

Engineer

THE PROFESSIONAL BULLETIN FOR ARMY ENGINEERS
Headquarters, Department of the Army

PB 5-87-4 (TEST)



BUILDING STABILITY IN TROUBLED REGIONS

Across the Andes With Task Force 1169
Lessons Learned - New In Issue

Approved for public release; distribution is unlimited.

RESERVE COMPONENT DUTY

by CPT William G. Snider

I have just completed a three-year assignment as engineer advisor to a Reserve Component Advisory Group. The rewards, challenges—and frustrations—taught me some important lessons. Total Army becomes more than a vague concept when reserve and active components meet. It is in this arena that the realities of readiness and coordination are tested.

It's good to learn the structure and command relationships that link the Active Army and the Reserve Component—that knowledge makes a whole army emerge from the shadows, and wipes out the stereotype of the 'weekend warrior' in the process. I also learned a great deal about the problems that face the reserve component and active personnel who work with them—problems of time, resources, and recognition.

The engineer advisor's job

Reserve components make up more than 50 percent of the total Army. More important to engineers is the fact that 70 percent of the engineer units are in the reserve components. The chance that you, as an engineer officer, will be assigned to reserve component duty are great and increasing all of the time.

As an engineer advisor to Seneca Readiness Group, I provided instruction, training assistance, and doctrinal advice. My work meant daily interaction with the reserve components' full-time personnel. I helped them draw up training plans and determine their resource requirements for weekend and annual training.

I also gave instruction in subjects that ranged from AirLand Battle doctrine to common skills, including the entire spectrum of combat engineer skills. Many times, training in a specialized area—like mine warfare—would require me to teach doctrine, all the leader tasks, soldier tasks, and common skills required to complete the tasks. I worked with officers, NCOs and some soldiers during weekend training.

Reserve units request training, outlining their requirements, proposed schedule, and audience. Branch teams (Infantry, Armor, Artillery, Engineers, Combat Support and Admin Support) provide the training.

Tactical training is available in the form of CPXs and battle simulation board games such as Pegasus and Dunn Kempf. The training is directed to the NCO and higher level, and is based on the Army Training Management System's "train the trainer" concept. This method of instruction increases the confidence of the unit in itself and its leaders.

When I and other readiness group personnel visited units, we took every opportunity to give training. If we saw a unit leader having trouble with a mission, we offered suggestions on more efficient methods. As advisors, we stood ready to help reserve units think creatively about opportunities for local training—construction projects, civic action projects, cooperation with local agencies that could offer in-service training on MOS skills—these are some of the how-tos that make the difference be-

tween an active, involved unit and one that drifts.

Learning the structure

Service in reserve component duty soon teaches you the basic command structure of the reserves. The reserve component is made up of both the United States Army Reserve and the Army National Guard. Both have similar missions, strengths, and weaknesses; however, they also have many differences.

The Army Reserve is made up mostly of combat support units, and has only a federal mission of mobilizing in wartime to augment the active force structure.

The National Guard is mostly combat units, and has a dual mission. One mission is to be the governor's militia, ready to meet the military needs of the state in an emergency. The federal mission is, upon mobilization, to augment the active force.

The differences also extend to the command structure. The Army Reserve units are normally organized in an Army Command (ARCOM), Major Army Command (MACOM), or Major Subordinate Reserve Command (MUSARC). The National Guard units are under the command of the governors. The state adjutant general is their state military commander.

The five Continental United States Armies (CONUSAs) provide peacetime liaison channels to the National Guard, command the Army Reserve, and serve as the higher headquarters for the readiness group. Forces Command

(continued on page 37)

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About the cover

Soldiers of the 145th Engineers, Alabama National Guard, muscle ACROW girders into place as they prepare to bridge the Rio Hollin in Ecuador.

Photo by Penelope Schmitt

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by MG William Henry Reno, Commandant, U.S. Army Engineer School

The most recent Joint Chiefs of Staff Publication 2, Unified Action Armed Forces, charges the services to prepare for "military operations short of war." While this terminology may be unfamiliar to many in the Army, the Corps of Engineers has successfully executed these operations for years.

Operations short of war range from military actions undertaken in times of peaceful competition among nations to low intensity conflict now receiving increased attention throughout the Army and DOD. Engineers play a major role in operations across this spectrum. Successive SOUTHCOM CINC's have said repeatedly that engineers form the foundation of their strategy and will continue to carry a major load in LATAM. Construction and nation building are fundamental to such a strategy. As conflicts intensify, so do missions for engineers. Construction tasks continue but may give way to classical combat engineering missions. Increasingly complex topographic support is required in all phases of operations from low to high intensity conflict.

The benefit versus cost ratio is a primary reason engineers are so vital to Army commanders and planners in this environment. This justification for construction projects plays an important role in deterring war. To the planner, the range of engineer options is wide without large-scale risk. Our flexibility and ability to deliver meaningful products, such as roads, bridges, schools, clinics, and water wells, to other nations at relatively low cost attract attention from those responsible for America's strategic planning. In his article, "Engineers Build Stability in Troubled Regions," COL John Schaufelberger explains the non-threatening role engineers play in assisting a nation's progress and the benefits to the host nation. The cost to the United States is minimal compared to the enriched quality of life and goodwill created.

All Engineers, whether active duty, National Guard or Reserve, are united in their execution of worldwide short of war missions. The majority of our efforts today are focused on Latin America. This issue of ENGINEER highlights the total commitment we have dis-

played in furthering the strategies of CINC SOUTHCOM.

Engineer actions in the short of war environment range from staff assistance visits to group-size, 6-month exercises. The article "Engineers for the El Salvadoran Armed Forces" describes the effect that well-planned staff assistance visits can have in forging friendly ties with our Latin American neighbors. Mobile training teams (MTTs) provide needed training to improve our allies' engineering capabilities. Progress in countermine and booby trap training is discussed in the article, "Zeroing in on Mines."

Engineer exercises range in size from company through group task forces. These exercises support host nation infrastructure development and U.S. contingency operational planning. "Across the Andes with Task Force 1169" covers group-level task force work on a penetration road in Ecuador. The combined exercise included active duty, National Guard, and Reserve units supported by Ecuadoran engineer, aviation, and infantry units. In his article, "Ahuas Tara 87 Honduras," LTC George Cajigal relates the successes of the 27th Engineer Battalion (Combat) (Airborne) in support of SOUTHCOM contingency operational planning.

While the strategic dividends of these engineer operations have a priority in mission formulation, we must not overlook inherent operational and tactical benefits. Units deployed on short of war missions experience the movement planning and execution they would otherwise attain only in wartime mobilization. They learn lessons in project planning, resourcing, and execution in a bare base theater. They effectively maintain long lines of communication and resupply to ensure mission success. They practice "Total Army" coordination, not merely discuss it across conference tables. Both individual and collective training benefit. Soldiers perform critical MOS tasks in an atmosphere they could conceivably face during war. They execute technical engineering skills flawlessly, and practice soldier skills until they become second nature. No better opportunity exists for us to practice during peace what



BRIDGE THE GAP

By CSM Matthew Lee, Jr., U.S. Army Engineer School

Isn't it beautiful when a plan comes together? Those words call to my mind the "sift...chunk" of glass forming patterns in a kaleidoscope—parts of the plan falling into place as if by magic and mirrors. Engineer soldiers can make a bridge seem to come together that way, or raise a building, or execute airfield damage repairs with clockwork precision. But mirrors aren't in our TO&Es—and our magic is a thing called TRAINING.

Two thirds of the Army's engineers are in the Reserve and National Guard components. Today, the engineer mission—and these "part-time" soldiers—are some of the most visible U.S. troops in the world. More and more, we are charged with making plans come together for host nations who need and appreciate our help.

Training is no longer a matter of pushing dirt around on a military reservation or "purifying" water already treated by a city water system. Training means being ready to build roads where there are no roads, or to purify water so the troops can fill their canteens safely. Soldiers in both the Reserve and Active components need to take training seriously—readiness is for NOW.

Throughout this issue of ENGINEER, the story behind the story is about training—and about how to train. NCOs in both the Active and Reserve components must stay up-to-date on techniques and lessons learned.

And we must communicate with each other. Guardsmen and Reservists—carry what you learn in annual training back home to your active counterparts. Often you will be the cutting edge on "how tos" for

working the rough terrain you've encountered in annual training overseas.

We in the Active component must strive to get the best training opportunities lined up for our troops, then work them—hard—until their tasks become second nature. We have to impart our expertise to our Reserve component partners—they may be on the job before us, and if a mobilization occurs, they may be in charge.

The Total Army is benefiting from increased opportunities for realistic training abroad, but we can't do everything in those precious weeks. The basis for success is sustained efforts in painstaking practice of the elements of the task at home. It's tough to squeeze complete training into short hours—but with imagination, you can find a way: see "The 229th Lightens Up," on page 25.

Plans don't crystallize by accident. The unit you'll read about in "From Craters to Concrete in 48 Hours," spent many hours honing and adjusting their techniques before they were able to inspire their CAPSTONE counterparts with dazzling performance. Whatever your unit's main mission, the same is true for you—rehearse if you want the performance to be a success.

Remember, engineer soldiers are on the "front lines" of the civic action mission. Whether we are building culverts or raising a new roof over a village school, we are the image of America and the U.S. Army for many in other nations. It is our duty—and should be our honor—to train hard and well, so we can summon the magic that makes a blueprint into a bridge, a sketch into a schoolhouse—a dream into a reality.

we must execute during war. CPT William Snider's "Personal Viewpoint - Reserve Component Duty" and MAJ Robert White's, "Redstone: A Readiness Group Helps the Guard Prepare to Blaze Trails" provide excellent commentary on training benefits gained in operations short of war.

The number of engineer operations in the short of war environment will increase in the future. Planners

with vision will prepare new missions that provide lasting benefits for the United States and host nations. Engineers must be prepared to both plan and execute their mission. As the "warfighters" at the forefront in short of war operations, engineers must stand ready to act in a number of roles. Their efforts today could well prevent the AirLand battles of tomorrow.

Engineer Update

— School News —

Department of Military Engineering (DME)

Construction Guidelines Developed The Structures and Utilities branch has developed planning, design, and construction guidelines for theater of operations construction. This three-page reference provides rules of thumb for construction management, concrete, base camps, utilities, pipelines, and port construction with the associated FM/TM references. To receive a copy, write or call:

Department of Military Engineering
ATTN: ATZA-TE-SU
Fort Belvoir, VA 22060
(703) 664-3806/2797
AV 354-3806/2797

Reserve Combat Engineer BNCOC POI Completed The DME has completed development of the initial program of instruction (POI) for reserve component combat engineer (CMF 12) basic noncommissioned officers course (BNCOC). This POI contains 120 hours of instruction, which closely parallels active duty training and can be completed during two weeks of active duty training. The course will be taught at selected reserve component schools and will be available for implementation 1 March 1988.

Development of POIs for the reserve component CMF 12 and CMF 51 advanced noncommissioned officers course is underway. The projected implementation date for these courses is 1 March 1989.

Defense Mapping School (DMS)

DMS Reorganization The DMS recently reorganized. The driving factors behind the reorganization were new missions and the projected transfer of two courses to the U.S. Army Engineer School.

To facilitate the transition of the Construction Survey and Construction Drafting courses to the Engineer School and relocation to Fort Leonard Wood, Missouri, the Department of Construction Engineering was established. The two courses will be offered at Fort Leonard Wood commencing with the FY 89 course schedules.

New missions necessitated the creation of two new divisions within the Department of Management and Technology. Joint Operations will provide mapping, charting, and geodesy (MC&G) courses to ser-

vice schools and other DoD agencies. Instructors will present the courses in both resident environments and via mobile training teams. Component Training Division has a totally new mission of developing and coordinating courses for all DMS employees.

It is the intent of the reorganization to improve the quality of instruction and to train a greater number of people in MC&G.

Engineer School Transition Office (ESTO)

School Move Underway ESTO has been extremely busy in the past quarter as we have already started to move the Engineer School. An in-process review was conducted at Fort Belvoir which included representatives from TRADOC, Department of the Army, Fort Leonard Wood, and the Engineer School.

Participants reviewed transition issues and events. The construction of the facilities is on schedule and the move will be completed by February 1990. Those interested in a civilian or military positions with the Engineer School at Fort Leonard Wood, should notify their assignment officers or call the Deputy Assistant Commandant, AV 581-2272, or ESTO, AV 354-6292.

Directorate of Training and Doctrine (DOTD)

Placed Training Mine Kit Developed The placed training mine (PTM) kit will contain inert replicas of the M14, M15, M16A2, M18A1, M19 and M21 service mines and is intended to be used for individual and unit training of mine warfare skills. The PTM will provide an audible response to the soldier when procedural errors have been committed that would have caused accidental detonation. The PTM Kit also contains five antihandling devices to be used with the antitank mines.

A contract has been awarded and fielding is expected to begin in the second quarter of FY 88. The first kits produced will be issued to the branch schools. Three kits will then be issued to each engineer company, and two kits to each infantry, armor, and artillery battalion.

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Army Occupational Survey Program The AOSP utilizes soldier questionnaires and surveys to determine the skills, knowledges, and tasks required to perform the duties of the MOSs being studied. The primary uses of AOSP data include:

- Analysis of training needs
- MOS structure revisions
- Skills assessment
- Personnel and manpower analyses

DOTD personnel are developing questionnaire items that will be used by the Soldier Support Center—National Capital Region—in its upcoming survey of five engineer proponent MOSs and Branch Code 21. The projected schedule is as follows:

Project	Surveys Mailed	Surveys Returned
Branch Code 21	April 1988	October 1988
MOS 83F	June 1988	January 1988
MOS 51G	July 1988	February 1988
MOS 82B	August 1988	March 1988
MOS 62F	January 1988	July 1988
MOS 62G	February 1988	August 1988

If you hold one of the above MOSs, you may be asked to participate. If so, you will receive your survey through your local MILPO. The information you provide is one of the most important sources of information that the Engineer School uses in determining training requirements for your MOS. Your help and timely response is most appreciated.

Equipment Repair MOSs Transferred to Ordnance School Proponency for MOSs 52C, 52D, and 52F changed from the Engineer School to the Ordnance School as of 1 October 1987. With the change of proponency went the responsibility for the Army Apprenticeship Program for the trade of refrigeration/air conditioning repairer/servicer, which serves MOS 52C. All inquiries about this program and request for evaluations/completion certificates should be sent to the following address:

Commander
U.S. Army Ordnance Center and School
ATTN: ATSL-TD-CDR
Aberdeen Proving Ground, MD 21005

All of the records of 52C apprenticeship participation were transferred from the Engineer School to the Ordnance School 3 October 1987. At present time there are no apprenticeship programs for MOSs 52D and 52F.

Department of Combined Arms (DCA)

Engineer Combat Operations FM Rewritten Tactics, Training, and Doctrine Division has rewritten FM 5-100, Engineer Combat Operations. The new draft emphasizes engineer planning and execution as part of the combined arms team to meet the challenge of the modern battlefield. Field units will receive the coordinating draft for comments in early 1988. Also look for the recently published FC 90-13-1, Combined Arms Counterobstacle Operations: The In-Stride Breach, which provides guidance for rapid breaching operations. We need comments from units with actual training experience on the employment of the MICLIC for ongoing doctrine development.

Course Revisions Ongoing revisions to the Engineer Officer Advanced Course (EOAC) emphasize more practical exercises in the employment of obstacles and in breach operations. We are developing sand table exercises for the additional hours of engineer tactics recently added to the POI. The focus for Engineer Officer Basic Course (EOBC) continues to be on the duties of the task force engineer, although troop leading procedures also receive emphasis. Additional hours of instruction in the recently revised POI allow more practical exercise time. The Advanced Noncommissioned Officers Course (ANCOC) will expand instruction in the future to include more engineer tactics at the platoon sergeant level.

Engineer History Tapes Available DCA and the Historical Division, OCE, have jointly sponsored a series of oral histories now available on video tape.

Titles include:

- Engineers in the Battle of the Bulge
- Engineers in the New Guinea Campaign (1942-1944)
- Engineers in the Mountains of Italy
- Engineers in the Rhine River Crossings
- Engineers in the Vietnam Conflict
- Engineers in the Normandy Invasion

These video tapes are available for loan through the Fort Belvoir Training Audiovisual Support Center (TASC), 664-2177/2893. Your local TASC may request the video tapes by writing to ATZA-PTS-AV, ATTN: TASC, U.S. Army Engineer School, Fort Belvoir, VA 22060-5058, or calling AV 354-2177/2893.

EOBC Introduces Specialty Training The Engineer Officer Basic Course POI is currently being revised by the Engineer School. The new POI will consist of

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a core curriculum for all students plus a specialized sequence of instruction depending on what type of unit the lieutenant will be first assigned. The specialized instruction—either close combat (heavy or light divisional) or combat heavy—is designed to make the lieutenants masters, rather than generalists, in their prospective assignments.

Reserve Component Advisory Staff (RCAS)

Reserve and Guard Queries Questions regarding Army Reserve and Army National Guard issues should be directed to the Reserve Component Ad-

visory Staff. LTC Richard G. Dubuque is the post's Army National Guard advisor and COL Joseph M. Cuschieri is the Army Reserve advisor. Correspondence should be addressed to:

Commandant
U.S. Army Engineer School
ATTN: ATZA-RCS
BLDG 270, STOP 245 Engineer School Library
Fort Belvoir, VA 22060-5245

They may also be contacted by telephone at the following numbers:

Commercial (703) 664-4166/4434/5921, AV 354-4166/4434/5921, or toll free (800) 336-3095.

— Regimental News —

Guard Regimental Regulation Revised The National Guard bureau has revised and published NGR 600-82, U.S. Army Regimental System—Army National Guard, with a 1 January 88 effective date. It provides the following policy for engineer soldiers:

- Each office and soldier will affiliate with a regiment based on MOS and specialty code... En-

gineer soldiers will affiliate with the Corp of Engineers.

- Each enlisted soldier will be issued a regimental insignia on a one-time basis. Officers will purchase theirs.

— Career Notes —

Commissioned Officers Branch

CAS³ Benefits Officers and Command Fort Leavenworth's Combined Arms and Services Staff School (CAS³) trains officers to function as members of a staff at brigade and battalion level. The course, a combination of a correspondence course and a 9-week resident phase, is currently required for officers of YG 79 and later (YG 80, 81, 82, ...). Officers normally attend the resident portion between the 7th and 9th year of active federal commissioned service.

Phase I, the home study portion, consists of 142 hours of programmed instruction divided into 15 modules. Communicative arts, quantitative skills, introduction of threat forces, basic logistics, tactics overview, and organization of the Army division are some of the subjects covered in the modules.

Upon completion of all Phase I modules, students must complete a comprehensive open book examination. Eligibility for attendance at Phase II resi-

dent portion depends on the successful completion of the exam.

Engineer branch will schedule eligible officers for TDY enroute attendance, and local commanders can use available TDY and return quotas for officers not eligible to move on PCS orders. No training costs are incurred by the MACOMS for a TDY and return quota; all training is paid for by Department of the Army funds. Commanders are encouraged to send eligible officers to this course. The return is high in terms of first-rate training for the officer and enhanced capability on his return.

Joint Duty Assignments Public Law 99-433, a law passed in October 1986, requiring a joint service assignment for promotion to the general officer grades, is greatly impacting the officer personnel management system. The major provisions of the law include:

- Requirement for a JDA as a prerequisite for promotion to brigadier general.
- Creation of the Joint Specialty Officer (JSO), a new officer classification.

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- Equity in promotion rates. Promotion rates for JDA-qualified officers must be at least equal to that of staff officers.
- Assignment of Joint Professional Military Education (JPME) graduates to joint duty assignments upon graduation.
- Preparation of the joint duty list.
- Specified tour lengths for JDAs.

Several new personnel management terms have evolved as a result of the law. They include:

Joint duty assignment - an assignment in an activity which is involved in the integrated employment of land, sea, and air forces of at least two of the four armed services. All assignments in the Office of the Secretary of Defense (OSD), the Office of the Joint Chiefs of Staff (OJCS), and the Unified Command positions qualify as joint duty assignments. Fifty percent of the positions in defense agencies (i.e. the Defense Mapping Agency, and Military Traffic Management Command) are designated as joint duty assignments. Assignments within an officer's own military service are excluded by law. In accordance with the law, the Secretary of Defense has published a list of joint duty assignments. Those positions designated as critical must be filled by a joint specialty officer (see definition below). Engineer joint duty opportunities include:

Joint Duty Type	Grade			TOTAL
	COL	LTC	MAJ	
Non-Critical	12	29	23	64
Critical	6	5	0	11
Total	18	34	23	*75

Note These are engineer coded positions only. There are other joint positions open to engineer officers who have functional areas. Combat Arms Immaterial (02A) and Branch Immaterial (01A) positions are also included on the joint duty list and can be filled by engineer officers.

Critical Operational Specialty (COS) - The following branches are designated as critical operational specialties: infantry, field artillery, armor, air defense artillery, special forces, and combat engineers (21B). This term is significant in determining the length of an assignment that will qualify as a full joint duty assignment.

Joint Professional Military Education (JPME) - Initially, graduates of the Armed Forces Staff College, Industrial College of the Armed Forces, and National War College received credit for joint education. For academic year 88-89, this list will expand to include

60 seats in the Army War College, and 104 seats at the Command and General Staff College. In addition, Army officers attending the Air or Naval War College or a military education level 4 producing school of another service will receive JPME credit.

Joint Specialty Officer (JSO) - An officer who has completed JPME, has JDA credit and has been awarded the JSO classification by the Secretary of Defense. The initial pool of JSOs will be designated by a board that convened 5 January 1988.

Enlisted Branch

Authorizations for terrain analyst, MOS 81Q, will approximately double over the next two years. The personnel inventory increase will be accomplished by a concurrent increase in new accessions and reclassifications/reenlistments of soldiers from other overstrength MOS in the Army. Attempts are being made primarily to increase the inventory at skill level one (E1-E4) to ensure continuing promotion potential for those currently holding the MOS and to maintain the high level of MOS experience when soldiers reach grade E6 and E7. Reclassification of E4(P) and E5(P) soldiers into 81Q will be considered on an exception basis and only with strong recommendations from the soldier's chain of command.

The Army Special Operations Forces (SOF) are expanding over the next few years and there are increasing requirements for soldiers qualified as special operations engineer sergeant (MOS 18C). The primary source of past input has been from career management field (CMF) 12.

The activation in August 1987 of the 37th Engineer Battalion (A) at Fort Bragg, North Carolina, increased the need for engineer airborne soldiers. Airborne volunteers are needed in MOS 62E, 62J, 81B, 82B, and 51G. Volunteers are also needed in MOS 83E and 83F for assignment to the Special Operations Command (SOCOM) at Fort Bragg. Eligibility criteria for airborne training can be found in Chapter 6, Section 2, of AR 614-200 and application is made by procedure 3-19 of DA Pam 600-8.

Volunteers are required from MOS 12B for Ranger School and assignment to engineer battalions (light). Assignment to these units is physically and professionally challenging. Application may be made via DA Form 4187 to Engineer Branch, DAPC-EPL-E. For more information on SOF, Ranger, or airborne training, contact SFC Abney at Engineer Branch (AV 221-7710/7711/7712).

Engineers build stability in troubled regions

by COL John E. Schaufelberger

 International terrorism, religious strife, drug trafficking, territorial disputes, communist expansion, and extreme economic conditions make instability—not peace—the unhappy way of life in many nations. Low intensity conflicts rising from unstable conditions are often the way in which interest groups seek political change. In fact, low intensity conflict may well become the characteristic war of the 21st century.

What are some characteristics of susceptible nations?

- Their populations are growing faster than their economies.
- Their rural areas are cut off from the nation's political life.
- The powerful are few, the powerless, many.
- The economy depends on one or two raw material exports.
- The industrial and transportation infrastructure is weak.
- Undeveloped land—and rugged terrain—dominate the landscape.
- Per capita income is low.
- The people's expectations are rising—and they are frustrated.

There are many other contributing factors, but all result in a dissatisfied population that is a fertile breeding ground for conflict.

The struggles between governments and insurgents are preeminently wars for legitimacy. The dynamics of such conflicts are roughly triangular. Each faction competes to win the apex of the triangle: the people. If governments are to stand, they must conduct war

at the expense of the insurgents—not the people. The people must be convinced of the government's moral superiority. If insurgencies can't command popular support, they will wither and die.

Insurgencies cannot be defeated by military means alone. The goal cannot be dead insurgents—they too, are the people. The goal must be reducing the number of insurgents—by eliminating popular support for the insurgency. Only a coherent attack on the underlying causes of civil discontent can bring about this result. Social, political, and economic initiatives are often more important than military ones. Early actions must focus on nation building—and nation building is a prime role for engineers.

The Engineer contribution

Internal development — nation building—is a process by which a government builds viable institutions and infrastructure, improves the quality of life for its people, and thereby strengthens its ties with the population. The goal is to correct conditions insurgents can exploit, and to integrate the people into a cohesive society. Engineer civic action operations can be the practical muscle that builds a nation, moving its people forward toward the goal of a stable society.

In a sense, engineer civic action operations aim to turn the destructive triangle of low intensity conflict into a two-way street of cooperation. The mission is to strengthen



the link between the government and the people, thus weakening or severing the link between the insurgents and the people. This is a primary mission of national military engineer units in many less-developed countries. In our own history, the U.S. Army Corps of Engineers assumed this role during the westward expansion of the United States in the 1800s.

U.S. military engineers are often deployed overseas to perform nation building missions. It's a job we welcome. Engineers demonstrate our commitment to aiding national development, yet pose no threat to local populations or to the host

nation's neighbors. Engineer units are perceived as a nonthreatening presence because they are not offensive in their organization or capabilities.

A strategy for progress

Before we airlift a single dozer to the jungle, extensive planning and consultation must take place. First, the State and Defense Departments must jointly design a coherent overall regional strategy. Then we must work with each host government to make a detailed assessment of national needs and capabilities. The parties can then draw up a comprehensive, synchronized, civil-military plan for each nation, designed to address the shortfall between its needs and capabilities. The country team, headed by the American ambassador, should serve as the focal point for the assessment in each nation.

Engineers must participate in the planning process. They must ensure that projects chosen for construction by host nation labor are really suited to local capabilities, and that adequate resources are locally available. Engineers must also ensure that adequate engineer forces are assigned to execute the more complex missions.

Good candidates for civic action projects include roads, schools and housing, medical and athletic facilities, water supply and sanitation infrastructure, and irrigation systems. Such projects directly improve the quality of life for a local population. Engineers can provide support in several forms.

- We can design projects for construction by the local labor force.
- We can design projects to be built by host nation or U.S. military engineers.
- We can send engineer advisors to help local agencies complete projects.

- We can set up and conduct training programs for local units and agencies.

We must always train local personnel: the real goal of civic action missions is to develop in-country expertise—whether it's skill in operation and maintenance or skill in engineering and construction.

Preparing the ground

Adequate public affairs preparation must precede the arrival of U.S. units. The local population must understand what our troops are going to do in their neighborhood. Public affairs officers must be ready to counter negative insurgent propaganda. They can also increase effectiveness of any civic action project by selling the coming benefits, and getting people ready to use the facility—whether it's a road or a schoolhouse. We often speak of combat multipliers—we should remember that public affairs campaigns are civic action multipliers.

On the U.S. side, our engineers must receive predeployment training on the history, customs, and culture of the host nation. Language training is also essential. We Americans often arrogantly expect others to communicate with us in English. We must break out of this mold and learn the host nation's language.

Foundations for growth

The final test of civic action planning is program execution. The country team must establish priorities to ensure the host nation's requirements and U.S. contributions continue to mesh.

Our procedures can and should work consistently to build host nation strength. Sturdy, usable, workable facilities are the goal. Specifically, we must standardize designs to expedite construction and allow

mass production of selected building components. We must produce simple standard designs to make local maintenance practical. We should use local materials to benefit the host nation economy and to ensure a ready source of maintenance materials. The equipment we install must be unsophisticated, and operation and maintenance instructions must be provided in the local language.

Each civic action project must be analyzed to take advantage of all training opportunities that it affords. Projects may be completed by local military units or agencies, U.S. military engineer units, contractors, or a combination of assets. The desired result? Useful facilities and improved host nation capabilities.

Every well planned and executed mission a host nation completes with U.S. Army Engineer assistance strengthens regional stability. Such projects make life better at the grass roots level, build the people's confidence in their government, weaken insurgent claims on popular loyalties, and create goodwill for the United States.

COL John E. Schaufelberger is the Commander of the Fort Worth Engineer District. He previously served as the Director, Department of Military Engineering, U.S. Army Engineer School. He also commanded the 299th Engineer Battalion (Combat) at Fort Sill, and served on the VII Corps Engineer Staff in Germany. He holds a B.S. in electrical engineering from the University of Idaho and an M.S. and Ph.D. in civil engineering from the University of Illinois. He is a registered professional engineer in Virginia.

REDSTONE: a readiness group helps the GUARD prepare to blaze trails

by MAJ Robert W. White

 Blazing Trails exercises have been part of U.S. policy to promote stability in Central and South American countries since 1984. The exercises extend and improve road networks in Latin America, and at the same time train engineers in the Reserve and National Guard components.

The supporting active component readiness group is a key player in the success of Blazing Trails operations. The readiness group assists with planning and training to prepare the task force for its job. It can also be a focus for lessons learned, thus helping future exercises produce better training results.

Redstone Readiness Group, linked with reserve components in Mississippi, Tennessee, and Alabama, assisted the 1169th Engineer Group (Alabama National Guard) in its work on Blazing Trails from June 1986 through December 1987.

The 1169th's last minute change of venue from a coastal road improvement project to a road and bridge-building assignment in the rugged trans-Andean interior of Ecuador confronted planners with every logistical nightmare in the book. We learned the job could be done—but more planning time would have made everything easier.

A massive planning task

Advance planning is a must. Planning begins when the engineer group receives a warning order and continues through deployment. Ideally, a warning order is issued a year in advance—less than 6 months notice can result in poor project ex-

ecution. The main problem with short lead times? Resupply and spare parts systems can't be firmly established.

Planners from the 1169th and Redstone set milestones early. They secured funds for repair parts—and followed up to ensure parts were ordered. Project designers established their blueprints in time to draw up a bill of materials for the original coastal project. Accounts for rations and other needed items were opened. These tasks had to be done—or materials could not be ready for deployment.

A game with many players

Preliminary coordination is vital. The task force commander and his representatives visited the host nation to define the project scope. Planning and coordination conferences included the State Department and extended down to units at the company level. Other agencies included the National Guard Bureau, the Office of the Chief of the Army Reserve, and the participating Continental Army and Reserve Component units.

Headquarters, Second United States Army played a crucial role in the 1169th's planning process. Second Army conducted an in-progress review with each major subordinate command and appropriate state National Guard agency providing status reports on personnel and equipment support requirements.

Redstone served as a resource for units preparing for the in-progress review. The Second Army's Commander directed spe-

cific actions to ensure planning objectives were met.

Big work force, high turnover

The Second Army and FORSCOM developed a troop list. Once the task force commander received his mission statement, he reviewed the troop list and recommended changes. He looked at each unit's status report, MOS qualifications, strength, and equipment on hand. Redstone helped the troop-listed units prepare for overseas deployment training.

Most reserve component soldiers serve only 2 weeks on a Blazing Trails operation. Thus, the troop list is large, and the task force headquarters deals with five to ten times more units than are actually on the ground at any time. The 1169th made an intensive effort to tailor its organization and develop a provisional force structure to accomplish the mission. The commander's effort in this area was vital in making this logistically difficult mission a success.

It is tough to develop a viable plan for building a road using a series of 2-week rotations. Yet limited military leave from civilian jobs makes short stays the obvious approach for reserve component soldiers. The task force composition for each rotation must be balanced to afford the best possible unit integrity.

Effective training depends on unit integrity. Platoon size and larger elements get effective training. This includes all engineer units, laundry and bath sections, and MP elements. However, integrity is

impossible for some combat service support elements, and as a result these units, with supply and service companies and some elements of maintenance support, do not get the right training.

Preparing for successful execution

To help the engineer group do its job, readiness group assisters organize themselves as a training task force. If several readiness groups are helping the task force, one should take the lead role in developing the assistance plan for the execution phase.

The readiness group must recommend ways to resource the task force for such factors as project design. Though the engineer group is capable of producing a design, it lacks time. The task force only has enough full-time personnel to handle day-to-day operations. Active duty training periods have to be devoted to preparing and training for the exercise.

Training leaders

Construction management procedures and ARTEP task proficiency are critical to mission success. Most platoon leaders and company commanders can develop a logical network using the critical path method and a construction schedule. But they often don't know how to use these tools to manage their project. Sustainment training is a must for leaders if they are to deal with project control and resource constraints.

Engineer officers and NCOs from the appropriate readiness group are ideal leader trainers. Redstone Readiness Group orchestrated refresher training on construction management to enhance task force proficiency.

Training troops

Units have to be well prepared. The readiness group offers a wide

range of training assistance including planning, train-the-trainer instruction, and squad-level training. Redstone learned that there has to be a constant effort to improve and expand predeployment training opportunities.

We need to improve and expand predeployment training.

During the initial execution phase, some elements simply did not know what was expected of them. One element deployed with less than 40 percent MOS qualified personnel. If units are not proficient in the needed ARTEP tasks, time can be lost. In a previous Blazing Trails, some culverts had to be reinstalled up to four times because squads were not trained to do the tasks properly.

Taking care of equipment needs

Preparing and deploying the equipment is critical. The task force defines equipment requirements and tasks units to provide equipment after the troop list is set. The task force also establishes equipment standards. The consequences of inadequate control are serious: in a recent exercise, inadequate follow-up resulted in equipment debarking at the seaport in inoperable condition.

With Redstone's help, the 1169th worked out a plan to avoid this disaster. They sent a technical inspection team to each unit providing equipment. The team left a technical inspection sheet to ensure the unit understood exactly what deficiencies to repair before the equipment could be accepted at port. The task force also established a dummy property book. They signed for the equipment at the port only after all the operator, organizational, and direct support standards

were met. The result? Ninety-nine percent of the equipment loaded on the ship was mission capable.

Maintenance and property accountability also affects mission execution. Trained operators and repair parts supply are integral to good maintenance. Since the last rotation uses the same equipment as the first, property accountability is imperative. If leadership is not held accountable, there's no guarantee of operational equipment near the end of the project.

Redeployment is yet another major task. To clear U.S. customs, equipment must be cleared of all organic and vegetable matter. Planners must ensure ten to fifteen simultaneously operating wash points equipped with hoses, steam jets, and other supplies, and plan for manpower to do the job. Maintenance checks must be arranged to ensure that equipment returns in as-deployed condition.

What we know now

We at Readiness Group Redstone have absorbed several important lessons during our work with Task Force 1169. Five stand out as being particularly critical.

Task force command and control must be better-resourced in the planning phase. The task force currently has two choices: they can try to do their job with limited personnel—and encounter problems in the execution phase. Or they can circumvent Army staffing regulations. For example, some guard units have put critical personnel on a series of 179-day active duty training assignments with one-day breaks between them. This has been the only means of assuring the task force command and control element is adequately resourced.

The two-week rotation is too short. Neither training nor project productivity is well-served when the

actual training period is shorter than 10 working days.

Duration personnel must be carefully selected. They must be properly prepared and motivated to do their jobs. The task force commander must be supported in personnel selection and replacement decisions.

Vital supply and repair parts systems must be improved. Of all support for the 1169th's mission, supply and resupply was the weakest. Training for maintenance supervisory and TAMMS personnel needs to be improved.

Remember—the prime objective is training. Blazing Trails is a training exercise, not an operation. Units participate to get training; they are not already trained. Frequent rotations mean a continuous learning curve. It is unrealistic to expect maximum productivity. If the Army were making the project itself the first priority, we would send a single, trained-up unit to work from the beginning to the end of the mission. Since our goal is to train engineers and logistic personnel to deploy, perform a mission, and redeploy, we must set our standards for achievement in these areas.

MAJ Robert W. White is an Engineer Unit Assister at U.S. Army Readiness Group Redstone, Huntsville, Alabama. He has served as war plans officer with the 18th Engineer Brigade in Germany, with the 94th Engineer Battalion, as a project engineer at WES, with the facilities engineer in Korea, and as a company commander with the 326th Engineer Battalion. MAJ White holds BS and MS degrees in civil engineering from Tennessee Technological University, is a graduate of EOBC, EOAC and CGSC, and is a registered professional engineer.



Engineer Problem

Your unit, a Combat Heavy Engineer Battalion (TOE 05415L000, 700 personnel), has been tasked to construct a base camp at a classified location. You were directed to use wood frame buildings, temperate region designs, and temporary (0-24 months) theater of operations standards. Your base camp will also accommodate the equipment and personnel of an MP platoon (40 personnel) and 100 logistical and support personnel.

Using the Army Facilities Components System (AFCS) answer the following questions sent you by the Battalion Commander.

Questions

1. Which AFCS installation design should you use?
2. How much real estate will you need?
3. What standard electrical, water, and sewage distribution systems should you use?
4. What are the vertical and horizontal construction efforts?
5. What assumptions have been made in AFCS with regard to--
 - a. the skill and training level of your personnel?
 - b. available MH/month in your battalion?
 - c. weather delays?
 - d. aggregate location?
6. What is the stateside purchase cost of the materials (CONUS)?
7. How would you derive a bill of materials (BOM) for your base camp?

Hotline (continued from page 49)

- enemy territory where observed fire is unlikely and other mines cannot be emplaced. They are not best used at the key, decisive time in battle.
- The engineer is responsible for calculating the minefield safety zone. This requires firing data, which the engineer must know how to use to calculate minefields.

ACROSS THE ANDES WITH TASK FORCE 1169

by Penelope Schmitt

 The new road peters out 16 clicks above Archidona, Ecuador, a red scribble left on the jungle floor as if by a giant's thumbnail. North of here the airport at Loreto waits—maybe will wait for a long time—to see dozers push their way out of the intractable rain forest and connect Archidona to the northeast by road. Task Force 1169, a muscular amalgam of National Guard, Reserve, and regular U.S. Army components, has begun the enormous job of getting there.

As recently as March 1987, the Task Force had set its sights on a coastal Blazing Trails project, within easy reach of the Ecuadorian seaport at Manta. Over 450 pieces of heavy construction equipment were enroute from the port of Mobile, Alabama, when a massive earthquake hit Ecuador's interior, destroying roads and a critical petroleum pipeline to the northeastern oil fields.

Responding to the Ecuadorian government's request for help, the task force shifted to higher ground in the remote Oriente. The 1169th thus became the first U.S. Army operational task force to cross the Andes—and a well-planned Blazing Trails project suddenly became Abriendo Rutas (opening roads) a Total Army effort to conduct tactical operations in an undeveloped theater.

A logistical proving ground

"If you're asking me would the Army choose this as a site for Blazing Trails," said COL Frank N. Sef-ton, III, Task Force Commander, "I'd have to say no. But for realistic training and lessons learned—well, you can't beat it." What lies behind the commander's words? Long, tenuous lines of communication.

Air support, provided by USARSO's 210th Aviation Battalion, connects Archidona to the outside

"I've never had training like this."

world by Chinook and Black Hawk helicopters. Logbirds — USARSO and Air National Guard C-130 aircraft—can only fly as far as Puyo, a small airfield 45 minutes south of Archidona. All construction equipment must be convoyed to the site—a three-and-a-half-day journey over the Andes. There's no more challenging terrain on earth, and the sudden rains of the Oriente regularly disrupt flight scheduling.

The communications detachments rotating in from USARSO in Panama and Fort Bragg are often the only link between Archidona and the other side of the Andean wall.

Since supplies, mail, spare parts, and troops depend on a thin air LOC and slow ground transport,



1SG Charles Smitherman and an Alabama National Guardsman consult over chess for the 300-foot ACROW bridge that stretches toward the far bank of the Rio Hollin.

the task force immediately learned to show grace under pressure. "I've been a 91 Bravo for about 80 years," said a medic, "and I've never had training like this. Panama's not ten minutes away—it can be two days away. I've got to be ready for anything."

According to 2LT Matthew Hart, task force safety officer, alertness is high, and safety practices are more carefully observed here. "We've been remarkably lucky not to have fatal accidents—one or two usually happen no matter how careful you are." His main concern? "We want to see soldiers protect their hearing around all this heavy construction equipment," he said. "It's also part of the engineer mission to be prepared to function as infantry—a soldier needs his ears. I make a big pitch for earplugs every rotation."

Mail, finance, and PX operations make time away from home easier.

As for the Judge Advocate General—"We're here in case we're needed. And I'm glad to say we haven't been."

Military police operations are a major point of contact between the Ecuadorian and U.S. military personnel working at Archidona. Regular Army MP units from USARSO, augmented by a squad of Spanish-speaking Puerto Rican MPs, provide a cooperative security element.

Water purification, shower, laundry, and mess personnel know that safe water, healthy food, and clean clothes can't be had if they don't do the job. Some soldiers are volunteering for second and third rotations to get more experience. As one sergeant said: "Back in the States, you just go through the motions. Here, if the water isn't clean, people will get sick. I feel really good about what I'm doing."

The Oriente—the far outback

Why here? Why now? These are questions that spring into eyes that gaze over the pathless forest below, a brocade of palms and treetops packed together—Sergeant Edie Wait says—"tight as broccoli." LTC R. K. Lettau, USAF, at SOUTHCOM Engineer Headquarters, has an answer. "You can't think about whether the road arrives somewhere in this region," he says. "You have to think about the opportunity it gives people to come out."

To Napo Province, the road means just this—an abridgement of the days of struggle it takes to get gold dust, coffee beans, and potatoes out of the hills to market. . . A dusty finger probing the wilderness so that a gaily-painted yellow and pink bus can reach a sick child. . . A way to bring goods across the Rio Hollin without spending a hard-earned 50 or 500 sucres

to get somebody to ferry your livelihood across.

In Archidona and in neighboring Tena the people don't ask "Why are you here?" They want to know when the Army is going to come back. According to COL Sefton, there's almost no chance that the job will continue into next summer, because of upcoming elections in Ecuador. Future exercises here are questionable because of logistical difficulties. "What we mean to do," he said, "is to leave a basis to build from. We've hauled more rock and built more road under worse conditions than any Blazing Trails exercise has ever done before."

Guayusa Bridge

The task force has also achieved its primary engineer goal—to bridge the treacherous Rio Hollin. The 92nd Engineers of Fort Stewart, Georgia supervised the construction of the bridge's center pier and abutments. Their task included such feats as sinking the pier 17 feet down into the muddy river bottom, keeping it pumped dry, then filling the foundations by hand with rocks. Soldiers stood up to their waists in the water, passing rocks from hand to hand to do this job.

After weeks of delicate negotiations with the host nation government, the task force took delivery of an ACROW panel bridge. The crossing, completed November 10, put the 1169th on the record books. The bridge is 300 feet long, and consists of a 100-foot double-single span and a 200-foot double-double span.

ACROW, an updated version of Bailey Bridge, is somewhat slower to build than the Bailey, but has superior strength characteristics. It can also span wider gaps, and requires less maintenance after it has been erected. The 145th Engineer Battalion, Alabama National Guard, put the bridge over in 3 days, and jacked it down and decked it in three more. An Ecuadorian contractor, invited to the site to watch

the bridging, said he estimated it would have taken his crew 17 days to complete the same job.

In ceremonies held on November 19, Guayusa Bridge—named to remind Ecuadorians of their nickname for the visiting troops—opened to traffic. One local farmer's gratitude shows what the bridge means here: he says it will cut his time to market from three days to just one, and make it possible to bring more to town than he can carry on his back.

Mud, rock, and mahogany

Engineer units from the Alabama and South Carolina National Guard have upgraded and reinforced the sketchy road from Archidona to the bridge site, and have pushed the road about 5 kilometers beyond the Rio Hollin.

To say the 1169th has laid down road is to say nothing. You have to know how they've done the job. Ecuadorian soil, one rueful engineer joke has it, is just there to keep Colombia from sliding into Peru—or maybe it's there to grease the slide. The soldiers compare the mud to chocolate pudding, quick-

At the bridge site on the Rio Hollin, swift water and flash floods are an ever-present danger..."The rains can make the river rise 6 feet in an hour—or higher. You have to watch the water every minute."

sand, and a bottomless pit. A mixture of dense clay, vegetable loam, and extremely friable shale, the soil turns liquid when it mixes with the abundant rains—often more than 20 inches a month—that fall in Napo province.

Fortunately, the rugged terrain here offers other resources. The Hollin, like all the many streams in

the Oriente, is choked with well-worn Andean granite. This rock, together with the hard, rot-resistant mahogany that fills the surrounding forest, can be used to build a pathway through the jungle.

Ecuadorian road construction techniques are based on these resources, and the 1169th is learning to use them. A corduroy substructure built of local timber (see "Palizada", page 19) floats a layer of rock over the mud. On these two hard-earned base courses, engineers build their one-lane road as fast as they can—sometimes less than 100 meters a day.

A workhorse at the bridge site, a 75-ton rock crushing plant has been kept busy all summer. Older than most of the soldiers who operate it and designed to handle relatively soft limestone, the plant has doggedly chewed and spat out granite for months. Every day, maintenance personnel wonder if the machinery is making its last stand, and only with constant effort have they kept it grinding out construction material. One thing is certain—vital but aging equipment like this must be replaced.

Labor and construction methods must be adapted to local conditions. Fortunately, Ecuadorian military and civilian workers have passed on valuable lessons to U.S. troops. According to COL Sefton, his soldiers are wielding picks and shovels to build ditches and culverts with skills they'd never have learned back in the states. The care and accuracy of Ecuadorian hand labor, he reports, is making a big impression.

Wood for the corduroy base course is being supplied by host nation loggers. Their timber-handling skills are an object of admiration for 1SG Charlie Smitherman, a veneer and plywood mill foreman in civilian life. "The Ecuadorians are chainsaw artists," he says. "They can saw mahogany into planks so straight and smooth you can hardly believe it." A cart full of smooth, deep red boards passing on the

finished road gave proof that his praise was no exaggeration.

In the Oriente, as in many remote regions, concrete construction is a near-impossible challenge. The task force poured concrete only where necessary. To fill the forms for the abutment on the far bank of the Rio Hollin, a Chinook helicopter made 20 very careful passes with hoppers full of fresh mix. Clearly this is a technique to be used sparingly.

For this reason, gabions are a construction element evident along the new road. These are steel wire baskets packed with rock and built up to work like concrete. The 1169th has used gabions to rebuild sections of collapsed road, to shore up the bridge abutment, and to lay a stabilizing blanket of rock around the bridge's central pier, making sure the Rio Hollin's bottom remains rock-solid.

Each gabion is spread open, set in place, and filled by hand. According to 2LT Elizabeth Franklin, of the 92nd Engineers, Fort Stewart, Georgia the Ecuadorians have given her troops invaluable instruction in the patience and hard work it takes to fill every cranny with rock. "When they're packed," she says "we shovel a sand and concrete mix into the gabion, so that moisture will provide a mortar."

Work and water

The 1169th is compiling a wealth of other lessons learned about work in tropical conditions. Some things—like how to build a corduroy base course—the command group admits had been lessons forgotten. "The army needs to get all this expertise we're relearning and finding out here together in one place—make it a resource we can use whenever we have to get into these situations," says COL Sefton. "The right kinds of equipment, the hand construction methods you need in remote areas, the knowledge of how to handle this type of terrain—we can't afford to



Soldiers loosen the concrete forms that top off a bridge abutment constructed with gabions—rock filled wire baskets.

learn it and lose it over and over again."

A prime discovery here is that much of the heavy construction equipment in engineer TO&Es is just too heavy for these conditions. Dozers and backhoes can easily sink hip-deep in the slick mud.

What does the task force need? "We've leased two types of items we'd like to see in the inventory," says Sefton. "The D6 swamp dozer,

and the hydraulic tracked backhoe, or trackhoe. They have wider tracks, they're lighter, they stay up and maneuver better in this mud. We've leased some and contracted Ecuadorian operators—they handle them with considerable skill."

A possible way to handle this specialized equipment, he suggests, is to treat it like prepositioned materiel and equipment in NATO—stock the items in tropical regions

as POMCUS so they can be ready when and where they're needed.

Strong winches to pull mired equipment out are also a must in this region. Equally important is a healthy respect for the savagery of the equatorial climate. At the bridge site on the Rio Hollin, swift water and flash floods are an ever-present danger.

"Talk about lessons learned," said COL Sefton. "The rains can make the river rise 6 feet in an hour—or higher. You have to watch the water every minute. When you see it get muddy looking, you set a pole in it and watch to see if the water rises. I had a couple of people here who failed to believe me when I told them that—and as a result two air compressors and a concrete pump got washed down the river in an 8-foot flash flood. That was one expensive lesson."

In taking on this extraordinary mission at short notice, Task Force 1169 faced on a micro level what the Army must face on a broader level if it is to be truly ready for deployment and operations in undeveloped theaters. Pulling together a working operation has meant, in some cases, creating a patchwork of personnel and units that doesn't reflect the CAPSTONE trace organization as well as it should.

The task force has also contracted out some vital jobs and leased essential equipment—a luxury that might not be available in hostile conditions. Balancing the task force so that rotational training is served and key support lies in the hands of competent duration personnel has also been a challenge.

Measuring the achievement

"Every Blazing Trails deployment walks a fine line," says COL Sefton. "Our primary goal is training—but the host nation's expectations are that we will complete some major construction. To train the maximum

number of people, you've got to face up to some sacrifices in kilometers of road completed."

The commander estimates this year's project will have trained about 8,000 troops. He'd like to see rotations lengthened. "Right now," he said, "rotating groups spend about a day getting here, a day getting oriented, and a day signing out and getting familiar with their equip-

In Archidona and in neighboring Tena the people don't ask, "Why are you here?" They want to know when the Army is going to come back.

ment. The administrative time lost is about the same on the other end. Out of each 2-week rotation, I'd say we see only about 7 productive work days." Longer rotations would, in his opinion, improve both training and productivity.

Base camp construction also costs significant time and labor. "We filled this area with 6,000 5-ton dump truck loads of rock, just to make a floor to build on," says COL Sefton. "But the time had to be spent. Remember, the Army put 3 years into building a base before a shovelful of dirt was dug out of the Panama Canal. In this part of the world, you have to take care of your soldiers. It's a life and death matter." Still, he admitted, productive road construction time amounted to only about 70 days of the 6 months the task force will spend in-country. "We have to do better," he concluded.

Right as the command group is—organization must be stronger, equipment more effective, and training more complete—a tangible spirit of deep satisfaction reigns in

Archidona. Soldier after soldier speaks of increased understanding of life outside the United States, and of greater appreciation for what he has at home.

Community-base camp relations are excellent. In Archidona, U.S. military are "amigos," not "gringos," and while the town is experiencing a heady injection of cash floated on an ocean of coca cola, a mountain of black shoe polish, and acres of llama-wool blankets, there has been no influx of contraband or high-tech goods.

Of all the lessons we bring home or leave behind in Archidona, it may be that the most important can be summed up in brief images. . . A Quichua Indian woman, loaded with a heavy sack of potatoes, walks unafraid near a maintenance area chockablock with 5-ton dump trucks. . . A girl stands behind the counter of a refreshment stand poring over an English phrase book with the help of an American soldier. . . A local man hands an officer a bottle of suspicious-looking water to be tested for impurities by the medical group. Trust, learning, and mutual assistance have all become the daily bridges for better inter-American relations here.

Task Force 1169 will leave Guayusa Bridge as a steel and concrete monument to the skill and determination of the U.S. Army Engineers. Its individual soldiers will also leave a legacy of friendship with our neighbors to the south. In many ways, Abriendo Rutas 87 has been Total Army—being all the Army can be.

Penelope Schmitt is features editor of ENGINEER.



Engineer Solution

NOTE: These generic answers use the standard 1,000-man base camp (NT 1531) all-climate, temporary standard, wood frame buildings. Your answers would vary with many factors—depending on which facilities you add or eliminate, whether your work periods vary from those assumed in AFCS, and changes you might make in standard designs to accommodate the situation on the ground.

Answer	Reference
1. NT 1531	TM 5-301-1; TM 5-302, vol 2
2. 52.1 acres	TM 5-301-1; TM 5-302, vol 1
3. Facility numbers:	TM 5-301-1; TM 5-302, vol 1
Electrical 81240	
Water 84210	
Sewer 83210	
4. Horizontal: 24,141 hours	TM 5-301-1
Vertical: 87,574 hours	
5. a. Skilled personnel	TM 5-304, paragraph 2-9
b. Work period for all units is 12 hrs/day, 7 days/week, 365 days/yr.	TM 5-304, paragraph 2-10
c. Construction efforts do not include weather delays.	TM 5-304, paragraph 2-9
d. Aggregates are available within 5 miles of the construction site.	TM 5-304, paragraph 2-11
6. \$2,102,011	TM 5-301-1
7. Use TM 5-303 Bill of Materials	TM 5-303

Hedgerows (continued from page 31)

tank over its entire width. Since the rail device had most of the advantages of the tusk arrangement plus added strength and durability, it totally removed the need for explosives.

Engineers no longer need to concern themselves with ways and means of getting tanks over the ground. We had found a way to conquer the terrain and to free ourselves to apply our resources to other tasks. Ingenuity, good planning, and the ability to capitalize on a fortuitous discovery helped us to clear the way for armor and infantry. We didn't make headlines—but we had a significant influence on the success of the Normandy campaign.

Note: Major General Ploger first wrote the story on Normandy hedgerows in Europe in late 1944 after the battle of Vire. He was then a lieutenant colonel commanding the 121st Engineer Combat Battalion of the 29th Infantry Division.

Major General Robert R. Ploger, United States Army (Ret.), is a 1939 graduate of the United States Military Academy. In 1965 he commanded the 18th Engineer Brigade in South Vietnam and from 1965-67 served as General Westmoreland's Army Engineer and commander of U.S. Army Engineer troops in South Vietnam. His staff assignments include duty with the War Department General Staff, Supreme Headquarters, Allied Powers Europe, Military Liaison Committee to the Atomic Energy Commission, GHQ and Japan Logistical Command in the Far East, Office Chief of Engineers as Chief of Military Personnel and later as Director of Topography and Military Engineering. He served as commander of the Engineer Center and Fort Belvoir from 1970-73. He resides in Ann Arbor, Michigan.

PALIZADA— road building, the Ecuadorian way

by MAJ Pat Balcazar and Dr. Jack Fowler

 Geotextile fabrics—these are one of the many construction materials you won't find in Ecuador—or in many less-developed nations where the Army has to be ready to build roads. Such roads have to be supported some other way. In this South American nation, road builders use palizada, a base course of logs packed tightly across the roadway. We call it corduroy, though we haven't used it much since World War II.

Conditions in the rain forests east of the Andes make this technique especially useful. The area offers no alternatives—every route lies on muddy subgrade with poor strength characteristics. The soil, classified ML, is constantly supersaturated. More than 150 inches of rain falls each year, at rates of over 20 inches a month in the rainy season.

Army Engineers studied Ecuadorian road-building techniques as

they began work on Abriendo Rutas near Archidona. Granito-Checa-Pazmino, an Ecuadorian contractor, is building a road from Jondachi to Loreto, the junction the Army engineer road aims for. Observations

**He who carelessly
blunders forward will get
stuck in mud.**

of Granito's techniques helped Task Force 1169 avoid some problems.

Granito had begun its road before a March 1987 earthquake that led Ecuador's president to ask the task force to move its Blazing Trails exercise over the Andes and help open Napo Province.

The contractor's original project—to strip topsoil to grade and construct a subgrade with a flexible wearing surface—changed as well. The Ecuadorian government in-

structed Granito to build a pioneer road in order to speed the opening of another isolated area. Granito proceeded by working its road in three phases: pioneer road, palizada or corduroy, and then the wearing surface.

The pioneer road is built by a squad of workers who clear the path with chain saws and low ground pressure dozers (D6 caterpillars). Army engineer observers immediately saw it was essential to clear the path, the whole path, and nothing but the path.

Why? Cleared areas can rapidly become bottomless sinks of mud—maximum vegetation is not retained. Field manuals that suggest clearing a swath along the roadside, as was the practice in Vietnam, are dead wrong about the soil conditions in this region.

Granito's minimalist method is to construct the road with a cut made by two wide-track dozers. Few fill sections are made on the road's centerline. Cleared trees, topsoil, and loose wet soil are washed down slopes to clear a 10-meter-wide area for a 6-meter-wide rock-filled base course and drainage ditch.

The drainage ditches are excavated, largely with hand tools, at the edge of the cut. The center of the cut slopes to drain the road on one or both sides. Turnout points are built every 100 meters; and streams are crossed with native timber bridges.

To prevent the pioneer road from becoming a swamp, the project engineer bans equipment from the road. Workers walk along the edge of the pioneer road, and only get on the roadway where a wearing



Ecuadorians lay a base course of logs—the palizada on which the finished road will "float".

3



Ecuador's mountain-fed rivers are full of well-worn boulders, excellent material for building roads.

surface has been added. If equipment must travel on the pioneer road, the project engineer supervises. Equipment is refueled in place—fuel travels the road in PVC pipe and is gravity-fed to equipment.

To construct the corduroy base course, logging crews harvest logs 6 meters long and 5 to 25 centimeters in diameter. The logs are laid perpendicular to the road's centerline. The project engineer explained that he prefers two rows of shorter logs—not one row covering the whole road. This reduces the load transmitted from the subgrade and wearing surface across the width of the road.

The corduroy is the Ecuadorians' geotextile fabric. It prevents base soil from mixing with the road's subgrade. It also allows ground water to percolate to the shoulder of the road and at the same time restrains soil movement. The timber in the palizada does not rot, since it is submerged in mud.

Granito has had the added good fortune to discover a deposit of petroleum-impregnated earth near the work site. This soil is being used to surface the road. Exposed to air, it hardens and forms a durable wearing surface.

Task Force 1169 has been constrained by time limits to build fewer turnouts, and to use one row of corduroy across the road. The wearing surface that the 1169th uses is a mixture of crushed rock and earth.

As the exercise nears its close, the task force is satisfied its road is a durable product that will stand the severe tests of the Ecuadorian climate. Observation of the Granito project has shown U.S. engineers valuable methods for constructing expedient roads in rugged, muddy terrain.

The most important lessons? Clear no more than the path. Keep traffic off the road until the wearing surface is built. The lighter the equipment, the wider the tracks, the better you move. Improve skills with hand tools.

The mobility moral here is simple—he who carelessly blunders forward will get stuck in mud. As in many other tropical and subtropical regions with heavy rainfall, progress may be measured in meters and in days, not in kilometers and hours.

But in this country no one asks how far it is to a place, only how long it takes to get there. Road builders, Granito and the 1169th

among them, take pride in the way their arduous work has shrunk travel time for Ecuadorians in Napo Province.

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AFCS: a flexible template for base camp design

by MAJ Edward A. Hayes and CPT David C. Wilson



Your unit is slated to train in Central America. Will you waste many precious days struggling to design a base camp? Your contingency mission makes you responsible for designing logistical facilities for an undeveloped theater. Must you draw up blueprints from scratch? The answer to both those questions is NO. The Army has the tool you need to help you design and build for the theater of operations. It's called the Army Facilities Components System (AFCS).

The AFCS is a military engineering construction support system. Planners can use it to choose, plan, and build almost any facility needed in a theater of operations. Its designs are adapted for use in any geographic area and in both developed and undeveloped theaters.

What will it tell you? The AFCS details construction standards, explains construction planning, shows standard plans and bills of materials, and recommends construction sequences. It gives estimates for the construction effort specific facilities require, and even offers data on materials and techniques you are likely to find in your theater of operations.

Who uses AFCS?

The AFCS is a primary source for planners and builders who are responsible for theater construction requirements. The civil engineering support plans for all major OPLANS include AFCS as their facility data file. Under the proponentry of the Army Engineer School, EOBC and ANCOC (MOS 51H Construction Specialist) classes

use the AFCS to plan and construct theater facilities. In EOAC, students use the system to plan and adapt designs for a base camp mission exercise.

What is AFCS?

The system is made up of four technical manuals (References, page 24). Related publications also include the *Theater-Oriented Guide Specifications (TOGS)*. These specs can be combined with AFCS blueprints for use by commercial contractors hired to build AFCS facilities. The *Foreign Equivalent Construction Stock Items and Local Building Components* guide gives detailed information on construction materials and practices in Europe, Asia, Africa, Central and South America, and the Middle East.

The AFCS has also been automated as the Theater Army Construction Automated Planning System (TACAPS). Using TACAPS programs, planners and commanders can quickly consult AFCS data to develop requirements and designs. The system is continually updated. Currently, users can access the system through a terminal/modem and phone link. In the future, TACAPS will be available on floppy disks that can be used with your unit's desktop computer.

What are AFCS standards?

The Joint Chiefs of Staff have defined just two appropriate standards for theater of operations construction: Initial—designed for up to 6 months of use, or Temporary—designed for up to 2 years of use.

The theater commander decides which standard will be used, based on his estimate of the operation's likely duration.

Employing AFCS

Planning. This system is an excellent design data base—but you will still have to do some thinking and planning. Most designs have to be modified to fit site conditions, materials and equipment on hand, special user needs, and threat conditions.

As you plan a facility or installation, you will have to consider the potential usefulness of existing facilities, the capabilities of the local transportation net, the resources the host nation may offer, the real estate available, the site conditions, and the threat environment. If you find that your design requirements exceed your unit's capabilities, request support from your higher headquarters, the local DEH, or division or district offices. If your mission is in an undeveloped theater, you'll probably have to do all the designing yourself. In this case, a good site investigation is critical for success.

You must request material for AFCS items through normal supply channels. The AFCS is not an authorization document. You can't use it to prestock or order construction material, even though installations and facilities are listed with a national stock number (NSN).

Building blocks. You can, however, use AFCS to find out exactly what you need to order. The system shows all its components as building blocks that you can fit together according to your needs.

INSTALLATIONS AVAILABLE IN AFCS

- Administration
- Airfields and heliports
- Troop camps
- Hospitals
- Maintenance facilities
- Medical depots
- Ordnance handling facilities
- Precast parts yard
- POL facilities
- Port (container piers)
- Post Office
- Railroad terminals, regulating stations
- Recreational centers
- Signal Intelligence
- Storage facilities (ammunition dry cargo)

The elements are identified as items, facilities, and installations.

Items are material or equipment that can be used as part of a larger product. Each has an NSN, description, unit of issue, and quantity.

Facilities are groups of items designed to provide a service. Some essential equipment is also designated as facilities. Each facility is numbered, described, listed by unit of issue, shipping weight, volume, cost, and associated vertical and horizontal construction effort.

Installations are groups of facilities designed to provide a service or support function in the theater of operations. Each is assigned a number, a shipping weight, volume, cost and required horizontal and vertical construction effort. The AFCS provides drawings that give complete site layouts (see illustration on page 23), including roads, utilities and individual facility locations.

Since it was first compiled in 1951, the AFCS has grown to include designs for over 4,000 facilities. Construction standards have been stripped to austere initial and temporary levels. Many designs are being further simplified, and updates are intended to further improve the system's versatility.

Help for overseas construction.

Clearly this system gives you much more than a vague idea of your goal in planning an installation or facility. You can design and plan procurement for optimal conditions. You can also use AFCS to help you when you're going into a foreign environment, and need to know how this will affect your plans.

If specified materials aren't locally available, check the cost in days and dollars carefully before you order stateside shipments. Prohibitive costs may require you to modify the design to make the best use of indigenous materials. Always remember that construction materials are precious in the theater of operations. Limit waste—order optimum lengths, and ensure materials are properly handled, stored, and secured.

When you make use of foreign construction materials, be sure to consult the publication on foreign equivalent materials described above. It will tell you which materials are compatible and interchangeable with U.S. components. Be sure to check materials and equipment based on the metric dimensioning system—you may have to adjust your design before you can use them.

Don't reinvent the wheel

The basics are all there for you in AFCS. Its modular, flexible design packages can be building blocks for a theater construction mission anywhere in the world. Its publications and computer software can save hours of research, planning and design time. The hours you might otherwise spend on calculations, paperwork, and design can go to the action mission. An accurate plan makes construction easier. Don't reinvent the wheel—use it!

AFCS is managed by the office of the Assistant Chief of Engineers (HQDA, DAEN-ZCM) with technical support from the Huntsville Engineer Division (ATTN: CEHND-ED-SY) or call AV 742-5312.

If you have questions about AFCS or need help with a planning or design mission, contact Structures and Utilities Branch, Department of Military Engineering, USAES, Fort Belvoir, VA 22060 (ATTN: ATZA-TE-SU) or call AV 354-3806, commercial 703-664-3806.

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CPT David C. Wilson is currently Structures Section Chief, Department of Military Engineering, U.S. Army Engineer School. He is a graduate of USMA and EOAC. CPT Wilson has served in the 549th Engineer Battalion in Germany as battalion S2, bridge platoon leader, and bridge company XO.

References on page 24

375-Man Troop Camp Installation No. NT 1211 Tentage					
No.	Facility	Qty	Size	AFCS Facility No.	Remarks
1	Unit Admin	1	18' X 52'	CTA	GP, Large
2	Training/Dayroom	1	18' X 52'	CTA	GP, Large
3	Dining	3	18' X 52'	CTA	GP, Large
3A	Kitchen	2	13' X 17'	TOE	Note 6
4	Supply	1	18' X 52'	CTA	GP, Large
5	Bath/Dressing Tents	2	16' X 32'	TOE	GP, Medium, Note 3
6	Latrine	4	8' X 10'	TOE/CTA	Latrine Screens, Note 2
7	EM Housing	28	16' X 32'	CTA	GP, Medium, 12/Tent
8	Off Housing	5	16' X 32'	CTA	GP, Medium, 8/Tent
9	Motor Maintenance	1	16' X 32'	CTA	GP, Medium
10	Cesspool	3		83190AA	Percolation Test to Determine Size
11	Site Preparation	8.8	Acre	87190AA	
12	Road, Graded & Drained	0.09	Mile	85130FA	20' Wide
13	Road Surface	0.09	Mile	85110BM	20' Wide
14	Hard stand, Graded & Drained	3.5	1000 SY	85210AU	
15	Hardstand Surface	3.5	1000 SY	85110DF	

GENERAL NOTES:

1. This installation diagram portrays a suggested arrangement of living related facilities only, for the field commander of a 375-man camp for use by a company/troop/battery under initial standards. Tentage: GP large and medium is to be provided by deploying units as CTA equipment. However, if camp is to be operational prior to deploying units' arrival, tents must be ordered separately as AFCS facility numbers 72590AA and 72520AA respectively. Billets may be reduced or added to for small variations in tenant unit strength.

2. Separate latrines are provided for female soldiers.

3. Facilities for bathhouses to be provided by QM bath unit. Separation of sexes in showers will be accomplished by scheduling.

4. Water will be supplied from TOE water points.

5. Fencing to be provided by unit if security situation requires it (triple concertina).

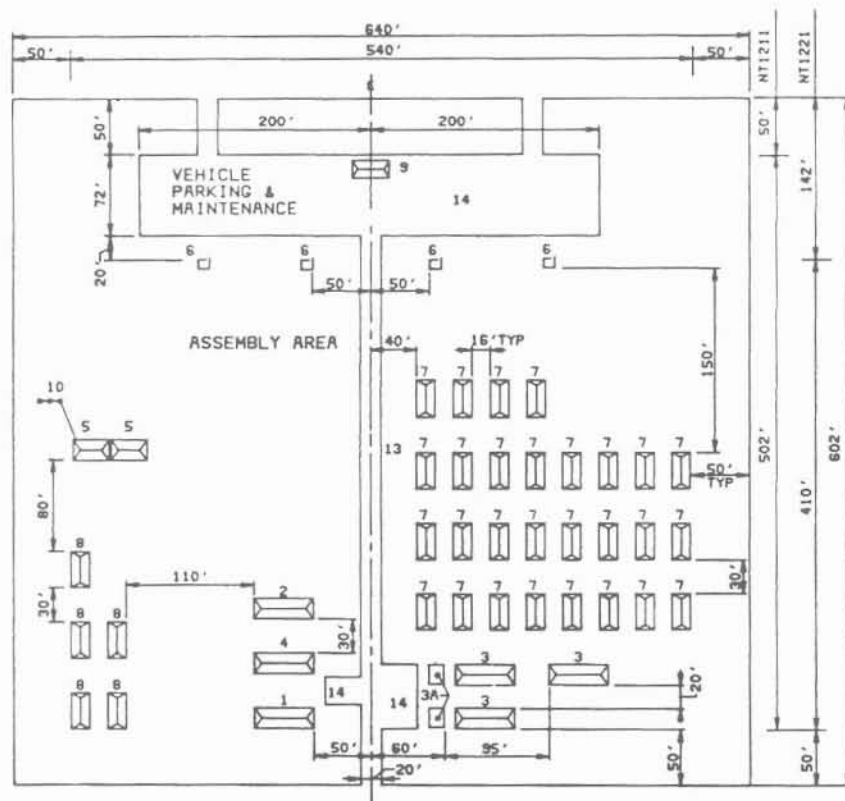
6. Kitchen trailer, LIN I 28351 or tent, kitchen 1948, I INV49948.

7. When company-sized camp is combined with other camps to house larger units, the vehicle maintenance and parking areas are relocated and consolidated. See installation MT 1511.

8. Electrical power and lighting to be provided with tenant unit's portable TOE generators and distribution systems or supplied by another installation.

9. Wood frames for tents: GP, large and medium are available and must be ordered, if desired, using the following facility numbers:

	GP large	GP medium
with earth floors	72520AH	72520AC
with wood floor	72520AJ	72520AD
with concrete floor	72520AK	72520AE



10. Stabilized roads and hardstands selected above are based on existing CBR = 20. Adjust thickness if CBR varies more than 5 up or down from CBR20. If in place CBR is 60 plus, no stabilization is required. If a dust palliative is required, DCA 1295 (NSN5680-00-541-3593) may be applied at a rate of 0.54 gal/sy. Troop camp roads used only as patrol roads should be graded and drained only with no stabilization required.

375-man troop camp installation no. NT 1211 w/motor pool installation no. NT 1221 w/o motor pool initial standard

scale no. 26

REFERENCES

NUMBERED PUBLICATIONS

TM 5-301, AFCS—Planning

This manual explains the concept and use of AFCS and contains tables of installations and facilities in the system. It is published in four volumes, each addressing a separate climate zone. These are:

- TM 5-301-1 Temperate
- TM 5-301-2 Tropical
- TM 5-301-3 Frigid
- TM 5-301-4 Desert

TM 5-301 provides material costs, logistical data, and engineering data for planning construction support. Its planning tables show requirements for real estate (acres), water supply and sewerage (gallons per day), electrical connected loads (kilowatts), aggregates (cubic yards), and construction effort (vertical, horizontal, and general construction manhours).

TM 5-302, AFCS—Design

This is a multivolume manual which contains detailed design drawings for installations and facilities. TM 5-302 also includes:

- Templates for prefabrication of facility components.
- Critical Path Method diagrams for construction management.
- Material procurement process diagrams.
- Decision trees for facility planning and design.

TM 5-303, AFCS—Logistic Data and Bills of Material

This manual is used by planners, builders, and suppliers to identify materials used to construct the desired facilities. It contains material descriptions, units of issue, quantities required, and National Stock Numbers.

TM 5-304, AFCS—User Guide.

This manual explains how to use AFCS. It contains terminologies, definitions, requisition and supply procedures, unit productivity data, and example problems. It also provides general guidance and information on theater of operations construction.

UNNUMBERED PUBLICATIONS

Foreign Equivalent Construction Stock Items and Local Building Components.

This publication provides a country by country construction material availability and compatibility and local construction practices listing for the following geographic areas:

- Europe
- The Middle East
- Asia and Africa
- Central and South America.

Theater- Oriented Guide Specifications (TOGS)

TOGS are a set of specifications designed to be incorporated with the AFCS drawings to make AFCS contracts executable. Each of the TOGS sections covers an item of construction. The TOGS are self-contained, without reference to commercial specifications of Federal standards. The language is unambiguous, assumes the contractor is operating in good faith, and that the Army takes the risks based on existing site conditions.

THE 229TH LIGHTENS UP

by SP4 Richard M. Sanborn

✠ SFC Clyde Hamrick readied to make an Australian descent of a craggy cliff face in the mountains of southern Virginia. "If you told me a year ago that I would be climbing face first down a cliff, I would have told you that you were crazy," he said.

Hamrick's vertigo may have echoed the collective feelings of his unit as it transitioned to a light engineer unit from a combat engineer/bridging unit. However, for the Virginia Army National Guard's (VANG) 229th Engineer Battalion of the 29th Infantry Division (Light) there was no turning back.

The 229th, headquartered in Fredericksburg, Virginia, faced a multitude of challenges. First, the leadership of the newly formed battalion had to reorganize the entire unit structure. As the 137th Engineer Company, the highest ranking officer was a captain. As the 229th transitioned from a single company to a battalion with four companies, officers came in from other units in the Virginia National Guard to build a leadership team.

The 229th was activated 1 July 1986 and began the process of retraining its personnel—a mixed group of 12Bs, 12Cs, and 12Fs—into sapper-trained combat engineers.

As a National Guard unit, it could only train during its scheduled weekend drills and annual training. Other requirements like civil disturbance training competed for training hours.

The 229th's soldiers got their first taste of light engineering during annual training (AT) 86, when they at-



SSG James McCarty rappels, Australian-style, down a cliff face in the Shenandoah National Park during Sapper Leader course training conducted there.

tended a 3-day "Rite of Passage" course conducted by the 29th Infantry Division's Light Leader Course at Fort A.P. Hill, Virginia. A 4-day field training exercise (FTX) followed the course. During the FTX, soldiers were airlifted to a partisan linkup point and then to riverside where they rafted downstream, performed demolition reconnaissance, and simulated demolition of a bridge.

More training—less time

Several members of the 229th had completed the resident Sapper Leader Course (SLC) at Fort Leonard Wood, Missouri, earlier in the year. Over the next several months, they introduced the unit to light en-

gineer training during weekend drills.

In the meantime, NCOs who weren't 12B qualified were attending a 12B20 course at Fort Belvoir, Virginia.

In December of 1986, a mobile training team (MTT) of instructors from the resident SLC came to the Fredericksburg Armory. Their task? To teach the 229th's line unit officers and 12B NCOs Sapper Leader techniques—a 28-day program at the resident course—within the framework of a weekend training schedule.

From December to June, 1987, SLC instructors guided students through subjects like expedient demolitions, aerial resupply, and hand-to-hand combat. Students

learned to develop operations orders and to perform demo calculations. They studied Soviet doctrine. They trained with the M-16, the M-60, and with foreign weapons. In every weekend drill, leadership was a key emphasis.

During AT 87, conducted at Shenandoah National Park and Fort A.P. Hill, the 229th's B and C Company engineers trained in mountaineering, water operations, survival techniques, and battle drills. The course culminated with a 4-day situational training exercise (STX) where soldiers put into practice the techniques they learned over the previous 7 months. This final part of the course challenged each soldier to test himself, and to push himself to the absolute threshold of his ability.

The 229th meets the test

Any soldier who has completed the SLC will attest to the strain that the 4-day STX imposes. "After working for about 72 hours with little or no sleep," said SGT Robert Olsen, "you go into what we called the 'drone zone'—your body is functioning but your mind is blank. Suddenly your brain clicks back on and for a second you wonder where you are."

But was the training that the VANG soldiers received the same training that students at the resident SLC receive? The program of instruction (POI) was the same, said SSG Giles Hulsmann, MTT senior instructor. And since the final 14 days of the training were conducted consecutively, the MTT version of the training was as much a challenge physically as the resident version.

Lessons from Monongahela

At the same time that B and C Companies' engineers were finishing their SLC training, A Com-

pany's soldiers were participating in Operation Little Mountain State 1, in support of the 1st Brigade of the 29th Division. The operation, conducted in the Monongahela National Forest in the mountains of West Virginia, used a cross section of the Division's assets to train a low intensity conflict scenario in a mountainous environment.

The engineers' responsibility was to establish the division and brigade support areas (DSA and BSA). "I think we underestimated the amount of heavy equipment we would need to provide engineer support to the exercise," said MAJ Arthur H. Verburg, assistant division engineer. Although the bulk of the company's workload was supporting the BSA, the engineers performed a variety of light engineering tasks including survivability, mobility, and counter-mobility missions. "The troops learned what it is like to encounter and deal with the contingencies that can occur on the battlefield—like missing a linkup with the infantry, or adjusting to drastic fluctuations in temperature."

The lower enlisted troops from B and C Companies were formed into a composite D Company at the outset of AT 87. SLC-trained instructors from within the unit led them through a mini-sapper school, also held at Fort A.P. Hill. This gave the EMs exposure to the techniques that their NCO leadership would be instilling in them.

Train and retain

Light engineering was a different challenge than many of the soldiers in the unit had faced before. Hauling an 80-pound rucksack up the side of a mountain is certainly more demanding than riding shotgun in a 2 1/2 ton truck. Many unit members said that they had begun regular exercise regimens in order to be able to keep pace with the training.

Over the course of the 2-year transition, approximately 55 soldiers left the unit. They were mostly older soldiers—some with upwards of 25 years with the Guard. However, nearly 115 soldiers have joined the unit since its transition to light.

"We had guys that left because of the training. Now we have people who want to join because of it," said MAJ Anthony J. VanderBurg Jr., battalion executive officer. "We now have people who are more mentally and physically geared for it."

Since competent, well trained, fit soldiers will be essential to the unit's future success, retention is critical. In order to enhance retention, the battalion developed Operation Train and Retain. Normally, a Guard unit's weekend drills run from early Saturday morning until late Sunday night. Under the Train and Retain program, soldiers train from noon Saturday through noon Sunday, giving them 20 hours of training with 4 hours of sleep. They hit the ground running and keep running until Sunday noon. Training is condensed but it is all high speed with no down time, and the schedule affords soldiers personal time during drill weekends.

On 3 October 1987, the battalion had a formation at its Fredericksburg Armory. After nearly a year of training separately, enlisted men and NCOs stood together in ranks. Squad leaders reported to platoon sergeants, platoon sergeants to first sergeants.

The goal of the 229th over the next training year is to train the squads and platoons in the unit to become effective light engineering teams—ready to conquer the precipices that lie ahead.

SP4 Richard M. Sanborn is news editor of ENGINEER

Photo by SP4 Richard M. Sanborn

FROM CRATERS TO CONCRETE IN 48 HOURS

"risky business" of runway repair

By CPT Thomas Round

 Working under cover of darkness, we positioned shape charges and cratering devices on the runway. An array of blasts and flashes erupted from the once smooth surface of the strip. Although we might ordinarily have been thrilled with the success of our mission, we knew that each blast that rocked the night signalled another crater we would have to repair come morning.

Although rapid runway repair (RRR) is generally an Air Force task, Army engineers are responsible for conducting emergency repairs if damage exceeds Air Force RRR capabilities.

Airfield damage repair (ADR) is the primary mission of the 463rd Engineer Battalion (C)(H), 99th ARCOM and our annual training 1987 (AT 87), at Fort Pickett, Virginia, was the culmination of a 3-year plan to develop our ADR capability.

In March 1985, battalion leaders travelled to the Federal Republic of Germany, hosted by our CAPSTONE unit. At our assigned airfield, Air Force personnel briefed us on the unit's role in the event of mobilization and also demonstrated rapid runway repair.

Back at our headquarters in Wheeling, West Virginia, we met with the battalion staff and worked to reestablish our priorities. We had been concentrating primarily on mobility, countermobility, and sur-

vivability missions. While these are still mission-essential tasks, our primary mission is ADR. We also found that ADR encompasses repairs to airfield structures such as the control tower, so we planned to emphasize vertical skills in our training also.

Our training schedule for AT 85, conducted at Fort A. P. Hill, Virginia, had already been established, so we requested additional missions that included concrete finishing and vertical tasks. Company D deployed to Fort Indiantown Gap, Pennsylvania, where they renovated World War II barracks — transforming them into classrooms and bachelor enlisted quarters (BEQs)—enhancing their vertical construction skills.

There was a great deal of opposition to blowing that many holes, but the unit agreed with the airfield and post commanders that we would leave the airfield in at least as good condition as we found it.

In the spring of 1986, Alpha Company was assigned to fabricate the equipment and material that Company C would require for the ADR operations they were to conduct at AT 86. We planned to use the concrete cap method of repair outlined

in FC 5-104-1, *Airfield Damage Repair*. Using a photograph of another unit performing ADR to draw the design, Alpha Company fabricated a screed beam and a trail boom. They scaled the drawing by estimating the height of a soldier in the picture. Pedestal design was taken from the manual.

We blew two large craters on an unused portion of Fort Pickett's airfield so Company C could conduct ADR operations. We repaired the first under non-tactical conditions allowing soldiers to try out the equipment and techniques involved. However, the second one was repaired under simulated combat conditions and under the observation of the First Army Commander and his staff.

When you blow a crater, it creates a heave in the concrete around the crater. So, before beginning repair procedures, soldiers conducted surface roughness checks measuring the upheaval to determine how much pavement had to be removed around each one to achieve a level surface.

If this heave concrete is damaged, it must be jackhammered out; however, if it isn't damaged, it can simply be pushed back down to level using a bulldozer. We found that the concrete displayed a great deal of flexibility.

We removed all chunks larger than 12 inches from in and around the craters using front end loaders.

We pushed all debris less than 12 inches in diameter into the craters, and compacted them to obtain a California Bearing Ratio (CBR) of between 3 and 5 percent. The grade following compaction had to be at least 28 inches below the airstrip's pavement elevation. We found that if we pushed all debris into the crater and then worked out toward the perimeter, it was easier to engage the larger chunks of debris and remove them from the area.

If crushed stone is available, it can be used as fill, eliminating most of the time expended in compaction. With loaders and shovels, soldiers placed two lifts of stone in each crater, compacting to 12 inches below the pavement elevation. They compacted the lower lift to 95 percent compaction effort (CE) 55 and the top lift to 100 percent CE 55.

Soldiers placed a prefabricated pedestal and headboard in each crater. The screed beam was then placed on a spindle mounted in the center of the pedestal. The key to correctly placing the concrete is to ensure that the pedestal is placed properly. In each crater, we poured 12 inches of concrete mixed to achieve 1500 psi in 24 hours. Working from the trail boom, we finished the surface until it was smooth and level with the surrounding pavement. We removed the screed beam from the pedestal—we found that we could simply slide the beam off the capped crater—and cleared the area of all debris and construction material.

While Company C repaired the runway, Bravo Company performed general engineering tasks, hardening the airfield's defenses—building log cribs, constructing tank ditches, and laying wire entanglements.

To ensure that all companies got full training, we brought the screed beam, trail boom, and remaining two pedestals home after AT 86, and Company B trained with them for 4 months. We then gave them to

Company D to train with for the rest of the year.

The screed beam we used for AT 86 was an 8-inch by 10-inch steel box beam, 30 feet long. Transporting it and the trail boom required the exclusive use of a piggyback trailer. So before AT 87, we made a change in the design of the beam. We fabricated it in sections—one 5-foot, two 10-foot, and one 15-foot length. The beam, which is scabbed together using steel plates, also makes it easier to haul to the site than a conventional one, and allows for various size craters.

Our plan for AT 87 was to blow multiple craters, simulating the type of damage that would close an airfield.

The engineers' nocturnal demo mission—once again on an unused section of the airfield at Fort Pickett—yielded 16 craters, some more than 24 feet in diameter.

There was a great deal of opposition to blowing that many holes, but the unit agreed with the airfield and post commanders that we would leave the airfield in at least as good condition as we found it.

"We call it risky business," said MAJ J. Michael Gilson, battalion S3. "Rather than ensuring success by repairing only one hole," he said, "we accepted the challenge of repairing 16 holes, risking failure."

At the same time, each company in the battalion was undergoing an external ARTEP. Since we had so many missions to perform concurrently, we had to apply engineer construction management principles—sometimes projects of lesser priority were put on hold so we could shift personnel to projects of higher priority.

We first conducted rapid damage assessment and identified a minimum operating strip (MOS), an area 50 feet by 1500 feet.

During AT 87, we began using mobile concrete mixers to repair small craters and spalls during hours when commercial wasn't avail-

able. We also found that a concrete saw gave a much cleaner edge around the crater than jackhammering, creating a smoother finish as the concrete is screeded.

Rather than enlarging the MOS after repairing it, we began a second MOS, creating multiple targets in the event of subsequent attacks. It also allows the first strip to be temporarily closed for maintenance, additional repairs, and upgrade.

We completed the mission by clearing the debris and ejecta from the runway.

While training up to our ADR mission, we learned some valuable lessons and these can be applied by any unit adopting a new mission:

- determine mission-essential tasks
- determine materials required for training and their costs
- determine ammunition and demolitions requirements—in the case of guard and reserve units, special permission may be required to obtain live ammunition
- secure permission from the training site
- train up to tasks and prefabricate materials during inactive duty training

Combine these elements with a battalion commander who is willing to take risks and perform new tasks, leadership in the field and individual skill and motivation and you have what it takes to make "risky business" a success.

CPT Thomas Round is an AGR officer assigned to the Directorate of Training and Doctrine at the U.S. Army Engineer School, Ft. Belvoir, as a Training Development Staff Officer. He is an Engineer Officer Advanced Course (EOAC) graduate and has served as an Engineer company commander in the USAR. His AGR assignments include Assistant Brigade Engineer for a Mechanized Separate Infantry Brigade and the Civil Engineer for a Combat Heavy Engineer Battalion.

CONDUCTING A COMMAND POST EXERCISE

by LTC Daniel T. Haakenson

 The group commander stood up. "I want to conduct an exercise that will challenge those two battalion staffs. It must include a planning mission that will run concurrent with the normal operations of the CPX. I want to complicate planning with mass casualties and extensive equipment losses, and messages that will constantly change the staff estimates."

With this guidance, the 164th Engineer Group staff developed a CPX (command post exercise) for two subordinate combat engineer battalions. It was the first time an exercise had been designed, written, and conducted by a higher headquarters without the assistance of a Maneuver Training Command (MTC).

Drawing up a plan

The staff chose a scenario and a maneuver plan, basing it on our CAPSTONE mission—corps combat engineers in support of a forward heavy mechanized division. We placed the battalions in direct support of an attacking brigade. Since this was our first experience with controlling an exercise, we gave both battalions the same mission and wrote one set of messages. This enabled us to compare the performance of two staffs as they responded to identical missions and messages.

The maneuver plan was more difficult. As National Guard engineers in a predominantly engineer state, we had lived in a maneuver vacuum. We decided to base our plan on

documents from the Command and General Staff College. Since we would be playing only one brigade, we wrote a brigade OPLAN based upon the division overlay.

Service support for corps engineers in a division area has always been a complicated issue. We wrote

It was the first time an exercise had been designed, written and conducted by a higher headquarters without the assistance of a Maneuver Training Command (MTC).

a corps service support annex and supplemented it with messages from the division in cases where they could supply our needs.

Our next step was to write the messages. We first determined how the war was going to evolve, so that all messages would present a coordinated picture of the progress of battle—regardless of functional area. We established time lines, so that all writers knew when they should insert specific messages into the exercise.

Messages were designed to exercise ARTEP tasks, and evaluators anticipated and tracked the required responses. Every message called for extensive staff coordination and communication.

We compiled a master message control log. The chief controller checked the messages against the

OPLANs and the projected battle scenario.

A dry run

Our final check was a dry run of the exercise. We received assistance from Readiness Group Denver and from our advisors, who acted as a battalion player cell. After communications were set up, messages began to flow. The trial exercise surfaced many problems that we corrected before conducting the CPX.

Executing the exercise

We began Friday evening with a briefing by the group commander and his staff on the objectives of the exercise, and evaluation procedures. Battalion staff briefings followed. These briefings indicated staff readiness and surfaced problems caused by simulated conditions.

We started the messages flowing early Saturday morning, with very limited traffic. We wanted the players to get organized and familiar with the scenario so we were careful not to overload them with too many messages. A team from the 1st Maneuver Training Command of Denver evaluated the exercise, working closely with the group staff to monitor the message flow and the unit responses to the requirements.

Periodic update briefs by the battalion staffs provided vital information on how they were handling the exercise. During these briefings, several experienced senior officers pressed the staff with hard questions, stringently testing how well the staff understood the exercise,

staff procedures, and engineer doctrine.

Message play stopped about 1800 on Saturday, and the staffs completed the decision brief. The briefs were presented to a combined session, so the two battalions could compare their mistakes and successes. The exercise concluded with after action reviews.

A look at results

Why did we go to all of this work when battalion level exercises are available from the MTCs? First, the group staff learned much more by doing than by simply observing an MTC conducting an exercise for a subordinate battalion. We also focused on several high priority training objectives. Finally, preparing the exercise proved a good vehicle for staff training in the six months before we conducted the exercise.

We have advice for engineer groups and battalions who want to conduct CPXs for their subordinate units.

1. Give yourself plenty of lead time. For reserve component units,

a year is about right. Establish milestones for completing the tasks outlined in this article.

2. Use an outside evaluation team. The exercising unit will be so busy that it will be difficult to both conduct the exercise and evaluate it. Finish documents soon enough so that they can be reviewed by the evaluators in advance.

3. Have a combat branch team to play the maneuver units. Together, you should develop the ability to free-play the war if required.

4. The company cells for an engineer group exercise are critical. The actual commanders should be there to learn and participate, but players should be trained to provide quality input to the battalion staffs. Well-designed status boards are vital to accurate simulations.

5. Exercise communications as they would exist upon deployment. Don't ignore this reality condition—or design the exercise so that communications break down from time to time, simulating the problems broken lines would create.

6. Administrative support is critical. First impressions are important.

From sign-in to sign-out, meals, billets, and other support requirements must be excellent and expedient.

7. Conduct briefings often. Staffs will benefit from the experience, and evaluators and controllers will get the opportunity to put tough questions.

Was the exercise worth the effort? Listen to the Commander of the 164th BN: "It was the finest CPX that I have ever seen. It uncovered some weaknesses in my staff. I now have a better idea what training I need to conduct before annual training."

LTC Daniel T. Haakenson is currently Executive Officer of the 164th Engineer Group in Bismarck, North Dakota. He has also served as the Group's S3, and as XO and S3 of the 164th Engineer Battalion. LTC Haakenson holds a BA from Minot State College, received his commission through OCS, and is a graduate of EOBC, EOAC, and CGSC.



In the early hours of the CPX, a staff team assesses its maneuver position.

ARMY CAREER COUNSELORS KEEP TOTAL FORCE STRONG

By SP4 Richard M. Sanborn

"We don't try to recruit soldiers from the active Army into the National Guard or Army Reserve. Our purpose is to give soldiers who are leaving active duty the opportunity to continue their Army careers," said MSG Julian Wicker, Fort Belvoir's Total Army career counselor.

Soldiers entering active duty ordinarily enlist with an eight-year commitment to the Army. When they finish their first tour of active duty, they usually have a three- or

four-year commitment remaining. If a soldier decides that he doesn't want to reenlist in the active Army he has several options available. He may serve in the individual ready reserve (IRR), or join the National Guard or Army Reserve to complete his enlistment commitment.

As a member of the IRR, it is the individual's responsibility to maintain readiness in the event of mobilization. There are no drills to attend, no uniforms to wear, and none of the pay or benefits active-duty soldiers, reservists, or guardsmen receive.

Soldiers in the middle of their careers may reach a point where they have little alternative but to leave the active Army—a great civilian job offer perhaps. However, they still have a substantial investment toward their retirement. Also, they may wish to maintain their technical proficiency in their military field of endeavor as well as continue their kinship in the Army family.

A career in the National Guard or Reserves offers the transitioning soldier pay and benefits including servicemen's group life insurance,

free uniforms, space available air transportation, limited post exchange and commissary privileges, and, with the completion of 20 years combined service, retirement at age 60. Retirement benefits include complete commissary and exchange privileges, medical and dental care, and unlimited space available air travel.

It is the Total Army career counselor's job to alert the transitioning soldier to the opportunities available in the Guard and Reserves. He will match the soldier with a unit in need of his skills that is in the same geographic area as the soldier plans to reside. Soldiers transitioning into the Guard or Reserves may also have the chance to train for and work in a new MOS if there is a need for it in the unit they are joining.

It is not the Total Army career counselor's job to sell the National Guard or Army Reserves. "Our goal," said Wicker, "is to keep the total force strong by keeping good soldiers in the Army."

SP4 Richard M. Sanborn is news editor of ENGINEER

Hedgerows (continued from page 51)

In preliminary tests, every phase of the gap-blowing worked as desired. Here was a method which reduced the communication, control, and supply problems to simple terms. We felt we had found a reasonable solution.

But we had accidentally discovered more than that. The tankers were agreeably surprised to find that their newly "tusked" vehicles could now make gaps without the help of explosives. The tusks engaged in the body of the hedgerow and prevented the nose of the tank from climbing when the treads met the side of the hedgerow. Result: the traction of the entire length of tread could now force the tank through the obstacle under its own power.

The tankers drove their tanks into and through one hedgerow after another to test the device thoroughly. As might be expected, many of the tusk supports bent from stresses imposed by the tanks and the earth with its mass of intertwined roots. But there was no failure of welds despite the rough treatment given the device.

Unfortunately, there was no time for further development before the next attack, and engineers planned to rely on the internal charge method's proven success, making use of the newly equipped tanks.

Other engineers meanwhile had sought a solution to the still-enormous supply problem. They had to find a way to carry the great weight of prepared charges cross country through the same gaps a tank would use. Luckily the division had many

M29s (weasels), tracked cargo vehicles slightly larger than a jeep. Loaded with forty of the prepared TNT cases, each of these highly mobile vehicles presented a comfortably low silhouette. The engineer battalion procured enough M29s (a small fleet itself!) for the attack and completed the other details in good time.

On the next D-day, with the tusked tanks, supported by engineers, their explosives and weasels, the infantry launched the attack. In spite of bitter resistance, they succeeded in reaching the limited objective.

Later, tankers devised a new augmentation for the tanks. The new device was a railroad rail, supported laterally on the front of the

(continued on page 18)

Engineers for the El Salvadoran Armed Forces

Building the military-to-military bridge

by LTC Mike Turner, LTC Clint Willer, and MAJ Chris O'Reilly

How many engineers are enough? What skills must they have? How should they be organized? What equipment do they need? These are the tough questions that our force structure experts face as they design units to carry out diverse engineer missions on tomorrow's battlefields. The same questions confront allied Third World governments today—so they battle active insurgencies.

Early in 1987, the El Salvadoran Armed Forces (ESAF) sought U.S. assistance in developing a plan to reconstitute and enhance their military engineering capabilities. To assist the ESAF and the U.S. Military Group (USMILGP) in El Salvador, a three-man team was formed by USSOUTHCOM. Participants represented DCS Engineer of USARSO, The Army-Air Force Center for Low Intensity Conflict, and the SOUTHCOM Engineer Directorate. The team traveled to El Salvador in late March of 1987.

The current situation

Approximately the size of Massachusetts, El Salvador is a densely populated country of over five million people. Since gaining its independence from Spain in 1839, El Salvador's history has been shaken by frequent coups and outbursts of political violence. Currently, the fledgling democratic government under President Duarte is actively opposed by the guerrilla coalition of the Farabundo Marti National

Liberation Front, and the Democratic Revolutionary Front (FMLN/FDR). One result of this conflict has been the expansion of the ESAF from a force of less than 10,000 in the mid 1970s to one of over 50,000 today.

Yet ESAF has only one engineer element—a company-sized unit (Destacamento Militar De Ingenieros De La Fuerza Armada) located at Zacatecoluca, southeast of San Salvador. This unit is more commonly employed as infantry, and its engineer skills have deteriorated. Thus the growing Salvadoran army has declining engineer capability.

The bedrock of the current ESAF force structure is six brigades which each cover a regional zone.

Competition for resources within ESAF is keen. Priority goes to immediate combat need. Allocations of funds is affected heavily by the knowledge that U.S. aid is appropriated on an annual basis, which promotes a "last chance, one-shot" attitude about spending.

They conduct tactical operations from well-established cuartels (bases similar to kasernes in Germany) which are maintained largely

by locally-hired civilians. Thus even facilities engineering is not an ESAF function.

The reasons for the lack of engineering capacity are diverse: METT-T differs greatly from zone to zone, so a standardized equipment menu, structure, and military occupational skill requirements are hard to achieve. The high cost of engineer equipment to an Army hard pressed to supply its troops with butter and bullets also limits force development.

Evaluating the engineer need

The assistance team sought to determine an appropriate engineer capability at brigade level, including training and equipment requirements. The team also evaluated the existing engineer unit's potential as an asset whose primary focus could be civic action work in support of the National Development Plan. The U.S. team also recommended allocation for new engineer equipment acquired through a Foreign Military Sales purchase.

The team traveled through El Salvador, visiting the brigades, the engineer unit at Zacatecoluca, and other headquarters in order to learn the realities of the force structure and needs from commanders, their staffs, and assigned U.S. trainers. The team also examined fortifications, terrain, and available equipment. The El Salvador area engineer, who oversees the many projects being built by the Corps of

Engineers, Mobile District, provided valuable supplemental information.

After the team's on-site mission ended, they turned to the resources available at the U.S. Army Engineer School, the Special Warfare Center, and the School of the Americas. From these sources, the team gathered information on force structuring techniques, equipment costs, mobile training team procedures, and Spanish-language training materials. They also took note of lessons learned by personnel who had hands-on experience working with Latin armies.

An Army with few resources

What were the findings of the initial assessment?

Competition for resources within ESAF is keen. Priority goes to immediate combat needs. Allocation of funds is affected heavily by the knowledge that U.S. aid is appropriated on an annual basis, which promotes a "last chance, one-shot" attitude about spending. Moreover, each brigade commander must manage a lump sum annual budget which includes his soldiers' payroll. Thus pay, food, and field uniforms compete directly with programming and procurement. Long-term programming in such an atmosphere is nearly impossible.

The educational level in the Army is low. Enlisted soldiers have little education; few engineer officers hold college-level degrees. Leadership is invested almost wholly in the officer corps. ESAF NCOs cannot be compared with U.S. NCOs either in technical expertise or in leadership credibility. To compound these problems of competence and leadership, the team learned that the ESAF's status as a conscript Army subjects it to a certain amount of political instability from within.

Scarce resources multiply ESAF's problems. Logistics and maintenance systems are rudimentary and highly centralized. There's no way to support and repair sophisticated equipment dispersed in the field. The few highly skilled engineers are used in key operational roles—at the expense of a viable training cadre. There are too few engineers to deploy throughout the working army in the field. Engineer doctrine can hardly be said to exist—even if the ESAF had more ways and means, standard know-how would be missing.

The U.S. Army's ability to provide training support to the ESAF is limited by the restrictions Congress places on U.S. military strength in El Salvador and in other such countries.

Despite these enormous challenges and narrow horizons, the U.S. team was able to construct some proposals for ESAF's consideration.

What to do—how to do it

The team's prime recommendation? Establish a platoon-size engineer element in the structure of each brigade. This strategy built on an ongoing ESAF initiative to train selected soldiers in each brigade. Specific training objectives included:

Focus exclusively on hand tools, mine detectors, chain saws, and motor transports with trailers. Any further acquisitions would have to depend on improvements in the Army's ability to program maintenance, repair, and parts supply support.

Recognizing that El Salvador's regional needs differ—some zones are areas of intense guerrilla activity, some are quiet—means that engineer skills must vary from zone to zone. Some commanders must emphasize mine-countermeasure training; some may concern themselves with civic action and other construction efforts. El Salvador may be a

small country, but its engineers cannot be structured under a template organization.

Initiatives for the future

The advisory team looks beyond these near-term possibilities to a further-developed engineer force. There's good reason to look ahead—just as the United States' westward expansion was supported by Army engineers, a stable, well-equipped engineer force could serve as a strong instrument for infrastructure development in El Salvador.

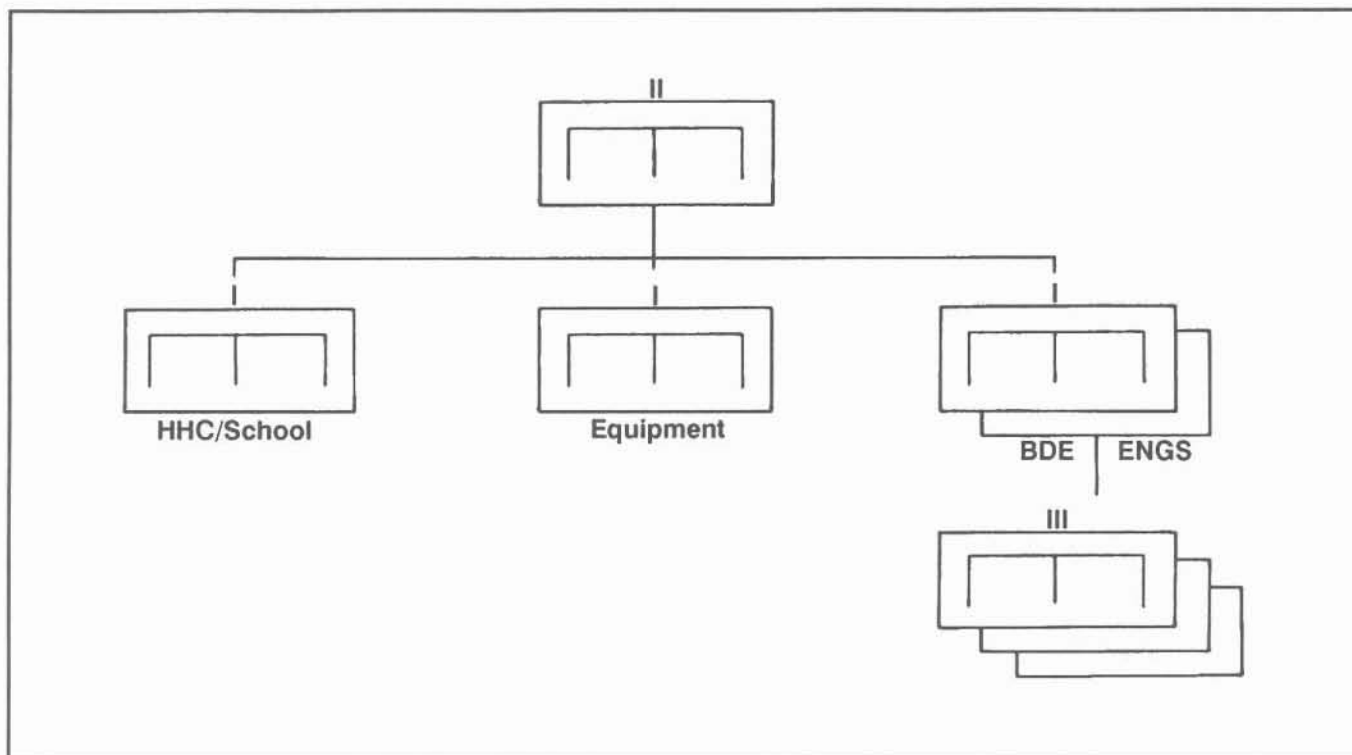
Some of the features the team proposed were:

A parent engineer command and control element. Brigade engineers could be assigned to this unit, thus allowing flexible allocation of engineer assets throughout the country. The engineer command at Zacatecoluca was identified as the most logical command headquarters.

An engineer school. The team envisions a combined U.S.-ESAF mobile training team that could prepare a cadre of trainers. Using Spanish-language training materials already available in the U.S., this cadre could conceivably meet the basic training needs at the brigade engineer level. The ultimate goal would be to give the ESAF enough expertise to sustain a suitable Engineer Officer Basic Course program, and to provide selected MOS training.

An equipment company. Building on the existing engineer unit, the conceptual company would have a TO&E similar to a U.S. combat equipment company. Its primary purpose would be to carry out civic action projects. Because of limited resources, the company should be deployable anywhere in the country, but its control and supply functions would have to be centralized.

Again reflecting the prospect of scarce resources, the team advised that new construction equipment be



Recommended ESAF Engineer Command.

consolidated at the engineer command. The team also advised that aging equipment be scrutinized, and eliminated from the inventory if it could not be maintained. Contract maintenance and operation was suggested as an interim way to meet short-term needs, but the team urged that the command work toward gaining the capability to support its own inventory.

Building the military-to-military bridge

The U.S.-ESAF cooperative effort may be a long time bearing fruit. The fluid political situation in Central America and the uncertainty and scarcity of funding make that certain. Yet both armies and their governments have benefited from the exercise. The ESAF now has a framework within which it can aim to support its government in the National Reconstruction Plan. The United States has learned valuable lessons about the engineer mission in the Latin American environment.

First, we have taken an honest look at the realities—these armies are dif-

ferent from our own, and to transpose our organizational structure on them would be futile. The art of the possible in this region is largely the art of scaling our expectations to an entirely different set of abilities and resources (See "Zeroing in on Mines," page 35, for a case study on assisting a developing army in a specific mission).

Second, our contribution must take the full regional situation into account. The army we assist must feel pride of ownership in its developing force structure, and neighboring nations must—if possible—be able to see changes in the direction of stability and responsibility. An improved capability to fight guerrillas may be viewed merely as an improved capability to fight by neighboring governments. Thus initiatives that support officer training, skill enhancement, and civic action capability have regional importance.

In working with small armies, we must be sensitive to the variety of needs we are trying to meet. Even in a country as small as El Salvador,

some regions are struggling with levels of violence that can hardly be described as "low-intensity-conflict." The needs of the military in such areas must be met. At the same time, the potential for an engineer contribution to stability in an emerging democracy can't be overemphasized. The plan developed by the tripartite U.S. team aims to help El Salvador's army—and others by extension—to develop an engineer force structure that can truly build the nation.

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ZEROING IN ON MINES

by MAJ James K. Waters

The Central American countryside is riddled with them—PVC pipe stuffed with shrapnel, battery-sized cylinders packed with black powder and an acid ampule, exploding coke bottles, Soviet PMN-5s. These mines are designed to deal out indiscriminate mutilation. Fewer of them will succeed in their ugly purpose as Central American armies learn to fight the countermine battle with U. S. assistance.

Mines and booby traps caused nearly 80 percent of the casualties suffered in El Salvador from January to June of 1986. In 1987, losses fell as a concentrated countermine effort took effect. U. S. Army South (USARSO), U. S. Southern Command (USSOUTHCOM), the U. S. Military Group in El Salvador, the Troop Support Command (TROSCOM), and the El Salvadoran Armed Forces (ESAF) cooperated to create a training and equipment program that is now being introduced in Guatemala.

The initial countermine effort focused on a train-the-trainer program, employing easy-to-use White 6000 metal detectors for finding mines. (See *ENGINEER* magazine, No. 1, 1987, p. 29.) Concurrently, an information campaign raised public awareness of the danger and eroded support for the insurgents who mine the countryside.

This initiative continues, and efforts to combat the stubborn problem are expanding. USARSO, in cooperation with the Army Materiel Command, is creating doctrine and designing more equip-



This comic-style manual makes its message clear—even to non-readers.

ment that works. In the process, the U.S. Army is learning valuable lessons in countermine warfare—and in the needs of small armies.

The right training

Soldiers in the Central American armies are typically recruited from rural areas. Their low educational level makes sophisticated, high-maintenance American equipment and training materials useless. USARSO has stopped trying to distribute high-tech equipment designed to identify specific types of mines, and has started equipping and training soldiers with materials they can easily use.

The first challenge is to train soldiers to recognize the threat. USAR-

SO Training Aids has produced a Spanish-language "comic book," *Ayuda de Instrucción Contraminas*, which tells its story in a series of detailed, dramatic illustrations. The booklet shows soldiers in more than a dozen kinds of danger, and illustrates common mine and booby trap setups. Even for non-readers, the message is clear.

The booklet has become the preferred training manual for ESAF, perhaps because the details of terrain and the well-drawn soldiers in local uniform so vividly convey the urgency of the threat. The text is economical—boxed checkpoints serve as the trainer's teaching guide and can be memorized quickly by troops.



The protective boot on the left is intact after the blast that shredded its standard-issue neighbor.

The right tools

The right training must be complemented by the right tools. The newest developmental piece of equipment in the countermine arsenal looks like a long-handled gardening claw. This simple but effective rake takes advantage of the farming skills that are second nature in an agrarian army. Troops can use the rake to remove undergrowth and to clear a path. With training, soldiers soon learn to feel out danger in loosened soil—where buried mines may wait.

This technique offers infantry patrols a low-tech method for rapid mine clearing. Still, the wide array of mines and booby traps and their density in hotly-contested areas makes mine clearing risky. Simple tools just don't find all the mines.

Protective gear

It remains important to protect soldiers who must patrol mine-infested areas. Under the auspices of TROSCOM, Natick Laboratories has developed protective clothing, boots, and glasses. The boots and Kevlar-reinforced blast protectors—as the photo shows—can make the

difference between superficial injuries and an instant amputation.

An informed public

A further, tragic dimension of mine warfare is the threat to non-combatants. Central American governments have been encouraged to produce posters, pamphlets and other materials to warn people of the danger. The Salvadoran government's campaign includes pamphlets that show photos of mines made to look like rocks or even sausages. The insurgency's victimization of the innocent is poignantly illustrated by El Salvador's "poster child," Angelica Bonilla, whose 6-year-old beauty is marred by an amputated foot.

Real hope

Such information, coupled with a government policy to restrict its own use of mine warfare, places the blame for terror squarely on insurgent forces. Thus, governments in the region are learning to practice the only strategy that holds out real hope—to earn their legitimacy by protecting the people.

The gain to Central American armies is obvious—fewer soldiers are



This simply-designed rake serves as a low-tech mine probe.

being injured already, and adoption of the new tools and protective gear may reduce casualties even further. The gains to the people themselves are less measurable—they can only be counted in pairs of uninjured legs and in slow changes in attitudes toward the insurgent groups. But it is such changes, over time, that build peace.

Learning what works

For the U.S. Army, valuable lessons are building. We are learning to begin assisting small armies where they are—at the beginning. We are learning to present information pictorially. We are finding ways to protect soldiers in compensation for the density of the threat and the limitations of simple tools. We are making equipment that fits the soldier's abilities. We are learning to do what works.

MAJ James K. Waters is Commander, HQ Command, USARSO, Fort Clayton, Panama.

(FORSCOM) sets policy for training and evaluations.

In order to establish wartime mission priorities, reserve units are CAPSTONE aligned with a higher headquarters. The CAPSTONE program was established to link stateside reserve component units to stateside and/or overseas active or reserve component higher headquarters.

This makes for complex command relationships. Under wartime conditions it would be entirely likely that you might find active component officers commanding Active Component, National Guard, and Army Reserve units—all under the command of a Reserve Component commander.

Those who serve

One of the most interesting aspects of Reserve component duty is understanding the men and women who serve in the Reserves. The Reserves are advertised as "the most important part-time job in America." The words "part-time" are somewhat misleading. The schedule of two training days per month and fifteen days training each summer total 39 days a year.

But this is just a baseline. Because of various CAPSTONE requirements, inspections, visits to sub-units spread over one or more states, and other recurring duty requirements, commanders at battalion and higher levels work three out of four weekends a month.

Company commanders and first sergeants must work three out of four weekends per month just to keep up with their administrative burden. Add one night a week for administrative functions, and suddenly the 39 day baseline has grown to 138 days. This "part-time" job now eats up almost 5 months. Many soldiers give these additional days "for the flag", and no additional pay.

Reservists often miss anniversaries, childrens' and spouses' birthdays, and holidays. Keep in mind

that these are people with full-time civilian jobs. They are principals, teachers, contractors, and businessmen.

Why do these men and women with successful civilian careers serve in this demanding "part-time" job? I once asked a commander who owned his own business why he endured the heavy burden of command, and the increased loss of his personal time. His answer was short and to the point: "Because what we do is important and my country needs us to do it."

This pride is the result of the heritage of the citizen soldier in our country's history. The militia forces fought before we were a country, fought to make us a country, and fought to keep us a country. This proud sense of heritage continues in the reserves today. One unit I worked with could trace a family lineage back to pre-Civil War service. I admired the pride of a reserve soldier when he spoke to me about his relatives who fought at Gettysburg, the Ardennes, and the Battle of the Bulge. Everyone shared in the pride of their units when the regimental battle flags from the Civil War were unfurled. Very few active units have such long, proud histories.

There's progress to be made

My assignment in reserve component duty was not without frustration. On many occasions when I or my team would go to a unit to give instruction, they were not prepared to receive it. Sometimes, units would simply gather bodies to satisfy us. The right people weren't trained. Why did this happen?

Poor planning or unimaginative training plans that fail to take advantage of locally available training opportunities are a common problem.

Overtasking in the reserve components is another difficulty that comes from many directions. The active component CAPSTONE units cause some of the problems.

They need to realize how important it is to get information to the reserve components on time. Reserve component units are required to construct a yearly training plan, which they must submit in the last quarter of the training year. Too often, the reserve component units get no CAPSTONE guidance until after the deadline—and the plan must be rewritten.

Active component officers will also find some personal and professional frustrations attend reserve component duty. Working with reserve units may remove you and your family from some of the "comforts of home" you are accustomed to finding on or near an Army post. You will need to be prepared to cope with finding your own services when the post medical and dental facilities and the nearest PX may be far away.

On the professional side, you may feel—and indeed be—further from the mainstream of career advancement than you want to be. Reserve component duty is important, satisfying, and challenging, but the rewards in terms of promotion are slower.

Even with the disadvantages, there's no better way to learn the structure and potential of Total Army than by getting involved with the Reserve Components. This is duty that puts you on the line, making you truly the vital link in the chain of Reserve and Active units prepared—and preparing—to stand strong in our nation's defense.

CPT William G. Snider was commissioned in 1979. His previous assignments include: platoon leader, D Co., 117th Engineer Battalion, executive officer, 237th Engineer Battalion, FRG and Engineer Advisor, Readiness Group Seneca in upstate New York. He is a graduate of EOBC, EOAC, and CAS3. CPT Snider is currently on the Department of the Army Staff, National Guard Bureau, the Pentagon.

COUNTERMOBILITY MATERIALS FOR THE LIGHT INFANTRY DIVISION

fast and flexible methods for successful light division

by CPT Kevin J. Wilson

As the light infantry divisions rise up from the Army's drawing board and become live, deployable combat units, they face many challenges.

One of the biggest is procuring Class IV and Class V counter-mobility materials crucial to the units' success. It's true that light units train for field expedient methods and the use of locally procured materials. But anything may happen on the real battlefield; the division must be ready to fight when local materials are not available. Light units need a quick, responsive, flexible supply system.

Organization and support

The light infantry division is designed as a rapidly deployable force capable of fighting in low intensity conflicts. Properly augmented, it can also enter medium to high intensity conflicts. By itself, the division is sustainable as a light combat force for 48 to 72 hours.

The light division is oriented around three maneuver brigades, each consisting of three light infantry battalions. The division support command (DISCOM) provides support in the brigade support area (BSA) using the forward area support team (FAST), rather than the forward support battalion (FSB).

The FAST is a task-organized configuration made up of platoons and companies from the provisional supply, transportation, maintenance,

and medical battalions, as well as other combat service support units. The FAST provides the same function as the FSB, only on a smaller scale.

Current problems

The FAST concept is good, but poses some problems. It takes too long for requests to move through the system. Lifting and hauling assets to move materiel forward of the BSA are not readily available.

The current procedures for planning, requesting, distributing, packaging and transporting counter-mobility materiel are time-consuming, labor intensive, and inefficient. Commanders must often divert key personnel and equipment to get critical counter-mobility items forward.

Ordering is difficult. Each type of counter-mobility materiel must be requested separately through two different supply channels. Distribution is also handled through separate channels. It takes a lot of manpower and equipment to break materiel down from bulk configuration and repackage it into usable configurations. Scarce transportation assets mean it's a tremendous problem to bring materiel forward.

Preconfigured solutions

The preconfigured unit load (PUL) concept offers an excellent solution to these problems. Each PUL contains all the materials and

tools needed to construct an obstacle on a 100-meter increment of a linear obstacle. One such load is already in the Army supply system. It includes everything the unit needs to construct 100 meters of triple-standard concertina fence, even gloves and sledgehammers.

This PUL is still awaiting final approval by the Army Materiel Command (AMC). Once it is approved and put to work, further PULs will be developed based on input from the light units and branch schools.

All packages developed for light units must meet two stipulations: equipment organic to light units must be able to handle them, and they must be configurable on pallets or in A-22 cargo bags for air transport.

The advantages PULs offer are that they simplify requesting procedures, eliminate time-consuming calculations and eliminate errors made when components are ordered separately.

Units can save much of the time engineers are forced to waste in waiting for materials. How? Echelon units above division can configure loads of counter-mobility materials as push packages. These will be sent forward soon after the operations order goes to subordinate units.

Load configurations are based on the appropriate staff engineer's estimate. For those materials not available in push packages, task force

and brigade engineers will still have to base materiel requests on their barrier plans.

Moving the materiel

Transportation assets in the light division are limited. Using organic assets, the light division can transport two infantry battalions in trucks and one in UH-60 helicopters. That equates to roughly one third of the maneuver units and does not include other combat, combat support, and combat service support unit requirements.

Light divisions have limited capacity to handle countermobility materials. The vehicle and personnel limits are severe, and the FAST has only four or five forklifts. Most of these must be used at the ammunition transfer point (ATP) while the others will be required to handle other classes of supplies.

In other words, when countermobility materiel reaches the BSA, there may not be enough trucks or forklifts available to move it to the obstacle site.

Movement solutions

Some possible solutions?—There are several alternatives that can alleviate the burden on the light division. Supplies can be put through from the corps support area to the base support area on corps transportation assets. To develop this transport option and make it work, planners are considering the use of logistic supply release points (LSRP). The LSRP would be close enough to the obstacle location so that assets organic to the light could haul or drag the materiel to the obstacle site. At the same time, the LSRP would be secure against enemy direct fire weapons.

Another way to ease the problem would be to install commercially available hydraulic lift tailgates on selected vehicles. Trucks with lift gates could load themselves and other vehicles. Even with the added

tailgates, the vehicles would still be air transportable.

The small emplacement excavator (SEE), which is organic to light units, will play an important part in handling countermobility materiel far forward on the battlefield. Although capable, SEEs are awkward and slow in unloading pallets. Their effectiveness could be increased if grab hooks or fabricated tines that fit the buckets could be added. These could be temporarily installed on the buckets.

Air supply

Maximum use of organic aviation assets at the division and corps level should also be considered. Air transport offers speed, flexibility, and agility. Both UH-60 and CH-47 aircraft can haul internal and external loads, and can drop payloads at the obstacle site. Requests for organic aviation assets go through operations channels and can be submitted as preplanned or immediate requests.

Air Force cargo aircraft can quickly deliver large shipments to

The engineer is the key to successfully handling countermobility materiel in the light division.

forward areas of the battlefield. Delivery methods include air drops (HALO, freedrop, low velocity, and high velocity drops), and low altitude parachute extraction systems (LAPES).

Preplanned requests for Air Force aircraft go through Army channels and typically require 48 hours advance notification. Immediate air requests, to be used under critical circumstances, are submitted through the Air Force Aviation Liaison Officer.

Corps air drop rigging companies can prepare 200 short tons per day

for airdrop and 50 short tons per day for LAPES delivery. Each division is designated the support of one rigging company during wartime. In reality, only one active duty and two reserve component companies exist. Rigging support will be limited for contingency and initial periods of operation, but should not cause air drop to be dismissed as a viable means of delivery.

The engineer puts it together

The engineer is the key to successfully handling countermobility materiel in the light division. When he makes his engineer estimate, he must consider obstacle priorities, accurate locations for prestaging, and possible drop zones for rotary and fixed wing aircraft. Concise and detailed information must be submitted to the maneuver unit S3 and S4 so they can coordinate the maximum use of available transportation assets.

The engineer must be the driving force to improve the acquisition of countermobility materiel if the light division is to succeed. Methods for requesting and distributing materiel must be fast and flexible. All available transportation must be exploited for maximum effectiveness. Finally, preplanning at all levels is essential: preconfiguring, prestaging, prerigging, and preplanned requests make the difference between vulnerability and a fortified light division ready to fight—and win.

CPT Kevin J. Wilson is assigned to the Directorate of Plans, Training, and Mobilization at Fort Leonard Wood, Missouri. He has served as a platoon leader, XO and battalion S4 with the 65th Engineer Battalion, 25th Infantry Division (light) at Schofield Barracks, Hawaii. CPT Wilson holds a B.S. in industrial engineering from Bemidji State University, and is a graduate of EOBC and EOAC.

AHUAS TARA 87 HONDURAS—

The best training available anywhere

by LTC George L. Cajigal

To some, "good training" means anything done in adverse conditions such as cold, hard rain, or the obscurity of night. But if realistic practice and execution of ARTEP and other tasks are good training, then I've never implemented better training than I did during exercises under the tropical sunshine of Honduras.

Task Force Tiger deployed to Jamastran, Honduras on 3 January 1987 to conduct engineer operations in support of a joint combined exercise, Ahuas Tara (AT) 87.

Our engineer mission was airfield repair and upgrade—a standard job for the 27th Engineer Battalion (Combat) (Airborne). In this case the 3-month length of the deployment was the primary challenge. How much could we do with the time? The record says plenty.

Moving in

The home front. The battalion's Family Support Group had been in place for three years. In the predeployment period and over the next three months, the mutual assistance group had the first full-scale test of its capacity to keep the home link solid.

They had a big job. Not only did we deploy all but Bravo Company of the 27th, we also took a Logistical Support Element made up of small elements from 1st Corps Support Command, an element from the 35th Signal Brigade, a U.S. Air Force element from the 840th Civil Engineering Squadron, and a Civil Affairs NCO to serve as our S5.

Deployment execution. Our equipment embarked from Wilmington, N.C., on a roll-on/roll-off ship, the

Cape Douglass, thus practicing equipment-deployment operations under optimum conditions from a modern port.

The advance party and equipment operators began AirLand operations by flying into Palmerola Air Base, Honduras. From there, the equipment operators drove to San Lorenzo, where they offloaded the ship and convoyed to Jamastran.

A week later, 210 soldiers made an airborne drop into the Jamastran airfield. By this time the unit had practiced a good number of the movement modes of our ARTEP deployment tasks as well as some airborne infantry tasks.

A secure base. Our first tactical mission on the ground was to secure the airfield and the base camp site. We knew that any stay of more than two weeks at one site made it worthwhile to set up properly. We built a solid, 500-meter square base camp which housed all facilities except for the water point, 7 kilometers away; the bulk POL storage area outside the gate, and the organizational maintenance shops by the airfield.

We factored two threats into our base camp design: a terrorist hit, and a guerrilla attack. We erected triple standard concertina fences, 25 meters apart, around the perimeter. Inside, we built six guard towers. Four were manned during the day; at night, all six were guarded by personnel with starlight scopes. We also built 200 individual and crew-served fighting positions inside the perimeter road of the base camp. Ensuring that all construction met ARTEP standards proved an outstanding training exercise.

Engineer missions

After finishing the base camp, the task force reorganized into two teams. Team Alpha—equipment heavy—took responsibility for the airfield upgrade. Team Charlie became combat engineer heavy, and undertook different missions.

Team Alpha effort. Team Alpha repaired a 4,587-foot by 60-foot flight landing strip (FLS). They stabilized it with cement and expanded the parking apron to a Movement of the Ground (MOG) for five C130 aircraft, and built a 1.5-kilometer access road.

The team worked 24-hour operations on the airfield for four weeks. This gave us the opportunity to train for work and sleep management in sustained operations.

The soil stabilization called for innovation—it took too long to place the cement manually. After several days testing for more efficient ways to apply the cement, we settled on a method which cut time by 75 percent. We loaded cement in a scraper, spread it in 60 by 300-foot strips, mixed it with rototillers, wet it down with water distributors, and compacted it to specifications. Over 2 and 1/2 million pounds of cement had to be manhandled into the scrapers during the operation.

Team Charlie effort. The combat engineers of Team Charlie had four basic missions or tasks, which they carried out in a tactical posture. The four platoons rotated on a four week plan.

The element in the security cycle performed security tasks for the base camp and water point. The platoon on "mission" conducted demolitions in support of Exercise

Blazing Trails on the northern mountains and helipad construction at Palmerola Air Base. The platoon in the training cycle planned and executed a week-long field exercise. The fourth group put their backs into support of the horizontal construction effort.

We covered many ARTEP and soldier tasks—including small unit infantry tasks, bridge demolitions, and airmobile operations. Platoon leadership had a superb opportunity to exercise troop leading procedures and work for unit cohesion. Each leader developed a schedule and an evaluation plan for the different individual and collective tasks to be trained.

We were also fortunate to have the opportunity to train for minefield detection with Honduran soldiers. These soldiers, who routinely sweep for live mines on the Nicaraguan border, brought a sense of urgency to the training.

Civic action

Civic action effort got attention too. Our vertical construction platoon built a classroom building for the Jamastran school, using the design of a tropical hut. The platoon also built a playground and made minor repairs to other buildings.

With the help of the well-drilling team from our sister task force to the south, we helped local workers to set up a manual water pump. We also used available time and equipment to grade short farm-to-market roads.

Under the direction and support of the medical personnel of JTF-Bravo, we conducted a medical readiness mission that served over 500 civilians.

Phase II operations

When the Jamastran airfield project was finished, the task force displaced to Palmerola Air Base, conveying all equipment. We took advantage of this move to conduct further deployment training.



The 27th Engineer Battalion's rapid cement application methods enabled them to cut work time by 75 percent.

On the early morning of 17 February, two C130 aircraft landed on our newly upgraded FLS. They picked up 108 jumpers who conducted an airborne drop on La Paz drop zone, near Palmerola. On the ground, the troops secured two landing zones from which they were extracted by CH-47 helicopters, to a location near our new camp, and marched 4 1/2 miles to their new home.

At Palmerola, the Light Equipment Platoon of C Company built a MOG for a dozen C130 aircraft. We cut the 1,450-foot by 600-foot apron from virgin ground. The project demanded as much earthmoving as the airfield at Jamastran. Luckily, the short haul distances made the job easier. We used the method for stabilizing the surface developed earlier, though high winds sometimes impeded our progress.

Alpha Company's equipment platoon built a cargo staging area adjacent to the apron. They capped the surface with crushed stone, but

couldn't finish the project because the local contractor was unable to deliver the crushed stone. This taught us that the industrial capacity of developing countries sometimes can't support even moderate construction efforts.

The combat engineer platoons worked hard both inside and outside the base. Charlie Company's 1st platoon deployed to the north coast and rappelled into the mountains to construct two helicopter landing zones. The company also built two 147-foot culverts under the access ramps from taxiway to the apron and loaded the cement bags for the stabilization. Finally, they built a 200-man protective shelter with sand grids in support of Joint Task Force Bravo.

To round it all out, the combat engineers conducted airborne refresher training for members of the 548th Engineer Battalion (Combat) (Heavy), who were transitioning to the 37th Engineer Battalion (Combat) (Airborne). This training

employed the facilities of the Honduran Army airborne school.

We also shared in combined training as 120 of our troopers jumped from a Honduran C47 while 120 Hondurans jumped from one of our CH-47s. Our paratroopers found the jump from World-War-II era aircraft quite a thrill.

Redeployment

We used intratheater air to transport the majority of our engineer equipment from the newly constructed apron to the airfield built by our sister task force near the port of San Lorenzo. From there, the equipment was transported a short distance to the port and staged for loading.

This port was not as well-equipped as Wilmington, so the Cape Douglass could not be as fully loaded as during deployment. We were forced to redeploy the remainder of our equipment on opportunity shipping.

Our personnel moved by air from Palmerola to Pope Air Force Base back in North Carolina and finished redeploying by 28 March. By this time we had practiced every mode of transportation we are expected to use except heavy drop of equipment and low altitude parachute extraction system (LAPES).

Total training

The 27th came home almost totally trained. We had deployed, secured and sustained ourselves in a foreign environment; we had conducted civic action operations. Most important, we had fully integrated individual and collective tasks into our exercise mission. Headquarters and headquarter company trained 160 of its 201 tasks and subtasks. A and B companies trained on 206 of their 289 ARTEP tasks. A scorecard like this—won in the field under demanding conditions—just can't be beat. The 27th is on the record—there's no better training in the world than Ahuas Tara.

So You're Converting to Light?

The 13th Engineer Battalion recently completed its conversion to the light engineers. We travelled a long, hard road to success, and on the way absorbed changes in the concept and doctrine of light engineers—as well as in our MTO&E. For you in engineer units on the line for conversion to light, here are some observations.

First sergeant: Keep physical training high on your agenda. That long road gets longer when rucksacks are full. Instill in your NCOs and men that in a light infantry division, they have to be infantry in their hearts, and engineers in their minds. Despite all the high-tech equipment, they still conduct movement to contact or assaults with the infantry unit they support.

Battalion staff: Most of your soldiers have a non-combat MOS. They will need time—and your understanding—as they march the road to light. Soldiers in a field bivouac with HHC have to help fight the rear battle and secure the bivouac. Don't let tactical training slide by so you can finish a DF or

move another vehicle out of the motor pool bay.

Platoon sergeant: You are THE man. You'll have to give 110 percent to conversion. Look to the future. Get your troops fired up for their dual roles as engineers and infantrymen. Go to Ranger School.

Engineer soldier: You are the light's success. Without you, there is no unity in the unit. Be proud to be a light engineer. Sure, it's harder to walk 12 miles with a rucksack than to load up in a 5-ton or an APC. But when you're done, the feeling is great. Take subcourses and learn all you can. Make your NCOs teach you. Show them you can do their job—learn the next higher skill level. In battle, you might become an NCO sooner than you think.

Most important, if you have an idea—speak up. Your brain is your most important asset. Many times it can make up for a lack of equipment or resources. Support your NCOs and officers.

Battalion commander: Sir, don't let your battalion get wrapped around the axle trying to reinvent the wheel. Consider having your unit personnel contact their counterparts in a unit that has already completed conversion. Don't rely on after-action reports or lessons learned papers. Talk with the people who learned the hard way—officer to officer, NCO to NCO.

Good luck to all of you—engineers blaze the trail for those who lead.

Best of luck to all of you,
SFC Glen Baxter,
HHC, 13th Engineer Battalion
Fort Ord, California

LTC George L. Cajigal is commander of the 27th Engineer Battalion (Combat) (Airborne), Fort Bragg, North Carolina. A graduate of the Armed Forces Staff College and CGSC, LTC Cajigal received his commission through OCS. He holds a BA in political science from Western Carolina University, an MA in sociology from Pacific Lutheran University, and an MS in civil engineering from North Carolina State University. He is a registered professional engineer in Virginia. LTC Cajigal has served in many troop and staff assignments in Europe, CONUS, Vietnam and South America.

LESSONS LEARNED

These Lessons Learned were compiled from worldwide training exercises, Integration Centers, and TRADOC schools. It is hoped that by sharing these experiences, all members of the engineer community will benefit.

Some of the subjects discussed in these Lessons Learned involve construction in Latin America, sandbag construction in Vietnam, replacement of fuel blivets, care of communications equipment in hot climates, and use of orange bicycle pennants to mark breached lanes through obstacles.

Items for Lessons Learned are always welcome. If you have any information concerning doctrine, equipment, and materiel from exercises, please send it to: U.S. Army Engineer School, Directorate of Evaluation and Standardization, ATTN: ATZA-ES, Stop 271, Fort Belvoir, Virginia 22060-5000.

SURVIVABILITY

Critical blade assets

ISSUE: Maneuver units do not understand the criticality for maximizing the use of blade assets.

REMARKS: A unit found that their associated maneuver unit did not understand the criticality of making maximum use of dozers. During linkup with the task force, dozers typically remained idle at the Engineer Coordination Point (ECP) for excessive periods of time. In one case, three dozers sat at an ECP for 15 hours.

Siting of survivability positions posed problems. Frequently, engineers would site positions with maneuver unit platoon/team sergeants and begin digging only to be later moved by the maneuver platoon/team leader. The problem was further exacerbated when the task force commander arrived and decided to relocate the positions. The end result was incomplete defensive preparation and bad feelings between the maneuver and engineer units.

SOLUTION: Combined arms training with the habitually associated engineer units is a must. Engineers should always advise the maneuver commander of their capabilities and how they are able to assist him. It is the engineer's responsibility to be productive even if lacking a timely response from the maneuver unit. The maneuver commander and staff have a number of problems that they have to solve. The engineer has to help with the burden by seeking early guidance from them and, if necessary, initiating work. Remember, one of the tenets of AirLand battle doctrine is initiative. Engineers must use their initiative (National Training Center).

CONSTRUCTION IN LATIN AMERICA

Quality control

ISSUE: Construction projects lacked quality control.

REMARKS: Construction projects lack quality control most frequently when supervisors are absent. Quality is further degraded when soldiers are not concerned with their work and rely upon experience from past projects while ignoring current specifications.

SOLUTION: Supervisors must remain on site during construction. They must be intimately familiar with specifications for the work to be accomplished and enforce the standards.

Appoint an inspection team to check construction standards throughout the project.

Prior to deployment, give classes on cut and fill stakes to officers, NCOs and operators.

Define a chain of command for each sub-mission. (27th Engr Bn)

Have the S3 construction section determine in advance the quality control standards for the project. These standards must relate to the type of design/construction, i.e., hasty/deliberate, temporary/permanent, one year/10-20 years. Once these standards have been determined, a quality control plan can then be developed by the units.

Train quality control personnel in expedient inspection methods to ensure specifications are met without delaying construction. (27th Engr Bn)

Construction site reconnaissance

ISSUE: Reconnaissance of construction site provided inadequate information for a complete design.

REMARKS: Two site surveys were made prior to deployment. Due to constraints on transporting soil out of the country without substantial coordination and quarantine time, laboratory soils surveys could not be conducted. Limited climatic data, as well as terrain intelligence, added to the problems of insufficient information.

SOLUTION: Designs were conducted on site. Geometric criteria can be determined using TM 5-330, worldwide climatic maps, verification of limited temperature data and 1:50,000-scale maps. Soils data was acquired by field tests and compared with stan-

dard curves. Temporary curves were developed using a soils penetrometer to determine acceptability in place of airfield indexes and using the nuclear densometer to determine actual dry density and moisture content. Optimum moisture content and dry density was then assumed based on these data until complete analysis was finished. While these data proved to be adequate for hasty designs, laboratory data greatly improves construction standards. (27th Engr Bn)

Construction drainage

ISSUE: Plan for construction drainage regardless of climate conditions.

REMARKS: Climatic data for the region indicated that less than one inch of rain falls normally during the period March through April. For this reason, construction plans did not include an effective drainage plan. An airstrip under construction was nearly completed when it began to rain for five days. Even though drainage was adequate in most areas and the strip sustained little damage, the Air Force would not use the newly constructed wet airstrip.

SOLUTION: To combat the damage and improve the wearing surface, mix river sand and gravel into the airfield surface. In the long run, the rain caused the building of a better airfield because it revealed natural drainage patterns and provided an appreciation for the magnitude of the tropical rainy seasons. (27th Engr Bn)

Dozer size selection

ISSUE: Smaller dozers can be more effective in soft soils.

REMARKS: It has been observed that the Ecuadorian Army is having much success using CAT D-6 dozers in soft soil instead of the much larger and heavier D-7s. The success is attributed to operator experience in soft soil conditions and the fact that smaller dozers transmit lesser ground pressure to the soil.

SOLUTION: Whenever possible a D-5 or D-6 dozer should be used for working in soft loose soil. The lighter weight of the equipment should enable it to maneuver better in this type of soil.

Make shallow cuts and avoid filling the dozer blade to the point where tracks slip. Track slippage in this condition will cause the ground to become unstable.

Plan the work site so the equipment will be working in a forward and backward motion as much as possible.

Dozer operators should train in soft loose soil to learn the necessary techniques needed for working in that type of environment. (536th Engr Bn)

VIETNAM LESSONS LEARNED

Sandbag construction

ISSUE: Sandbag structures serve as expedient substitutes for construction materials.

REMARKS: Construction of headwalls for culverts with sandbags is, at best, expedient. Durability is not as good as can be expected, but it can be improved.

SOLUTION: Durability of sandbag structures can be improved by adding cement to the materials in the sandbag. The best proportion is about 1:20 cement to soil. The sandbag should only be filled 2/3 full with the mixture. This allows forming of the individual sandbags to give a tight, interlocking pattern which increases the strength of the structure. The manpower expenditure is only slightly greater, and the durability is markedly improved. (Vietnam, 62nd EBC)

LOGISTICS

Lumber supply

ISSUE: Air transportation of large amounts of lumber is impractical.

REMARKS: Because a contract to have lumber procured locally was not executed prior to arrival, it was necessary to ship lumber by C130 and CH47 aircraft to Mocoron. Resources required for this proved to be very inefficient. Since locally procured lumber is rough cut, unfinished, and heavy (45 pounds per three feet for pine), it was difficult to transport. The procedure for C130 aircraft involved mating two 463L pallets together and building end walls for the elongated platform. It required the use of an Air Force K-loader, a critical item of equipment generally not available for such use.

SOLUTION: Intensely monitor local purchase contracts to insure their completion before arrival if required. If lumber must be procured locally, preposition it on site when possible. (27th Engr Bn)

Replacement of blivets

ISSUE: Defective 500-gallon fuel blivets.

REMARKS: A unit acquired new 500-gallon fuel blivets for an exercise and discovered that 15 percent of the new blivets were defective on use. Sixty percent of the Low Altitude Parachute Extraction System (LAPES) resupply missions damaged at least one blivet. These defective and destroyed blivets drastically reduced the number available for resupply.

SOLUTION: It was found necessary to have a 20 percent excess of blivets in order to replace those defective and damaged. (27th Engr Bn)

PLL shortages

ISSUE: Maintenance for equipment belonging to attached units.

REMARKS: Attachments arrived with equipment for which the support unit had no PLL or demand history. One particular problem was 5K and 10K generators used to power RATT rigs and DS communication vans.

SOLUTION: The commander must ensure that careful maintenance planning is done to include support for all organic and attached equipment. PLL must be modified appropriately and applicable technical manuals be obtained prior to deployment. (27th Engr Bn)

INTELLIGENCE

Intelligence operations

ISSUE: Incomplete and inaccurate weather data.

REMARKS: Climatic data and weather forecast of the Mocoron area was insufficient and inaccurate because weather forecasting agencies and equipment are not available in country. The lack of information made it difficult to effectively make accurate operational decisions concerning aviation support and construction activities.

SOLUTION: A military linkup with the National Weather Service in Florida may prove to be useful since the service has access to forecast information for the area. Use international and maritime weather service for additional climatic data. (27th Engr Bn)

Lack of intelligence data

ISSUE: Lack of intelligence information from command channels prevented unit from making effective operational decisions.

REMARKS: The unit received virtually no intelligence through command channels relative to the area of operations. Intelligence relevant to the area of operations was obtained by the unit through direct reconnaissance and the local populace. Repeated requests for aerial photography went unanswered.

SOLUTION: Intelligence summaries need to be made available to deployed units applicable to the area of operations. Daily updates must be provided to the units even if the update constitutes a negative

report. Key leaders should be briefed on highly sensitive information so as to enable them to make more effective operational decisions. (27th Engr Bn)

COMMUNICATIONS

Communication backup

ISSUE: Communication lines in the vicinity of construction sites are susceptible to damage.

REMARKS: Construction equipment and other vehicles on site, such as tracked vehicles, often cut communication lines lying on the ground.

SOLUTION: Run two strands of communication wire between each field phone and switchboard. By burying the lines along different paths, there is an increased probability that one line will remain operational.

Communication equipment in hot climates.

ISSUE: Hot weather causes radios to overheat.

REMARKS: HR/RATT rigs operating in Latin America without air conditioners experienced numerous heat related problems. Radios often malfunctioned during prolonged use due to the hot climate, hampering communications.

SOLUTION: Air conditioners should be deployed with HR/RATT rigs when they deploy to hot climates. Monitoring and shutdown of radios should take place when air conditioners are not available and temperatures dictate. (27th Engr Bn)

MAINTENANCE

M929A1 transmission mounting bolts.

ISSUE: Loose transmission mounting bolts on M929A1 series vehicles.

REMARKS: Transmission mounting bolts on several M929A1 5-ton dump trucks worked loose causing the transmission on one truck to fall to the ground, cracking the transmission casing. Another truck experienced two stripped bolts which had to be drilled out.

SOLUTION: Commanders should make their personnel aware of potential problems. Remove old bolts and replace with case hardened steel bolts and lock washers. Check bolts as part of PMCS and more often during operations, for looseness, cracks or other defects and correct as necessary. (20th Engr Bn)

SAFETY

Air valve caps

ISSUE: Defective air valve caps (TACOM Safety-of-Use Message)

REMARKS: TACOM issued a warning on the use of air valve caps manufactured by the Eaton Dill Corporation.

Use of the air valve caps poses a potential safety hazard due to the loss of tire pressure.

The air valve caps have been issued to all branches of the military where they are used on almost every military vehicle.

The safety-of-use message was disseminated in TACOM message, AMSTA-QRT, 131400Z Aug 87, subject: Safety-of-Use Message, number 87-63, Advisory "Technical/Maintenance" Potential Safety Hazard When Using Eaton Dill Air Valve Caps on Wheeled and Tracked Vehicles (All Military Vehicles).

The air valve caps manufactured by Eaton Dill Corporation have the following NSN and part numbers:

NSN: 1650-00-222-4525
PN: MS20813-1

These caps can be easily identified. They are yellow and stamped with the Eaton trademark "Dill" and part number MS20813-1. Two types of caps are identified with the above stated markings. The defective caps have a plain black gasket with a clearly visible brass center ring. Both caps were produced on contract DAA EO7-86-C-1388.

SOLUTION: TACOM has highly recommended an inspection be made on all vehicles that use this air valve cap and destroy all caps that meet all of the above listed criteria. (TACOM)

MISCELLANEOUS TOPICS

Field sanitation

ISSUE: Duties for monitoring field sanitation must be clearly delineated.

REMARKS: Throughout the deployment period there were four latrine areas built at the camp, consisting of six toilet seats and five urinals per point. The battalion aid station was given the responsibility for inspecting field sanitation. This included inspection of the mess hall, water points and latrines on a daily basis. However, there was no one detailed to maintain the latrines.

SOLUTION: Commanders should ensure that a field sanitation team is appointed to maintain field hygiene standards. The aid station personnel will inspect hygiene conditions but should not be expected to maintain the latrine areas. (27th Engr Bn)

Rigging

ISSUE: Rigging manuals do not always accurately reflect use of unit rigging equipment.

REMARKS: All dump trucks, tilt bed trailers and engineer equipment require unit preparation and additional equipment for air drop. Most of this equipment must be fabricated. Rigging manuals list and describe most of the parts required, however, in several cases the rigging manuals were inadequate.

SOLUTION: Develop complete lists of pre-rig and unit rigging parts required for each item of equipment. Have these items procured or fabricated and stocked for deployment. Because some items are not reflected in the rigging manual, the pre-rig list should be maintained as a supplement to the Readiness SOP. (27th Engr Bn)

Personnel accountability

ISSUE: Accurate personnel accountability was difficult to maintain.

REMARKS: Personnel were located at four separate sites. As the construction effort expanded, personnel were required to move. Constant movement between sites made it difficult to maintain personnel accountability.

SOLUTION: Establish personnel accountability procedures prior to deployment. Ensure that personnel sign in and out of each location as they move. Daily accountability reports should be rendered at the end of the day upon completion of all work and travel. (27th Engr Bn)

Civil affairs

ISSUE: Thorough troop briefings are essential prior to deployment.

REMARKS: A good troop country briefing is essential to mentally prepare soldiers and leaders for OCONUS exercises. The task force received a briefing from a unit which had limited experience in the area of operations. As a result, the briefing did not inform soldiers as to what they could expect in terms of culture and living conditions. The problem was

exacerbated by the general lack of intelligence concerning the area.

SOLUTION: Deploying units should coordinate for briefings as early as possible to allow adequate time for careful study of existing resources to develop more accurate and up-to-date area briefings. (27th Engr Bn)

Lane marking system

ISSUE: Innovative methods and simple materials can be used to mark breached lanes.

REMARKS: A unit tried several methods for marking breached lanes through obstacles. A system which is reliable and simple to use was made of readily obtainable or fabricated items.

SOLUTION: One method of marking lanes is to use two 6-foot pickets driven in the ground on the friendly side of the breach. Attach to these an orange bicycle pennant (15 by 24 inches) mounted on a 6-foot fiberglass staff. Dependent on METT-T, additional pickets with pennants can be added on the enemy side and engineer tape can be run to delineate the lane. A green smoke grenade can be used to signal a successful breach. Road flares attached to pickets (4-5 feet above ground level) provide a light/thermal signature. Typically, a soldier with a green flag is used as a guide for follow-on forces. (19th Engr Bn)

USAES NOTES

ESSAYONS program

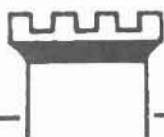
ISSUE: Expeditious method to make low-cost changes and developments to existing systems and force structures.

REMARKS: Patterned after the Field Artillery's "Battleking", a new USAES program, ESSAYONS is a vehicle for soliciting, testing and implementing ideas

from engineer soldiers in the field regarding improvements in engineer systems, force design, doctrine, and testing. Evaluation will document shortcomings and deficiencies that can be quickly remedied and identify other engineer development requirements. ESSAYONS will give your ideas the proper attention, the engineer perspective, and, if necessary, test your ideas in an operational environment. It is a quick method to improve your equipment, organization, or training. Just clearly describe your proposal in writing (include a sketch if appropriate) and send to: Commander, USAES, ATTN: ATZA-CDT (ESSAYONS) Fort Belvoir, Virginia 22060. (DCD, CPT Kenney)

Remarks from Engineer leaders (history)

An anonymous engineer company commander from Reforger 77 was heard to say: "I know no place where it is written, but an engineer commander must be able to anticipate the needs of his tactical commander. He must be ready to create obstacles where the old man would want them. And he can do this only by knowing the mind of his commander, his style of fighting, and the weapons he fights with. He must be so capable and have confidence to know that should the maneuver commander suddenly disappear, he could assume command and fight a successful engagement." (Article written by then Colonel R. S. Kem)



Hotline Q & A

Q. Which Engineer School manuals describe current doctrine for and employment of the FASCAM mine system, especially the artillery-delivered FASCAM system?

A. The Engineer School's Department of Combined Arms(DCA) responds that the school's Scatterable Mine Handbook contains current fielding and systems data as well as planning and employment considerations. Information can also be found in FM 20-32 with errata sheet, FC 6-20-5, FM 6-40, the TSM-MWS Handbook of Concepts for the Employment of Mine Warfare Systems, and the draft versions of FM 6-20-40 and FM 6-20-50.

DCA further advises that the engineer is responsible for all mines and minefields, regardless of delivery system, and must coordinate, through staff or command channels, with artillery (ADAM/-RAAMS), aviation (M56/VOLCANO), Air Force/Navy (GATOR), and Engineer (GEMSS/FLIPPER) elements. Staff officers must know delivery techniques and munition availability in their areas. The engineer must know employment concepts and delivery techniques to brief the commander. The engineer recommends each minefield's location, time, and density, and determines which system is best.

Because minefield dimensions, aimpoint determination, and safety zone dimensions for ADAM and RAAMS vary based on gunnery data and firing data location, these factors must be a joint engineer-artillery decision. The handbook outlines steps required to calculate artillery-delivered minefields and includes problems and solutions.

DCA offers specific information and guidance on the following issues:

- Number of rounds for any one minefield (can vary by a factor of 6).
- Time required to emplace an artillery-delivered minefield (can vary from 8-9 minutes to about 1 hour). Number of rounds and firing time are impacted by firing data, size and density, and whether fire can be accurately observed.
- Observed fire means fewer rounds are required to emplace the minefield. DPICM rounds are used in self-registration mode to adjust fire for scatterable mine rounds.
- The ADAM/RAAMS minefields are best employed and most likely to be emplaced in

(continued on page 12)

through normandy's hedgerows - 1944

By MG Robert R. Ploger, USA
(Ret.)

Immediately after U.S. forces crossed the Normandy beaches, we met the peculiar Normandy terrain. The country rolled gently—from the upper floors of buildings we could see for miles in any direction, though little of military value was visible. On the ground, we could see for a hundred yards or less. What blocked our views?—hedgerows.

Every road, every field, every trail was bordered by a wall of well-packed earth 3 feet thick at the base and 4 to 6 feet high. These hedges were overgrown with bushes and grass. Trees stood firmly rooted in their earth walls. They enclosed an irregular maze of fields that were seldom larger than 200 by 300 yards. The fields opened at one or two gaps, each with a single swinging gate.

G.I. Joe soon learned to use the hedgerows to advantage. The earth walls afforded concealment for lateral movement and protection against flying shell fragments. Jeeps could travel unseen on all roads, and in the "sunken roads" (old wagon trails) even a 2 1/2-ton truck was invisible from the flank. A machine gun placed at the junction of two hedgerows commanded two fields to the front or flank. An automatic weapon at a corner could deliver enfilade fire along three "natural" obstacles.

Since tank avenues of approach were canalized to roads, antitank guns were placed to cover curves in the road or stream crossings where hedgerows were not continuous. Fields of fire in other directions were severely limited when weapons were so placed.

The enemy also cleverly used the terrain to his best advantage. He tunneled under hedges, posted snipers in trees, used many build-

ings for observation points, and placed his weapons with skill and ingenuity. We found that captured machine gun positions sometimes consisted of a gun mounted at a corner of two hedges sited for enfilade fire, with one or more crew members occupying dugouts and operating the machine gun by means of a string on the trigger.

At times the Germans allowed waves of infantry to pass their positions, then shot them in the back from dug-in hedgerow positions. Time and again they ambushed columns of men or vehicles as they moved down the confined routes of communication. We Yanks had nothing more tangible to shoot at than the top of the next hedge, or the second or the third. We could only guess where the fire had originated.

Until the impetus of the initial assault began to decline, we accepted the landscape and gave neither time nor energy to overcoming its obstacles. After the 15th of June, however, each attack became more difficult to carry out. The infantry needed more and more support from automatic weapons to advance against an entrenched enemy. Yet hedgerows restricted tanks—and their mobile, protected machine guns—to the roads. Any tank advancing on a road without close infantry support simply invited enemy antitank fire. Flanking maneuvers denied the infantry the support they needed because the tanks could not follow them. Frontal assaults were costly in both men and materials.

The infantry problem was this: how could we defeat this terrain so that the infantryman could fight the enemy?

After learning of an attack to be launched on a limited objective by

the infantry on June 22nd, an engineer officer proposed that tanks accompany the infantry in a cross country maneuver. Tanks would move through gaps blown in hedgerows by charges carried and placed by engineers. The infantry commander enthusiastically received this suggestion, and with the help of the armor and engineer officers, began working out the details of this operation. They adopted this plan: the infantry would jump off at 0900 hours covered by overhead direct automatic fire from tanks in place behind the line of departure. As the assault waves reached the first hedgerow, engineer teams would place two 25-pound charges in front of each tank. After lighting the powder train, the engineers would retire, the gaps would be blown, and the tanks would plunge through the gaps to the next hedgerow. There the process would be repeated.

The assault would cross 13 hedgerows. Engineers multiplied that number by the number of tanks, then by two charges per tank to find the total explosive requirements. Overnight, the charges were prepared, personnel briefed, and the ground reconnoitered by commanders. The attack proved successful, and marked a milestone in the history of the division—it was the first operation on the continent in which tanks moved cross country in close support of infantry.

The attack taught us several lessons. The 25-pound charges were not always heavy enough to breach the dense hedgerows. Test runs in the division rear showed that 50-pound charges were the smallest to guarantee positive results. Secondly, the poor communication link between tankers and engineers slowed

operations. Tankers needed a way to tell engineers where they wanted a gap so the tactical element—the tank—would have freedom of action. Thirdly, the logistics of a large operation involving tanks were staggering. Using the proven 50-pound charge in front of each tread of each tank for each hedgerow, the materiel needed for a sustained attack grew to astronomical proportions. Our attached tank battalion, after all, contained nine platoons.

Imagine a platoon of tanks four abreast tasked to support an infantry company attack on an objective 1 mile away. Aerial photos show 15 hedgerows confronting each tank. Allowing for possible flanking maneuvers, 20 hedges must be cut. Multiply 20 hedges by four tanks by two charges by 50 pounds and you have 8000 pounds or 4 tons of explosives for each platoon of tanks. And each charge had to be hand carried cross country, and hand placed under fire!

This solution was not satisfactory, but it was a solution. Engineer, tank, and infantry personnel began to organize and train on this basis. Meanwhile a search for new solutions to the hedgerow problem went on.

The engineer's first inclination was to reduce the supply requirements by increasing the effectiveness of the explosive. This could be done by tamping the charges or by using the internal charges. A neighboring division dug excavations for charges in each hedge. Our division decided that this procedure would slow the attack and expose skilled personnel to antitank artillery and mortar fire for too long.

Still pursuing the internal charge principle, our engineers turned their attention to the tanks. They thought about using the tanks themselves to prepare a cavity in the hedgerow for internal charges. A search of captured dumps yielded several hundred feet of steel pipe, 6 inches in diameter. Engineers cut the pipe into 4-foot lengths, with one end

APPROVAL FOR A NOVELTY

General Ploger remembers how difficult it was, even in war time, to get approval to weld pipes to the tanks:

"Impressed with our solution to the hedgerow obstacles, my commanding general ordered 'prongs' be put on all tanks in the division. I was also to report personally to higher headquarters so that this solution could be universally adopted.

I soon lined up work crews: motor maintenance people to cut and weld pipe and angle iron supports; engineer drivers to handle the 'weasels'; and engineers to break up TNT blocks, load 105-mm shell boxes, and prepare powder trains, fuses and primacord links.

Dutifully, I checked in with the corps headquarters engineer who listened with considerable interest until I explained about attaching the pipes and supports to the tanks. The solution fell outside his province, he said. I would have to talk to the ordnance officer. I soon learned that there was no such officer at corps. I would have to travel to field army headquarters.

Later and still farther to the rear from my division I found the ordnance officer and recounted what I considered a noteworthy success story. His response, however, was deflating.

Such an appendage could NOT be welded to the front of the tank because that would be tampering with the armor protection of the tank's final drive mechanism, he said. Furthermore, the field army headquarters could not approve the solution without the OK from Chrysler Corporation in Detroit. He could not request approval based on my story alone, but my division commander could apply, he added.

Meanwhile the fighting continued. I left army headquarters baffled and frustrated.

Back at my division, I was instructed to proceed with existing plans to modify the tanks. I suspect that some members of our tank battalion had more success in promoting a 'hedgerow buster'. Reportedly, other tankers later attached remnants of angle irons from former German beach obstacles to their tanks and were able to drive right through the hedgerows just as our pipe 'prongs' had permitted.

For me, I was pleased that an idea had been implemented with such speed and effectiveness within our division."

closed and pointed. They welded two pipes to the front armor of a tank, supporting it with three angle iron braces.

The modified tanks would lunge into a hedge wherever the tank crew wanted a gap, piercing the earth of the hedgerow with holes which could be filled with internal charges. Discarded shipping containers for 105-millimeter artillery shells proved to be exactly the right diameter to contain the charges—

they held between 15 and 17 pounds of crushed TNT. This charge could blow the necessary gap. The two charges for each gap were designed with four feet of free primacord for connecting the charges. Fuse lighters, fuse, and caps already assembled could then be attached to the primacord and the fuse lighter pulled.

(continued on page 31)



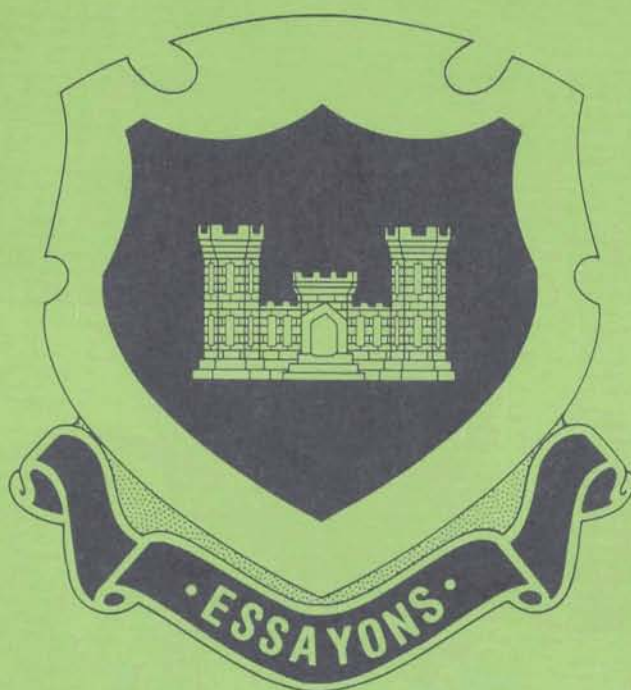
This ACROW bridge will be a stable carrier for bus traffic—the swing bridge it replaces was precarious even for travelers on foot.



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