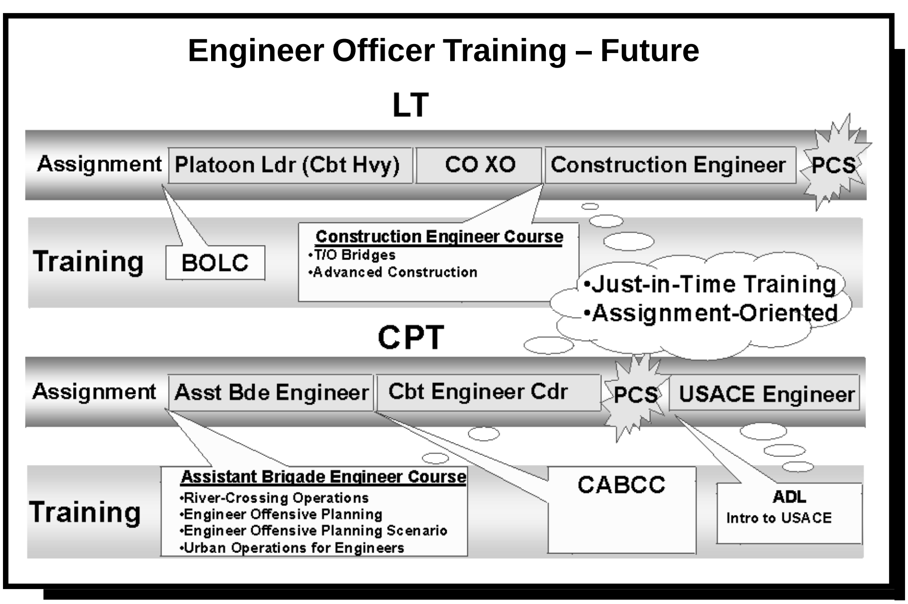


Figure 1

All six courses will include advanced distributed learning (ADL) and intense resident experiential training. The officer's initial CASC course will include a 2-week common-core ADL, followed by a 1-week functional ADL module, and then a 2-week resident phase. The resident experience is the vehicle by which the officer will demonstrate a mastery of knowledge gained through completion of ADL. The experiential training will immerse the officers in simulations, history-based vignettes, and progressive problem-solving situations related to developing the skill sets required of the position.

These courses will provide assignment-oriented training just in time for a staff duty position. The construct of this design allows engineer officers to receive training before assuming a staff/technical position anywhere along their career path. The six courses have some foundational knowledge in common, which is organized into modules. This commonality allows for reduced training time as officers receive the foundational knowledge in the first course attended. Subsequent courses will not repeat this baseline but will build on it to train the unique skills and knowledge for that course. For instance, an officer can take the fourteen required ADL modules for the Construction Engineer Course but only have to take five additional course-unique ADL modules to complete the Assistant Brigade Engineer Course. The residential phase is still required, and the officer has an option to repeat modules if desired. Current plans call for the implementation of CASC for 3d quarter FY05 (see Figure 2).

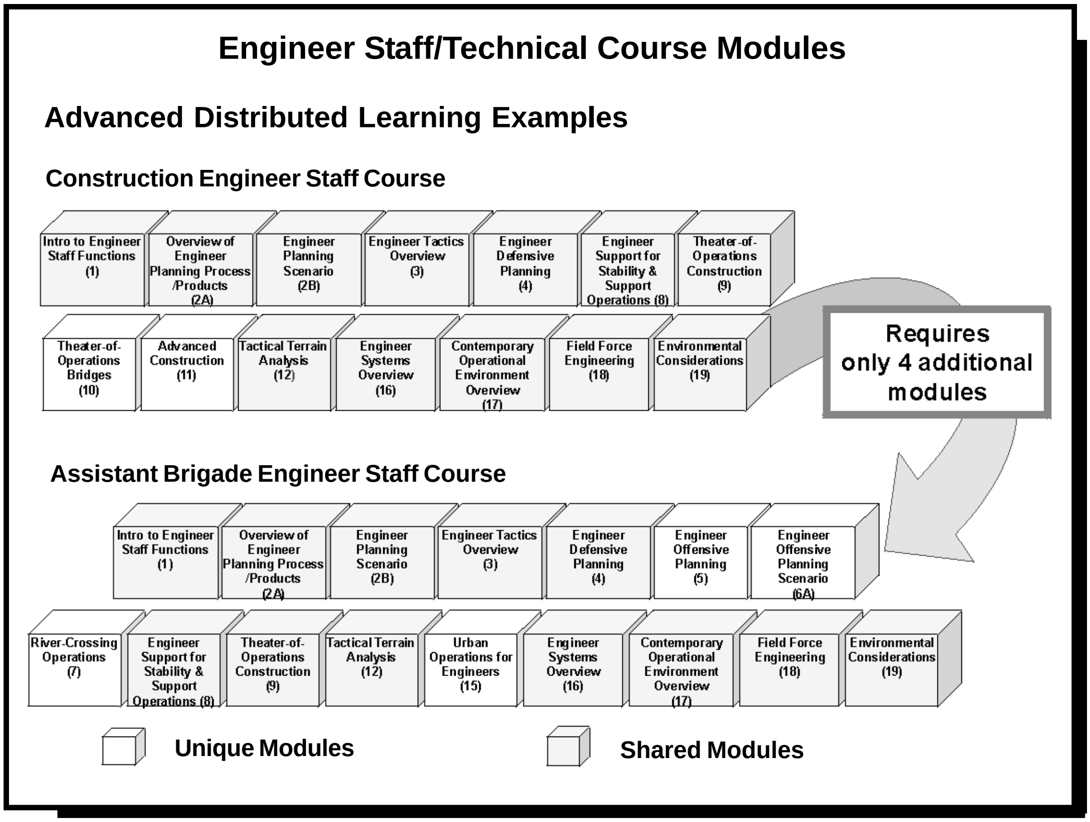


Figure 2

As with the CASC, the Engineer School has developed a modular construct to train battle command skills in the CABCC. The curriculum in the proposed command course is divided into seven modules: take command, train, administer, maintain, deploy, fight, and lead. Each module will include both ADL and experiential training activities that focus on company command. Leaders and officers in the field will also benefit from the modular design. The time an officer spends completing his ADL will be more focused, and leaders will be able to provide more focused mentorship, which should result in a more meaningful and rewarding learning experience for junior officers. The course will culminate with a 2-week combat training center experience, which will expand upon training management skills. Current plans will implement CABCC in 2d quarter FY06.

The current Command and General Staff College (CGSC) will change to Intermediate Level Education (ILE). All majors will attend 12 weeks of common-core operational instruction. An additional phase of up to 28 weeks will be provided to meet the requirements and needs of officers in their respective career field and/or functional area. Current plans are for ILE to be fully implemented by 4th quarter FY05.

Lieutenant Colonel Bedey is chief of the Directorate of Instruction, U.S. Army Engineer School, Fort Leonard Wood, Missouri. Previous assignments include commander of the 299th Engineer Battalion, 1st Brigade, 4th Infantry Division, Fort Hood, Texas, and S3 and company commander, 15th Engineer Battalion, 9th Infantry Division (Motorized). LTC Bedey is a graduate of the Command and General Staff College and holds a bachelor's in construction engineering from Montana State University and a master's in construction management from Colorado State University.

Major Reynolds is chief of Officer Education System Transformation, Directorate of Instruction, U.S. Army Engineer School, Fort Leonard Wood, Missouri. He was previously a small-group leader and commanded the 84th Engineer Company, 2d Armored Cavalry Regiment, and Alpha Company, 46th Engineer Battalion (C) (H), Fort Polk, Louisiana. A graduate of the Captain's Career Course, MAJ Reynolds holds a bachelor's of architecture from Texas Tech University and a master's in business administration from Webster University.

FM 3-34, *Engineer Operations*: A Blueprint to Forge Our Future

By Lieutenant Colonel Anthony C. Funkhouser

In the last few years, the world has been transformed, with new threats to our nation requiring a broader range of military missions, new technologies for our armed forces, and a new National Security Strategy. The Army took these matters into account as it established new doctrine, beginning with Field Manual (FM) 1, *The Army*, and FM 3-0, *Operations.* This iteration of doctrine was developed more systematically and, for the first time, linked Army doctrine to joint doctrine. The new numbering system also reflects this change. FMs 1 and 3-0 are the capstone manuals and, as such, are at the pinnacle of the doctrine hierarchy from which all other Army manuals descend. Additionally, FM 3-0 is written at the operational level of war, relating doctrinal principles that will enable senior commanders to fight full-spectrum operations and campaigns. It lays out the doctrinal frameworks, tenets, and principles for senior leaders to consider when fighting over extended time and space. As the Regiment's capstone manual, the doctrinal principles within FM 3-34, *Engineer Operations*, were derived from FM 3-0. Like a blueprint, FM 3-34 will provide the foundational principles that will forge the Regiment's future at the operational level of war.

To understand where we will go with FM 3-34, we should understand its history and relationship to FM 3-0 *(*formerly FM 100-5). The origins of engineer operations doctrine can be traced back to the first edition of FM 5-100, *Engineer Operations*, published in 1979. This version of FM 5-100 melded two other engineer manuals, FM 5-135, *Engineer Battalion Armored Mechanized and Infantry Divisions*, and FM 5-136, *Airborne Division Engineer Battalion*, both published in 1961. These two manuals focused solely on the principles and tactics, techniques, and procedures for battalion commanders operating in a division (tactical level). Coming just after the 1976 edition of FM 100-5, *Operations*, this 1979 version of FM 5-100 addressed common themes of divisional engineer operations against a Cold War threat. The manual (again written at the tactical level) explained how the engineer functions of mobility, countermobility, survivability, and topographic and general engineering support the maneuver commander. Since then, FM 5-100 has been revised four more times, three of which were in direct response to revisions of FM 100-5 (see table above).

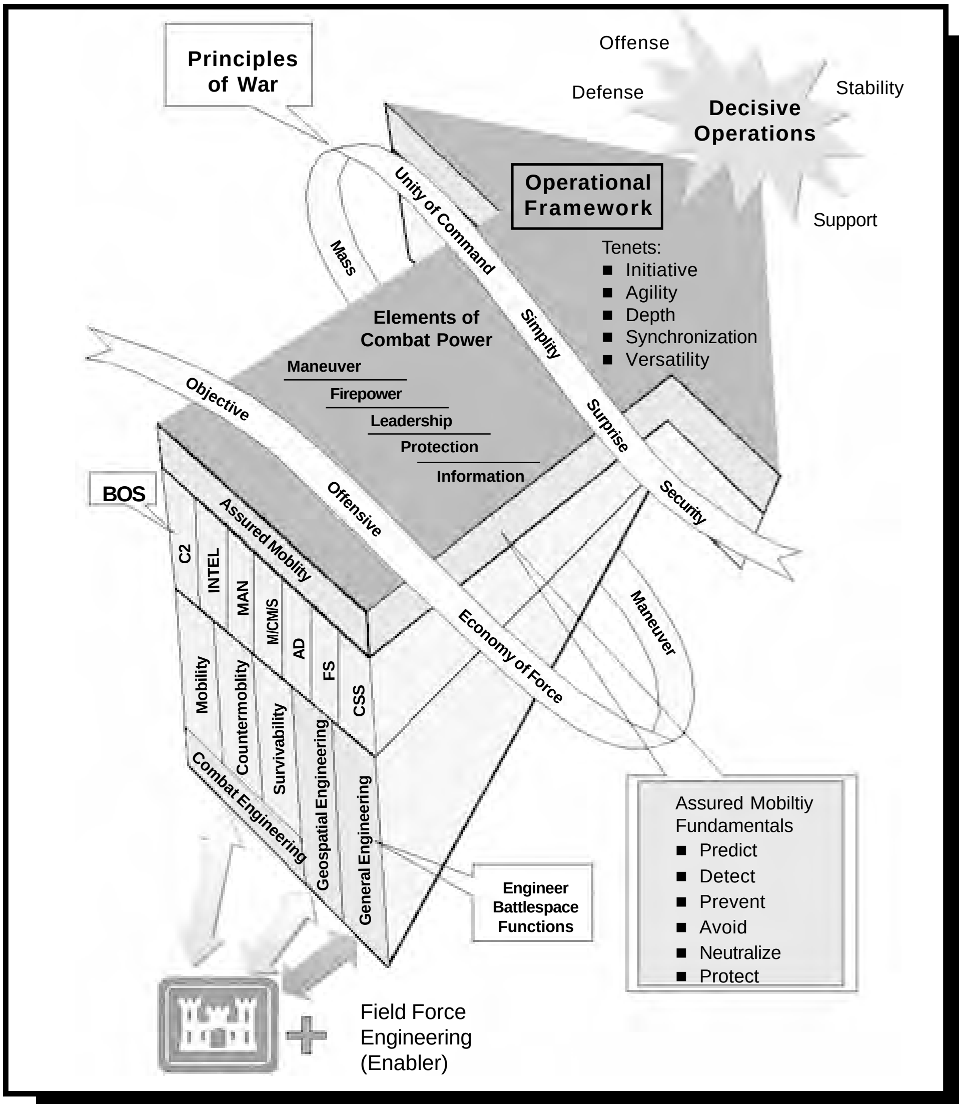
FM 100-5, *Operations*	FM 5-100, *Engineer Operations*
1968	1961 (FM 5-135/136)
1976	1979
1982	1982
------	1984
1986	1988
1993	1996
2001 (FM 3-0)	2003 (FM 3-34)

Publication dates of capstone manuals

The revisions of each of these manuals are indicative of changes to organizations, equipment, and how the Army was to fight. However, the enduring principles of war did not change. It was not until the Army began to think of how to train and participate in military operations other than war that new doctrinal principles began to emerge. The current version of FM 3-0, published in June 2001, addresses participation in the full spectrum of operations (offense, defense, stability, and support) in noncontiguous areas of operations and the impact of a new operational environment. Throughout the process of developing this new doctrine, principles of war endured. The authors of FM 3-0 also established an operational framework, integrating elements of combat power, principles of war, and Army tenets to achieve decisive operations. It is this framework that provides the basis of all discussions in FM 3-0 and, therefore, other manuals in the doctrinal hierarchy.

The U.S. Army Engineer School's Doctrine Development Division has taken this framework into consideration, along with feedback from senior engineer leaders in the field, and has started drafting a new FM 3-34. To maintain integrity with higher-order manuals and to create the parameters from which the manual could be written, this manual integrates the engineer functions, responsibilities, and principles addressed in joint publications and our Army capstone manuals. These parameters give us the latitude to address our advances in how we will fight the Regiment and serve as the foundation for all other engineer manuals.

FM 3-34 provides many firsts for the Corps of Engineers. First, the manual weaves a theme of engineer operations at the operational level of war throughout the entire manual. Second, it describes new threats in the operational environment and the implications to engineers around the Regiment. Third, it expands upon the role of the Regiment. It specifically discusses how the entire Regiment contributes to operational-level



Assured Mobility Within the Operational Framework

commanders and how the Regiment interacts with all of its various engineer organizations to support the Army's senior-level commanders. Toward this end, we propose a regimental mission essential task list (METL) to support the Army's METL. Establishing a common engineer METL is another means to tie the Regiment together. Last, but certainly not least, is the center of gravity for this manual. The figure above, which is excerpted from the manual, takes the operational framework described in FM 3-0 and explains how the engineer functions support this framework, through the assured mobility subframework we recently published.

The manual uses this amalgamation to establish the relationships of the assured mobility imperatives and fundamentals to the elements of combat power within the operational framework. It should facilitate maneuver commanders' understanding of what assured mobility does for them, as it is explained within the context of their operational structures. It also shows how field force engineering enables engineer functions throughout the Regiment and expands our capabilities down to the point of the spear.

In FM 3-34, we try not to regurgitate doctrine from other manuals but rather refer the reader to the source document. Also, we steer away from tactical-level discussions that will be addressed in other manuals. FM 3-34 does not directly address the Objective Force, but by integrating a number of principles and introducing frameworks such as assured mobility and capabilities such as field force engineering, it provides the foundation for future doctrine focused on the Objective Force.

As you can see, FM 3-34 is different than previous editions, and those with a vision for the future of the Regiment will appreciate the contrast. It is critical to the Regiment that we are tightly linked to Army doctrine so we are not overlooked and made irrelevant. Therefore, it is very important that we get feedback from the field and make this an interactive process as we come to closure and publication.

In draft form, FM 3-34 was posted to the Army Knowledge Online (AKO) collaborative Web site (Army KCC Home/ Army Communities/TRADOC/Engineer/Engineer School/

Directorate of Training/Doctrine) for feedback until 21 March 2003. The comments were integrated for a coordinating draft and posted to the AKO Web site on 4 April 2003. This version will be used to discuss the manual and identify areas for modification.

The Engineer School plans to publish and distribute FM 3-34 by the end of FY03. The manual will be the foundation and blueprint for future engineer manuals. In the next year, the Doctrine Division will take the principles in FM 3-34 to revise our next tier (engineer functions) of manuals as follows:

- FM 3-34.1 (FM 90-7 and FM 5-102), *Combined Arms Obstacle Integration*
- FM 3-34.2 (FM 90-13-1 and FM 5-101), *Combined Arms Breaching*
- FM 3-34.112 (FM 5-103), *Survivability*
- FM 3-34.250 (FM 5-104), *General Engineering*
- FM 3-34.230 (FM 5-105), *Geospatial Engineering*
- FM 3-97.13 (FM 90-13), *River Crossing Operations*
- FM 3-34.32 (FM 20-32), *Mine/Countermine Operations*

Lieutenant Colonel Funkhouser is chief of the Doctrine Development Division, U.S. Army Engineer School, Fort Leonard Wood, Missouri. He was previously the Engineer Brigade executive officer, 1st Cavalry Division, Fort Hood, Texas. A graduate of the School of Advanced Military Studies and the Command and General Staff College, LTC Funkhouser is a professional engineer in Virginia.

Letter To The Editor

Planning Engineer Support for an Urban Attack

I originally wrote "Planning Engineer Support for an Urban Attack" (published in *Engineer*, July 1998, and reprinted in *Engineer*, January-March 2003) to provide options with the technology and doctrine fielded to table of organization and equipment engineer units. Since I left the Joint Readiness Training Center, the Army has developed new doctrine and equipment to address some of the challenges I discussed. We have learned well from our experiences in the Balkans and Afghanistan. Notably, the sensor arrays now in development through the Infantry Center and in testing with the Special Operations Forces community mitigate the need for explosive entry during precision-strike military operations on urbanized terrain (MOUT). Remotely controlled breaching equipment has improved mobility and reduced the need for explosive breaching in many cases. Unmanned aerial vehicles and improved intelligence dissemination systems have greatly improved our situational awareness, reducing the need for "brute force" approaches. Indeed, the entire Army is making great strides in addressing the MOUT challenge.

Given that the world continues to urbanize, we must continue to develop new techniques to meet a wide range of MOUT tactical problems. Lieutenant Colonel Funkhouser and Major Kirkton ("Doctrinal Changes in Urban Operations," *Engineer*, January-March 2003) rightly state that we have an obligation to reduce collateral damage as a way to protect civilians and maintain legitimacy for our operations in the host nation. I would add that the complex three-dimensional battlespace of a large city, such as Seoul or Baghdad, presents a broad range of tactical problems for the maneuver commander—high population density, complex terrain, and dispersed-but-lethal military opponents. The supporting engineer soldiers have a responsibility to prepare a broad range of solutions to these tactical problems, some of which may be quite destructive. For example, explosive mine clearing may be appropriate in engagement areas like urban parks, and explosive-entry techniques may be required to gain access to enemy-held buildings. The Israeli-Palestinean conflict provides rich examples of improvised obstacles supporting small groups of determined opponents and demonstrates that excessive force can have significant unintended consequences. We must balance the risk of collateral damage with mission accomplishment, force protection, and proportionality. Excessive force risks escalation and violates the principles of legitimacy and restraint that are the foundation of successful smaller-scale contingency operations.

In any case, good mobility/survivability support contributes to maintaining initiative and momentum. Detailed mobility/survivability planning and preparation is essential in every environment. It must address the needs of the entire tactical force—from tooth to tail. Resupply and ground casualty evacuation routes, movement corridors for armored support forces, and a variety of assembly areas must be thoroughly planned and resourced. Engineer support to dismounted infantry platoons and companies in urban environments must remain prepared to clear a variety of reinforcing obstacles, including breaching buildings.

This is a superb discussion topic that should rightly take place in the pages of our professional publication.

Major John DeJarnette

The Countermine Center Forges Ahead

By Mr. Eric Johnson and Colonel Jeffrey P. LaMoe

"The enemy will fight asymmetrically. He cannot face us frontally and will come at us from the side and in the gaps he can find. My challenge is always loss of momentum. If I can keep momentum, he will stay off balance and have to fight my fight. The area where loss of momentum is always greatest is in crossing gaps and breaching complex obstacles. Any piece of ground that stops us takes away the initiative. A great challenge. Having an adequate countermine program is a level-of-confidence issue and one of our key responsibilities."

—General Eric K. Shinseki
Chief of Staff of the Army

Since Operation Desert Storm, U.S. military missions have spanned the spectrum of conflict. Those who oppose U.S. interests and objectives acknowledge that their forces would not survive a direct confrontation with our forces in conventional war. With U.S. involvement in a conflict, direct combat actions become less frequent as opponents disperse their forces and adopt tactics, techniques, and procedures (TTP) designed to offset our advantages. The effectiveness of this approach has been demonstrated repeatedly. In Chechnya, forces confronted with numerically or technologically superior opponents also realized that they must operate in complex terrain and urban environments to offset the advantages of their adversaries. Analyses reveal that our potential adversaries believe that denial of regional access can dictate the tempo of conflict to the U.S. disadvantage. Adversaries understand that if they attack our alliances and coalitions, they can delay the start of decisive operations and dictate the strategic tempo by frustrating U.S. and allied access.

The current force is trained, equipped, and organized to breach complex linear obstacles intended to shape the battlefield. The Army's countermine capabilities were developed to breach linear obstacles. With few exceptions, all current countermine equipment in our inventory employs one of three strategies: metal detection or mechanical or explosive "brute-force" neutralization. While this is a critical capability that must be maintained, recent experience in multiple operations demonstrates that there is a distinct need to *clear* mines from an area, not just breach.

The Army is not organized—and has very few organic assets—to detect and neutralize mines for area and route clearance operations. We cannot clear routes at operational speeds; technology will not support it. We must bridge the current countermine capabilities gap with commercial off-the-shelf (COTS) equipment to conduct operations in the contemporary operational environment (COE) for the Legacy and Interim Forces until countermine equipment that meets our required countermine capabilities is fielded to the Objective Force.

However, the COE—with adaptations by potential adversaries to offset U.S. advantages—is leading conflict toward nonlinear, simultaneous operations conducted throughout the depth of the area of operations, using conventional and unconventional means oriented on the destruction of U.S. national will and weakening international support. As in the attack on the Khobar Towers in Saudi Arabia in 1996, adversaries have added new depth to the battlespace. They have demonstrated that they clearly understand the political value of attacking soft targets when they are unable to achieve success in conventional operations.

In January 2002, the U.S. Army Maneuver Support Center (MANSCEN) began to establish a Countermine/Counter Booby Trap Center (CMCBTC) at Fort Leonard Wood, Missouri, as the "go-to" Center of Excellence for all things having to do with countermine.

The requirement for a CMCBTC is the result of the challenges presented by the extreme proliferation of mines, booby traps, and unexploded ordnance (UXO) in the COE. The challenges have been intensified by the employment of improvised explosive devices (IEDs), side-attack mines, and command-detonated devices. Potential adversaries have learned that they no longer have to achieve military victory; instead, a way to achieve success is to avoid defeat while inflicting casualties on U.S. and allied personnel. This is an effective way to attack political will and popular support for military operations. Demonstrated repeatedly over the last decade, taking hostages, using civilians as "shields," using mines as instruments of terror, and using IEDs for ambushes have proven very effective. From southern Lebanon to Oklahoma City, from the Balkans to Latin America, mines and explosive devices in the hands of renegades have been successful in making our superpower military feel helpless and ill-prepared.

The CMCBTC was created to help remedy the current shortfall in mine/countermine training that currently exists in the Army. The center's goals are to—

- Integrate, not duplicate, countermine and counter-booby trap doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) issues and solutions.
- Develop expertise in countermine and counter-booby trap techniques to detect and defeat booby trap and mine threats and enhance mobility and force protection in the COE.
- Maintain superiority in all facets of countermine warfare, including resident and reach-back technical capabilities.
- Focus the science and technology community on developing new technologies to counter the mine and booby trap threats that support countermine technologies for Objective Force assured mobility.

Today the CMCBTC is well on its way to establishing itself as a fully resourced Center of Excellence, which will become the recognized leader in countermine and counter-booby trap training and technology. The center will focus and synchronize aggressive countermine exploitation of present and emerging mine and explosive threats, enhance countermine interoperability and hazard awareness with the combined arms, and develop DOTMLPF solutions and TTP for integrating newly developed or COTS equipment into countermine operations.

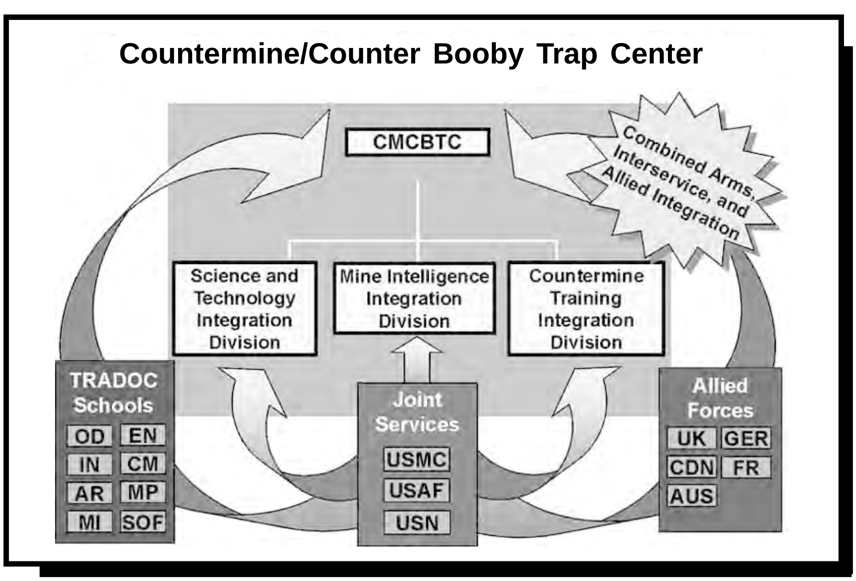
Many organizations are trying to help solve the explosive hazard problem; this synergy of effort did not exist previously. The focus of the CMCBTC's efforts this past year centered on interfacing and integrating countermine issues and solutions with other U.S. Army Training and Doctrine Command schools, allied forces, and joint services. This past year has also shown an increased awareness of the challenges in the countermine environment and initial integration of effort across branches, services, and Department of Defense agencies. The figure below shows the number and scope of organizations with involvement and interest in countermine.

The CMCBTC, working in concert with the MANSCEN Directorate of Combat Developments, developed a specification for a standard minefield database linked to Geographic Information System (GIS) tools to track and graphically display minefields and hazard areas. This effort, dubbed the Tactical Minefield Database (TMFDB), is being developed through the Topographic Engineering Center (TEC), Alexandria, Virginia—the government lead for the Maneuver Control System (MCS)-Engineer (MCS-E)—and Northrop Grumman, TEC's software development lead for MCS-E. The TMFDB will be forward-compatible with the beta release of MCS-E, which is scheduled for FY03.

The TMFDB resulted from urgent requirements emanating from Operation Enduring Freedom to develop a database of minefield and explosive hazard information. This initiative provides Coalition Joint Task Force 180 the ability to capture explosive hazard data and print georeferenced minefield maps and tactical decision aids to support the mobility and force protection of the force.

The TMFDB is relational, versatile, and customizable. The database will operate on a host unit's local area network, permitting near-real-time sharing of hazard data among U.S. elements. Friendly and enemy obstacles are assigned obstacle numbers based on the obstacle-naming convention in Field Manual (FM) 90-7, *Combined Arms Obstacle Integration*, and hazard locations will be displayed on tactical map backgrounds using color schemes and symbology shown in FM 101-5-1, *Operational Terms and Graphics*, and Military Standard (MILSTD) 2525B, *Common Warfighting Symbology*.

The TMFDB and GIS software can track and display point, linear, and area obstacles, minefields, and explosive hazards. Built as a subset of MCS-E, the application is being designed to interface with the command and control personal computer (C2PC) and MCS-Light and to input and output the minefield database to multiple formats (for example, the UN-approved Standard Information Management System for Mine Action [IMSMA]). The CMCBTC is presently demonstrating TMFDB capabilities to U.S. forces in Afghanistan and Kuwait.



The past year has been demanding for the CMCBTC Countermine Training Integration Division. The CMCBTC developed mine awareness, engineer-specific countermine and counter-booby trap training to prepare forces for Operation Enduring Freedom. The CMCBTC also trained more than 4,000 soldiers and qualified more than 100 instructors at Fort Leonard Wood and various other locations (eleven mobile training teams in the continental United States [CONUS] and three outside CONUS [OCONUS]). Recently, nine CMCBTC personnel were deployed to Germany, Kuwait, and Afghanistan for countermine predeployment and on-site training.

In addition, the CMCBTC—along with the National Ground Intelligence Center, Charlottesville, Virginia, and the Navy Explosive Ordnance Disposal Technical Center, Indian Head, Maryland— developed two handbooks that describe common explosive hazards, their doctrinal usage, recognition features, immediate action drills, reporting, countermeasure equipment, and TTP to deal with these threats. One handbook, which is titled *Land Mine and Explosive Hazards Reference Guide*, concerns Afghanistan. The second one is the *Soldier's Handbook, Land Mines and Explosive Hazards–Iraq*. The CMCBTC also developed a detailed Training Circular (TC) 20-32-5, *Commander's Reference Guide, Land Mine and Explosive Hazards (Iraq)*.

Our current practice, in response to urgent circumstances, does not fit the "train-alert-deploy" model; instead, it is "alert-deploy-train." We need to emphasize common soldier skills training in mine awareness, detection, avoidance, and extraction, and develop combined arms strategies across Battlefield Operating Systems. The CMCBTC proposes the five functional courses shown in the table below to enhance and integrate individual and combined arms skills and to ensure that we have requisite skill sets trained before deployment. Funding is needed to support the functional training courses until the FY05 budget submission establishes funds for a throughput of 400 students per course.

The U.S. Army requires a mine-detection-dog program to support Operation Enduring Freedom and the Objective Force and to reduce the risk to soldiers. Mine-detection dogs are the only tool we have to identify mines and explosive hazards based on the chemical odor of the explosives used in these devices.

In August 2002, the U.S. Army Engineer School Assistant Commandant briefed the Vice Chief of Staff of the Army and the Army Requirements Oversight Council on the school's solutions for dealing with the countermine threat. They approved funding for the Operation Enduring Freedom area and route clearance sets, but not a CONUS-based training set. Approved items include mine-clearing armor-protected (MCAP) dozers, berm sifters, medium flails, mine-detection-dog teams, flares, weight-dispersion boots, interim vehicle-mounted mine detectors, and mine-protected vehicles.

Included in the briefing was the establishment of a mine-detection-dog unit, which was approved and funded. After careful research, it was decided that the British Army can best train the baseline requirements the U.S. Army needs for its mine-detection-dog capability. The first squad and the detachment sergeant were transferred to Fort Leonard Wood,

Countermine Functional Courses

Course	Description
Countermine Course	Will provide joint service and combined arms leaders with an understanding of countermine operations and equipment and will advise commanders on force protection, area clearance, route clearance, and maneuver and attack missions. It will also train personnel on COTS and Legacy Force equipment.
Counter-Booby Trap Course	Will teach knowledge- and technical-based tasks that support detection, identification, marking, recording, reporting, extraction, and neutralization of booby traps on the battlefield.
Urban Breacher Course	Will provide individual training for Department of Defense and Department of Justice personnel. The course will teach advanced urban breaching operations, explosive theory, planning combined operations, safety issues, urban reconnaissance, employment of urban breaching assets, and breaching techniques for urban operations. It will also train personnel on COTS and Legacy Force equipment. We are working with the Marine Corps to exploit their current course (joint training).
Master Countermine Course	Will provide training to noncommissioned officers (E-7 and above) with battle staff qualification and officers (lieutenants, captains, and majors) to increase the planning capability of joint service and combined arms staff personnel in mobility tasks influenced by mines, booby traps, and UXO. The course will enable staff personnel to establish a mine information and coordination cell within an operational headquarters and advise commanders on all countermine TTP, including force protection, area clearance, and route clearance. It will also train liaison skills for operations with coalition forces, United Nations, nongovernment organizations, private volunteer organizations, and demining organizations.
Unexploded Ordnance Reconnaissance Agent Course	Will teach non-explosive ordnance disposal (EOD) soldiers to conduct initial procedures to mitigate the hazards of UXO, booby traps, and IEDs.

future home of the mine-detection dogs, and are awaiting orders to the United Kingdom for training. Training is expected to begin in May 2003. Training for mine dogs is 24 weeks long.

Mine-detection dogs give Army engineers an additional tool for countermine operations—a tool last used in the Army during the Vietnam conflict. Today's planned detachment will have an offensive capability similar to that of the Vietnam-era units. However, the threat today is very different and complex. Dogs have performed civilian humanitarian demining missions for more than a decade, but the U.S. Army requires more than just that capability. This new unit will be breaking ground with TTP and doctrine for the military countermine dog. In fact, this unit will be trying to advance procedures used by other armies. The U.S. Army mine-detection-dog unit will be the world's most advanced dog unit.

It will take almost three years to field this unit of 30 dogs. The time delay is because the U.S. military has no training capability for mine-detection dogs and will have to stand up a trainer base while the unit stands up. The British Army has a small training base and the CMCBTC will be taxing it to the fullest in support of our efforts.

The Engineer School is addressing the area clearance shortfall with updated doctrine, training support plans, and TTP and certified instructors to help train our Army for ongoing and future area clearance operations.

Mr. Johnson is the lessons learned researcher in the Countermine/Counter-Booby Trap Center, Fort Leonard Wood, Missouri. He holds a master's in computer resources and information management from Webster University in Saint Louis, Missouri, and is a graduate of the U.S. Army Command and General Staff College.

Colonel LaMoe is the Director of Training, U.S. Army Engineer School, Fort Leonard Wood, Missouri. Previous assignments include senior combat engineer trainer, Sidewinder 07, National Training Center, Fort Irwin, California, and deputy commander, 555th Combat Engineer Group, Fort Lewis, Washington. He holds a master's from Michigan State University and a master's in strategic planning from the U.S. Army War College.

Regimental Awards

Each year we recognize the best noncommissioned officer, lieutenant, and engineer company, in each of the components, for outstanding contributions and service to our Regiment and Army. Every engineer unit in the Regiment can submit the name and achievements of its best of the best to compete in these distinguished award competitions. Only the finest engineer soldiers are selected as recipients of these awards. They will carry throughout their careers the distinction and recognition of being the Engineer Branch's best and brightest soldiers and leaders. Following are the results of the 2002 Active Component Itschner and Grizzly Awards and Sturgis Medal selection boards:

The Itschner Award committee selected the U.S. Army Europe nominee—Company C, 9th Engineer Battalion (C), 1st Infantry Division Engineer Brigade, Schweinfurt, Germany, APO AE 09033—as the 2002 winner.

The Grizzly Award Committee selected First Lieutenant Michael White, Company A, 54th Engineer Battalion (C) (M), Bamberg, Germany, APO AE 09139, as the 2002 winner.

The Sturgis Medal committee selected Sergeant First Class Bradley J. Schneier, Company B, 54th Engineer Battalion (C) (M), Warner Barracks, Germany, APO AE 09139, as the 2002 winner.

All of the nominees represented their major commands with the highest professionalism and dedication to the Engineer Corps's vision and deserve our highest praise. The award recipients will be recognized at the U. S. Army Corps of Engineers Ball, tentatively scheduled for 23 October 2003.

For many years, senior leaders of the Regiment have debated about an appropriate award to recognize the very best engineer soldier, private through specialist. In keeping with the tradition of naming such an award after a distinguished member of the Regiment, the Regimental Command Sergeant Major, along with other senior sergeants major, recommended and gained approval for an award named after the most distinguished command sergeant major in the history of our Regiment—the fourth Sergeant Major of the Army, Leon Van Autreve.

The award is extremely significant for two reasons: first, it was created to recognize the most outstanding junior enlisted soldier of the three components of our Regiment as a tribute to one of our Army's greatest champions of welfare and care of soldiers and their families; second, it showcases and highlights the important and significant service our junior enlisted soldiers provide to our nation. They are truly our most valued resource, and we wouldn't be the Army or Regiment that we are without their selfless and dedicated service. The Van Autreve nominations will be submitted for FY03 and presented at ENFORCE 04.

Lieutenant General Robert B. Flowers
Chief of Engineers

Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School

Operation Enduring Freedom:

A Waypoint Toward Geospatial Engineering Transformation

By Chief Warrant Officer 3 David Kasten

In early December 2001, I was just settling down in Kosovo—doing my part toward fulfilling the 10th Mountain Division's Kosovo Force (KFOR) rotation—when I received a call to go to Afghanistan to support Central Command's (CENTCOM's) Operation Enduring Freedom. So I packed up and moved out, leaving a three-man element deployed in support of KFOR. The other personnel from our detachment remained at Fort Drum, New York, supporting the rear commander and performing force protection missions.

Terrain Team Mission

My unit, the 66th Engineer Detachment (Terrain), works for the 10th Mountain Division assistant chief of staff, G2 (intelligence), in support of the intelligence preparation of the battlefield (IPB). Being collocated with the G2 section is helpful in getting access to required geospatial information and imagery. However, due to our capabilities to rapidly visualize the terrain, we also stayed in the back pocket of the division chief of staff. Our main piece of equipment was the Digital Topographic Support System (DTSS)-Deployable (DTSS-D). We also had some augmentation equipment from the National Imagery and Mapping Agency (NIMA), headquartered at Bethesda, Maryland. Despite our small size and the austere environment in Afghanistan, we were still able to provide support to the division with on-demand, non-standard, unique terrain products in a timely manner.

The 10th Mountain Division had many successes during Operation Enduring Freedom. The terrain team supported the division during the deployment and was extremely successful during the planning and execution of Operation Anaconda. Adequate planning would not have been possible without the DTSS-D. The overall DTSS was christened during the combat operation. (To learn more about the DTSS, see the Topographic Engineering Center [TEC] Web site at *www.tec.army.mil*.) It enabled us to provide many tactical decision aids and other nonstandard products. Most engineers are familiar with the products we were asked to generate—elevation tints, shaded/painted relief maps, high-resolution image maps, multispectral image maps, combined-obstacle overlays, lines of communication overlays, hydrology overlays, limited map reproduction, perspective views using high-resolution imagery, threat domes, intervisibility products, and virtual fly-throughs. This may sound like "the short list," but every product was tailored to its intended user, and a lot of imagination from both the analyst and the user was required to make it useful.

One particular item we generated was the initial air insertion visualization product of the Shaikot Valley in southeastern Afghanistan. The aviation commanders needed to know what air routes were available from Baghram into the objective area of operation with specific cloud ceilings. These corridors had to be displayed using the Earth Resources Data Analysis System (ERDAS®) Virtual Geographic Information System (VGIS®), an invaluable commercial applications program included in the DTSS-D. Using the VGIS, the commander was given a better understanding of how rugged the terrain was and what options were available. After looking for air avenues with varying ceilings, the aviators and terrain technicians determined that the ceiling could not be less than 7,500 feet in order to use the corridors that were selected. The value of this information allowed premission decisions to be made by the division chief of staff in support of CENTCOM's overall mission.

Lessons Learned

The DTSS proved to be the right system to support warfighters of Operation Anaconda, aviation units, and division decision makers—it fulfilled its requirements. The many lessons we learned during this operation concerned things such as equipment challenges, the importance of maintenance, enhancements that the system should incorporate, understanding data and data limitations, new training we need, the importance of working closely with the G2 imagery section, the need to push software to users, and on-demand printing. Based on my recent experiences with the 10th Mountain Division, I will discuss these lessons in this article.

Equipment and Maintenance

Although it is labeled as a deployable system, the DTSS-D is geared more toward a garrison-type environment. Dust and heat will quickly render the system useless, and maintenance can't be stressed enough. The initial problem we had was that we were in a very dusty environment in Afghanistan, which took its toll on all our equipment. Saving factors were a good industrial vacuum cleaner and regular maintenance. Even then, we still lost the capability to output to soft mediums such as floppy, jazz, and digital video disks (DVDs) and compact discs-recordable (CD-Rs). Luckily, we brought extra (off-the-shelf) computers that had the same output capability that we connected through the DTSS.

The constant moving of systems also created havoc on external wires. We lost many small computer system interface (SCSI) cables and terminators and one power cable. These were mission stoppers. The bottom line is: gather spare parts prior to departure. The Department of Defense Manufacturing Technology (ManTech) Program, which provides DTSS contract support, will help obtain spare wiring.

Digital Topographic Support System-Deployable

It is important to understand the limitations of the system—both the hardware and software aspects of it. We thought we had a good handle on this until we really pushed the system. Bring your own networking tools, such as RJ45 (Internet) cable, testers, crimpers, and spare 6- to 8-port hubs. We need to take it upon ourselves to understand our systems so we can do our own basic troubleshooting.

Enhancements

We used VGIS exclusively in special operations mission rehearsals and quick-response force planning. This included helping users visualize their insertion route, extraction route, helicopter landing zones, and tactical operations. We used VGIS to visualize where the battle was taking place, determine mortar threat domes, build line of sight from known enemy and friendly locations, and assess possible exfiltration and infiltration routes from known enemy locations (commonly referred to as "rat trails"). However, VGIS would work even better if we incorporated a high-end graphics card to allow better resolution and larger-sized fly-throughs. Also, a better three-dimensional (3-D) fly-through program that could be rendered and flown in real time would be helpful in the future (such as Skyline's TerraExplorer Pro®).

Lack of Information

We sometimes take for granted that everyone understands the possible lack of geospatial information and the limitations of the data we use and require for geospatial analyses. As geospatial engineers, it is our responsibility to make our customers understand data accuracy and data resolution—for example, by creating line-of-sight or visible-area plots (360-degree line of sight) using Digital Terrain Elevation Data (DTED) Levels 1 and 2 or Shuttle Radar Topographic Mission (SRTM) Level 2. Very little vector data was available in December 2001. The terrain team extracted as much data as possible from 1:50,000 Russian maps, and then we used imagery for critical areas.

Training

Geospatial instruction taught in the U.S. Army Engineer School is only the basic building block. It's our responsibility to teach soldiers the reality of the field. We must give them realistic training, to include holding them to the time constraints we can expect in a high-tempo operation. Encourage creativity when producing a product, pass on the shortcuts we use when we produce products, and get soldiers to understand the mission of the customer. We have to prepare for the fact that we may have to deploy as a small element. We need to ensure that we cross train everyone from the bottom up, keeping in mind that the terrain technicians are still the experts. There will always be a learning curve to overcome, but there are basic items that must be addressed before any deployment. Following is a list of tasks with which all of us should be familiar. Most deal with computers, and many may think this is an assistant chief of staff, G6 (information management), function. This is correct, but if your G6 is as undermanned and overtasked as ours, you'll find that this knowledge will help cut out minutes, hours, or days of downtime. These skills include—

- Basic networking, such as setting up Internet protocol addresses for plotters, printers, and computers.
- Setting up gateways, workgroups, domains, and RJ45 cables, both standard and crossover; up-linking hubs.
- Basic computer operation and troubleshooting (including maintenance), such as file transfer protocol (FTP) and file allocation table (FAT) 16 versus FAT 32 versus New Technology (NT) file system.
- Understanding the common errors/problems/limitations with Environmental Systems Research Institute (ESRI™) ArcInfo®, such as missing information within vector coverages and inverted fly-throughs (VGIS).
- Understanding the problems/shortcomings of all data that is being used and being able to convey this to the customer.
- Understanding the IPB process better.

G2 Imagery Section

Understand the functions and limitations of your imagery section. The terrain team relied heavily on imagery during this operation. With the lack of standard maps, we filled the data gap by producing multiple image maps. Imagery was vital in producing products because NIMA maps that were available were at 1:100,000 scale and almost 20 years old. These did not provide the ground operator with enough information. Australia shared scanned Russian 1:50,000 digital maps that provided great detail but were still 15 to18 years old.

We created many updates using imagery provided from two main sources. The first was unclassified, high-resolution imagery that the TEC Imagery Library provided as soon as it was available. The second source was the NIMA support team (NST), formally called the Customer Support Response Team (CSRT), that provided high-resolution, georeferenced, classified imagery. The team could download current imagery (less than 30 days old) via the Secret Internet Protocol Router Network (SIPRNET) and could also create image maps. Later in the deployment, the NST brought its own dedicated satellite dish for connectivity, which improved the team's ability to download imagery that the division needed. Both sources were vital to the success of the mission.

One misconception many users have is that all imagery is accurate and precise; however, we found errors that were as great as 400 meters off of actual locations. Geospatial engineers must inform their users of the possible data inaccuracies.

National and Coalition Partners

There are many organizations that can assist us in just about every aspect of our job. During our deployment, we asked for assistance from ERDAS, ESRI, NIMA, TEC, ManTech, ILEX Systems (a software support contactor), and terrain units from the United States, Britain, and Australia. They all bent over backward to assist us; just like the old cliché, "no question is a dumb question."

Software and Data

Push terrain/map programs to the people we support. Give the tools and basic instructions to our customers. The programs that we pushed were Terrabase 2, FalconView™, ArcExplorer®, ERDAS Viewfinder®, SID® Viewer, and screen-grabbing software. We also pushed as much raw data as possible, such as DTED, raster product format (RPF) images, and raster data. This helped eliminate the small taskings that we were constantly receiving. The training that the customers need to use these map programs will take some time, but the payoff in time saved in the future will be worth it.

Printing

One of the functions of the DTSS-D is low-volume map printing. Although this is a thorn in the side of many terrain detachments, it is also a great asset. Due to the lack of information on standard NIMA 1:100,000 maps, we turned to printing some of the Russian 1:50,000 maps. These maps had an abundance of information that was helpful to the ground operators, such as water velocity, bridge information, and road width. The most helpful information was that contours on these maps were 20 meters versus the 50 meters on the 1:100,000 maps. Because of this, the terrain team overlaid World Geodetic Survey 84 grids on the Russian 1:50,000 maps and reproduced more than 500 copies to support the ground operators.

Conclusion

The DTSS is a great system. It works in combat, it works in the field, and it works in garrison. There are aspects that can be improved, and I challenge the Engineer School to make that happen. The terrain warrant officer and 81T soldiers are in high demand. There are many customers in your organization beyond the traditional support to the IPB. In my case, the division chief of staff and the aviation and special operations forces were new and prized customers. No information set is going to be perfect—and may not even be good enough to use—but I used imagery to improve upon existing NIMA- and Soviet-produced maps. Finally, the best job is done in collaboration with NIMA, TEC, and our allies. We really have the interoperability built in to allow us to work together smoothly.

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Transforming Geospatial Engineering . . . Critical to Success of the Objective Force

By Colonel David A. Kingston, Lieutenant Colonel Steven H. Tupper, and Major Carl G. Herrmann

With the fielding of the Digital Topographic Support System (DTSS) and the increase in the size of terrain detachments in the heavy divisions and the Stryker Brigade Combat Team (SBCT), many changes in geospatial engineering have occurred over the past five years. These changes enabled significant improvements in geospatial engineering support to commanders and proved critical to success in recent combat operations. (The article on page 27 tells how the DTSS supported Operation Enduring Freedom.)

As successful as we are, our current capabilities still do not meet the total requirements for our Legacy and Interim Forces. Furthermore, the requirements for geospatial engineering support for the Objective Force will be even greater. This article explains how the geospatial community will transform to meet the needs of the Objective Force. It also covers deficiencies in the current force that must be fixed, what we see as the emerging geospatial requirements for the Objective Force, and the organizational and materiel system changes that are necessary to meet these requirements.

Current Force Support Deficiencies

One deficiency in the current force is a lack of accurate, robust, and timely geospatial data for worldwide missions. The possibility exists that a terrain team will not have the required terrain data to support a unit's mission and will have to acquire that data from an outside source or create it internally. The National Imagery and Mapping Agency (NIMA), headquartered at Bethesda, Maryland, is the primary outside source for our digital geospatial data and imagery. The problem commonly associated with this source is that the resolution is often insufficient (for example, Digital Terrain Elevation Data [DTED] Level 1 or 2, with 100- and 30-meter spacing), and it often takes too long for NIMA to provide the data. When terrain teams support operations, particularly special or airborne operations or military operations on urbanized terrain, high-resolution geospatial data (such as DTED and Imagery of 1 meter) is often required. Thus, to overcome the shortfall, terrain teams need to have the capability to generate their own geospatial data internally. The current DTSS suite of software tools has limited capabilities to rapidly generate geospatial data.

Another deficiency of the current topographic force is that the organizational structure is not designed for generation, management, fusion, and dissemination of digital data. The current organizations do not support the growing geospatial needs of the Army. A case in point is the topographic unit chain of command: units designed to task have no authority to task. For example, the production and control (P&C) team has the mission to manage P&C for an entire theater, but it has no authority over the underlying geospatial units. Additionally, there is an awkward relationship between the topographic battalion and the accompanying P&C team. While both are led by a lieutenant colonel, their lines of responsibility seem to be interwoven.

Finally, there is no distinct line of communication between the terrain team assigned to a brigade and units assigned at echelon-above-corps units. There is no established organizational structure that a terrain team can use to acquire new or updated terrain data from a higher-echelon support unit.

A further deficiency of the current structure is that there are still seven divisions in the active Army that have only a single nine-person terrain team assigned to them. Digitized divisions have 36 soldiers who support them and each maneuver brigade. This capability should not be limited to the digitized divisions; the nondigitized divisions can also make use of these larger terrain teams.

Objective Force Support Deficiencies

The Objective Force has a number of constructs that will cause it to fight in a manner completely and totally different than the way we fight current forces. These constructs include—

- *Use of knowledge as a substitute for armor and mass.* The Objective Force must see first and understand first to be successful. In the case of geospatial engineering, this will require an unprecedented amount of timely, accurate, and robust geospatial data to proactively understand the effects of terrain. This is particularly true if we are to accomplish the concept of assured mobility. In this case, knowledge of the terrain is part of the first of the four imperatives of the assured mobility concept. Our current organizational structure and materiel solution don't even come close to meeting this requirement. We can't rapidly generate data, and we can't manage data sufficiently.

- *Use of reach-back to minimize the footprint of deployed forces.* This requires robust home station operating centers (HSOCs) and high-capacity communications systems, plus the ability to fuse/conflate data from multiple sources. It also requires a capability to create a predictive geospatial tool that can be disseminated to soldiers for use in a stand-alone mode. None of these currently exist.
- *Emphasis on battle command.* Objective Force systems must have as their main focus the ability to support the commander wherever he may be to execute the art and science of command. Individual stovepipe systems will not work for the Objective Force. The current Army Battle Command System, which includes DTSS, does not meet this requirement. There must be organizational and system changes.

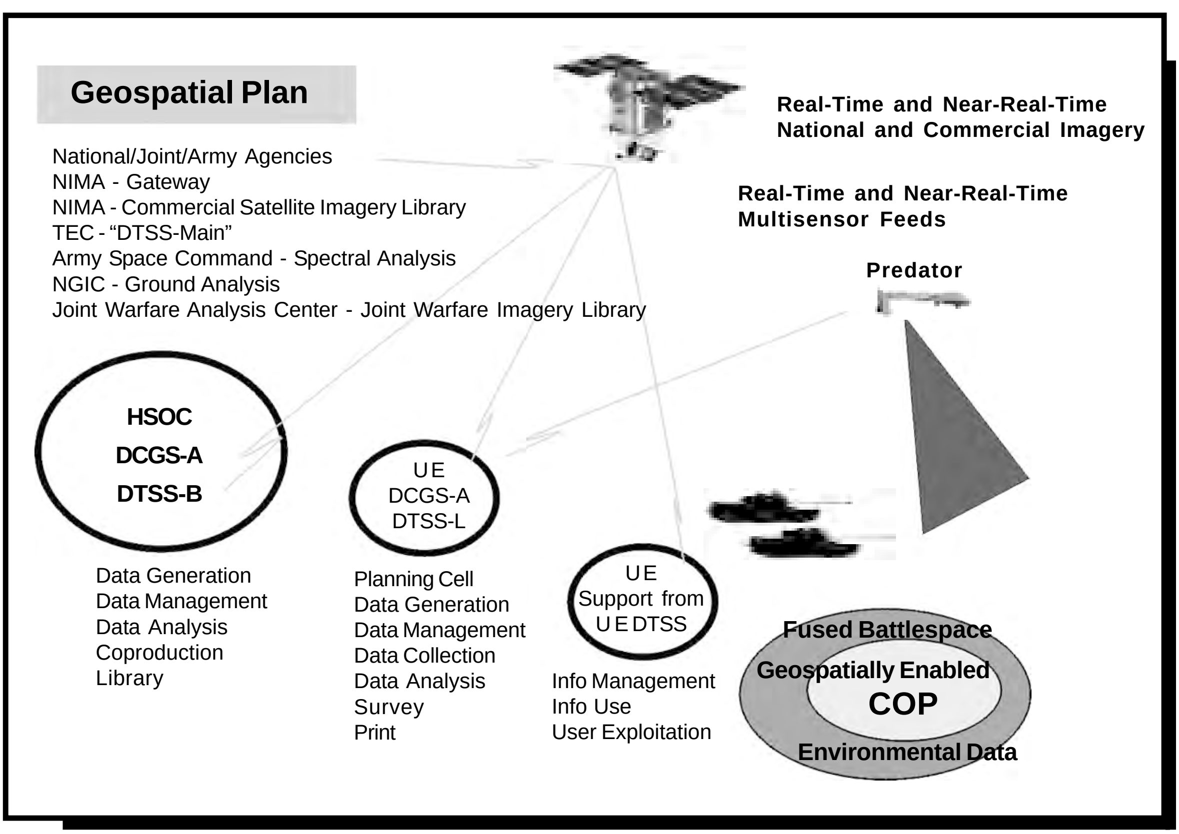
Objective Force Organization and Materiel Solutions

From the above, it is obvious that organizational and materiel changes are needed if the geospatial engineering community is to meet the requirements of both the current and Objective Forces. It is clear that the organization needed to support the Objective Force must have some capability at the unit-of-action (UA) level, a fairly robust topographic capability at the unit-of-employment (UE) level, and a very robust capability at the HSOC level. The organization must enable the critical missions of data generation, management, analysis, survey, and printing. The figure below shows the operational architecture that we believe is needed to make this work.

Table 1, page 32, shows the major teams that we envision will be put together as modules that will be able to execute at the UE and be plugged into the UA, should it need augmentation. Also shown is a geospatial planning cell at theater level that will have all of the capability needed for the entire theater (such as database management, conflation, and generation).

As far as the HSOC is concerned, we envision the Army's Topographic Engineering Center (TEC) at Alexandria, Virginia, as being the premier geospatial engineering center of excellence. However, TEC's current organization would need to be greatly expanded in size and capability to meet the Objective Force HSOC requirements.

The Objective Force will also require major upgrades to our primary system—the DTSS. This system, which we currently call DTSS-Objective Force (DTSS-OF), must be able to rapidly generate data from numerous sensors and sources, to include sensors in unmanned aerial vehicles (UAVs) and satellites and data sources from NIMA; the National Ground Intelligence Center (NGIC), Charlottesville, Virginia; TEC; etc. The Objective Force system must rapidly generate whatever data it needs to support specific missions. All this must be semiautomated in gathering data from whatever source is available, generating the data, and providing the smart geospatial database (logic



Geospatial Structure Based on Small-Unit Modules	
Geospatial planning cell	HSOC (joint-land component commander level) Theater
Geodetic survey	(UE level) Corps
Geospatial data collection/ cartography/printing	(UE level) Corps
Data generation	(UE level) Division
Data management	(UA and UE levels) Brigade
Geospatial analysis	(UA and UE levels) Brigade

Table 1

DTSS-OF Major Requirements/Capabilities
■ Precision push of terrain information/intelligence to user
■ Exploitation down to user/command and control system (command/joint mapping tool kit [C/JMTK]) by applets (terrain reasoning)
■ Advanced inputs and outputs
■ Intuitive visualizations
■ Position navigation (POS/NAV) enabler
■ Autonomous operations with little human intervention
■ Predictive terrain analysis (course of action analysis, planning)
■ Reach enabled; auto data mining (brilliant pull)
■ Virtual/simulations data driver (battle simulation, mission rehearsal)
■ Auto filtering and scaling of information
■ Wireless
■ Mounted and/or dismounted
■ Artificial intelligence
■ Generation of responsive terrain information (Multispectral Scanner and Data System [MSDS])
■ Conflation of MSDS and national readiness terrain information
■ Connectivity to the intelligence community (NIMA, NGIC, National Astronomy and Ionosphere Center [NAIC], National Reconnaissance Office [NRO])
■ Integration of output with DCGS-A (IGI)
■ Leverage of Army Space Command – commercial imagery
■ Exploitation of all sources and sensors
■ Addition of new data types (ground photo, video, audio)
■ Sensor tasking and control
■ Data collection, including sensors and platforms (engineer-dedicated UAV feeds)
■ Update of terrain information
■ Certification and control of terrain information sets to guarantee a COP
■ Map service responsibilities
■ Geospatial database and products database
■ Ability to perform at joint level when command-designated as joint task force
■ Builder of exploitation applets
■ Adaptive/complex analysis
■ Overlay early warning/threat/environment (weather) impacts

Table 2

"network") that will eventually be sent to each system platform. It must seamlessly provide data to other Objective Force systems, such as the Distributed Common Ground System-Army (DCGS-A), the Objective Force Battle Command System, and the Future Combat System. This Objective Force geospatial system will provide unparalleled capabilities to understand the terrain and provide the foundation for the Objective Force common operational picture (COP). Table 2 shows the major requirements of the Objective Force geospatial system.

Conclusion

In conclusion, the transformation of geospatial engineering began in the late 1990s with the fielding of the DTSS and the increase in size of the geospatial teams. This transformation has already brought great success in current operations. However, the current DTSS and organization structure still does not meet all of the requirements that will be needed to support the Objective Force. The organizational and materiel solutions presented in this article will serve as the road ahead in overcoming these deficiencies and allow the Objective Force to see first and understand first. Additionally, we will develop the changes in doctrine, training, leader development, and facilities needed to bring about those solutions. Our efforts will be closely coordinated with those of other members of the community (such as NIMA, the Battle Command Battle Laboratory, the Military Intelligence School, and TEC). The future of the geospatial community and the Engineer Regiment has never been brighter.

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Major Herrmann is the command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) project leader for the materiel team, Directorate of Combat Developments (Engineer Division), U.S. Army Maneuver Support Center, Fort Leonard Wood, Missouri. He holds a master's in business administration from Indiana University of Pennsylvania.

Terrain Visualization Systems: Rapid Path to Terrain Understanding

By Mr. Ken Bergman

In the mid-1990s, an Army warrant officer in Korea flew his helicopter north of the demilitarized zone and was shot down. He flew north of the border because he was unfamiliar with the terrain, and he became lost. Joint Task Force –Korea responded by purchasing a mission-rehearsal system called Tactical Operational Scene (TOPSCENE™), a software package that used elevation data with imagery draped over it to provide a three-dimensional (3-D) terrain fly-through, with annotations and labels on key terrain features. The software facilitated night flying because it showed scenes as they would appear using night-vision goggles. The system provided Army helicopter pilots the technology to rehearse missions in Korea many times before ever getting into the cockpit. The Army paid about half-a-million dollars for this high-end TOPSCENE capability, which was supported by a refrigerator-sized workstation. Databases had to be built and maintained by contractors. Although terrain warrant officers could update the databases, this required nonstandard training, and rotation of trained personnel made in-house database generation a challenge. However, the capabilities gained by having this system at Joint Task Force–Korea were extremely useful.

The cost of computers has decreased significantly, and many high-end Unix®-based workstations have been replaced by Windows®-based personal computers (PCs). Today's high-end laptop can easily compare with yesterday's refrigerator-sized workstation in terms of processing capability and speed. Software has rapidly evolved to leverage the new, powerful PCs. There are now literally hundreds of terrain visualization systems that use imagery draped over elevation data to provide 3-D terrain fly-through capabilities.

Terrain Visualization Systems Capabilities

Terrain understanding is a key aspect of warfare. Thousands of years ago, Sun Tzu said that knowing the terrain is a significant advantage on the battlefield. This axiom has not changed. Tactical decision aids built by the Digital Topographic Support System (DTSS) are very useful tools to achieve terrain understanding; for example, the modified combined-obstacle overlay is a tool that is familiar to all topographic engineers. Tactical decision aids are typically used in a two-dimensional (2-D) presentation, either digitally or as hard-copy products. Terrain visualization systems, on the other hand, provide a bird's-eye view of the terrain, to give the user another way to achieve terrain understanding.

Terrain visualization systems use elevation data to provide a basic understanding of the lay of the land (such as hills, valleys, plains, and escarpments). More detailed elevation data provides a better terrain understanding, but it also requires higher data storage and processing capabilities. Imagery or digitized raster maps are draped over the elevation data to display terrain features. As with elevation data, more detailed imagery provides better terrain understanding, but this comes with a data storage and processing cost.

Many terrain visualization systems have additional capabilities:

- Display radar domes and surface-to-air missile threat domes.
- Drape vector (feature) terrain data over elevation data and imagery.
- Add landmarks and signposts for improved orientation.
- Page in more detailed images or maps as you fly closer to the ground.
- Extrude (stand up) buildings to show detailed urban terrain data.
- Render the scene to look like a night-vision or infrared scene.
- Export stand-alone files to any PC for 3-D fly-through capability.
- Interface with battle command systems.

The last two points listed here merit some elaboration, since they are key aspects in the utility of terrain visualization systems.

Export Stand-Alone Files to Any PC

This aspect refers to the recent phenomenon of high-end terrain visualization systems being able to export a file that can run without any software license support. Figure 1, page 34, shows five leading terrain visualization systems that are being used in the field. DTSS Imagizer, TerraExplorer®, and TerraVista® are systems that are capable of exporting stand-alone files to "any PC" (for example, a mainstream Pentium® computer purchased in the last couple of years). The process of building and using terrain visualization data in Figure 1 starts with *source data* (elevation, feature, and urban data and imagery), *data preparation* (processing the data to provide a smooth fly-through), *viewer* (type of file or software used to display the data), and *data interchange* (data

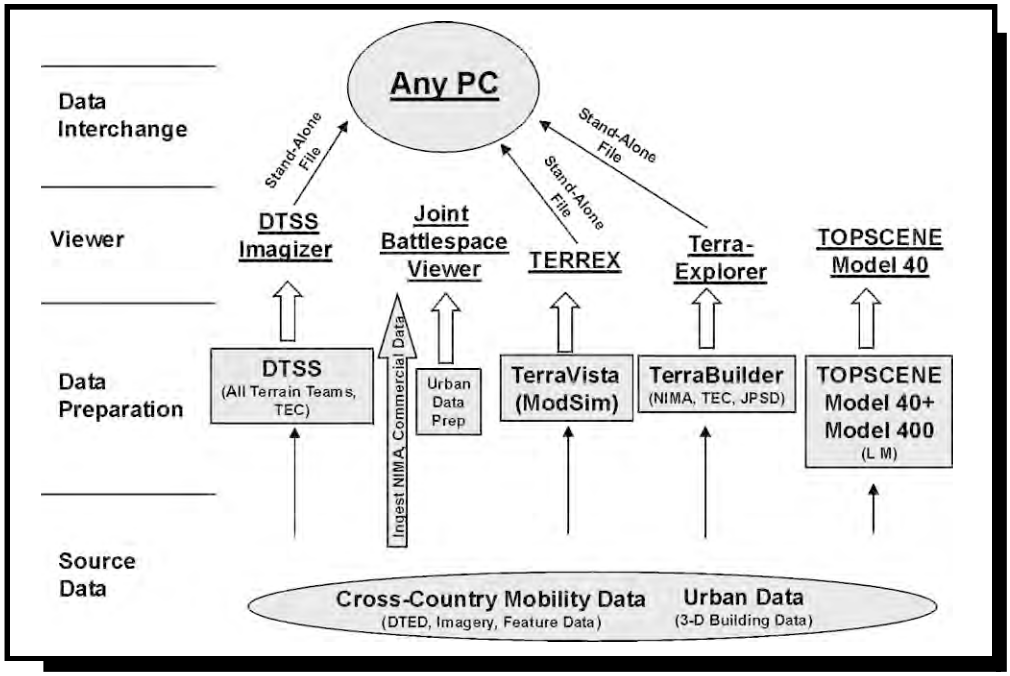

Figure 1. Export Stand-Alone File to Any PC

interoperability from the system to other systems). The capability to export stand-alone terrain visualization files makes it possible to provide unlimited copies of compact disks (CDs) or digital video disks (DVDs) to soldiers, who can load the files on their laptops at no cost. This is a huge technology breakthrough that the Army needs to leverage more effectively.

Interface With Battle Command Systems

Interoperability with battle command systems is another key capability for terrain visualization systems. The acquisition community has developed the Army Battle Command System (ABCS) to achieve command and control in the field. Windows-based systems in the ABCS can use stand-alone 3-D fly-through files (see Figure 2). This figure also shows that products from DTSS can be exported to ABCS workstations using the DTSS overlay provider.

The ABCS is being fielded to numerous units, but fiscal limitations have precluded fielding to all units. Some field units have obtained systems on their own to achieve battle command functionality. Command and control personal computer (C2PC) is a popular government off-the-shelf (GOTS) battle command software package being used by the Army. It uses the media gateway controller (MGC) or "magic" file to display overlays (such as fire support control measures). The Advanced Deep Operations Command and Control System (ADOCS), another popular GOTS battle command system (see Figure 3), can be used to ingest shape files from the DTSS and export MGC files to C2PC. A new software patch in the DTSS enables direct export of MGC files from DTSS to C2PC.

Terrain Visualization Categories

Terrain visualization data can be categorized into two types:

Cross-Country Mobility Data

This terrain visualization data is derived by draping imagery or digitized maps over elevation data. There is some level of elevation data and imagery available over the entire planet, and it is possible to provide some rudimentary level of terrain understanding anywhere in the world.

Urban Data

Urban data is built by extruding buildings, based on an estimation of building heights from image shadows, blueprint

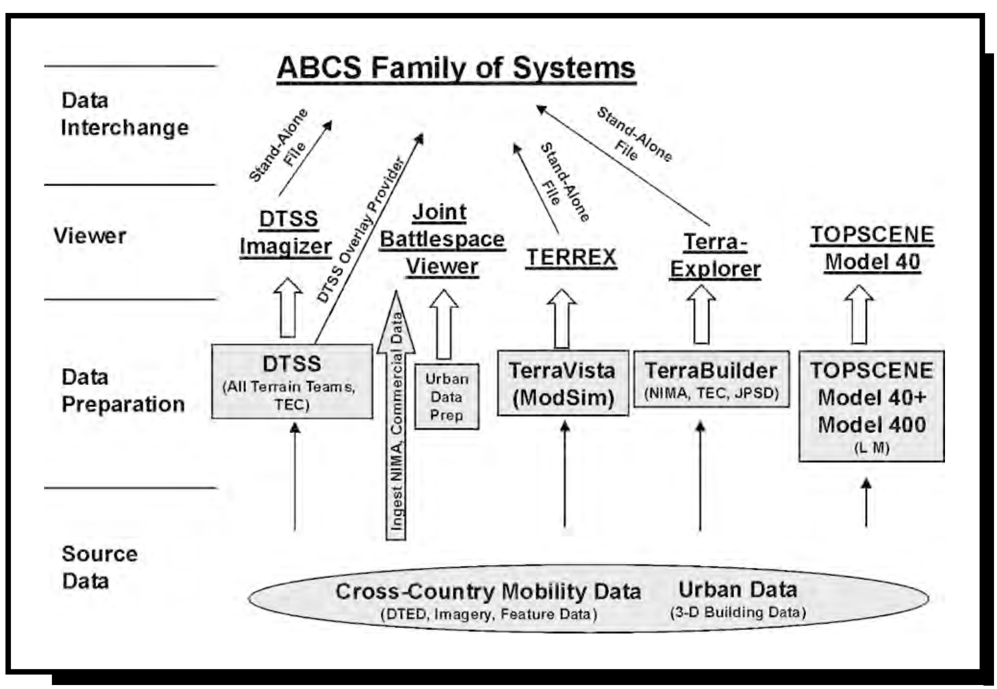

Figure 2. ABCS Terrain Visualization Data Flow

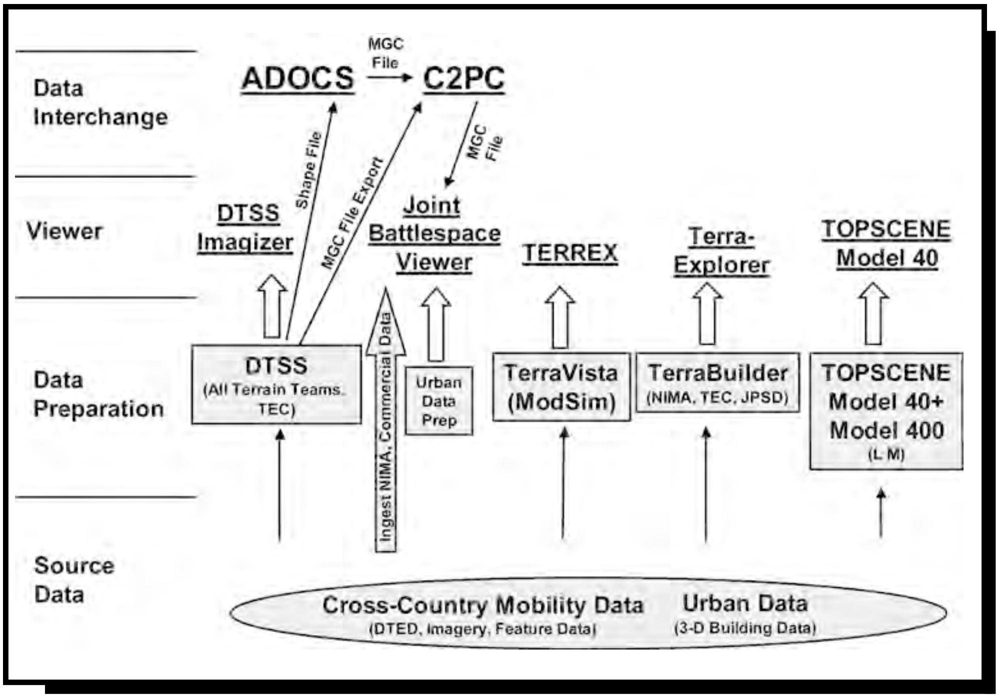

Figure 3. C2PC Terrain Visualization Data Flow

data, or stereo photogrammetry. These are all slow, labor-intensive processes. The only other way to get accurate urban data is to fly a light-detection and ranging sensor over the city to obtain detailed elevation data (1 meter post spacing). Although it is presently not possible to collect urban data using active sensors over denied areas, programs are underway to achieve this capability using unmanned aerial vehicles.

Low-End Software Packages

There are many low-end terrain visualization systems that are free. These systems provide a basic capability to build a 3-D terrain fly-through, but without the impressive visualization capabilities of more powerful high-end systems. TerraBase software, which is trained at the U.S. Army Engineer School at Fort Leonard Wood, Missouri, provides a basic 3-D terrain visualization capability. This GOTS software can be downloaded from the Engineer School Web page (*http://www.wood.army.mil/tvc/DefaultPageContents/MicroDEM_TBII.htm*) for free. TerraBase also provides a variety of other basic geospatial functions. FalconView™ is another free GOTS package that is popular with many users in the field; it is often used in conjunction with C2PC.

High-End Software Packages

More powerful software packages incorporate advanced aspects of terrain visualization. The following systems are currently being used by Army units in the field:

DTSS Imagizer

DTSS software now has the capability to generate the Earth Resources Data Analysis System (ERDAS®) Imagizer file, which can be exported to laptops and PCs as a stand-alone capability. Once the Imagizer 3-D fly-through has been generated on DTSS, it can be disseminated to as many users as needed—for free. Additional tools will be available on the Imagizer file, to include terrain analysis tools, simultaneous 2-D and 3-D displays of detailed data, and the ability to add (ingest) more products. Imagizer will use the Virtual World file generated for the DTSS Virtual Geographic Information System (VGIS®), so terrain analysts are already trained to build data sets. Most PCs can run the Imagizer stand-alone file, but at least a 36-megabyte graphics card is recommended. The DTSS is designed to be compatible with systems in the ABCS architecture. Marine Corps teams are also likely to have this software in the near future, since the DTSS and the Marine Corps topographic production capability have the same basic software architecture.

Joint Battlespace Viewer (JBV)

This free GOTS software, developed by the Navy, requires a PC with a 128-megabyte graphics card. It is capable of using multiple resolutions of imagery and digital raster maps. As the user flies closer to the earth, higher-resolution imagery or map products are displayed automatically. The JBV was designed to have good interoperability with C2PC. Army users who need to achieve data interchange with C2PC have shown a high level of interest in the JBV, which can only use Digital Terrain Elevation Data (DTED) Level 1.

TerraVista®

This system is typically associated with modeling and simulation; however, it is relevant to terrain visualization in that it can be used to build detailed urban terrain data for export as a stand-alone file and also for export as source data for other terrain visualization systems. This is the type of data interchange capability that is needed in a world where different systems are being purchased by field units.

TerraExplorer

This system is used to build large terrain databases that can be displayed on most modern PCs. It can display hundreds of miles of data at varying levels of imagery and elevation resolution, with a "seamless" fly-through. It is very simple to install and use. A key benefit of TerraExplorer is that it can be exported to as many users as necessary, limited only by the file size or the number of CD or DVD copiers available. Another aspect that is unique to this system is its capability to support Web-streaming video. This means that the 3-D terrain fly-through can be achieved remotely using a Web browser. The National Imagery and Mapping Agency, the Engineer Research and Development Center-Topographic Engineering Center (ERDC-TEC), and the U.S. Army Joint Precision Strike Demonstration Program Office are using this system to provide terrain visualization capabilities to a wide variety of users.

TOPSCENE

As mentioned at the beginning of this article, TOPSCENE has been used for many years by Army units to achieve high-end terrain visualization capabilities. Costs can be relatively low ($1,000 - $5,000 for each viewer software license) or very high (hundreds of thousands of dollars for the top-level data generation hardware and software). Lockheed Martin Corporation builds the database in a company-proprietary format. Soldiers in the field can update and modify the data by purchasing a midlevel capability to edit the data sets. System capabilities include the infrared and night-vision rendering of a scene and data interchange in a number of formats. The Lockheed Martin data sets built under contract to other Department of Defense users can be obtained for use on TOPSCENE-licensed workstations.

Data Interchange

There is a need for data interchange among the various terrain visualization systems that various units have purchased. The costs associated with building and processing a terrain visualization database can be very high. This is particularly true for generation of detailed 3-D features (such as urban buildings). Contractors and government agencies that build terrain visualization data would serve the needs of the Army best if their data could be used by more of the systems in the field. Limited resources for the production of this data could be conserved by data reuse. If a unit built a terrain database over its immediate area, then adjacent units and higher headquarters could use the same data even if they had different terrain visualization systems.

One of the goals for the Objective Force is to have battle command, modeling and simulation, and mission planning and rehearsal systems—all using the same data. The best way to achieve this is to begin using interchangeable data formats that are commonly accepted. OpenFlight® is one example of a terrain data format for 3-D terrain data interchange in the modeling and simulation community. OpenFlight files can be exported from TerraVista and TOPSCENE. Another interchange format that the modeling and simulation community uses is Synthetic Environment Data Representation and Interchange Specification (SEDRIS™), which contains more detailed terrain information than OpenFlight. TerraVista and TOPSCENE can import and export SEDRIS files. Other commercial standard formats are used to represent imagery, elevation, and feature data. DTSS, TerraVista, and TOPSCENE can import and export data in commercial formats. TerraExplorer and JBV can ingest commercial-format terrain data. The use of common terrain data formats must be increased to achieve data interchange for terrain visualization systems.

Nonstandard System Considerations

When field units purchase nonstandard systems, they enhance their capabilities immediately. However, at least one soldier must start performing tasks that were not established by U.S. Army Training and Doctrine Command (TRADOC) schools through the requirements process. Training and maintenance of the system is a task set that is added as a collateral duty, or the new tasks take the place of tasks that the soldier was performing before. A couple of systems added to the unit can improve operations, but the addition of *many* nonstandard systems can become a problem for individual units and for the Army in terms of training and interoperability and achieving common tactics, techniques, and procedures.

The Army's doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) must be adjusted to keep units compatible and interoperable. The TRADOC Program Integration Office for Terrain Data (TPIO-TD) at Fort Leonard Wood, Missouri, is conducting an assessment of terrain visualization systems in conjunction with the ERDC-TEC, the Engineer School, and the TRADOC Battle Command Training Program to address DOTMLPF issues.

Conclusion

Terrain understanding is a fundamental ingredient for success on the battlefield. Soldiers are increasingly using 3-D terrain visualization systems to show the "lay of the land," primarily using elevation data and imagery. The rapid advancement of computer technology and emerging terrain visualization technologies have made it possible for any soldier with a PC to achieve rapid terrain understanding. The Army uses standard systems provided through the acquisition cycle to meet the terrain visualization needs of field users. Field units are also acquiring nonstandard capabilities to augment standard systems and meet their immediate needs. The Army must address DOTMLPF and interoperability issues associated with these emerging capabilities in order to effectively manage the use of standard and nonstandard terrain visualization systems on the same battlefield.

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Correction: The January-March 2003 issue—which was labeled as Volume 32, PB 5-03-1—should have been Volume 33, PB 5-03-1.

Brigade Returns to USAREUR After 11 Years

By Mr. Arthur McQueen

Note: This article is a reprint from a U.S. Army Europe (USAREUR) News Release from 21 January 2003.

Campbell Barracks, Heidelberg, Germany—The 18th Engineer Brigade (Theater Army) was reactivated 21 January here in a ceremony attended by more than 150 people.

USAREUR Chief of Staff Major General Anthony R. Jones unfurled the colors of the brigade, cased in 1992 at another ceremony just 50 kilometers away in Karlsruhe, Germany.

Jones presented the colors to the new commander, Colonel William H. McCoy, Jr., who also serves as USAREUR's Deputy Chief of Staff, Engineer. McCoy then passed them to Engineer Regimental Command Sergeant Major William D. McDaniel, Jr., for inclusion in the color guard.

McCoy told the attendees the brigade will be at full strength by the end of the year and praised the efforts of the USAREUR staff and others who made the reactivation possible. McCoy challenged his soldiers to be "ready to deploy, tactically and technically proficient." He told USAREUR Commanding General B. B. Bell, "Sir, we are ready."

Specialist Abraham Santana was picked by his first sergeant to be the first soldier to receive and carry the colors. "It's really an honor to carry this flag because of the Army tradition behind it."

The 18th Engineer Brigade, whose motto "Essayons" means "Let us try," has a history dating back to 1921 when it was constituted as the 347th Engineers (General Service) as a reserve unit. It entered active service on 6 May 1942 and entered combat on 29 June 1944, in France.

The brigade was inactivated and reactivated several times prior to July 1965, when it was reactivated and moved to Vietnam. The brigade constructed everything from depots to seaports and airfields to orphanages throughout central and northern Vietnam. It won four meritorious unit commendations and one Republic of Vietnam civil action honor medal, first class, prior to inactivation in 1971.

USAREUR benefited from 15 years of service by the 18th Engineer Brigade, from 1977 to 1992. The brigade provided rail and sea deployment support to the VII Corps and deployed a combat heavy battalion and topographic company to support operations in southwest Asia.

The brigade also coordinated all engineer efforts of a joint and combined engineer force, providing construction and relief support to Kurdish refugees during Operation Provide Comfort. It was last inactivated as part of the reduction of forces in Europe on 15 October 1992.

Mr. McQueen is a public affairs specialist with Headquarters, USAREUR and 7th Army in Germany.

Photo by Arthur McQueen

Colonel William H. McCoy, Jr. (left) passes the just-unfurled colors of the 18th Engineer Brigade (Theater Army) to Engineer Regimental Command Sergeant Major William D. McDaniel, Jr. (right).

Forging the Environmental Ethic:

Transforming the Army through Environmental Stewardship

"An important part of the Army's Transformation is our continued emphasis on caring for the training lands that sustain and enable Army readiness."

—General Eric K. Shinseki
Chief of Staff of the Army

By Mr. Daniel Taphorn

Most soldiers will agree that the environment is important, but few understand the wide range of issues that make environmental stewardship critical to the military and society at large, particularly in light of Army Transformation initiatives. The ever-increasing need for a collective military environmental consciousness is driven by factors today that directly affect military readiness. It is a combination of these factors and others that helps forge an environmental ethic in soldiers at all levels. For example, knowing the consequences of environmental law violations, understanding the health implications of environmental pollution, and realizing the impact of the environment on military training are just a few of the forces that shape the environmental ethic. Readiness and environmental stewardship are inextricably tied together, and as such, a strong environmental ethic in soldiers will be critical to ensuring that the Army is ready to fight the nation's future wars and win decisively.

Soldiers today are fully engaged, many in the global war on terrorism, and spread out internationally across some 120 countries. Transformation is also increasing the demand on soldiers, requiring them to be smarter, faster-thinking individuals who can operate in extraordinarily complex, asymmetric, and dangerous environments and apply knowledge in increasingly varied and unique situations. In light of these challenges, it is not surprising that soldiers today focus on little more than compliance, to speak nothing of environmental stewardship. One might argue that stewardship of any type must stem from an ethic or set of guiding moral principles or values in order to be truly meaningful. Stewardship thus transcends mere compliance, and it is when environmental protection becomes part of one's system of beliefs that real, meaningful stewardship begins. This paradigm shift in the way soldiers approach the environment will likely be a precondition for Objective Force realization and a key

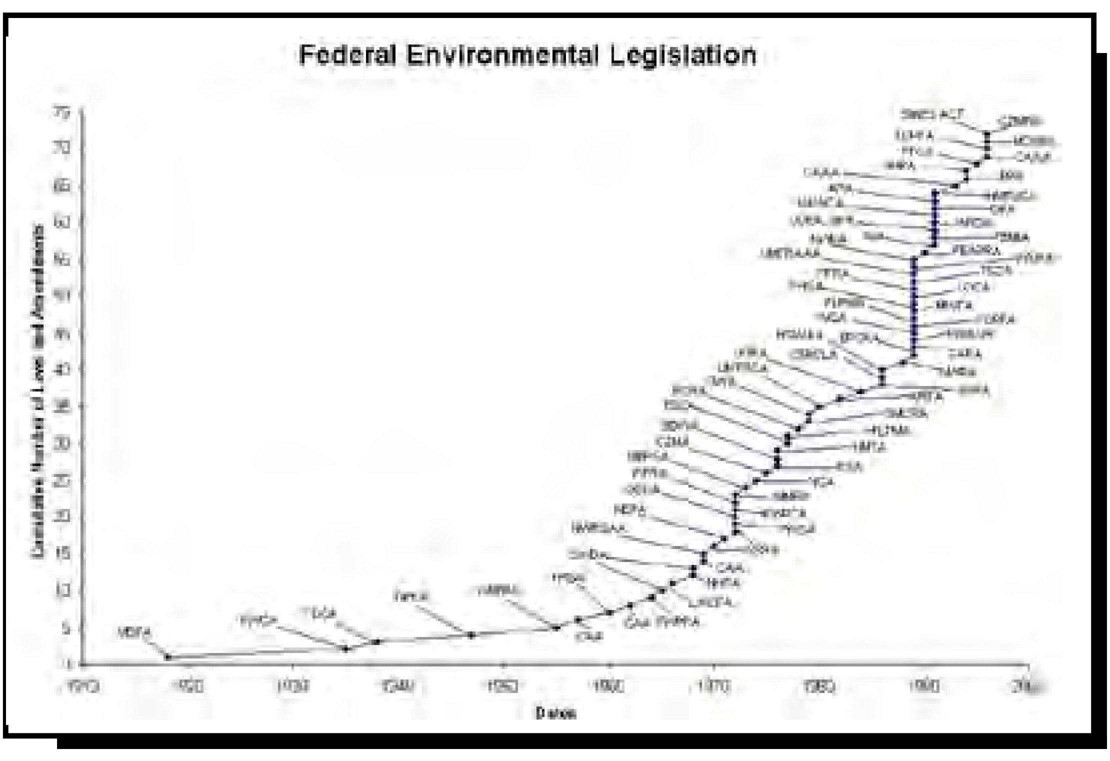


Figure 1

component of Army Transformation if the Army is to maintain a strong readiness posture and climate as a values-based institution.

As an evolutionary phenomenon, the development of environmental stewardship is a relatively new occurrence. When put in perspective, the passing of U.S. federal environmental legislation supports this assertion. It has only been in the last few decades that a national environmental consciousness has matured to a point that obliged the passing of what is the majority of environmental federal legislation in existence today. This has resulted in a 400 percent increase in federal environmental legislation passed in the last 33 years over the amount passed in the first 183 years of U.S. history (see Figure 1). To say that the military has been operating under the guise of such legislation since World War I would be a gross fabrication. Even the amount of environmental legislation that existed during the Korean and Vietnam conflicts represents less than a third of the legislation that exists today. Furthermore, it was not until the passing of the Federal Facilities Compliance Act (FFCA) in 1992 that state and local governments could impose fines on Department of Defense (DOD) facilities for noncompliance with environmental laws and regulations. The FFCA also established criminal liability against federal employees who violate federal and state hazardous waste legislation. While the Army has done well to comply with these laws (reducing the number of environmental fines imposed by the federal and state governments over the past several years, going from 58 fines in 1993 to 16 in 2002 and from 307 enforcement actions to 106 over the same period), the impact of growing and existing legislation is hampering military readiness more and more each day. This legislation boom—coupled with other encroachment considerations (the cumulative and aggregate effects from environmental regulation and urbanization that restricts or encroaches on the ability to train on installations)—and Objective Force operational requirements are having a detrimental impact on the conduct of realistic training by creating unacceptable levels of artificiality.

Urban sprawl has contributed to several of the encroachment problems DOD is facing today. During World Wars I and II, military installations were constructed in relative isolation to support the training of a much larger military. Over the last half century, urban sprawl has pushed communities up against installation borders, resulting in an increase in civilian complaints due to live-fire exercises and aircraft noise, smoke, and dust caused by maneuvers. In some cases, installations have self-imposed restricted training hours to pacify disgruntled citizens. Additionally, urban development has continued to eliminate the natural habitats of threatened and endangered species surrounding installations. As a result, these species are forced onto installations, turning these training areas into "islands of biodiversity," which generate further training restrictions for units. Consequently, there are more than 150 endangered species residing among 94 U.S. Army installations today. Figure 2 portrays this and several other environmental variables that contribute to the degradation of a unit's ability to train.

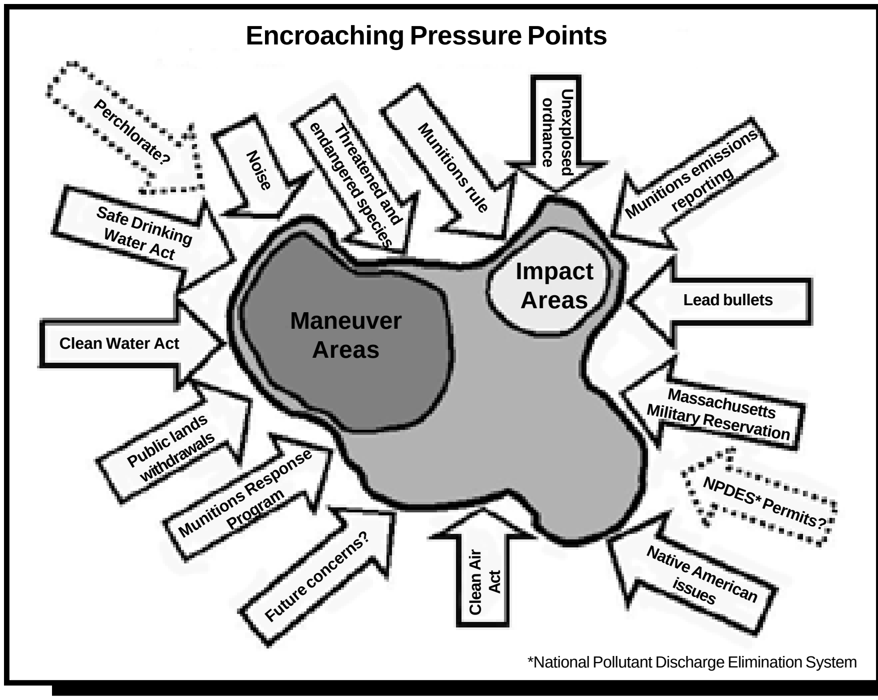


Figure 2

Urban sprawl is affecting installations in other ways. Natural resources are being consumed at a rate that stresses installation capacities. For example, Fort Bragg, North Carolina, has experienced water shortages from the increasing consumption of the growing, upstream Raleigh-Durham community. Additionally, the industry and population growth in North Carolina has resulted in more stringent air quality requirements. Regional shortfalls in complying with Clean Air Act (CAA) standards may further restrict training, construction activities, and transportation.

Objective Force operational requirements are also exacerbating the situation. Doctrinal distances for operating maneuver units are expanding from about 96 square kilometers (km^2) during World War II to an operating area of about 2,500 km^2 for the Stryker Brigade Combat Teams (SBCTs). Consequently, the Army today is faced with the dilemma of exploring ways to sustain the Objective Force, with its known and still developing doctrinal requirements, in an increasingly restrictive training environment. The situation at Fort Hood, Texas, illustrates the encroachment problem. Of the some 185,000 acres of training land, only 16 percent (or roughly 30,000 acres) is restriction-free throughout the year. The white areas on the Fort Hood map in Figure 3, page 40, represent training areas without encroachment-related restrictions. The

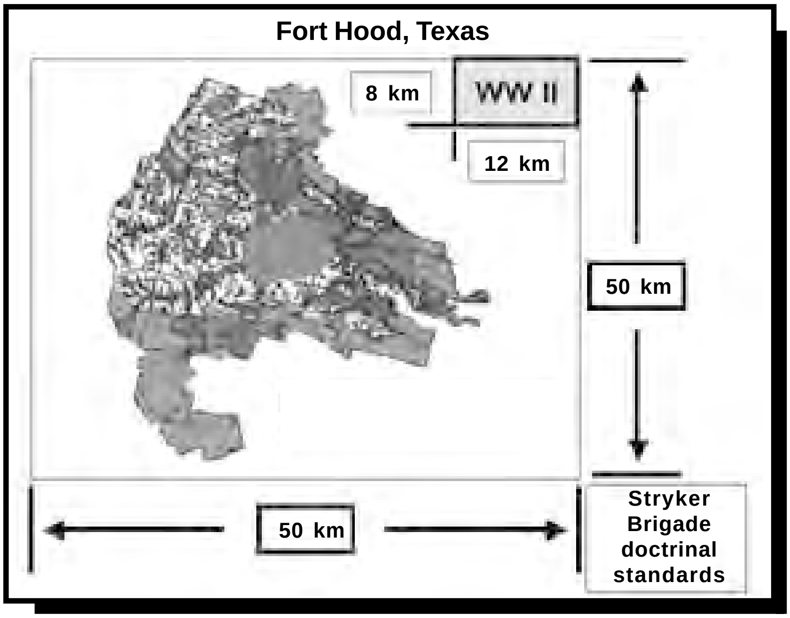


Figure 3

Achieving these objectives will be an arduous task—one that lends greater credence to the importance of an Armywide environmental ethic.

To promote the environmental ethic in support of Army Transformation, in 2000, the Vice Chief of Staff of the Army designated the U.S. Army Engineer School as the proponent for integrating environmental consideration across doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) and into military operations. On behalf of the Engineer School, the Directorate of Environmental Integration (DEI) has since developed several training products (such as resident courses and distance learning products like Army Correspondence Course Programs and Graphic Training Aids) and doctrinal publications such as FM 3-100.4, *Environmental Considerations in Military Operations*. Additionally, DEI incorporates pollution prevention initiatives into the materiel requirements determination and development process to maximize efficiency and minimize pollution throughout a system's life cycle. This represents some of the DEI initiatives that promote Army environmental stewardship in direct support of Army sustainability initiatives.

figure also depicts the doctrinal change in operating areas from the U.S. Army of World War II (96 km^2) to the new requirements of the SBCT (2,500 km^2).

The concept that addresses environmental issues and others is *sustainability*. Not to be confused with the operational term *sustainment* as defined in Field Manual (FM) 3-0, *Operations*, or Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, sustainability (or sustainment) in the context of transformation is a comprehensive approach that brings all Army resources to bear on achieving readiness. As such, initiatives like the Sustainable Range Program and Installation Sustainability Program are at the forefront of Army efforts. Transformation of Installation Management (TIM) realigns installations into seven regional directorates as part of the Installation Management Agency under the Office of the Assistant Chief of Staff for Installation Management. TIM creates a more efficient, businesslike structure and supports these sustainability initiatives. In short, sustainability is about—

- Creating efficiencies that reduce waste.
- Reducing dependence on nonrenewable resources.
- Enhancing productivity.
- Lowering system life cycle costs.
- Decreasing the environmental impacts on training and the potential for fines.
- Creating mutually beneficial relationships with local communities.
- Enhancing the well-being of soldiers and civilians.
- Optimizing the ability to conduct realistic training in support of readiness.

An event that will soon be a benchmark of the Army's environmental stewardship posture is the implementation of an environmental management system (EMS). Required by Executive Order 13148, each federal agency will be required to implement an EMS at all appropriate facilities by 31 December 2005. EMS (as defined by International Organization for Standardization [ISO] 14001) is "the part of an overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining environmental policy." ISO 14001 does not define absolute requirements for environmental performance. Instead, it requires a commitment by the organization to continuous improvement. Since the goal is for improved environmental performance, the ISO 14001 methodology involves integrating effective management mechanisms into the management structure of the organization. There are five essential and auditable elements of an ISO 14001-compliant EMS. They include environmental policy, planning, implementation and operation, checking and corrective action, and management review.

The benefits of the Army's EMS directly support many activities on sustainable installations, and the areas that EMS has the potential to positively affect are abundant. The EMS will improve the forecasting ability of installation leadership in identifying environmental issues, allowing leadership to take proactive steps toward addressing these issues rather than reacting to them. It will facilitate Army Transformation by protecting training and maneuver areas. The EMS will also enhance the well-being of Army soldiers, civilians, and families through more robust management of environmental health issues. It will facilitate compliance with the law and will help foster a climate of environmental stewardship. For example, in a post-September 11 world, the EMS will facilitate faster, more prepared responses to environmental modification threats on sensitive U.S. targets (such as attacks on power plants, wastewater treatment plants, and industrial sites) through sound consequence management and planning as part of the global war on terrorism. As part of sustainable installations, the EMS will also contribute to cost savings by reducing waste and mitigating the risks that result in environmental fines. Undoubtedly, the EMS will play a vital role in the management of environmental issues during future base realignments and closures. By providing these benefits and others, the EMS will support unit training and readiness for decades to come. However, since an effective EMS feeds into the installation management structure, it will be soldiers and civilians at all levels who will feel the effects of the EMS and ultimately determine its success or failure.

While critical to readiness, environmental considerations do not cease to be important when units deploy on missions away from installation boundaries. Although installation environmental issues may seem administrative in nature, integrating federal, state, and local environmental restrictions into the military decision-making process while training directly supports real-world contingency planning across the spectrum of military operations. FM 3-100.4 is the U.S. Army and Marine Corps guide in applying appropriate environmental protection procedures during all types of operations. In it, an excerpt from Joint Vision 2010 states—

"The American people will continue to expect us to win in any engagement, but they will also expect us to be more efficient in protecting lives and resources while accomplishing the mission successfully. Commanders at all levels will be expected to reduce the costs and adverse effects of military operations, from environmental disruption in training to collateral damage in combat."

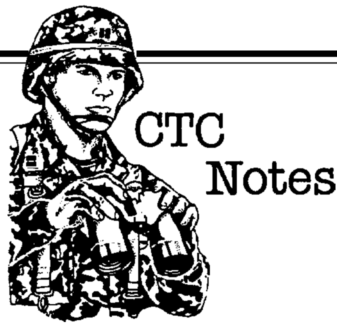
Increasingly, environmental considerations are playing a larger role in preserving mission legitimacy. A lessons learned publication for judge advocates, titled *Law and Military Operations in the Balkans, 1995-1998,* states that "Task Force Eagle noted that environmental considerations in peace operations are enormous because preserving the mission's legitimacy is as critical as combat readiness to overall success."

This bold premise, while sometimes disconcerting to warfighters, is often a defining characteristic of military operations other than war. Consequently, integrating environmental considerations across the spectrum of military operations, both vertically and horizontally, is critical to managing risk on today's asymmetric battlefield.

DOD and the Army have embraced environmental protection as both a necessary and an ethical responsibility to achieve sustainability and readiness. Environmental stewardship directly supports the Army Vision by protecting the natural resources that contribute to the health and welfare of our soldiers, families, and surrounding communities (people); providing forces with the land and resources necessary to conduct realistic training with minimal constraints (readiness); and transforming business processes through the implementation of an Army EMS. The EMS is a key component of sustainable installations and forging an environmental ethic in soldiers and civilians at all levels through the integration of environmental considerations across DOTMLPF (transformation). FM 3-100.4 affirms that "from every philosophical or moral perspective, environmental stewardship is the right thing to do." Department of the Army soldiers and civilians must support this cause, not solely based on the legal requirement to do so but because it is "the right thing to do." Understanding this moral imperative will foster the development of an environmental ethic and promote meaningful environmental stewardship.

Of the many uncertainties lingering in the future, one thing is clear: Environmental stewardship is and will continue to be part of the way the Army does business. Stewardship does not exist separate from the Army values of loyalty, duty, respect, selfless service, honor, integrity, and personal courage; rather, it is unequivocally bonded to each of them. Stewardship founded on a solid environmental ethic is an evolutionary process with the potential to reap huge benefits for installations and their surrounding communities. As institutional knowledge of the environment continues its accelerated growth, environmental considerations will play an increasingly important role throughout peace and conflict. It is the environmental ethic that facilitates the EMS. It is the EMS that supports sustainable installations. It is the sustainable installation that enables Army Transformation, and it is transformation—among other things—that will enhance readiness. While viewing these items linearly is helpful, it only partially represents what is an otherwise intertwined and difficult process. Environmental stewardship provides many benefits that extend beyond installation boundaries. Community goodwill and the enhanced prestige as the nation's defender are also benefits of military environmental stewardship. However, achieving sound environmental stewardship requires strong environmental leadership. As FM 22-100, *Army Leadership,* puts it, "Doing the right thing is good. Doing the right thing for the right reason and with the right intention is better." This will be the yardstick against which the Army and its soldiers will be measured, as the Army enhances combat readiness through early consideration and resolution of environmental impacts and transforms into the Objective Force.

Mr. Taphorn, a training analyst with Horne Engineering Services, Inc., works in the Training Division, Directorate of Environmental Integration, U.S. Army Engineer School, Fort Leonard Wood, Missouri. A former Army engineer captain, his assignments included S3, 554th Engineer Battalion, and platoon trainer, B/554th Engineer Battalion, Fort Leonard Wood, Missouri; and executive officer, HHT/2-17 Cavalry Regiment, and platoon leader, C/326th Engineer Battalion, Fort Campbell, Kentucky.



National Training Center (NTC)

Conventional Threat Antipersonnel (AP) Mines (OZM-3)

By Master Sergeant Mark A. Sankey

As NTC continues to implement the contemporary operational environment (COE), the Opposing Force (OPFOR) will also adjust its inventory of battlefield effects to match worldwide threats and challenge the rotational units. The OZM-3 marks the arrival of the AP mine to NTC. Units should realize that AP mines are a realistic threat and will be replicated during their rotations. Units do not train on or emplace AP mines but must react to their presence on the battlefield.

Capabilities

The OZM-3 can be detonated with a variety of fuses, including trip wires and electrical command. The mine weighs 3.0 kilograms and has a cylindrical cast-iron body that is sent into the air by a small charge at the base of the mine. Triggered by a delayed charge, the body of the mine explodes approximately 1.5 meters off the ground. The fragmentation results in a casualty radius of 25 meters. Because of its metal content, the OZM-3 can be readily detected by demining/detection equipment.

Actual (L) and training aid (R) OZM-3s

OZM-3 Characteristics	
Height	120 millimeters
Diameter	75 millimeters
Mine weight	3 kilograms
Explosive weight	75 grams TNT
Casing material and color	Olive-green cast-iron body
Fuse type	Mechanized utility vehicle (MUV) series,VPF, RO-1, RO-8, and electrical and seismic firing systems NM, MVE-72, and VP-4/12/13)
Sensitivity	As for each fuse
Detectability	Yes

Rules of Engagement (ROE)

There are no ROE changes to explosive- and mechanical-reduction techniques. For manual reduction, proper grappling techniques (according to FM 20-32, *Mine/Countermine Operations*) will result in the AP mines being detonated without casualties. Failure to adhere to this procedure will result in casualty assessment of the grappler. If a grappling hook hits a mine, the mine will be assessed as destroyed along with the grappling hook and a small portion of the grappling hook line. The assessment of the line will be based on the materiel type and how the line is laid near the mine.

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Engineer Support Area (ESA) Live Fire

By Major Gerald O'Connor and Captain Thomas D. Patton

For several years, the brigade support area (BSA) has conducted a defensive training event during the live-fire rotation. Other separate support elements have also had live-fire training events. Though these events have always been important, the asymmetrical threat posed by the COE has demonstrated the necessity of all elements. Throughout the depth of the brigade's area of operations, it is necessary to maintain a high level of protection. Starting this year, Force XXI unit ESAs and units with separate unit maintenance collection points can also take part in a live-fire defensive training scenario.

When reacting to a mounted and dismounted threat within the brigade rear boundary, units must defend their perimeter from a combination of light armored vehicles, dismounted soldiers, and aerial attacks. Units are required to analyze intelligence reports from higher headquarters, raise their readiness posture, and defend their perimeter from prepared fighting positions using individual and crew-served weapons, sector sketches, and fire control measures. As units defend their perimeter, they must evacuate casualties and conduct ammunition redistribution and resupply. This scenario gives soldiers greater confidence in their weapons proficiency and an ability to defend themselves from an attack.

Units wishing to take part in this training must meet the following requirements:

- They must request the ESA live fire in their 180-day letter to the NTC.
- Firing soldiers must have qualified on assigned weapons within 180 days of the live-fire event.
- They must complete the Dragon Team live-fire safety brief.
- Soldiers must be in flak vests and proper field uniforms.
- M2s must be screened according to the ROE, Chapter 3.
- They must complete a minimum of hasty fighting positions to standard for the firing soldiers.
- Fighting positions must have aiming stakes with methods to limit elevated fires over 45 degrees.

This event also requires resources from the brigade rotational ammunition allocation that is equivalent to the amount of Class V supplies currently used by engineers involved in the BSA live fire.

Suggested Ammunition Allocation

Department of Defense Identification Code (DODIC)	Nomenclature	Weapon	Number of Rounds
A557	.50-caliber 4:1 (M2)	M2, .50-caliber	300 rounds per M2
A059 or A064	5.56-millimeter ball 5.56-millimeter 4:1	M16	40 rounds per firing soldier
A062	5.56 4:1 squad automatic weapon (SAW)	SAW	200 rounds per SAW
A131	7.62-millimeter 4:1	240B	200 rounds per 240B

Units should coordinate for the ESA live fire with the Sidewinder Team at Fort Irwin during the leadership training program or in the brigade 180-day letter.

The ESA live fire gives rotational units a tremendous opportunity to focus on total unit protection and provide their soldiers realistic live-fire training.

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Wet-Gap Crossing

By Major Michael W. Rose and Captain James Koeppen

NTC has developed a river-crossing scenario for rotational units. Blue Force (BLUFOR) units may be required to conduct a river-crossing operation in order to deploy into its area of operations. In the scenario, the "Calusan Canal" is the main water source for "Irwin Military City," making it an environmentally and politically sensitive site. The canal is narrow enough to cross with an armored vehicle-launched bridge (AVLB), but in certain areas the water velocity exceeds vehicle-fording capabilities. Vehicles that enter the canal will be assessed as a mobility kill and will require recovery assets. After the brigade crosses the canal, it may request division assets to come forward and establish permanent crossing sites.

So that the scenario does not fall under the category of a true deliberate river crossing, units have at least three options when planning for the mission:

- Use the crossing fundamentals as outlined in FM 90-13, *River-Crossing Operations*.
- Use the breaching tenets covered in FM 3.34.2, *Combined-Arms Breaching Operations*.
- Use a combination of doctrine covered for both river-crossing and breaching operations.

Regardless of the technique used, there are four critical aspects that must be fully developed during the planning process:

Command and Control (C2)

Units must fully develop effective C2 to ensure a deliberate and coordinated effort in establishing river-crossing sites as well as managing traffic control and flow. One technique used recently was to have AVLB commanders report directly to platoon leaders, who acted as crossing site commanders at the call-forward area to control throughput from the call-forward area to the crossing sites.

Traffic Control

Detailed planning for traffic control must include routes used by separate task forces from the release line to holding areas, call-forward areas, and crossing sites. Integration of military police platoons is vital to marking routes and establishing and manning traffic control points. Ultimately, the goal is to enable the brigade combat team to rapidly reroute units if one or more crossing site becomes unavailable.

Communication

A solid communication plan will bring together the C2, traffic control, and throughput of the brigade across the canal. Although this list is not all-inclusive, you should ask yourself the following questions during the planning process:

- Who is controlling traffic from the release line to the staging areas and on what net?
- What net are the traffic control points operating on and to whom are they reporting?
- What nets are the crossing sites and call-forward areas operating on and to whom do they report?
- Who is tracking traffic flow at the task force and brigade combat team levels?

Risk Management

Most brigade combat teams have not crossed an entire team across AVLBs. This makes it essential to conduct proper risk management at all levels. Using AVLBs during rehearsals in the rotational unit bivouac area (RUBA) is one mitigation technique. Inspecting and configuring equipment at the call-forward area, as well as briefing vehicle crews on AVLB crossing procedures, is also a way to mitigate risk during the operation.

Summary

The canal-crossing scenario at NTC provides units an opportunity to plan and execute a realistic gap-crossing operation and develop tactics, techniques, and procedures addressing critical issues that are likely to be encountered in real-world contingencies.

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Joint Readiness Training Center (JRTC)

Engineer Participation in the Targeting Process

By Captain Mark C. Quander

Today, we face a more asymmetric threat than in the past. The enemy does not look like a conventional force and has become more unpredictable and more lethal. As we adapt, commanders at all levels will have greater challenges in focusing combat power effectively against these forces. Failure to do so can be perilous. However, a process already exists to assist the commanders and staff in focusing combat power to win decisively—the targeting meeting. A successful targeting meeting requires active participation from all members of the Battlefield Operating System. The following paragraphs describe how engineers take an active role in targeting:

Why Targeting?

FM 6-20-10, *Tactics, Techniques, and Procedures for the Targeting Process*, states—

"The targeting process supports the commander's decisions. It helps the targeting team decide which targets must be acquired and attacked. It helps in the decision of which attack option to use to engage the targets. Options can be lethal or nonlethal and/or organic or supporting. For example, they can be maneuver, electronic attack, psychological operations (PSYOP), attack helicopters, surface-to-surface fires, or a combination of these. In addition, the process helps in the decision of who will engage the target at the prescribed time. It also helps targeting teams determine requirements for combat assessment to assess targeting and attack effectiveness."

Targeting Methodology

The targeting process is formed from the model of *decide*, *detect*, *deliver*, and *assess* (D3A). The targeting methodology can be used to describe how engineers can provide input into the process. In *deciding* which targets to attack, engineers must provide input to develop the high-payoff target list (HPTL). A high-payoff target (HPT) is something that friendly forces perceive to be necessary for enemy forces to accomplish their mission. Some HPTs that engineers could recommend are enemy scatterable munition systems, tactical minefields, and enemy breaching assets. However, you must be specific. Usually, not all HPTs will be targeted because the unit may not have assets available to target them all. If you want to target enemy breaching assets, list the type of breaching asset you want targeted (such as the KMT-4). If you want minefields listed as HPTs, then nominate the ones that will affect future operations (such as minefield B01). The templated minefields will be used to continue describing the process. See Figure 1 for examples of assets that can be used during various stages of the targeting process.

To *detect*, nominate the templated minefields that impact future operations as named areas of interest (NAIs). NAIs are used to help confirm or deny a particular enemy course of action. During the targeting meeting, the D3A model is captured on the target synchronization matrix (TSM) (see Figure 2). The templated minefield located at WQ01654015 on the TSM will be used to describe the process. The staff recommended this minefield as NAI 43 on the TSM. If practical, have multiple assets (primary and alternate) target the NAI at various times. Ensure that the collectors have time windows in which to collect on the NAI, because you don't want all the collectors at the NAI at the same time. Also, the assets you are targeting must report back in a timely fashion. Give them a time for the latest time of intelligence value (LTOIV). Be cognizant of the other minefields, but the targeting process should focus on what has a bearing on future operations. In this instance, the unit has chosen to use OH-58D scout reconnaissance helicopters as the primary detector and B/1-187 Infantry as the secondary collector on the NAI. Again, the detection windows must be at different times. If the NAI is denied, then the assets to *deliver* or *assess* are free for other missions.

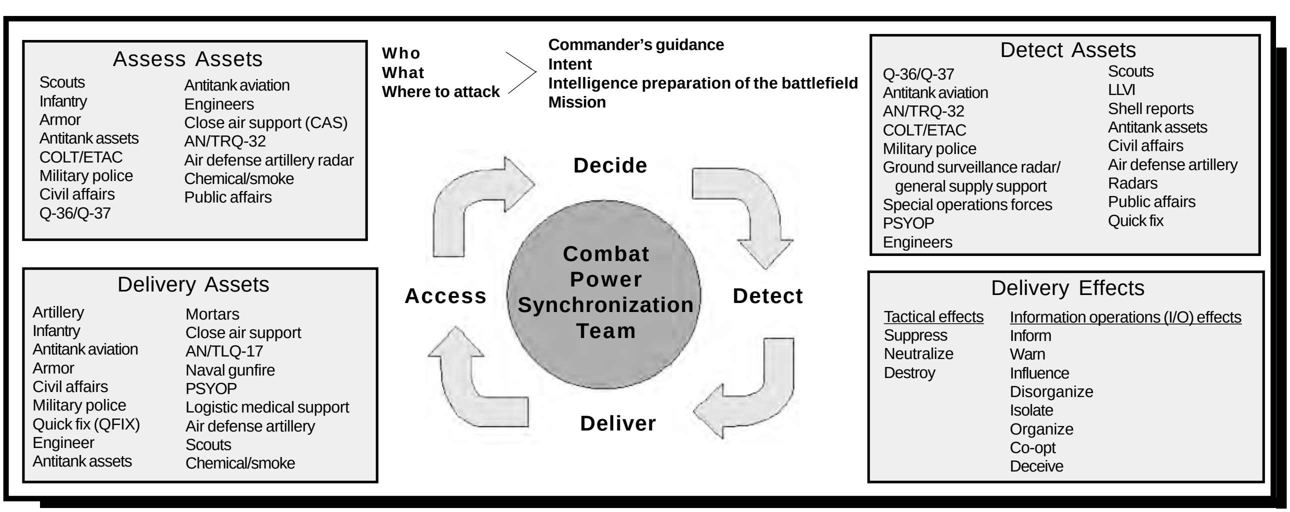

Figure 1. Targeting the Rakkasan Way (Based on a figure in CALL Newsletter No. 02-3 Feb 02)

Target Synchronization Matrix (Phase/Event: III – Expand the Lodgement) H-Hour is 052200MAR03							As of: 031200ZMAR03 to 041159ZMAR03	
Decide		**Detect**			**Deliver**		**Assess**	
HPT	Location	NAI	Agency	Assets	Agency	Assets	Agency	Assets
DShK	WQ02404210	1	Division	LRS	Division	NGF/CAS	Division B/311 MI Bn	LRS QFIX
			B/311 MI Bn	QFIX	3-320 FA	105 mm		
			B/311 MI Bn	QFIX	3-320 FA	105 mm		
SA-18	WQ00654372	6	Division	LRS	Division	NGF/CAS/ J-SEAD	B/311 MI Bn	QFIX
			B/311 MI Bn	QFIX	3-320 FA	105/155 mm		
Minefield	WQ01654015	43	2-17 Cav Rgt	OH-58D	Team Heavy	MICLIC	Team Heavy	Mine roller
						Mine plow		
			B/1-187 Inf Rgt	Mine detectors	Team Clear	Explosive		
					C/326 Engr Bn			
	WQ01563567	23	2-17 Cav Rgt	OH-58D	Team Heavy	MICLIC	Team Heavy	Mine roller
						Mine plow		
					Team Clear	Explosive		
			C/1-187 Inf Rgt	Mine detectors	C/326 Engr Bn			

Legend:

DShK = [12.7mm Krupnocalibernyj Pulemet Degtyareva-Shpagina, DShK] A heavy machine gun used as an antiaircraft weapon and also as a heavy infantry support gun.

JSEAD = joint suppression of enemy air defense

LRS = long-range surveillance

NGF = Naval gun fire

SA-18 = A Russian manportable surface-to-air missile

Figure 2

If the NAI is confirmed, the *deliver* assets committed will bring effects against the target.

Deliver against the target by destroying, neutralizing, or suppressing it. In this case, we would neutralize the minefield by breaching a lane or by clearing. In choosing the deliver asset, don't just think about what assets engineers bring to the fight, but rather what assets the unit brings to the fight—plows, rollers, mine-clearing line charges (MICLICs), Antipersonnel Obstacle-Breaching Systems (APOBs) (for AP minefields and wire), etc. For NAI 43, the staff used Team Heavy, the armor company team, as the primary unit to *deliver* effects against the minefield with primary means of the MICLIC, then the plow. It is a planned operation, so the unit should have time to prepare and rehearse before execution.

The final part—*assess*—can be done again by engineers or any number of assets to report battle damage. In this case, the minefield was proofed by Team Heavy. The unit used a roller to assess the minefield and ensure that no mines were present in the area they breached or cleared. However, battle damage is usually very difficult to assess. When a unit thinks about preassault fires on an objective to attrit enemy forces before an attack, how do we confirm that the forces have been attrited sufficiently? *Assess* is generally the hardest part of the process. At the completion of the targeting meeting, the information from the TSM will be used to build a fragmentary order (FRAGO). Brigade-level targeting should focus future operations 48 to 72 hours out and battalion-level operations 24 to 48 hours out.

Preparing for the Targeting Meeting

The same level of detail that goes into preparing for the military decision-making process (MDMP) should be applied to the targeting meeting. Targeting should be built into the MDMP timeline as well as a unit's battle rhythm. Generally, products used in the targeting meeting are refinements to already-existing products. As part of course-of-action analysis and comparison, the staff generally starts the targeting process with a targeting conference. Using the results of staff wargaming and intelligence preparation of the battlefield (IPB) as a guide, the planning staff focuses assets to assist with the collection process. Engineers should do the following before the targeting meeting begins:

- Update the assets-available list.
- Refine the obstacle template (from initial entry).
- Prepare the obstacle-tracker overlay.
- Collaborate with the S2 to ensure that enemy engineers are portrayed on the situation and event templates.

During the Targeting Meeting

During the targeting meeting, the engineer should consult with other staff officers. Engineers must talk in maneuver terms in order to get mobility/survivability/countermobility targets that support the commander's plan serviced. During the targeting meeting, the following coordination should take place:

With the S2:

- Confirm the template.
- Perform predictive analysis—nominate NAIs.
- Assist in developing the situation and event templates with probable enemy employment of engineer assets and obstacle emplacements.
- Describe the effects of terrain and weather on maneuvers.
- Participate in the selection of decision points, NAIs, and targeted areas of interest (TAIs) for obstacles.
- Identify enemy engineers supporting the reconnaissance effort.
- Confirm HPT (bridging assets, breaching assets, and scatterable mine delivery systems).

With the S3:

- Assist in developing the high-value target list (HVTL) and nominating high-value targets (HVTs) to the HPTL.
- Advise on the employment of scatterable munitions to attach targets and the selection of TAIs to support the employment.
- Review the minefield report.
- Prioritize the clearance of routes.
- Draft tasks to subordinate units.
- Recommend task organization changes.

With the S4:

- Synchronize the logistics package resupply with the brigade combat team route clearance package.

With the medical officer:

- Synchronize the route clearance package with casualty evacuation routes.

Conclusion

The targeting process enables the staff to direct all the elements of combat power against enemy forces to win decisively. Conducted daily, the targeting meeting should provide subordinate units sufficient time to prepare for future operations. The end product of targeting should be an updated TSM, reconnaissance and surveillance plan, HPTL, and FRAGO with appropriate task organization changes. Engineer participation in targeting is critical and, in doing so, they ensure that engineers are out front, providing the commander mobility on the ground.

CPT Quander is a light engineer platoon senior observer/controller. Previous assignments include commander, C/326th Engineer Battalion (Air Assault), Fort Campbell, Kentucky—deploying to Afghanistan in support of Operation Enduring Freedom; platoon leader, A/307th Engineer Battalion (Airborne), Fort Bragg, North Carolina; and assistant brigade engineer, 1st Brigade, 82d Airborne Division, Fort Bragg, North Carolina.

Combat Maneuver Training Center (CMTC)

Synchronizing the Brigade Combat Team Breach —"SOSRA in Effect"

By Major John Horstmann and Sergeant First Class Danny Petersen

"Obstacle breaching is the employment of a combination of tactics and techniques to project combat power to the far side of an obstacle. Breaching is a synchronized combined-arms operation under the control of a maneuver commander."

—FM 3-90.3, *The Mounted Brigade Combat Team*

All too often, maneuver forces come to a stalemate at the breach, leading to mission failure immediately thereafter. CMTC discovered that one of the causes of this is the failure to synchronize the breach during brigade combat team (BCT) planning and rehearsals. Typically, units happen into breaching operations before doctrinal conditions are set. Although FM 3-34.2, *Combined-Arms Breaching Operations*, serves as the capstone breaching manual, many maneuver commanders focus primarily on FM 3-90.3. It discusses combined arms breaching operations in Chapter 12, where Table 12-4 (see Table 1 below) provides a basic framework. However, it does not specify who has direct responsibilities for each decision or event. As a result, these decisions are routinely delegated to very low levels within the BCT.

Decisions	Criteria
Decide the point of penetration and reduction site.	- Reconnaissance force identifies obstacles and enemy positions related to priority intelligence requirements (PIR).
Commence suppression and obscuration fires.	- Observers are in position. - Support force crosses designated phase line (PL).
Occupy support-by-fire (SBF) position (support force).	- Critical friendly zone (CFZ) is in place over the positions. - Obscuration is in place to screen support force movement. - Designated essential fire support tasks (EFSTs) are completed. - Support force maintains more than 70 percent of its combat power.
Commit the breach force.	- Suppression and obscuration is adjusted and effective. - CFZ is in place over reduction site. - Engineer preparations are completed. - Fire control measures are in effect.
Commit the assault force.	- Lane is created, proofed, and marked. - Far-side security is in position.

Table 1. Establishing criteria (Based on Table 12-4 from FM 3-90.3)

Fundamental to achieving synchronization are detailed reverse-breach planning, clear subunit instructions, well-rehearsed forces, and effective command and control. Without proper breach synchronization, the conditions for executing the breach will not be established when necessary, generally resulting in the rapid destruction of breaching assets.

The assistant brigade engineer (ABE), as the staff officer primarily responsible for setting the plans groundwork, has many tools available to assist him during the planning process. FM 3-34.2, Chapter 1, paragraph 1-44, provides a detailed explanation of how to synchronize breaching planning and operations. Table 2, (which is Table 1-2 in FM 3-34.2) is a breaching complexity chart, which shows successful synchronization of breaching operations and provides an example of the complexity of the operation. It is also a good tool to use as a template during planning or rehearsing or when explaining the complexity of breaching operations to maneuver brethren. This same chart is also a template to effectively build an execution matrix of the breaching operation. This chart, like Table 12-4 from FM 3-90.3, does not designate responsibility for decision making.

A good relationship between the ABE and other BCT planners, especially the fire support and chemical officers, enables the ABE to create a framework for the breach that best fits the brigade commander's intent. Using the reverse-breach planning process, the ABE must ensure that the commander's intent—as it relates to mobility, countermobility, and survivability operations—is understood. The ABE also recommends changes to support that intent, based on the capabilities and limitations of engineer assets under brigade control. But more importantly, the ABE must convey to the brigade staff the conditions that must be set before attempting the breach in order to synchronize these conditions throughout planning and war gaming. If the reverse-breach planning process is followed, and the staff members have synchronized their efforts, the stage is set for a fluid breach at the combined-arms rehearsal (CAR) and in combat.

Far too often the breach force commander commits assets only to have them killed by direct and indirect fires as they reach the obstacle. As engineers, we must communicate to the brigade commander that the conditions must be set before moving breaching assets forward to the obstacle. Disaster awaits if units attempt to breach before setting these basic conditions. This level of synchronization begins with the planning process, is reinforced at the CAR, and continues through the beginning of operations. At the CAR, all too often the term "SOSRA [suppress, obscure, secure, reduce, assault] in effect" is heard from senior leaders when addressing breaching operations, and the rehearsal continues with the assault force conveniently placed on the other side of the breach. Such a simple wave of the hand does not work on the battlefield. Leaders need to demand specifics during the rehearsal, with each step addressed individually. Following is an example of such a rehearsal:

- *Suppress*. Who is suppressing? With what systems and ammunition? Who is being suppressed and where?
- *Obscure*. Who is obscuring and for how long? With what system and ammunition? Who is the obscuration being directed against and where? What is the required duration of the obscuration? Who determines whether the

Actions	Element	Time (Minutes)	Controlled By
Develop the situation (verify the boundary of the enemy obstacle system).	Force in contact	M to 2	S3
Maneuver the support force into the overwatch position.	Support	M + 2 to 15	Support commander
Maneuver the assault force into the covered assault position.	Assault	M + 2 to 15	Assault commander
Call for artillery.	Direct support (DS) artillery	M + 2 to 15	Fire support officer (FSO)
Build smoke.	Mortars	M + 5 to 10	FSO
Suppress the enemy with direct fires.	Support	M + 15 to 29	Support commander
Suppress the enemy with artillery fires.	DS artillery	M + 10 to 29	FSO
Maintain smoke.	DS artillery mortars	M + 10 to 30	FSO
Maneuver the breach force to the breach location.	Breach	M + 20 to23	Reduction commander
Reduce the obstacle and prepare two lanes.	Breach	M + 23 to 30	Engineer leader
Place smoke pots.	Breach	M + 23 to EOM	Reduction commander
Shift direct fires off the objective.	Support	M + 29 to 30	Assault commander
Shift indirect fires beyond the objective.	DS artillery	M + 29 to 30	Assault commander
Assault to destroy the enemy on the far-side of the obstacle.	Assault	M + 30 to 45	Assault commander
Reorganize to continue the mission.	Task force	M + 45 to EOM	S3
NOTE: M = Contact with the obstacle			

Table 2. Breaching complexity (Table 1-2 from FM 3-34.2)

Breach Fundamental	Decision	Criteria	Decision Maker
Suppress	Initiate suppression	- Position of support force - Reconnaissance of enemy position	Support force commander
	Shift suppressive fires	- Position of breach and assault forces	Support force commander
Obscure	Initiate obscuration	- Position of breach, support, and assault forces - Observers in position	Task force commander
	Adjust obscuration	- Wind direction - Terrain - Ammunition remaining	Breach force commander
Secure	Initiate near-side security	- Position of security force - Templated position of overwatching force	Task force commander
	Initiate CFZ/ADA coverage	- Position of breach force	Task force commander
Reduce	Determine breach area	- Engineer battlefield assessment (EBA) and intelligence preparation of the battlefield (IPB) - Forces available - Reconnaissance results	Brigade commander
	Initiate breach	- Successful obscuration - Successful suppression - Nearside security established - Position of breach force	Breach force commander
	Breach lane complete	- Position of breach force - Initial marking complete	Breach force commander
Assault	Initiate assault force	- Position of breach force - Far-side security established - Lane marking complete	Breach force commander
	Shift fires	- Position of breach, suppression, and assault forces	Assault force commander

Table 3. Assigning responsibility for key decisions

obscuration is successful or not? Who is the primary/secondary observer?

- *Secure*. Who is securing and where? And with what systems? What fire control measures are in effect? What air defense artillery (ADA) coverage is there, and who provides it? Where is the CFZ, and who controls its initiation and termination?
- *Reduce*. Where are the breaching assets, and who controls them? What are the primary and alternate means? How many lanes are there, and where are they located? What is the separation between the lanes? Where is the breach force located before commitment? Who commits the breach force? What is the lane-marking technique?
- *Assault*. What fire control measures are in effect, and who controls the transition of firing from the breach to the assault force? Are there protective obstacles between the breach and the objective? Who is responsible for breaching these and with what systems? Who assumes traffic control through the breach?

These questions need to be answered with clarity and rehearsed at the CAR for SOSRA to be synchronized, while setting up successful breaching operations during the battle.

However, even in answering these questions, the process is not complete. A fundamental of successful synchronization is effective command and control. As previously mentioned, current doctrine does not discuss a crucial aspect of command and control—determining who is responsible for key decisions. As part of the planning process, the brigade staff must identify those responsible for critical decisions and make sure they are addressed in the decision matrix and at the CAR. Table 3 is a guide to assigning responsibility for key decisions of breaching operations.

The bottom line is that engineers are the doctrinal experts regarding breach planning, rehearsals, and operations. If we plan and rehearse according to our published doctrine, and help the maneuver commanders understand this doctrine, we will be more successful at the breach. The "proof in the pudding" is our ability to discuss SOSRA in detail at the CAR in order for SOSRA to indeed be "in effect."

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SFC Petersen is the engineer battle staff NCO observer/controller at CMTC. Previous assignments include assault section sergeant/combat engineer vehicle commander, 82d Engineer Battalion, and assault and obstacle platoon sergeant/operations sergeant in the 58th Engineer Company, 11th Armored Cavalry Regiment (Opposing Force), Fort Irwin, California.

Rear-Detachment Risk Management Options

By Mr. Fred E. Fanning and Mr. Carter T. Boggess, Jr.

With the fast pace of today's Army, it would be easy to overlook the details of deployment preparation. However, we must diligently complete these preparations in order to ensure a successful deployment for all. Part of this preparation should include consideration for hazards faced by rear detachments and the families of deployed service members. The overall risk management of the deployment should be done as an integral part of deployment planning. It should be a part of the military decision-making process and must include rear-detachment operations and families.

There are seven primary areas that should be addressed, in addition to the normal hazards: geographic location of the unit, geographic location of services, leadership experience, leadership training, planning, training/exercise schedule, and family support (see Table 1). Geographic considerations are more important for the Army National Guard, Army Reserve, and organizations outside of the continental United States. Leadership experience and training are key for all rear detachments. The farther down you go from the rank designed to command a unit, the more risks you assume.

The geographic location of the unit (if separated from its parent unit), as measured in driving time, can cause or contribute to the hazards of operating a motor vehicle—one of the most dangerous things rear-detachment personnel and family members do. The hazard is determined by comparing the type of unit with the driving time. This can range from thirty minutes to well over an hour. The longer the driving time, the more risk involved.

Geographic location of services involves distances from services measured in driving time. Again, this measures the risk involved with operating a motor vehicle to obtain services. These measurements are by service type, which would include the hospital, dental clinic, family assistance center, commissary, post exchange, and recreation services. The more important the service, the more times personnel are likely to visit it. The second measurement can be the miles that must be driven to get to the service. The more important the service, and the more driving time, the more risk involved. However, additional risk is often present if essential services are not provided. Many of us can live for a short time without a library, but if a medical facility is a great distance from our home and we have no transportation, the risk becomes high that we will not have appropriate medical treatment when it's needed.

Leadership experience can cause or contribute to accidents in many ways. The most obvious is that lower-ranking military personnel normally have less knowledge, skills, and abilities than higher-ranking personnel. This is due to the training, education, and job experience of a normal career. Leadership positions for rear detachments often range from brigade-command level down to platoon level. If you compare this with the individual assigned as the rear-detachment commander, you can obtain a risk level. The rear-detachment commander at the brigade level might be a captain, while the company rear-detachment commander might be a sergeant first class. Units can also offset this risk by providing training to personnel to prepare them for the duties and issues of rear-detachment command. With training provided, you can

Rear-Detachment Risk Management	
Geographic location of the unit	Distance from parent unit in driving time compared with unit type
Geographic location of services	Distance from services in driving time compared with service type
Leadership experience	Leadership position held prior to rear detachment compared to rear detachment command level
Leadership training	Type of training provided and the level of rear detachment command
Planning	Preparation guidance compared to time for preparation
Training/exercise schedule	Operating tempo guidance compared to type of training
Organized family support group	Includes access and availability of privately owned vehicles, commercial transportation, telephones, a family support group alert roster, and a medical and dental facility

Table 1

compare the rank of the individual assigned with the training received. The training can be in the classroom, on the job, or both. Without any training, the risk may be high; with classroom and on-the-job training, the risk could easily be reduced to a low level.

Planning preparation and guidance will still be necessary for the rear detachments and family member activities. Planning is often measured as in-depth, adequate, minimal, vague, implied, and specified. The more time that can be provided to the rear-detachment commander, the lower the risk during mission execution. The general rule of thumb is to take one-third of the time allotted to conduct your planning and then give the subordinate unit two-thirds of the time for them to plan. This allows additional time for rear-detachment commanders who have little planning experience.

Training and exercises will still be conducted at the rear-detachment level. The operating tempo, compared to the guidance provided, determines the risk level. A field training exercise or a command post exercise with good guidance present less risk than an exercise with medium or low guidance.

Whether or not a unit has an organized family support group determines the risk level of family members while the service members are deployed. The better organized and the lower the unit level, the less the risk. These support groups can provide invaluable assistance to family members that can reduce their risk. It also relieves a great deal of stress on family members when they know they are not alone at this difficult time. Young family members with privately owned vehicles might be at a higher risk than older, more experienced drivers. Furthermore, some vehicles may not be in good working order. Sharing rides or using public transportation through the family support group can produce less risk.

Whether or not family members have access to a telephone can determine the type and availability of medical treatment. Again, the family support group can help family members work through this issue by using neighbors or other means to provide telephone service. Sharing rides and telephone support are made much easier and more effective with a family support group alert roster. This document can be a family member's best friend, by listing other family members who want to help.

You should include the hazards posed by these seven categories just as you would hazards from missions and operations. It works just like the procedures outlined in Field Manual 100-14, *Risk Management*. The leader identifies the hazards present. The highest risk of these initial estimates becomes the initial risk. The leader then identifies risk reduction measures to reduce the risk and then identifies the risk based on the control measures.

After reducing the initial risk as much as feasible without adversely affecting the rear detachment's ability to conduct its mission, we then identify the residual risk. This level of risk is accepted or refused by the rear-detachment commander. The amount of approval authority should be determined in the early stages of the deployment planning process (see Table 2).

This risk acceptance approval authority should be agreed to by the individuals at the various levels of command within the organization. In addition, the risk acceptance levels should be documented in the operations order or operations plan to ensure that commanders and staff at all levels understand who the approval authority is. These levels are based on the knowledge, skills, and abilities of personnel at different ranks. These levels describe the amount of risk each level agrees to accept.

A good safety program must include the particular hazards faced by rear detachments and the families left behind. By including these two areas in the initial risk management process conducted during deployment planning, you can identify and reduce the hazards to rear-detachment personnel and families. The risk management process can and should be updated periodically as the mission and situation changes.

For additional information, please refer to the U.S. Army Maneuver Support Center Safety Web page at *www.wood.army.mil/safety/*.

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Rear-Detachment Risk Acceptance Matrix				
Risk Level	Approval Level			
	Squad	Platoon	Company	Battalion
Low	Squad leader	Platoon leader	Company commander	Battalion commander
Medium	Platoon leader	Company commander	Battalion commander	Brigade commander
High	Company commander	Battalion commander	Brigade commander	Division commander

Table 2

ENGINEER UPDATE

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

Directorate of Training (DOT)

WANTED! Applicants for Terrain Analysis Technician Warrant Officer. Military occupational specialty (MOS) 81T NCOs with five to twelve years of service may apply. The duty description is in DA Pamphlet 611-21, *Military Occupational Classification and Structure*. Soldiers may get information on how to become a warrant officer on the home page of the Warrant Officer Career Center at *http://www.leaven-worth.army.mil/wocc/* or U.S. Army Recruiting Command at *http://www.usarec.army.mil/hq/warrant/*.

POC is CW4 Frederick Kerber, (573) 563-4088, DSN –4088; e-mail *kerberf@wood.army.mil*.

Deployment and Mobilization Training. The Department of Instruction has established a contingency operations (CONOPS) training program for students who are likely to deploy after completing their training at Fort Leonard Wood. Students in the Basic and Advanced Noncommissioned Officer Courses, Engineer Officer Basic Course, and Engineer Captain's Career Course have been screened to determine those students with follow-on assignments to deploying and/or deployed units. These students are then given training in four areas: intelligence update, mine awareness, lessons learned from previous operations, and terrain visualization. All four classes focus on the Iraqi threat but also highlight items of interest from operations in Afghanistan, the Balkans, and other locations.

National Guard and Reserve units that mobilize through Fort Leonard Wood also receive focused training from the Engineer School. Many of the units have been bridging units and therefore received additional instruction in river-crossing operations. These units also received training on mine awareness and division- and corps-level operations and instruction on the planning process.

Mobile training teams (MTTs) are a critical element to getting focused training to units in the field. In September, an MTT was sent to Afghanistan to train a cadre of instructors on mine awareness. This team also helped develop a mechanical area clearance SOP. Mine awareness training is the most frequently requested training for both CONUS and abroad.

POC is CPT Ken Boggs, (573)-596-0131, ext 35593; DSN –5593; e-mail *boggsk@wood.army.mil*; or MAJ David Ray, (573)-596-0131, ext 35695; DSN –5695; e-mail *rayda@wood.army.mil*.

Individual Ready Reserve (IRR) Train-Up. As part of IRR call-ups, engineer officers are given refresher training before deployment. They attend a modified Reserve Component Engineer Captain's Career Course for thirteen days with an average nine-hour workday. They receive training in the military decision-making process and brigade and task force tactics. The course is rounded out to meet the needs of the individual by including theater-specific threat analysis, mine awareness, and threat engineer capabilities training. The final phase of the course focuses on the technical engineering issues of force protection, base camp development, road and airfield design, and airfield damage repair.

POC is MAJ Craig Jolly, (573)-596-0131, ext 34128; DSN – 4128; or e-mail *jollyc@wood.army.mil*.

Officer Education System. On 4 February 2003, the Army announced significant changes to the Officer Education System. During 3d quarter fiscal year (FY) 06, the Officer Basic Course will transition to the Basic Officer Leader Course (BOLC). The Combined Arms Staff Course (CASC) will replace the Combined Arms Services Staff School (CAS3) and portions of the Captain's Career Course (CCC). CASC will use both distance and residential learning to prepare officers to take staff jobs. The CASC implementation date is currently 3d quarter FY05. The Combined Arms Battle Command Course (CABCC) will replace the CCC and will focus on training officers to take command. It is scheduled for implementation during 2d quarter FY06. The Command and General Staff College (CGSC) will transition to Intermediate Level Education (ILE). This change will focus educational requirements for majors in their respective career fields. ILE is scheduled for implementation by 4th quarter FY05.

POC is MAJ Storm Reynolds, (573) 596-0131, ext 35747; DSN - 5747; or e-mail *reynoldss@wood.army.mil*; or LTC Jeff Bedey, (573) 596 0131, ext 35647; DSN – 5647; or e-mail *bedeyj@wood.army.mil*.

Stryker Brigade Combat Team (SBCT). The Engineer School continues to work closely with the SBCTs on how to use organic enablers to improve the mobility of the force while operating in the nonlinear and noncontiguous battlefield of a small-scale contingency. In July 2002, during the Senior Leaders Course, assured mobility was introduced to 1/25th SBCT to help it optimize its mobility by using situational understanding as a fundamental enabler.

POC is MAJ Ted Read, (573) 596 0131, ext 37060; DSN – 7060; or e-mail *readt@wood.army.mil*.

Countermine Mobile Training Team (MTT) – Germany. An MTT from the Countermine/Counter Booby Trap Center conducted training from 19-31 January 2003 in Germany. The

MTT instructed members of the 130th Engineer Brigade, 1st Armored Division, and 1st Infantry Division on Mine Awareness Instructor Training (MAIT), Engineer-Specific Countermine Instructor Training (ESCIT), Counter Booby Trap Familiarization (CBTF), Mesa Associates' Tactical Integrated Light-Force Deployment Assembly (MATILDA) Robot System Training, and Handheld Standoff Mine Detection System (HSTAMIDS) New Equipment Training. The team provided a three-hour seminar for senior engineer leaders at Grafenwohr, including a Tactical Minefield Database (TMFDB) overview and the latest National Ground Intelligence Center threat assessment for Iraq. The team also taught a one-day mine awareness course to Corps Support Command soldiers.

POC is LTC Mark Thompson, (573) 596-0131, ext 37347; DSN – 7347; or e-mail *thompsma@wood.army.mil.*

Countermine Mobile Training Team–Kuwait and Afghanistan. From 3-18 February 2003, MTTs from the Countermine/Counter Booby Trap Center conducted training in Kuwait and Afghanistan. Afterwards, the two teams met in Afghanistan to provide instruction on the MATILDA, HSTAMIDS, and TMFDB. The team also provided feedback to Combined Joint Task Force (CJTF) IV in Kuwait on the Mine Intelligence Collection Center (MICC) design for posthostility reconstruction and assisted with the MICC design, organization chart, and mission statement development.

POC is LTC Mark Thompson, (573) 596-0131, ext 37347; DSN – 7347; or e-mail *thompsma@wood.army.mil.*

News and Notes

Unit Seeks Engineer Instructors. Do you enjoy instructing and mentoring soldiers? If so, we may have an opportunity just for you! The U.S. Army Reserve's 1/98th Battalion (Engineer), 98th Division (Institutional Training) (W76H01, W76H02) is seeking highly motivated NCOs and officers from active duty, the National Guard, the Army Reserve, and the Individual Ready Reserve, who are in military occupational specialty (MOS) series 12, 51, or 62 and want to join the Army Reserves as engineer instructors.

Headquartered in New Windsor, New York (near West Point), the 1/98th plans to relocate to Fort Dix, New Jersey, in training year (TY) 04. The unit conducts only two consolidated weekend drill assemblies at its battalion headquarters each year, and the remaining weekend duty is conducted at training sites throughout the northeast. Therefore, unit instructors can teach closer to their homes. Instructor training sites are located throughout New Jersey, New York, and New England.

This table of distribution and allowances (TDA) unit is responsible for engineer MOS training in an eight-state region—New Jersey, Rhode Island, New Hampshire, Connecticut, New York, Massachusetts, Maine, and Vermont. The unit—which trains Active and Reserve Component engineers in MOSs 12B10, 51B10, and 62E10—is scheduled to expand its list of classes to include nearly all 12-, 51- and 62-series training for 10-, 30-, and 40-level soldiers. Besides the MOS-qualified (MOSQ) classes, instructor and small-group courses are also taught.

The 1/98th Battalion currently has the following openings:

Openings	Rank	Title	Branch/MOS
1	MSG	Course manager	Any 12/51/62 series
1	SFC	Supply sergeant	92Y
18	SFC/SSG	Instructor	Any 12/51/62 series
2	SSG	Personnel Staff NCO	74B/71L

If you do not have the specific MOS skill required, the unit can train you to get you qualified and certified. We'll ensure that you complete the Total Army Instructor Training Course (TAITC) and/or Small-Group Instruction (SGI) course before you begin teaching. By completing the TAITC course, you will be granted an "H" designator authorizing you to teach MOSQ classes. This designator is a key differentiator that can enable you to get promoted faster and get the positions that you want!

If you are interested in this opportunity, please contact Catherine M. Burke, the 1/98th Battalion staff administrator at (845)-567-3975, or e-mail *catherine.burke@usarc-emh2.army.mil.*

Civil Affairs Battalion Needs MOS 11B and 12B Soldiers. The 96th Civil Affairs Battalion (Airborne), the Army's only Active Component civil affairs unit, is adding two more tactical companies. One company will be activated in FY 04, the second in FY 05. The battalion needs to fill a total of 84 positions in MOSs 11B and 12B. These positions are part of six tactical teams in the two tactical companies; each team will have a team sergeant, a team engineer, and a team medic.

Interested 11B soldiers in the rank of SFC and 12B soldiers in the rank of SSG should contact MSG Deel at (910) 432-8423/5555 or DSN 239-8423/5555 or SFC Campbell at (910) 432-6406/8102 or DSN 239-6406/8102.

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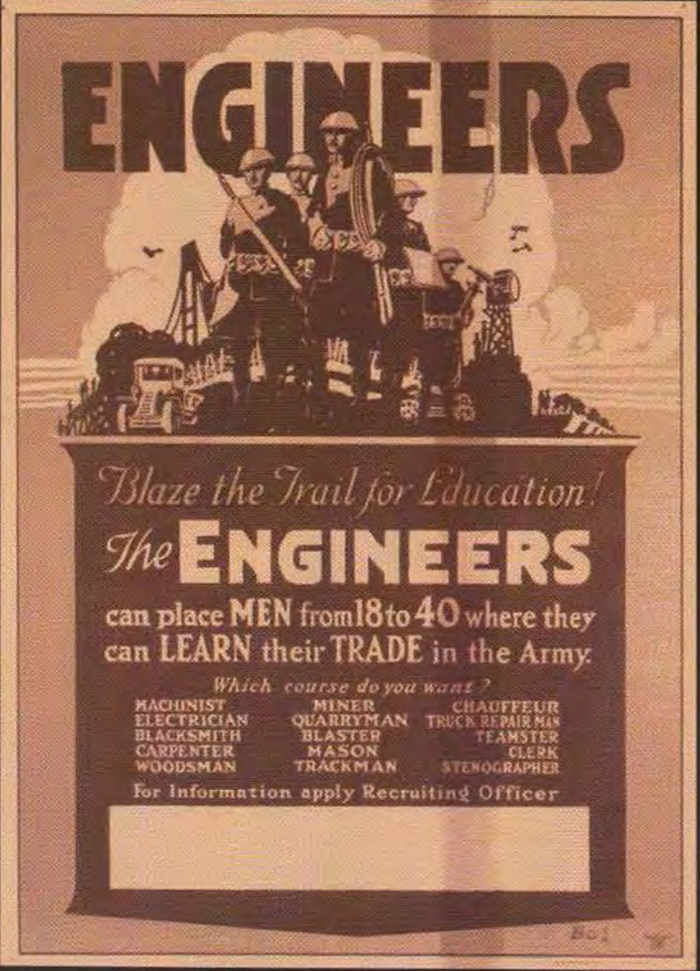

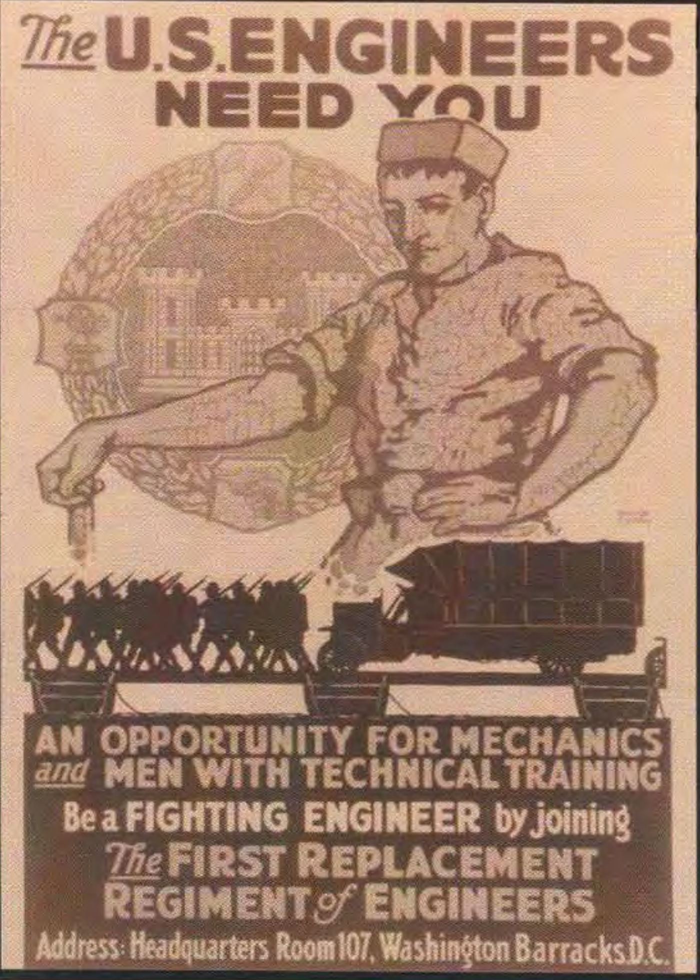

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