Engineer

THE PROFESSIONAL BULLETIN FOR ARMY ENGINEERS

The Great Flood of '93

PB 5-94-2 Approved for public release; distribution is unlimited. April 1994

CLEAR THE WAY

By Major General Joe N. Ballard
Commandant, U.S. Army Engineer School

In June 1993, with the publishing of FM 100-5, the U.S. Army officially recognized versatility as the fifth basic tenet of Army operations. Versatility has long been one of the basic principles and proud traditions of our Engineer Regiment. But in today's uncertain strategic environment, where resources are dwindling and Army missions are increasing, our regiment must remain versatile to meet the challenges we will face.

This month the U.S. Army Engineer Center is hosting the sixth annual Senior Engineer Leaders Training Conference (SELTC) at Fort Leonard Wood. I have selected "versatility" as the theme of this year's conference because of the many diverse missions engineers have been called to perform since the end of the cold war. Numerous engineer units have distinguished themselves and have demonstrated their versatility by successfully accomplishing a wide range of missions either sequentially or simultaneously.

The recent operation in Somalia is just one example that shows our regiment's versatility. Often on the same day, engineers found themselves supporting humanitarian operations, then combat operations, and then back to humanitarian operations. Before they deployed to the horn of Africa, those same engineers were in Dade County, Florida, providing assistance to the victims of Hurricane Andrew. Those versatile engineers excelled in a wide variety of rapidly changing missions.

Versatility is reflected in the way our regiment adapts to different missions and tasks, many of which are not on unit mission essential task lists. Our regiment has always prided itself in meeting the challenge of rapidly and efficiently shifting focus, tailoring forces, and moving from one mission to another. But today's force-projection Army demands an even more versatile Engineer Regiment.

We are now faced with a dynamic global environment, where assumptions made during the cold war no longer apply. Forward defense has given way to force projection, and AirLand Battle doctrine has evolved to the doctrine of Full Dimensional Operations. Versatility is essential for a force projection Army, where engineer units must rapidly build and sustain substantial combat power in remote parts of the globe and achieve success in a wide range of missions.

Engineer soldiers must seek ways to perform a wide range of roles, in a wide range of environments, and under the conditions of war and operations other than war. Full Dimensional Operations in the 21st century will require our regiment to expand its already wide variety of basic competencies and skills. Our officers and noncommissioned officers must be mentally agile and competent across the entire spectrum of engineer functions in both war and operations other than war. Our units must be multifunctional; operate at tactical, operational, and strategic levels; harness new and evolving technologies; and deploy as modular and tailorable elements. As in the past, our regiment needs soldiers who are well led, well trained, well equipped, and held to high standards. This is, and will continue to be, a truly challenging and rewarding time to be an engineer soldier.

Articles in this issue of *Engineer* highlight our regiment's versatility. Lieutenant General Williams addresses the Corps of Engineers' 1993 flood assessment and future flood control proposals. Lieutenant Colonel Davis and Major Feierstein discuss the 43rd Engineer Combat Battalion's deployment to construct Victory Base in Somalia. And, Mr. Stewart addresses engineer support to the theater in force-projection operations. These and other articles portray a versatile Engineer Regiment, one that is capable of operating across the full spectrum of military operations.

Versatility is of great interest to the leaders of our Army and our regiment, and is a timely theme for the SELTC. This year's conference features presentations that promote that theme. Speakers include the Chief of Engineers, the Commander of the XVIIIth Airborne Corps, the Commanding General of the U.S. Army Combined Arms Command, the Director of the Army staff, the Deputy Commander and Chief of USAREUR, the Commander of the 10th Mountain Division, the Director of the Louisiana Maneuvers Task Force, and the Commander of Joint Task Force Six. As always, the conference provides an opportunity for the military engineering community to focus efforts and resolve key issues. The goal is to share experiences and gain the knowledge needed to develop a better trained and more versatile Engineer Regiment.

While the SELTC presents information and challenges for our senior leaders, we must remember that the versatility of the regiment begins in the mind of the engineer soldier. The imagination and ingenuity of our engineer soldiers will help us maintain and carry forth our proud tradition. ESSAYONS!

Engineer

April 1994 Headquarters, Department of the Army **Volume 24 PB 5-94-2**

Cover photo: *A rural home owner taunts Mother Nature as floodwaters creep towards his front door. U.S. Army photo.*

FEATURES

DEPARTMENTS

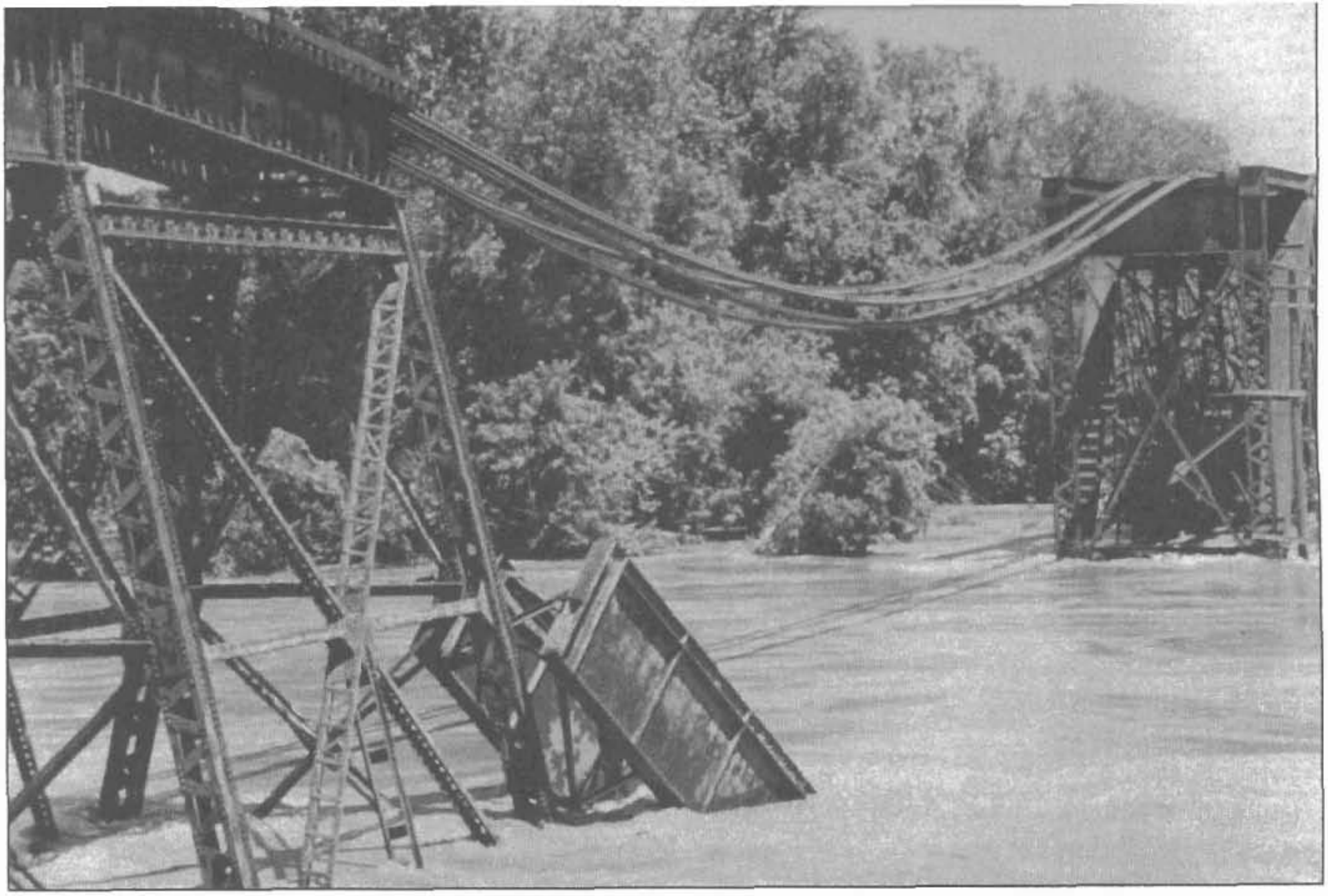
ENGINEER (ISSN 0046-1989O) is prepared quarterly by the U.S. Army Engineer School, ATTN: ATSE-T-PD-EB, Fort Leonard Wood, MO 65473-6650. Second Class postage is paid at Fort Leonard Wood, MO, and additional mailing offices.

POSTMASTER; Send address changes to ENGINEER, the Professional Bulletin for Army Engineers, ATTN: ATSE-T-PD-EB, Fort Leonard Wood, MO 65473-6650.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to ENGINEER, at the preceding address. Telephone: (314) 563-4104, DSN 676-4104.

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

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



The Corps' Response to the Great Flood of 1993

This article is an edited version of LTG Williams' statement before the Subcommittee on Investigations and Oversight, House Committee on Public Works and Transportation, October 28, 1993.

Flooding in 1993 of the Upper Mississippi and Lower Missouri River Basins was the most devastating flood in our nation's history. Nine states: North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Nebraska, Illinois, Kansas, and Missouri, received the brunt of nature's onslaught.

The great flood of 1993 was a rare event, which many hope will not be repeated in their lives. Expected to occur only once every 100 to 125 years (which equates to a 0.8 percent to 1.0 percent chance of occurrence), the flow of water down the Mississippi River to St. Louis peaked at 1.1 million cubic feet per second. At locations in the upper Mississippi River, flooding approached a 500-year flood. Pappillion, Nebraska, received an inch of rain in only six minutes; at Fargo, North Dakota, the Red River rose four feet in just six hours. Uncommon events such as these quickly became commonplace throughout the midwest.

This flood event left an unforgettable mark on the people and the land. Not only was the flood characterized by its record peak levels, but also by its sheer volume and duration. The volume of runoff produced by incessant and protracted rains dwarfed that produced by the previous record flood of 1844. At St. Louis, the Mississippi River remained above flood stage for more than three months.

This article describes the Corps of Engineer's role in this epic flood, summarizes the damages and relief efforts, and identifies lessons learned during the recovery process.

The Corps Role in the Region

The U.S. Army Corps of Engineers constructed and operates a vast flood-control infrastructure on tributary rivers in the Upper Mississippi

By Lieutenant General Arthur E. Williams

River Basin. This system consists of 72 dam and reservoir projects, more than 200 levees, floodwalls, pumping plants and diversion structures. Additionally, other federal agencies and numerous nonfederal public and private interests have built thousands of flood control structures throughout the basin. Some of these flood control structures are eligible for Corps assistance during flood disasters.

Each reservoir in the system has a water control plan that specifies how water will be stored and released under a variety of hydrologic conditions in its watershed. Under flood conditions, reservoirs impound and later release floodwaters in a controlled manner to lessen the impact downstream. By August 1, 1993, reservoirs in the midwest were at their peak storage—almost 20 million acre-feet of floodwater. Once a flood crest has passed, operating plans call for the release of stored floodwaters as quickly as possible without further impacts to the flooding downstream. It is important to rapidly return each reservoir to its normal pool level so storage space is available to capture the next flood. The Corps operations in the spring of 1993 were no different in this regard.

Federal navigation projects in the Upper Mississippi River Basin are vitally important to our nation's economy. Upstream from St. Louis, there are 34 locks at 29 sites along 854 navigable miles of the Mississippi River. Along the 753 miles of navigation on the Missouri River, there are no locks. The Illinois River has nine locks along its 327-mile system, and the Kaskaskia River has one lock on its 30-mile length. Navigation on these flood-swollen rivers was essentially stopped from June through August 1993 because of dangerous channel conditions. Navigation industry losses exceeded $300 million. As an example of the impact on navigation, approximately 8 million tons of cargo normally pass through Lock 27 near St. Louis during the month of July. The total tonnage for July 1993 was zero. Other locks within the system above St. Louis reported similar impacts.

Damages

The great flood of 1993 earned the dubious distinction as the flood of record. Unlike a hurricane or earthquake, where the disaster strikes quickly, the 1993 flood sustained its relentless attack from the spring through the summer, leaving 50 people dead in its wake. It inflicted more than $20 billion in damages. Communities witnessed the destruction and damage to 72,000 homes. Water inundated 20 million acres of agricultural land, destroying $1.5 billion of soybeans in Illinois and $1.0 billion of corn in Iowa.

The Corps' flood control infrastructure, including flood control reservoirs, levees, walls, and other structures, performed extremely well during the crisis; they prevented billions of dollars in damages. For example, of the 230 levees constructed by the federal government, only 38 were overtopped and two breached, compared with an 80 percent rate of overtopping and breaching of private levees. Since the flood, the Corps has begun spending an estimated $250 million to make repairs to both federal and nonfederal levees.

Photo this page: **At Sny Island, Illinois, a dozer clears dredged material from the riverbank.**

Photo opposite page: **A railroad bridge at Glasgow, Missouri, succumbs to rising water. Floodwaters ravaged the midwest from spring through late summer 1993.**

Flood waters moved large quantities of sediment into the navigation channels, causing additional damage. Estimates are that $11 million worth of dredging will be needed to restore these navigation channels.

Recreation areas were also affected. The Corps temporarily closed more than 100 recreation areas, either fully or partially. Shower buildings and comfort stations were severely damaged, roads and areas around boat ramps and swimming beaches were eroded, and campsites were destroyed. These recreation areas suffered damages amounting to about $11 million.

Relief Efforts

The Corps operates under two basic emergency authorities that allow it to prepare for and respond to disasters. These authorities are the Flood Control and Coastal Emergency Act (Public Law 84-99, as amended) and the Robert T. Stafford Disaster and Emergency Assistance Act (Public Law 93-288, as amended). Public Law 84-99 permits the Chief of Engineers to undertake activities that include flood response and rehabilitation of flood control works. Under the Stafford Act, the Federal Emergency Management Agency (FEMA) developed a contingency plan for a holistic federal response called the Federal Response Plan. This plan calls on 26 federal departments and agencies and the American Red Cross to execute coordinated disaster relief and recovery operations. Specifically, it allows FEMA to assign public works and engineering missions to the Corps. The intent of both the Stafford Act and Public Law 84-99 is for the federal government to assist states, not to take over and direct disaster relief operations.

Under the authority of Public Law 84-99, the Corps assists state and local agencies with planning, flood fighting, and the rehabilitation of eligible flood control structures. The Corps maintains supplies such as sand bags and pumps for use in flood fights. If these stocks are depleted, each district emergency operation center has on file lists of sources where supplies and equipment can be quickly procured. As early as June 1993 the Corps began to distribute what would eventually exceed 31 million sand bags and loaned 430 pumps to aid local communities. In some instances the Corps contracted with private construction firms to reinforce levees. This emergency work amounted to about $25 million. Our professional engineers also assisted local governments by providing technical advice. By working closely with the levee districts, local and state officials, and other federal agencies, the Corps maximized its effectiveness during the response phase.

Once FEMA activated the Federal Response Plan on July 11, 1993, the Corps executed FEMA-directed missions. The Environmental Protection Agency, U.S. Public Health Service, Departments of Transportation, Agriculture, and Interior, and the General Services Administration provided valuable support to the Corps mission assignments. The Corps provided damage surveys, generators, and portable toilets; installed culverts; and supplied potable water. A significant water supply mission involved the transportation and storage of potable water to Des Moines, Iowa, when that city's water treatment plant was flooded. The recovery phase of the mission included technical assistance to rehabilitate the plant and restore the water supply to approximately 250,000 people. The cost of these FEMA missions amounted to more than $20 million.

Throughout this flood emergency, the Corps coordinated relief operations with several federal agencies—the U.S. Coast Guard (USCG), the U.S. Geological Survey (USGS), the Bureau of Reclamation (BOR), the National Weather Service (NWS), the Soil Conservation Service (SCS), and the Federal Emergency Management Agency (FEMA). Of particular note, the Corps called on the USGS to make additional flow measurements at key river locations for use in making water control decisions. Because of the close working relationship between the Corps and USCG, navigation issues and safety concerns were quickly addressed and disseminated to the public. Engineers from the BOR supplemented Corps damage survey teams so that damages were rapidly quantified. A triumvirate of the Corps, SCS, and FEMA coordinated federal policies regarding levee rehabilitation and developed joint management teams at the disaster field offices established by FEMA. In late August, representatives from the U.S. Fish and Wildlife Service (USFWLS) and the Environmental Protection Agency (EPA) were added to these interagency teams to evaluate nonstructural alternatives to levee repairs where appropriate. Contractors, soldiers and private citizens emerged to lend their valued support. All partners contributed their personnel, expertise, and professionalism. This team effort expedited relief operations and alleviated the suffering of those affected.

Especially productive were the efforts to bring back navigation to the Upper Mississippi River Basin without creating additional damages to, or threatening the stability of, weakened levees. The possibility that the wakes caused by barge traffic would further damage levees alarmed local officials. On July 19, the Corps met with the River Industry Executive Task Force and the Coast Guard to develop a plan for restoring navigation. The plan included a test tow protocol for opening the waterways. The plan of operation included a navigation traffic control center for direction, monitoring, information exchange, and public announcements. The test tow protocol required that three tows descend the Illinois and Mississippi Rivers to determine if wave action would cause additional stress to the levees. Levee district representatives rode the three tows to see first-hand the effects of commercial traffic. We commend the navigation industry for this cooperative effort. The River Industry Executive Task Force exemplifies what government and industry can accomplish in cooperative approaches to problem solving.

Volunteers fill sandbags at Roshenport, Missouri. The Corps provided more than 31 million sandbags to the midwest to hold back flood waters.

The flood fight demanded a massive commitment of Corps personnel. When the call went out for assistance, more than 1,000 Corps team members came forward and volunteered for duty in the affected areas. They deployed to the three Corps divisions (North Central, Missouri River, and Lower Mississippi Valley) and their subordinate districts (St. Paul, Rock Island, Omaha, Kansas City, St. Louis, and Memphis). Our volunteers brought that indomitable credo "The Corps Cares." Armed with their professional skills and concern for their fellow citizens, the volunteers worked tirelessly to help mitigate the damage. Throughout the remainder of 1994, between 200 and 500 deployed personnel will finalize levee rehabilitation. Once again, Corps personnel have proven to be our organization's greatest asset.

As the magnitude of the flood grew, I directed the establishment of a coordinating office to oversee the flood fight. Known as the Deputy Director of Civil Works (Forward), the office activated August 4, 1993 in St. Louis. The Forward Office, headed by MG Albert Genetti, Commander of the Ohio River Division, developed a strategic management plan for implementing recovery operations. It provided a regional setting to ensure Headquarters USACE policies were reviewed, interpreted, and applied uniformly. The office also became a one-stop shopping center from which to coordinate all public affairs and to provide liaison with congressional, state, and local interests. On September 17, having set recovery policies and procedures in place, the office closed.

As the floodwaters finally receded during October and November, the Corps began in earnest to rehabilitate more than 200 damaged federal and eligible nonfederal levees. Districts identified 38 levees where immediate and provisional measures could be provided to reduce the risk of further damage. The Corps expedited initial repairs to those levees, with final repairs to follow in 1994 for the remaining eligible levees. All initial repairs will be completed prior to the spring of 1994, when the annual thaw may again threaten to send floodwaters south to the Gulf of Mexico. The first 38 levees entered the Corps' Fast Track Levee Rehabilitation Program. This program typifies the creative solutions the Corps team developed to solve immediate threats to life and property. Design, contracting, and construction teams sped temporary repairs to these levees so that a minimum 20-year level of protection would be in place before the possibility of spring flooding.

Corps contractors will restore many of the more than 200 eligible levees scheduled for final repairs to their predisaster condition; however, more than half of the final repairs will not be completed until late 1994. Thus, the Corps will be fully engaged in rehabilitating levees for more than a year after the great flood of 1993 struck the region.

The Corps' Levee Rehabilitation Program is analogous to an insurance policy that promotes levee integrity and financially protects public levee sponsors. Active program sponsors comply with engineering and maintenance standards that ensure reliable protection against floods. In return, when an eligible levee is damaged by a flood, the Corps funds 80 percent of the repair cost. This program benefits public sponsors and minimizes the destruction caused by floods.

In the aftermath of the 1993 flood, the Corps received more than 500 requests for levee rehabilitation. About 300 of these requests were rejected because levee sponsors had previously elected not to enroll in the Corps program, or because the levees were in an unsatisfactory state of maintenance prior to the flood. These levee sponsors had no Corps "insurance policy." Levee sponsors enrolled in the Corps program spend thousands of dollars each year to maintain the integrity of their levees. Their steadfastness to sound engineering and maintenance resulted in Corps assistance after the 1993 flood—often exceeding $1 million per levee.

Lessons Learned

Some significant lessons learned from the great flood of 1993 follow. The list is incomplete because the task to repair damaged eligible levees will not be finished until late 1994, and we expect more lessons will be learned.

- The Deputy Director of Civil Works (Forward) in St. Louis was a success. Not only was the office able to coordinate implementation of policy, but it was a "one stop" information office that elected officials and members of the public could contact for specific information. The Public Affairs Office released information that affected the entire area to both the news media and the public. Thus, the responsiveness and credibility of the Corps increased with those most affected by impacts of the flood.
- On the engineering front, the Corps recognized the need for a better computer model to simulate the flows of the Mississippi and Missouri Rivers and their tributaries. The computer model will be used to determine impacts of flooding on facilities and water control plans. We are already involved in developing that model and will coordinate with the National Weather Service in its development.
- The automation of data dissemination among the Corps headquarters, divisions, and districts requires improvement to take advantage of current technology. As a result of this flood, we have identified the need to develop a better means for the exchange of water data between federal agencies on a real-time basis.
- The 1993 flood showed that Corps flood control projects, including reservoirs and levees, worked as designed and withstood the test of this flood. The water control plans for the reservoirs helped guide Corps decisions during these unprecedented conditions.
- The emergency operations centers at Corps headquarters, divisions, and districts functioned very well during the crisis. They provided timely responses to needs throughout the affected area.
- The River Industry Executive Task Force worked extremely well and illustrated the benefits of government and industry cooperation.
- The Corps' volunteer program was also a great success. It provided a pool of more than 1,000 individuals who were willing to go to the stricken area and join in the flood fight.
- As a result of the 1993 flood, many sponsors of public levees now realize the value of the Corps' levee rehabilitation program. If more sponsors join our program, more levees will be better maintained and better able to protect life and property.
- Our federal partners are a great force multiplier. Each organization has unique capabilities and dedicated professionals who contributed to the Corps successes. Teamwork provided the most effective relief possible.

The Future

In anticipation of spring flooding during March and April 1994, the Corps has developed an action plan. Routine planning activities include the identification of emergency contractors and borrow sites, and pre-positioning of sand bags and pumps. Additionally, the Corps will continue to educate the public, especially state and local governments, in flood fighting techniques and Corps assistance programs. In cooperation with the National Weather Service, we will assist in forecasting flood-vulnerable areas by estimating rainfall amounts, soil moisture content, and water content of the snow cover. The Corps stands ready against potential spring flooding.

Chaired by the White House, an interagency committee is analyzing floodplain management policies. The goal is to formulate coordinated and coherent interagency policies toward floodplain management that optimizes and balances uses of the floodplains. State and local participation in this effort are crucial. The committee has the difficult, but important, task of balancing the legitimate uses of navigation, flood control, water supply, recreation, industry and economic development, agriculture, environmental preservation, and habitat restoration. It will examine the whole ecosystem, while keeping in mind that 260 million humans are also part of that system. All committee members share a common hope—that the magnitude of the devastation caused by the great flood of 1993 never revisits the midwest. Whatever the decisions resulting from this effort, the Corps will be intimately involved in implementing them.

ESSAYONS!

Lieutenant General Williams is the 48th Chief of Engineers. He previously served as U.S. Army Corps of Engineers Director of Civil Works, Pacific Ocean Division Commander, Lower Mississippi Valley Division Commander, Sacramento District Commander, and 44th Engineer Battalion Commander. He is a graduate of the Naval War College and holds a masters degree in civil engineering from Stanford University. LTG Williams is a registered Professional Engineer in Minnesota.

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Letter to the Editor

Reference Bosnia: Engineer Planning for Operations Other Than War, By Major David R. Brown, *ENGINEER* magazine, November 1993.

The feature article referenced was an interesting introduction to the engineer specific concerns in OOTW. In an arena which includes numerous vital topics, the author succeeds in providing thought-provoking opinions. The "Mine/Countermine Operations" portion of the article was undoubtedly intended to cause appropriate self-reflection in the combat engineer community and units concerning their proficiency in countermine operations. Instead, the misplaced emphasis of the article may only have destroyed soldier confidence in a good piece of equipment, the currently fielded AN/PSS-12 mine detector.

The mine danger to our soldiers is very real. Antitank and antipersonnel mines are among the most lethal munitions on the battlefield, even though much of the world mine stockpile may NOT be very "high-tech." There is not presently any fielded means of stand-off detection to allow our soldiers to locate camouflaged or concealed mines without exposing themselves to serious injury or death. There also is no non-metallic mine detector fielded or presently available to U.S. forces.

The key to our detection "deficiency" was correctly identified by the author: TRAINING. In fact, proper training is so crucial that the lead sentence in the Mine/Countermine part should more correctly read "Many soldiers have little confidence in their ability to detect any mines with any equipment currently fielded." Despite such valid concerns, however, documented recent field use on live-armed mines in Southwest Asia by civilian contractors and in Bosnia by allied peace-keeping forces indicates unreservedly that trained operators using the AN/PSS-12 successfully detected the majority of all AP mines, even those touted as "non-metallic." This was possible because even non-metallic mines generally have at least a metal firing pin which can be detected by a well-trained operator using the AN/PSS-12. The confidence level has nothing to do with the extremely capable AN/PSS-12 detector, and everything to do with the frequency and realism of the detector training conducted.

An article featuring the successful use of the AN/PSS-12 is being written and will be submitted for publication in a future edition of *ENGINEER*.

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Letters to the editor are welcome. They should be addressed to: Editor, ENGINEER Professional Bulletin, ATTN: ATSE-T-PD-EB, Fort Leonard Wood, MO 65473-6650.

Return to Somalia: The Construction of Victory Base

By Lieutenant Colonel Robert L. Davis and Major Mark D. Feierstein

On 12 March 1993, the rear detachment of the 43d Engineer Combat Battalion (Heavy) departed Mogadishu, Somalia, leaving a vertical construction platoon as part of the residual engineer force. When the platoon returned to Fort Benning on 26 May, our soldiers thought their mission in Somalia was over. However, events on 3 and 4 October changed all that. After the President announced that an armored task force would be sent to Somalia to protect U.S. forces, we were alerted to deploy a company (-) to "bed down the task force." That requirement quickly grew into providing a task-organized combat heavy battalion. The following is a summary of the 43d's experiences on our second deployment to Somalia, in support of Operation Continue Hope. The article focuses on our main effort, the construction of Victory Base, a 1,700-soldier base camp.

Deployment

The battalion was alerted on 8 October, with the initial requirement to deploy a company (-), departure date unknown. The battalion staff quickly prepared Alpha Company for deployment, but within hours the requirement increased to a battalion (-). More changes followed. By change number three, the battalion staff conservatively decided to prepare for the worst-case scenario: prepare the full battalion for immediate deployment. By the end of the weekend that assumption was close to fact; our equipment was enroute to the port of Savannah by rail and commercial line haul.

Each line company deployed vertical heavy and horizontal light, taking all vertical construction assets and enough horizontal equipment to clear, grub, and build roads for the base camp. Included were two D7 dozers, two graders, two 2 1/2-cubic-yard loaders, and one small emplacement excavator (SEE) per company. Each company also deployed with eight 20-foot MILVANs with chassis to hold sets, kits and outfits, tents, and other supplies. Based on experience gained from our first deployment to Somalia, we painted 1-foot equilateral triangles on the sides of all containers, including the top, to uniquely mark them for rapid identification.

Because Class IV construction materials were not available in Somalia, the Army component of Central Command (ARCENT) contracted with Brown and Root to ship $1.7 million (about 60 MILVANs) of Class IV items. This estimate was based on our bill of materials from Operation Restore Hope. We purchased an additional seven MILVANs of Class IV material to build latrines and showers to meet the task force's immediate needs. These containers deployed with Alpha Company.

On 17 October, Alpha Company's advance party flew to Somalia aboard a C5A. The battalion's advance party and the rest of Alpha Company departed three days later on a commercial charter plane. We flew into Mogadishu on KC-10s from Cairo because the increased threat prevented commercial aircraft from landing in Somalia. The battalion's main body departed 10 November, also on commercial charter, to arrive at the same time as its equipment.

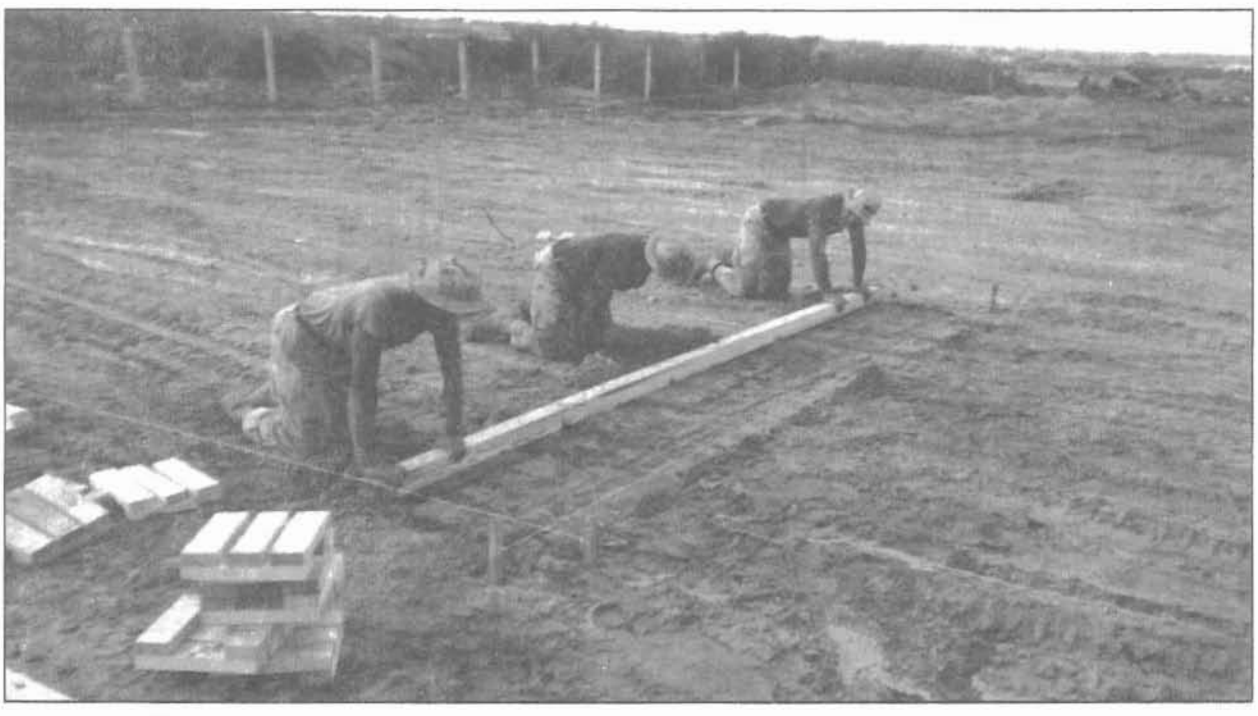
Missions in Somalia

Situation. The probability of random attacks against coalition forces or of being drawn into fighting among clans was high. Force protection was our top priority, and we continually stressed rules of engagement to soldiers before they deployed and while they remained in Somalia. When we left secure areas, we wore helmets, body armor, and load-bearing equipment and carried loaded weapons. Convoys consisted of three or more vehicles with sandbagged floors. One vehicle was a "gun truck," which was armed with at least one M60 machine gun. Redundant communication with all convoys was essential, as was reflexive knowledge of fire support, MEDEVAC, and SALUTE procedures.

Victory Base was secured with a perimeter berm and wire network. Our innermost protective barrier was an 8 to 10-foot high berm that had an outer perimeter road directly outside for mounted patrols. The innermost ring of triple-standard concertina was just outside that road, followed by a double-apron fence and one last layer of triple-standard concertina. This dead zone was 40 meters wide, was illuminated with 3,000-watt perimeter lights placed 50 meters apart, and was overwatched by MILVAN guard towers embedded in the berm.

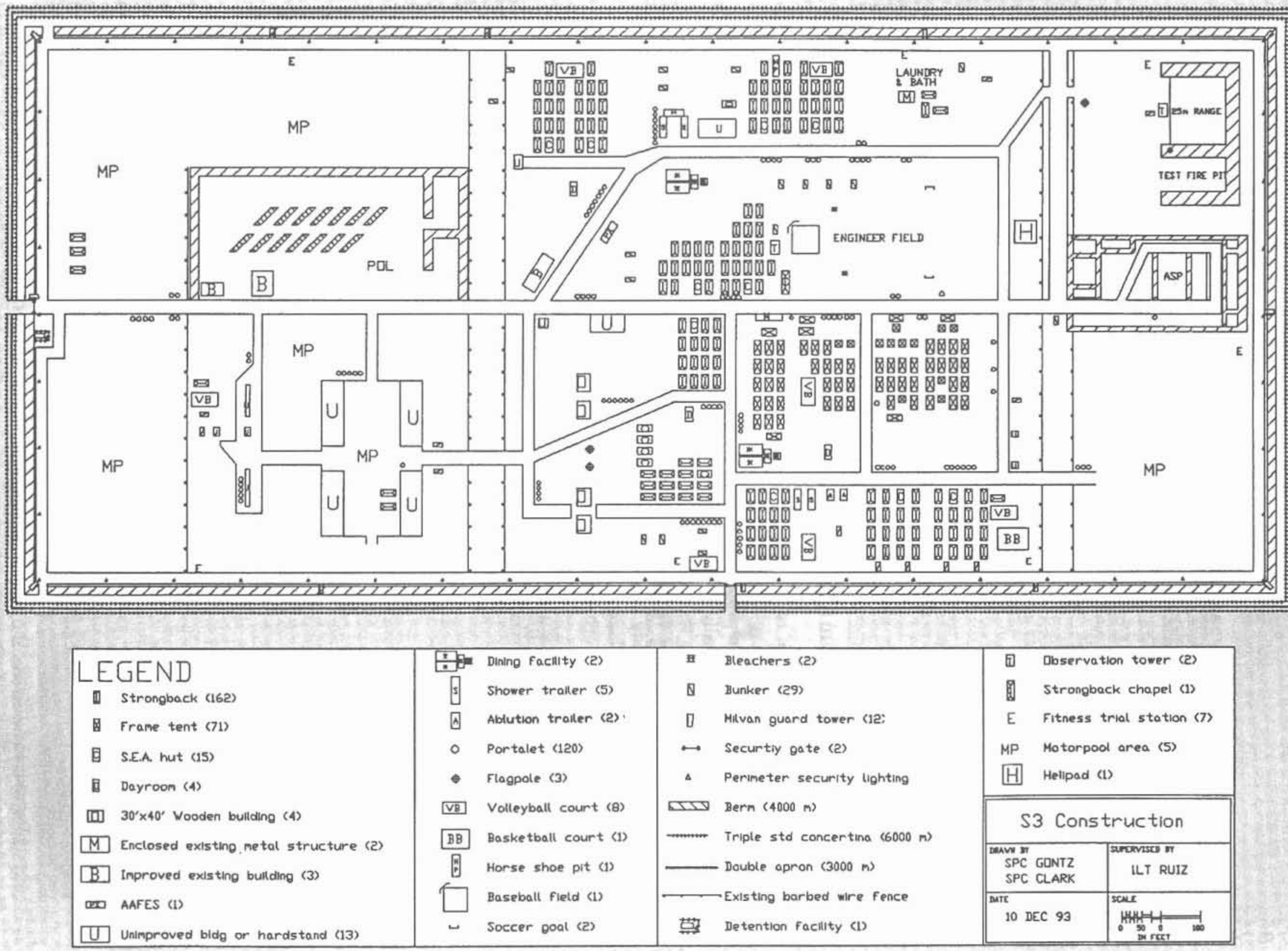
Inside the base camp, the enemy threat was evening 60-mm mortar attacks, so we sandbagged tents and wore helmets and body armor after dark. Because vector-borne diseases were rampant, we religiously took mefloquine once a week to sustain our health. We also used insect repellents and sunscreen, slept on cots with mosquito netting, and avoided local food and water.

Mission. The 43d was attached to the Falcon Brigade, 10th Mountain Division, which was part of Joint Task Force (JTF) Somalia. We were in direct support (DS) of Task Force 1-64 Armor to bed them down, while maximizing force protection and quality of life. Mission creep was minimal, and the



SPC Martin, SPC Fullwood and SPC Massey (left to right) of 1st platoon, B Company, level the ground prior to placing strongback footings.

43d Engineer Combat Battalion (Heavy)
Power for Service
Victory Base, Mogadishu, Somalia



PV2 Mebane of 1st platoon, B Company, marks floor joist positions on a strongback tent beam.

battalion directed almost all its efforts to Victory Base.

Task organization under the JTF, as opposed to the United Nations Logistics Support Command (UNLSC), worked well because it linked us directly to the units we were sent to support and precluded potential conflicts of interest from competing UNLSC priorities. Charlie Company, 3d Engineer Battalion, the habitually associated divisional engineer company, built Victory Base's perimeter berm and wire system. The 535th Prime Power Detachment established the electrical grid and was the only UNLSC engineer unit on Victory Base. Brown and Root provided contracted support.

Execution. A viable site for Victory Base had not been identified when the battalion advance party arrived on 21 October. The 43d Commander and S3 reconnoitered the proposed site and determined that it lacked sufficient drainage and trafficability. The search for a new site began immediately. A joint effort between the 43d and TF 1-64 identified an abandoned Soviet missile site just 3 kilometers north of Mogadishu. That site seemed perfect—it had good drainage and an existing road network, was easy to secure and defend, was just the right size, and was out of range of 60-mm mortar shells launched from the city's dingy back alleys. Falcon Brigade Civil Affairs had even concluded favorable negotiations for the land (you couldn't just take what you wanted in Somalia).

The problem was that the site contained more than 90,000 pounds of warheads and rocket propellant from abandoned missiles. The explosive ordnance detachment was immediately notified, and they determined that the ordnance was too unstable to move and had to be destroyed in place. Unfortunately, the propellant and warheads were located in the best five of ten salvageable structures.

While EOD planned the big bang, our S3 section planned construction, and Alpha Company worked at Sword Base prefabricating latrines and staging equipment from the first ship. Satellite and aerial photographs of the site were not available, so our construction officer boarded a helicopter to "shoot" some. That night he drafted a scaled layout from those images to make a planning board. We conducted detailed coordination with TF 1-64 at this point to ascertain specific needs and desires. We then made scaled vehicle cutouts and generic task force company "footprints," each of which contained 12 strongback tents and one Southeast Asia (SEA) hut, and arranged them on the board to determine optimal billeting and motorpool locations. All other base-camp facilities (showers, administrative buildings, dining facilities, bunkers) logically followed.

Once the task force was satisfied with the base layout, we completed construction estimates and assigned each of our companies specific areas of responsibility (AORs). The AORs were selected to maximize use of the battalion's resources by optimally allocating company workloads while simultaneously giving each company a wide spectrum of construction missions and training. The AOR concept was also used to promote unit pride by giving each company a sense of ownership for its assigned work areas.

The S3 wrote an operation order (OPORD) to integrate resources and clearly define, by phase of construction, exactly what needed to be done, in what priority, how, and by whom (the 43d, C/3, 535th, and Brown and Root). All changes, refinements, and additions to the base OPORD were specified in subsequent written fragmentary orders (FRAGOs). The S3 also provided designs for all work to be accomplished.

Base Construction. Victory Base was constructed in four overlapping phases. Phase I, horizontal construction, began with site occupation on 30 October, after the ordnance was detonated. It included clearing and grubbing operations (3.7 million square feet); emplacing crushed coral (880,000 cubic feet); and constructing a perimeter berm, roads, motorpools, an ammunition supply point (ASP), a test fire pit and a petroleum, oil and lubricants (POL) yard. Phase I ended on 8 December.

Phase II, vertical construction, began on 5 November with the start of the first company footprint. Before starting construction, we removed hundreds of tons of twisted metal and rubble left by EOD's blast. Force protection work included the perimeter wire obstacle system, perimeter lights, and 12 MILVAN guard towers. Quality of life construction included building 162 strongbacks (16 feet by 32 feet), 15 SEA huts (16 feet by 32 feet), and 4 SEA huts (30 feet by 40 feet), all equipped with electricity and lights; a GP large strongback tent chapel; a laundry and bath facility; and a power grid. Phase II ended on 10 December.

Phase III, bunker construction, also involved both vertical and horizontal efforts. However, it was different from Phases I and II because we executed it as assets were freed from those phases. The threat determined the priority we placed on Phase III. Phase III ended on 10 December when the last MILVAN bunker was completed.

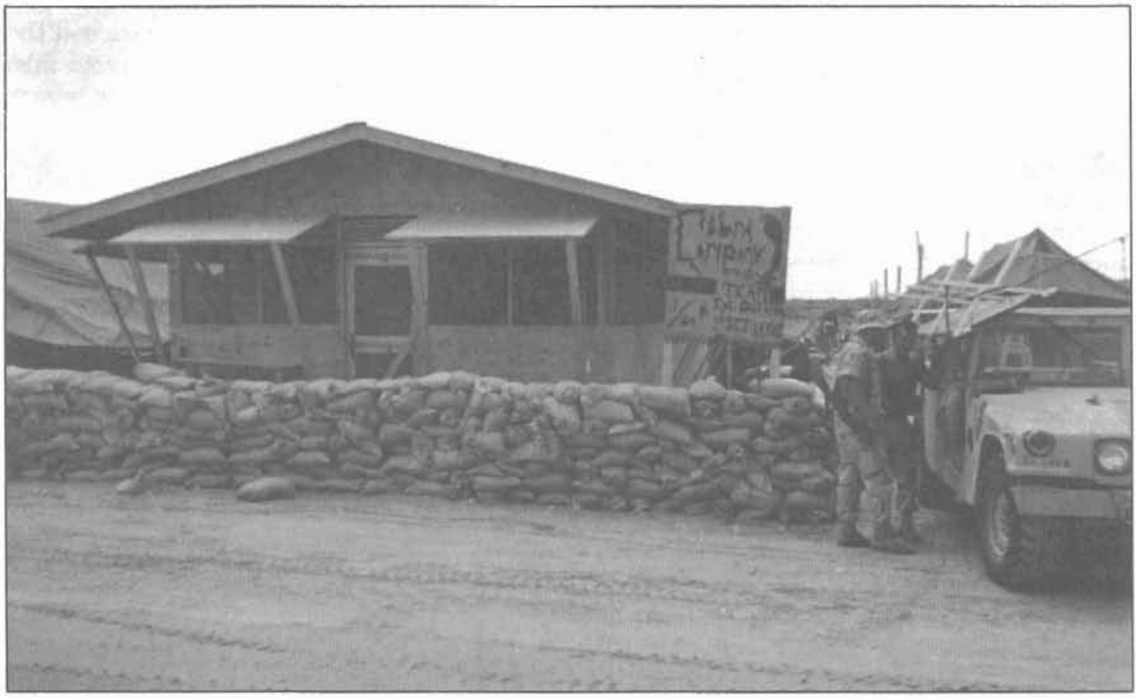
Phase IV's purpose was to continually improve on work performed in Phases I through III and to do new projects to enhance base-camp efficiency and quality of life. Phase IV projects included a 25-meter qualification range; a detention facility; an air conditioned PX; decks, benches, and privacy screens for shower trailers; over 200 pieces of modular furniture; a fitness trail with seven exercise stations; and baseball and soccer fields complete with a backstop, goalposts, bleachers and a line chalker. Phase IV ended when the battalion left Somalia on 18 December.

Victory Base construction was a highly dynamic process. Not everything went as planned—we completed some projects earlier than anticipated and some later. There were also plenty of fresh ideas for improvements and new projects, the best of which were implemented in Phase IV. Examples include counterweighted I-beam gates and hedgehogs for base-camp entrances, SEA hut window shutters and five-roll paper holders for portalets. We expected such changes and effectively managed them while keeping workloads balanced with clear, concise mission orders (FRAGOs). Active quality control at the company level and quality assurance at the battalion level were also important to ensure that work was done right the first time. Additionally the companies, platoons, and squads learned lessons daily, which they shared each evening at the battalion command and staff meeting, to minimize learning curves.

Military engineers did not build Victory Base by themselves. Brown and Root played an integral role by providing contracted equipment, services, material, and construction. When we first occupied Victory Base, not all of our earth-moving equipment had arrived, so we relied on Somali dozers and compactors to assist with initial clearing and site preparation. Contracted Somali labor cleared brush, filled sandbags, removed waste from portalets, and disposed of trash. Somali carriers hauled most of the 880,000 cubic feet of crushed coral that we emplaced in motorpools and around company areas to improve trafficability and control dust.

Brown and Root also provided Victory Base with five 18-head shower trailers and two 3-head units with water tanks and pumps, five reefer vans, several chest freezers, ice machines, and air conditioners. Brown and Root also built two dining facilities, four dayrooms, and the base's 3-kilometer perimeter lighting system. Working with Brown and Root and their Somali subcontractors highlighted the importance of proactive civil-affairs operations when inter- and intra-clan fighting stopped crushed coral deliveries for more than a week.

The battalion executed several smaller missions while constructing Victory Base. They include work performed at the boat factory, the JTF Headquarters, Checkpoint 31, Gotham City and the Mogadishu Airport. The boat factory was an abandoned works on the coastline southwest of Victory Base. We prepared it for occupation by friendly forces by clearing it; establishing drainage; wiring two existing warehouses and an administrative building for electricity; and constructing a dining facility, six guard towers, two bunkers, a 25-meter range, a test-fire pit, and several berms. We built bunkers, mortar-blast shields, and tent floors for the JTF Headquarters; constructed a guard tower at Checkpoint 31; and cleared a holding area for Somali refugees near Gotham City. Finally, at the airport, we conducted site preparation for future construction, waterproofed the terminal roof to increase usable space in the passenger holding area (PHA), and built picnic tables for use in the PHA.



Each company footprint contained one SEA-hut for administration. B Company built this one for Cobra Company, Task Force 1-64 Armor.

Service Support. With the exception of Class IV, assistance from Brown and Root and laundry and bath service (furnished on-site by the 16th Field Service Company, UNLSC), the 224th Forward Support Battalion (FSB) provided all the battalion's logistical support. The 224th was attached to TF 1-64 and received its support from the UNLSC. The theater had matured considerably from the time of our first visit and, excluding Classes IV and IX (repair parts), obtaining routine support was no longer an ordeal. Construction material shortages were recognized, which is why ARCENT furnished our Class IV. Repair parts nonavailability, especially for low-density engineer equipment, was just as broken as during Restore Hope. Units in country could more easily acquire Class IX by calling back to home station than by requisitioning it in theater. Even though we were in Somalia a total of only two months, the Class IX situation was so desperate that our group commander brought all the parts he could carry when he came to visit.

Command and Signal. Confusing theater command relationships made routine duties much more trying than necessary. Our task organization under the JTF and Falcon Brigade greatly clarified our mission requirements, but the lack of a theater engineer made engineer coordination outside of the JTF difficult and burdensome. Out of frustration and the desire to facilitate our work, we met weekly with all key engineers in country. This was very successful in that it expedited actions, corrected miscommunications, and prevented duplications of effort.

The battalion experienced many communication challenges during Continue Hope. Single-channel, ground airborne radio systems (SINCGARS) were our organic and primary means of communication. We operated in single-channel mode because many U.S. and all allied units could not frequency hop. Although we had no organic mobile subscriber equipment (MSE), we employed devices borrowed from other units. Five mobile subscriber radio terminals were used throughout the battalion. Nine digital, nonsecure voice terminals were used at Victory Base for operational control and morale, welfare, and recreational purposes. We used a UXC-7 secure tactical facsimile device to send and receive classified situation reports (SITREPs), OPORDs, and FRAGOs to and from Falcon Brigade Headquarters at the embassy.

Two electronic-mail tactical terminal adaptors allowed us to send unclassified reports to other headquarters and to update our rear detachment and family support-group network at Fort Benning. These daily progress reports were recorded on a Somalia hotline that the battalion's friends and family members could access by dialing a toll-free (800) number. Commercial hand-held and AN/PRC-127 radios facilitated communication between the battalion tactical operations center and worksites. A TA-312 network provided reliable and redundant communication in the base camp. The major problem that persisted to the very end was the apparent lack of compatibility between the digitally grouped multiplexed (DGM) system and MSE. This problem plagued not only the 43d, but all of Victory Base. All other communication challenges were surmountable.

Redeployment

The battalion completed the enormous task of constructing Victory Base in a little over two months after our initial alert in garrison. Due to the drawdown of U.S. forces in theater, we turned much of our engineer equipment over to Brown and Root. We transferred our remaining Class IV to the 224th FSB, and provided Brown and Root with a memorandum delineating base-camp maintenance requirements. As we prepared our remaining equipment for shipment, we experienced one final reminder of Somali hospitality: Aidid strongholds in the city forced us to convoy on a circuitous route from the washracks to the port along a dusty main supply route. The battalion returned to Fort Benning on 19 December.

Lessons Learned

We learned many lessons during Operation Continue Hope. Some carried over from our first Somalia deployment and were reinforced, while others were specific to this deployment.

- Make force protection your number one priority. It should drive all planning and execution and is ultimately achieved through continuous command emphasis. It ranges from base-defense planning that is commensurate with the threat, to squad leaders ensuring that their soldiers keep their flack vests closed while on long, hot convoys.
- Distinctively mark containers before shipping to facilitate recognition at destination. Mark all sides and the top with a symbol that can be seen from a distance.
- Try to find out about Class IV availability. You may have to bring your own. If you don't, you may end up sitting in theater waiting for materials. Ship it in 20-foot MILVANs with chassis to ease transportation. Deploy with a supplementary, command-directed prescribed load list, especially for low-density equipment, based on anticipated missions and theater conditions, such as hot, dusty roads and jagged rocks.
- If you can influence task organization, try to work directly for those you will support to preclude competing priorities.
- Ensure you understand your customer's needs and desires and meet often to stay attuned to them. Once you know your customer's expectations, use scaled site layouts, OPORDs, and FRAGOs to manage the details and maximize efforts so you can exceed those expectations. Use these tools to avoid mistakes and wasted effort, even if there is pressure to produce quick results.
- Bring any special tools you think may help. For example, pneumatic nail guns are great when you have a lot of carpentry work, and a K-SPAN machine is the most efficient way to roof most existing structures.
- Perform meticulous quality control and quality assurance to catch mistakes early. Share lessons learned at all levels daily.
- Use contractors for whatever you can, whenever you can. Start planning the engineer end state early by focusing on transition to the contractor when possible. When you do transition, do so clearly and in writing. Until you put it in writing, you probably haven't thought it through. Be aware, however, that civil disturbances and unrest can hinder or even stop contracted support so have a strong civil affairs program and back-up plans.
- Finally, meet at least weekly with fellow engineers in theater, military and civilian, to synchronize efforts.

Conclusion

The true keys to the phenomenal success of the 43d Battalion during its second trip to Somalia were the speed and versatility of construction in support of combat operations. The experience gained from the first deployment allowed the battalion to exceed all task force expectations and safely redeploy soldiers once the mission was accomplished. The lessons learned will serve engineers well in the future and help ensure that we represent the Corps with distinction, by continuing to prove that engineers are vital to the Army in its changing roles.

Lieutenant Colonel Larry Davis is currently the battalion commander for the 43d Engineer Battalion. Previous assignments included tours with the 101st Airborne Division (Air Assault), 5th Special Forces Group (Airborne), and exchange officer to the Australian School of Military Engineering. LTC Davis is a CGSC graduate. He holds a masters degree from Georgia Tech and is a registered Professional Engineer in Virginia.

Major Mark Feierstein is currently the battalion S3 for the 43d Engineer Battalion. He previously served in the 36th Engineer Group Headquarters, the 7th Engineer Brigade, and as the engineer team chief at Readiness Group Snelling. A CGSC graduate, he holds a bachelors degree from Kansas State University.

Let's Really Train to Project the Engineer Force!

A "woe be us" lassitude seems to have struck the active duty Army engineer force as budget realities keep engineer units locked up at home station. Yet, along the United States' southwest border, requirements for engineer support provide tremendous opportunities for engineer leaders to conduct realistic, rugged training in a real threat environment, at no cost to their own training budget. Aggressive unit commanders can accomplish more METL (mission essential task list) training on a 60-day deployment to the southwest border than they may realize in a year at home station.

Changing Mission Requirements

Professional military journals continue to chronicle the changing nature of military operations. The changing face of threats to national security has spawned the doctrine of operations other than war (OOTW). In some respects, OOTW is similar to low intensity conflict in that those engaged in it, and taking rounds, may find it anything but low intensity or unwarlike.

Changing doctrinal emphasis has also intensified the necessity to project the force into regions where it is needed. We no longer have the luxury of massive, in-place forces. We must rely on the speedy and efficient deployment of forces, whether overseas or to disaster spots in CONUS.

Counterdrug operations along the southwest border of the United States are an important part of the OOTW mission that supports national security interests. The southwest border region is a designated high intensity drug trafficking area and support to counterdrug operations in this area is one of the five key elements of the national drug control strategy. For the past four years military engineer units have made great contributions in this effort while supporting law enforcement agencies along the border.

Fumbled Training Opportunity

Unfortunately, recent military engineer contributions have been without Army engineer unit participation. Force drawdowns, downsizing, split-stationing of units, and budget cuts have caused Army engineer units to become decisively engaged in post and installation construction and maintenance activities. A look at the fiscal year (FY) 94 JTF-6 engineer mission program reveals that for the last two and one-half quarters of the FY only one active duty Army engineer unit has volunteered for a southwest border deployment. The counterdrug engineer construction mission is quickly becoming an air and sea service show.

Army engineers are missing tremendous opportunities to engage in meaningful training in an area desperate for their support. JTF-6 missions offer excellent opportunities for units to gain critical training in deployment and redeployment activities, logistics planning and execution, and construction. These opportunities are available at virtually no expense to employed units or their parent headquarters. JTF-6 assumes the costs for transportation, rations, fuel, and operating costs associated with a southwest border mission. Units can augment their training program, gain valuable METL training, and execute meaningful engineer missions at no expense to themselves.

Training Focus

Engineer support focuses on improving interdiction capabilities of law enforcement agencies through repair and construction of border fences and patrol roads. A secondary focus of construction missions is to optimize the number of law enforcement agents on patrol by building close-in firing ranges and enhancing existing facilities. Engineer missions in support of law enforcement agencies run the spectrum of complex to simple and offer a variety of mobility, countermobility, and survivability tasks. Typical missions executed on the southwest border range from barriers/obstacles (border fences of various styles and designs), construction and repair of combat trails and roads,

(Continued on page 33)

By Lieutenant Colonel Mark A. DeHarde

ENGINEER THEATER SUPPORT OPERATIONS

By Jeb Stewart

The Army's Role in Containment

From 1946 until 1991, the strategic security policy of the United States was "containment"—containment of the Soviet Union, its surrogates, and the spread of world communism. Since 1950, about half the U.S. Army has been positioned in Europe to thwart Soviet designs on western Europe. For decades, many USAREUR units were stationed almost where they were when the fighting stopped in 1945. And, until quite recently, operational-level thinking and many Army support structures reflected the World War II experience.

In 1991, containment was finally victorious. Facing intolerable pressures, the Soviet economic system collapsed and with it the Soviet military empire. The war of the giants had been averted, but frustratingly, the quarrels of the pygmies have intensified. Now our Army is coming home, downsizing, and learning how to protect vital national interests abroad by developing more deployable forces that can meet the realistic goal of dealing with two almost simultaneous, major regional crises. Our now-obsolete doctrine was developed with a global threat in mind; its basic premise was the defense of western Europe. Doctrine is now being rewritten as fast as possible to reflect and support our new security needs. Among the doctrinal challenges facing the Engineer School is the preservation of a central core of doctrinal substance as we rewrite our doctrine or participate in other proponents' doctrinal development process. Many talented writing teams are hard at work on this immense task. Unfortunately, the possibilities of inadvertent conflicts in doctrine or substantive errors are quite high.

Core Guidance

To articulate the core guidance and to serve as the intellectual precursor for subsequent doctrinal publications, the Engineer School has developed a white paper that describes engineer theater support operations. This paper describes in specific terms how theater U.S. Army engineer field organizations will respond to various contingency requirements with a mix of military and contractor capabilities and how the U.S. Army Corps of Engineers (USACE) will be integrated into this effort. This article is an abridgement of the white paper. It describes what must be done to fill the doctrine and force design "gap" and discusses engineer organizations that are designed or can be adapted for theater support operations and the inclusive missions they may have to perform.

The White Paper

The current national military strategy envisions a response to regional crises with a mix of rapidly deliverable and initially self-sufficient forces. The unified commander (CinC) may assign a single service to respond or, more likely, may select from a broad spectrum of capabilities from all services and tailor a joint task force. The U.S. Army contribution to either option may be a brigade, a division, a corps, two or more corps or a task force organization of any size. This force must have the capability to operate for a notional 90-day period without the theater support structure described in current doctrine.

Some critical engineer missions are currently staffed for planning only at theater level. The absence of early-on theater engineer support could jeopardize missions to a degree that is not clearly understood outside the engineer community. If a corps is deployed, under current doctrine the troop list typically includes a corps engineer brigade headquarters and several engineer group headquarters along with engineer troop units. If a division or a brigade is deployed, only those organic engineer elements (engineer brigade for heavy

Theater Support Engineer command and control elements

Geographical size and complexity of theater engineer mission

Size of force	Large/mature	Large/immature	Small/mature	Small/immature
Multicorps	ENCOM	ENCOM	ENCOM	ENCOM
Single corps	ENCOM/ TA Bde	TA Bde	TA Bde	TA Bde
Division	Corps Bde/ Group	Group	Group	Group
Brigade	Group	Group	Group	Group

divisions, engineer battalion for light divisions and a battalion slice for a heavy maneuver brigade) are normally included in the troop list.

All these elements are focused on combat engineering in combined arms operations and have a limited capability for "theater support" engineering. In most conceivable scenarios, the combat engineers will be unable to cope with requirements for construction engineering and related services. Theater support engineering will almost certainly be conducted jointly with other U.S. service components and probably combined with our allies. Engineer topographic support (other than divisional terrain teams) is provided by engineer topographic units found in theater and corps support structures.

Reliance on Reserve Components

An important assumption is access to critical engineer theater support skills that reside either predominately or exclusively within the Reserve Components. The resolution of certain mobilization issues, the discussion of which is outside the scope of the white paper, is of vital importance to the engineer force.

Focus of Engineer Operations

At theater level, the engineer and the logistician share numerous interests; they are equally concerned about such matters as logistics base construction and the maintenance of supply routes. Their concerns are often considered so closely related as to tempt planners to combine their command and control structures. However, such a policy works to the pronounced detriment of the theater commander's ability to execute his campaign plan, which requires a flexible engineer task organization to achieve operational objectives.

In addition to supporting forward commanders, engineer forces are responsible for constructing, maintaining and rehabilitating the theater support base. The theater army (TA) commander tailors the engineer structure to theater requirements. Establishing a theater base depends heavily on the extent and nature of the civil and military infrastructure existing in the theater before hostilities begin. All engineer units (combat, construction and topographic) are focused on actions at the operational "tip of the spear."

While they fully support logistical requirements, engineers must not be rolled into the theater logistics support structure. Theater engineers are often employed in reinforcing combat engineers organic to the corps, divisions, separate maneuver brigades and cavalry regiments. The senior engineer commander ensures that all engineer battlefield functions are fully planned, integrated, synchronized and executed to support the maneuver commander's intent and scheme of maneuver. Engineers must be full participants in current and future operational planning and have their own command and control headquarters to ensure the timely and proper execution of the intent and scheme of maneuver.

The senior engineer commander in a theater of operations may be responsible for any or all of the following missions:

- Planning and coordinating combat operations.
- Engineering assessments of theater infrastructure requirements.
- Planning, coordinating, and supervising military and contract engineer support to the Army, other services and coalition forces in the theater.
- Allocating engineer resources (units, contractors, materials, and equipment) to meet mission requirements.
- Prioritizing the use of available theater engineer assets to include tradeoffs between combat and construction requirements.
- Coordinating topographic and military geographic intelligence support to the force.
- Providing real estate support to the Army, other services, and allies throughout the theater.
- Providing technical assistance to real property maintenance activities (RPMA) throughout the theater.
- Planning construction material requirements and prioritizing their use.

Engineer command and control headquarters with theater support capabilities include:

- Engineer Command (ENCOM).
- Engineer Brigade (Theater Army).
- Engineer Brigade (Corps).
- Engineer Group.

The central organizational framework for theater support operations is the theater army, of which an ENCOM is a major subordinate element. There are two ENCOMs in the current force structure; both are U.S. Army Reserve units. Each ENCOM is focused to support one of two major regional contingencies occurring simultaneously. An ENCOM normally consists of one or more engineer brigades (theater army), at least one topographic battalion, and several other specialized engineer units. The ENCOM structure was designed to support a multicorps theater and represents prudent force planning for a major regional contingency. During lesser regional contingencies, the ENCOMs are a source of highly trained professional engineers and support personnel who can deploy incrementally as necessary to augment other engineer staffs.

The TA engineer brigade consists only of a headquarters and headquarters company (HHC), with all other subordinate elements assigned based on METT-T considerations. The TA engineer brigade may have a number of engineer group headquarters, engineer battalions, companies, detachments, and teams. The TA engineer brigade area of operation (AO) normally coincides with the theater army area command (TAACOM) boundaries. During contingency operations, the TA engineer brigade, augmented from the ENCOM or USACE, can deploy and serve as the theater's senior engineer headquarters.

The corps engineer brigade commands and controls the combat engineers in the corps troop list and other engineer units task-organized under the control of the corps commander. Although not designed for theater-level engineering, as an early deployer the corps engineer brigade often gets the responsibility anyway. The corps engineer brigade requires augmentation from the TA engineer brigade, ENCOM or USACE to execute theater support missions.

The engineer group has an organic HHC and can provide command and control for as many as seven engineer battalions, plus a number of separate companies, detachments and teams. The engineer group is the principal subordinate unit of an engineer brigade. The two types of engineer groups are the combat group and the construction group. The primary difference is the size of the construction management section (five soldiers in the combat group, 17 in the construction group). The engineer group functions as the principal manager of engineer combat forces or as the construction manager for a given area or specific tasks and has planning and design capabilities. For maneuver brigade or division-level force contingencies, the group may be utilized as the command and control headquarters for engineer theater support.

Engineer Theater Missions

Planning and coordinating combat operations. Theater engineer units conduct combat operations by providing mobility, countermobility, survivability and topographic services to maneuver units. Missions include replacing assault bridging with support or lines of communication bridging, clearing minefields and removing other obstacles, maintaining main supply routes and constructing heliports and airfields. Topographic support includes mobility "go/no go" overlays and geodetic survey products.

Engineer assessment of theater requirements. Combatant commands maintain libraries of information on countries within their AO which the CinC has identified as potential contingency areas.

Engineer assessments describe the countries' infrastructure, including ports, airfields, soils and topography, construction materials availability and civilian construction industry. This information is useful but does not have the level of detail or accuracy required for thorough construction management planning. The first arriving engineer command and control element will determine macro requirements and report their initial observations. This first-arriving engineer command and control element will likely be a combat engineer element and will lack the staffing or expertise to do construction management planning. The first-arriving engineer element may be able to conduct an initial assessment but will be unable to plan or execute missions to correct theater-wide engineering deficiencies. This element will likely require augmentation to plan theater-level engineering regardless of the size of the theater of operations.

Planning, coordinating, and supervising general troop and contract construction or rehabilitation support to the Army and other services and allies within the COMMZ and construction support in the corps areas. The engineer supports the theater of operations through construction of new facilities or repair or modification of existing facilities. Wartime facility requirements will be satisfied, in order of priority, by—

- Maximum use of existing facilities (US- or host-nation controlled).
- Modification of existing facilities rather than new construction.
- Expedient and initial standard construction and site preparation necessary for emplacement and operation of unit equipment and bed-down of troops.
- "Temporary" standard construction.

The CinC establishes broad construction policies and standards and designates a staff engineer, who may be from any service. To assist this engineer, the CinC may establish a regional contingency engineering management (RCEM) cell. This cell provides policy interpretation, oversight and project prioritization recommendations. The RCEM cell does not have command and control responsibility. Command of Army engineer theater-support forces rests with the senior engineer commander, normally the ENCOM commander, who may wear a second hat as the regional contingency engineering manager. The mission of the regional contingency engineering manager may include the following:

- Set construction priorities and policies based on CinC's guidance.
- Allocate force construction capability.
- Balance engineer support to operational and logistical requirements.
- Manage construction materials.
- Plan for future construction.
- Program construction funding requirements.

Allocating engineer resources (units, contractors, materials, and equipment) to missions. The senior engineer headquarters will allocate scarce resources and adjudicate among claimants. The requirement may fluctuate significantly between mature and immature theaters. For example, during Desert Shield, 26 of the 29 engineer battalions in the theater were assigned to the two corps engineer brigades because much of the rear infrastructure was already in place.

Missions can be executed by troop units, host nation, or contracting. Engineer services include but are not limited to hazardous waste and waste water disposal, trash removal, maintenance services, construction equipment/operator services, and firefighting. Contingency force operations may have an austere combat service support base and will require contract-provided services and supplies. The use of large, multifunctional civilian contractors, LOGCAP (Logistics Civil Augmentation Program) to perform various theater-support engineering jobs is usually desirable and may be feasible in many overseas areas. The Corps Support Command (COSCOM) or Division Support Command (DISCOM) will operate a contracting element to provide contracting support. When a full corps or a complete division is not deployed, the COSCOM or DISCOM may provide a contracting task force tailored for the specific contingency operation. The RCEM cell will determine the need for and availability of engineer services contracting.

Prioritizing the use of engineer assets. The senior engineer will be tasked to refine the notional time-phased force deployment list (TPFDL) to more closely match existing requirements with capabilities. Focusing on the campaign plan, the senior engineer commander must make tradeoffs between combat and construction engineering. Sometimes, despite the versatility of the engineer force, this process results in apparent "square pegs" as units temporarily perform missions for which they are not trained or equipped in anticipation of future requirements for work in which they are. This concept outlines the use of selected ENCOM elements and their entry into the deployment stream through the process of force modularity.

The ENCOM will provide a construction management cell to the senior deploying engineer element. This Army reserve cell will train in peacetime for ENCOM or contingency force engineer missions. The cell will be quickly called to active duty for deployment during contingency operations.

Early deployment is critical because the cell will be involved in force reception and bed-down. The cell will become the senior engineer commander's construction management staff. It will be equipped with and trained in the use of an automated construction management system (for example, the developmental Theater Construction Management System or a similar system). If and when the theater matures and the ENCOM deploys, the ENCOM and brigade commanders will coordinate a hand-off of construction management responsibilities.

Coordinating topographic and military geographic intelligence support to the force. Commanders planning or executing contingency operations will require accurate, timely, and tailored topographic engineering products in order to visualize, operate on and exploit their battle space. Topographic engineers will provide critical mapping, charting and geodesy (MC&G) support and products during contingency operations. Contingency operations may occur anywhere on earth, and surprisingly little of the earth's surface has been accurately mapped. Contingency operations frequently occur, as if with malicious intent, in sparsely mapped areas. Topographic engineering support will provide operational and tactically oriented terrain analyses, nonstandard and substitute maps, and survey data to combat, combat support, and combat service support forces in all phases of operations throughout the contingency area. The Defense Mapping Agency (DMA) will be responsible for producing all standard MC&G products and data bases.

Throughout the operation, topographic engineer planning and control elements will process and refine topographic information passed between deployed forces and DMA. Some terrain features may change rapidly once operations begin; others may be unaltered by operations. Knowledge of the terrain will rapidly increase as a result either of focused study or on-the-ground reconnaissance. Topographic engineers will maintain qualitative information concerning coverage, resolution, standards, source, currency, accuracy, uncertainty, and limitations of all topographic data. They quickly replace older, superseded data to ensure that users are provided the most current data available. This support includes passing provisional or locally acquired data back to DMA for possible exploitation as DMA updates and maintains its standard data bases and products.

The commander of the topographic engineer battalion identified within the OPLAN/CONPLAN/-OPORD to provide topographic engineer support will command all topographic units involved in the operation. The topographic engineer battalion provides general support to unified and specified commands and to subordinate topographic units for requirements beyond their capabilities, and provides topographic support to all theater Army units. The senior engineer commander will serve as the theater topographic engineer and, as such, will recommend the size, composition, support relationships, and location of the topographic engineer force.

Topographic support may require augmentation by an ad hoc rapid-response terrain team to ensure the proper level of support. The ARFOR command MC&G officer will request and coordinate the formation of a team based on the urgency and quantity of the support required. The team will be developed from reserve units, topographic units not deployed, and technical experts from Army laboratories and MC&G production agencies. Its mission will be to help deployed forces develop a detailed topographic data base quickly to allow development of required MC&G products. Deployed topographic units will continue to seek host-nation and all-source intelligence data to provide required MC&G products and enhance the force capability.

Providing real estate support to the Army, other services, and allies throughout the theater. The US Army Corps of Engineers (USACE) is the Army's real estate agent for acquisition and disposal of real property and is capable of providing real estate services for all services. During combat or contingency operations, the Chief of Engineers discharges his real estate functions through the theater commander. The work is actually done by the ENCOM, but if an ENCOM is not deployed, it may be done by the senior engineer headquarters with augmentation support. The ENCOM's contingency/wartime CAPSTONE organization includes Army engineer real estate (AERE) teams. These teams may provide general support to TAACOM in order to conduct real estate operations within a designated area. To support Operation Desert Shield, we needed an immediate in-country real estate contracting capability before the ENCOM was activated and deployed. This concept codifies many of the successful doctrinal improvisations from Operation Desert Shield and Operation Restore Hope that can be applied in future force projection operations.

USACE will provide a contingency real estate support team (CREST) for deployment as part of the contingency force. The CREST personnel will be predesignated volunteers who possess the requisite knowledge, skills, and abilities to successfully accomplish all tasks. They will maintain passports, immunization certificates, and other documents necessary for quick deployment and will have the required training to operate in a combat theater environment. The USACE CREST will participate in the annual training of the ENCOM personnel and their AERE teams so that improved training and close working relationships are achieved prior to operational deployment. The USACE CREST and ENCOM AERE personnel will review OPLANs for real estate impacts and provide recommendations to the planning headquarters. Among the areas reviewed will be level of infrastructure development and facilities leasing ceilings for potential operational areas.

When the contingency force deploys, the USACE CREST deploys and serves as the real estate cell. The CREST is attached to the senior Army engineer headquarters in theater. If the campaign develops a theater-level structure, this cell will become a staff element to the theater engineer. Among the duties of this staff element are:

- Provide technical real estate guidance and advice to the contingency force and/or theater commander, staff and all echelons of the contingency force and theater command.
- Recommend real estate policies and operational procedures to the contingency force and theater logistics officer.
- Acquire, manage, dispose, administer payment of rents and damages, handle claims and prepare records and reports for real estate used within the contingency force area or theater of operations.
- Exercise staff supervision over real estate operations of subordinate Army commands and provide real estate support to other U.S. services.
- Ensure compliance with international agreements and the laws of land warfare.
- Direct processes for seizure, requisition, or lease of real property in liberated or occupied countries.

If and when the theater matures and a Reserve Component ENCOM deploys, the USACE CREST will become OPCON to the ENCOM. The AERE teams, when employed, will conduct real estate operations in conjunction with the USACE CREST according to the theater real estate policy. The AERE teams' duties are:

- Acquire, manage and dispose of real estate.
- Investigate, process and settle real estate claims.
- Conduct utilization inspections.
- Conduct real estate operations forward of the COMMZ.

As combat subsides and forces begin returning to CONUS, real estate functions will be conducted by the USACE CREST as the ENCOM AERE team is redeployed.

Providing technical assistance to Real Property Maintenance Activities (RPMA) throughout the COMMZ. Principal RPMA functions in a theater of operations include the repair and maintenance of facilities and utilities, fire prevention and protection, and refuse collection and disposal. RPMA is the responsibility of the TAACOM or area support group, who look to a senior engineer (normally a TA brigade or a group) for technical assistance and support that are beyond the capability of their attached engineer element. RPMA work typically involves host-nation support and local contractors; however, active military operations may limit the feasibility of this option.

Managing selected construction material stocks. Engineers look to a corps or division materiel management center for most of their Class IV construction materials. Adequate Class IV supplies and timely delivery of the materials to the work sites are key to mission accomplishment. Materials typically include nails, ready-mix concrete, concrete building blocks, lumber, plywood, wire, pipe, fittings and hundreds of other "hardware" items. During initial contingency force operations, we may buy most of our Class IV requirements on the local market. We can expect little mission sealift or airlift space to be allocated for construction materials, especially in the early phases of an operation. Complete reliance on locally procured materials will be challenging. Some items may be scarce, and some manufactured items will differ significantly from U.S. building codes specification items. Dimensional materials may be cut metrically or rough-hewn.

Engineer participation in construction material purchasing is key to adapting and substituting local materials. Engineers must identify requirements with considerable specificity (including acceptable substitutes) and work with the logistics support unit to develop a delivery plan that gets the required materials to the right place and in time to keep engineers working. The COSCOM, DISCOM, or the area support group will direct a survey of the local construction material market, identify potential sources of Class IV materiel, and open blanket purchase agreements with local vendors. Engineer unit S4 officers will be appointed ordering officers to execute purchases against these agreements and will maintain a stockage of high demand items. Scarce items will be managed by the senior engineer commander. Subordinate engineer commanders will report on-hand quantities of all construction materials (Daily Logistics Report). Stockpiled materials are subject to cross-leveling. Consideration should be given to pre-positioning selected Class IV materials and/or identifying "basic load" of these materials to accompany early deploying engineer units.

The Future

Doctrine determines how engineers think about waging war and drives weapons and systems design. Doctrine incorporates the equipment and weapons of war and the cultural strengths, weaknesses and values of an army and its society into coherent concepts of how to conduct a battle. Doctrine helps soldiers and their leaders act in the absence of detailed instructions that would require continual restatement for different situations. Sound doctrine, intelligently applied to the circumstances, can have a profound, even war-winning effect on an army's performance. Doctrine formulation is a continuous process, reflecting the changing calculus of geopolitical and "break-through" scientific events. Obsolete doctrine, especially when rigidly applied, can have a disastrous effect.

By articulating our core values and vision in white paper form, the Engineer School is providing both an azimuth for coherent doctrine development and a starting point for debate within the engineer community. We need the experiences and thoughts of our engineer senior leadership. Because the impact of engineer work upon theater support operations is not fully understood outside the engineer community, many of our unique concerns may be overlooked unless we speak up as the Army wrestles with all the implications of force projection from CONUS. We urgently need your help if we are to make our positions heard.

Comments are appreciated and the mode is unimportant. Write: Commandant, USAES, Attn: ATSE-CDB-S (Stewart), Fort Leonard Wood, MO 65473-5000; call (314) 563-4083; or send via PROFS: WOO1 (STEWARTJ). Your input can help us formulate dynamic doctrine to carry the engineer force into the 21st century and beyond.

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The ENGINEER Writer's Guide

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

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

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

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

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

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

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

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

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

All submissions are subject to editing.

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

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

If you have any questions about an article you're working on—or considering writing—give our editor, Catherine Eubanks, a call at Autovon 676-4104, or commercial (314) 563-4104.

We look forward to hearing from you. P.S. *ENGINEER* welcomes response from our readers. Letters regarding information in our magazine are published in our "Letters to the Editor" department. Let your thoughts be heard.

Lessons Learned:

Operations Other Than War

By Major Bill Breyfogle

As an engineer commander, you and your staff have been closely watching a developing situation. Knowing that you may be deployed for an operation other than war mission, you have done some homework and are prepared for almost any contingency. Your personnel are familiar with the mission's requirements and you have reviewed the appropriate regulations and manuals. Most importantly, your dynamic staff have gone the extra mile—they have dug through the "lessons learned" from previous operations. Now you stand ready to deploy.

Operations other than war (OOTW) cover a wide spectrum of missions, from disaster relief and humanitarian assistance to peacekeeping, but some lessons learned ring true through them all. This article addresses lessons from a variety of OOTW missions; they are organized into phases experienced in most force projection operations.

Predeployment

Engineer Assessment. Early in all OOTW missions, commanders must conduct an accurate engineer assessment to determine the engineer effort required. For some missions this is fairly easy. Identifying the priority of effort for a peacekeeping mission, for example, is similar in many ways to the engineers' normal war-fighting support mission.

Disaster relief operations, however, present very different challenges. Lessons from recent disaster relief operations show that the priority of effort must include the needs of local governments. Commanders and staff must work with the local civilian leadership early in the process to establish work priorities. Local fire, police, water, sewage, electrical and telephone service agencies all play critical roles in re-establishing order and control. Be sure to also consult relief agencies such as the Red Cross, Salvation Army and United Way to help identify priorities.

LESSON: Conduct an accurate "on-the ground" engineer assessment to identify personnel and equipment requirements and priorities of effort before the main body is deployed.

Center of Gravity. Determining an operation's "center of gravity" is important to the success of every OOTW mission. For peacekeeping operations, the center of gravity may be opening main supply routes, controlling key terrain, or maintaining boundaries that separate belligerent forces. For a disaster relief operation such as Hurricane Andrew, it was opening the schools. The simple fact of children returning to school established an atmosphere of normalcy that showed the local population that things were getting better.

LESSON: For every OOTW, determine centers of gravity that help focus mission accomplishment.

Maps. Regardless of the type of operation, don't overlook the importance of timely topographic support. During disaster relief operations it is crucial to establish one specific map or map series for operations. This may be a standard U.S. Geological Survey (USGS) map sheet, a city or county map sheet, or even a realtor map. Whenever possible, planners must be proactive in identifying required topographic products before they are needed during crisis actions. Units alerted for deployment to theaters without standard map coverage must quickly identify their topographic requirements and pass them through their respective operations channels for validation.

LESSON: Identify and pass standard map and other topographic product requirements through operations channels as quickly as possible, either before a crisis occurs or early in the response effort.

Deployment

Take It All! It is critical that units deploy with all of their equipment! While this seems obvious, many units have deployed recently without their full table of organization and equipment (TOE). Examples include engineer units that deployed for Operation Just Cause without taking demolitions, and engineer units that deployed for Hurricane Andrew relief operations without such basic debris-clearing tools as chain saws. Units that fail to deploy with all personnel and equipment may seriously hinder their ability to provide critical engineer support to the commander; this failure may ultimately jeopardize overall mission accomplishment.

LESSON: Deploy with your entire range of engineer personnel, equipment and supplies and be prepared to provide flexible and versatile support.

Class IV Supplies. Many past OOTW demonstrate that Class IV supplies were critical to successful mission accomplishment, but often those supplies were delayed due to low shipping priorities. These experiences show that units need to preposition and stockpile critical Class IV items in possible force projection theaters, especially when deploying to austere environments. Follow-on airlift and sealift shipments should include frequent loads of the Class IV items required to support follow-on operations. By stockpiling supplies and ensuring the steady flow of Class IV items into the theater, units can avoid problems associated with large bulk supplies taking up critical space on ships.

In some recent operations, the problem was not so much in obtaining Class IV items as it was in controlling the storage and issuing the supplies. A solution that worked well in some cases was to make an engineer the S4 or liaison officer to help identify, order, store and distribute Class IV materials.

LESSON: The success of engineer support to OOTW is closely associated with the availability of Class IV materials. Leaders must be proactive to ensure that required Class IV materials are on hand when they are needed.

Entry

Rules of Engagement and Force Protection. Force protection in any OOTW mission requires units to follow appropriate rules of engagement (ROE). Units training for OOTW missions usually need extensive training on the application of the ROE. Engineer soldiers should reinforce the tactics, techniques and procedures for situations they expect to encounter when executing OOTW, such as how to execute a road block or checkpoint and react to sniper fire or an ambush. When engineer units deploy for disaster-relief missions, they are often called to assist local law-enforcement authorities. Effective ROE training and battle drills will enable soldiers to respond immediately in various law enforcement situations.

LESSON: Develop ROE for individual soldiers that are clear, concise, simple, and unclassified, and that allow soldiers to implement them under stress without referring to a ROE pocket card. Develop and train OOTW battle drills to protect the force, especially in the areas of troop movement and security.

Real Property Maintenance Activities. Engineers play a critical role in developing the infrastructure needed for any OOTW mission. Engineers provide real property maintenance activities (RPMA) capabilities such as base camps for disaster relief operations and lodgement and expansion operations in austere theaters. To facilitate RPMA, commanders should identify a terrain manager before they deploy for a joint operation and use a joint facilities utilization board to resolve RPMA problems that develop on-site. For disaster relief operations, a joint coordination board composed of impacted federal, state and local governments and agencies as well as the public may be extremely useful. During Hurricane Iniki recovery operations, a board composed of interested parties determined priorities for allocating available electrical resources.

LESSON: Commanders must plan to provide real property maintenance activities in any OOTW mission. Use terrain managers and joint facilities boards to coordinate RPMA support with all concerned civilian and military agencies and groups.

Sanitation and Hazardous Waste Control. Sanitation and hazardous waste control will be a critical engineer mission during any OOTW. Commanders must ensure waste management capabilities are emplaced early in the deployment cycle. In Somalia, engineer units immediately needed Class IV construction materials and heavy earthmoving equipment to collect and dispose of human and solid wastes. Following Hurricane Andrew, engineer units found it difficult to properly identify, locate, and control all commercial assets such as portable toilets. Another problem arose when some contractors refused to service any portable toilets except their own. Procedures are also needed to direct the disposal of hazardous wastes, such as waste oil, PCPs (found in electric transformers), asbestos and medical wastes. Publicize these procedures as early as possible once operations begin.

LESSON: Be prepared to perform sanitation and hazardous waste disposal operations during OOTW to protect the environment while meeting mission requirements.

Operations

Communications. Communications are especially vital during OOTW missions because of the many diverse services, agencies, and personnel involved in them. Commanders should consider purchasing cellular phones and police-compatible radios for disaster relief missions. Coordinate communications equipment frequency requirements with local supporting forces and local agencies prior to deployment. Purchase or lease fax machines, copiers, and E-MAIL capability and provide them down to the task force level. Also consider deploying tactical satellite

(TACSAT) to enhance communications in austere environments.

LESSON: Deployed units must maintain effective communications with all personnel and agencies involved in the operation. It may be necessary to supplement military communications equipment with off-shelf, commercial communications equipment.

Contracting. Do not overlook the different contracting mechanisms available for OOTW missions. During Hurricane Andrew relief operations, the use of contracted civilian engineer equipment increased productivity and dramatically improved debris removal. Command and control of the contractors' equipment, however, became significant. In this operations, engineer company grade officers and noncommissioned officers were required to supervise contracted work. Prior to deployment, units should identify the names, locations and telephone numbers of authorized dealerships capable of providing contracted engineer parts and equipment in theater. Dealership parts manuals should also be acquired. To ensure timely contracted services are provided for follow-on forces, contracting officers should deploy with the advance party.

LESSON: Plan on contracting for civilian services and/or equipment. Be prepared to provide contracting officers.

Termination and Post-OOTW Operations

End State. "Determining the end state and ensuring that it accomplishes the national objectives are the critical first steps in the operational planning process. Failure to make this determination will waste scarce resources and put the entire effort at risk." (FM 100-5, Operations). While determining the end state is difficult during combat, it is more difficult during OOTW.

Commanders must focus their vision beyond the immediate OOTW objective and clearly articulate the conditions of success or the end state. For example, during the 1993 midwest flood-relief operations, the National Guard developed consensus by mutual agreement with local authorities to help determine an end state. A common technique was to tie the disengagement of National Guard forces to a measurable event such as river depth or opening of a bridge. Once an end state is identified, it is crucial that disengagement actions be fully announced and understood by all concerned parties. Where appropriate, establish disengagement criteria with the Federal Emergency Management Agency (FEMA) and state and local authorities.

LESSON: The importance of defining an end state and the requisite conditions for mission success cannot be overstated. Use quantifiable measures to define the end state. Whenever possible, gain consensus among all interested parties and ensure all parties are informed when the end state has been reached.

Redeployment, Reconstitution and Demobilization

Redeployment. Commanders must focus on many of the same requirements during the redeployment phase that they had to contend with during the deployment phase, including a plan for the orderly flow of personnel, equipment and supplies. This requirement became blatantly obvious after Hurricane Andrew, when an engineer brigade, an engineer group, two combat heavy engineer battalions and two engineer combat support equipment companies received redeployment orders within three days of each other. Their requirements overtaxed engineer line-haul capabilities and caused long delays in redeploying equipment.

An important consideration on redeployments from OCONUS is the need to perform customs inspections prior to redeployment. Extensive cleaning will be required before engineer equipment can be loaded on ships or planes. Commercial steam cleaners provide valuable assistance in this endeavor.

LESSON: Be prepared to support redeployment operations, while simultaneously redeploying yourself and your unit.

Your unit has just returned from a successful deployment. All personnel and equipment performed exactly as planned. The time spent reviewing the lessons learned from previous operations was well spent. As with any operation, however, the mission is not finished until the paperwork is done. You have incorporated lessons learned into your after-action report planning. Throughout the entire operation you ensured that observations and lessons learned were captured when they occurred, while they were fresh in everyone's mind. As a result, the after-action report was completed almost as soon as the last vehicle closed on the motor pool. After completing the report, you sent a copy to the Directorate of Evaluation and Standardization at Fort Leonard Wood, which serves as the Center for Engineer Lessons Learned for the U.S. Army Engineer School.

For more information write to: Commandant, U.S. Army Engineer School, ATTN: ATSE-ESA-L, Fort Leonard Wood, MO 65473-6630 or call (314) 563-4005 or DSN 676-4005.

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Integration of Engineer Groups in Support of a Light Division

By Lieutenant Colonel Peter Madsen and Major Wayne Whiteman

Future world trends indicate a more frequent and increased role for the military in humanitarian missions and disaster relief. Recent examples include protecting Kurds in Iraq, securing Haitians at Guantanamo Bay, cleaning up south Florida after Hurricane Andrew, and assisting in humanitarian efforts in Somalia. The 10th Mountain Division, Fort Drum, New York, was involved in the last three of these missions.

When faced with operations other than war, military leaders must go through a rapid mission-analysis process to determine the best force mixture to send. The decision in Florida and Somalia was to focus efforts around a light division's structure and tailor the forces that augmented the division to meet the specific needs at the moment. The strategic mobility, command and control structure, logistics support, and medical systems of the military lend themselves well to these types of missions.

Because engineers will always play a large role in humanitarian missions and disaster relief, their augmentation to the force is often significant. During Hurricane Andrew relief, the 10th Mountain and the 41st Engineer Battalion (light) were augmented by one engineer group, three engineer battalions, two combat support equipment companies, and one assault float bridge company (see chart). During Operation Restore Hope, the 10th Mountain's augmentation consisted of one engineer group, one combat heavy engineer battalion, and two combat support equipment companies.

The augmentation process can be complicated. This article addresses the integration of forces in support of a light division and the lessons learned from both of these operations.

Operational Integration

Engineer staffs in light divisions are austere. The assistant division engineer (ADE) section is authorized only four personnel by the modified table of organization and equipment (MTOE). The S3 section is authorized only seven personnel. The challenge is to form an engineer staff strong enough to direct significant engineer augmentation as an extension of the division G3. Within the 10th

Engineer Task Organization

Hurricane Andrew Relief—

<u>Initial</u>	<u>Final</u>
41 Engr Bn (Light) (Drum)	41 Engr Bn (Light) (Drum)
642 Engr Co (CSE) (Drum)	642 Engr Co (CSE) (Drum)
937 Engr Gp (Riley)	92 Engr Bn (Cbt) (Hvy)
43 Engr Bn (Cbt Hvy) (Benning)	
63 Engr Co (CSE) (Benning)	
841 Engr Bn (Corps Cbt) (USAR) (Florida)	
586 Engr Co (ARFB) (Benning)	

Operation Restore Hope—

41 Engr Bn (Light) (Drum)
36 Engr Gp (Benning)
43 Engr Bn (Cbt Hvy) (Benning)
63 Engr Co (CSE) (Benning)
642 Engr Co (CSE) (Drum)

Mountain, the 41st combines the assets of the ADE, S3, S2, and the communications sections to form engineer operations and planning cells collocated at the division main command post (DMAIN). (See a related article in the July 1992 issue of *Engineer*, "Light Engineer Command and Control.")

The engineer operations cell is located in the division tactical operations center (DTOC). This cell works closely with the division G3 and tracks current engineer operations and missions throughout the division sector. Operational reports are sent through the engineer operations cell and forwarded to the division and the engineer sections of the next higher headquarters. Brigade engineers send reports directly to engineer operations for all engineer assets working in their brigade sector. When faced with significant engineer augmentation, as was the case in the Florida and Somalia missions, the reports of other engineer units in support of the division are rolled up under the engineer group, forwarded to engineer operations, and included in the situations reports to division and higher.

The engineer planning cell is located adjacent to the DTOC within the security perimeter of the DMAIN. This cell works closely with the division G3 plans section and the operational planning group. Future engineer plans and operations are developed as part of the command estimate process. If required, liaisons from the engineer group or other engineer units can operate from this location. The engineer plans cell also serves as a briefing/meeting area for the division engineer.

Two engineer soldiers clear debris during Hurricane Andrew relief operations in south Florida.

The Division Engineer

An age-old debate is who serves as the division engineer when an engineer group is attached to a light division. The group is commanded by a colonel; the divisional battalion commander is a lieutenant colonel. The dilemma is whether to interject a senior engineer commander and his field grade staff from outside the division or leave the organic engineer section integrated with the divisional staff under the direction of the divisional battalion commander. FM 5-71-100, *Division Engineer Combat Operations*, states that the group may become the engineer headquarters for a light division when the division receives significant engineer augmentation. In special cases, the division commander may transfer division organizational responsibilities to an engineer group that has been task organized to the division on a long-term basis. Normally this is done only when the augmentation surpasses the command and control capability of the light battalion headquarters. While many factors weigh in the final decision, two important factors are the length of unit integration and the expected duration of the operation.

In a crisis response such as hurricane relief, a premium is placed on how fast engineers start work on the battlefield. The division staff relies heavily on its training, teamwork, and personal chemistry to respond effectively to emergency situations. Substituting engineer staffs during a crisis response creates problems for the deploying group headquarters and can be disruptive to the time-sensitive division staff planning.

In short-duration operations, engineers are working against a timeline, and similar arguments are true. For example, during Operation Restore Hope, Army engineers were given a defined mission to accomplish in six weeks. Redefining roles would have been disruptive when time was a critical element. It made more sense to allow the group headquarters to focus its efforts on planning and executing the engineer operation and to permit the divisional engineer section to integrate this plan with the overall scheme of maneuver and identify future engineer requirements.

Engineer groups are flexible organizations designed to strengthen the command and control of subordinate units. As quickly as they respond to engineer requirements exceeding divisional capability, they can be withdrawn to support other sectors or commands. For example, during Hurricane Andrew relief, the 937th Engineer Group was attached to the 10th Mountain in early September but redeployed with the XVIII Airborne Corps in late September, leaving behind one combat heavy battalion.

The division commander decides who his principal engineer staff advisor will be. Regardless of his choice, the engineer group commander serves as a major subordinate commander for the division and has direct access to the CG. During Hurricane Andrew relief and Operation Restore Hope, the divisional engineer battalion commander retained staff responsibility as the division engineer. Both operations were a response to a crisis on an engineer intensive battlefield, and it made sense to leave the organic divisional engineer section in place.

Shaping the Engineer Force

Mission analysis identifies the engineer requirements that drive the force structure. Generally, the organic sapper battalion of a light division deploys with maneuver units and provides sustainment, force protection, and direct support. Augmentation engineer forces address other engineer requirements: road and airfield construction, basecamp support, utility repair, fire fighting, power generation, and more. The group staff has the capability in personnel and equipment to plan, design, manage, and support these extensive operations.

The relief operations for Hurricane Andrew and humanitarian assistance in Somalia were quite different tasks. In both operations, the mix of augmentation engineer forces and the task organization structure were tailored to meet specific requirements. For example, in Florida, the 586th Engineer Company (ribbon bridge) deployed trucks from Fort Benning without their bridge bays. These trucks hauled critical food distribution requirements and augmented the limited transportation assets of the 10th Mountain. Also, the 642d Engineer Company (combat support equipment) served as a brigade engineer headquarters in Florida and deployed only bucket loaders and dump trucks to clear debris. In contrast, during Operation Restore Hope, the entire 642d deployed and was attached to the 36th Engineer Group for road construction as part of the group's mission to revitalize Somalia's infrastructure. Force structure design and task organization of augmentation engineers are major tasks that must be addressed early in the planning cycle by the divisional engineer battalion command and staff.

Lessons Learned

The lessons learned by the 10th Mountain Division in Florida and Somalia will be applicable to future operations other than war. Analysis of each operation offer insights for future engineer planning and execution.

Reception Mission. Early reception of the engineer group into the division is critical. Key leaders and staffs must be integrated into the division's planning cycle. They should be briefed on the current situation and be familiar with the division planning and methodology. Division SOPs and report formats must be exchanged. The desired end result is division ownership of the engineer group as a major subordinate command in support of the operation.

Reception of the engineer group includes the arrival of their subordinate units, personnel and equipment in the area of operations.In most situations, the division is on the ground before the engineer group and other augmentation units arrive. The division battalion must facilitate this reception and serve as the coordinating headquarters for the smooth introduction of engineers into theater.

An assembly area or base of operations must be identified. An engineer base may require motor parks, tentage, field latrines, and a mess operation to support the arriving personnel while they await equipment. If equipment arrives into theater before the personnel, divisional engineers may need to receive it to avoid congestion at the railhead or port. (During Restore Hope, divisional engineers off-loaded the ship bearing group equipment and MILVANS when the personnel arrived later.) Depending on the size of the augmenting force, this can be a significant mission and can detract from other efforts.

Reception also includes activities such as the alignment of maintenance support and the opening of supply accounts within the division. The two most significant challenges are communications support and Class IX repair parts for commercial engineer equipment. These problems must be addressed before deployment to facilitate integration into the division and early execution of the engineer plan.

Selling the Engineer Plan. Mission analysis identifies the engineer requirements. The division engineer recommends the assignment of missions to subordinate engineer forces and the G3 tasks these missions to subordinate commands. Then the engineer group must develop its plan for execution. Often the division engineer may be involved in war gaming the courses of action, and may even be asked for a recommendation. Once the group commander selects the plan for execution, the division engineer must sell the engineer plan.

The first step in selling the plan is to get the support of the division commander. The division staff is then brought on line and the G3 integrates the engineer plan with maneuver operations. The G4 acquires necessary logistics support, and signal aligns necessary communications support while other staffs play their appropriate roles. The plan should then be layed out and briefed in detail for subordinate maneuver and support commanders.

Expanding support and awareness of the engineer plan will facilitate its execution. Besides briefs to key leaders, other methods worked well during Restore Hope and Hurricane Andrew. Brigade engineers from the divisional engineer battalion kept maneuver commanders informed on execution and progress. Daily staff meetings at division headquarters and periodic engineer meetings at the higher headquarters served similar purposes. Public affairs also assisted in selling the engineer plan, especially when the plan significantly impacted on the public or nongovernmental organizations.

Making the Plan Work. Brigade engineer efforts will dramatically influence the success of an engineer group in support of a division. By coordinating direct support in the brigade sector, they promote the mission of the brigade commander while allowing the group engineer the flexibility to shift engineer effort as priorities change.

The division engineer influences the engineer effort by grasping the engineer multipliers as they become available on the battlefield. For example, after Hurricane Andrew, volunteer assets from municipal public works departments throughout the southeast came into south Florida. With very little coordination but a lot of cooperation, they teamed up to haul debris in one brigade sector. This allowed the brigade engineer to free up critical haul assets for use in another sector.

When deployed overseas, tapping into the capabilities of the Corps of Engineers (primarily through contracting) or the DOD logistics capabilities contract can save troop effort and enhance success. In Somalia, engineers gained a unique experience working with civil affairs and psychological operations (PSYOPS) teams. Leaflet drops, print media, coordination meetings with local elders, and the hire of local laborers facilitated the engineer effort. In operations other than war, engineer multipliers are many, and the division engineer has the best vantage point to identify them.

End State and Mission Creep. An important part of the engineer plan is the end state. Engineer requirements in operations other than war often greatly exceed the forces or time available. Identifying standards for construction, repair, and troop support is key. The scope of work and proposed completion date are essential elements of the plan. The engineer end state should be synchronized with the maneuver plan.

A key factor in creating engineer success is avoiding mission creep. Every plan under execution will be challenged with new or expanded missions that may or may not have to be done. However, each new mission expends time and resources. The key is understanding the division commander's and the next higher commander's intents as they apply to the engineer effort. The division engineer can then make mission assessments, understand impacts, and advise the G3 on which missions to accept or decline. The engineer group should focus on executing the engineer plan; the division engineer staff should address mission creep.

Future Operations

The past several years have demonstrated that Army units can be very successful in operations other than war. In these situations, engineers are always a key player. During Hurricane Andrew relief operations and Operation Restore Hope, engineer groups played a key role in support of the 10th Mountain Division's efforts. The division engineer and engineer group relationship is critical to the quick integration of augmentation engineer forces and organization for execution. From the perspective of the division engineer, significant lessons were learned regarding the reception of the group and the development and promotion of the engineer plan. Early identification of the roles and responsibilities is critical. Given the professionalism and initiative of our leaders, coupled with trained and ready soldiers, engineers will always succeed.

Lieutenant Colonel Peter Madsen is the battalion commander for the 41st Engineer Battalion, 10th Mountain Division. Past assignments include tours with the 82nd Airborne Division, 7th Engineer Brigade, Germany; and the Missouri River Division, USACE. A graduate of the Command and General Staff College, he holds a masters degree in civil engineering from Georgia Tech.

Major Wayne Whiteman is currently studying for a doctorate in mechanical engineering at Georgia Tech. Previous assignments include S3 of the 41st Engineer Battalion, assistant professor at West Point; and company commander of the 2nd Engineer Battalion. Major Whiteman is a graduate of West Point and holds a masters degree from Massachusetts Institute of Technology.

Photo courtesy Javelin Joint Venture team

The Javelin:

Reach Out And Touch Someone

By Sergeant First Class Daniel Copson,
Sergeant First Class Richard Kelley and
Staff Sergeant Bret Harley

Combat readiness groups will launch into a new era in fiscal year 1996 when a new weapon system designed to kill tanks at ranges greater than 2000 meters is fielded. The system, called the Javelin, is a man-portable "fire and forget" antitank missile with a tandem-shaped charge warhead. Designed to defeat all types of armor, including reactive armor, it will be a welcome addition to the engineer squad's arsenal. The system consists of two components, the command launch unit and the round.

Components

The command launch unit (CLU) controls all aspects of Javelin operation. It houses all the controls, indicators, and sights the gunner will use during surveillance and target engagement procedures. The Javelin has three sights that the gunner can select at the push of a button. They include one day sight, which has a 4X magnification, and two imaging infrared (IIR) night sights, which have a wide field of view at 4X and narrow field of view at 9X magnification. The IIR night sights allow the gunner to see enemy tanks at extended ranges in adverse weather conditions and times of limited visibility. The CLU's IIR night sights also make it a useful reconnaissance and surveillance tool. It will give readiness groups the ability to reconnoiter an area or objective from an over-watch position in hours of darkness or poor visibility conditions.

The second component, the round, consists of the missile and the launch tube assembly (LTA). The missile has an automatically self-guided, passive IIR seeker to lock on a target before it is launched. It has a two-stage solid propulsion system. The first stage is the launch motor, which is designed to burn for only 1/10th of a second. It propels the missile away from the gunner before the flight motor fires, and reduces the initial back blast, heat, flames, and debris that the gunner is exposed to with other antitank weapon systems. The soft-launch design of the Javelin allows the gunner to safely fire from inside buildings or from covered fighting positions. The second stage is the flight motor. After the launch motor propels the missile about 15 meters away from the gunner, the flight motor ignites to carry the missile to the target.

SFC Copson tests a soldier on one of the 15 qualification exercises that can be used with the basic skill trainer (BST).

Operations

After the gunner has identified a target using the CLU, he can quickly attach it to the round and begin the engagement sequence. In the engagement sequence, the gunner views the target scene in the eyepiece, places the track gates over the selected target and locks the missile onto the target. Once locked on, the missile is ready to fire.

When firing, the gunner can pick between two attack modes: the top attack and direct attack. The top attack, the primary attack mode, is used to engage targets in the open at up 2000 meters. Using an arched trajectory, the Javelin climbs above its target for improved visibility and then strikes where the armor is weakest. The direct attack mode is used for targets within 1000 meters that have overhead cover, such as inside buildings or under bridges. The direct attack mode is also used for special targets such as helicopters, bunkers, and very short-range targets.

Training Devices

A key feature of the Javelin system is that two training devices, called the basic skill trainer (BST) and the field tactical trainer (FTT), come with the system.

The BST (shown above) is designed for classroom use. It consists of an instructor station and a simulated round attached to the CLU simulator. Computer-generated battlefield images are

A soldier tests the fully integrated, three-dimensional training (FTT) devise during a field exercise.

displayed in the CLU to teach basic target identification, acquisition, and lock-on skills to gunners. The instructor can select one of 31 scenarios and any of 15 qualification exercises. After each engagement, the instructor immediately scores and critiques the gunner's performance.

The FTT (shown above) is a fully integrated, three-dimensional training device that is designed to simulate the form, fit, and function of the real tactical Javelin system. It is configured either with or without the FTT instructor station. In either configuration, the FTT integrates the tactical CLU with a simulated round. The FTT allows the gunner to simulate war-fighting in a tactical environment (force-on-force). With the FTT instructor station installed, the instructor can tape the gunner's engagement sequence on an 8mm video tape. This tape is used for review and critique after the exercise. A backpack is provided to help transport the instructor's equipment during the training exercise.

The simulated round is incorporated as a subsystem for the Multiple Integrated Laser Engagement System (MILES); it is used for use during force-on-force engagements. The FTT MILES subsystem enhances the soldier's learning experience during the training exercise by allowing simulated engagements of targets and immediate feedback concerning the success or failure of the engagement. Even without the FTT instructor station installed to record the engagement on video tape, the gunner's engagement actions are recorded as MILES events. The FTT MILES Event Recorder stores up to 300 of the gunner's events for later review and critique.

Fielding

Select units are scheduled to begin receiving the Javelin during fiscal year 1996. Due to production delays, other units will not receive the Javelin until the year 2000 or later. Therefore, units must retain their 90mm

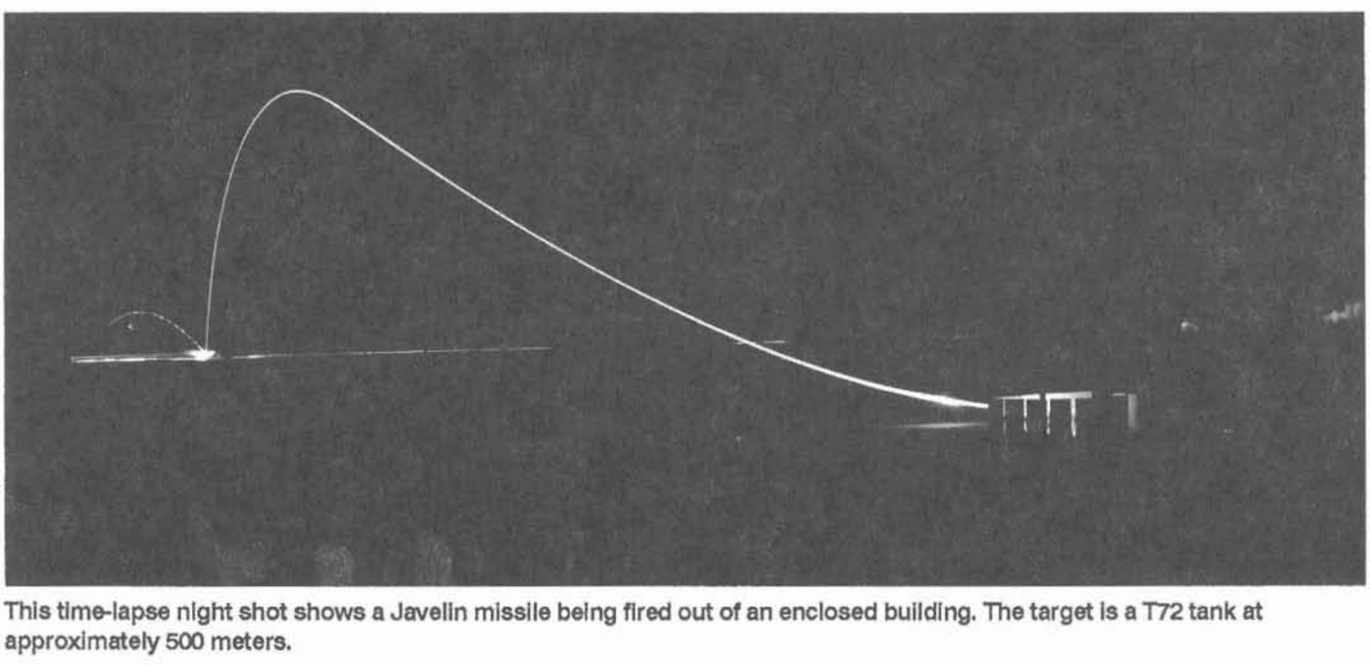


Photo courtesy Javelin Joint Venture team

This time-lapse night shot shows a Javelin missile being fired out of an enclosed building. The target is a T72 tank at approximately 500 meters.

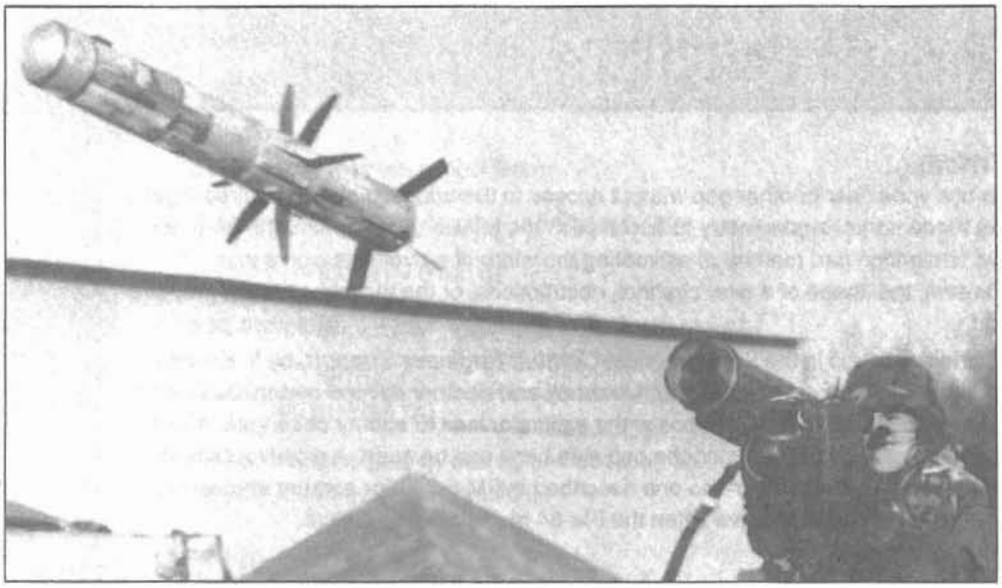


Photo courtesy Javelin Joint Venture team

A soldier launches a missile from the Javelin launch tube.

recoilless rifles until they receive the Javelin system for replacement.

The new Javelin system is designed to enhance the missile-launching skills of combat readiness groups. The high-tech characteristics and "fire and forget" capabilities of the Javelin will thrust these groups forward into the 21st century and improve mission readiness for troop deployments Army-wide.

Sergeant First Class Daniel Copson, a senior writer/instructor for the Department Tactics and Leadership at the U. S. Army Engineer School, has completed the Javelin subject-matter expert course. He previously served as a platoon sergeant with the 8th Infantry Division during Desert Storm. SFC Copson is a graduate of the Advance Non-Commissioned Officer Course (ANCOC) and holds an associate degree from Central Texas College.

Sergeant First Class Richard Kelley, a writer/instructor for the Department Tactics and Leadership at the U. S. Army Engineer School, has completed the Javelin subject matter expert course. He previously served as a platoon sergeant with the 1st Armor Division. SFC Kelley is a graduate of the ANCOC.

Staff Sergeant Bret Harley, a writer/instructor for the Department of Combat Engineering at U. S. Army Engineer School, has completed the Javelin subject-matter expert course. He previously served with the 54th Engineer Battalion during Desert Storm and is a graduate of the Basic Non-Commission Officer Course.

(Personal Viewpoint, continued)

helipad construction, communication tower construction, building demolition, and firing range construction. A conscious effort is made to match unit capabilities with mission requirements. Unit commanders working for JTF-6 have documented training on at least 85 percent of their METL tasks in their post deployment after-action reports.

During FY 93, engineer units repaired or constructed 362 miles of road (with accompanying culvert, fords and drainage), seven firing ranges, two helipads, and more than 14 miles of border fence. Other missions included power line relocation, fitness course and rappel tower construction, a drug-dog kennel, and structural demolitions.

Units also receive hands-on training in the requirements of environmental law. Units operate under strict environmental constraints. To ensure compliance with laws and regulations, JTF-6 provides qualified environmental surveyors and monitors to constructing engineer units. Commanders plan and execute environmentally sound projects, and troops become familiar with environmental procedures and protection.

Join Us!

There is a vital mission for engineers on the southwest border, one that directly supports our national security. Training opportunities abound for engineer units that are aggressive and innovative. We must convince installation commanders and ourselves that counterdrug operations are a valid, vital military mission. They offer great opportunities to support law enforcement, provide service to the American people, and conduct realistic training in a rugged environment, against a real threat.

Each quarter, the JTF-6 engineer branch publishes an electronic message addressed to corps, divisions, engineer brigades and groups, and individual units announcing missions available along the border. For information about engineer missions, call me or Major Brian Hearnsberger at (915) 568-8209/8733 (DSN 978). Join us for some great engineer training!

Lieutenant Colonel DeHarde is the staff engineer for Joint Task Force Six, Fort Bliss, Texas. Previous assignments include instructor at the U.S. Army Command and General Staff College, battalion executive officer, USAREUR Engineer Plans officer, deputy resident engineer/operations officer in Riyadh, Saudi Arabia, and company commander. LTC DeHarde holds a masters degree in civil engineering from Texas A&M University.

Engineer Problem

Estimating Gap Width

Measuring the width of a wide river or other gap without access to the opposite shore requires ingenuity and the use of some fundamental trigonometry to accomplish the mission. Field Manual 5-34 (page 5-16) provides an easy, straightforward method of estimating the width of a river that works in most cases. Sometimes, however, the shape of a river channel, obstructions, or the tactical situation may preclude using this method.

An alternative method is described in the Soviet manual *Combat Engineer Support*, by Y. Kolibernov. This method uses two measurements, one at the river bank and another several meters back from the bank. Advantages to this method are that it exposes the estimator less to enemy observers, and it may be accomplished wherever two landmarks on the opposite bank can be seen. A disadvantage is that this method is subject to greater error than the one described in FM 5-34. For combat engineers, Kolibernov's method may be a useful alternative when the FM-34 method is impractical.

Method

At the gap's edge, locate a landmark directly across the gap. Choose another landmark several meters away and measure the angle between them with a compass or binocular scale. (This is the angle "η_1" in the figure on page 35). Step back from the bank a known distance (the distance "B" on the figure) and measure the angle between the same landmarks at the new observation point. (This is the angle "η_2"). The width of the gap, W, now may be approximated using the expression:

$$W = B\frac{\eta_2}{(\eta_1 - \eta_2)}$$

The angles may be measured using any device because the formula is independent of units used. For those interested, the derivation of the expression follows:

Imagine that the lines of observation in this problem form two triangles on the ground, as shown in the figure. If you chose the landmarks correctly on the opposite shore, the angle between L and W is a right angle. Therefore, the smaller triangle, from the Law of Sines is:

$$\frac{L}{\sin \eta_1} = \frac{W}{\sin \alpha_1} = \frac{W}{\sin (90 - \eta_1)}$$

Similarly, for the larger triangle:

$$\frac{L}{\sin \eta_1} = \frac{W+B}{\sin \alpha_2} = \frac{W+B}{\sin (90 - \eta_2)}$$

Now, the length "L" is identical in both triangles, and you can multiply each expression by the sine terms under the L and equate the results:

$$L = W\frac{\sin \eta_1}{\sin (90 - \eta_1)} = (W+B)\frac{\sin \eta_2}{\sin (90 - \eta_2)}$$

Note that for any angle, sin (90-a) = cos a. You can substitute the cosine for the denominators above:

$$L = W\frac{\sin \eta_1}{\cos \eta_1} = (W+B)\frac{\sin \eta_2}{\cos \eta_2}$$

Since $\frac{\sin a}{\cos a}$ = tan a for any angle,

$$L = W \tan \eta_1 = (W+B) \tan \eta_2$$

Engineer Problem

$L = W \tan \eta_1 = W \tan \eta_2 + B \tan \eta_2$

Gathering terms involving the W to the left side,

$W(\tan \eta_1 - \tan \eta_2) = B \tan \eta_2$

and, therefore:

$$W = B \frac{\tan \eta_2}{(\tan \eta_1 - \tan \eta_2)}$$ (This equation is the exact expression.)

However, if both angles η_1 and η_2 are less than 30 degrees, a good approximation of the distance W may be made by the expression:

$$W = B \frac{\eta_2}{(\eta_1 - \eta_2)}$$

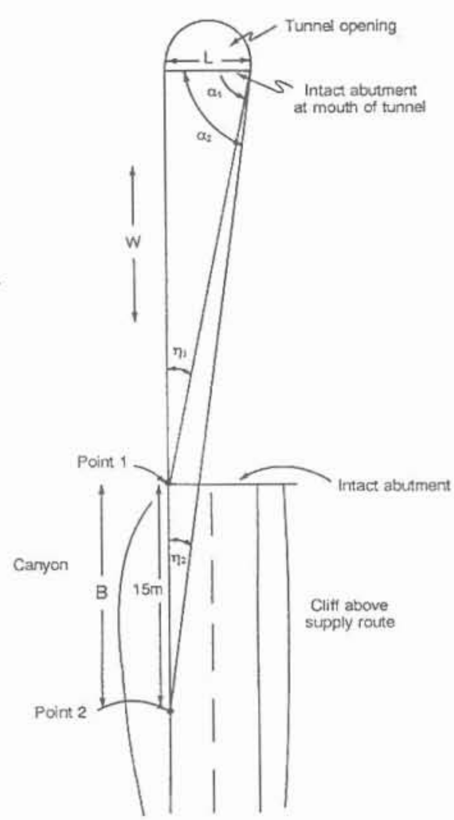
Note that the expression is independent of the units involved.

Problem

Recent faction activity in part of Bosnia-Herzegovina has rendered a main supply route impassible due to a destroyed bridge over the mouth of a canyon. The route is cut along the side of a gorge, and the destroyed bridge spanned a tributary of a larger river. Traffic must be restored quickly so humanitarian aid convoys can resume. The UN Protective Force (UNPROFOR) has several sets of Bailey bridge available for route repair.

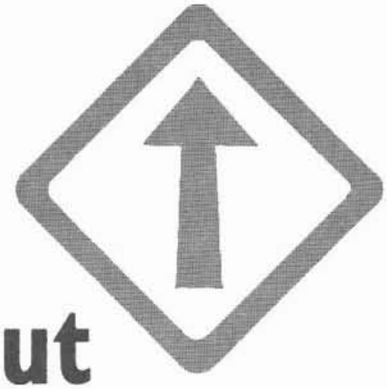
Your mission is to determine the width of the gap the Bailey bridge must cross. A major difficulty is that you have access only to the near shore because of the nature of the gap and because uncooperative factions control the surrounding territory where all bypasses are located. The road is cut along the side of the gorge and cliffs to the right and left of the route deny access along the tributary. Therefore, it is not possible to determine the gap width using the method described in FM 5-34. On the near side, the road is reinforced concrete and the abutment of the bridge is intact. On the far shore, the abutement is intact and the road enters a tunnel of unknown width.

Standing at the near edge of the gap and measuring the angle between the two sides of the tunnel opening, you find the angle is 14 degrees. Moving away from the gap on a straight line for a distance of 15 meters, you again measure the angle between the same landmarks; this angle is 9 degrees. Using only this information and the standard design criteria for a Bailey bridge, determine the design length for the bridge.



Reference: FM 5-34.

ENGINEER Solution is on page 42.



Leadership Without Speed Bumps

Changing Times

It was so easy in the good old days. We had the forces and we were focused. We could see, touch and even smell the "enemy." Our Army was combat ready and leaning forward to the sights of a Berlin Wall, red star, and hammer and sickle, even to the whiff of smoke from a Havana cigar. But, times have changed.

The international road signs of evil are gone. It appears that the United States no longer needs a large standing Army. As other priorities demand our nation's dollars and attention, the reductions in military resources quickly translate to a "do more with less" mentality where the ultimate "less" is leadership time. Our "flash to bang" on mission execution has just been tightened. But the enemy is not gone, it has only changed its shape. What is gone is TIME.

Our nation expects Army engineers to accomplish the unknown without any "on your mark, get ready" preparatory signals. Time to get ready and focus perspectives is gone. The past leadership era where leaders could pace themselves has vanished. Simply stated, they have taken away the "speed bumps" but not the hills and curves. We are in a leadership warp drive.

Our old Army had great speed bumps built in that provided blocks of time for us to get ready. The large size and redundancies provided time. Being able to track and predict international trouble spots allowed us to shape our responses in a timely manner. We had the luxury of being able to delay decision making until more information was available and more options were developed. Now we find ourselves moving at accelerated speed past discarded time regulators and protectors to undefined decision points.

While time has been drastically cut, readiness missions remain. There will never be another six months of prep time while the enemy watches. "Come as you are" roll-outs are here with all of their inherent dangers. It's as though the fire station has been moved to another county but folks still expect the firemen to make it in time to put out the fire. The issue for engineer leaders is how to make up for that lost time. We need to somehow create more time so that we can continue to perform within that expected band of excellence.

Finding Time

There are six ways to do it. Each one involves the understanding that time is most critical during final decision making. If that period is used for preliminary, time-consuming activities, then everything will stack up in a gridlock within that "do or die" time element. We need to protect the 11th hour. In other words, planning ahead is more critical than ever before. You may think the problem is that you don't have time today to read on, but a more accurate statement is that you don't have time not to read on. To assure having future time, you must invest some now. The following training objectives will help you recapture control and regain that needed time.

Soldier Care. How often have we found ourselves in the last throes of a roll-out when a "Why didn't I know this before?" crisis hits us? Crises range from "I didn't think I needed the power of attorney" to the more complex "His 17 year-old wife speaks no English." No matter what the issue is, it will consume time. As a leader, you will face crises involving your soldiers and their families. You have two choices: You can wait until the crisis to learn about your soldiers, and in so doing, consume critical decision and action time; or you can do that essential soldier caring now. The latter choice will protect time during the critical period where it is needed most. In essence, caring leadership done today will provide time to be banked, with time dividends available for future use.

By Colonel Herb Harback

Fitness. The thought, " Given enough time I could be in better shape," goes through my mind near the end of every PT test. Those push-ups, sit-ups, and runs are only part of the total fitness required for mission success. Total soldier fitness encompasses mental, moral, and professional skills as well as physical readiness. There will never be enough time to get up to speed when we are playing the catch-up game. If your soldiers are not physically fit; are not clear in their sense of fairness, direction and values; or are not competent in their skills, knowledge and abilities when a crises occurs, you will be tasked with trying to turn everything around at the last minute. The old Fram oil filter commercial is an accurate metaphor: "Pay for me now at the low price of an oil change, or pay for me later at the devastating price of a new engine." The right time to be in physical, mental, moral and professional shape is now, not later.

Standards. If you don't know the rules of the game, it is hard to win. You would never send a team to participate in a game until they knew the plays, rules and "what if" drills. While we know it is hard to bone up while on the move, we often try to do it. Now is the time to engrain the standards of discipline, safety, and performance. These standards define the boundaries and set the azimuth. They must be communicated, understood and followed. Standards may be met in the last seconds, but they will consume all available time and result in ultimate mission failure. Standards provide the common language and direction for battle drills and SOPs; they allow us to call more "audibles" and be flexible to last-minute changes.

Battle Focus. We are our own worst enemy when it comes to battle-focused training. Too often we view training as being "real" only when done in a major training environment, and garrison training is often seen as a training distractor. We tend to take a "National Training Center or nothing" approach. We do our soldiers a disservice by assuming that mind-set. We also set ourselves up for unnecessary work when we assume a "go administrative" mind-set for garrison training and a "lets get serious" set of rules for the field. A recent example drives that point home. During this past winter's formidable storms, many engineer battalions were tasked by their garrison to help support snow removal. Units were tasked with heavy equipment demands and round-the-clock operations. The question is, did they approach the situation in a battle-focused manner with TOCs and appropriate FSOPs, or did the soft-cap shuffle take control? I'll bet that many heavy equipment operators were sent out to remove snow without basic combat equipment. Although they worked hard, they learned bad habits while plowing snow-packed streets. Just think how much time those units could have banked for the future if they had used that training opportunity for productive training.

Teamwork. Another way to provide more time is to be organized now. It may sound simple, but we generally come up short on this. When we get the next quick-reaction mission, let's see how much time we devote to team building and getting the team together. If we would build and sustain our teams now, much prime time would be freed up for the "stand in the door," critical decision making which always comes. Prearranged teamwork is what our units need to be able to call those critical, on-the-line "audibles." The time to work on team togetherness and fine-tune the synergism is before the kickoff not after it. Even the best football teams do practice drills before the game.

Attitude. Finally, there is the issue of attitude. It defines the team's vitality and high performance capabilities. A bad attitude sets our aiming sticks too narrow and places our marks too low. The ruts in the road begin to look like the horizon. To change that takes a lot of dedication and energy. Developing a winning attitude involves commitment and trust. Neither can be accomplished with "shake and bake" traits nor with a "quick fix" mentality. A positive attitude takes time and attention. It will be nearly impossible to establish when we are in the starting gate. If we develop a positive attitude now, we will have more time during the decision/action period.

High Speed-Low Drag

Our Army's vision states that there will be no time-outs for readiness. This article provides a simple solution to our accelerated pace and loss of leadership time. I'm talking about a strategic and think-ahead mind-set. Doing things concurrently, knowing our soldiers, developing a relationship with each one, and keeping them fit in body, mind, soul and abilities will establish standards based on our Army's vision. It will also provide our soldiers with clear mission essential task lists that are combat focused, founded on teamwork, and driven by a truly positive warrior spirit.

Colonel Harback is the commander and district engineer of the Louisville District, Corps of Engineers. He previously served as commander of the 14th Combat Engineer Battalion (Corps), Fort Ord. Other command and staff positions included executive officer, Bayonet Combat Support Brigade, 7th Infantry Division (Light); and deputy commander, 7th Engineer Brigade, VII Corps. COL Harback is a graduate of the Army War College.

Unit History: A Two-Edged Sword

By Dr. Larry Roberts

Quite often, young officers have walked into the History Office at the Engineer Center with the mission of writing a history of their unit. Usually, the task was given to them by a battalion commander, who wanted something for new soldiers to read. The obvious purpose of such a document is to instill a sense of pride in the unit, fostering unit morale and esprit. This is the traditional view of unit history. It is the reason units are allowed to maintain an organizational history file within the Modern Army Recordkeeping System (MARKS). However, that file, and unit history in general, can actually serve the unit commander in two ways. It can enhance unit morale/esprit and provide information for command decision making. This is possible only if there is command emphasis.

Few of those young officers who entered my office knew of a unit history file. Once informed of its possible existence, they went to it and often found little of value to their task. Unit history files run the gamut from little or nothing, save last year's annual history report, to a collection of random newspaper clippings, change of command brochures, and pictures of changes of command and organizational day activities.

While these items have merit, they do not completely document the unit's accomplishments in war or peace. Invariably, those officers returned to my office in search of more information. They ultimately learned that gathering material on their units is a slow process that involves working with a number of federal organizations. However, with patience and determination, they can get what they need.

Before contacting federal organizations for information, the unit historian should examine the unit's Lineage and Honors (see page 39), often found in the commander's office. This will save a lot of time. The Lineage and Honors details the unit's federal service and identifies the various campaigns for which the organization has service credit. By knowing the periods of federal service, the action officer can disregard those conflicts during which the unit was inactive. The Lineage and Honors will also identify parent organizations. Their files and histories are logically a part of the heritage of the unit and should be examined as well. The campaign credits will tell the researcher where the unit served. Campaign credits for the Pacific in World War II mean that the officer can ignore the European theater when doing work in published historical works. After reviewing the Lineage and Honors, the action officer can begin contacting other organizations for additional information.

There are a number of sources of unit history. The National Archives contains unit files for hundreds of organizations, especially for the years of World War I, World War II, Korea, and Vietnam. The major liability of the Archives is the cost charged to reproduce those files. If a unit chooses to purchase complete files, it normally finds copies of material, such as unit orders and correspondence, which have little merit for a written history. However, scanning the files to sort out the unwanted material requires a trip to the Archives, something few units can afford. One of the best approaches is to contact friends or associates in the Washington area and ask them to spend a couple of hours in the Archives.

Other information can be found in written histories, such as the official history of World War II, published by the Center of Military History, or books written by participants. Some material can be found in publications such as

DEPARTMENT OF THE ARMY

Lineage and Honors

589th ENGINEER BATTALION

Constituted 1 July 1940 in the Regular Army as the 31st Engineer Company and activated at Fort Belvoir, Virginia

Reorganized and redesignated 15 December 1941 as the 31st Engineer Battalion

Reorganized and redesignated 29 April 1942 as the 31st Engineers

Redesignated 1 August 1942 as the 31st Engineer Combat Regiment

Regiment broken up 22 March 1943 and its elements reorganized and redesignated as follows:

2d Battalion as the 241st Engineer Combat Battalion

(Headquarters and Headquarters and Service Company as Headquarters and Headquarters Company, 1114th Engineer Combat Group; 1st Battalion as the 31st Engineer Combat Battalion - hereafter separate lineages)

241st Engineer Combat Battalion inactivated 31 January 1946 in Japan

Redesignated 30 January 1947 as the 589th Engineer Combat Battalion

Redesignated 10 January 1966 as the 589th Engineer Battalion

Activated 21 January 1966 at Fort Hood, Texas

Inactivated 1 November 1971 at Fort Lewis, Washington

Headquarters transferred 30 September 1986 to the United States Army Training and Doctrine Command and organized at Fort Leonard Wood, Missouri

CAMPAIGN PARTICIPATION CREDIT

World War II
Asiatic-Pacific Theater, Streamer without inscription

Vietnam
Counteroffensive, Phase II
Counteroffensive, Phase III
Tet Counteroffensive
Counteroffensive, Phase IV
Counteroffensive, Phase V
Counteroffensive, Phase VI
Tet 69/Counteroffensive
Summer-Fall 1969
Winter-Spring 1970
Sanctuary Counteroffensive
Counteroffensive, Phase VII
Consolidation I

DECORATIONS

Meritorious Unit Commendation (Army), Streamer embroidered VIETNAM 1967

BY ORDER OF THE SECRETARY OF THE ARMY:

WILLIAM A. STOFFT
Brigadier General, USA
Chief of Military History

Unit crest of the 589th Engineer Battalion.

Stars and Stripes and *Yank* magazines. Command newsletters, such as the *Castle Courier*, the newsletter of the Engineer Command in Vietnam, are excellent sources for those units who served in Southeast Asia. Often, the Military History Institute at Carlisle Barracks is the best single source for much of this type of publication. The *Military Engineer* and *Engineer* magazines have traditionally published articles on unit activities. The Defense Technical Information Center (DTIC) has some of the quarterly reports (lessons learned) written by engineer units in Vietnam. Many Army libraries have access to DTIC and can order these reports.

The History Office, Office of the Chief of Engineers, at Alexandria, Virginia has an extensive unit history collection. A master index for each unit identifies what type of material is present, including oral interviews with senior engineer officers. In addition, a call or note to the Organizational History Branch, Center of Military History, Washington, D.C., can produce information on the unit's history and the symbology of the organization's crest (Distinctive Unit Insignia- DUI).

While the Engineer Center at Fort Leonard Wood has been slowly collecting unit material, there is much we do not have. A call or note would determine what is available. Again, with patience and determination, a young action officer can collect enough material to write a unit's history that is useful in telling the new soldier a story of challenges and accomplishments.

That story normally deals with operations in war. This is because most of the information found in the Archives, Carlisle Barracks, and other places deals with units in war. While that is important, combat constitutes only a small part of any unit's overall history. A greater amount of time is spent in peacetime and involves the countless challenges and requirements of an Army not at war.

Ironically, the unit's efforts in peacetime, in such areas as training, can provide the second important benefit of unit history and the organizational history file, support for decision making. A unit

Photo from the Brady Collection of Civil War photographs.

This historical photo of the 8th New York State Militia is an example of recording unit history.

This photograph, taken by CPT Dunham of the 43rd Engineer Battalion, Fort Benning, Georgia shows humor in recording his unit's history.

commander faces numerous challenges over the course of his or her command. Requirements for maintenance, training, post support, and family support compete for attention and resources. This is not new. Peacetime is traditionally the most demanding period for an army because resources are scarce and requirements are not. The knowledge of how one's predecessors handled these conflicting demands would benefit any commander.

For example, if after-action reports from unit field training exercises, to include the National Training Center, were maintained over time, the current command could identify areas of consistent strength or weakness. When coupled with completion reports of construction projects, post support detail summaries, etc., a new commander would know quickly what challenges he or she might expect. Copies of annual organizational inspections, especially in the areas of maintenance, would reveal the impact of these demands on the readiness of equipment, unit morale, and soldier support.

Many of these reports are found in other files in the headquarters, such as the S3 and S4 files. However, these items normally have a comparatively short file life. Regulatory requirements to retire certain files after a cutoff date and the simple need for file space normally account for the demise of historically-significant documents. By contrast, the Organizational History File, 870-5s, is a permanent file. Regardless of who maintains the file, it exists as long as the unit does. Therefore, material placed in that file will always be available to the commander or his/her staff.

Some may consider it strange to put a command inspection report or a field exercise after-action report in a "history" file. That is because too many believe that history is what happened 20 or 30 years ago. In fact, yesterday is history; it has happened and cannot be changed. The material placed in the historical file today becomes the historical material for all who will serve in the unit. Invariably, the value of that file is driven by the quality of material placed in it.

One of the most important items which could be placed in the file is a commander's review and assessment of activities. Virtually every unit is required to produce some form of annual historical report. Often, these documents are of marginal value being only copies of last year's input with the names, statistics, and dates changed. However, this report could be valuable if seen in the context of what was done, why, how, and the lessons learned from the effort. An annual, or even more frequent, summary of what the unit did, what initiatives were taken, what worked/what did not would be extremely useful to future unit leaders.

In times past, end-of-tour reports were common for many unit commanders and key personnel. Today, we tend to limit that type of report to general officers. However, there is no reason why key officers and NCOs in a command should not write such a report. It would not only be valuable in the unit history effort, but would also be useful in providing perspectives and insights gained during service with the unit.

History is valuable to the profession of arms. Many famous leaders have attested to the value of applying the lessons of the past to the challenges of the present. The knowledge and appreciation of a unit's accomplishments are important in building and sustaining esprit. Soldiers are challenged to maintain the traditions and standards of those who came before them. However, the raw materials of a unit history, the reports and papers that document what happened and why, can also be used to help current leaders guide their soldiers through the demands of today. Maintaining a viable file will also serve those who will follow.

Dr. Roberts is the historian for the Engineer Center, Fort Leonard Wood, MO.

Engineer Solution

Solution

Complete the following steps to determine the required length for the Bailey bridge.

1. Using Kolibernov's approximation, determine the width of the gap:

$$Gap\ W = B\frac{\eta_2}{(\eta_1 - \eta_2)}$$

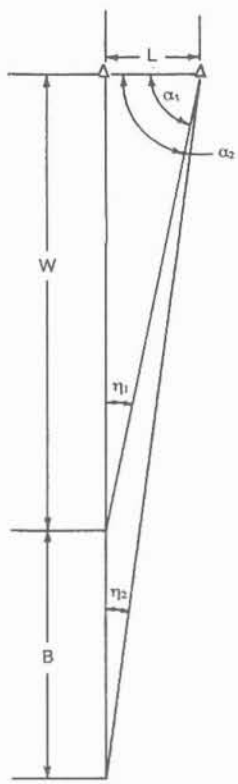
$$Gap\ W = 15m\frac{9}{(14-9)} = 27m = 88.6\ feet$$

2. Determine the safety setback for a Bailey bridge on prepared abutments (FM 5-34, p. 7-52).

SS = 3.5 feet (on each side).

3. Design gap = true gap + safety setbacks = 88.6 + 3.5 + 3.5 = 95.6 feet.

4. Rounding up to the next higher increment of 10 yields a required Bailey bridge length of 100 feet.



Note: Using the exact form of Kolibernov's formula, you should have obtained a gap width of 25.2 meters (82.68 feet), which yields the same bridge design. Note that the formula is very sensitive to error in the angle measurement. Therefore, you must measure carefully and verify the gap measurement as soon as you can reach the far shore.

This ENGINEER Problem/Solution was submitted by LTC William Bayles, executive officer, Old Ironsides Engineer Brigade, Bad Kreuznach, Germany. LTC Bayles has previously served as engineer brigade S3, battalion executive officer, and assistant professor of mathematics, U.S. Military Academy. A graduate of the School of Advanced Military Studies, he is a registered Professional Engineer in New Hampshire.

Engineer Force Structure:
Past, Present, and Future

By Peter Malley

Many articles have been published in recent months about changing the Army's strategy to account for a post cold-war threat and downsizing of the Army's force structure to meet that new threat. Most information written on this subject was taken from a "bottom-up review" study ordered by the Secretary of Defense, Les Aspin. The bottom-up study was a comprehensive examination of defense strategy, force structure, modernization programs, industrial base, and infrastructure in light of the new world situation.

This article is not an overview of the bottom-up review or of other articles on force structure. Instead, it explains what the Army engineer force was during the cold war, in the transition period from the old to the new strategy, and what the structure may look like as we enter the 21st century. It begins by defining the defense strategy and explaining how the force structure is developed through a process called "Total Army Analysis."

Changing Defense Strategy

Prior to the collapse of the Soviet Union, the United States' defense strategy was defensive in nature; it was primarily designed to hold the Soviet Union and China in check. The new strategy, as outlined in the bottom-up review, identifies four "dangers" to our national interests:

- Nuclear weapons and other weapons of destruction, including dangers associated with the proliferation of nuclear, biological, and chemical weapons.
- Aggression by hostile regional powers.
- The potential failure of democratic reform in the former Soviet Union, Eastern Europe, and elsewhere.
- Economic dangers to national security, which could result if we fail to build a competitive and growing economy.[1]

Building Force Structure

Senior Army leadership uses a process known as "Total Army Analysis" (TAA) to determine the force structure requirements to meet the threat. The process develops, for each program objective memorandum (POM) year, a projected program force that will meet mission requirements within anticipated resource levels.

TAA—What It Is and How It Works

Total Army Analysis is a complex, multiphased force structuring process. It consists of both qualitative and quantitative analyses that generate the tactical-support forces and general-purpose forces needed to sustain and support division and nondivision combat forces designated in the "objective force." [2] The objective force is the desired force in terms of force structure, readiness, modernization, and sustainability; it is constrained by expected fiscal and manpower levels. The Secretary of the Army (SA) and Chief of Staff of the Army (CSA) use the objective force when they provide guidance to the Army staff and major Army commands (MACOMs) for program development.

The Army conducts an analysis of force alternatives to determine the best force mix. Decisions on the objectives reviewed by the SA/CSA are then reflected in the The Army Plan (TAP).

TAA is a biennial process that is conducted during even-numbered years. It is followed by a Force Integration Analysis (FIA) that is conducted during odd-numbered years. Senior leadership is considering whether to change from the biennial to an annual process and possibly deleting the FIA portion; their decision will be made during TAA 2003.

The continuum and combination of the TAA and FIA are the basis for the Army's POM development and establishment of the program force, known as the "M-Force." The M-Force is based on the objective force and is neither fully structured, fully modernized, nor fully supported. It is responsive to operating strength deviation (OSD) sizing and structuring scenarios and is resource-constrained based on the OSD projections. The M-Force is

Engineer Force Structure Personnel Losses			
	TAA 96	TAA 99	TAA 01
Active	40,025	24,004	22,043
National Guard	57,245	39,105	37,138
US Army Reserve	32,663	22,005	21,729
Component 4 (Unresourced)	10,704	5,724	1,339
TOTAL	140,637	90,838	82,249

Table 1

projected from two to six years and has a higher degree of risk than the objective force.[3]

The TAA is a four-phased process that consists of force guidance, quantitative and qualitative analyses, and leadership review. The process evolves as follows:

Phase 1 (Force Guidance). Force guidance consists of input and guidance from various sources. The Defense Planning Guidance and The Army Plan provide the national strategy, threat data, resource assumptions and priorities. Force structure guidance is obtained from the TAP objective force. DOD-directed scenarios are specified in the form of illustrative planning scenarios. Additionally, the Army Force Planning Data and Assumptions (AFPDA) manual provides planning factors for theater-level studies and modeling by the U.S. Army Concepts Analysis Agency (CAA). For example, the number of engineer battalions (combat heavy) required in the force structure is based on information provided in the AFPDA manual.

A critical step in Phase 1 is the review and update of allocation rules used by CAA in Phase II. An allocation rule is the statement of a unit's capability, mission, and/or doctrinal employment. Put another way, doctrine justifies force structure and allocation rules translate that doctrine. Engineers have 281 allocation rules, which are updated during the Force Structure Conference I. This conference culminates when the General Officer Steering Committee (GOSC I) approves the rules and forwards them to the Concepts Analysis Agency (CAA) for implementation in Phase II.

Phase II (Quantitative Analysis). The quantitative analysis process takes the major combat forces (divisions, separate brigades, armored cavalry regiments, and special operations units) identified in the Army's objective force and determines the necessary tactical support requirements. The CAA accomplishes this analysis through a series of computer models and simulations. Through a series of reports, CAA then compares the new doctrinal support requirements with a current list of on-hand and programmed units to provide the "delta" for future programming. The TAA decision force is then disseminated to the MACOMs for review. As the last step in Phase II, the MACOMS and the Engineer School formulate issues to be analyzed during Phase III.

Phase III (Qualitative Analysis). During the qualitative phase, the initial program force is developed within end-strength guidance and then is used to develop the POM.

The second major conference, Force Structure Conference II (FSC II), is held during this phase. At this conference, senior leaders develop a force requirement structure through a series of analyses and panel reviews. They consider and validate the computer-generated requirements and review MACOM and HQDA inputs, proposed changes, and issues that center on claimants versus billpayers and prioritization. While the doctrinal basis of allocation rules were reviewed in FSC I, FSC II centers on the review of each discrete level and type of TOE unit in the decision force and the integration of TDA issues. Issues raised during the FSC II are resolved during GOSC II. The proposed force requirements are then forwarded to the Army's senior leadership for review and approval.

Phase IV (Leadership Review). The leadership review is initiated after the GOSC II meets to resolve any outstanding issues from FSC II. The Vice Chief of Staff of the Army chairs a force program review to resolve any issues from GOSC II; results are then briefed to the Army Chief of Staff for decision. The resulting force, the TAA base force, represents the force structure for POM development. It captures all components (active and reserve) and TDA requirements through the end of the POM years.[4]

Determining the Engineer Structure

Since 1988, the Army has conducted three TAAs; they developed the program forces for 1996, 1999, and 2001. As mentioned earlier, the program force is projected two to six years; thus, the program force 2001 in reality will be the force structure for fiscal year (FY) 1995. The programmed engineer force structure has dropped from 140,637 spaces in TAA 96 to 90,838 spaces in TAA 99, and to 82,249 spaces in TAA 01. Table 1 identifies, by component, the number of engineer spaces lost in each TAA. As of 1995, 72 percent of the engineer force structure will be in the Reserve Components.

Total Army Analysis Planning Scenarios

Total Army Analysis 1996 - 28 Division Force
Europe + Southwest Asia + Northeast Asia = Total Force

Total Army Analysis 1999 - 20 Division Force
Major Regional Contingency-East + Major Regional Contingency-West or Europe = Total Force

Total Army Analysis 2001 - 20 Division Force
Major Regional Contingency-East + Major Regional Contingency-West + Forward Deployed Europe + Unique = Total Force

Figure 1

Engineer Structure Losses

The following discussion, with Figure 1 and Table 2, page 46, outline the type of scenarios, number of divisions, and engineer structure (from command and control elements to echelons above corps units) in the three TAAs. The engineer combat battalion (mechanized) used in this discussion is an example and does not represent actual battalion losses.

Figure 1 shows the type of scenarios and number of divisions used in each TAA. In TAA-96, each theater was allocated engineer forces. For example, the number of engineer combat battalions, (corps mechanized) required for Europe was 15; Southwest Asia required 5; and Northeast Asia required 5; making a total of 25 battalions.

During TAA-99, the types of scenarios changed from major theaters to regional contingencies. What was previously called Southwest Asia was changed to Major Regional Contingency-East (MRC-E); Northeast Asia was changed to Major Regional Contingency-West (MRC-W); and Europe remained the same. The number of engineer units required in TAA-99 was based on whichever two scenarios (MRC-E + MRC-W or Europe) required the majority of forces. For example, engineer combat battalion (corps mechanized) requirements for MRC-E was 5; requirements for MRC-W also was 5, making a total of 10; Europe required 15 battalions. The total battalions required for TAA-99 was 15 because Europe was the largest theater.

In TAA-2001 the scenarios changed again, as shown in Figure 1, but the divisional force remained at 20 divisions. The European theater is no longer considered a major theater. The scenario used by CAA was: MRC-East + MRC-West + Forwarded Deployed Europe + Unique = the total force. Korea is included in MRC-West. A "unique" requirement is a one-of-a-kind unit, such as a prime power battalion.

For example, the number of engineer combat battalions (corps mechanized) required for MRC-E was 5 + MRC-W was 5 + Forwarded Deployed Europe was 1 + Unique was 0, making a total requirement of 11 battalions.

The number of units shown in column TAA-01 in Table 2 is the programmed engineer structure as of FY 95.

In the past, the majority of engineer units lost were component (compo) 4, which means they were required by doctrine but were unmanned and unresourced. However, during the TAA-99 and TAA-01 processes, actual active and reserve organizations were selected for inactivation.

In the TAA process, only the type of organization (i.e. engineer combat battalion (corps mechanized) is selected. The actual unit to be eliminated is selected by the MACOM, i.e. 00th Engineer Combat Battalion, Corps Mechanized.

Future Force Structure

What will the engineer force structure look like as we enter the 21st century?

The bottom-up review identified two future planning scenarios: Iraq against Kuwait and Saudi Arabia, and North Korea against the Republic of Korea.[5] The force structure required to fight and win those two "nearly simultaneous major regional conflicts" will be 18 divisions (10 Active Component divisions, 15 enhanced National Guard brigades, and 8 National Guard divisions). Previous publications have described the future force structure as having 10 active divisions and 15 enhanced reserve brigades, with five divisional headquarters[6]. That structure, however, was changed in the past few months. The current and future divisional force structures, as of March 1994, are compared in Figure 2, page 47.

In response to regional contingencies and to advance our national interests, forward-deployed forces will continue to play an important role. Army forces should remain at the current strength in Europe and Northeast Asia. Army forces in Europe will participate in two multinational corps with German units. They will train for rapid deployment outside Europe and for peacekeeping missions, as well as for the traditional mission of stabilization in central Europe.[7]

Engineer Force Structure				
	Organization	TAA 96 AC/RC	TAA 99 AC/RC	TAA 01 AC/RC
Division	EN BN, ABN	1/0	1/0	1/0
	EN BN, AA	1/0	1/0	1/0
	EN BN, LID	2/1	2/1	2/1
	EN BN, HVY	0/7	0/0	0/0
	EN BN, HVY ERI	20/3	20/27	19/27
	EN CO, ACR	3/2	2/1	1/1
	EN CO, LTACR	0/0	0/0	1/0
	EN CO, HSB	1/5	1/4	1/4
	EN CO, SIB	2/4	2/1	1/1
Corps	EN BN, WHEEL	0/30	1/10	1/10
	EN BN, MECH	4/4	3/15	3/14
	EN BN, ABN	1/0	1/0	1/0
	EN BN, LT	1/0	1/2	1/2
	EN CO, CSE	6/15	7/30	6/21
	EN CO, LT EQUIP ABN	1/0	1/0	1/0
	EN, CO, LT EQUIP	1/0	1/2	1/2
	EN CO, MGB	5/17	4/11	2/9
	EN CO, AFB	4/11	6/14	5/6
	EN CO, TOPO	0/0	0/0	3/1
Echelons Above Corps	EN BN, CBT HVY	11/29	7/27	7/29
	PRIME POWER BN	0/0	0/0	1/0
	HHC, TOPO BN	3/1	3/1	3/0
	EN CO, TOPO	6/3	5/2	2/0
	EN CO, CSC	1/8	0/8	0/8
	EN CO, PORT CONSTR	1/2	1/2	0/3
	EN CO, PIPELINE	1/3	1/3	0/4
	EN CO, DUMP TRUCK	0/4	0/8	0/8
Command and Control	ENCOM	0/2	0/2	0/2
	BDE, TA	1/4	0/3	0/3
	GROUP, EAC	2/9	1/6	1/5
	BDE, CORPS	2/2	2/2	2/2
	GROUP, CBT	1/10	2/8	2/7
	BDE, DIV	8/0	8/7	8/7

Table 2

Engineer Divisional Force

The Active Component engineer force will consist of 10 divisions: six heavy, one airborne, one air assault, and two light. Each of these divisions will have three active brigades; they will not have the round-up or round-out reserve brigades they have today. The engineer support programmed for each division will be:

- Six heavy divisions - one engineer headquarters and headquarters detachment (HHD) and three engineer battalions
- One airborne division - one engineer battalion
- One air assault division - one engineer battalion
- Two light divisions - one engineer battalion per division

In addition to the divisional units, there will be one armored cavalry regiment, one light armored cavalry regiment, and one heavy separate brigade, each with an engineer company for support, as they are configured today.

The National Guard force structure will consist of 15 enhanced brigades and eight divisions. The 15 enhanced brigades will consist of:

- Seven heavy brigades - one engineer battalion (heavy division) per brigade
- Seven light brigades - one engineer company (separate infantry brigade) per brigade
- One armored cavalry regiment - one engineer company (armored cavalry regiment).

The enhanced brigades will be authorized 5 percent above their personnel strength. Ten of the 15 brigades will have training affiliations with active brigades and should be equipped in the same priority as their active counterparts. The goal of the enhanced brigades is to be mobilized, trained and prepared for deployment within 90 days. If these brigades are realigned to a divisional structure, the command and control will come from the eight National Guard Division headquarters.

In addition to the 15 enhanced brigades, the National Guard will retain the eight divisions they have today. However, the type of the divisions will change to:

- Four heavy divisions - one HHD and three engineer battalions
- Three medium divisions - one engineer battalion per division
- One light division - one engineer battalion

Engineer CS AND CSS Requirements

At this time, the combat support (CS) and combat service support (CSS) structures required for the 18 divisions are unknown. However, the eight National Guard divisions will not be programmed CS or CSS organizations because that structure will already be in place. These requirements will not be determined until Phase III of TAA 2003 is completed.

Current and Future Engineer Force Structures

Current (TAA 01) -

Active	National Guard
8 - Heavy Divisions	7 - Heavy Divisions
1 - Airborne Division	1 - Light Division
1 - Air Assault Division	
2 - Light Divisions	

Future (TAA 03) -

Active	National Guard
6 - Heavy Divisions	15 - Enhanced Brigades: 7 Heavy, 7 Light, 1 ACR
1 - Airborne Division	4 - Heavy Divisions
1 - Air Assault Division	3 - Medium Divisions
2 - Light Divisions	1 - Light Division

Figure 2

Future Planning

The Engineer School is now preparing for TAA-2003, which begins this fall. Numerous conferences are scheduled with "key engineer players" who represent the Combined Arms Center, CINCs, Chief of Engineers, and ODSCOPS. The school's mission is to ensure that the allocation rules applied adequately reflect engineer doctrine and that the "right mix" of engineer forces will be available to support future Army requirements. Decisions concerning that structure will be made throughout 1995 as the programmed force evolves and is modelled. Since the TAA process never ends, our senior leaders will continue to modify the engineer force structure to support the Army's response to the changing threats to our nation's security.

Mr Malley is a military equipment and personnel analyst in the Directorate of Combat Developments, U.S. Army Engineer School. Before retiring from the Army, he held positions in engineer, armor, and infantry units. Mr Malley holds a master's degree from Webster University.

End Notes

1 The Bottom-Up Review, 1 September 1993, page 1-2.
2 Army Command, Leadership, and Management, 1992-1993, pages 11-12.
3 Ibid, pages 10-11 and 10-12.
4 Ibid, pages 11-12, 11-13, and 11-14.
5 The Bottom-Up Review, 1 Sep 93, page 5.
6 Ibid, 17.
7 Ibid, page 14.

The Corps of Engineers and the Origins of Federal Disaster Relief

*By Dr. Martin Reuss**

The 1993 midwest flood ranks among the most catastrophic disasters in our nation's history, shattering previous stage and discharge records on major portions of the Mississippi and Missouri Rivers. More than 500 Corps employees were involved in the flood response, and the agency supplied 31 million sandbags and loaned 430 pumps to local interests. Along with other federal and nonfederal agencies, the Corps helped drain flooded areas, conducted damage surveys, and inspected and repaired levees.

As impressive as the Corps' capability to respond to disasters such as the midwest flood is now, this mission was not envisioned by early champions of the Corps. Instead, it evolved after Congress and the public recognized that the Corps' organization and capabilities made the agency a valuable resource that was tailor-made to meet the urgent demands brought on by calamitous disasters.

Civil War Era

Some federal legislation was passed to alleviate the distress caused by several disasters prior to the Civil War, including the loan of naval vessels to transport private, charitable contributions to the famine-stricken people of Ireland. But direct federal participation in disaster assistance really began in 1865, at the close of the Civil War, when the government helped freedmen (freed blacks) of the south survive flooding along the Mississippi River. Once disaster relief had been given to one group, it became legally and ethically difficult for members of Congress to oppose extending similar assistance to others.

The Bureau of Freedmen administered the first federal

The Cambria Iron Works warehouse shows debris resulting from the 1889 Johnstown, Pennsylvania, flood.

Refugees and livestock retreat on a levee opposite the lower end of Island 8, near Hickman, Kentucky, during the 1912 Mississippi River flood.

disaster-relief program from 1865 to 1872, and then the Army Quartermaster Corps became responsible for this slowly expanding responsibility. The Corps of Engineers, however, with men and equipment stationed along the inland rivers, was the best suited federal agency to perform rescue and relief work during flood disasters. Consequently, although the Quartermaster Corps retained overall administrative control, the execution of relief operations during floods became the Corps' responsibility. The Corps of Engineers performed its first disaster-relief mission during the Mississippi River flood of 1882, when they supported Quartermaster Corps efforts to rescue people and property. Congress also directed the Corps to distribute Quartermaster Corps' supplies during flood disasters.

Thus, by the late 19th century, the words "flood fight" automatically produced in the minds of the public a vision of Army engineers directing men heaving thousands of sandbags into place or steaming up bayous to pick people out of treetops. In the aftermath of the catastrophic Johnstown, Pennsylvania flood of 1889, which killed 2,209 people, the government used engineer troops for the first time for emergency disaster relief. In this effort, troops cleaned up debris and built temporary pontoon bridges. The special training and experience of the engineers soon brought other disaster-relief missions: preparing damage surveys, placing temporary bridges, and fighting civil conflagrations. Those missions were assigned to the Corps by the President, the Secretary of War, and Army Department commanders.

Early 1900's

The engineers believed that disaster relief, as administered by the Quartermaster Corps, hampered flood fights and had other unfortunate consequences. After 1913, the engineers proposed substituting a "no work, no rations" policy, or work relief, for disaster victims instead of free rations distribution, and in 1916 Congress gave the engineers an opportunity to implement that new policy. For a short time, in 1916, the Corps of Engineers replaced the Quartermaster Corps as the primary administrative agency for federal disaster relief. During that period the engineers conducted a work-relief program that foreshadowed activities of the "alphabet" agencies that developed during the Depression years.

In 1917, the Army reorganized its disaster-relief responsibilities and assigned command and control during disaster situations to department or corps area commanders. The engineers retained their responsibility for the preservation of navigation channels and flood-control structures, but during the rescue, relief, and recovery phases of disasters both the engineers and the quartermasters acted in support of the American Red Cross.

Some disasters exceeded even the Red Cross' resources and capabilities. To facilitate relief for those disasters, the Executive Branch began in 1927 to appoint federal disaster-assistance coordinators, who supervised the activities of the Red Cross, the Corps of Engineers, the Quartermaster Corps, and all other interested federal agencies. During the

A 7th Army soldier clears Highway 83, near Minot, North Dakota, during Operation Snowbound, in 1949. More than 6,000 snowfighters cleared 115,000 miles of snow-blocked roads in that operation.

Depression years, disaster-relief efforts were also strengthened by manpower supplied by such agencies as the Works Progress Administration and the Civilian Conservation Corps.

1940s and Beyond

The engineers improved their disaster responses after the extensive 1937 floods by initiating emergency operations planning. This initiative resulted in a perceptible improvement in readiness and a new aggressiveness in reaching disaster sites and furnishing needed relief. That planning reaped important benefits during World War II, when it became necessary to use engineer troops and prisoners of war for flood fights and other disaster operations. Their readiness was also apparent during such post-war disasters as the 1947 Texas City explosion, which killed 512 people and injured 1,784, and during Operation Snowbound in 1949.

Operation Snowbound, the first snow-removal emergency for the Corps, covered most of the states in the Missouri River watershed. Eventually it involved nearly 2,000 Corps of Engineers personnel, including 807 Army officers and more than 4,000 contractor employees. Lieutenant General Lewis Pick, the Chief of Engineers, had used 394 bulldozers during the peak construction period on the Ledo Road between India and Burma during World War II. During Operation Snowbound, he put 1,320 bulldozers to work. In that operation, Corps efforts succeeded in opening 115,000 miles of road, providing supply access to more than 243,000 people, and providing access to feed for more than 4 million livestock. Operation Snowbound was the first disaster-assistance mission for which Army Commendation Ribbons were awarded. Of the six enlisted men thus distinguished, two (Corporals John Donnelly and Melvin Shoemaker) were from the Corps of Engineers.

By 1950, the Corps of Engineers had an established reputation for swift and effective response. The Corps' geographic organization and special training had brought the agency a wide variety of disaster-relief missions, and Army engineers had built on that experience to improve their emergency readiness and response. Some engineer officers in 1950 thought the entire federal disaster-assistance program should become an engineer mission, just as it had been in 1916.

The Army General Staff, however, fearing that disaster-relief work might interfere with national defense responsibilities, did not approve of involving the Army in what they viewed as a civil function. Nevertheless, under the Federal Disaster Relief Act of 1950, the Corps of Engineers preserved its role as the leading federal agency during flood disasters, and other governmental relief agencies learned that they could rely on the Corps of Engineers to respond in its customary "Essayons" spirit.

***Note:* This article is largely based on, and occasionally paraphrases, an unpublished manuscript by Leland R. Johnson, "Emergency Response: the Army Engineer Disaster Relief Mission, Origins to 1950." The manuscript is in the records collections of the Office of History, Headquarters, U.S. Army Corps of Engineers, Arlington, Virginia.

Dr. Martin Reuss is a senior historian in the Office of History, Headquarters, U.S. Army Corps of Engineers, Alexandria, Virginia.

ENGINEER UPDATE

Commercial numbers are (314) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

New Director Welcomed. We welcomed LTC Thomas J. Hodgini, our new director, in March. LTC Hodgini previously served as Chief, Force Integration Division, Directorate of Combat Developments, at the Engineer School. LTC Hodgini may be reached at -4093.

Engineer Officer Advanced Course (EOAC). Students attending EOAC classes now receive 80 hours of training on Janus computer simulations, double that received previously, so they can conduct both an offensive and defensive exercise. This "hands-on" tactics exercise requires students to perform the roles of the combined arms task force staff. The objective is to reinforce tactics instruction and prepare students for future simulation warfighters like the Battle Command Training Program. POCs are MAJ Susan Myers or SFC Samuel Campo, -4124.

Directorate of Combat Developments (DCD)

Concept Evaluation Program (CEP). The Engineer School is the proponent of three CEPs in FY 94: the Assault Breach Marking System, the Command Post/Bunker; and Multi-Spectral Camouflage Systems for Mobile Equipment. The CEP is a Training and Doctrine Command (TRADOC) program that provides quick, innovative testing to resolve training and combat development issues. Proponents such as the Engineer School use the program to refine materiel requirements or determine the operational and training potential of new materiel. Nonmaterial applications, such as testing of doctrine or organizations, is limited to instances where confirmed troop support is available from another Major Command. The CEP is not intended to circumvent normal testing requirements of the materiel acquisition process and is not planned as the primary test to support a production decision. The process is initiated each July, when proponents submit CEP candidates to the appropriate Battle Lab for review, validation, and forwarding to HQ TRADOC. A review committee meets in August to prioritize the candidates and determine which will be funded. POC is CPT Chris Newton, -4082.

Directorate of Evaluation and Standardization (DOES)

Operations Other Than War (OOTW) After Action Report. Engineer observations from OOTW will be described in an AAR to be distributed in May. The AAR provides recommendations to help engineer units improve on-going training readiness and leadership development. It includes hurricane, earthquake, and flood recovery operations as well as humanitarian assistance in Somalia and nation assistance in Central America. Comments are welcome. To provide information or receive additional copies, write: USAES, Attn: ATSE-ESA, Fort Leonard Wood, MO 65473-6630. POC is Vern Lowrey, -4007.

Post-Fielding Training Effective Analysis (PFTEA) for the Armored Combat Earthmover (M9 ACE). Emerging results from the PFTEA indicate that units with high operational readiness rates on the M9-ACE exhibit common characteristics:

- High level of supervision over ACE operations.
- The level of supervision increases as the amount of ACE operation time increases.
- ACE operators with less than 12 months of experience are supervised more than other operators.
- ACEs are used in teams not as single units.
- New equipment training is given and reinforced for both operators and mechanics.

The bottom line is that supervision is the key to maintaining a high operational readiness rate for the M9-ACE. A final report is scheduled for publication this summer. POC is Peggy McAvenia, -4009.

New Director Welcomed. We welcomed James G. Runge, our new director, in February. Mr. Runge came to us from the Defense Logistics Agency, Defense Contract Management District North Central, in Chicago. He is a sergeant major in the Army Reserve, serving in the office of the DCSOP, 86th USARCOM. Mr. Runge may be reached at -4024.

Engineer Branch Safety Office

Explosives and Demolitions. The best way to avoid accidents on demolition ranges is to have properly trained and certified range personnel, be in compliance with minimum safe distance requirements, and perform to standards. Standards for using explosives and demolitions are in AR 385-63 and FM 5-250. POC is Paul Rusinko, -4024.

Engineer Personnel Proponency Office (EPPO)

Military Occupational Specialty (MOS) 12C, Bridge Crewmen. Women bridge builders will soon be assigned to 12C positions in divisional engineer brigade headquarters, medium girder bridge companies, and assault float bridge companies. MG Ballard, Commandant of the Engineer School, has approved opening MOS 12C to female soldiers. MOS 12Z (Combat Engineering Senior Sergeant) was also opened to females in the headquarters company of engineer battalions and above (brigade, corps, etc.) to allow for career progression. POC is MSG Tom Crow, -4087.

BRIDGE THE GAP

By Command Sergeant Major Roy L. Burns, Jr.
U.S. Army Engineer School

The theme for this year's Senior Engineer Leaders Training Conference (SELTC) is "Versatility and the New Strategic Era." The Corps of Engineers is growing, not in greater numbers but through "progressive development." This is the projected vision of the Engineer School's Commandant.

For those senior leaders who attend, conference speakers will reveal the future of the Engineer Corps, concentrating in three key areas: training, processes/-systems, and personnel. Our goal is to involve Active and Reserve Components equally in all activities. It will be the responsibility of those who attend to take the information back to their units and disseminate it to the lowest levels. Major topics to be discussed follow.

Training. This is the cornerstone of readiness and the basis for our Army's credible deterrence and capable defense. Training is the means by which engineer soldiers and leaders develop their warfighting proficiency and exercise the collective capabilities they will require in combat. My goal at the conference is to involve each senior NCO leader in a review of—

- The individual critical task list for the combat and sustainment engineer military occupational specialties (MOS), for Career Management Fields (CMFs) 12, 51, and 81.
- The programs of instruction (POI) for the Basic Non-Commissioned Officer Course. The POIs reflect the learning activities to be implemented to train, in resident, those tasks within subject areas outlined in MOS training plans for the three CMFs.

Army leaders must ensure that the individual tasks taught at both resident and unit levels support our collective mission essential task lists (METLs). We cannot afford to waste valuable training dollars on training that does not support engineer missions. Training dollars are shrinking, and we must judiciously follow the principles outlined in FM 25-100 and FM 25-101 in all resident and unit training.

Processes/Systems. Some of the processes and systems to be discussed at the SELTC include the Battle Lab process, the new heavy assault bridge (HAB) and the new breacher.

Battle Labs provide a framework for merging new technologies with requirements. Networking is a key component of the Battle Lab concept. The labs are linked electronically and allow us to control change, direct it, and guide it for our benefit. The Battle Labs allow us to refocus the Army's modernization efforts from a stove-piped, proponent-oriented process to a horizontal process that simultaneously addresses several systems. The Battle Lab process encourages innovation and benefits the entire Army.

The mobility capabilities of combat engineers will increase with the procurement of two new systems. The Heavy Assault Bridge (HAB) is scheduled for fielding in the 1st quarter of FY 99. The Breacher, also called the "Grizzly," is scheduled for fielding in the 4th quarter of FY 99. These systems will add new meaning to the term "battlefield mobility."

Personnel. Personnel issues to be discussed include operational assignments, institutional training, and self-development.

Operational assignments are the catalyst for leader development. Senior leaders play a critical role in the development of our junior leaders. Therefore, we must ensure that unit leader development programs meet the needs of both our organizations and our junior leaders. This is accomplished through varied assignments and METL-based training.

Institutional training, the formal resident training conducted in the Army Schools System, also is critical to leader development. Senior leaders must seek opportunities to send their soldiers to competitive institutional training, such as the Primary Leader Development Course, the Basic and Advanced Noncommissioned Officer Courses, and the Battle Staff Course. These courses benefit both the unit and the individual soldier.

Self-development programs enhance the soldier's overall professional competency. For it to be effective, senior leaders and their soldiers must share responsibility for maintaining and increasing proficiency. Senior leaders must determine where soldiers are along their career path and help them design a meaningful plan for future development. Their plan should include professional reading, correspondence courses and civilian education.

The senior leaders who attend the 1994 SELTC should come prepared to share their professional views on the future of the Corps of Engineers and our Commandant's vision. His vision will take us into the year 2000 and beyond, and we must support it.

Wheeling, West Virginia flood conditions, March 18-19, 1936.

PIN: 072-330-000