Engineer

THE MAGAZINE FOR ARMY ENGINEERS
Summer 1981



MCMS

SPR 81

Where we are, Where we're going . . .

page 18

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Engineer

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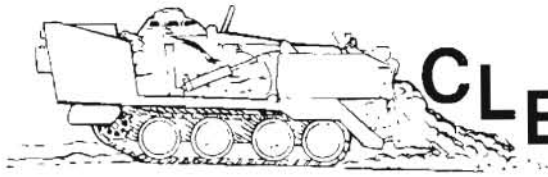
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CLEAR THE WAY

by Maj. Gen. Max W. Noah

M-CM-S, Systems Program Review

In this issue of Engineer, our lead article emphasizes the combat engineers' role in the Airland Battle. I urge you to read it, learn how and why we plan to fight this way and train for it.

The name "Airland Battle" by itself describes the national dimensions of a conflict much larger in geographic size and means of waging war than we have thought about heretofore. The Airland Battle is extended" in depth, meaning that commanders at each level must "see deep", consider and take action on every echelon behind the one with which they are engaged. The action in this battle is integrated in that chemical and nuclear warfare must be anticipated and prepared for. The battle is one requiring the integration of air and normal forces to carry the battle to the enemy and win.

Combat Engineers are key to the success of this battle in supporting the mobility countermobility, and survivability (M-CM-S) of the maneuver, fire support and logistic support forces engaged in the battle. The overall concepts and doctrine derived from this battle, drive the combat engineer concepts, doctrine, and, in turn, the organization, force structure, training and material.

At our M-CM-S Systems Program Review (SPR) held in April here at Fort Belvoir the leadership of the Army took a close look at the way we plan to proceed in the areas described above. The results of the SPR are encapsulated in the article on the Airland Battle. However, it would serve well to highlight a few major areas of emphasis.

Ensuring that our forces can move unhampered has always been a first priority mission for us. On the battlefield we face the problem of massive minefields and obstacles when we carry the fight to the enemy. Our method of clearing mines and obstacles is still in the WWII mode—slow and unprotected. To take minefields and obstacles "in our stride"—at the pace of the M1 tank and M2-M3 fighting vehicle—will require much more in speed, survivability and capability. Training in speedy, precision combat drills for the combined arms and procurement of new equipment such as mine rollers, SLUFAE and line charges is essential.

Our capability to cross rivers and dry gaps is probably in better shape than any other area of combat engineering. With the new ribbon bridge and MGB plus the current MAB and AVLB, we are not exactly lacking for good equipment. But we can stand for improvement, especially in our assult capability. But for the AVLB we are currently not very capable of crossing gaps under fire.

The "Family of Scatterable Mines" concept is turning into reality with artillery delivered autotank (RAAM) and auto-personnel (ADACM) and air delivered mines (GATOR) leading the way. Our problem with these mines will be getting into the operations net to insure the mine placements are recorded. Also the preferred method of use of these mines is to compliment direct or indirect "killing" fire with a "fixing" munition dropped in *on top* of the enemy—not just to place minefields by remote means.

Finally, we as engineers must look at our own capability to operate under fire and with speed. This is the primary reason for our efforts to procure the M9 Armored Combat Earthmover (ACE). We need to move dirt, to dig, and move obstacles. We are looking for a viable concept for a new counterobstacle vehicle (COV) to replace the Combat Engineer Vehicle (CEV). The need for a turret, a gun, a dozer blade, and A-frame on such a vehicle is being looked at. If you have any ideas, let me know.

General Vessey, the Army Vice Chief of Staff, General Starry, Commanding General, TRADOC and Lt. Gen. Otis, the DCSOPS, were very complimentary on the results of the SPR. We have forwarded an Action Plan to DA to insure support as we build up and modernize much-needed combat engineer capability. Next fall we will give General Vessey an update on where we stand.

We are currently revising our doctrine to support the new FM 100-5. We will have the new Engineer FM 5-100 out in draft later this year (or early next year). We in the combat engineers need to start working and training now to support the new doctrine. M1 tanks will soon start arriving in the force. We as members of the Combined Arms Team will have to provide the best way we can to use their speed and agility. We have to be ready when they say,

"Clear the Way".

Noah
Engineer

PIPELINE

Illinois Guard shows how it's done

During their two-week stint of duty last summer, members of Company B of the 682nd Engineer Battalion of the Illinois Army National Guard cleared 58 rubble-filled, vermin-infested tracts that had been eyesores in East St. Louis for more than two years. And in the process, they made a lot of friends. About 70 members of the unit, based in Lawrenceville, IL, demolished abandoned structures and cleared mounds of rubble in the largest community service project ever undertaken by the Illinois Guard—a result of innovative cooperation with city officials. A total of 96 men worked on the project. Mechanics, medics, and administrators were supplied by HHC, 3rd Battalion, 130th Infantry Division, Illinois Army National Guard.

The project has paved the way for a new face lift for the city of East St. Louis, Mayor Carl Officer said. The cluttered lots had stood as a symbol of scandal of past years, when federal money was paid for demolition work that was not completed.

Those responsibile were convicted of fraud and imprisoned, but with the money gone and the job unfinished, the U.S. Department of Housing and Urban Development decided in 1978 to withold $700,000 in additional community development block grant money, pending completion of the work.

East St. Louis lacked money to do the work and Mayor Officer, a former Guard member, came up with the idea of enlisting military aid.

"With this project, the Guard embarked on a new era of community service and public commitment," Mayor Officer said. "They showed not only East St. Louis but Illinois the positive direct side of the military's potential influence with a community."

"Without the Guard's assistance, none of this would have been possible," said mayoral assistant Artis Talley, who added that the city would try to have the Guard's labor accepted as part of the required local matching contribution toward federal grants for a new fisheries and gardening program.

Lt. Col. Carl Johnson, an aide to Illinois Adjutant General John R. Phipps, said the project is "probably the largest community relations project the Illinois National Guard has ever been involved in. It will not only enhance the image of the Guard and aid the community, but also improve our military readiness."

Reader wants info on Pershing Rifles

Kevin M. Born, an ROTC cadet from Lincoln, NE asks Engineer readers to help him compile a detailed history of the National Society of Pershing Rifles. The organization was founded in 1894 in honor of then Professor of Military Science and Tactics at University of Nebraska, 1st Lt. John J. Pershing.

Cadet Born is interested in contacting former members, and anyone with information on the organization. He said all loaned materials will be returned, and you can contact him at 1826 "A" Street #5, Lincoln, NE 68502.

World War I trunk is donated

A World War I Army-issue trunk full of memorabilia, which belonged to an Army engineer who fought in France, was recently donated to the U.S. Army Corps of Engineers, through the Detroit District Office.

2nd Lt. Edwin E. Scott's trunk, donated by his son Robert of Bloomfield Hills, MI, contained canteens, insignias, helmets, uniforms, equipment, photos, maps, a diary, a compass, and even a pre-1911 .45-caliber pistol. All of the items were well preserved, an official said.

The maps in the trunk are the same maps used during the Battle of the Agonne Forest, in France. The 1st Regiment of engineers frequently relieved infantry units on the front line, and in eight days of that engagement, Scott's unit suffered more than 225 casualties.

During his Army career, Scott specialized in designing buildings and vehicles. He even modified a transport plane's body to accommodate his unit's equipment. After the war Scott worked for Ford Motor Company, in Dearborn, MI, as a body design engineer. As a civilian, Scott designed the first B-24 bomber (the Liberator), the Willys Jeep, and the 1927 Ford body.

"Scott was a well-respected engineer," a senior Ford executive said. He was a member of the Society of Automotive Engineers and served on its Body Activity Standards Committee until his retirement in 1948. Scott died in 1957 at age 62.

The Detroit Distinct Office forwarded the objects to the Historical Office of the Chief of Engineers, Washington, DC, as part of the Corps' historical collection.

Reserve responsibility includes medical care

If you were injured or became sick during weekend drill or annual training, what would you do? Failure to understand the health care policies contained in Army regulations (AR 40-3 and AR 135-200) has already cost some U.S. Army Reservists thousands of dollars and as many hours of perspiration.

Take the case of an Army Reservist who fell off a truck and injured his knee during drill. Accepting the word of his supervisor and his company commander that all his medical costs would be paid for, the Reservist consulted a civilian orthopedic specialist and received $2,600 worth of therapy.

Unfortunately for the Reservist, that $2,600 had to come out of his own pocket since he never received authorization from the nearest military medical treatment facility to receive non-emergency care from a civilian source. Neither he nor his supervisor nor his company commander understood the provisions of AR 40-3; for the Reservist, it proved to be an unnecessarily expensive lesson.

U.S. Army Reservists, who want to avoid a similar fate, should be aware of the procedures to follow to obtain the medical benefits they're entitled to. Those benefits differ depending upon the Reservist's duty status.

Reservists who are injured in the line of duty or become sick during active or inactive duty of training should inform their unit of the mishap and seek care in a **military facility** as soon as possible.

Get DA Form 2173 (Statement of Medical Examination and Duty Status)

filled out by your unit commander and by the attending physician or hospital registrar. Failure to accomplish this step could severely hamper any future efforts to secure reimbursement or medical attention. Once the form is completed, it's up to the individual's unit commander to see to it that he is placed in the proper pay status and receives disability pay or whatever allowances may apply.

AR 135-200 should be consulted for pay and allowance entitlements as they vary depending upon the Reservist's duty status at the time an injury or sickness occurs.

Of course, an ounce of prevention is worth a pound of cure. But, should you need medical attention, seek military medical treatment first, inform your unit commander, and obtain written permission prior to obtaining civilian care.

Safety reminder for field sleeping

Editor's note: This item appears courtesy of Countermeasure, published by the U.S. Army Safety Center, Fort Rucker, AL.

The Army Safety Center conducted a hazard awareness survey in 1979, prior to a major field training exercise. Soldiers' answers to questions about sleeping in the field revealed that most of them don't recognize the dangers of sleeping outside designated sleeping areas. The following mishap briefs confirm this finding:

•At 2130 hours a soldier decided to take a nap while waiting for resupply during a squadron ARTEP. He lay down on the ground behind a small bush between two sand dunes and was soon asleep. A few minutes later an M113 operating under blackout conditions drove between the dunes and over the soldier. He died instantly.

•Shortly after midnight, three soldiers on an FTX climbed into an M88 tracked recovery vehicle to get some sleep. They closed and locked all the doors, turned on the heater, and went to sleep. Theydied of carbon monoxide poisoning.

To prevent these types of accidents, sleep only in designated sleeping areas, or if your mission requires you stay near your vehicle, sleep where a tree or some other large natural barrier will protect you from moving vehicles. If natural barriers are not available, sleep beside your vehicle—not in, not on, not under, not inside, not behind, not in front of, but beside the vehicle. Don't let your next nap last forever.

Mine detector performance improved

The Army's AN/PRS-7-man portable mine detector will soon be retrofitted with new electronics to improve its arid soil performance.

The Countermine Laboratory, U.S. Army Mobility Equipment Research and Development Command, Fort Belvoir, VA, has been working to improve the system since its poor performance in arid soils was first noticed in the mid 1970's.

The AN/PRS-7 had performed well in the Far East, Europe and the United States. However, during a mine clearing operation in the Suez Canal region it was discovered to have a very poor response to nonmetallic mines in desert soils.

The heart of the improved mine detector is a microcomputer which digitally processes the received signal and controls wide band RF transmitter and receiver assemblies.

When fielded, the improved mine detector, designated the AN/PRS-8, will enhance the capability of the Rapid Deployment Force, or any other unit that may be called upon to operate in a Middle East type desert environment.

Corps cleared in erosion suit

The U.S. Court of Claims recently agreed with Trial Judge Thomas J. Lydon of New York that the navigation dams on the Ohio River did not cause bank erosion or cause the natural occurrence of bank to be more severe.

The court also dismissed all claims that landowners had brought in a law suit against the U.S. Army Corps of Engineers, who built and operate the dams.

The court rejected the landowners claim that they were unfairly compensated by the Federal Government for land purchased as part of the construction process for the dams on the Ohio River.

In commenting on the decision, Col. Charles E. Eastburn, District Engineer for the Corps' Louisville District said, "Naturally we are pleased. It is a vindication of the professional and personal integrity of the people of the Corps of Engineers. We are aware that bank erosion has had a negative impact on the people who live along the banks of the Ohio River. This is a real problem and should not be dismissed lightly.

However, it is the result of a natural phenomenom and not the result of the navigation improvements that have meant so much to the lifestyle and economics of the Ohio River Valley."

Philippine library needs your help

A recent fire at the Philippine Military Academy, the Republic of the Philippines equivalent of the U.S. Military Academy at West Point, destroyed more than 14,000 volumes, including English language books, magazines and other resource materials.

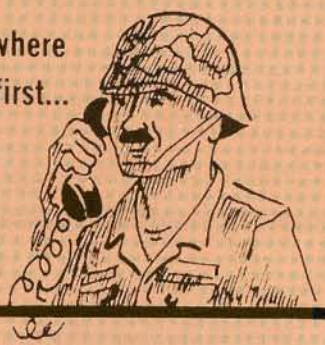
During a recent trip to the Philippines Major General Herbert E. Wolff, commander of U.S. Army Western Command (WESTCOM) here, became aware of this severe loss to the Academy.

In coordination with the Chief of the Joint U.S. Military Advisory Group, Philippines (JUSMAG-Phil), WESTCOM has offered to assist in efforts to restore the library's materials by making the need known within the U.S.

Accordingly, WESTCOM, with Army missions througthout the Pacific theater, including interactions with the Armed Forces of the Philippines, requests donations from interested parties of books, magazines, corporate and institutional publications, or any English language materials of interest to college-level professional military students.

Materials should be sent directly to the Chief, JUSMAG-Phil, ATTN: Ground Forces Service Section, APO San Francisco 96528. For more information write LTC Karl Piotrowski, DCSOPS HQS WESTCOM, Fort Shafter, HI 96858; or phone him at (808) 438-1821/2905.

Remember where you heard it first...



ADVANCE NOTICE

The latest Engineer Personnel Management Contacts in OPMD have been released. All phones listed below are in Area Code 202, or use Autovon 221. Colonels should contact DAPC-OPC-AE at 325-7870/1. LTC's through 2nd LT's should contact DAPC-OPF-E at 325-8392. Warrant Officers with Primary or Alternate Specialties 621A or 310A should contact DAPC-OPW-WU at 325-7839/40. Warrants with Primary or Alternate Specialties 811A/821A or 833A should contact DAPC-OPW-GA at 325-7837/8.

Unofficial word has reached ENGINEER that possible fraud or misrepresentation rip-offs are occurring that involve enlisted assignment "swaps". Someone has been contacting individuals who send their names into service journals asking for a CONUS assignment swap listing. The potential "swapee" is asked by person or persons unknown to send in money for the listing. Be advised that service journals carry such listings free, as a convenience to their readers. The US Postal Service has been alerted that mail fraud could be involved.

Between FY 74 and FY 80 the Army's Senior Enlisted Career Force, i.e. soldiers with 10 or more years service, declined by 10,488. During the same period, the average experience level for soldiers in grades E-5 through E-9 declined from 11.1 to 10.3 years. What can YOU do to reverse this trend?

Congratulations to the 1981 Itschner and Sturgis Award winners, whose names were announced at the recent 114th Annual Engineer Dinner. These awards are presented to outstanding Engineer companies and one outstanding Engineer enlisted each year. 1981 Itschner winners are: for the Nat'l Guard, Co. D, 1457th Engineer Bn (Combat) (Corps), Utah Army Nat'l Guard, Mount Pleasant, UT; for the Reserves, Co. B, 479th Engineer Bn (Combat) (Corps), 98th Division (Training), Massena, NY; and the Active winner, Co. A 65th Combat Engineer Bn, 25th Infantry Division, Schofield Barracks, HI. SSG Billy D. Miller of Co. B, 62d Engineer Bn, 13th Support Command, Fort Hood, TX received the coveted Sturgis Award.

ENGINEER Magazine actively solicits manuscripts about Corps civil engineering projects. Civil engineers are a vital part of the Corps of Engineers, and ENGINEER strives to serve the needs of every Corps component. Other suggested topics include ideas for new or improved training methods, critiques of unit FTX's, unusual problem solving methods, and feature profiles of units or MOS's.

The Army Apprenticeship Program has 74 trades representing 134 military occupational specialties registered with the Dept. of Labor. Since the programs inception 105 soldiers have received Journeyman certificates. This program gives soldiers an opportunity to obtain a marketable skill as a direct result of their Army training. Support of this program aids recruiting and retention efforts. Your education office has the details.

Editorial

Something to say? Write it!

by N.P. Lang

Soldiers attending the Engineer Officer Advanced Course are required to write a manuscript, suitable for publication in ENGINEER magazine, as part of their studies. Some of these students have asked for guidelines and suggestions for their work. I propose the following for all who have difficulty facing written assignments.

If you listen to people around you for a moment, you'll realize many things people say don't transfer to the printed page. People speak in incomplete sentences. They use facial expression, shrugs, nods, voice inflection, etc., which can alter the meaning of words in a profound way.

Therefore, if you try to write like you speak you may find yourself in a bind. You can't do it. You must develop a writing style just as lecturers must develop their speech.

This accounts for some of the problems students encounter when called upon to produce a written argument. They cannot effectively write what they want to say, and frequently end up in a panic because of it. The problem is not limited to students, however. At one time or another, most people find themselves poised over a writing instrument searching for the right word. No one who writes can avoid this dilemma indefinitely.

Many people come to me and say "I would like to write for Engineer, but just can't seem to get started." They are awash in a sea of ideas, but can't turn their thoughts into words.

Before **any** battle a soldier must be properly armed, and writing is a battle for most, so familiarize yourself with the available weaponry before writing a single word. You must also decide what you want to say; what you want your reader to feel, and how will you make him feel it. Making an outline before you start should help. If possible, target your paper, too. Instead of trying to write about the entire Civil War, pick one battle to dissect. Remember your audience. You wouldn't use the same style for generals as for privates, neither would you compose a memorandum for record as you would an ENGINEER manuscript.

Arm for writing by acquiring a **recent** dictionary. Get into the habit of checking the spelling and definition of every article, letter, or DF you write. Nothing will turn off your boss quicker than a proposal riddled with spelling errors. They can cost you jobs or promotions; and too many will make an editor toss your manuscript into the nearest waste can.

You may want to **shop** for your dictionary as well. There are wide differences in the number and types of words dictionaries carry. Most "pocket" editions aren't worth the money, so you may want to invest in one that will last your entire career. Sometimes I check three or four editions before finding the word I want, so if you can't verify a word using your dictionary, check someone else's. Also keep a Thesaurus handy. It's an alphabetic listing of synonyms and antonyms which is most useful when searching for that "right" word.

Once armed, your outline complete, begin the "challenge" of writing. Remember, the more words in a given sentence the longer it will take your audience to figure out what you're saying. Make one point at a time, and keep sentences to a reasonable length. A good test is to read aloud. If you can't finish a sentence without gasping for air, it's too long.

Try to write actively. ENGINEER guidelines call for manuscripts written in the "third person, active voice". Very simply, this means writing "they run" instead of "I ran" or "you were running". (Editorials and FORUM articles excepted.)

Once you've written a first draft, following your outline, check your thought construction to make sure ideas flow smoothly. If you "just can't seem to get started," try taking each note on your outline and writing a paragraph about it. Once you have 30 or so paragraphs, **then** go back and try to group them. Before you know it you will have written your first magazine article.

When you think you're finished, go back over the whole paper word by word. Check spelling, word usage, and for words that do not add to your paper's meaning or clarity. For instance, "The problem with the car was that the steering was not operating properly." Of the 14 words in this sentence, **10** of them are unnecessary! (See how many you can eliminate). The major the problem with the sentence is redundancy. If the steering isn't operating, it's obviously not operating properly. "That" can often be left out of a sentence without changing its meaning, as can "both". If the squad and squad leader are both present, you need only say the squad and squad leader are **here.** Don't use a big word when a little one will do. And don't be afraid of contractions. Re-write the above sentence as "The steering wasn't working."

Practice writing succinctly. Instead of **prior to**, use before. **Due to**, means because. **Despite the fact that**, means although. Check everything you write for redundancy and you will soon have your own list of condensed phrases.

Armed with these hints you should at least be able to face a blank page without breaking into a sweat, and you may even discover you like writing. In any event, you can't avoid this issue forever. Paperwork is as much a part of the Army these days as rifles, and you must communicate effectively to lead effectively. There is no way out, save to gird your loins and **write** what you have to say.



New Road Design Criteria for Theater Operations

by Capt. Ira Wagreich

The US Army Engineer School is presently reviewing road design geometrics for Theater of Operations (T/O) construction. This is being accomplished as part of the revision and update of TM 5-330 "Planning and Design of Roads, Airbases and Heliports in the Theater of Operations," and FM 5-34, "Engineer Field Data." In an effort to provide greater flexibility, the design criteria contained in the Army Facility Component System (AFCS) are being incorporated into the new edition of the manuals.

The AFCS contains road designs using two different traffic lane widths, 10 feet and 12 feet. This represents a major change from past design criteria. Traditionally, the minimum design width of a traffic lane has been 11.5 ft. This measurement has continuously been specified by the Standard NATO Agreements (STANAG) as the normal requirement for the width of a traffic lane. The newest agreement, STANAG 2174, dated 10 Aug 78, still specifies the 11.5 ft trafic lane for wheeled vehicles. However, the purpose of this STANAG is to standardize procedures used to determine the optimum traffic flow for a particular **existing** route. In this manner the movement of supplies over finished road can more easily be planned. STANAG 2174 describes several traffic flow possibilities, with the selection of the traffic flow pattern based on the width of the traveled way. But, at the present time there is no STANAG providing design criteria for the construction of **new** roads. In the absence of such a STANAG, AFCS is the only source of current design criteia for US Army Theater of Operations construction.

Design Control Elements	Class A 2 lane	Class B 2 lane	Class C 1 lane
Traffic Lanes			
Minimum Width (ft)	12	10	10
Lateral Clearance from edge of traffic lane to obstruction (ft)	6	6	4
Normal cross-slope (in/ft)	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$
Shoulders			
Minimum Width (ft)	4	4	4
Normal cross-slope (in/ft)	3/4	3/4	3/4
Type (perm road)	Stable	Compacted Soil	Compacted Soil
NATO Classification for the AFC Road	Double Flow	Single Flow	Limited Access

AFCS Road Design Criteria
from TM 5-302 Vol. 3drawing #5130 3 Mar 78

The AFCS is an index to all the Army facilities that may be required in the Theater of Operations. It contains all the necessary construction drawings and specifications as well as a list of the resources needed to build each facility. The construction drawings are presented int he TM 5-302 series of publications. Drawing number 85130 dated 3 March 1978, serves as a header sheet for the road design drawings. Found in Volume 3 of the series, it contains a full seet of design specifications for three classes of roads. These specifications include vertical and horizontal alignment criteria, design speeds and expected traffic composition. Also provided are road network requirements for typical Army units. A summary of these design specifications is presented in Table 2.

It must be stressed that, while the AFCS design specificaitons do not match the STANAG criteria, the two documents are not in conflict with

each other. Each was written for a different purpose. The STANAG is to be used to determine road classification for planning movement over an existing road. The design criteria presented in the AFCS are for the construction of new roads. These AFCS design classifications are not to be used as road classification criteria for existing road nets. For example, the engineer constructs the AFCS Class "B" Road as a two lane road with a 20 ft travel way. The logistician, complying with STANAG 2174, must realize that this is a "single flow" road permitting only occasional traffic in the opposite direction. The traffic flow allowed by the STANAG for each of the three AFCS roads is presented here.

The Army Facility Component System is a valuable management tool for the engineer. It can be used in both the planning and execution phases of any T/O construction project. Because of its flexibility, it has already been incorporated into the coordinating draft of FM 5-330 which was circulated for comments in late 1979. It is also being incorporated into FM 5-34 which is currently under revision at the Engineer School.

Fort Leonard Wood
Looking for a new image

by SFC Ron McCumber

FORT LEONARD WOOD, MO— "I'm going to where!? Fort Leonard Wood, Missouri? Isn't that 'Lost in the Woods?' Oh, Lord, what did I ever do to deserve this?"

This has often been the first thought of soldiers upon receiving assignment instructions to the U.S. Army Training Center Engineer, Fort Leonard Wood, Mo. Such morbid thoughts come to mind because of hearing the World War II vintage horror stories and none of the up-to-date facts about one of the Army's finest military installations and one of the best kept secrets in the Army for enlisted as well as officer personnel.

What has changed since 1940? Everything. Everything except the physical location. Upon being designated a permanent post in 1956, the post began to change and is continuing to do so.

The first large, visible project was the demolition of World War II barracks and the erection of a three-brigade sized area of modern three-story, brick barracks and the erection of a three-brigade sized area of modern three-story, brick barracks complexes complete with chapels, theaters and post exchange branches. Each brigade also has a full size gym for the off-duty enjoyment of assigned soldiers. Three brigades now have some 9,000 soldiers residing in these barracks while in a training status.



Fort Leonard Wood has more than 3,000 family quarters in 23 styles. (U.S. Army photo by R.J. Staples).

The permanent party barracks, Specker Barracks complex, was completed last year at a cost of $45 million. Permanent party personnel residing in this college dorm-style complex have either private or semi-private, centrally heated and air conditioned rooms, complete with bath, some with tub.

Family housing at this mid-Missouri post is a pleasure to occupy without the waiting lists and specific requirements often faced at many other posts. If a soldier and his wife sign in one day, they will probably move into one of the 23 styles of housing usually within 2 weeks. Government furniture, however, is in short supply.

Bachelor NCO and officer housing is available in either the new Specker Barracks complex or in the Sturgis Heights area. Both include modern facilities with E6s authorized semi-private rooms and E7s and officers authorized private rooms or suites. Suites usually have a waiting list. Geographical bachelor housing in these facilities depends upon the availability of rooms.

Dependents attend the school closest to their quarters if they reside on post. Three elementary schools and one junior high serve dependents, with high school students being bused to nearby Waynesville, Mo., a seven-mile drive. Pre-school kindergarten is available on post; the nearest parochial school is in Rolla, Mo., a 25-mile bus ride.

Fort Leonard Wood and the Show-Me State offer some of the best recreation in the nation. Hunting,

fishing, trapping, spelunking, boating and swimming are just a few of the available attractions.

The post golf is an 18-hole championship course over natural rolling terrain complete with sand and water traps, clubhouse and picnic area. The Roubidous Creek and Big Piney River flow through the reservation offering outstanding fishing as well as canoeing and boating. The run-off of a natural spring has been diverted to form a cold water stocked trout stream with the season opening March 1 annually. Other trout parks are readily accessible within a two-hour drive, featuring lunkers up to 10 pounds.

The Lake of the Ozarks, 45 miles away, offers boating, fishing, skiing and night club style entertainment. This lake, one of the nation's largest, has approximately 1,000 miles of shoreline. Fort Leonard Wood has a recreation area on the lake to include a marine, PX and cabins for rent at nominal costs. Lake Taneycomo, Table Rock Lake and Branson Lake are also within easy driving range.

Turkey and deer hunting are two of the favorite sports on the military reservation. Fort Leonard Wood is one of the few areas in the United States that has never lost its wild turkey population. Firearm, black powder and bow and arrow seasons are observed. Hunters took 356 deer on the installation during 1979. Deer season includes the taking of does during certain days. Firearms, black powder and bow and arrow hunts are licensed.

If a soldier or his/her dependents are equestrian oriented, the Fort Leonard Wood Riding Academy offers stables and instruction. Mounts and gear are available at a nominal cost. Trail rides as well as rodeos are sponsored periodically.

The relatively low cost of living in the Fort Leonard Wood area has proven attractive to many personnel. The post exchange with numerous branches and the post commissary are well stocked. Civilian shopping centers are available in St. Robert, Rolla, Springfield, St. Louis and Kansas City. Most are within a two or three hours drive. St. Robert is one mile away and Rolla, 25 miles.



The General Leonard Wood Army Community Hospital is a modern 500 bed facility offering a variety of specialized clinics. (U.S. Army photo by R.J. Staples).

If an individual is an avid swimmer, the facilities are available at three outdoor pools. Tennis buffs can choose the area in which they desire to play on cement, well-lighted courts that remain open throughout the year. Courts are located in the housing areas as well as in other recreational areas. Five gyms are available with most including squash and handball courts. A two-wheel and 4-wheel off the road area track for multi-terrain vehicles is open most of the year.

Fort Leonard Wood offers a variety of assignments for the professional soldier. The 3d Basic Training Brigade, composed of four battalions, teaches basic training to both male and female soldiers. The 2d Training Brigade (One Station Unit Training) teaches basic and combat engineer advanced individual training while the 4th Training Brigade teaches OST training and 15 different military occupational skills to include two warrent officer courses. These 15 MOSs are taught to male and female soldiers and also to U.S. Air Force, U.S. Marine Corps and to selected foreign soldiers.

The General Leonard Wood Army Community Hospital, a modern 500 bed hospital, is rated as one of the finest in the military. This is one of the few hospitals that has never curtailed services to retirees, their dependents or any other category of authorized patients. The Fort Leonard Wood Dental Activity includes six dental clinics that continue to give service to dependents and retirees as well as active duty personnel.

Fort Leonard Wood has all of the above. What doesn't it have? It doesn't have a large city immediately outside the gate, it doesn't have unreasonable costs of living, it doesn't have a high crime rate, it doesn't have air pollution. What else is present? The opportunity for one of the best assignments in a professional career, for the soldier as well as his/her dependents. If any soldier or dependent desires further information, he/she may call the Fort Leonard Wood Public Affairs Office at commercial (314) 368-8514/7925 or AUTOVON 581-8514/7925.

NCO Corps: Museum is first to be dedicated solely to noncommissioned officer

FORT BLISS, TEXAS—The Army's only museum dedicated to the history of the NCO Corps opened at the U.S. Army Sergeants Major Academy here, June 24, 1980.

According to museum curator, Dr. Daniel Zimmerman, the museum honors the NCO's accomplishments and service to the nation. "There are other museums that have exhibits covering the same periods of history," he said, "but this is the first museum dedicated soley to the history of the NCO corps."

The exhibits depict the history of the NCO corps by historical periods: The Revolutionary War period, 1775-1783; 1784 to 1860, including the War of 1812 and the Mexican War; The Civil War period, 1861-1865; The Indian War period, 1866-1891; 1891 to 1916, including the Spanish American War and the Pershing Expedition; World War I; World War II and Korea, 1940-1952; And from 1952 to the present, to include the Vietnam Era.

According to Dr. Zimmerman, some reproductions were used in creating the exhibits. "Original artifacts," he said, "make up about 95 percent of the exhibited items, some of which (like a wooden canteen) date back to the Revolutionary War." From the Civil War period the museum has three original uniforms (two Union Army and one Confederate) as well as original documents, military equipment and photos. Additionally the museum has several Regular Army knap sacks from the Civil War Era, which Dr. Zimmerman states are "exceedingly rare."

Other original items on exhibit at the museum include: several weapons such as a NCO Light Artillery Sabre from the War of 1812 and a model 1842 percussion pistol from the Mexican War period; personal items from various periods of history like a Bible, musical instruments, letters, books and post cards; and tools and living essentials such as an oil lamp, wood burning stove and kitchen utensils from the Indian War period.

"Reproductions," Dr. Zimmerman tells us, "were used where original items were unobtainable because of their extreme rarity." Also, according to Dr. Zimmerman, those reproductions which were used were created only after extensive research. "Before building any reproductions we researched each item," he said.

"In creating the 1890's barracks scene for instance," Dr. Zimmerman explains," we first had to research and answer several questions in order to get an idea of what barracks life was like in the 1890's. We wanted to know how the barracks were furnished and how they were heated. Where did the soldiers store their valuables and clothing and where were their weapons kept. What kind of bed did the 1890's soldier sleep on?

Once we learned all that we could about the soldiers life style during that period then we could begin to design the exhibit. We know for instance that the soldiers had very little free time. They spent most of their time cleaning the barracks, grooming their horses, or out on patrol. And, up until the time that towns began to spring up around Army posts for protection, the soldiers assigned to these outposts had to be totally self-sufficient. They would arrive in the middle of nowhere and build their own barracks, mess hall, orderly room, and other buildings. They even grew their own food.

When creating the barracks scene, "he continues," we were able to locate many original furnishings such as a chair, lamp, footlocker and stove. We even found some original playing cards and dime novels from that period of history. But we couldn't find a bed which, of course, was crucial to the exhibit. So, based on an old photo and some original documents, we reconstructed a bed similar to the kind used during the 1890's. We also had to build a table and we laid down a hard-wood floor, as would have been the case back then. Additionally, we used a special lighting arrangement to create a 'warm' glow around the exhibit."

When asked just what a person would learn from visiting the museum, Dr. Zimmerman replied: "Hopefully, people who visit the museum will leave with a better understanding of the history of the noncommissioned officer. They will know something about how the NCO lived and worked during each period of history. One little known fact, for example, is that it really wasn't until the Civil War that NCO's were officially put in charge of troops. Prior to that only officers had authority over soldiers. There may have been isolated incidents where NCO's took command during emergency situations, but officially NCO's were not in charge of troops until the Civil War. After visiting the Museum of the NCO, perhaps people will have a greater appreciation for the NCO's accomplishments and contributions to the nation."

In addition to telling the history of the NCO Corps through artifacts, the museum will initiate and maintain an ongoing oral history program. This will include a series of personal interviews with NCO's, both retired and still on active duty. The purpose of the program will be to add to the current knowledge of NCO history. According to Dr. Zimmerman the program will probably begin with interviews of past Sergeants Major of the Army and will include questions like: "What was your perception of the role and status of the noncommissioned officer when you entered the Army. Had it changed after you earned your first chevrons?"

According to Dr. Zimmerman, transcripts from the oral history program will be maintained at the museum along with other historical documents and artifacts for research purposes and traveling exhibits. Visiting hours are 8 a.m. to 4 p.m. Monday through Friday.

Domestic Action Projects:

BOON OR BUST?

DAP can build good will or destroy it—It's up to you!

by Maj. Stephen Morse

Editor's Note: Although this article specifically addresses Reserve DAP, Active commanders can apply these guidelines, too.

Domestic Action Projects (DAP) by Army Reserve Engineers can benefit both the community and Reserves. The community benefits by obtaining a needed facility at nominal cost, and the Reserve's mobilization readiness and strength can benefit by training at tasks not usually available to the unit.

Satisfactory DAP do not happen by chance. To be successful, a DAP requires extensive planning, coordination, and supervision. This article briefly describes the DAP process, and some lessons learned from a Reserve Engineer unit viewpoint.

GETTING STARTED

Long before any extensive plans are made, both the Reserve unit and the "customer" organization must know the rules, regulations, and needs of the other. Army Regulation 28-19 specifies the Army's requiements, but local commanders and the chain-of-command may add their own requirements. A fact sheet is helpful. The customer must be specific in its request but should be flexible as to how the project may be accomplished, especially in terms of time. A clear representation of the needs of both parties can eliminate an unfortunate misunderstanding later.

The ideal scenario for determining an acceptable DAP for the Reserve Engineer commander would come after he has assessed his training needs for the year (utilizing FORSCOM Reg. 350-2, command guidance, internal and external ARTEP, AT evaluations, SQT requirements) and just before he finalizes his Yearly Training Program Forecast. While some Reserve commanders may have this ideal situation, mot commanders experience DAP requests that are sporadic, tend to fall into several repetitive types of projects, and may often have cogent reasons other than training for their consideration (e.g. public exposure, command request, recruiting, retention).

REGULATION, COORDINATION

The usual situation for initiating a DAP is an organization with a project request contacting a Reserve unit. If the customer meets the eligibility criteria of AR 28-19 (and any local requirements), and the commander finds that a brief joint reconnaisance be made of the project site to ensure that the type and scope of the project matches the customer's proposal. If the commander does not have the approval authority for DAP, he should also inform his next higher headquarters of the contact and his initial disposition of the DAP request.

Once the commander and the customer agree that the proposed DAP meets their needs (with higher headquarters approvals as necessary), the detailed planning and coordination can begin. The commander should require the customer to furnish:

1. A release from the local building trades council (i.e. unions) that they will not oppose the Army Reserve's participating in a specific DAP.

2. A statement releasing the Army Reserve from liability (i.e. a "hold harmless" clause).

3. A statement that the customer will supply all materials and underwrite all costs above normal training incurred by the project.

4. A statement acknowledging the fact that due to changes in commitments, the Army Reserve may have to leave the DAP imcomplete at any time.

5. Any building permits or approvals as may be necessary.

6. A statement of ownership as necessary.

7. Plans and specifications as agreed upon.

8. Contact person/coordinator (with telephone number).

It should be made especially clear to the customer that the project cannot commence until the above acitons are complete, and the command has given all necessary approvals.

The Army Reserve Company Commander has an obligation to provide the customer with:

1. Any plans as agreed upon.

2. A construction management scheme that includes:
   - schedule of tasks
   - bill of materials (BOM)
   - surveys and construction control
   - quality control/inspection
   - equipment needs and scheduling, including rentals if necessary
   - supervision/management responsibilities
   - construction progress reports.

3. Contact person/project officer (with telephone number).

4. Cost estimates and monies necessary.

5. Procedure for changes.

To enhance unit training and project control, the commander should additionally develop (and usually higher headquarters requires):

1. A project order with specifications for mission, responsibilities, and time schedule.

2. Tasks to be trained and evaluation plan:

- by Soldier's Manual
- by ARTEP
- by Yearly Training Program and Forecast.

3. Unit logistic support, i.e. mess, fuel, maintenance, transport.

4. Integration and evaluation of other unit training needs, i.e. tactical security, tactical feeding, and camouflage.

5. Project, progress, and after-action reports.

Experience has shown time and time again that thorough planning and coordination prior to any actual construction pays significant dividends that will result in an orderly work and material flow, satisfactory training, identification and resolution of potential problem areas, and proper assignment by task for the responsibility of supervison and implementation.



The 1249th Engineer Battalion recently completed a Domestic Action Project which earned them the Oregon Govenor's Unit Citation.

LESSONS LEARNED

I have found that the "hands on" experience of implementing numerous DAP with Reserve Engineers has provided several insights for successful projects. I offer the following lessons learned:

Keep a permanent sample request on hand, and/or a checklist of actions to be completed. This can help you and the customer by making applications easier, uniform, and complete.

Don't string a prospective customer along. One should be able to immediately ascertain from his YTP and YTF wheather a proposed DAP can proceed past the initial customer contact. If the customer must be turned down, do it in a gracious and timely manner.

The best DAP are those that are of short duration (e.g. less than three MUTA-4), are well organized and coordinated, involve maximum manpower and minimum equipment, and are visible, lasting, and useful.

If a proposed project offers significant training benefits, but is too big to fit alloted training time, alternate proposals to the customer should be considered, such as reducing scope, dividing the project into sub-elements with Reserves only doing work for which they are best suited, extending time for completion, renting additional equipment and/or using transit mixed concrete to shorten time.

Delegate! DAP are valuable training tools for training and evaluating junior leaders. DAP offer one of the few opportunities during MUTA to exercise and evaluate the full spectrum of command and leadership. Time-tested methods include mission-type orders, required pre-work briefings, project planning documents (i.e. CPM, BOM), and on-site inspection.

Make sure the customer's coordinator represents the organization and can make responsible decisions "on-the-spot".

The scheduled work should be stages such that if it must be stopped or delayed some benefits will be evident for both parties and no irrepairable harm will result (e.g. erosion, materials storage, and security).

Keep travel time to a minimum. A short travel time will lessen logistic problems and put more productive time to use training.

Don't forget safety. Designate a safety NCO. A short daily pre-training "tailgate" session oriented to the day's tasks works best.

Avoid DAP that are heavily equipment dependent. Maintenance, security, and logistics can be overwhelming. However, you should consider the following when evaluating equipment dependent DAP:

- equipment dependent projects are acceptable if equipment operator training, especially for non-MOS qualified personnel, is the primary goal.
- don't accept DAP that will significantly impact your fuel allocation unless the customer will pay additional fuel costs; be especially concerned with hauling projects.
- where a DAP could provide good equipment training benefits, consider splitting training of the unit to different MUTA's so that more hours are available for equipment useage and training.
- don't forget maintenance and equipment security each MUTA.

You should capitalize on DAP with an active community relations effort through contacts with newspapers, TV, or radio. Utilize the Public Affairs office of your command. An active DAP is often cited as a reason for retention of unit members and the first exposure to new members.

Project reports, records, and after-action reports are important. These records provide good training documentation, briefing background papers, and references for consideration of similar DAP.

BUILDING THE RESERVES WITH DAP

The Army Reserve as a part of the community draws its strength and support from the community. The Army Reserve Engineers can increase their strength and community support by participating in DAP. However, the Reserve commander must assure himself that a proposed DAP will meet his mission and training goals.

When a DAP is selected for implementation, the commander must gain the maximum benefits from the DAP by accomplishing as many objectives as possible without sacrificing quality. With the proper selection and tailoring of DAP, and an imaginative implementation of his training program, the commander can simultaneously meet his training goals and benefit the community.

Major Stephen Morse served 13 years with the 820th Engineer Battalion (Combat), San Pueblo, CA, (USAR), four years as the battalion's Operations Officer. Major Morse presently serves as Medical Regulating Officer for the 2nd Hospital Center at Hamiliton Field, CA.

Corps celebrates 206th birthday

114th Annual Engineer Dinner Remarks

Chief of Engineers, Lt. Gen. Joseph K. Bratton, sums up Corps commitments around the globe

You have already been welcomed. Let me extend to you now my own warm greeting. These annual dinners are very special events—memories commingled with present challenges and anticipation; and all of us gathered together out of respect and devotion to our particular part of the U.S. Army—its Corps of Engineers.

I should like to add a personal special welcome to my mentors and predecessors here present: Generals Wilson, Cassidy, and Clarke. I have received personal letters from Generals Itschner and Morris, who are unable to join us this evening, but who wished to pass on their warm regards to us all.

Our theme tonight is the Engineers as Soldiers and Builders, and I have had a remarkable opportunity to observe both over the past several months while traveling in the United States, Europe, and the Middle East. I have visited the other Army major commands and all our principal Engineer offices save those in the Pacific area, where I am planning to go next month. As I expected, following a decade of wise leadership by Generals Clarke, Gribble, and Morris I find the Corps to be superbly professional and in vigorous good health. There is consistently outstanding work being done in our Engineer Divisions, Districts, and labs, as well as by Engineer troop units and staff elements throughout the world. Had you traveled with me, you would have been as proud as I am.

You would also have found—or rediscovered—the high regard in which the Corps is held by the large majority of the American public and by their elected officials, both in Washington and elsewhere throughout the country. We should keep in mind (and not hesitate to remind others, in and out of uniform) that the Corps is that part of the Army, and indeed of the Defense establishment, which most contacted and observed by the people—usually at our construction sites and recreation areas.

If we are properly to regard ourselves as Soldiers and Builders, we need to establish a common perspective. The Corps is so big, so diverse, and is doing so much in so many parts of the world that it is sometimes difficult to sort out our priorities.

We must keep clearly in mind the nature of our root mission: to support the Army. We do this by doing our best to insure that Engineer soldiers both Active and Reserve—remain an effective part of the combined arms team and provide engineer support on the battlefield and throughout the combat zone; by building for the Army and the Air Force; by maintaining to high standards our facilities and housing; and by being ready, using our active in-place military construction and civil works organizations, for the very large construction demands we could expect in event of mobilization.

In addition, because of our proven capabilities, the Corps through the years has been given a variety of nation-building tasks which we identify today as our Civil Works program. The Corps has proved itself an organizaton sensitive to evolving national objectives and responsive to changing national needs. We have given the nation quality products, reliable financial manage-

ment, and sound environmental practices; and we have done so with a continuing awareness of public needs and desires and a careful stewardship over its investments. I doubt that any other single organization has contributed to the strength of the United States so well for so long, and with such a high return on the taxpayer's investment.

But let me reiterate: the fact that we do and build so many things so well should not mask our basic objective: to support the Army and its soldiers. We continue to stress the priorities of Manning, Force Sturcture, Training, Modernization, and Mobilization as spelled out in the Chief of Staff's White Paper. That guideline remains a charter for actions by the Corps, and indeed Corps involvement is an important factor in achieving the Army's objectives in each of these major areas of priority.

The years ahead

Four years ago, at the beginning of the previous administration, the Corps was forced to fight for survival, at least as far as its civil programs were concerned. We won that struggle because of the excellence of our work and our reputation; our projects stood the test of hard scrutiny.

We face no similar situation today, but I do suggest that we nevertheless are gonig to be directly challenged—at a time when Mr. Stockman's budget shears are sharp and when there are compelling pressures to reduce the federal work force—to prove our mettle and streamline our operations. For example, the Corps has been directed to reduce its Civil Works civilian personnel spaces by 3,000 by October 1982—that's more than a 10% reduction in the next 16½ months. A further reduction of 10% is programmed for the subsequent four years. For this substantial reduction, we can no longer limit ourselves to the salami slice approach; we must cut functions and examine organizational realignments.

On the other side of the Reagan coin, the Army will benefit from the increased funding for national security. The Army budget requests for 1981 and 1982 have been increased by about $2.5 billion and $7.5 billion, respectively. Most of this increase of $10 billion plus is for modernization of equipment—unfortunately, very little for engineer equipment—but there is a substantial amount for construction and repair and maintenance of facilities. Moreover, because of the sizable increases forecast in construction for the Army and Air Force, the Corps is scheduled for significant increases in Army civilian strength for our military programs in FY 1983 and the out-years. We are now looking at a total Army budget for FY 1983 of almost $60 billion; that's more than any of us could have estimated even a short time ago.

Overseas, in Saudi Arabia our work is literally nation-building, with a program now amounting to almost $20 billion, stretching at least through this decade. It provides excellent experience for many of our officers and civilians in large-scale construction management.

In Israel, our effort is smaller but more urgent. The mission is to complete two new airbases in the Negev Desert for the Israeli Air Force by next April, to permit Israeli withdrawal from their present bases in Sinai under terms of the Camp David Accord. This job is a major challenge to all involved—fast track construction of two extremely sophisticated bases which must be done on time, within budget, and with first-class quality to suit a very discriminating customer.

In March I was able to visit our U.S. Army in Europe, a force of over 200,000. The Engineer units there are in good shape and are receiving high praise from senior commanders. The soldiers are good—as capable and confident as any I've worked with in CONUS, Europe,

"If we are properly to regard ourselves as Soldiers and Builders, we need to establish a common perspective . . ."

Korea, or Vietnam. They reflect the excellent training program at Fort Leonard Wood. I saw little evidence of the quality problem about which we frequently read; only one commander, of many I queried, had complaints. As always, the better the NCO and junior officer leadership, the better the troop performance.

Support your troops

Unfortunately, I cannot report that we are supporting those soldiers as well as they deserve—in housing, facilities, or equipment. General Kroesen made the point strongly to me when he told me that the number one peacetime problem in Europe is family housing—not training, not manning, not stationing, and not modernization. We are short over 7,000 family housing units in Germany, and those we do have need a higher sustained level of maintenance and repair. In a number of units, we are still maintaining equipment in stables built for the Kaiser's World War I army, with costly vehicles parked in muddy motor pools—hardly the environment to motivate young soldiers to care properly for their equipment; and all this some 36 years after V-E Day.

In agreement with General Kroesen—and the other MACOM commanders—I consider it imperative that we make a major effort to do better. At present our Facilities Engineers and Directors of Engineering and Housing, in CONUS and overseas, have a big job trying to make too few dollars go far enough against a big maintenance backlog. If you believe a battalion commander has a tough job in USAREUR today, consider the understaffed and overworked DEH in one of our larger communities there—Frankfurt, for example, or Nurnberg. Fortunately, the Reagan budget is going to help us in Europe and elsewhere; but we have a lot of hard work ahead in this area, and we had better realize that a big part of the Army perceives the engineers from the perspective of the facilities management, and great work in the field by engineer troops and around the nation in our engineer MACOM can be offset quickly when the Facilities Engineer does not have the tools to take care of the soldier and his family.

There is some hope for improvement in our garrison support of the soldier and his family. The 1982 budget as

"In a number of units we are still maintaining equipment in stables built for the Kaiser's World War I army"

amended by the new Administration will, for the first time in some years, arrest and reverse the growth in the Backlog of Maintenance and Repair. We plan to give this area special emphasis, since it has for so long eluded an effective solution.

Two other major construction programs which are already underway but not yet fully defined are those associated with the RDF in Southwest Asia and the Missile-X program. The latter, in particular, could be the largest construction task we have ever undertaken. The full construction price tag for the system approved by the Carter administration exceeds $22 billion. We expect a major impact on the Corps, assuming continued M-X support by the Reagan Administration. Pending the report of Secretary Weinburger's Blue Ribbon Panel and a final decision by the President, we have begun to staff up at Norton AFB, and will be sending an Engineer general officer there next month to assume Construction Agent responsibility.

The root of our mission

Let me turn back now to what I said was our root mission—support of the combat Army in the field. We need Engineer forces that can keep pace on the battlefield with the armor and mechanized infantry and artillery units. Unfortunately, we don't yet have such a force; our Engineers are largely equipped with the technology of WW II and Korea. But there is hope; last month, for the first time in several years, a full Engineer Systems Program Review was conducted here at Fort Belvoir and chaired by General Vessey, the Vice Chief of Staff. A first step in closing our equipment gap should be with the fielding of the M-9, or ACE (for Armored Combat Earthmover), formerly called the Universal Engineer Tractor. The first buy is supported in the 1982 budget and units should be receiving the first M-9's in 1983. With the M-9's and hopefully the other items needed to provide for modern Mobility-Countermobility-Survivability, Engineers will be able to keep up with the new tanks, fighting vehicles, and self-propelled artillery. Unfortunately, all of this won't be in the hands of the 12 billion until near the end of this decade. We do have the ears and support of the combined arms commanders; now we need to give our Engineer soldiers the tools to do the jobs those commanders are expecting.

I would be remiss this evening if I did not mention a subject which I find increasingly of concern, and that is our perennial shortage of Engineer officers in all grades from captain through colonel. At a time when we must struggle to compete for good people against strong private sector demands, we Engineers have too much to do with too few. Our problem is worsened by a disappointing retention record and the necessity to turn on several tracks—notably troop command, contract construction, and facilities engineering, while still accepting our fair share of branch-immaterial assignments. Our officers—more than any other branch of the Army, I believe—must do all things well; they must be "officers for all seasons." We must all be vigilant recruiters for the Corps, doing our best to counsel and retain young officers and encourage their further studies in engineering disciplines where academic credentials so indicate.

Looking to the future in this year of the Yorktown Bicentennial, we should be impressed by the fact that—if we are really going to rearm and reindustrialize America—the nation will need more than ever the disciplined precision, the inquisitiveness, the professional excellence, and the personal integrity of its engineer leaders. It will need the full measure of our capacity to plan, organize, and execute complex military engineering tasks. I believe the Corps, as the nation's premier engineering organization, is ready to provide that capacity. We are in for years of tough going—but this is a decade of national opportunities as well as vulnerabilities, and there are many in this room who will be coping with our national security problems into the 21st century.

General MacArthur called WW II in the Southwest Pacific an "Engineer's War"; perhaps he would perceive this present time as an "Engineer's Peace."

Let me leave a final thought with you tonight. I ask you to look around this room, at the company you are in, and ask yourselves how many other Americans can take the pride and satisfaction we have in what we are doing, how we are doing it, and the organization which unites our interests and efforts. We are a fortunate few, measured among 230 million Americans. We count our service in tangible ways. We leave a trail of professionalism and achievement for all to see and benefit from. We are proud to sign our work. Finally, we are not content to stand still and rest on successes of the past; we are a proud and forward-looking part of the Army team, and we intend to stay up front where we belong.

And now, I wish you all continued professional achievement and personal satisfaction. I consider it a great honor to be here tonight as a speaker and a member of the team, and I thank you very much.

The Civil Engineer Problem

Solutions page 31

An airport requires 4,500,000 cubic yards of fill. The fill will be compacted to a void ration of 0.7. Three borrow pits are to be evaluated to determine the most economical fill operation. The void ratio and estimated haul cost for each pit is:

Pit	Void Ratio	Haul cost per bank cy
A	1.2	$0.24
B	0.9	$0.26
C	1.1	$0.25

Which pit should be utilized, and what will be the Haul Cost for this project?

The Military Engineer Problem

The 52d Infantry Division (Mechanized) must defend a portion of the II Corps defensive sector. The G-3 has analyzed the threat and established Brigade sectors.

2d Brigade is given the narrowest sector, astride the enemy's probable main avenue of approach. A supporting attack is expected in 3d Brigade's sector. 1st Brigade's area has restrictive terrain and a major attack there is unlikely.

As the Assistant Division Engineer (ADE), you have completed estimate of the required engineer effort. The divisional covering force requires four engineer companies, 2d Brigade requires three companies, 3d Brigade requires two companies, and 1st Brigade requires one company, as indicated below.

Since 12 companies of engineer effort are required, the division has requested and received the support of two corps combat battalions.

Acting as Assistant Division Engineer, task/organize the divisional engineer battalion (mechanized) and the two corps combat battalions within the division area. In developing your solution you should consider:

- The Command/Support (C/S) relationship of the Engineer Corps Combat Battalions to the 52d Division.
- The C/S relationship of any engineer companies sent forward to work in the Brigade areas.
- The utilization of the mechanized divisional engineers in conjunction with the less mobile corps engineers.
- Who is to be the Brigade engineer for each brigade area and who will direct the engineer effort in the covering force area?

REQUIREMENTS

1st Brigade
1 company

2d Brigade
3 companies

Covering Force
4 companies

Division Control
52d Engr Bn
500 Engr Cbt Bn
502 Engr Cbt Bn

3d Brigade
2 companies

—M-CM-S—

Mobility, Countermobility, and Survivability in the Airland Battle

by Maj. Gen. Max W. Noah

The Airland battle combines such concepts as the integrated battlefield and the extended battle. The concept stresses a deep attack of the enemy's follow-on echelons, together with a quick decisive strike against the assault echelons. The need for Mobility, Countermobility, and Survivability are the requirement and the business of the combined arms team, with the combat engineer providing the expertise and much of the capability. The recent M-CM-S Systems Program Review '81 at Fort Belvoir, focused on these tasks and provided direction for the future.

More than ever before, our success in the first and succeeding battles of the next war will hinge on the battle commander's use of time and terrain. These are the critical two variables open to the commander as the battle begins. He will fight outnumbered. His resources—troops and equipment—are essentially fixed at the onset of battle. His plans and training must be perfected and he must use time and terrain to reduce the odds against him.

He uses time by seeing the enemy deep and determining where to apply all his assets at the precise time to win the battle. He uses terrain to enhance combat power by blocking, delaying, and destroying the enemy while overcoming obstacles and moving his own force. Whether the combined arms team with its combat engineer can sufficiently achieve these effects is critical to winning.

This is what Mobility-Countermobility-Survivability (M-CM-S) is all about. It is essential to battle success and ensuring its understanding and use is the primary job of the combat engineer in the combined arms team.

The business of M-CM-S in the Airland Battle was the topic of the April 8-9 Systems Program Review held at Fort Belvoir. About 150 participants representing a broad cross section of the Army's decision makers in the U.S. and abroad, both active and reserve components, and the Marines and Air Force, reviewed the current and future status of M-CM-S. Only those M-CM-S tasks forward of the corps rear boundry were addressed. Certain engineer functions such as water and power generation were excluded from review so that the scope could be limited to combat tasks.

Three fundamental points emerged: First, M-CM-S is a total combined arms job—while the combat engineers are key to achieving M-CM-S, they cannot and should not do it alone. Secondly, the entire team needs the integrated concepts, doctrine, and training to achieve M-CM-S on the battlefield through well defined and rehearsed battle drills to breach or cross mines and obstacles in stride, create obstacles, and dig in for increased battle position survivability. Finally, the hardware to support these tasks must be compatible with the systems being supported. It must be mobile, efficient, survivable, and deployable, and it must be developed systemically based on concepts and doctrine to solve the M-CM-S tasks.

The commander's skill in fighting the Airland Battle is the key to winning wherever the enemy uses Soviet-style tactics. These tactics are based on three fundamental concepts: mass, momentum, and continuous combat. His operative notion is to break through quickly and collapse the defender's system of defense. Alternatively, he uses suprise, which he may substitute for mass, but either tactic depends heavily upon maneuver. Those tactics coupled with a numerically superior enemy demands that we see him early and attack deep into his follow-on echelons to wrest the initiative from him and retain it to win.

As analyzed by Gen. Donn A. Starry's "Extending the Battlefield" article in the March 1981 *Military Review*, this extension of the battlefield deep into the enemy rear means that we must simultaneously engage both the assault and the follow-on echelons. In doing so, we disrupt his timing, frustrate his plans, and complicate his command and control.

The battlefield must also be extended in time—the commander develops his plans to ensure the close-in battle can be won decisively.

Lastly, the battle is extended to higher level resources which the commander uses to complement his own assets to win. These resources include all higher level army and other service acquisition and attack capabilities.

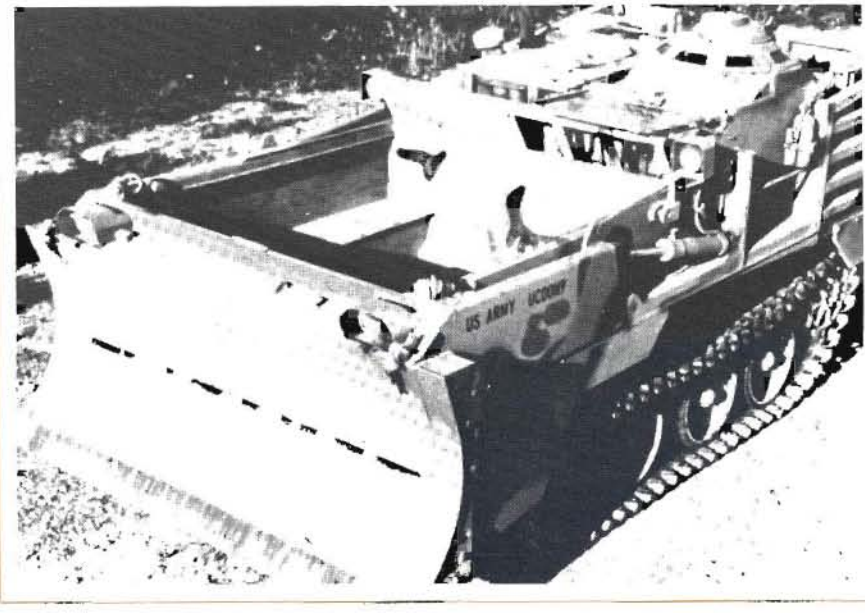
All of this, then, means that the battle must be fought more deeply—in place, in time, and in resources—than now forseen by our current doctrine. Our doctrine must be defined to cope not only with depth but with the entire range of conventional, nuclear, and chemical warfare.

Certain requirements are fundamental to this battle. To delay, disrupt, and destroy the enemy's follow-on echelons, we must **see deep** and maximize our interdiction efforts through all available means. At the same time, we must **move fast** against the assault echelons and **strike them quickly**—they cannot be permitted to achieve their objective. Lastly, the opening fight against these assault and follow-on echelons must be finished rapidly.

Mobility, countermobility and survivability are clearly key to these Airland Battle requirements. Without mobility on that battlefield, we cannot move or maneuver our forces with sufficient speed to destroy the overwhelming numbers facing us. And we must block, disrupt, and slow the enemy—hence the countermobility need. Lastly, to meet the first blow and survive to win, we need to dig in to protect our high value resources. Each of these hinges upon altering the terrain to our benefit, and so basic to all is the need for continuous and accurate terrain analysis.

The M-CM-S battlefield tasks may be divided functionally as follows: mobility is composed of countermine, counterobstacle, and gap crossing; countermobility of mine warfare and obstacle development; and survivability the provision of fighting/protective positions through digging and overhead cover. Each of these tasks needs to be accomplished by the application of systems to do the job—systems which stem from the integration of concepts and doctrine with soldiers drilled in the task and using hardware designed to the requirement.

Countermines. The threat use of mines to disrupt and delay our maneuver elements and logistic support will be widespread and continuous. We can expect mines throughout our operational area—from forward of the front line of troops to all the way into our rear areas. Additionally, our own use of scatterable mines may well require the commander to move through or near his own minefields. With the critical importance of maintaining our mobility in the Airland Battle, it is absolutely essential that we have an effective countermine detection and neutralization system. In countermine concepts and doctrine, the critical questions today are the extent to which the non-engineer members of the combined arms team should be capable of breaching minefields, and what percentage of assured neutralization is needed. In this as well as the other M-CM-S tasks, we need combined arms team battle drill techniques for breaching minefields in stride. Organization and force structure, training and materiel all hinge upon this requirement.



M9ACE

The highly mobile, highly survivable, combat engineers' **A**rmored **C**ombat **E**arthmover advances with the maneuver force, performing tasks across the entire M-CM-S spectrum.

The countermine capability fielded today is essentially unchanged from World War II. It is too slow and vulnerable to fire. The only detection and breaching capability with reasonable speed close to being available now is the mine roller, which, while effective now on our M-60s, may prove extremely effective when mounted on the front of the far more powerful Abrams tank. While this item is helpful, no one device will do the entire job. Hardware must be designed as an integrated system based on the concepts and tactics of the drill. For stand off breaching, there are two explosive devices which have been developed—the surface launched fuel air explosive mine detonation system (SLUFAE) and the mine clearing line charge (MICLIC). Complementary items which round out a countermine hardware system set are the plow and clear lane proofing systems for proofing, and the combat lane and hand emplaced marking devices. In development with significant promise of contributing to the light infantry needs is the POMINS—a man portable mine and light obstacle neutralizer. Still to be solved is the vexing problem of a remote minefield detection capability—one of the most important and difficult technological challenges facing our army today.

"We must move fast against the assault . . . They cannot be permitted to achieve their objective"

Counterobstacles. Here, as in countermine, the critical need to move quickly and without delay on the extended battlefield demands an ability in the combined arms team to breach and clear obstacles in stride. While the offensively oriented threat forces are not expected to make a great deal of use of prepared obstacles, the havoc of war on the integrated, conventional, nuclear and chemical battlefield will sever roads and render large areas of terrain all but impassable through contamination, tree blow down, and rubbling. Again, we need battle drills taught and practiced by the combined arms team to move rapidly through these obstacles. No delays can be permitted if we are to destroy the assault echelons quickly and penetrate to attack deep.

Counterobstacle tasks are similar to countermine—they include reconnaissance, detection and neutralization. Time is key and obstacles must be reduced under fire. Currently we have the Combat Engineer Vehicle (CEV) for this, although only a very few in each division area. With the addition of the M9 Armored Combat Earthmover to the force, we will have a significantly more mobile and survivable capability. Looking to the future, an improved—more powerful—CEV will help in the near term. Further along, there is a need for a dedicated Counter Obstacle Vehicle (COV) which can move and survive with the maneuver elements and remove or clear battlefield obstacles.

Gap Crossing. The tasks in gap crossing depend upon the nature of the gap—whether wet or dry—its width, the access and egress conditions, and the local battle condition. This last is critical, for a crossing under fire affects the speed of installation and dicates how survivable the crossing system and its installers must be. The nature of our combat materiel in the maneuver elements—its extremely limited fordability or swim capability—forces us to use crossing means to carry the heavy combat elements forward.

Again, the task of gap crossing is one that lends itself to combined arms drills. These need to be fixed and taught, and the supporting materiel altered or designed to fit the requirement. While much of our rafting and bridging materiel is excellent, the greatest equipment problem facing us in the future is that of the assault crossing for both light and heavy forces. It is a problem without a quick fix. The light forces need a mobile and strategically deployable wet and dry gap crossing capability which is survivable under battle conditions. Additionally, a more survivable assault wet crossing capability (probably using ferries on broad frontages) is needed for the heavy forces. It may be that an improved Mobile Assault Bridge or a modified ribbon bridge can fill this role. Finally, for the future, there appears to be a need for improved bridge mobility, which can be obtained through upgrading our current AVLB fleet, eventually going to the M1 chassis for AVLBs, and research and development to provide a method for longer and quicker dry gap crossing.

Through all the gap crossing task areas we need to continuously analyze whether we have sufficient means based on the Airland concept. Our assests now tend to keep our forces canalized in assault crossings rather than spread across a wide front at multiple crossing sites. We cannot afford the probable damage the enemy can inflict due to this "necking down" of maneuver elements at gaps to be crossed. Our entire range of combat equipment lacks an acceptable across-the-board swim capability. This forces us to have wet and dry gap crossing systems to supplement mobility. Additionally, the class load limit of our materiel is being pushed gradually upwards, which, if it continues, will overload not only most civilian bridges but all the fixed bridges in the inventory.

Mine Warfare. The interdiction, delay and disruption of the follow-on threat echelons is fundamental to success in the Airland Battle. One technology which makes this possible is the advent of the dynamic, remotely scatterable mine. Whether fused conventionally, magnetically, or in some other fashion, and whether preprogrammed to self destruct or not, this capability is key to the disruption of enemy mobility. Conceptually, the entire arena of these new mines poses significant questions. Should they be marked, reported, or otherwise controlled? Who has placement authority? How do these questions apply to self-destruct versus conventional mines? What percentage should be placed by artillery? By air? By ground system? All of this is the subject of ongoing work to develop an approved mine warfare concept. Crucial to the use of mines is speed and proper site selection.

Our currently fielded emplacement techniques are slow and labor-intensive. Conventional mines are heavy and logistically burdensome for transport and storage. Marking and recording systems need to be fast and simple, and responsive to the maneuver commander's need to know.

The new artillery and air delivered mine systems—the RAAMS, ADAM and GATOR—will be key tools in the Airland Battle. They make deep interdiction possible and are fundamentally important to how we must fight. It is important, however, that we do not overload these valuable delivery systems with close-in mine warefare missions which can otherwise be accomplished. Other ground based mining mechanisms such as the Ground Emplaced Mine Scattering System (GEMSS) and the Modular Pack Mine System (MOPMS) need to be fielded. For the future, we need an improved conventional mining capability and a universal mine dispensing system which can be mounted for employment on air or land transport. Lastly, and very significant to both our own mobility and countermobility functions is the control and integration system requirement for mines as well as other obstacles, which must emphasize "real time" reporting and mesh with command and control systems being fielded.

Like mine warfare, the tasks of obstacle development include emplacement, execution, and recording. Obstacles can be created in many ways using explosive or mechanical means. The development of obstacles and use of mines to delay and disrupt the enemy's assault echelons so we can absorb his first blow and hold him in the planned target areas—thus extending time—is fundamental to the Airland battle. Today's obstacle execution is also slow and labor intensive. Explosive cratering or excavation is often difficult to control. Non-explosive excavation by earthmoving equipment is slow and must be done with equipment which today lacks battlefield mobility and survivability. Also available are the aging atomic demolitions (ADM), subject to the entire array of political constraints, maintenance and training headaches, and deployment difficulties. The entire question of the applicability of our current ADM is under study.

Conventional explosive technology offers the best near-term solution to the effective quick execution of obstacles. The combination of inert components into a powerful blasting slurry—blasting agent, XM268 — provides an explosive with 1½ times the excavating energy of TNT. By preemplacing underground pipes horizontal to the ground surface, large antitank ditches may be created quickly by filling the pipes with blasting agent and detonating. This greatly reduces manpower requirements and produces fast results. Other agents, such as nitro-methane, are also under study. For point obstacles, such as cratering roads, the M180 cratering charge is a valuable tool. It is being fielded.

Non-explosive obstacle digging will be improved with the survivable M9 which can move with the maneuver elements. For the future, the M9, as well as the entire range of explosive technology, will greatly improve our ability for quick obstacle emplacement.

Survivability. The mass, momentum and surprise of the opening threat strike must be absorbed. To absorb this first blow, our fighting elements must be protected so that they can destroy the assault echelons, counterattack decisively, and move to the offense. To a greater or lesser degree, almost every element of our force in the Airland Battle must be protected—decisive for this is the question of who digs in the force, and, admitting a limited digging capability, who will be dug in first? Competing requirements for digging include our maneuver elements prior to the first day of battle, the fire support elements, and command and control centers. To the rear, logistic support also has a critical need. Whether a digging capability should be organic to all or a part of the



Symbol of the 1981 Systems Program Review

combined arms team or centralized in the engineer elements is a derivative question. The fact that emerges clearly, however, is that our digging capability must have a compatible mobility with the maneuver elements—it must be there when needed. There will be no time to wait. While the current D7 bulldozers and JD410 backhoes are excellent diggers, they have neither the mobility nor the survivability to do the job in the main battle area or covering force area. Here we need a mobile and survivable digger—the M9 ACE. For smaller emplacements, especially for our light force, the Small emplacement Excavator is needed.

The preeminent need which runs through all the M-CM-S tasks is that the executing force must have speed, survivability and deployment capability. These are fundamental requirements for any combined arms team member. Additionally, combined arms battle drills must be written, taught, and drilled on if we are to do the especially tough jobs of countermine, counterobstacle, and gap crossing—under fire. These battle tasks cannot be viewed as solely the realm of the combat engineer. While the engineer member of the combined arms team remains the commander's principal executor and advisor, he cannot do the job alone. These are tasks for the entire team, and without the team approach of practicing and training together we will not be able to move, block the enemy, nor survive to win on the battlefield. We must retain mobility to fight outnumbered and win. We must see deep and delay, disrupt, canalize, and block the follow-on echelons early by all means available, and we must be capable of absorbing and holding the assault and finishing the fight if we are to defeat the assault echelons. This requires a total integration of combat power and demands that we achieve mobility, countermobility and survivability in the Airland Battle.

THE 36TH ENGINEER GROUP



by Col. Frederick E. Bittl

The 36th Engineer Group (Combat), now located at Fort Benning, Georgia, was organized over forty-seven years ago, and fought with distinction in World War II, and the Korean War. Constituted on 1 October 1933 in the Regular Army as the 36th Engineers, it was activated at Plattsburg, New York on 1 June 1941. It was redesignated as the 36th Engineer Combat Regiment on 1 August 1942, and after undergoing several reorganizations, was finally redesignated as Headquarters and Headquarters Company, 36th Engineer Group.

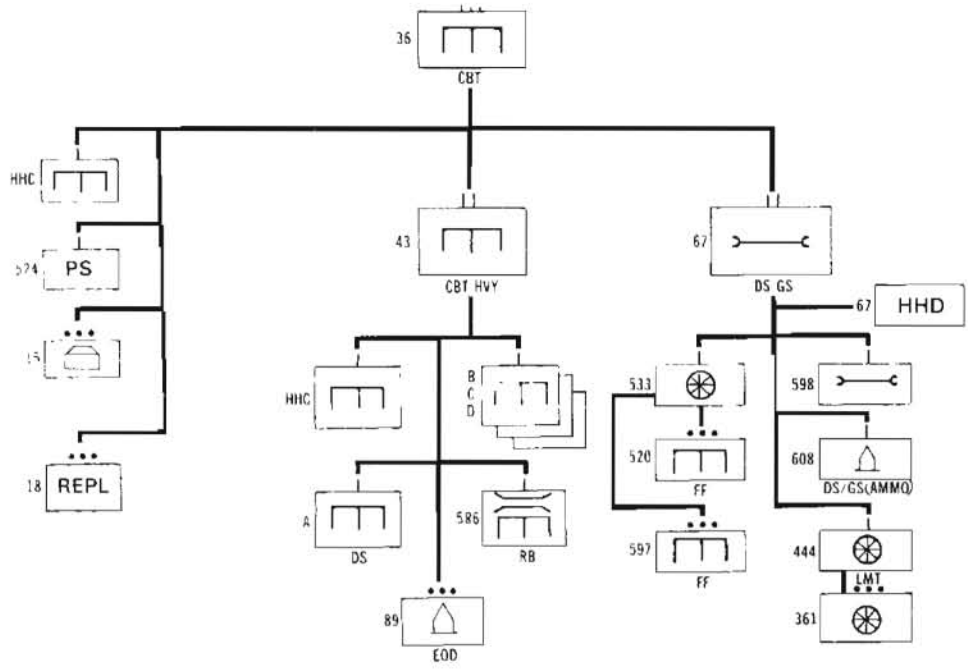
Members of the 36th Engineer Group boast of their unit being one of the first engineer units to train in amphibious tactics. A seahorse on a red and white shield constitutes the unit's distinctive insignia, and is worn proudly by the Group's members, proclaiming to the world the prowess demonstrated during the many amphibious assault landings made by members of the 36th Engineer Regiment in European Campaigns of World War II. The Group's colors carry nineteen battle streamers with five bronze arrowheads representing five amphibious assault landings.

During World War II, the unit performed all types of combat engineering and was committed as Infantry on several occasions. It helped take the Army into North Africa in November 1942, and operated invasion ports. In July 1943, the 36th went into Sicily with General Patton's Seventh Army. With Sicily conquered, General Clark wanted the 36th assigned as a corps combat regiment with the Fifth Army for the Italian Campaign. At Salerno they were in the line fighting off the counterattack, which the Germans openly boasted would throw us back into the sea. They bridged the Volturno at a place they called the Boresight Bend, as the Germans in the hills were looking right down their rifle barrels at them. At Anzio, for fifty consecutive days, the 36th was committed as Infantry, and held a 7-mile sector of front line around the beach head. The Germans started calling them the Little Seahorse Division, because through some oversight in the War Department, this engineer unit was still wearing a seahorse shoulder patch which was adopted during its amphibious training period. General Mark Clark's recommendation for the award of Combat Infantry badges to the men of the 36th was turned down because of the War Department policy restricting the award solely to Infantrymen. However, General Clark wrote the 36th a farewell letter when it sailed for France. He wrote, "The record which you have established with it (the Fifth Army) since D-Day at Salerno, is indeed an enviable one. During the crucial days on the beaches in September (1943), during the advance to Naples, to the Volturno, and to the enemy's mountainous winter line, you comported yourselves in accordance with the very finest traditions of the Corps of Engineers."

It was the 36th Engineers who helped put the Seventh Army into Southern France, and when the Seventh Army sped north from Marseilles, the 36th collected its arsenal and went along. By the time the Seventh was moving through the Rambervillers Sector, the 36th was in the line again, fighting as Infantry, a sight to behold. Not being officially Infantry, the 36th was free to choose its own weapons, American or captured German. Its heavy-weapons section carried every kind of "Shooting Iron" except field artillery. On New Year's Day 1945, it assembled as Infantry on two-hours notice to meet the German attack in Alsace-Lorraine.

The 36th never made it to the Pacific during World War II, but it did arrive in Pusan in October 1950 at the beginning of the Korean Campaign. While assigned to the IX Corps, the Group fought the toughest foe in its history—the Korean weather. Road construction and maintenance in the corps area were the primary mission, and their accomplishment was obstructed continuously by the elements. In the winter of 1951-1952, new roads and bridges were built through rugged mountainous terrain. Equipment and men were punished severely by the sub-zero temperatures and frozen ground. In November 1951, the units of the 36th Engineer Group carried assault troops across the Pusan River, built 1,236 feet of treadway bridge, punched 6-miles through rough mountainous terrain, and transported tons of supplies by water to insure the success of the operation.

The 36th Engineers served continuously in Korea from their arrival in Pusan in October 1950, until May 1972 when the unit's colors were returned to the United States. For its service in Korea, the 36th Engineers received the Republic



of Korea Presidential Unit Citation, and two awards of the Meritorious Unit Commendation.

The 36th Engineer Group (Combat) was reactivated 1 July 1973 at Fort Benning. It is quite ironic that this engineer unit, which spent so many days fighting as Infantry, should be assigned to Fort Benning—The Home of the Infantry.

The peace-time mission of the Group, briefly stated, is to support the US Army Infantry School and Center, and to be prepared to commit forces in support of the Unit's contingency mission. On the surface this seems to be a rather simple, straight-forward mission until we look at the Group's extraordinary organization. Extraordinary, in that approximately only 50% of its assigned personnel are Engineer soldiers and that the Group has Engineer, Ordnance, Transportation, Adjutant General, and Finance units assigned. Support of the Infantry School and Center involves all aspects, including operating a replacement detachment, finance operations, ammunition handling and transportation, maintenance, construction, and the 89th Ordnance Detachment even provides assistance to the Secret Service in protecting the President of the United States.

The 43rd Engineer Battalion, the only engineer battalion assigned to the Group, has provided considerable construction efforts to the Center over the last year. Major construction projects of the battalion include the construction of a sub-caliber tank range, a mechanized infantry assault training course, a military operations in urban terrain (MOUT) site, and a 4,000 foot assault landing strip. In addition to its organic organization, the 43rd has the 89th Ordnance Detachment, and the 586th Engineer Company (ARB) attached. The 89th Ordnance has the responsibility for providing Explosive Ordnance disposal in the southeastern portion of the United States. It has been called upon on numerous occasions to assist the Secret Service in providing security for visiting dignitaries.

The 586th Engineer Company, which is equipped with the Ribbon Bridge, is very active in keeping itself Combat Ready and ready for deployment. The 586th is a shining example of a highly trained and motivated unit. It is not unusual to find it "on the road" traveling to Fort Bragg or to Fort Campbell to support training or to participate in FTX's.

The units of the 67th Maintenance Battalion provide support not only to units of the Group, but the 598th Maintenance Company provides vehicle, small arms, and electronic maintenance support to other units and commands on Fort Benning. The 444th Light Truck Company performs all of the ammunition hauling in support of the Infantry School. The 608th Ordnance Company (Ammunition) provides support to the Directorate of Industrial Operations for operation of the Fort Benning Ammunition Supply Installation. The 67th is also in the fire fighting business in that it has two attached Fire Fighting Detachments who provide support for the Ranger Camp in Florida.

As difficult as the day-to-day missions are in support of the Center, planning and conducting training in preparation to meet the wartime missions are certainly more difficult due to the varied units assigned. Imagine, the Group must, on its own, plan and conduct eight separate and different company ARTEPs and assist in two battalion ARTEPs. As FORSCOM units, quarterly FTXs are required of each unit, weapons qualification, EDREs, and NBC training must be conducted without interfering with the vital support to the Infantry Center.

New Countermine Capabilities Emerging in 1980's

by Maj Marion C. Miller

Editor's Note: The entire countermine function—from doctrine through hardware and tactics—has been undergoing an intensive review by the whole combined arms team. Launched by the recent Mobility-Countermobility-Survivability Systems Program Review at Fort Belvoir, we engineers along with the armor and infantry are systemically examining what countermine tasks need to be done on the battlefield. This article addresses a number of hardware items each tailored to some specific tasks. Lacking is the overall systemic grouping—perhaps, extending one's mind—one machine, robotically controlled, which can detect, neutralize, clear, proof and mark a minefield—all in one! In August of this year, the Engineer School launched a telescoped two to three year effort to field such a countermine first generation system. Progress will be reported in detail in subsequent issues.

The radio cracked as the message came across. "Two one, we've hit a minefield enroute to Checkpoint Delta. Estimated depth—80 meters. Lost one track. No casualties. Request further instructions."

The commander realizes the unit has no other alternative but to breach the minefield. Bypassing it in that area would delay him still further. Luckily the minefield is not under direct enemy fire. He gives the order to breach.

At Checkpoint Delta, the platoon leader puts his APC's and support tanks in defilade positions to provide covering fire if necessary. He then organizes his men to breach a lane in the minefield. Out comes the tools of the trade: the ANPSS-11/ANPRS-7 handheld detectors, bayonets and hand probes, and TNT/C-4 to detonate the mines in place. Only two hours later does the call come, "Two one, lane cleared and marked. Prepared to move out."

The Korean War, 1952? . . . Minefield breaching operations characterized by slow, dangerous, labor-intensive work? No, this is the year nineteen-hundred and eighty-one! This brief situation characterizes the current fielded state-of-the-art in minefield detection/breaching in the US Army today. (The Army does have some explosive line charges but they are very limited in number, remain in stateside storage, and units are not training with them. These include approximately 550 serviceable M157 (Diamond Lil) rigid, tank-pushed, line charges and 360 rocket-propelled, sled-mounted M173 line charges.)

It is a well-recognized fact that the Army's countermine capability in the field has been relatively unchanged since the Second World War. However, as this article will point out, we are not in as bad a shape as one may believe. A number of new items will 'graduate' from the development school R&D over the next few years, which will significantly upgrade our capabilities. The real question, though, is whether the Army will fund full-scale production of these countermine items, as they compete with everything from the M1 tank to night vision goggles for limited procurement dollars.

This article will look at those new countermine systems capable of being in the field in the 1980's which would support the new Army 86 force structure, which by the way was very aptly described in the June 1981 issue of ARMY Magazine. After discussing the characteristics of each system, we will look at the same minefield obstacle problem to see how the 1986 commander might then handle it.

Figure 1 tabulates the hardware by acronym as to capability (detect/neutralize) and development status. "Advanced" is merely a special category to indicate that certain systems are far enough along in development that they could be fielded in an expedited manner should a national emergency or a declaration of war occur. A system "splitting the line" exhibits both a detect and a neutralization capability.

A major short term improvement in detection has been in upgrading the capabilities of the AN/PRS-7, hand mine detector, however, the AN/PRS-7 was designed as both a metallic and non-metallic mine detector. However, a product improvement was initiated to correct an operational deficiency in identifying non-metallic mines in arid soil conditions. The improved PRS-7 (designated the AN/PRS-8) has increased non-metallic detector rates in tests from 8% to greater than 83% in dry soils. Other human engineering system improvements include the addition of a metronome pacing signal to set the optimum sweep rate, a chest strap for distributing the weight to reduce operator fatigue, and more distinctive audio "Clicks" to assist in mine identification. Over a 31 month period beginning later this year, a recall will be initiated to retrofit the AN/PRS-7 in the field and rename it the AN/PRS-8.

The only new item in mine detection scheduled for fielding in the 1980's is the ANVRS-5, vehicle-mounted road mine detector. It is designed to fit on the front of any standard army vehicle from a ¼ ton jeep up to an M113.

The device is principally designed for use over roads, but can also be used over flat, sparsely vegetated terrain. The device can be used at speeds of 5-8 mph, (considerably faster than the

	DETECT	NEUTRALIZE
Fielded	AN PRS-7/8 AN PSS-11	Bangalore M157 M 1 7 3
ADVANCED DEVELOPMENT	ANVRS-5	SLUFAE MICLIC POMINS ROLLER VEMASID
EXPLORATORY DEVELOPMENT		CLEWP TW-PLOW FW-PLOW DOZER

Figure 1. 1981 Countermine Program Status

hand-held detectors), over a width of 6-11 feet. Once a mine is detected, the system gives off both an audio alarm as well as provides a visual indication on a video-screen of the mine's exact location under the antennae search heads. The vehicle operator must stop when he hears the audio alarm. Once detected, the mine then must be neutralized or bypassed. The system uses the latest microwave and microprocessor technology. It also represents a major technological breakthrough in that it can detect both metallic and plastic mines with a low false alarm rate. The ANVRS-5 will be issued to engineer, armor, infantry and field artillery units on the basis of 2 per battalion, one per separate company. It should reach the field by 1985.

Mine Neutralization

By the spring of 1982, the first Track-Width Mine Rollers will be arriving in Europe to upgrade the mine neutralization capability of armor units. An additional 80 are scheduled to be procured in 1983 also for Europe. The Mine Roller will give tank units, for the first time, an organic capability to breach a minefield. The Roller, mated to an M60, is designed to survive the blast effects of the least two consecutive anti-tank mines, each containing up to 25 pounds of high explosives.

Under battle conditions it can be mounted on the tank in less than 15 minutes and released remotely from within the tank in less than 30 seconds. At a breaching speed of 10 mph, it is 90% effective in neutralizing single impulse pressure type mines. The Mine Roller will be issued 3 to a tank battalion.

Fielding the Surface Launched Unit Fuel-Air Explosive (SLUFAE) in 1986 will provide the Army with a significant new countermine option. Field units will have the capability to create a breach of a known mine field from a stand off distance of more than one-half mile. Intended primarily for assault breaching of defended enemy minefields, it is the only minefield breaching system in the world with such a standoff capability. With SLUFAE, the minefield can be breached while the combined arms task force is moving rapidly forward to exploit the breach.

SLUFAE consists of a 30-tube launcher, mounted on an M548 full-tracked cargo carrier. A Resupply Vehicle (RV) with on-board crane is, used to load the rockets and supports the system. The fuel air rockets can be fired individually or in ripples from concealed positions in all types of weather during daylight or darkness.

All Operational and Development testing on SLUFAE was completed in 1980. However, the Army has delayed production funding for the system until 1984. SLUFAE launchers will be issued two per engineer company in armor, and mechanized divisions.

By 1985 the Army will have a trailer-mounted, Mine Clearing Line Charge (MICLIC), which will be used to complement the SLUFAE system in breaching minefields where standoff distances are not required. Once a minefield is encountered, the MICLIC is pulled forward behind a tank or armored personnel carrier to within abouit 50 meters of the edge of the minefield. The line charge is then fired over the combat vehicle, creating a breach 100 meters long by 8 meters wide, while the crew remains buttoned up within the vehicle. If a longer breach is required, a second MICLIC is pulled forward and fired from within the breached lane. The trailer can be released on the spot or dropped at a preselected position for recovery and reloading.

The current line charge under evaluation to meet the Army's MICLIC requirement is the Marine Corps M58A1 trailer-mounted line charge. The MICLIC will be issued two trailers per engineer company in divisions, separate brigades, armored cavalry regiments and corps.

In order to counter the potential threat posed by magnetic impulse fuzed mines, the Army will field the Vehicle Magnetic Signature Duplicator (VEMASID) in. The VEMASID is an easily attachable/detachable coil device which can be mounted on selected combat tracked vehicles such as the M113, M60, CEV, IFV, CFV and the M1. The system is designed to project a magnetic field forward of the vehicle. This magnetic field resembles a tank-like signature, thereby harmlessly exploding any magnetic mines before being encountered by the vehicle.

The VEMASID system can be used with other mine countermeasures, such as the mine roller and track width mine plows, to provide the capability to defeat all type mines. Even though the Soviet Union and Warsaw Pact countries have no known magnetic mines, the technology for development is

readily available. At least three foreign countries are selling magnetic mines on the international arms market. Furthermore, US scatterable mines are also magnetic. The proposed basis of issue for VEMASID is one per CEV plus one per platoon engineer, armor, and mech infantry units.

A final system in advanced development is the Portable Mine Neutralization System (POMINS). It is used to neutralize antipersonnel (AP) mines, booby traps, and wire obstacles for the dismounted combat soldier. The system, weighing 58 pounds, is back-packed by a single man and is primarily designed for ground attack of bunkers and strong points by light forces. It can be set up and fired in less than a minute and clears a path 0.6 meters wide by 25 meters long. Soldiers can then quickly move through the breach and continue forward to attack positions on the far side of the obstacle.

Additional systems in exploratory development should also be mentioned. These systems are all geared to providing armored units with additional organic minefield breaching capabilities. This is important on the extended battlefield, especially in cases where engineer support may not be readily available in a fluid encounter.

Several specific items are being developed for potential use and adoption to the M1 main battle tank. These include a Track-Width (TW) Mine Plow and a Full-Width (FW) Dozer Blade. A special "universal" adaptor s also being developed so that all these hardware items can be attached to the M1 at the same existing hardpoints on the M1 glacis.

The Track-Width Mine Plow is a relatively light weight system designed to be carried on the tank at all times. It is capable of physically extracting, neutralizing and removing land mines or booby traps located on the surface or buried in 4 to 6 inches of soil. The easily identifiable cleared path can then be followed by other follow-on assault vehicles. A "dog bone" and chain assembly activates any tilt rod mines located between the tracks. The Plow can be raised or lowered from within the tank.

There are currently no plans to field the Track-Width Plow for any combat vehicle other than the M1 and the CEV. Use of the Mine Plow will give maneuver units the organic capability to breach known minefields as well as chance-encountered scatterable surface-laid mines without significant difficulty of loss of momentum. The Plow will be used in attacks on enemy positions which are known suspected to be protected by minefields, in armor thrusts or pursuit deep into enemy areas where minefields are known or expected to exist, and when scatterable mines are a probable threat. The TW Plow could be in the field by 1986 on the basis of one per armor platoon.

The Full-Width Plow is a relatively new developmental item. Its principle design requirements are to be light in weight, not obstruct the operator's vision in a carry or operational mode, and be capable of principally pushing aside light/surface rubble and surface-laid or scatterable surface mines. Any digging capability will be minimal.

The Full-Width Dozer Blade is being modeled after a foreign developmental item and could also reach the field by 1988. It will provide a digging and leveling capability to allow the M1 to go places it cannot not go, or to take better advantage of the terrain. It is envisioned that the dozer blade would be attached to an M1 on a mission basis only and issued one per armor company. The dozer blade can be used to breach tank ditches, natural terrain obstacles, battlefield rubble, and minefields. With its digging capability, it can also construct defilade or defensive positions.

All four of these M1 hardware attachments are being developed as a one-of-a-kind item to determine their compatibility with the M1. Based upon test results during 1982, decisions will be made as to what further design modifications need to be made and which hardware items should be further developed for the M1.

A final neutralization system which could be fielded by 1986 is the Cleared Lane Explosive Widening and Proofing (CLEWP) charge. The system being considered was developed by a foreign government and uses an explosive line charge, mounted on the rear of the breaching armored vehicle. It is designed to be used with the Track-Width Mine Plow or Mine Roller. As the breaching vehicle approaches the near edge of the minefield, the lid of the explosive container is ejected. The explosive line charge is attached to the lid, which serves as an anchor, and is unraveled as the vehicle proceeds throught the minefield. When fully extended, the charge is then detonated, thereby widening the initial breach and proofing it.
The CLEWP system is an important new capability that the US does not currently possess. The advantage of this system over rocket propelled line charges is that it can be accurately emplaced in the exact breach lane of the initial assault vehicle in a continuous forward movement mode. CLEWP will be a Class V ammunition item to be used by engineer, armor, and armored cavalry units.

That concludes the possible graduating systems which could reach the field in the 1980's. So, let's now see how our platoon leader now tackles the minefield at Checkpoint Delta.

The year is 1986. As he is not under fire, the platoon leader elects to breach one lane with a MICLIC while other lanes are made by assault vehicles mounted with Rollers/Plows/VEMASID and CLEWP attached to widen and proof the breaches. Ten minutes later comes the call, "Two one, lanes cleared and marked. Prepared to move out."

If the platoon had been under fire, the platoon leader would first call for smoke and counterbattery fires to deceive the threat and decrease the threat's ability to use remotely delivered scatterable mines to reinforce the mined area. Then he would proceed with the breaching operation as before.

Let's look at one more situation to emphasize our new flexibility and system capabilities. The unit has so far been able to bypass all known minefields. But now at Checkpoint Charlie, scatterable mines, previously undetected or recently delivered, are suddenly encountered.

If this were 1981, the leaders options would again be to bypass, bull through, or methodically clear lanes by hand. But since this is 1986, he has his lead elements organized and outfitted with organic, close range minefield breaching systems such as Rollers, Plows, CLEWP and VEMASID, just in case such unexpected or undetected mines were encountered. Counterbattery fire is immediately initiated so suppress delivery of additional mines, and smoke is employed to both deceive the threat and defeat his target acquisition systems. An assault breach is initiated by quickly clearing lanes with Track-Width Plows and Tanks with Rollers and CLEWP attached. The remaining combat vehicles follow rapidly through the breached lanes. The chance-encounter minefield thus no longer creates a significant obstacle to force momentum.

This brief summary has highlighted the Army's emerging countermine systems in the 1980's. Fielding these added capabilities will allow our force structure to move, fight, and win on the extended battlefield.

There are many other exciting developmental items and ideas in R&D, with such "catchy" titles and WAND, AMIDS, MIDURA and Super Serpent. As ideas and technology combine to take a more definitive shape in the future, you will hear more of them.

Persons or organizations interested in obtaining additional information on the Army countermine systems, should contact the Directorate of Combat Developments, USAES Ft Belvoir, VA 22060.

Engineers at Yorktown

The last great battle for American independence

Reprinted with permission from The Military Engineer

by James N. Hasket

Though crude by today's standards, the warfare of the American Revolution relied as heavily upon the military engineer's expertise as does contemporary combat. The campaign leading up to the seige of Yorktown, Virginia, in 1781 offered the greatest challenge to the engineers of all the armies. They were called upon to support extensive and complex troop movements and then to direct both defensive and siege operations. Whether they were French, British, or American, their energies and skills would be taxed to the fullest before the hostilities ended.

The burden of responsibility was disproportionate to the number of individuals upon whom it was placed. For in the 18th Century the title of Engineer was not casually bestowed. Of the 25,000 men engaged at Yorktown, less than two dozen were so designated. They truly represented an elite group.

Opening the campaign

In the late summer of 1781, Lord Cornwallis' British Army seized the ports of York and Gloucester on the York River in Virginia. These were located at a narrow point in the river where a British fleet could anchor ships well protected by shore batteries. Fortifications were quickly begun at Gloucester and somewhat more leisurely at Yorktown. Cornwallis had abandoned his position in the Carolinas and moved to Virginia in the spring. Here he assumed command of a force already raiding in Virginia and consolidated it with his own. Throughout late spring and early summer, his force destroyed military supplies and installations throughout eastern Virginia. His raids were hampered somewhat by a small force under th Marquis de Lafayette, who was sent to Virginia by Washington.

Washington, though cherishing the hope of recapturing New York, the site of some of his worst defeats, moved quickly when he learned that a large fleet under Admiral de Grasse was en route to the Chesapeake Bay with a sizable infantry reinforcement and badly needed funds. In co-operation with General Rochambeau commanding the French Expeditionary force, he worked out a plan of action. The combined armies feinted against the British stronghold in New York City and then moved rapidly southward to concentrate against Cornwallis.

Admiral de Grasse arrived in the Chesapeake Bay and disembarked some 3,200 troops under General St. Simon. When a British fleet under Admiral Graves arrived off the mouth of the bay, the French fleet moved out to engage them. Though the battle which followed was not decisive from a naval point of view, the French re-establishment of the blockade of the bay would prove to be. While the fleets moved southward after the battle observing each other, another French fleet under Admiral de Barras slipped into the bay. It brought from Newport, Rhode Island, the vital heavy artillery of General Rochambeau.

The blockade secure with the return of the British fleet to New York, De Grasse dispatched vessels to assist the fleet of American coastal vessels bringing Washington's and Rochambeau's armies from Head of Elk, Baltimore, and Annapolis. These forces soon began to arrive, reinforcing the troops of St. Simon and Lafayette already assembling at Williamsburg.

Since the arrival of the French fleet, Cornwallis had been working to prepare the defense of Yorktown and Gloucester. The burden of this activity fell heavily upon the British engineers. Since making the recommendations that led to the sites' selection, they had carried out a variety of assignments. This stretched thin the very small engineer unit with Cornwallis' army, which consisted of First Lieutenant Alexander Sutherland, Principal Engineer, and Second Lieutenant James Stratton,



Maj. Gen. Louis LeBegue DuPortail
Chief of Engineers 1777-1783

Practioner Engineer. As the danger increased, the detachment was augmented. On September 3, Lieutenant Chapman of the 23rd Regiment was appointed to act as an Assistant Engineer. Seventeen days later Lieutenand Dunn of the 63rd Regiment received a similar assisgnment. Dunn would later die of wounds received in the fighting, the only casualty in this group. Sutherland had arrived at Yorktown to survey the area and prepare a plan for fortifying the posts of Yorktown and Gloucester. Stratton stayed at Portsmouth to oversee its evacuation and leveling.

Spades, shovels, and pickaxes

The tools available to the approximately 8,000 troops of the British and perhaps 2,000 slave laborers represent a striking contrast to the equipment available to the modern combat engineer. An inventory taken in August of 1781 showed 400 spades and shovels, 190 pickaxes, 160 hand hatchets, 200 felling axes and 32 wheelbarrows on hand for fortification construction. The engineers would not only be faced with an area not selected with a land defense in mind and troops unaccustomed to the southern climate and diseases, but also a shortage of necessary tools.

The organization of the French and American Corps of Engineers was more unusual for its similarities than for any differences. This is due primarily to the enlistment of virtually all Corps members from the French Royal Engineers. Throughout the entire war there would be only one American serving in the American Corps of Engineer's which was commanded by Brigadier General Louis Le Begue du Portail, on leave from the French Royal Corps of Engineers. During the Seige of Yorktown there would be present three American Engineers including the commander. The French engineers would be under the over-all command of Colonel Desandrouins. However, he fell ill and had to remain at Williamsburg during the entire operation.

Upon arrival before Yorktown, the engineers of the two armies were consolidated into three divisions. Though the divisional structure was not fully adhered to in the initial stages of the action from the 9th of October forward, it was utilized with the members of the division being assigned in unit groups only.

Because the engineers were few in number, they needed support, particularly during the complex siege operations. Each army approached this problem in a different manner, though all had specialized units which could do much of the siege warfare routine.

With the exception of the pioneers and carpenters who supported the operations of the line units, the British had developed no units throughout their army capable of supporting siege operations. However, there were exceptions. While at Portsmouth, Cornwallis wrote his commanding officer that the variety of fatiguing services demanded of the pioneers obliged him to augment the detachment to a company of 50 men commanded by Captain Ebenezer Brown. Even this is confused by the orderly book entries and surrender returns. At the capitulation the pioneers listed two Captains, three Lieutenants, four Sergeants, and only 33 rank and file. Shortly before this, it was ordered that a portion of the recently enlisted pioneers were to be discharged. Whether this accounts for the high ratio of officers to men remains for more research to reveal. However, there are frequent references to the Black Pioneers. The genealogy of the British Army notes that the 33 rank and file pioneers surrendered at Yorktown were negroes and were used to form the nucleus of the First West Indian Regiment.

The French incorporated their specialized troops into their artillery regiments which consisted of two battalions composed of ten companies. One of these companies was the Sappers, used for the specialized siege activities and similar duties.

In the American Army, regulations had established several companies of Sappers and Miners composed of experienced troops trained in both the basic military skills and in the conduct of the siege. Their company grade officers were selected for their experience and background in the rediments of engineering.

The greatest difference in the various units seems to have been in their place in the organizational structure. While the British and French units were incorporated into the line organization, the Sappers and Miners of the American Army were under the direct command of the engineers. In addition to the skilled support of the specialized units, all armies used their rank and file in routine construction and siege activities. At Yorktown, the British would also use large numbers of slaves captured throughout the community on their works.

The investment of Yorktown

When their concentration at Williamsburg was complete, the Allied American and French forces marched towards Yorktown on September 28th. By evening they had swept aside any limited resistance and loosely encircled Yorktown. The next day the investment was further perfected. It was discovered on the morning of September 30th that Cornwallis had abandoned his outer works during the night and retained only the actual defenses of Yorktown, the Royal Welch Fusiliers Redoubt upstream, and Redoubts 9 and 10 downstream.

To ensure that Cornwallis would not suddenly debouch from Yorktown, the Allies reverse captured works and constructed others in a line of containment. They also located their camps in a loose circle to provide forces at any point of the perimeter if it were attacked.

From the early stages of the concentration, Washington feared that the British would cross the York River and move northward. He ordered a concentration of the Virginia Militia at this point. This force was reinforced first by the French Legion of Lauzun and then by a detachment of infantry from the fleet. Led by French General de Choisy, it then tightened its investment of the British defenses of Gloucester Point. While this sector would see minor skirmishes from this point on, it would not experience formal siege activity.



"Interesting lining on your flag here, Mister."

Preparation for the Siege of Yorktown

Through Cornwallis had eliminated the danger of a French fleet-supported waterborne flank assault and reduced the amount of work needed on his defenses, his withdrawal gave the Allies a great advantage. They could begin their assault upon his main defense line without first reducing the outer works and could also concentrate the bulk of their men and firepower in a relatively small segment of the perimeter.

The upriver section of the Allied front rested on a plateau which extended from the York River to the Yorktown Creek Marsh. The tip of this triangular high ground was controlled by the Royal Welch Fusiliers' Redoubt. The wide marsh encircled the north and west of Yorktown. From the Yorktown Creek drainage there stretched a relatively wide flat area to the York River. The latter area was accessible from a series of ravines caused by the Wormley Creek or Yorktown Creek.

Though the engineers had responsibilities for mapping the access routes into the area, laying out temporary fortifications, forwarding entrenching tools, and countless other duties, the most demanding period of their craft was ahead. This involved the planning and execution of a formal siege.

During the next few days they reconnoitered every inch of the access to Yorktown until they decided upon the best approach. This involved not only the best utilization of topography, but also the careful analysis of the British ability and desire to resist. They also defined the amount of siege materials necessary to erect fortifications and where they should be stored to best support the forthcoming operations. Their work was impatiently watched by Washington. He and General du Portail advanced to within 300 yards of the British works to obtain an estimate of the situation. Washington knew what the British were assembling a relief force in New York and that time was of the essence. While he hoped to open trenches on October 1, it would be several days later before this was possible.

It was decided that the siege lines would be opened simultaneously across the neck before the Royal Welch Fusiliers' Redoubt and from Yorktown Creek across to the York River. By the evening of October 6th, all was in readiness. The lines laid out by the engineers were marked by strips of pinewood laid end to end. the British patrols had been driven off by vigorous Allied patrols and outposts. Fifteen hundred workers with tools and trenching materials were assembled with 2,800 men under arms to be stationed nearby to protect them from a British sortie. Two engineers were assigned to the upriver sector and four to the larger downstream sector. The workers went to work with a will. The soil was soft and sandy, the night dark with a gentle rain. All seemed to favor the Allies, but the troops had to be under cover by dawn.

The British did not detect this activity to their south. However, in the upstream sector they had been warned by a French deserter. Here they kept up a heavy fire. The few casualties of this evening would occur here.

By dawn the British learned the extent of the works erected against them and opened an angry fire. However, the working parties were now under cover and protected.

From this point forward, the Allied effort would grind inexorably forward. Work party would follow work party into the trenches night and day. Those troops not working would be producing more entrenching materials or resting. Now within 800 yards of Yorktown, the Allies worked to perfect this line. Redoubts were added to house infantry supports and batteries constructed for the siege artillery. All the Allied activities were carried on with a careful eye to the nearby British. Cornwallis was known as an aggressive commander. His large force of experienced troops represented a threat at any time that he decided to attack.

The Allies had encountered difficulties in forwarding their siege artillery and Washington was not going to commit it until he could achieve fire superiority. The French completed their first battery on the afternoon of October 9th. To reward their diligence, Washington ordered the battery which was located in front of the Royal Welch Fusiliers' Redoubt to open fire at three in the afternoon. Later that afternoon, Washington fired the first round from the Grand American Battery. During the next two days the remaining batteries on the first line were opened. The Allied superiority in quality of artillery soon became obvious. The British guns fell silent as their embrasures were closed or their crews decimated. The parapets of their fortifications began to crumble; the obstructions before them were frequently breached.

Resistance weakened

With the weakening of British resistance and the urgency of capturing Cornwallis before assistance could arrive, the Allies decided to open an even closer, or second, siege line. Early on the night of October 11th, the troops began construction of the second line approximately half the distance between the first works and the British. The second line could only be erected before the French sector of the main Allied siege line because British Redoubts Nine and Ten still held out. Though in the area of French responsibility, the troops of both armies were used to expedite the action. Because of the proximity of the British, the troops were carefully selected for this duty.

The morning presented the British with a line extending from Yorktown Creek to the upper drainage of Wormley Creek in the center of the line. Because the British downstream redoubts were contiguous to the new line, an epaulement or shoulder had to be erected to at right angles to the line to protect the workers from the fire from the redoubts. The erection of the works was difficult because the British, using light mortars, reopened a very heavy fire. The French found it hard to silence the British fire due to the difficulties of firing over their own working parties. Despite short rounds, they found it necessary to keep up a continual fire to suppress the opposition's shelling. Because of the threat of British sorties, the line was quickly strengthened by redoubts. Then batteries were begun to house the guns now firing from the first line.

The continued possession of Redoubts Nine and Ten by the British thwarting their efforts, the Allies decided to reduce them by night assault. On the night of October 14th, after being assured by the engineers that the British works had been sufficiently damaged by artillery fire, the French took Redoubt Nine and the Americans captured Redoubt Ten. By morning these were incorporated into the second line now stretching from the river to the marsh.

During the next few days the troops worked to perfect the new positions. The redoubts were reversed, new batteries erected, and communications completed. There was difficulty in moving the guns forward from the first line while keeping British fire to a minimum, but it proceeded according to schedule.

Despairing of relief, Cornwallis first carried out a sortie on the early morning of the 16th. This failing to retard the Allies, he then decided to extricate his elite troops by crossing to Gloucester, overwhelming the smaller garrison there, and escaping to the north. A shortage of transport and a sudden violent storm prevented this attempt.

On the morning of October 17th, facing Allied works recently completed, with more batteries joing the bombardment, Cornwallis decided to end the useless waste of his men's lives. He requested a parley. There was an exchange of letters, and the next day commissioners met to complete the terms of surrender. The following day the British troops marched out and laid down their arms. This event, marking the surrender of one-third of the British Army in North America commanded by England's best general, was to set in motion events leading to the nation's independence.

During the siege, the demands on the engineers of all armies were monumental. The professionals of two armies trying to capture an objective; the professionals of the third army seeking to prevent this through a skilled defense. That the strain was great is illustrated by General du Portail's illness at the end of the battle which prevented him from being present during the surrender to personally receive the credit due him.

Though there are some data on the contributions of all military engineers at Yorktown, the story is far from complete. This is unfortunate because of the importance of their role there. Many intriguing clues are available. This is an encouragement to the researcher but generally answers less questions than it raises. Perhaps one of the long-reaching benefits of the Bicentenial will be the uncovering of information leading to the full story of the contributions of these men to their nations. Certainly no one can deny that this tiny handful of men, whatever the color of their uniforms, played a major role in this truly significant American campaign.

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The Engineer Solutions

Military

There are many possible solutions to this problem, depending on the tactical situation. In this solution, Corps engineer units are attached to the Division, and further attached to the Brigades and Covering Force. The mechanized divisional engineers are also attached out to the maneuver forces. This gives maneuver commanders the flexibility to further attach, or direct support (DS), engineers to subordinate commanders as deemed necessary. The habitual association of divisional engineer companies to maneuver elements was followed, except in the case of 1st Brigade. A/52d was attached to the Covering Force, based on a well defined need in the CFA. It can be assumed that once the Covering Force battle is completed, A/52d will return to 1st Brigade support.

This solution also provides for a mix of the mechanized divisional engineers and the less mobile Corps engineers. It gives maneuver commanders the haul capability of Corps engineers (56 5-ton dump trucks per battalion) and the mobility and survivability of the Division's mechanized engineers. In the case of 3d Brigade, D/502d is OPCON to C/52d to ensure coordinated engineer effort in the 3d Brigade area.

The Brigade Engineer in 1st Brigade is the commander of C/500th Engineer Combat Battalion. In 2d Brigade it would be the commander of the 502d Engineer Combat Battalion, and in 3d Brigade, it would be the commander of C/52d Engineer Battalion, the habitually associated company commander. The commander of Engineer Task Force Red would be the engineer responsible for the Covering Force engineer effort. The 500th Engineer Combat Battalion provides the headquarters element for TF Red. This headquarters would probably consist of the Battalion XO and representatives from the various staff sections. The remainder of the 500th Engineer Battalion's headquarters would remain under Division control and plan for future operations.

This solution diverts from the "norm" of Corps engineer units being DS to a Division. If the Corps Engineer Combat Battalions were DS to the Division, they would have to be employed (according to FM 5-100, Engineer Operations) in a General Support (GS) role, since a unit that is in DS cannot be further subdivided. The problem with GS (and the centralized control that it entails) is that Brigade commanders are not assured of a timely response from Corps engineers in their sectors, even though they may have a recognized need for responsive engineer effort in their area.

Another problem which arises from the DS situation above is that of logistically supporting the Corps engineers as they move forward into the division area. Since these units are still under the command of their parent Corps unit, they must obtain their logistics through Corps channels. On paper, this is no problem. On the ground, however, Corps engineer units employed in the Division area often work great distances from their parent units so logistics support becomes more difficult as the distance increases.

Attaching Corps units to the Division eliminates the logistics problem since the Corps engineer units can receive support from the Division Support Command (DISCOM). The Corps Support Command, in turn, can send a slice of its assets to the DISCOM to account for the attached units.

One could argue that once the Corps engineers are attached to the Division they should be placed in DS to the Brigades (not the Covering Force), rather than attached. This option provides more centralized control of the engineer effort within the Division area and could be an acceptable alternative, depending on the tactical situation.

Civil

If we assume Volume of Solids equals 1.0, then Volume of Voids equals Void Ratio. Using this method, Pit B is most economical.

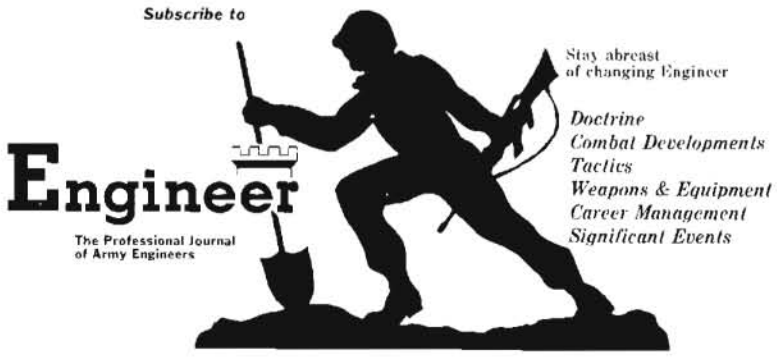
$$\text{Void Ratio} = \frac{\text{Volume of Voids}}{\text{Volume of Solids}}$$

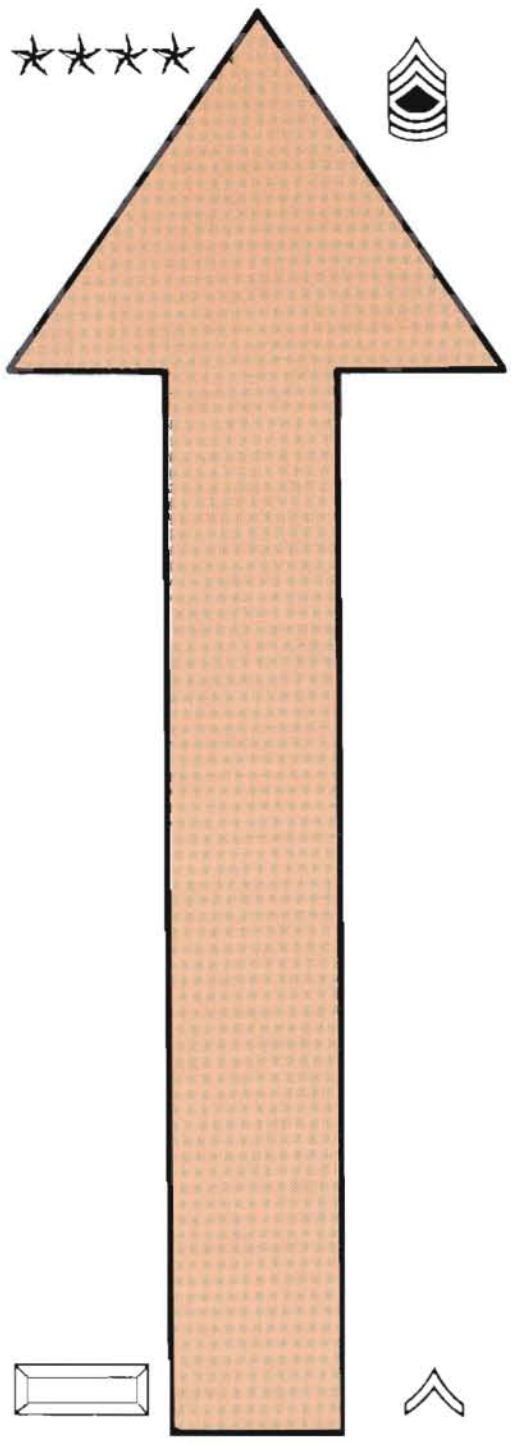
$$\text{Initial Total Volume} = 0.9 + 1.0 = 1.9$$

$$\text{Final Total Volume} = 1.7$$

$$\text{Total Cost} = \frac{1.9}{1.7} \times 4{,}500{,}000 = \$1{,}307{,}647$$

Pit A would cost $1,397,647, and Pit C would cost $1,389,706.





UPWARD MOBILITY

Special Weekend Courses for Engineers

The U.S. Army Engineer School, in cooperation with the Defense Mapping School here, conducts Special Weekend Courses for Engineer on Saturdays and Sundays. The courses are 12 hours long, and students planning to attend should have a job assignment or MOS that requires them to plan, conduct, or supervise unit training in the subject studied.

Course and course dates for fiscal year 1982 are: 3-4 Oct 81, Nuclear, Biological, and Chemical Warfare; 17-18 Oct, Medium Girder Bridge or U.S. Mine Hardware; 14-15 Nov Engineer Management or Engineers in the Offense; 9-10 Jan 82 Roads and Airfield in the T/O or Engineers in River Crossing Operations; 30-31 Jan Practical Applications of Terrain Evaluation or Camouflage and Field Fortifications; 27-28 Feb Demolition Practices and Target Folders; and 27-28 Mar Military Explosives or Practical Applications or Terrain Evaluation.

For further information contact the U.S. Army Engineer School, Unit Training Section at Commercial 703-664-3008/5921, or 800-336-3095, Extension 3008; or use Autovon 354-3008/5921.

College degrees made easy

Enlisted servicemembers and warrant officers can now earn job-related associate degrees with fewer problems than ever, through the Army's new Servicemembers Opportunity Colleges Associate Degree program, or "SOCAD".

SOCAD is the first program of its kind in civilian and military adult education. U.S. colleges and universities join a SOCAD network in specific occupational-education fields and are linked to major Army installations. Soldiers then contract with these institutions for associate degree producing programs.

Once a study program is worked out, the college makes a contract with the soldier to award an associate degree when the program is successfully completed. That college then becomes the soldiers "home" school. This way soldiers can transfer anywhere in the world or even separate from active duty and still continue the program at other colleges. Earned credits are transferred back to the "home" school.

When they join the SOCAD network, the institutions agree to provide professional counselors to advise soldiers on enrollment, academic matters, and financial aid. They also help soldiers get college credit for the skills, experience, and knowledge already acquired in their career specialties.

For further information contact your local Education Center or write: Servicemembers Oppertunity Colleges, Suite 700, One Dupont Circle, Washington, D.C. 20036.

12B Basic NCO has math prerequisite

The 12B track of the Basic NCO/Combat Arms trains engineers to be effective squad leaders. It is taught at nine CONUS locations, plus Hawaii and USAREUR. The new AR 351-1, effective April 1981, opens the course to all 12B, 12E, and 12F E-4's and E-5's in a leadership position (E-4's must be graduates of PNCOC).

Due to the technical nature of the course, especially in the area of demolitions, it is considered math intensive. Although many students have a significant problem with math, these problems can be solved prior to the attending the course. Battalion S-3's have been provided copies of the 12B BNCOC Prerequisite Program, which should be administered to the student as soon as possible after he has been selected to attend.

This will help identify weak areas which can then be improved through use of TEC lessons and Programmed Texts.

If you are to attend the 12B track of BNCOC soon, and have not been given this prerequisite test, contact your S-3 as soon as possible. He will make arrangements for you to take this test. (NOTE: Unit S-3's: If you cannot locate copies of the 12B Prerequisite Test, contact the Engineer School at Autovon 354-3632/5363.)

Take home training for 12E's

An Exportable Training Package (ETP) has been developed for MOS 12E. ETP is an excellent refresher for 12E's of all ranks. The ETP should reach units at Fort Hood and throughout Europe during the month of September. All 12E's preparing to attend the BNCOC Course should study up on squad defensive tactics, engineer and bridge reconnaissance, demolitions, and mine warfare. Good luck!

12F SQT starts soon

As of September 1979, AVLB crew members, CEV crew members, and engineer APC drivers in the Active Army, Army National Guard, and Reserve Components come under MOS 12F (Engineer Tracked Vehicle Crewman). The Soldier's Manuals were published in September 1980 and are available at the AG Publications Center in Baltimore, Maryland.

FM 5-12F/CM is the Commander's Manual (Trainer's Guide), FM 5-12F1/2 covers E1 through E5, and FM 5-12F3/4 covers E6 and E7. The initial distribution has been completed. If you do not have your manuals, you will have to order them from the AG Publications Center in Baltimore using your unit pinpoint distribution system.

Administration of the 12F SQT for the Active Army will begin in January 1982, with the Reserves and National Guard being tested starting January 1983. Now is the time to order your Soldier's Manuals. You will need them for training and preparing for the SQT.

Questions concerning **any** Engineer SQT can be directed to the Engineer School SQT Branch at Autovon 354-6051.

Officer Corps needs enlisted help

More than 30 Army officers are reported missing and a search is underway to locate them.

Officials are certain the missing officers are hidden within the enlisted ranks, appearing to the casual observer as ordinary soldiers. However, certain tell-tale traits distinguish them from their peers: they have obvious leadership qualities and above-average academic skills.

The disappearance of these officers was noticed when, at the end of fiscal year 1980, 20 percent of the classroom slots at the Officer Candidate School remained vacant. The school regularly reserves 160 spaces for active duty soldiers, and this dropoff in enrollment means a loss of more than 30 junior officers with the benefit of previous unit experience.

What accounts for the shortfall? It's definitely not a lack of qualified soldiers, says the Army Military Personnel Center. More than 13,000 active duty soldiers meet the age and education requirement for OCS attendance.

To qualify for OCS a soldier must:

Be an enlisted person or warrant officer on active duty;

Be at least 19½ years old but no more than 29 at the time of enrollment;

Have completed at least two years of a four-year college degree program;

Have a minimum GT score of 110 (males), 115 or higher on the Officer Candidate Test (OCT), and a minimum composite score of 200 on the OCT and Officer Qualification Inventory (OQI). OCT and OQI are not required for females; however, they must have a minimum GT score of 115;

- Meet medical fitness standards prescribed in AR 40-501 and weight standards prescribed in AR 600-9. An applicant must also score a minimum of 300 points on the Physical Fitness Test;
- Accept a three-year service obligation upon graduation.

Enlisted personnel can apply for OCS as soon as they have completed advanced individual training, whil warrant officers can apply at any time. Anyone who would have 10 or more years of service by the date of commissioning is not eligible.

Acceptance to OCS opens the door to training that will move to soldier from enlisted to officer status. But that move can't be made until elegible soldiers recognize themselves as being among the Army's "missing officers".

Enlisted Reserve retirement changes

Army Reserve enlisted members who have completed a full 20 years of active federal service are now eligible to retire with the same benefits as Regular Army enlistees, according to DA officials. Previously, only Reserve officers were eligible for retirement after 20 years of active duty. Enlisted Reservists had to wait until age 60 to collect their retirement checks. The broadened eligibility is the result of recent legislation enacted by Congress.

The change will immediately affect an estimated 500 soldiers who have accumulated 20 years of active federal service through a combination of long tours, active duty for training and annual training. Active duty does not include inactive duty training such as monthly assemblies or any duty performed as a member of the Army or Air National Guard under state control.

Although Army spokespersons have no estimate of the number of soldiers who will be affected annually, they believe that the recently implemented Long Tour Management Program for Reservists will increase the number of men and women eligible for immediate retirement benefits in the future.

For more information and retirement applications, interested Reservists currently on active duty should contact the Military Personnel Office to which they are attached. Troop Program Unit members may obtain information from the Military Personnel Office at the nearest Army installation or by writing to The Commander, Reserve Components Personnel and Administration Center (ATTN: AGUZ-RAD) 9700 Page Blvd., St. Louis, MO 63132.

Promising careers stopped short

A below-the-zone O-4 selectee had been receiving married rate BAQ for a number of years since his divorce. His protests of "I forgot to stop it" and "honest mistake" were undercut by his annual recertifications of dependency in the years following his divorce. In addition to his Article 15, he must reimburse the government the amount of overpayment—and he will do it as an O-3.

An NCO, described as a sure bet for E-8, packaged concrete blocks and shipped them as household goods in his do-it-yourself PCS move. The inflated weight brought him several extra "bonus" dollars, but he got an Article 15, suspended bust, and a sizeable forfeiture—several times the amount of his "bonus".

An E-3, selected for special career training, reported the theft of his stereo from the barracks. He filed a claim and was reimbursed, but investigation revealed he had sold the stereo to a friend and faked the theft in a scheme to finance a costly new system. His false claim resulted in an Article 15 and another than honorable discharge.

The Federal government is gearing up for war against fraud, waste, and abuse. Please, don't be the next casualty.



"ENGINEER MAGAZINE"

Information for Contributors

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Sincerely,

SP4 Nancy P. Lang
Editor,
ENGINEER MAGAZINE



"Impress on every man from the first to the lowest the importance of the cause and what it is they are contending for."

G. Washington

GENERAL GEORGE WASHINGTON



Enlisted pipefitters train at Camp A.A. Humphreys, now Fort Belvoir, circa 1921.