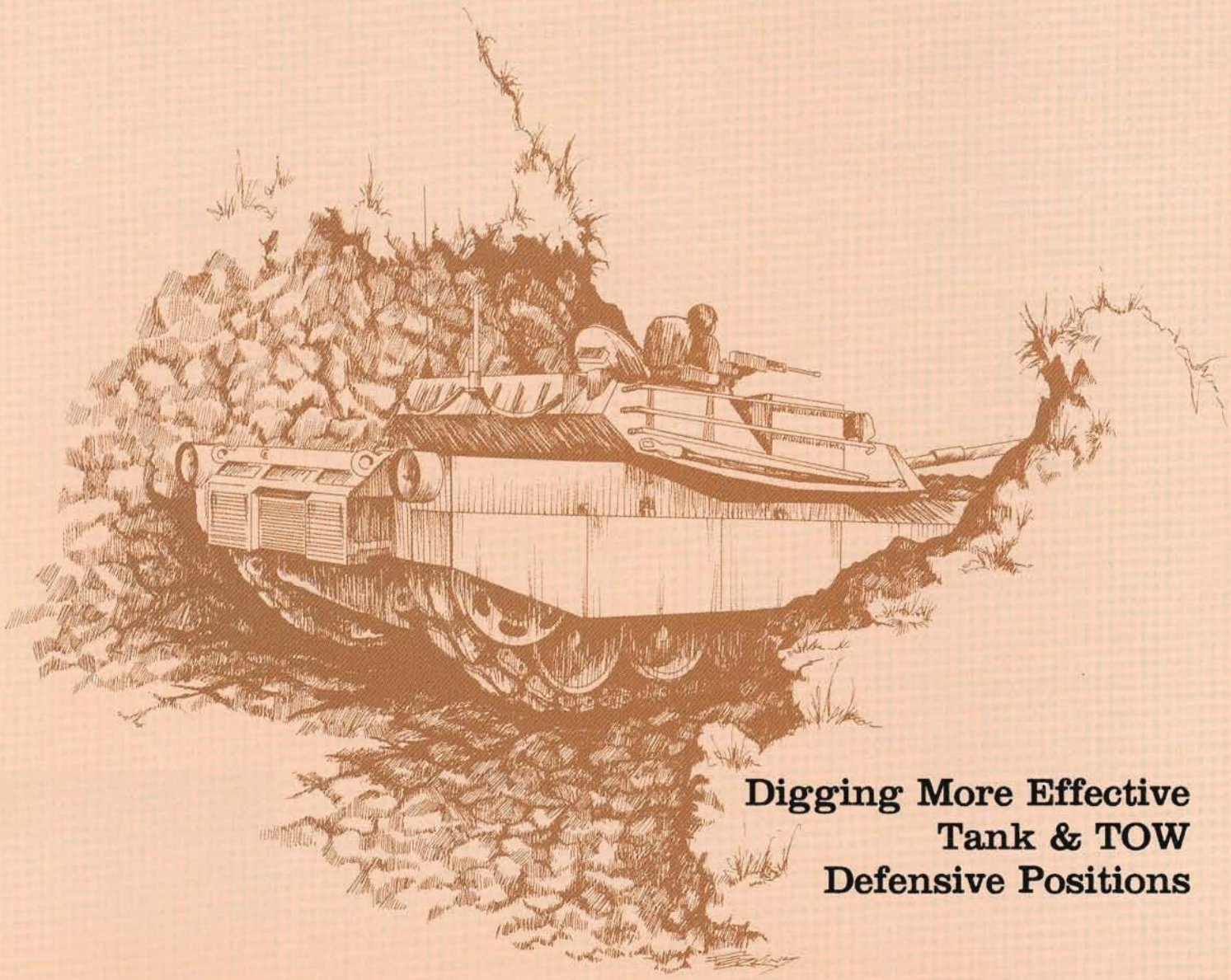
Engineer

THE MAGAZINE FOR ARMY ENGINEERS

FALL 1980



Digging More Effective Tank & TOW Defensive Positions

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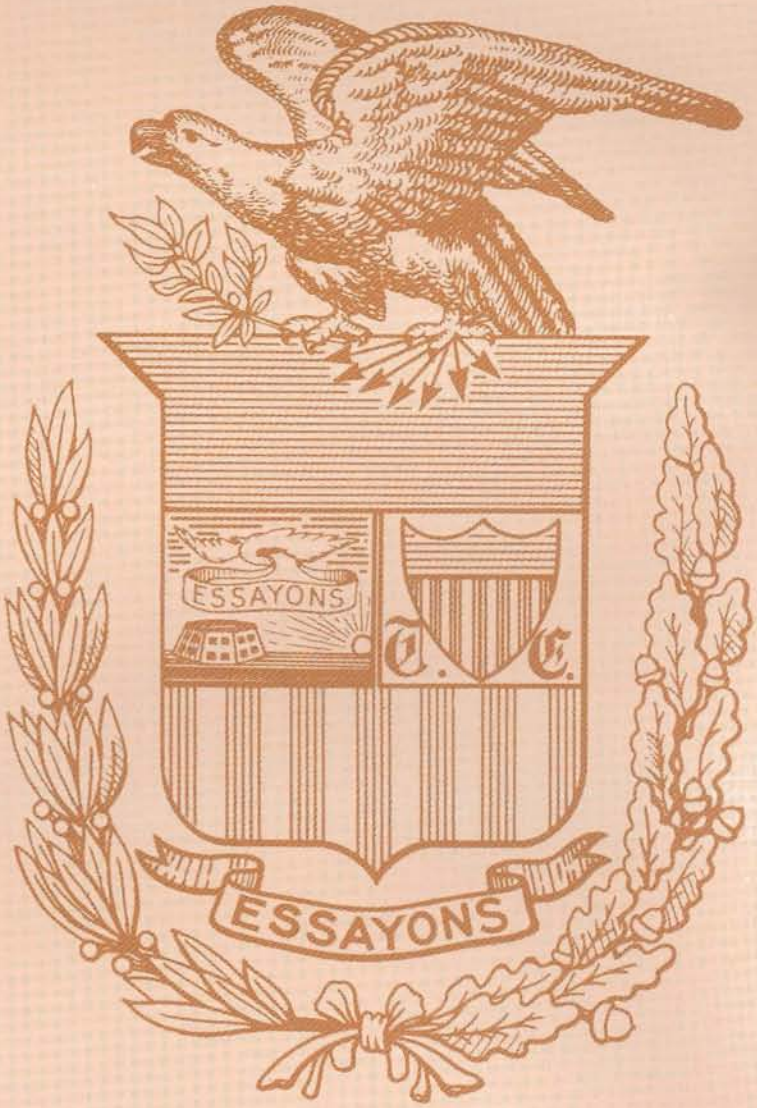
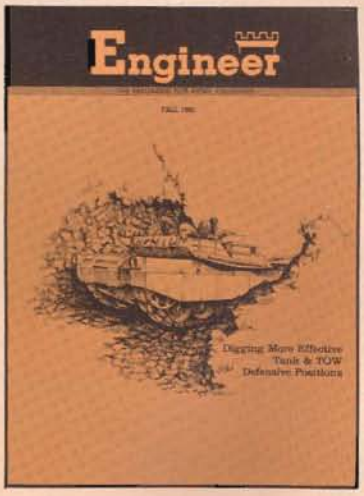


THE COVER

Better concealment and greater killing effectiveness of antitank weapons are possible by digging defensive positions deeper and facing them alternately left and right to take advantage of flank shots, as illustrated on the cover by Ron Perkins. For details, see Captain Eric T. Mogren's article beginning on page 10.



Engineer

THE MAGAZINE FOR ARMY ENGINEERS

VOLUME 10 FALL 1980 NUMBER 3

FEATURES

page 13

page 20

page 29

DEPARTMENTS

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NEWS & NOTES

NEW CHIEF OF ENGINEERS

Lieutenant General Joseph K. Bratton will become the Army's 45th Chief of Engineers on October 1. He will succeed Lieutenant General John W. Morris, who retires September 30.

Bratton has served as Deputy Chief of Engineers since August 1. He was the division engineer of the Corps of Engineers' South Atlantic Division at Atlanta, GA, prior to August 1.

Bratton's command assignments have included the 24th Engineer Battalion with the 4th Armored Division in Europe, and the 159th Engineer Group in Vietnam.

His staff assignments have included director of military application for the Department of Energy; chief of nuclear activities, Supreme Headquarters, USAREUR; executive to the Supreme Allied Command in Europe; secretary to the Joint Chiefs of Staff; and military assistant to the Secretary of the Army.

He has also served in the War Plans Division, Plans Directorate, Office of the Deputy Chief of Staff for Military Operations; and with the Division of Reactor Development, Atomic Energy Commission.

ENGINEER HOTLINE

The US Army Engineer School at Fort Belvoir, VA, has a telephone *HOTLINE* to help provide answers for specific Army Engineer problems in the field. If you experience problems related to engineer doctrine, TOE organization, MOS, equipment, manuals, training and/or training development, call the HOTLINE number, AUTOVON 354-3646 or COMMERCIAL 703-664-3646. A recorded message will ask you to identify yourself by name, unit, unit address, and unit telephone number. Then you will be required to identify the subject area of your problem and state the problem as clearly as possible. Subject matter experts within The Engineer School will then be contacted about your problem and return your call. HOTLINE has responded to an average of about 20 calls a month during the last year. If you have a problem, call the Engineer HOTLINE.

WEST POINT WOMEN CHOOSE ENGINEERS

The first women to graduate from the United States Military Academy at West Point include six engineers currently enrolled in the Engineer Officer Basic Course at The Engineer School, Fort Belvoir, VA. They were among the 61 women commissioned as second lieutenants during graduation ceremonies at West Point in June. The six precedent-setting engineer lieutenants include Brigid Benya, Bobbi L. Fiedler, Kathleen M. Gerard, Clare Kirby, Debra M. Merriken, and Carol A. Young. Benya and Kirby have been assigned to the 130th Engineer Brigade, USAREUR, following EOBC, while Young has been assigned to the 7th Engineer Brigade, USAREUR. The other three will report to stateside commands following completion of EOBC—Fiedler to the 937th Engineer Group, Fort Riley, KS; Gerard to the 20th Engineer Brigade, Fort Bragg, NC; and Merriken to the 36th Engineer Group, Fort Benning, GA.

continued

NOAH SUCCEEDS KELLY

Major General Max W. Noah has succeeded Major General James L. Kelly as Commanding General of the US Army Engineer Center and Commandant of the US Army Engineer School at Fort Belvoir, VA. MG Kelly retires from active service on September 30 after a distinguished 30-year military career.

MG Noah last served as Division Engineer for the Corps of Engineers' Huntsville Division in Huntsville, AL. He was previously assigned to the US Army Training and Doctrine Command at Fort Monroe, VA. as Deputy Chief of Staff for Resource Management.

MG Noah is a 1953 graduate of the US Military Academy at West Point. In 1958 he received a master's degree in electrical engineering at Purdue University. He also is a graduate of the Army Command and General Staff College, the Army War College, and the Institute of Defense Analysis.

MG Noah's 27-year military career includes two tours in Korea (1954-55, 1973-74), a tour as chief of operations for the 18th Engineer Brigade in Vietnam (1966-67), and a tour as commander of the 307th Airborne Engineer Battalion, 82nd Airborne Division, at Fort Bragg, NC (1968-70).

The Greensboro, NC, native is a registered professional engineer in the state of New York.

SOLDIERS EARN OLYMPIC MEDALLIONS

Displaying official Olympic medallions they received for their part in the Winter Olympics at Lake Placid, NY, are SP6 Clark J. Heinkel, SFC Joseph T. Tenschert, and SP6 Marshall R. Thacker. All three are members of Team C, 535th Engineer Detachment, Fort Eustis, VA. They assisted in providing backup electrical power at Lake Placid in February. Their performance also earned them certificates of appreciation from the Secretary of Defense.

NEW BORE CLEANER

A new product, now available to units through the national military supply system, not only breaks loose grit, rust, salt, etc., from metal surfaces but also lubricates and preserves them by providing a long-lasting thin film protective coating. This new product, called Break-Free CLP (cleaner-lubricant-preservative), is produced by the SAN/BAR Corporation of Santa Ana, CA.

Break-Free was first used to clean primer vent holes, which ordinarily clog up with hard residue after seven or eight rounds, requiring the use of a mechanical reamer. Not only did the solution do the cleaning, but it also extended the time for the next cleaning to 17 or 18 rounds.

The moisture-displacing film deposited by the Teflon-based Break-Free compound is less likely to break down under heat and pressure as have other oils and lubricants. Nor does it attract dust, grit, and powder residue, a principal limitation of other lubricants and penetrating oils.

News & Notes

NUMBERS GAME

Topographic Engineers of the 649th Engineer Battalion, 18th Engineer Brigade, stationed at Tompkins Barracks, Schwetzingen, Germany, commemorated Armed Forces Day in an especially fitting manner. At precisely 6:49 a.m., First Sergeant John Miller was reenlisted by 649th Engineer Battalion Commander Lieutenant Colonel Daniel R. Clark. Miller was the 18th soldier in the battalion to reenlist this fiscal year. The battalion commander and Command Sergeant Major Jimmie L. Christensen then led a team of 118 topographers on an 18 kilometer march to honor the reenlistment. The march started 18 kilometers north of Karlsruhe, home of the 18th Engineer Brigade headquarters, and followed a scenic route analyzed, plotted, and surveyed by the 649th Engineer Battalion terrain analysts. The march ended at the 18th Engineer Brigade's Armed Forces Day river crossing and engineer equipment display site at the Rhine River Harbor (Rheinhafen) in Karlsruhe. The marchers carried 18 flags and completed the march in six hours and 49 minutes. Reenlistment receives a lot of attention in the 649th Engineer Battalion and results seem to indicate that attention pays off.

HUMANITARIAN SERVICE MEDAL

More than 3,000 soldiers are eligible to receive the Humanitarian Service Medal for their participation in the cleanup operation on Enewetak Atoll, the Pacific site of earlier US atomic tests. The Defense Nuclear Agency was responsible for the cleanup and was the agency that approved award of the HSM to all participants. Soldiers who have questions concerning their eligibility for the medal for that operation should address their inquiries through command channels to: HQ, Defense Nuclear Agency, Washington, D.C. 20305. Criteria for the HSM for the Eniwetok operation include direct, meritorious participation for at least 24 continuous hours between January 24, 1977 and April 15, 1980, the official end of the cleanup.

ESSAYONS RETIRED

The Army Engineers hopper dredge *ESSAYONS*, which helped clear the Suez Canal of damage suffered in the 1956 war, was retired last Spring. The vessel, the flagship of the US Army Corps of Engineers dredge fleet, took part in many epochal engineering events in both continental United States and foreign waters. Its name is the motto of the Corps, which translated from the French, means "Let us try." Commissioned January 16, 1950, after being completed at the Sun Shipyards in Chester, PA, it was the largest in the Corps fleet, with a length of 525 feet. Its capacity was 8,270 cubic yards and its speed while loaded was 12 statute miles per hour. The place at the head of the Corps dredge fleet vacated by the *ESSAYONS* will be filled by a modern large class hopper dredge under construction in New Orleans. Chief of Engineers Lieutenant General John W. Morris, said the *ESSAYONS* was retired because the dredging industry has demonstrated an ability to take over more of the workload which previously has been accomplished with Corps of Engineers equipment. The Corps is phasing out the older dredges in the Corps fleet as industry's dredging capability increases.

COLD WEATHER TRAINING

Members of Company A, 7th Engineer Battalion, 5th Infantry Division (Mech), offload rail cars at Fort Drum, NY, during exercise "Winter Raider 80" last winter. Company A personnel and equipment were deployed to Fort Drum with the 1st Brigade of the 5th Infantry for cold weather training. The P&H crane above unloaded more than 200 conexes and engine crates during the deployment and repeated that performance during the redeployment. (US Army photo by 1LT Matthew P. Saitta)

CODE-A-PHONE FOR ACCP

The Army Institute for Professional Development maintains a 24 hour Code-A-Phone service on AUTOVON 927-3085. This line may be used by any individual having questions about the Army Correspondence Course Program or services performed by the Institute for Professional Development, the Army manager of the Army Correspondence Course Program.

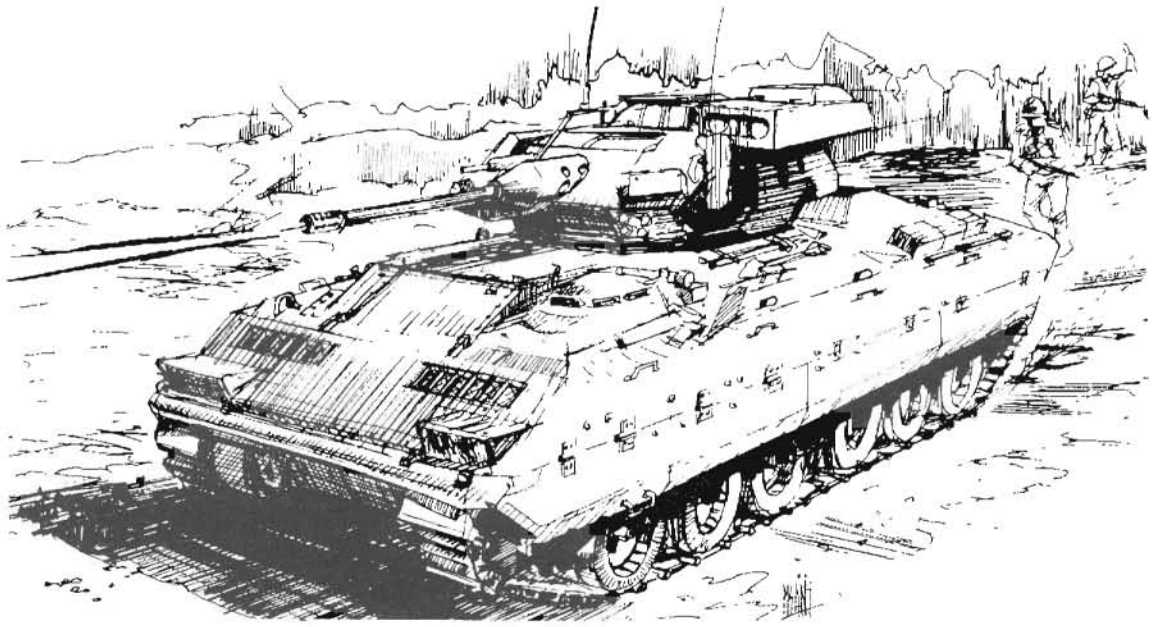
ENGINEER COURSE

The Engineer Army Correspondence Course Program has moved to Newport News, VA. Inquiries and applications concerning non-resident instruction should be addressed to the Institute for Professional Development, US Army Training Support Center, Newport News, VA 23628.

NEWS & NOTES

FIGHTING VEHICLES

The M2 Infantry Fighting Vehicle (IFV) and the M3 Cavalry Fighting Vehicle (CFV) will replace the M113 Armored Personnel Carrier (APC) in mechanized infantry and armored cavalry/scout units beginning next year. Officials say the fighting vehicles are perfect companions for the new XM1 "Abrams" Tank. The IFV will be the first US combat vehicle that provides infantrymen with the ability for a mounted attack. The IFV and CFV have numerous advantages over the APC. A combination of engine performance, power train efficiency, and improved suspension increases their battlefield mobility. They have a top road speed of 41 mph, a cruising range of 300 miles while loaded for combat at 48,000 pounds, and the Cummins four-cycle turbo-charge engine can power each vehicle from zero to 30 mph in about 19 seconds. The hydro-mechanical transmission allows the driver of each vehicle to operate in a variety of terrain. With a stabilized 25mm cannon, 7.62mm coaxial M240 machine gun, and TOW antitank guided missile system, the fighting vehicles have more firepower than the APC. Also, the IFV has six ball-mounted XM231 5.56mm firing port weapons. Other improvements include the fighting vehicles's "swimming" ability, increased armor protection for the crews, and the advanced automatic Halon fire extinguisher system located in the engine and crew compartments. About 7,000 fighting vehicles have been programmed for production over the next few years.

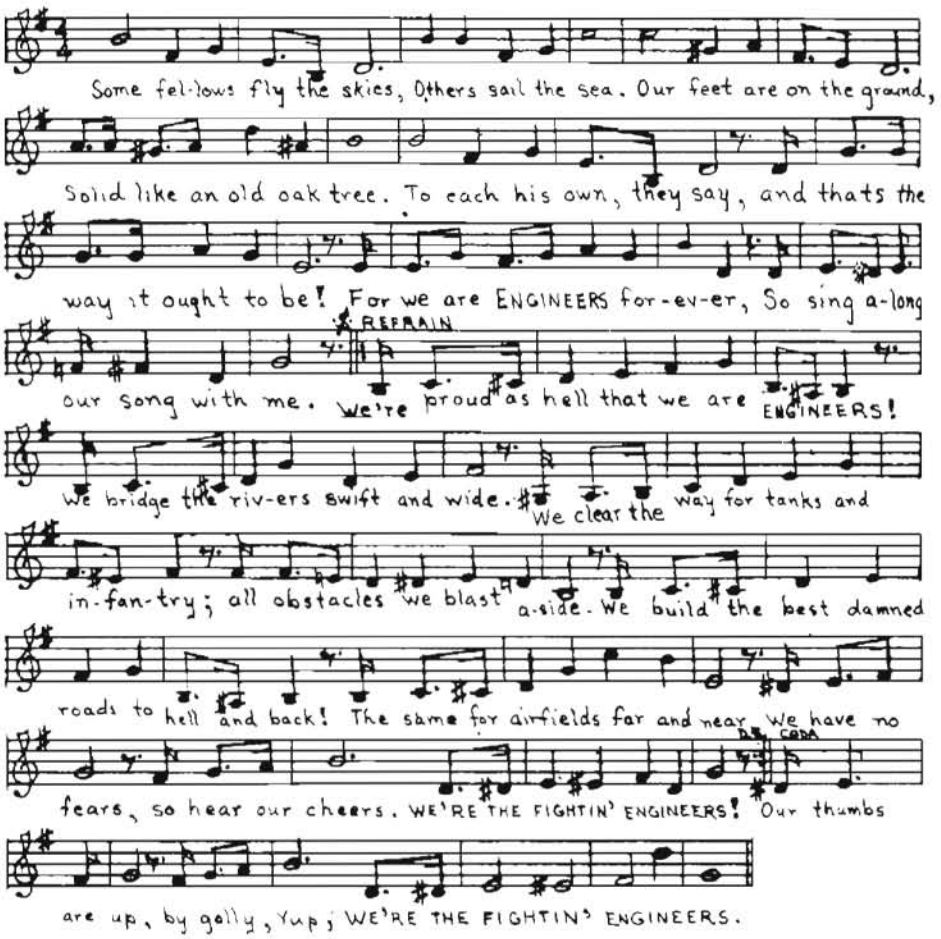


UNIT CONSOLIDATION

Two battalions of the Engineer Training Brigade (ETB) at Fort Belvoir, VA, were consolidated into one battalion in August for the purpose of more effectively utilizing assigned personnel and equipment. The 1st and 4th Battalions were consolidated under the command of LTC John A. Knutzen on August 8. The reorganized 1st Battalion now consists of a headquarters company and three student companies. In addition to providing command and control, administration, and logistical support for assigned and attached personnel, the 1st Battalion also provides Advanced Individual Training and skill level instruction in MOS 35E, 52C, 52D, and Maintenance Management. The Engineer Training Brigade at Fort Belvoir is now composed of the 1st and 3rd Battalions, a Noncommissioned Officer Engineer School Detachment, and an Allied Student Support Detachment.

' THUMBS UP '

J.R.L.D. 'We're the Fightin' Engineers' JAMES R.L.DUFF



James R. Duff, a retired Army engineer officer currently employed at Fort Belvoir, VA, wrote "Thumbs Up! We're the Fightin' Engineers" more than six years ago. Ever since then he has been campaigning to have it adopted as the official marching song of the Corps of Engineers, without success. But Duff's campaign to gain official acceptance appears to be gaining momentum. The march was used for the first time during an official military ceremony in August at Fort Belvoir. Duff will provide copies of the tune to anyone who sends him a stamped, self-addressed envelope. His mailing address is: Training Literature Division, Directorate of Training Developments, Building 201, Fort Belvoir, VA 22060.

FORUM

Should Ethics Be Taught in Army Service Schools?

Chaplain (MAJ) Stanley J. O'Loughlin

EDITOR'S NOTE: FORUM is a new section or "department" designed to provide additional space for the expression of professional views by Army engineers worldwide. It is hoped that engineer officers, enlisted personnel, and DA civilians employed in Army engineer related jobs will take advantage of the opportunity to express their views on doctrine, organization, tactics, equipment, management, training, leadership, or any other subject with potential interest for soldiers in general, or engineers in particular. What you have to say is the most important consideration, not how you say it or how much you say.

Should ethics be taught as part of the Course of Instruction in Army service schools? This is an issue of considerable discussion within most Army service schools today. Pressure comes from above to "do something." The struggle rages in terms of how many hours to teach and from what academic division or branch they they should be taught. The opinions of students are so diverse as to be inconclusive.

The issue of ethics is certainly a live one within the military profession, just as it is among most professions in our society. The cause may be fallout from the Watergate, My Lai, and corporation scandals, or it may be merely an issue whose time has come. Nevertheless, ethics is an extremely controversial issue throughout our society today.

In recent years, several significant surveys and studies have been done within the Army and each gives indication that disturbing factors exist. The most recent study, conducted at Fort Carson in 1978, seems to suggest considerable confusion about what constitutes a realistic military ethic and a tremendous variance between the perceptions of junior officers as opposed to the perceptions of senior officers.

So, the issue of ethics is with the Army and there is certainly enough evidence of serious, if not critical, concerns that must be considered more completely. The question is, who should tackle the problem, and how?

I suggest that the Army service school is the ideal agency to carry a significant amount of the responsibility. The reasons are obvious:

—Over a three to four year period, using the model of the US Army Engineer School, two whole generations of junior officers and one generation of senior noncommissioned officers attend The Engineer School for one class or another.

—The student is already in an academic atmosphere in which he/she is exposed to new and signicicant developments.

—Generally, time and expertise are more available within a service school environment then in field units.

Yet, a number of problems exist when ethics is taught as part of a service school Course of Instruction:

—How much time is available for teaching ethics? Service schools seem to have the unique ability to say things like, "Teach all that is significant about ___ and do it in one hour." A subject like ethics in the military requires at least four hours to minimally expose a student to the salient issues.

—A school atmosphere is extremely sensitive to pressure from "stovepiping." Ethics may be a "hot" issue now, but a "cold" issue tomorrow. Ethics needs to be taught on the merits of its own validity, and not because it is the newest novelty.

—The danger exists that what is taught as ethics will relate only to the trivial. Every school remembers the ethics classes that never got beyond the issues of taking government pens home and drinking coffee in the unit dining facility without paying for a meal.

—Perhaps the greatest issue is the subject matter. There is so much confusion on the issue of ethics. How can something of relevance be taught?

Having looked at these difficulties, the problem of whether, when, and how to teach ethics remains. At the US Army Engineer School we require each Advanced Class officer and noncommissioned officer to write a short paper on an ethical issue they have experienced. Their papers vividly demonstrate the number and seriousness of ethical dilemmas confronting Army leaders today, as well as the confusion surrounding an appropriate response. But most of all, we see the frustration and anger of the respondents who feel they have little guidance or understanding in these matters.

Clearly, the problems are real and urgent. The service school, despite these problems, still represents the best source of military education in ethics. Yet, we need to define the limits of our abilities to teach in an academic environment, and our goals in teaching.

My suggestion is that the service schools can eliminate, or at least, minimize the confusion. Too often, what one reads in military publications seems to indicate that our generation discovered ethics. In addition, there is no clarification of terms. Do such words as *values*, *morals*, and *ethics* mean the same thing? If an ethical act is a moral act, who determines the morality of it? Most misconceptions stem from the basic resistance toward the study of ethics.

Surely, one requirement of an ethics class is to show how the study of ethics is rooted in the framework of ethical philosophy. The student must be aware that he/she has no more or less ethical options open to him/her than the philosopher did 300, 500, or even 2,500 years ago. It is from the same options that current military leaders must make their decisions.

A second requirement for an ethics class is to sensitize students to the major ethical issues in the Army today. Our findings at The Engineer School indicate that most students are not even aware that lying publicly to support a commander is an ethical consideration. We cannot tell students that there is only one correct decision for each situation, but we can help them be aware of the possible consequences of their decisions.

A third requirement for teaching ethics is to educate students on resources available to help them make ethical decisions. Bibliographies, handouts, and references are just some of the possible sources.

Finally, students can be taught basic skills in arriving at an appropriate ethical decision. These include the means of isolating a problem, weighing the effects of a given decision, and separating rationalization from fact.

In summary, it can be said that the US Army, reflecting society as a whole, is experiencing a great deal of ethical confusion and concern. The young military leader indicates in many ways a need for assistance in facing ethical dilemmas. Despite numerous problems, Army service schools seem to be the ideal proponent for instruction in ethics.

Ethics instruction should:

—clarify existing confusion

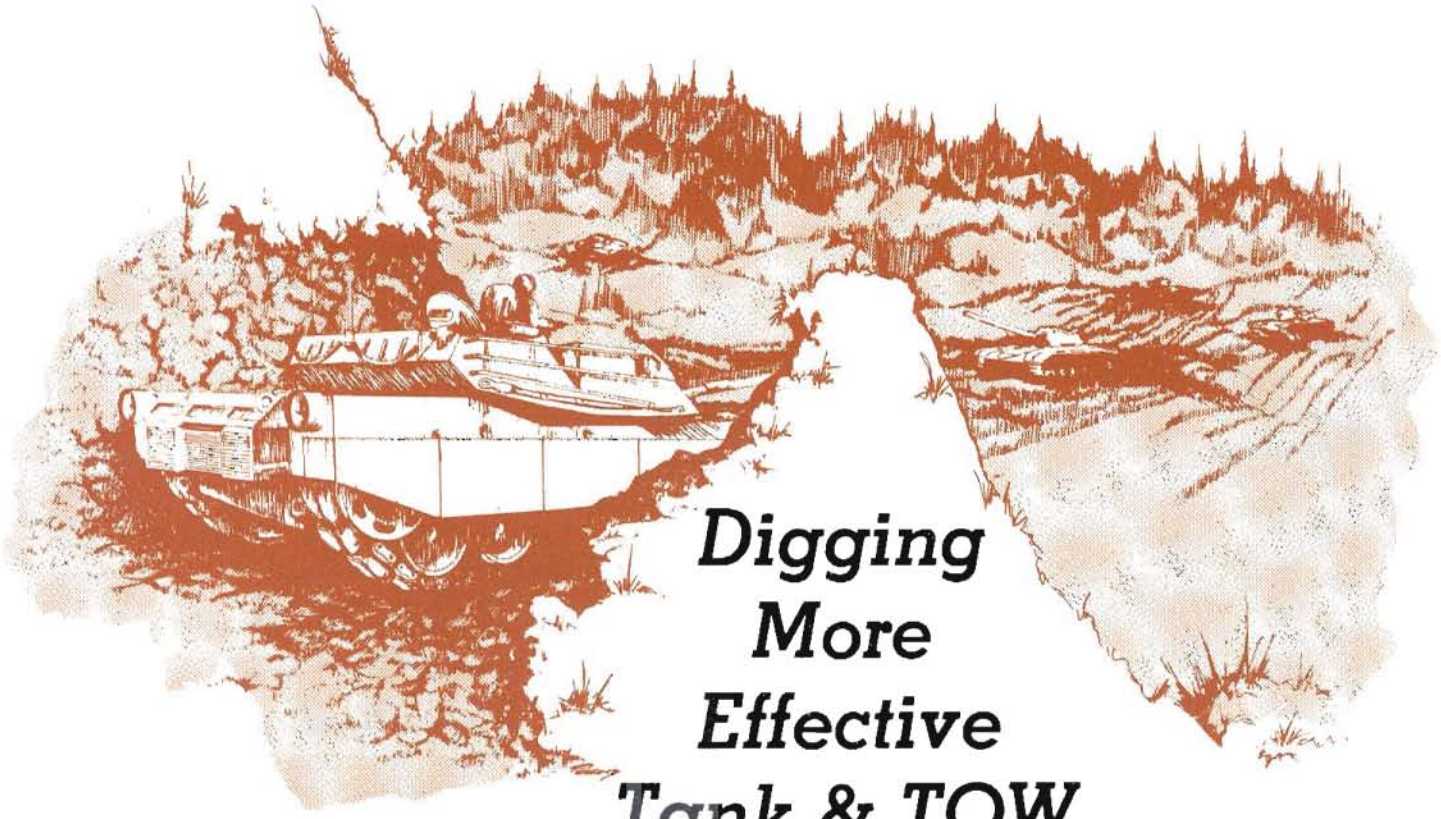
—sensitize students to the major ethical considerations at each grade level

—provide guidance for finding reference material

—provide the basic skills and techniques for making ethical decisions.

Should ethics be taught in US Army service schools? Given adequate time and instructors with genuine expertise, the answer is YES!

Chaplain Stanley J. O'Loughlin is presently assigned to the 1st Brigade, 2nd Infantry Division, Camp Casey, Korea. When he wrote this article, he was assigned as Chief, Command and Organizational Effectiveness Branch, US Army Engineer School, Fort Belvoir, VA.



Digging More Effective Tank & TOW Defensive Positions

by CPT Eric T. Mogren

The concept of positioning antitank weapons to take advantage of flank shots and provide greater protection for antitank weapon crews is described and supported

Some time ago, the brigade commander (whose unit my Engineer Company supported), his plans officer, and myself were making a reconnaissance of a stream valley in Germany. The objective was to select potential battle positions and obstacle locations to support a defense along that valley. In the course of our discussions, the commander came up with an idea that would greatly increase the killing effectiveness of his tanks and TOWs and would provide much greater protection from enemy observation and fire than the standard hull defilade position.

His concept was similar to that of the two-man fighting position; instead of facing to the front, antitank weapons would alternate facing left and right. Instead of shooting across the valley, each weapon would shoot up the length of the valley, (Figure 1). By integrating well-sited minefields and antitank ditches, the crews would be able to engage targets with deadly flanking shots, often at maximum range.

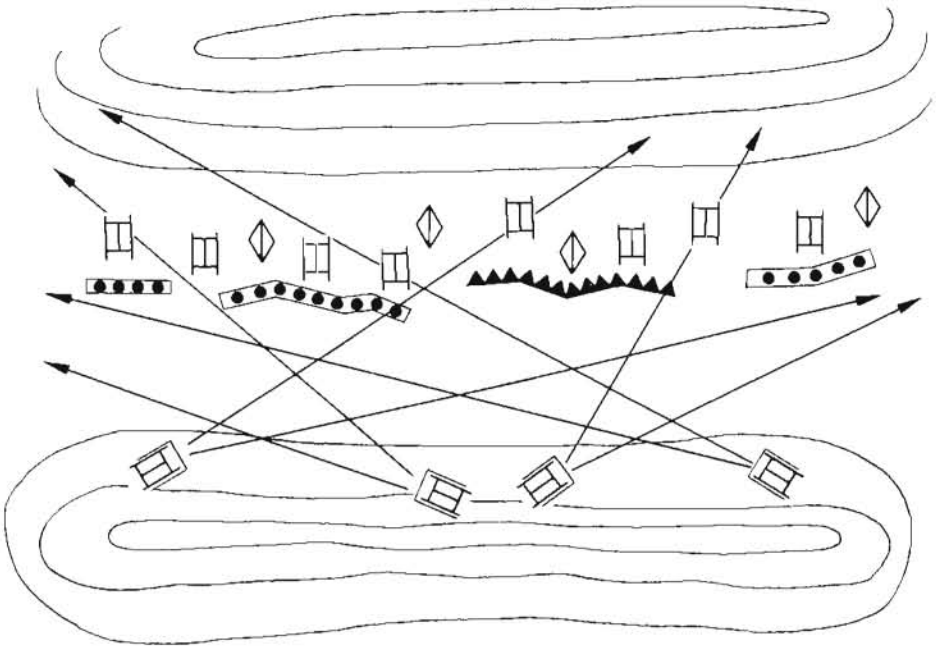


FIGURE 1

The idea of positioning antitank weapons to take advantage of flank shots is certainly not new. In fact, FM 71-1 (The Tank and Mechanized Company Team) discusses the concept in detail. What is not discussed adequately is the method of digging vehicular defensive positions to accomplish this. The standard tank and APC fighting position is a hull defilade trench scooped out of the ground by a bulldozer, dozer tank, or similar piece of equipment. Oriented to fire to the front (i.e. directly at oncoming forces), these positions are susceptable to enemy observation and fire from both assaulting and supporting weapons systems (Figure 2). The result is that a tank or TOW can fire only a limited number of rounds before having to move to an alternate position.

By facing weapons to the left or right, it is possible to dig the fighting positions far deeper. Since the weapon is not firing to the front, the position is dug to put tanks in *turret* defilade, thereby providing maximum protection from the direct fire of assaulting forces. Similarly, antitank guided missiles (ATGM) can be dug in, placing both weapon and operator below ground level (Figure 3). By camouflaging the position and its entry/exit routes, crews are both covered and concealed from frontal observation. This allows them to fire numerous rounds before having to move to an alternate position, if indeed they have to move at all. The only real threat is from a direct artillery hit.

Criticism of this concept centers around three points: a weapons system so entrenched cannot engage frontal targets at maximum range; crews cannot observe enemy activity to their immediate front, and therefore are vulnerable to direct frontal assault; and this position, being deeper, will take longer to construct, thereby aggravating what is already a critical shortage of engineer construction equipment.

First, many positions (especially in Germany) cannot engage targets

continued

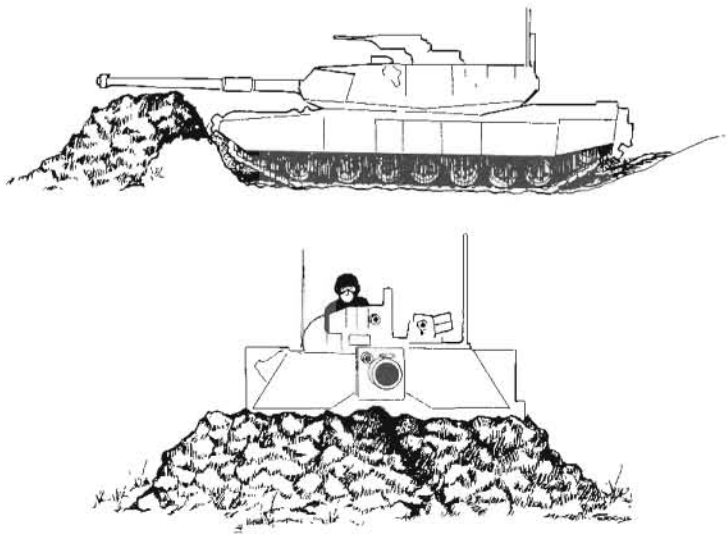


FIGURE 2

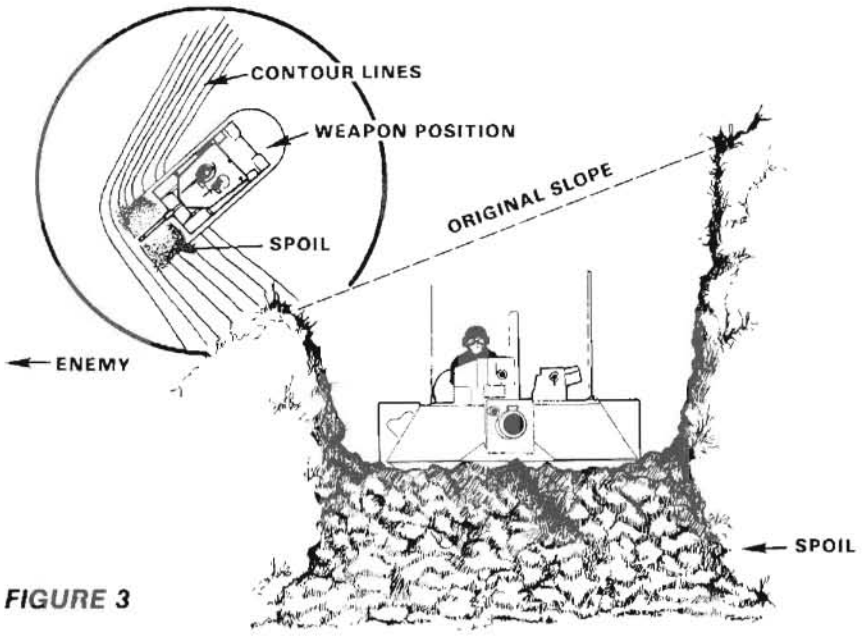


FIGURE 3

at maximum range anyway. Weather conditions, hills, forests, built up areas, and (in the case of ATGM) power lines inhibit taking full advantage of a weapon's range capabilities. In such cases, preparing positions as described would be very effective. Obviously, if engagement at maximum range is possible, this will govern the siting of weapons and the type of defensive position employed.

Immediate security to the crew is provided in several ways. Careful interlocking of fires from adjacent positions, the use of hasty protective minefields, and integrating dismounted infantry machine gun and DRAGON positions would overcome the lack of frontal observation (Figure 4).

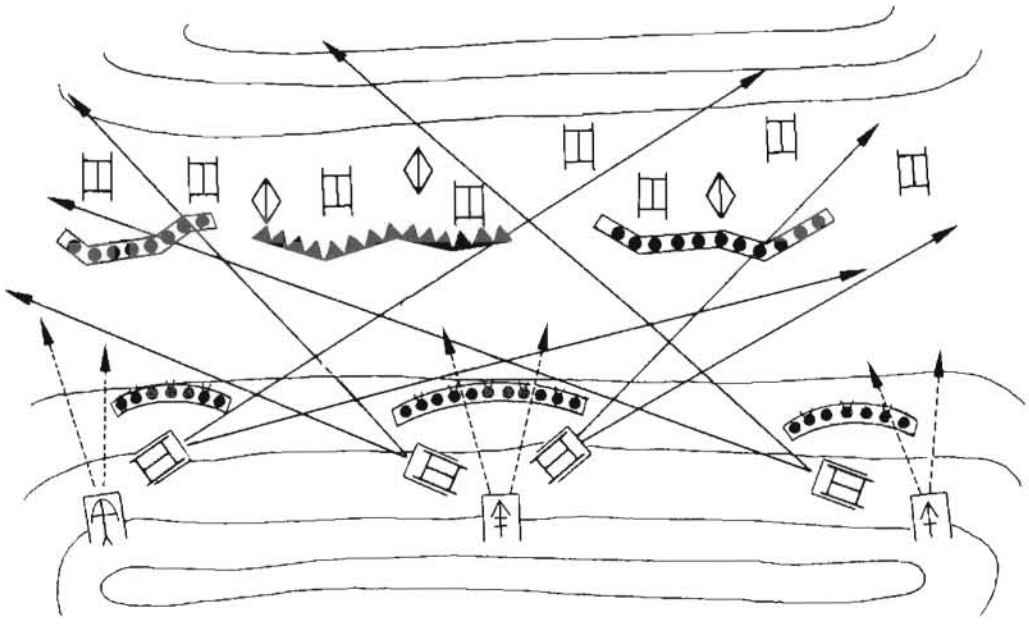
It is an unfortunate fact of life that much of our defensive capability is based not on what would do the best job, but on the limited resources available with which to do the job. This is particularly true with engineer operations. The shortage of engineer digging capability will be somewhat alleviated by the fielding of the new M-9 Tractor. It takes a bulldozer 20-30 minutes to dig out a standard hull down position for a tank, a rate that will increase with adverse soil or weather conditions.

I estimate it would take an additional 15-20 minutes to provide a turret defilade position as described above. This additional time is more than offset, however, by the increased killing effectiveness of the weapon and greater protection provided for the crew. In some cases, overall engineer work may be reduced by the need for fewer alternate positions.

Due to increased construction time and weapons orientation, this concept has limited application within the context of the active defense. But it is made to order for strong points, defense of key terrain, and defenses along river or stream valleys. Critical to winning the first battle will be our ability to inflict maximum destruction on the enemy while providing maximum protection to our own soldiers. Careful siting of tank killers, the integration of obstacles, and the preparation of deep, well camouflaged fighting positions is one way the manuever commander can achieve this.

Captain Rick Mogren is presently assigned as a lesson author in the Sergeants Major Academy, Fort Bliss, TX. He previously served four and a half years with the 12th Engineer Battalion, 8th Infantry Division.

FIGURE 4



PROJECT KRYPTONITE

by CPT Norman G. Comstock

Project Kryptonite has been called the largest explosive demolition project conducted by US Army Combat Engineers in Western Europe since World War II. The expenditure of 5,000 pounds of C4, 2,100 pounds of TNT, 3½ miles of detonating cord, 3,740 feet of time fuse, 720 non-electric caps, fifteen 15-pound and fifty 40-pound shape charges, two bangalore torpedoes for good measure, and over 45 project days lends credence to that assertion. For those involved, it was nothing less than the chance of a lifetime in peacetime for "a real blast."

The mission for Company D, 78th Engineer Battalion (C), 7th Engineer Brigade, was to demolish and remove an iron ore storage and processing facility called Barbara Mines. The facility was located in southwestern Germany, about 75 kilometers south of Karlsruhe. It was a German-American project for the city of Herbolzheim.

Six concrete and brick buildings required explosive demolition to one meter below ground level. Two other buildings demolished very easily with bulldozers. The six buildings requiring demolitions varied in size from a basement to two six story buildings. One structure, an airshaft and tunnel, was about two stories in size, but completely underground. Residents of the area said the buildings were constructed in the 1930s. The design

continued

Building number 4: note how close to the railroad the building is located. If it had fallen in the wrong direction, it would have meant disaster

criteria of the buildings far exceeded strength and durability requirements of the period. That became painfully clear early on. Thereafter, our first question was "When was it built?"

Project Kryptonite was accomplished in two phases. Phase I, work aboveground, took place in late October through November 1979. Phase II occurred from Feb. 10–25, 1980 with the below ground demolition and destruction of the tunnel and air shaft.

Buildings were assigned to line platoons and Direct Support (DS) elements for destruction. Decentralized execution was the order of the day. D/78 is a Corps Combat Engineer company augmented with dozers, cranes (one with clamshell), and 250 cfm air compressors from sister line companies. Since the project site was so close to the railroad linking northern and southern Europe, special constraints were imposed during the first 10 days. The most significant early constraint was that blasting was permitted only on weekends after midnight when train traffic was lightest. Later, blasting was permitted every day of the week.

The lessons learned from Project Kryptonite fall into four categories: General, Safety, Maintenance and Technical

GENERAL

- Our soldiers can do anything and endure anything as long as what they do has purpose, meaning, and challenge. Company personnel spent many lonely hours guarding the explosives and performing KP, CQ, and runner duties. They never complained because the project was a great source of satisfaction and pride.
- The Germans were unprepared for our work ethic. They were amazed at our tenacity and fortitude as we worked long hours and holidays in all kinds of weather.
- Be on the lookout for abandoned mines. The one used for our ASP provided a great storage facility. It would have been a good CP, too.

SAFETY

- During the haul operation, driver control was a real problem. Our drivers wanted to speed going up the hills of the haul route. To prevent speeding on a two-lane road with a blind curve, stern control was required.
- The local populace was extremely curious. Crowds could be controlled, but individuals came out of nowhere at the most critical times. They always cooperated, however, when asked to leave.
- Safe handling of unprimed explosives, as emphasized in training, is exaggerated, except for nonelectric caps. After about two weeks, D Company personnel realized that unprimed C4 or TNT is safe to handle. But much time was lost due to initial reticence. Safe handling of nonelectric caps and primed charges in not at all exaggerated and requires constant supervision. We had to prime shape charges nonelectically, requiring extra care, especially when working on a 75-80 percent slope 20 feet above ground.
- When drilling concrete with a 250 cfm air compressor, ear, eye, and lung protection are required. Dust created by drilling caused breathing and vision problems. Breathing protection devices need to be added to the components of the 250 cfm compressor. Drilling noise was deafening. Fatigue from constant drilling also was a problem.
- Know the number of explosions that are scheduled and keep count of them as they occur. Varying the length of time-fuse facilitated counting detonations. This is an old lesson worth emphasizing.
- On lengthy demolition jobs, a full-time safety officer or NCO is required. Laxity, overconfidence, and fatigue were constant problems. Continual vigilance is required.
- Have subordinate leaders wear distinctive apparel, such as helmets. When positive control is required, it was necessary to get to subordinate leaders quickly.

MAINTENANCE

- Preventive maintenance must increase as time on-site increases. During the last two weeks of November, one-third of the company's dump trucks (4) went "down" for preventive maintenance (PM) every third day.
- Since the concrete was heavily reinforced with steel, rebar created a big problem with truck tires. A special tire-changing, tube-repairing squad had to be employed.
- A DSU contact team was very helpful in repairing brakes and hydraulic lines. Given the haul distance and uphill drive, a team with brakes, transmissions, and transfers is a good idea.

TECHNICAL

- A detailed SOP for Project Kryptonite was necessary. It governed the job as both a project and a range. Requirements for transport, storage, security, and safety of the explosives were identified and incorporated into the SOP. Every officer and NCO was issued a copy.
- For the one-mile haul (two miles round trip) five 5-ton dump trucks were optimum. More than five trucks caused underutilization as they waited for loads; less than five meant underutilization of the lifting and loading equipment. Generally, the scoop loader loaded three trucks to the clamshell's two.
- At the height of the project, three large rubble piles were worked at a time. Dozers built the piles, segregating very large pieces into piles for the clamshell to load and smaller pieces and gravel for the scoop loaders. This insured that all equipment was working and equipment idle time was kept minimal. Almost 6,700 five-ton dump truck loads of rubble were hauled during the project.
- Do not forget the shock wave created by explosives, particularly when using external charges.

More than 400 pounds of externally placed C4 were detonated on a very clear night and blew out several windows 750 meters away. When the charges were placed and until 30 minutes before the blast, the weather was overcast with a low level of fog. At detonation, the weather was "clear as a bell."

- For any charge, tamped, or untamped, the minimum safe distance is 300 meters. Straw and hay bales worked very well to minimize the missile effect of each blast.
- Dual priming was wasteful on this project. Dual initiation, however, is an absolute requirement in order to minimize misfires and eliminate delays if the first fuse lighter does not light the time fuse.
- If a building is to be dropped on one side, overload the first story support on the side you want it to fall on. Prime half of the next support and charge the rear support only to insure it cracks or breaks. The idea is to use the building's weight against itself so it will break upon hitting the ground. When we cut one building on the same plane, all we did was reduce the height of the building by one story.
- Shape charges generally bored textbook size holes. However, when shooting straight down or at an angle, the holes were filled in by loose rock after the blast. When the shape charge was inverted and fired upward at a slight angle, the result was a textbook size hole, but with some unexpected cracking of the concrete. Even though tamping was a little more difficult, this technique saved two to four hours in priming.
- With exactly the same poundage and placement, we got four different results when we detonated the charges in the buttresses of the Bunkerkeller. We drilled several 1.5 inch diameter holes three feet deep in each buttress. Holes were spaced five feet apart, starting 2.5 feet from the wall and 2.5 feet from the ground. One block of C4 (1.25 pounds) was put in each hole, primed with det cord, and left untamped. The results varied considerably. One buttress was nearly demolished. The results were attributed to two factors—hand tamping was probably different for each buttress; and placement of Ule knot varied from the end to the middle of the charge. The explosives seemed more effective when the knot was placed on the external end of the charge.
- TNT was inadequate for cutting through steel unless the charge was tamped. An external, untamped charge on a concrete wall reinforced with steel mesh merely blew the concrete away from around the steel mesh. However, TNT was effective when the charge was external and backfilled with about three feet of dirt. Half-inch rebar in an eight-inch thick wall was cut along with the concrete when this technique was used.
- Test shots are required. They reveal how much and what type of reinforcing material is in the concrete.

The Bunkerkeller: note the different results from the same amount of explosives placed in the same location

- Internal charges are nearly always successful. External, relatively untamped charges yield a myriad of results.
- Have an operational cutting torch available to cut the rebar. Once the buildings were rubbled, it was not practical or efficient to keep blasting on them to cut them into small pieces for loading. So, a cutting torch instead of explosives was used.
- There was compatibility of German time fuse, det cord, and nonelectric caps with US fuse lighters, det cord, time fuse and caps. The powder train in the German det cord was more easily broken compared to the US det cord. Static electricity resistant caps were used very effectively on this project as well. For contingency planning purposes, it would be very helpful to know where German civilian stocks of explosives are located, along with other engineer resources.

Project Kryptonite clearly pointed up the need for more realistic training of Combat Engineers. The lessons we learned are far more meaningful and extensive than those learned on a normal demolition range. Keeping in mind the timidity of soldiers in handling explosives, the holes that filled in when shooting shape charges straight down, dual priming that is time consuming and wasteful, and the unexpected heavy reinforcement, some rethinking and redesigning of target folders needs to be accomplished. Perhaps a review of doctrinal publications is also in order.

Project Kryptonite was a truly outstanding experience. Those who took part in it probably would endure the foul weather, guard duty, KP, and all the other burdensome distractions to be able to accomplish such a mission again.

Captain Norman G. Comstock was the Officer-in-Charge of Project Kryptonite while serving as commander of Company D, 78th Engineer Battalion. He has held several command, staff, and advisor positions.

THE DIVISION ENGINEER IN THE GERMAN ARMY

by LTC Juergen M. Erbe

Hardly any task in the Army is more difficult or more controversial than that of the division engineer. The same difficulty applies to the brigade engineer. It is possible to be trained and selected as a commander, but the additional responsibility of advising the division commander and his staff proves to be much more difficult.

It cannot be the purpose of this article to solve future problems. If it were that easy, there would not be any more problems. I cannot and do not want to give the impression of being a schoolmaster. It is my interest to stimulate thought and discussion in order to come to a solution, or at least a reduction of the difficulties. A final solution is possible only when our armies are able to appoint an engineer colonel (0-6) with experience (i.e. commander of a division engineer battalion, G3/S3 of a brigade or division) as division engineer in main utilization. That is how it is done in the British Army. At this time, however, I do not see any possibility of realization for the US and German Armies.

The commander of the engineer battalion is the division engineer. He works directly for, and is the adviser to, the division commander, his staff, and other commanders (Artillery). In emergencies, he can be represented by the S3, but not by the engineer staff officer of the division, who lacks insight into the engineer battalion and, as a rule, lacks the required experience.

In the support section is an engineer cell, where engineer information is gathered and summarized, proposals and orders are prepared, obstacle plans are handled, engineer reports are worked on, connections are kept, etc. The head of the engineer cell is the division engineer. He works for the chief of staff and is, in case of absence, represented by the division engineer staff officer (0-4 or 0-5).

These dual responsibilities as adviser to the division commander and as head of the engineer cell in the support section must be separated in order to fully understand the tasks of the division engineer. Therefore, the position seems to be more complex at first. It is my impression, however, that it will become easier if the division engineer concentrates on his role as adviser, and provides only guidance for other activities in the engineer cell and watches over the execution.

The division engineer is not tied to one place. Where he locates depends on the needs of the division commander and his own decision. Surely the personalities of the division commander and the chief of staff, and the working manner of the staff are significant. Contact and communication with the G3, G2, and the division artillerist can be helpful. There is no procedure for the position of the division engineer, which makes the task so difficult. It requires a certain sense of touch and sensibility, and sometimes luck. But surely there are events which require him to be at a certain place.

Normally he will be needed at the *division* main command post:

- for a situation estimate;
- while awaiting a corps operation order;
- during change of the type of operation (delay, defense, offense);
- during change of a main effort;
- in case of a substantial change in the task organization;
- during change of the operational control for the division.

He would be at his *battalion* command post:

- for preparation and distribution of engineer operation orders;
- for a joint scouting of the commanders;
- during a main engineer effort like a river crossing operation in a critical situation;
- during each first employment of his battalion.

This way he can often recognize difficulties in the execution of the order in the beginning, handle crises, and provide leadership. Here again, it depends on sensitivity, knowledge of his unit, and luck in being at the right place at the right time. The division engineer must never be enroute between the division command post and his battalion when he is needed at one or the other place. Even during his absence from the command post, he must always be available for the division commander. He also must always be oriented to the situation in his engineer units in order to become engaged in time. Which means that he must have good lines of communication at his disposal.

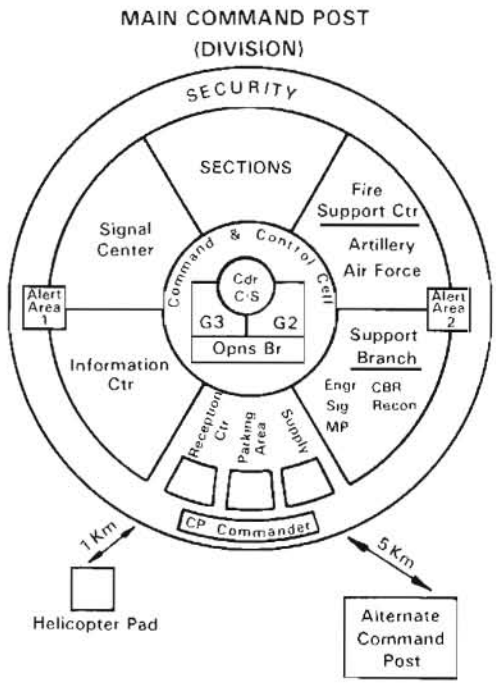
Again and again there are discussions about control of the obstacle plan. *Who* shall accomplish it? *Where* shall it be accomplished? *Who* has to approve it? The only certainty, however, is that it has not functioned satisfactorily in the past. It has not been up-to-date or accurate. Often, approval for obstacles is received too late or execution is begun without permission. It is advisable to

keep a general obstacle map at the division command post, which includes blocked areas, obstacle-free areas, obstacle gaps, and gap routes. It is preferable to keep the obstacle plan, with all details, at the division engineer battalion.

At present, the German Army is studying the concept of retaining obstacle control at brigade level because of the independent and fast operations of brigades. Experiments have been successful and a change is quite likely. One problem yet to be resolved is the personnel (staff) outfit of the brigade engineer.

While planning the first action, and when development of the situation outdates the elaborated operation plan, the division engineer must be available. He must also for the purpose of command and control in battle and in peace time.

The mission of engineers is to give support. They shall ease the battle, complete fire, and influence mobilities. Mobility and countermobility are the decisive engineer contributions on the battlefield because mobilities determine success or failure. Therefore, the division engineer must ask himself: How can I be of help to my troops, and how can I hurt the enemy by impeding his movements? That's what counts in the framework of the division, not the number of tanks lost from mines. The disturbance of enemy mobilities results in additional time for reconnaissance, preparation of the battlefield for combat, and destruction of enemy forces.



get involved as soon as possible and should not wait to be called. It will be clever and valuable to be in contact with the G3, G2, G4, and division artillery commander in order to work as a team. The division mission should be analyzed as soon as possible for impact on engineer missions. To think and act jointly in accordance with the division order is of great importance. All possibilities must be considered, and manpower and means must be coordinated. If the division engineer simply recites the engineer action in support of division operations, he will only get arguments when questioned. All too often, he must explain, prove and apologize for his proposals.

The engineer contribution to the division operation plan must be formulated and recited and/or presented in writing to the G3. If time permits, the division engineer should communicate considerations, thus eliminating confusion in his battalion, in the brigades, with the G4, and the Artillery.

With thorough communcation, the classic demands of staff duties—cooperation, analysis, coordination, and information—are fulfilled. These demands must be met not only during the planning phase of an operation, but

The division engineer has to think jointly. He must not confine his thoughts to engineer matters, but should consider all factors influencing the battle.

The job of division engineer remains one of the most difficult in the Army. It is difficult because of his triple role as battalion commander of the division engineer battalion, as adviser to the division commander and his staff, and as a member of the division staff. Besides experience and knowledge of engineer techniques, he needs a sense of feeling for human beings and for situations in order to be at the right place at the right time and to provide the right advice or to take the right action. This surely can be learned only to a certain degree.

We engineers should start to educate and train our lieutenants to work two levels higher at maneuver battalion for the combined arms team. To be an engineer commander is a challenge. Let us stand up to it.

Lieutenant Colonel Juergen M. Erbe is currently assigned to the Office of Research, Development and Acquisition of Engineer Equipment, Minister of Defense, FRG.

The Terrain Analysis Center

by CPT David R. Gallay

TAC's products can provide timely, accurate advice to maneuver commanders and enable them to use terrain as an effective combat multiplier

"How fast can my vehicles cross this terrain?" . . . "Will the lines of communications be adequate?" . . . "Where are likely drop zones?" . . . "What areas will afford us adequate cover and concealment?" . . . These are some of the "terrain" questions that commanders and staff officers often ask when planning tactical operations. They will turn to their engineer for the answers.

But, where does the combat or topographic engineer turn for quick, accurate information?

One place is the Terrain Analysis Center (TAC) at the US Army Engineer Topographic Laboratories (ETL), Fort Belvoir, VA. TAC, established by the Chief of Engineers in 1975, is a small organization comprising 39 military and civilian terrain experts, cartographers, and information specialists. Its primary mission is to produce terrain analyses in support of tactical-level operations.

TAC supports requirements generated from the field. Field commanders and their planning staffs identify potential areas of interest. The initial demand and size of the area typically exceed the capacity of supporting field terrain detachments. Thus, requests for analysis support are submitted through command channels to the Department of the Army level. If the Assistant Chief of Staff, Intelligence, validates the requirements, TAC may be tasked through the Office of the Chief of Engineers to do the work.

Upon receipt of a tasking, source materials are identified and acquired for use in the analysis. The materials range from various kinds of maps and studies to aerial photographs, satellite imagery, and computer tapes of digital terrain models.

After the material is assembled, analysis teams go to work. The team approach is "interdisciplinary." The team leader integrates the interpretations and analyses of his team members—civilian engineers, geographers, geologists, foresters, soil scientists, military image interpreters, and terrain analysts. The team concentrates on the essential elements of terrain analysis (Figure 1). They first interpret and classify "basic" data. Then, they synthesize a number of basic elements to arrive at the "evaluative" data. For example, a cross-country movement prediction is a function of all the basic data.

The final product format, as well as the number of essential elements in each study, depends on what the requestor wants. However, TAC's typical output is graphic, either an overprinted map (Figure 2) or a factor overlay. Regardless of the type, each graphic item displays an essential element keyed to a base map. Some studies contain only

BASIC DATA	EVALUATIVE DATA	OTHER DATA
SURFACE CONFIGURATION	CROSS-COUNTRY MOVEMENT	WATER RESOURCES
SLOPE	COVER AND CONCEALMENT	ENGINEERING GEOLOGY
ENGINEERING SOILS	AVENUES OF APPROACH	BUILT-UP AREAS
VEGETATION	LINE OF SIGHT	PORTS AND HARBORS
SURFACE DRAINAGE	KEY TERRAIN	AIRFIELDS
CLIMATE	STATE OF GROUND	TRANSMISSION FACILITIES
LINES OF COMMUNICATION	DROP ZONES/LANDING ZONES	STORAGE FACILITIES

FIGURE 1

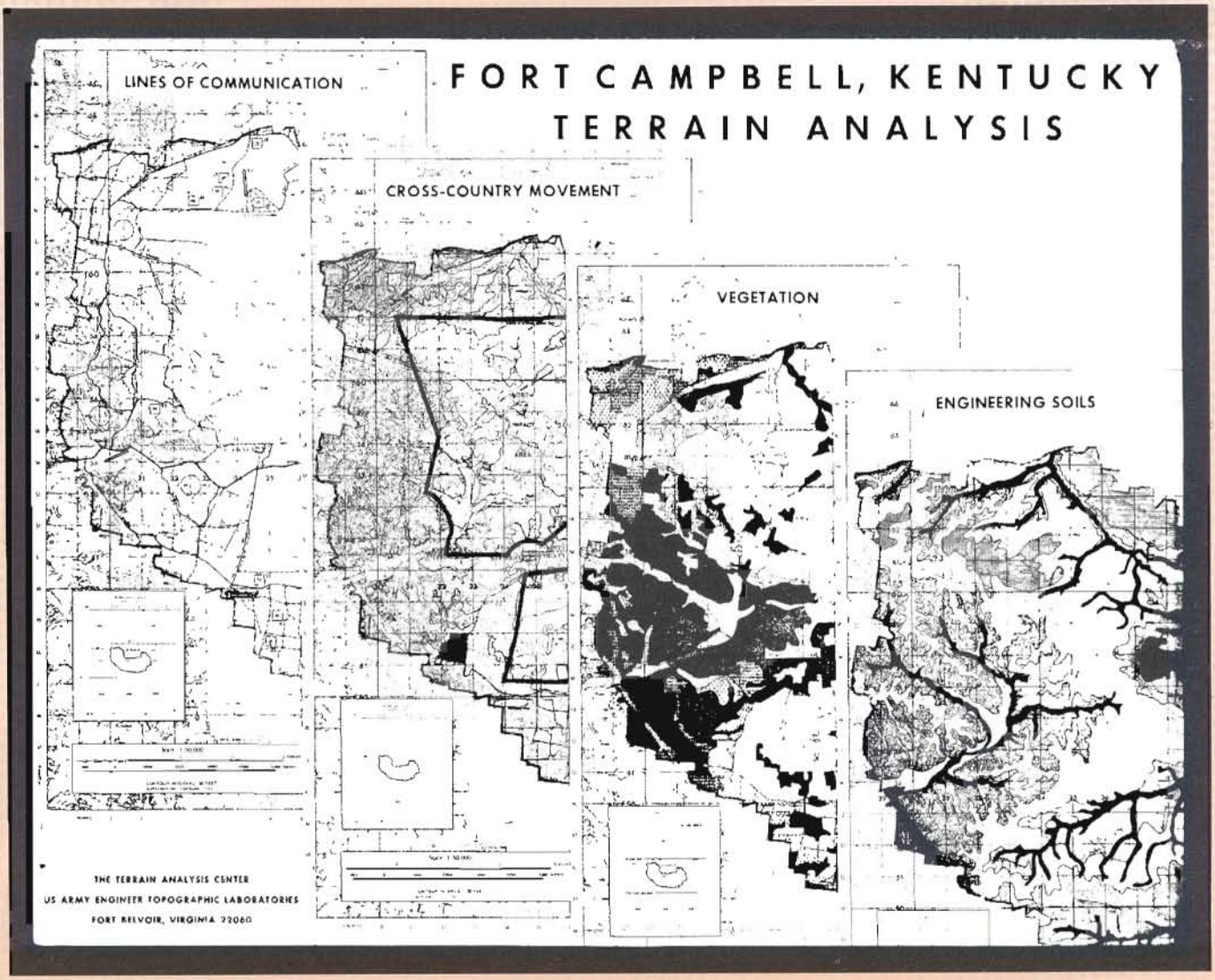
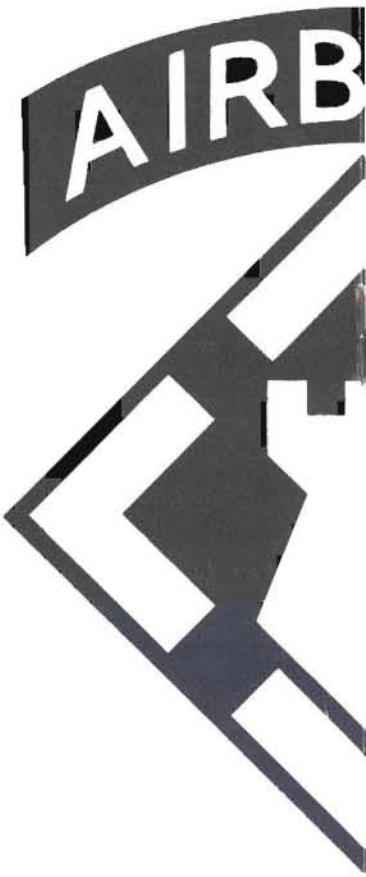


FIGURE 2

ten or twelve elements, while others may have many more.

TAC's products are not ends in themselves. They are designed as operational planning tools that often need to be supplemented by ground or aerial reconnaissance for site-specific operation. Yet, on the modern battlefield, where terrain is a decisive factor and planning time is limited, these products can be of great value. The engineer who uses these products will be able to provide timely, accurate advice to maneuver commanders and enable them to use terrain as an effective combat multiplier. This will help win the first, and subsequent battles.

Captain David R. Gallay is presently assigned as a Research and Development Coordinator in the Terrain Analysis Center, US Army Engineer Topographic Laboratories, Fort Belvoir, VA. He has commanded engineer companies in Korea and USAREUR.



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Third in a series of articles describ
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The 20th Engineer Brigade (Combat) (Airborne Corps) is located at Fort Bragg, NC. It exercises command and control over all non-divisional engineer units assigned to XVIII Airbone Corps. During peacetime, the brigade is assigned one airborne combat engineer battalion, one combat heavy engineer battalion, and one composite battalion. When deployed as part of the newly formed Rapid Deployment Force, the brigade's span of control extends to several additional battalions.

In most contingency operations, a brigade command and control element would precede most non-divisional engineers into the area of operations to coordinate the arrival and employment of those forces. In cases where the command and control element arrives in the area of operations prior to completion of airfield construction by the airborne engineer battalion, the brigade element is capable of parachuting into the airhead.

The lineage of the 20th Engineer Brigade dates back to the Civil War. It was designated as the Battalion of Engineers on August 3, 1861. Unit designations have changed many times since then as predecessors of the 20th served in the War With Spain, the Philippine Insurrection, the Mexican Expedition, and World Wars I and II.

On August 16, 1950, the brigade was first designated as the 20th Engineer Brigade and activated at Fort Leonard Wood, MO. It deployed to France in November 1952, and established headquarters at Croix Chapeau. The brigade redeployed to Fort Bragg in March 1956 and was inactivated on November 12, 1958.

Brigade headquarters was reactivated in May 1967 at Fort Bragg and departed for the Republic of Vietnam in August 1967. During the Vietnam conflict, the brigade numbered over 13,000 officers and enlisted men, organized into three engineer groups, with 14 battalions and 31 separate companies and detachments. The brigade

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provided all non-divisional engineer support in Military Regions III and IV during 11 campaigns. Units cleared more than one-half million acres of jungle, paved 500 kilometers of highway, and constructed bridges totalling more than six miles in length.

As US forces were withdrawing from Vietnam, the brigade was inactivated in September 1971. Reactivated in June 1974 at Fort Bragg, it is the only engineer brigade in CONUS, and the only airborne engineer brigade in the entire US Army.

The brigade's airborne engineer battalion, the 27th Engineer Battalion (Combat) (Airborne), is designed to provide direct engineer support to a committed airborne division as required, to construct airfields, to perform expedient repairs to existing airfields, and to complete general combat engineer missions. Battalion equipment can be introduced into an area of operations by either heavy drop or by Low-Altitude Parachute Extraction (LAPES). The battalion has the capability to provide the Corps with two medium-lift forward landing strips within 72 hours.

The 27th Engineer Battalion was activated in January 1918 and saw action in World War I in both the Saint Michiel and Meuse-Argonne campaigns. After cessation of hostilities, the battalion was inactivated.

In 1941, prior to US entry into World War II, the battalion was reactivated as the 37th Engineer Battalion at Camp Bowie, TX. In 1943, redesignated as the 209th Combat Engineer Battalion, it deployed to Bombay, India. It served throughout the war in the India-Burma Theater, building portions of the strategic Ledo Road in Burma as well as joining "Merrill's Marauders" for the surprise attack that captured the vital Myitkyina Airfield in Burma. The battalion was inactivated in November 1945 at Camp Kilmer, NJ, and reactivated in September 1950 at Fort Lewis, WA, as the 27th Engineer Battalion.

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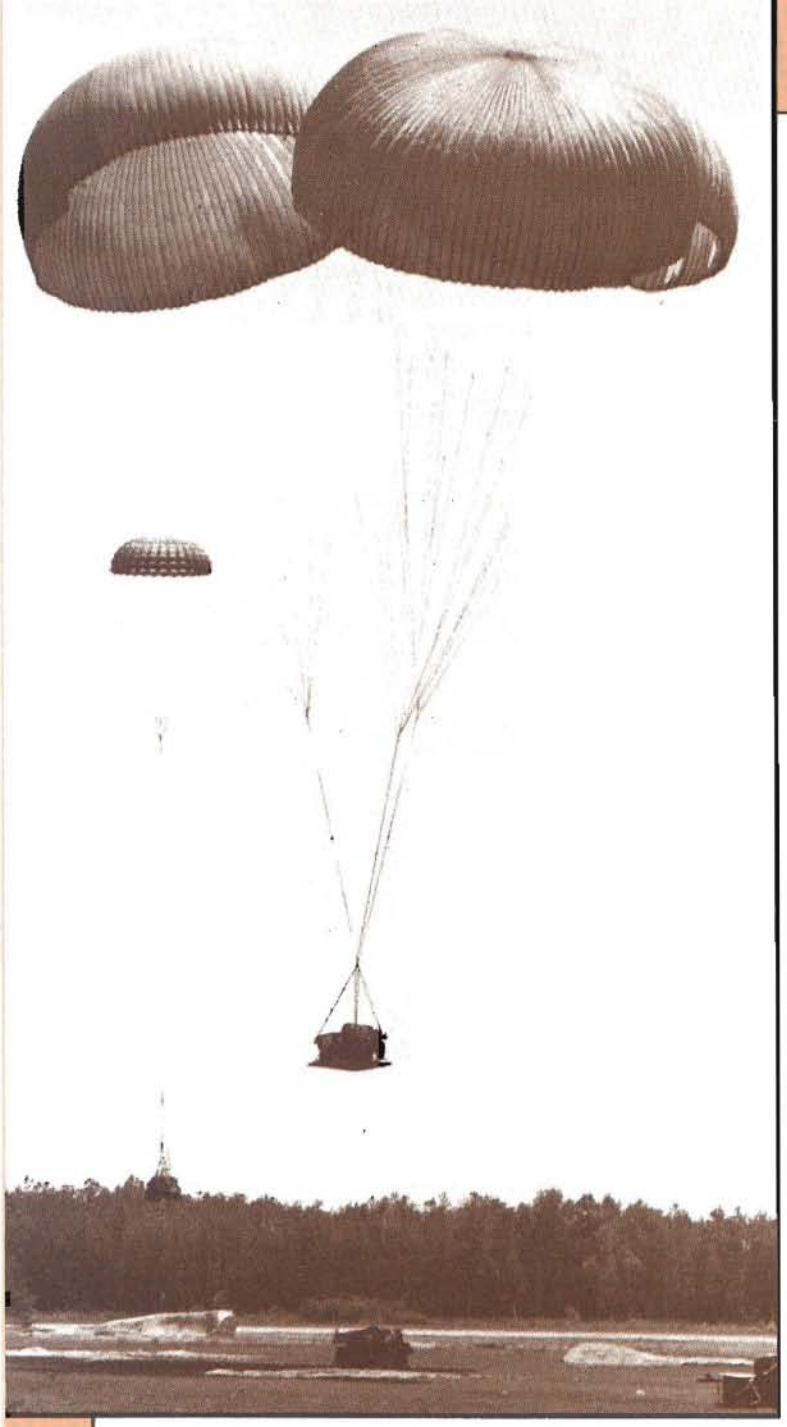


In 1951 the 27th was relocated to Fort Campbell, KY, and remained there until 1966, when it deployed to the Republic of Vietnam. During the next six years, it participated in 12 campaigns. In January 1972, the battalion was deployed back to Fort Bragg and redesignated as an airborne combat engineer battalion.

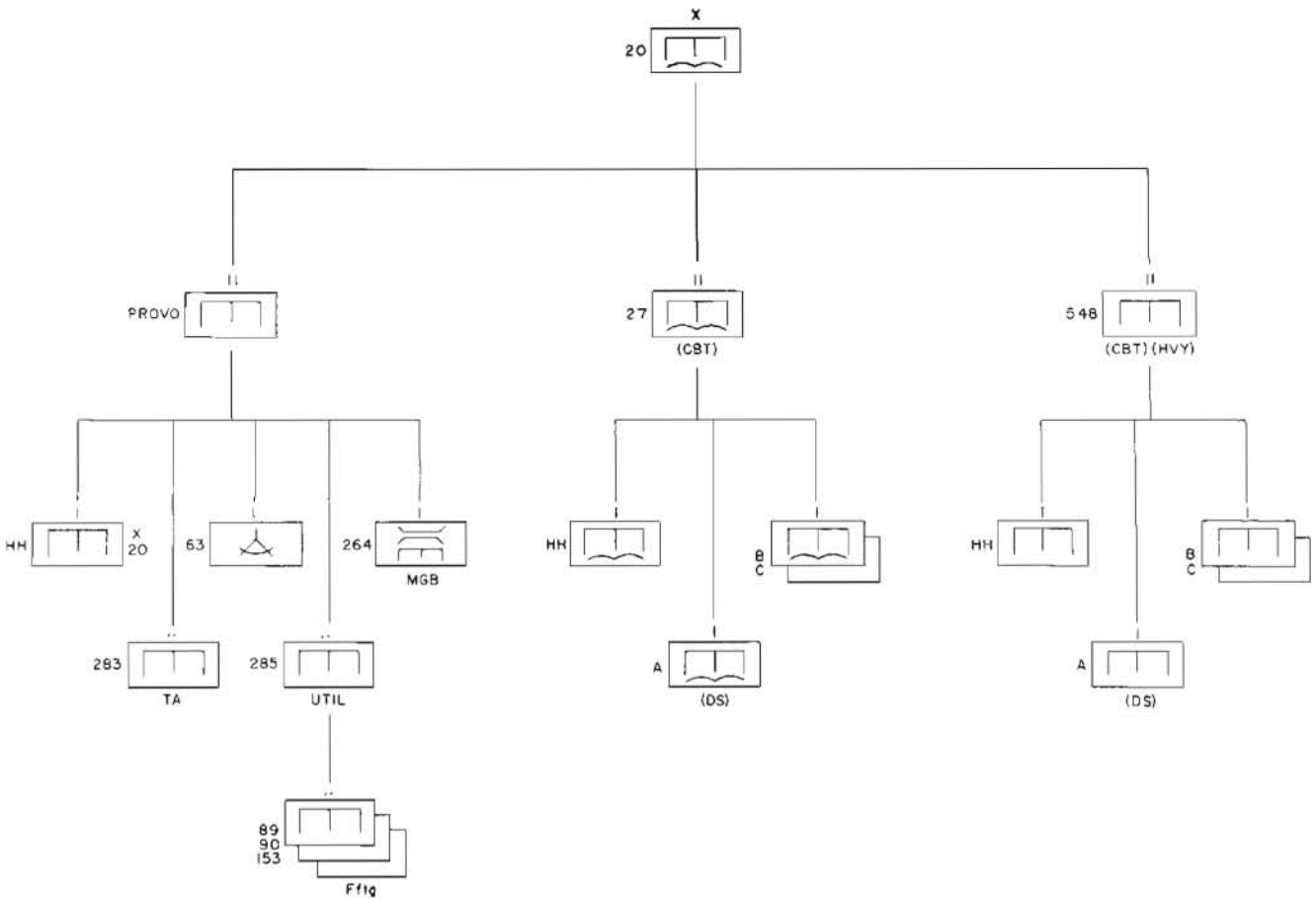
The 584th Engineer Battalion (Combat) (Heavy) provides the 20th Brigade with a heavy construction capability. The unit is equipped with military and commercial construction equipment, such as the D-8 bulldozer, the five-cubic yard front loader, and the 20-ton dump truck. Deployment by sealift is normal, but it can also deploy by air, utilizing a combination of C-141 and C-5A aircraft.

The lineage of the 548th Engineer Battalion (Combat) (Heavy) began with activation of the 548th Engineer Light Pontoon Company in March 1943 at Camp Blanding, FL. After four campaigns in the European Theater, the unit was inactivated in November 1945, only to be reactivated a year later in Germany and redesignated as the 548th Service Battalion. The 548th saw extensive service during the Korean War, earning nine campaign streamers before inactivation in Korea in March 1953. It was reactivated for less than a year in Italy in 1957 and again in 1961-62 at Fort Richardson, AK, for 18 months. On March 1, 1968, the 548th Engineer Battalion was again activated at Fort Bragg.

The Composite Battalion consists of the Brigade Headquarters Company, the 264th Medium Girder Bridge Company, the 63rd Topographic Company, the 283rd Terrain Analysis Detachment, and the 285th Utilities Detachment.

The 264th Engineer Company (Medium Girder Bridge) provides the Corps with tactical fixed bridging. The unit can supply and construct four medium Girder Bridges, each 104 feet along. The unit also has a secondary mission as a dump truck company, with 30 five-ton dump trucks. The 264th has also retained the Bailey Bridge for training.

Above, equipment of the 27th Engineer Battalion (Combat) (ABN) is airdropped onto a DZ at Fort Bragg during ARTEP. Right, members of the 264th Engineer Company (MGB), Composite Battalion, emplace panels of the Medium Girder Bridge during recent training exercise



The 63rd Engineer Company (Topographic) (Corps) represents a significant resource for the dissemination of topographic information in graphic form to the tactical commander. The company contains survey, cartography, and reproduction platoons, and runs the Post Map Depot. The unit is best suited for constructing non-standard graphics, overprinting standard maps, and producing photomaps.

The 283rd Engineer Detachment (Terrain Analysis) also provides valuable topographic analysis to the tactical commander. The unit collects and evaluates military terrain data and provides terrain studies in both graphic and textual form to the Corps and other major headquarters.

The 285th Engineer Detachment (Utilities) has primary responsibility for establishing and maintaining facilities for the Corps headquarters in an area of operations. At Fort Bragg, the 285th also provides a valuable repair and construction resource for the post. The 89th, 90th, and 153rd Detachments (Fire Fighting) provide fire-fighting support to the military installation. Their wartime mission is to support forward landing strips in an area of operations.

Overall, the 20th Engineer Brigade has the capability to provide XVIII Airborne Corps with a wide spectrum of engineer support. With both light and heavy units, the brigade has the flexibility to meet the variety of contingencies facing the Rapid Deployment Force. It can provide conventional combat engineer support, as well as topographic, terrain analysis, and utilities support.

The 20th Engineer Brigade is proud of its long service to both the nation and the Army. Having participated in 30 campaigns—more than any other major unit in XVIII Airborne Corps—the brigade is confident of a future of continued service to XVIII Airborne Corps, the Army, and our country.

APOLOGY

We apologize to current and former members of the 7th Engineer Brigade for publishing the wrong unit crest with an article on the 7th Brigade in the Summer 1980 issue of ENGINEER. We inadvertantly selected the 7th Engineer *Battalion* to illustrate the article.

ROAD CRATERS

Technical and Tactical Considerations

by CPT Robert D. Volz

The coordinated use of obstacles to delay or cannalize opposing forces is an essential task for engineers of the combined arms team. The engineer must be proficient not only in coordinating the siting of obstacles with the manuever commander, but he must also construct the obstacles so that they optimize the use of manpower and material.

Studies of obstacle plans have shown that road craters are perhaps the most frequently preplanned demolition target. However, few engineers have an appreciation for the environmental factors which influence crater effectiveness and construction time. The objectives of this article are to familiarize the reader with some of these factors and to compare some alternatives for construction of road craters.

Road craters are point obstacles created by explosive excavation of a roadway. While it is possible to use earthmoving equipment for this excavation, it is generally not considered practical since some pavements are difficult to break and also since such operations divert equipment from the important task of digging

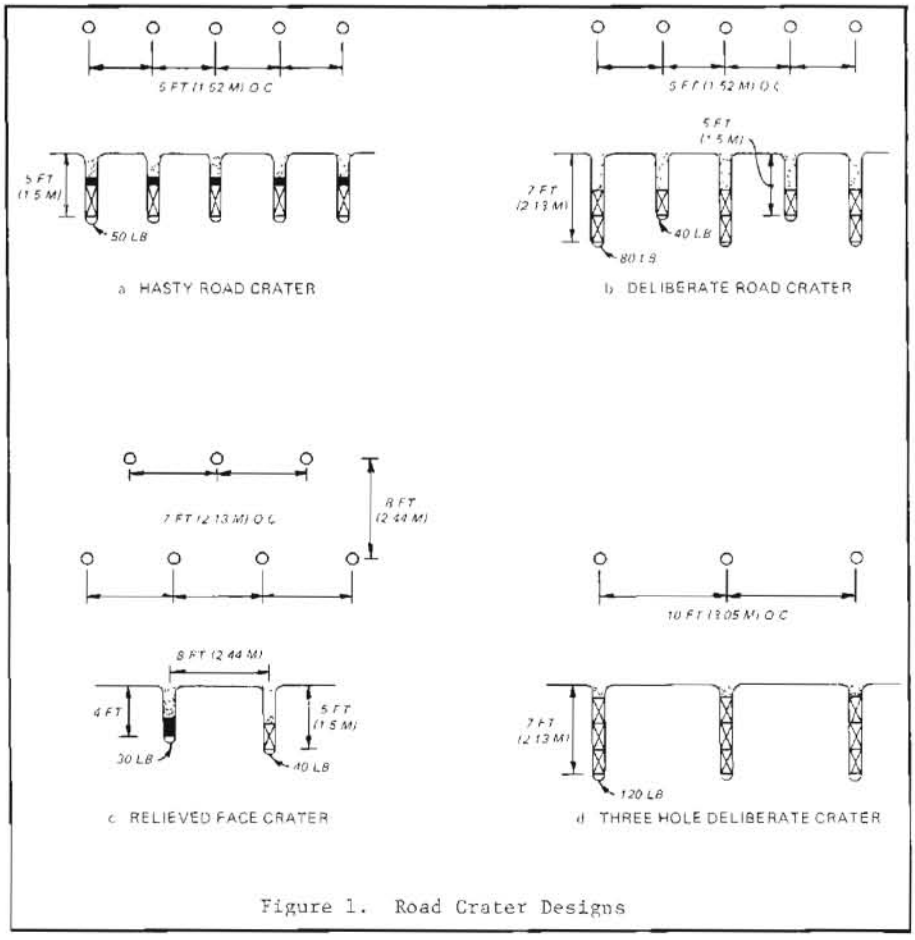


Figure 1. Road Crater Designs

hull defilade positions and tank ditches. Prechambered craters which require a preconstructed emplacement cavity, and employment of Atomic Demolition Munitions (ADM) are special cratering applications limited by political as well as strategic considerations.

Current doctrine recognizes three road crater designs: the hasty, deliberate, and relieved face craters, listed in increasing order of effectivness. The charge configurations of these designs are illustrated in Figure 1A, 1B, and 1C, and are discussed in FM 5-25 and FM 5-35. The expected size and relative effectiveness of each design is included in Chapter 3 of FM 5-25 and the estimated emplacement times can be obtained from ARTEP 5-145 and FM 90-7. These characteristics are summarized in Table 1.

While these designs and information have been utilized extensively for planning purposes, just how reliable are they? What factors should the engineer leader consider before selecting a particular crater design or system? A look at the results of cratering experiments and a comparison of existing and proposed cratering systems may well answer some of these questions.

The crater data published in FM 5-25 was derived from a single test program conducted at Camp A.P. Hill during 1963. Many craters were detonated as part of the test, but most of them did not utilize the standard crater designs or explosives currently in the inventory. During the entire test program, only five hasty, four deliberate, and two relieved face craters were executed with standard Army crater designs. The results have molded Army cratering doctrine for the past 17 years. Subsequent cratering tests have shown that cratering doctrine published in our field manuals is both inaccurate and incomplete.

Two important factors are ignored in present publications: the effects of soil conditions on crater size and effectiveness, and the dependence of preparation time on shaped charge performance in different road materials.

Terminology is important in comparing the results of cratering tests. Consider the crater profile of Figure 2. When a buried explosive charge is detonated, it creates a crater and forms an upturned lip around the crater rim. The apparent width and depth are the dimensions measured in relation to the original undisturbed ground surface. Crater site elevations must be measured both before and after detonation with a level or transit to determine the apparent dimensions. The obstacle dimensions are measured in relation to the crater lips and can be obtained by simple tape measurements. While obstacle dimensions are easily and quickly measured, the apparent dimensions provide a more accurate picture of cratering effectiveness. Comparisons of cratering data must utilize consistent dimensions.

One is led to believe that if he follows the instructions of FM 5-25 he will detonate a crater which is similar in size and effectiveness to the "hypothetical crater" shown in Table 1. Unfortunately this is not always true. Table 2 presents a comparison of deliberate road crater dimensions from FM 5-25 with the test results of craters detonated near Fort Peck, MT, and Aberdeen Proving Ground, MD. The effects of soil and moisture conditions are immediately apparent. The Fort Peck crater is approximately one-half as deep and three fourths as wide as the Aberdeen crater. Comparison of both sets of dimensions with those predicted by FM 5-25 demonstrates the wide variation in crater size which can result in different environments.

These variations in dimensions dramatically affect a crater's value as an obstacle. A deliberate road crater detonated in a wet clay soil may completely immobilize a tank while the same quantity of explosives used in the dry sand or clay of an arid region will not significantly delay a tracked vehicle. It appears that none of our standard cratering procedures will produce an effective crater in all soils.

While it may be possible to relate crater dimensions to moisture content and the unified soils classification system, such a system would be impractical for field use. Perhaps a suitable compromise is to group cratering

continued

TABLE 1

Standard U. S. Road Crater Characteristics
(FM 5-25, Feb 71)

Type	Average Crater Dimensions				Side Slope Degrees	Passes Per Tank Traverse	Installation Time (Squad Hours)*
	Depth		Width				
	ft	m	ft	m			
Hasty	6-7	1.83-2.13	20-25	6.10-7.62	25-35	4	2
Deliberate	7	2.13	25	7.62	30-37	8	2
Relieved Face	7	2.13	25-30	7.62-9.14	30-40	—	2

* Installation time from draft FM 90-7, Dec 77; ARTEP 5-145, Jun 78 lists 1 hour, 15 minutes, plus time required to clear emplacement holes. Time does not include travel to or from site.

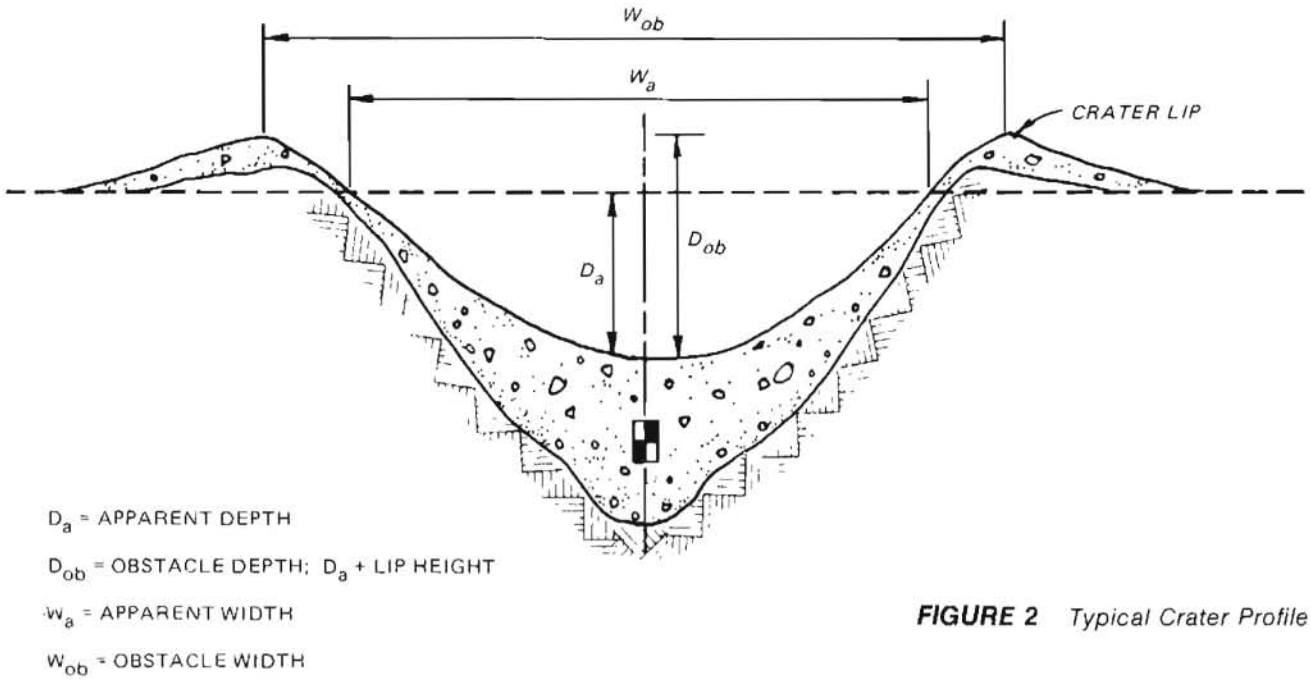


FIGURE 2 *Typical Crater Profile*

effects as a function of relative moisture content. In general, large effective craters can be blasted in wet, fine grained soils such as those at Aberdeen Proving Ground (sandy silt-ML), the Panama Canal Zone (clayey silt-MH) and Camp A.P. Hill (clayey sand-SP). Poor cratering results are obtained in dry soils such as those at Yuma Proving Ground, AZ (gravelly sand-SP), Fort Peck, (highly weathered shale) and Tooele Army Depot, UT (silt and clay CL-ML). Table 3 provides a means of relating approximate crater dimensions to relative soil moisture content. The dividing line between wet and dry soils for this table is a 10 percent water content and/or 50 percent saturation. As noted in the table, one can expect a considerable variation in dimensions even for shots fired in the same location.

The data for hasty and relieved-face craters is incomplete because I could not locate any test results for the performance of these designs in dry soils.

While crater effectiveness is related to crater size, the true measure of a crater's effectiveness is its ability to delay a vehicle. The test report published in 1963, mentioned earlier, provides what appears to be the only comprehensive study of tank mobility in standard Army craters. Some of the conclusions of that test program were:

TABLE 2

Results of Deliberate Road Crater Tests

Location	Soil Type	Apparent* Depth ft (m)	Obstacle** Depth ft (m)	Apparent† Width ft (m)	Obstacle†† Width ft (m)	Apparent† Length ft (m)
Para 3-17 FM 5-25	?	7 (2.13)	—	—	25 (7.62)	36 (11.0)
Ft. Peck, MT	Highly weathered shale	3.9 (1.2)	5.4 (1.7)	18.4 (5.6)	26 (7.9)	33 (10.1)
Aberdeen Proving Ground, MD	Wet sandy silt	8.1 (2.47)	10.8 (3.2)	24.5 (7.5)	35 (10.7)	40 (12.2)

* Depth from original ground surface to bottom of apparent crater.
** Maximum depth from lip crest to bottom.
† Width and Length of apparent crater measured at original ground level.
†† Width as measured from lip crest to lip crest.

TABLE 3

Expected Crater Dimensions For Ammonium Nitrate Explosives

	Crater Type	Average Apparent Depth ft/(m)	Range of Depths ft/(m)	Average Apparent Width ft/(m)	Range of Widths ft/(m)
Wet Soils*	Hasty	6.5	5.5–7.0	19.5	15–23
(clay, silt, clayey sand)		(2.0)	(1.7–2.1)	(5.9)	(4.6–7.0)
	Deliberate	7	6.1–8.1	23	18–25
		(2.1)	(1.9–2.5)	(7.0)	(5.5–7.6)
	Relieved Face	6	—	23	—
		(1.8)	—	(7.0)	—
Dry Soils*	Deliberate	4.2	3.5–5.5	17	13.5–18.5
(Sand, shale, clay)		(1.3)	(1.1–1.7)	(5.2)	(4.1–5.6)

* Soil Moisture: Wet soil — Saturation ≥50% Water content ≥10% — Dry soil — Saturation <50% Water content<10%

• that hasty craters are only marginally effective against modern tanks;

• deliberate craters are effective obstacles;

• that relieved-face craters are more effective than either of the other designs.

During the 17 years which have passed since the first test report was published, the deliberate crater has been tested in at least six test programs, and the relieved face crater in two programs. I have been unable to find any evidence of further scientific testing of the hasty crater. The deliberate crater has proven its effectiveness in wet soils, but is probably marginal to ineffective in desert soils. The two subsequent tests of relieved-face craters have raised serious doubts about the reliability of this design. A test program conducted by the 54th Engineer Battalion in 1969 concluded that the cratering method described in FM 5–25 will not produce a satisfactory relieved face crater. Another test program found that the detonation of the first row of charges disrupted the ring main of the second row, resulting in misfires. From a statistical point of view, additional testing of hasty and relieved-face craters would seem warranted.

FIGURE 3 *Optimum 15-lb shaped charge blast hole*

The current doctrinal definition of an effective crater is at best cumbersome. FM 5–25 states that road craters are effective if a tank requires *three or more* passes to traverse it. I believe that crater effectiveness should be defined in terms of how *long* a vehicle will be delayed in the crater, not how many passes it will take to traverse it. A reasonable criteria would be the time required to acquire a target, to launch an antitank missile, and to track it to the maximum effective range of the weapon. For present systems, 30 seconds is a reasonable minimum required time delay for a road crater.

Longer delay times are necessary for craters spanning multi-lane highways or for tank ditches where several vehicles can enter the crater (or ditch) at the same time. An upper bound is most likely that of a crater blasted in a four-lane highway. Assuming that four vehicles could enter the crater simultaneously and that only one AT weapon system would cover the ditch, a minimum delay time of two minutes would be required. On the basis of this simple analysis, it appears that road crater designs should provide time delays on the order of 30 seconds to two minutes. A table relating delay time to soil conditions and crater type would provide a valuable planning tool for defensive operations.

continued

The most significant time and labor factor in road cratering is the preparation of emplacement holes. While current doctrine (FM 5-35, ARTEP 5-145) recommends the use of 15-pound (M2 A3) or 40-pound (M3 A1) shaped charges to blast emplacement holes, many factors influence the overall time required to produce a usable hole. Since shaped charges require large stand-off distances to produce emplacement holes, valuable time is lost trying to jury-rig tripods or other devices to hold them at the proper height. In some cases, shaped charges blast deep, large-diameter holes which can be loaded with cratering charges with minimal cleaning (Figure 3). In other tests, the shaped charge detonation caused surface craters which filled the holes with loose base course material. Excavation of such holes is slow and tedious. The posthole digger is useful in removing rocky soil but it cannot dig or clean holes more than five feet deep. The hand auger can clean down to seven feet but is difficult to use where rocks in the hole exceed two to three inches in diameter.

FIGURE 4 *Pouring slurry into shaped charge blast hole*

In a series of cratering tests conducted at Raystown, PA, more than 85 40-pound shaped charges were used to blast emplacement holes. While the shaped charge jet penetrated at least six feet, virtually all of the holes required cleaning and it was found that a well prepared base course makes excavation particularly difficult. All of the holes blasted in a light duty road could be cleaned to five feet, but only 55 percent of the holes with a planned depth of seven feet could be cleaned to that depth. Tests were also conducted on a medium duty road which had a four-inch asphalt pavement over a four-inch crushed limestone base. Only 30 percent of the holes in this road could be excavated to design depth.

The problem of excavating shaped charge holes is compounded by a lack of hole diggers and augers. Road cratering is a squad task, but organic equipment includes only one post hole digger per squad and one auger per platoon. During a squad cratering mission, boreholes must be cleaned one at a time (unless reinforced with additional equipment) and the platoon's auger must be shared by three squads.

Given real world problems of fabricating shaped charge stands and cleaning emplacement holes with limited resources, road crater empacement time may well exceed the two hour planning figure found in most references. The Raystown test results indicate that crater emplacement time may vary significantly for different

sites. While it is possible for a squad to blast a hasty crater in an unpaved demolition range within two hours, it is unlikely that the same squad could blast a deliberate road crater in a well constructed paved road in the same length of time.

The performance of standard shaped charges presents a dilemma for the use of ammonium nitrate cratering charges. Forty-pound shaped charges reliably blast clean holes in thick (10-inch) reinforced concrete pavements which are deep and wide enough to load cratering charges. However, when these charges are used on thin (three-inch) concrete pavements, extensive concrete breakup and base course cratering fills much of the hole with debris. The 15-pound shaped charge blasts holes in most thin pavements and soil, but the hole diameters are normally too small for a cratering charge.

One product which offers a possible solution to the dilemma is the XM268 blasting agent. Testing of commercial slurry explosives has led to its limited procurement. The blasting agent is packaged as two inert components, a liquid oxidizer solution and a powdered fuel. They are mixed to form an explosive. It has been proven to be about 1.5 times more effective than an equal weight of TNT in producing crater volume.

In tests conducted at Yuma Proving Ground and in the Panama Canal Zone, deliberate road craters produced with XM268 had apparent dimensions approximately 20 percent deeper and 28 percent wider than those obtained with ammonium nitrate charges.

XM268 is denser than ammonium nitrate and has the consistency of a syrup which allows it to be poured or pumped directly into emplacement holes. This combination of superior density and fluid consistency allows XM268 to fill all voids within the emplacement hole and to form a more compact charge than ammonium nitrate cannisters. When shaped charges blast open holes, they can be loaded with slurry even if they are too small to load with ammonium nitrate charges. Figure 4 shows the XM268 blasting agent being poured through a 3½-inch diameter hole which was blasted with a 15-pound shaped charge.

Results of testing the shaped charge and the blasting agent suggest two design configurations—one for thick pavements and the other for thin pavements and unpaved roads. The *thick* pavement design uses 40-pound shaped charges to blast holes spaced 10 feet on centers as shown in Figure 1D. One hundred and twenty pounds of blasting agent is poured into each hole. Testing of this three hole deliberate crater design has shown that it performs at least as well as the standard deliberate road crater.

The *thin* pavement design is a modification of the hasty road crater design of Figure 1A. Fifteen-pound shaped charges are used to blast holes five feet on centers. Each hole contains between 50–80 pounds of XM268 blasting agent. The exact quantity would depend on actual hole size since blasting agent would be poured until either the hole is almost filled, or 80 pounds had been used.

These proposed designs minimize the number of blast holes that require cleaning. Balancing shaped charge size to pavement thickness insures that the majority of shots produce open holes. The blasting agent's fluid state is used to allow its placement in open holes too small for standard cratering charges. Note that these designs offer advantages even if the holes require cleaning. Since the thick pavement design utilizes a 10-foot hole spacing, there are fewer holes to clean. The thin pavement design uses just as many holes as conventional designs, but they are never deeper than five feet. Certain logistical and cost benefits are quantified later.

The M180 cratering kit (Figure 5) offers a substantial improvement in preparation time over other systems. Unlike conventional cratering procedures, the M180 does not require site preparation. Tests indicate that this system will reduce the time required to execute a crater from over two hours to less than 30 minutes under good conditions. During tests

continued

FIGURE 5 *M180 cratering kit*

FIGURE 6 *Single M180 crater in 7.5-inch concrete pavement*

at Aberdeen Proving Ground, three kit configurations produced craters which averaged 7.9 feet deep (apparent), 24.6 feet wide, and 29.1 feet long. The average crater for a five-kit configuration was 8.5 feet deep (apparent), 34.0 feet wide, and 37.5 feet long.

Comparison of cratering data from different test areas indicate that these dimensions are probably optimum and will be smaller for many soil conditions. M180 kits have been successfully fired through concrete and asphalt pavements up to 7½-inches thick (Figure 6). The M180 creates effective obstacles in wet soils but is apparently ineffective in dry desert soils. Training requirements for the M180 are less than those for standard cratering procedures.

While the M180 system will allow rapid cratering, certain factors limit its tactical use. Due to system requirements, no more than five kits can be fired simultaneously. Thus, the longest crater which can be executed at one time is approximately 36 feet (11 meters). This corresponds to a five-hole deliberate crater. This limitation, coupled with the M180's poor reliability in thick (12-inch) concrete pavements, indicates that the M180 will not reliably crater an autobahn.

In addition, the system requires electric initiation by a blasting machine with a 50-cap or larger capacity. The electric caps in the system are subject to premature detonation by any strong radio frequency (RF) source. Thus, the use of tactical radios and radar must be controlled where the set is used.

Furthermore, the kit's rocket motor cannot be fired if it becomes hotter than 130°F. Due to this limitation and cratering performance in dry soils the kit is probably not suited to desert operations. The M180 rocket motor and, to a lesser degree, its warhead are likely to burn or detonate when struck by small arms fire. These limitations must be considered in planning its tactical use.

TABLE 4

Road Crater Explosives Requirements (20 ft Roadway)

Type	Shaped Charges 15-lb	40-lb	40-lb Crater Charge	TNT (lb)	BA (lb)	Packaged Weight lb (kg)	Packaged Volume ft^3 (m^3)
Standard Systems:							
Hasty		5	5	50		657 (298)	18.3 (0.52)
Deliberate		5	8	8		756 (343)	21.1 (0.60)
Relieved Face		7	4	94		798 (362)	22.2 (0.63)
M180			5 Kits			825 (374)	36.0 (1.02)
Proposed Systems:							
3-Hole Deliberate (Thick Pavement)		3		6	360	643 (292)	16.3 (0.46)
Modified Hasty (Thin Pavement)	5			10	400	609 (276)	15.3 (0.43)

It is questionable if the M180 is suited for reserved demolitions. While the kits can be quickly assembled, they cannot be placed on the roadway until all traffic has passed. This may well require final kit assembly and arming when enemy forces are close at hand. Since the M180 is electrically primed, an engineer squad either must give its blasting machine and firing wire to the demolition guard commander, or the squad must wait at the site and fire the device themselves. The assembled kits would be particularly vulnerable to small arms fire, mortars and artillery which could either knock the kits over or prematurely detonate them. In direct summer sunlight, assembled kits may require shade to keep their temperature below 130°F when exposed for long periods of time. Conventional crater systems are inconvenient and slow since they require closing the road to traffic during construction. But once the charges are buried and properly primed with a non-electric firing system, they may well prove to be much more reliable in closing a passage point at crucial time during battle.

Logistical efficiency is of particular importance to engineer units which must transport their Class V materials over long distances. Table 4 compares the logistics requirements for cratering a 20-foot (6.1-meter) roadway (and shoulders) with various systems. This table was compiled using the weights and volumes of *packaged* charges, since explosives are normally issued and transported in this manner.

For planning use, the weight and volume of mines should be added to these figures. General trends can be noted by comparing these values to those of the hasty crater. Deliberate and relieved face designs require about 15 and 20 percent more weight and volume, respectively. The M180 system weighs 25 percent more than the hasty crater explosives and requires almost double the volume. The proposed designs average about five percent less in weight and 10 percent less in volume. When weight is the limiting factor, there is at best a 35 percent difference in the number of systems per vehicle load. When volume capacity is critical (i.e., five-ton dump truck), a vehicle can carry almost twice as many hasty road crater systems or blasting agent systems as it can M180 systems.

TABLE 5

Estimated 1980 Procurement Cost to Crater a 20 ft Roadway

Type	Cost	Relative Cost
Standard Systems:		
Hasty	$ 1,675	1.0
Deliberate	1,860	1.1
Relieved-Face	2,095	1.3
M180	16,000	9.5
Proposed Systems:		
3 Hole Deliberate	855	0.5
Modified Hasty	1,255	0.8

At the user level, system cost is seldom considered. But cost impacts upon procurement and is also reflected in the amount of live fire training that can be conducted. Table 5 compares the estimated 1980 cost of cratering a 20-foot roadway (and shoulders) with various systems. The cost figures reflect either actual or estimated costs for purchasing all required items at current prices. The figures show a big cost difference between craters produced by blasting agent, present amonimum nitrate explosives, and the M180.

Conceptually, cratering is a simple process. Once the obstacle location has been chosen, an engineer squad prepares and fires explosive charges to create an effective obstacle within a scheduled time period. Unfortunately, not all test data agrees with doctrinal estimates of effectiveness and preparation time. While the effectiveness of the deliberate crater design in wet soils is well documented, performance testing of the hasty and relieved face designs is virtually nonexistant.

The few tests of the relieved face design indicate it is unreliable. In addition, all of our cratering systems are probably marginal to ineffective in desert environments. Our time-planning figures are probably too optimistic for our current level of experience in cratering actual roadways with squad-sized elements. Barrier plans and war gaming based on optimistic estimates will give a distorted view of engineer requirements and capabilities. While the M180 will provide a rapid cratering system, it is by no means an all-purpose device.

Many aspects of military cratering need additional research. Tables should be developed which correlate crater size and trafficability to soil conditions. It may prove necessary to develop two sets of crater designs, one for soils which are easy to crater and the other for less favorable soils. Emplacement timetables should be developed which relate construction time to the difficulty of producing emplacement holes. There is room for development of better hole blasting techniques, or even lightweight drilling equipment which could rapidly create emplacement holes. Elimination of heavy shaped charges from cratering systems would considerably lighten the logistical load. The XM-268 and the M180 offer distinct improvements over current products. But further research to fully measure the potential of these concepts and products seems justified. It is vital that engineers apply the best available technology to support the combined arms team.

Captain Robert D. Volz is presently assigned as a Research and Development Coordinator at the Waterways Experiment Station in Vicksburg, MS. Previous assignments include company commander, S-2, and platoon leader with the 54th Engineer Battalion (CBT), USAREUR.

We have seen, in recent years, many instances of newly appointed noncommissioned officers (NCOs) not knowing what their job was or what was expected of them by their subordinates or superiors. We have also seen newly appointed NCOs who did not know what to expect of their superior NCO.

When the noncommissioned officer receives his first set of chevrons, he becomes a different individual. He is no longer "one of the guys," but the man his subordinates *look to for leadership*. He is no longer responsible only for himself but for all those who work for him. The NCO must know and live up to his duties and responsibilities at all times. The term, "That is not my responsibility," cannot be accepted if it concerns one of his subordinates, his unit, or the US Army.

To earn and maintain the respect and trust of his men, the NCO must prove he knows his job. This does not mean to merely know what the book says about a specific assignment, but to have the vision to see the completed task, and the ability to lead his men to that objective. The noncommissioned officer must have an open mind and be able to realize and accept new ideas and concepts. He must keep himself well informed by self-study, attending school, learning from superiors and peers and, last but not least, from subordinates. Remember, good ideas do not always come from the supervisor. Today's young soldier will not accept the reasoning "That is the way we have always done it," so we had better present a valid reason.

In addition to job knowledge, the NCO must know the overall unit mission. He must be able to explain the mission, how it is to be accomplished, who is going to do what, and the reason behind all actions. The good NCO will be able to answer these questions and employ his men properly to insure prompt mission accomplishment.

Too many times we hear complaints that individuals within a unit are not utilized properly. Before an NCO can properly utilize his personnel he has to know more than rank and last names. By knowing each individual's ability, personality, and patterns of behavior, the noncommissioned officer can readily assign duties and expect them to be accomplished. Other factors which should be considered are: conditions existing within his family; financial problems; complaints concerning the unit or other personnel within the unit. These factors can influence the actions or attitude of subordinates.

The Noncommissioned Officer

by CSM (Ret) Johnny W. Greek

Professional development of subordinates is another responsibility of the noncommissioned officer. By knowing the limits of their ability and their interest, he can provide educational guidance. In selecting an individual to attend school, the NCO must carefully consider the needs of the Army as well as the individual. Consider the man's past record as well as his demonstrated potential. Training received at unit level is even more important than school training. Unit level training conducted by the NCO must be conducted properly if it is to produce the desired results.

This does not mean there has to be a fancy classroom, charts, slides, and expensive training aids available. It does mean, however, that there has to be a needed subject, a competent instructor, and motivated personnel. The instructor must know his subject matter, rehearse the class, and be confident in presenting material to the students. The instruction presented must be needed by the students or they will have little desire to learn. Spend your limited training time with classes that help the student become more proficient in his job.

When presenting information, talk *to* the class. Don't talk above or below their level of understanding. If students are confused, they cannot learn. Whenever possible, use appropriate training aids. If the subject is operation of the M-16 rifle, have sufficent weapons available for each student. Since all classes cannot be conducted in this manner, the instructor should provide adequate training aids to maintain student interest.

Another type of training is disciplinary in nature. Most soldiers relate discipline to punishment, but NCOs cannot administer punishment. By definition, discipline is "a branch of knowledge or learning; training that develops self control, character or orderliness or efficiency."

To be concise, discipline means training, teaching, and learning. We should not confuse discipline with punishment. Disciplinary action to correct a discrepancy is corrective training and must be conducted where a discrepancy exists. If an individual is forced to perform a menial task in retaliation of a breach of discipline, he is being punished and is not receiving corrective training. Normally, due to lack of time during duty hours, corrective training is conducted during nonduty hours. This period of instruction must be conducted in such a manner as to teach the individual and not belittle him. One method of administering discipline is on-the-spot correction. In making on-the-spot corrections, always use courtesy and tact.

The good NCO will be available to his subordinates at all times and will insure they are aware of it. When a man comes to his superior for help, day or night, he expects to be helped. The NCO must be willing to give up much of his free time to assist the individual who is troubled because that soldier may not be around tomorrow to ask for help. When problems arise that he cannot solve, he must have access to his superiors or personnel trained to assist with those problems. The availability of all members in the chain of command must be established and publicized.

One area that could cause problems for the NCO today is the supervision of women. In the past, few NCOs had women under their direct supervision, but World War II brought the realization that women can perform most of the same military tasks as men. On the average, military women are more educated than their male counterparts. Even though most women do not have the varied experience of their male counterparts, they can just as easily be trained to perform essential duties. Once the woman has become accustomed to her unit, she must receive no special treatment or privileges or she will never feel that she has become a part of her organization.

As the NCO progresses in grade, so do his duties and responsibilities. The first step up in responsibility is the assigned duty as a squad leader. At squad level the NCO is in more direct contact with the working body of a unit than at any other level. The squad leader is the first link in the chain of command and in the NCO channel of communication. Through this channel, the squad leader transmits the pulse of the unit to his superiors. He must supervise his subordinates in daily activities and in the performance of special missions. He is responsible for the appearance, accountability, and training of his squad, and for the maintenance and accountability of all equipment issued to his squad.

The squad leader must set the example. He must maintain his appearance well within the limits set by accepted and prescribed policy. The overweight NCO can expect a negative response when he tells a subordinate he needs a haircut.

The squad leader must at all times be able to account for the members of his squad. Accountability includes the knowledge of where his people are, what they are doing, and when they are expected to return.

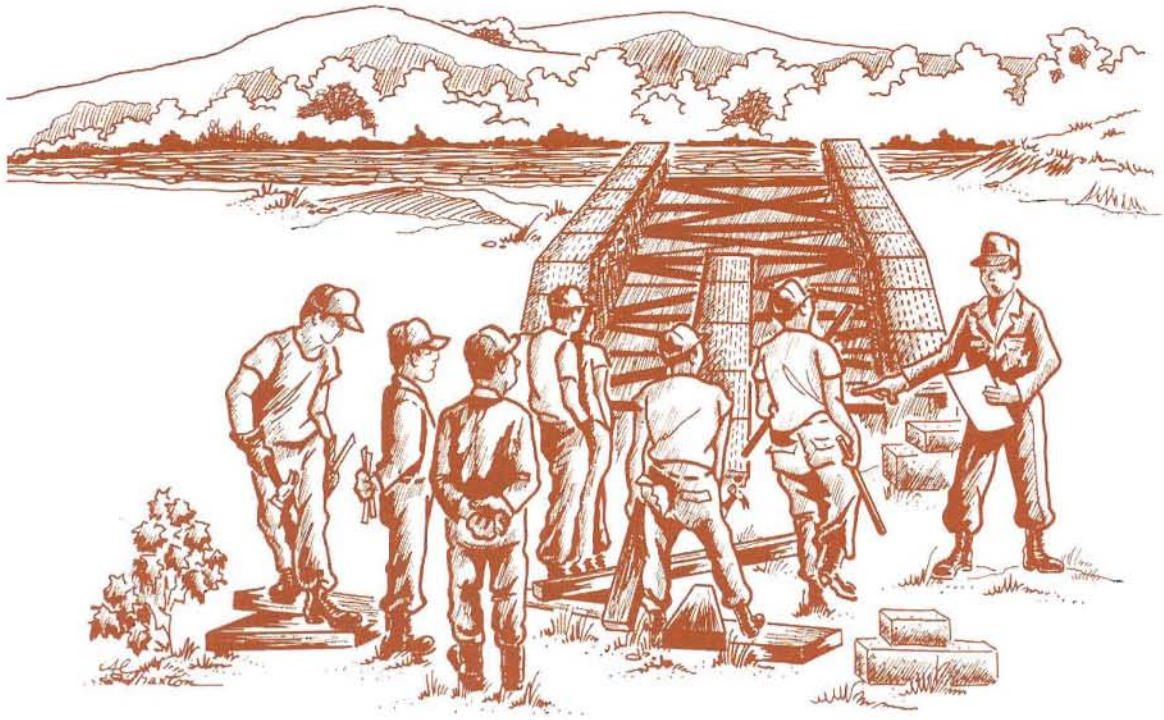
The squad, as the base element of the platoon, must be prepared to perform its mission at all times. This requires unit training, and is a responsibility of the squad leader. Training should include the cross training of individuals within the squad to enable the squad to function even during the absence of one or more members and under the most adverse conditions.

Normally, time is not available for formal classroom training, so the squad leader must be prepared to present impromptu or "tool-box" classes at any opportunity. Classes could be presented during breaks or while the squad is waiting to move from one location to another. Any time the squad leader has five minutes, he should be prepared to instruct squad members on subjects such as safety, personal hygiene, or maintenance of equipment. After all, it is the squad leader's responsibility to see the individuals' equipment is properly maintained.

These basic duties and responsibilities of the squad leader will consume most of his duty hours. During off-duty hours, he must prepare himself to assume the duties and responsibilities of platoon sergeant.

The platoon sergeant is the first step in the NCO channel of communication that has an officer as the immediate supervisor. Therefore, many of the duties will be prescribed by the platoon leader. The platoon

continued



sergeant advises and assists the platoon leader in supervising the performance of platoon members through the squad leaders. Most platoon leaders are young and inexperienced, and look to the platoon sergeant for guidance, instruction, and encouragement. It is up to the platoon sergeant to provide this leadership. He should not try to confuse or "snow" his platoon leader. It is only natural for a platoon sergeant to feel possesive toward his platoon, especially if he has been in the unit for a period of time, but possessiveness should not affect his relationship with the platoon leader.

The platoon sergeant further assists the platoon leader by relaying information to squad leaders, coordinating the efforts of squad leaders assisting in acquiring supplies and equipment needed, counseling personnel concerning promotions, job performance, reenlistment and personal problems, accounting for personnel by utilizing the squad leader's reports, and passing information up and down the NCO channel of communication. He must also assist squad leaders in the pursuit of MOS proficiency while, at the same time, preparing himself for advancement to the position of first sergeant.

The first sergeant is the senior noncommissioned advisor to the company commander. He must assist the commander in the operation of the unit, and advise him on all matters pertaining to the unit mission or personnel. Army Regulation 611-20 contains a long list of first sergeant responsibilities. In addition, he is responsible for and to every man in his unit and if he should ever become so mission-oriented that he forgets this, the unit will surely suffer.

The first sergeant is usually the most experienced man in his unit and should be able to assist in solving many problems that confront his men. The first sergeant should take every opportunity to be with unit personnel at work, in the field, or at play.

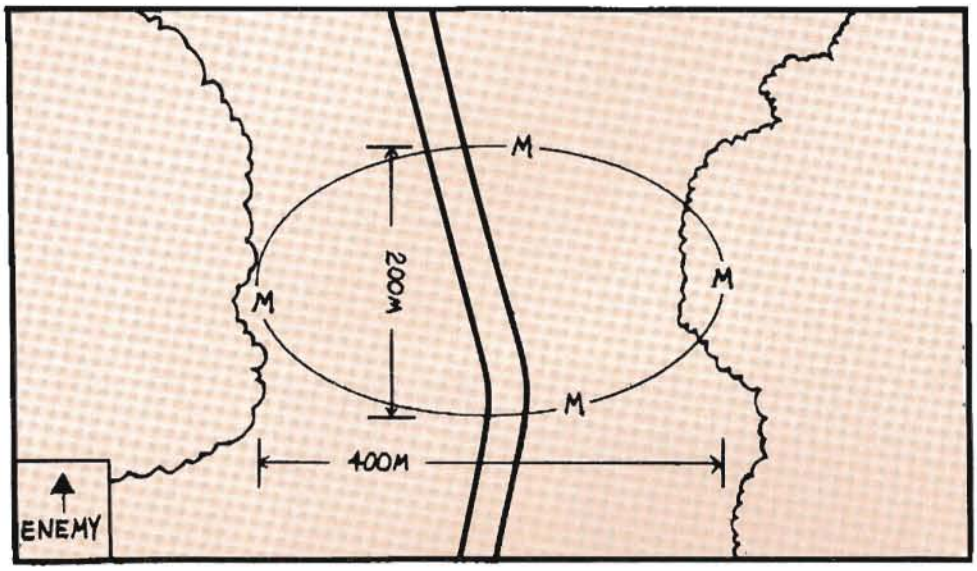
The command sergeant major, as advisor to the battalion commander, cannot afford to be tied to his desk. He, like the unit first sergeant, must know and be known, by everyone in the command if he is to advise the commander on their welfare and morale. One of his duties, listed in AR 611-20, is to "make note of observed discrepancies and institute appropriate corrective actions in the name of the commander." On-the-spot corrections should be made for the sake of discipline.

The last duties and responsibilities to be examined herein are those of NCOs assigned to positions outside the normal chain of command, including operations, intelligence, logistics, maintenance, and personnel activities at battalion level and higher, as well as messing, motor, and supply activities at company and troop level. Commissioned or warrant officers supervise these activities. Therefore, NCOs assigned to these activities must assume responsibility for the duties of their supervisor in their specialty area. Personnel assigned to TDA positions and positions created for short periods of time are in the same category as personnel assigned to special skill positions.

This was not intended to be a "laundry list" of duties and responsibilities, but rather a description of the most important NCO requirements. If the NCO performs these duties to the best of his ability and training, he will belong to a unit he can be proud to call his own. If he cannot live up to these requirements, then he is in the wrong profession.

Command Sergeant Major Johnny W. Greek retired from active duty in November 1978. He died in November 1979.

ENGINEER PROBLEM



You are a squad leader in Company A, 52nd Engineer Battalion (CBT). Your squad is conducting a reconnaissance mission in advance of division maneuver units. After a short period, you discover an enemy minefield 200 meters deep and 400 meters wide. Further reconnaissance reveals that bypassing the minefield would be impractical due to heavily wooded terrain on each side of the minefield.

Advising your commander of the situation, he instructs your squad to clear a footpath and a one-way vehicle lane through the minefield so that advancing units will not be delayed. You are given 10 hours to complete the mission. But you have only eight M157 breaching kits, 20 M1A1 breaching kits, and four squad members available due to other requirements.

Do you have the resources (personnel and equipment) to complete the mission within 10 hours? If not, what additional resources are required?

See THE SCHOOL SOLUTION, page 39

SPECIAL WEEKEND COURSES

In continuing to provide training assistance to Active Component, Army National Guard, and Army Reserve engineer units, the US Army Engineer School (USAES) has scheduled weekend courses during FY 81. Each course will be approximately 12 hours. These are the only special weekend courses offered during FY 81.

The purpose of the program is to train officers and NCOs who will be conducting training courses in their respective units. Therefore, students attending these courses should be personnel who, by MOS or job assignment, are most likely to be responsible for conducting unit training in these particular subject areas. Selected students should also be familiar with the subject matter, since instruction is a fast-paced review and not designed for initial learning.

Enrollment in any one course will be limited. Application for attendance should be made in the same manner as for other Active Duty for Training (ADT) or Full Time Training Duty (FTTD). Units may wish to consider using IDT, with TDY, as an alternate method for sending personnel at reduced costs.

Units must verbally confirm availability of student allocations to the Unit Training Section, TMD, USAES, by calling AUTOVON 354-3008, commercial (703) 664-3008, or INWATS 800-336-3095, ext. 3008, before issuing orders to personnel selected to attend courses.

Qualified Army National Guard personnel interested in attending one or more courses must apply through their chain of command to the National Guard Bureau, Schools Branch, utilizing NGB Form 64.

Units which have been provided course allocations are responsible to insure attendance of those personnel. If circumstances preclude attendance, orders issuing headquarters must notify the Unit Training Section of cancellation as soon as possible, but not later than 10 working days prior to the start of class.

Orders should read: "For individual training with USAES Special Weekend Course 80-SP____". Individuals must report for inprocessing prior to 8:15 a.m. the first day of class. They will be released on or before 1:30 p.m. the second day of class.

Students must submit pay and travel vouchers at their home station per TRADOC Supplement to AR 5-9, dated November 21, 1978.

Inquiries concerning this program and the confirmation of class allocations should be directed to the Unit Training Section, TMD, USAES, by calling the phone numbers listed above, or writing to Commandant, US Army Engineer School, ATTN: ATZA-DTR (UTS), Fort Belvoir, VA 22060.

MISSOURI GUARD UNIT CONSTRUCTS BRIDGE

Sharpening their military skills while performing a public service, members of Company A, 110th Engineer Battalion, Missouri Army National Guard (Kansas City), construct a pedestrian bridge at Pom de Terre recreation area near Wheatland, MO. The bridge was one of several projects completed by the 110th for the Corps of Engineers and the Missouri Conservation Commission while conducting annual training at Camp Clark, MO.

CAPSTONE PROGRAM

The Army Capstone Program reached new heights this summer when top officials of the Army's Active and Reserve Components signed a Memorandum of Understanding at Headquarters, US Army Forces Command (FORSCOM), Fort McPherson, GA.

Capstone ties the peacetime training and planning of the Army's active and Reserve Components (RC) to stateside and European wartime needs. Its objectives are to improve training, mobilization, deployment, and management of the force. It forms Active and RC units into packages for wartime deployment.

The Memorandum of Understanding clarifies the role each component plays in carrying out the Capstone program. It also explains how command channels function under the program.

Department of the Army has directed

FORSCOM to implement Capstone. All commands involved in the program must establish planning and training associations with their Capstone units.

Gen. Robert M. Shoemaker, commanding general, FORSCOM; Lt. Gen. LaVern E. Weber, chief, National Guard Bureau; and Maj. Gen. William R. Berkman, chief, Army Reserve, signed the agreement.

MILITARY DUTY DEFINED

Medical management of incapacitation pay has presented a problem in the past to RC commanders. To clarify, the following current definition is offered concerning the return to "normal" military duties: "Normal military duty refers to that military duty for which the service member is qualified or for which he/she can be trained within the scope of his/her functional abilities and limitations as set forth in his/her physical profile. In this instance, the phrase "normal military duties" does not infer that the service member should be capable of performing the same duties performed prior to incurring the present injury and/or illness. In cases where medical evaluation alone is insufficient to establish the effect of an impairment upon performance of normal duties, the MTF commander should seek evidence from the member's unit commander to substantiate ability or inability to perform normal duties."

MOBEX 80

"Proud Spirit"/MOBEX 80 is scheduled for late fall. It is designed to evaluate the capability of CONUS command and control headquarters, and playing installations to command and support the mobilization of US Army Reserve and National Guard units. Unit level play will be limited to the preparation of unit data packets for submission to playing mobilization stations.

MORE MOS BONUSES

During fiscal Year 1981 the Selected Reserve Incentive Program (SRIP) is scheduled to incorporate several critical MOS in all Troop Program Units. Current plans call for bonuses for MOS 11, 12, 13, 19, 91, and 95B. This method of program expansion is considered the most constructive to achieve strength goals in the weaker part of the USAR structure. Instructions should already be in the hands of field units for implementation on October 1.

PREGNANCY

A change to AR 135-91 establishes the policy and procedures for processing members of the Army National Guard and Army Reserve who become pregnant.

NEW TERMS

The Ready Reserve is divided into three major categories: Selected Reserve Units, Pretrained Individual Reservists, and the Training Pipeline.

Selected Reserve Units (SRUs) are those organized to serve as units upon mobilization.

Pretrained Individual Reservists (PIRs) include trained individuals who have completed initial training and are not members of Selected Reserve Units. These augment Active or Reserve units as fillers or replacements upon mobilization.

Ready Reserve Training Pipeline (TP) consists of all Ready Reservists who have not yet completed initial active duty for training.

There have been numerous changes during the past year in the meaning of various terms applied to the Reserve Components. These changes are intended to clarify and simplify understanding and to improve the management of the Ready Reserve.

PX PRIVILEGES DOUBLE

In April, Post Exchange privileges doubled for members of Army Reserve and National Guard units.

Reserve Component members now earn one day of Post Exchange privileges for each four-hour drill weekend. For example, a two-day drill weekend earns the member four days of privileges. Red Reserve Component ID cards and leave and earning statements must be presented when using the Post Exchange.

ENGINEER RESERVES UNDERGO DIVER TRAINING

Specialist Four Luis Cabrera and Staff Sergeant Paul D. Loeffler inspect a diver before he enters the 33-foot training tank operated by the Fort Eustis Diving Detachment. Cabrera and the diver are members of the Army Reserve's 699th Port Construction Engineer Company from Puerto Rico that spent two weeks of active duty training at the Virginia installation. Loeffler is a member of the Fort Eustis Diving Detachment.

ENLISTED CAREER INFO

FULL TIME MANNING PROJECT

More than 1,000 soldiers on active duty will be assigned to Reserve Component (RC) units by the end of this month as part of the Army's full-time manning (FTM) project Additional assignments are expected in FY 81 and later.

FTM is aimed at improving the readiness of selected high priority Army National Guard and US Army Reserve units. The added full time soldiers will work in the personnel management, administration, training, maintenance, and supply areas. Guard and Reserve units have the same training standards as active units, which include performing level one missions, but they have only two days each month and two weeks of annual training to do it.

The only full time people in most National Guard and Army Reserve units are one or two civilian employees, Admin and Supply Technicians (ASTs) in each company-size unit, and additional supervisory technicians at battalion and higher headquarters. Eight percent are performing full time duty in support of the Guard, while only three percent of the authorized strength of the Army Reserve is in full time support.

The entire FTM project will provide more than 3,000 full time soldiers for the RC. In addition to the 1,070 active Army soldiers, 1,108 Guard members and 1,060 Reservists will be put on special three year active duty tours this year.

MORE E-3s TO BE PROMOTED

More E-3s may be promoted to E-4 under a promotion policy change, DA officials announced this summer.

Unit commanders will be able to promote E-3s to E-4 as long as the number of E-4s in a unit with 15 or more months service stays below 95 percent. In the past, promotions to E-4 stopped when the E-4 strength reached 85 percent of the E-3/E-4 total.

The reason for the change is the decline in the E-4 strength, officials said.

The current method of computing the number of E-4s allowed remains the same. Commanders may promote soldiers in the waiver zone (15–23 months service), providing the number in that zone does not exceed 20 percent of the E-4 strength. The limit is based on the actual or projected number of E-4s assigned to the unit and not on the total number allowed.

SHORTER OVERSEAS TOURS

Some junior soldiers will begin shorter tours in Europe or Japan October 1. First termers on a three-year enlistment who are not command sponsored will have to stay only 18 months. Soldiers now serve 24 to 32 months in these areas.

This change allows junior soldiers to serve part of their first enlistment overseas and part at a stateside post. It also shortens tours for those first termers who are already overseas. Under an adjustment plan, these soldiers won't have to serve there involuntarily beyond March 30, 1982.

Soldiers in a four-year enlistment and those who take their dependents overseas at the Army's expense will serve the present tour length.

An Army review board recommended the 18-month unaccompanied tour early in 1979. Army officials feel the reduced tour will improve morale among single and unaccompanied soldiers serving long tours away from the states.

CORRESPONDENCE COURSES

Soldiers, E1–E5, can now earn promotion points for completing Army correspondence courses, even in their primary MOS. One promotion point is earned for every five credit hours completed.

In addition to the traditional "home study" courses, soldiers may also earn promotion points by completing courses in three new programs—Supervised On-The-Job Training (SOJT), TEC Conversion Subcourses, and Group Study Correspondence Courses.

SOJT Subcourses provide hands-on training in specific skill areas. You don't just read about the skill or task, but actually perform tasks under the guidance of a supervisor or instructor.

Training Extension Course Conversion Subcourses involve the use of a TEC cassette and the Beseler Cue/See projector for study, followed by an exam for point credit. Many TEC Conversion Subcourses are still under development, but some are already available, like Engineer Subcourse 5524, the Universal Trestle.

Group Study Correspondence Courses involve group study under the direction or guidance of an NCO or supervisor. Examples of available courses are Engineer Subcourse 0501, Combat Engineer, and Engineer Subcourse 0063, Soils and Pavements.

Soldiers are, in increasing numbers, using Correspondence Courses to gain expertise in their MOS and to help prepare for their Skill Qualification Tests. Latest figures compiled by the Army Institute for Professional Development reveal that enrollment in the Engineer Correspondence Course Program is near 20,000 students.

The increasing popularity of Correspondence Courses may be due to the fact that all courses are self-paced, enabling the individual to work at his own rate. Self-paced instruction is used increasingly Army-wide, so that many soldiers are familiar with it.

Anyone interested should check out the courses listed in the Army Correspondence Course Catalogues (DA Pam 351–20) at their education center. A DA Form 145 enrollment application must be completed and mailed to: The Army Institute for Professional Development, US Army Training Support Center, Newport News, VA 23628.

OFFICER CANDIDATE COURSE

Branch Immaterial Officer's Candidate Course (BIOCC), formerly called Officer Candidate School (OCS), provides enlisted soldiers an opportunity to become Army officers.

Applicants to BIOCC must meet the following requirements:

—Be no more than 29 years of age at the time of enrollment.

—Be an enlisted member or warrant officer on active duty.

—Score at least 300 points on the Physical Fitness Test.

—Be a U.S. citizen or have lawfully entered the US for permanent residence. Military Intelligence branch applicants must be a US citizen.

—Have a GT score of at least 110 for males and 115 for females, score at least 115 on the Officer Candidate Test

(OCT) and a minimum composite score of 200 on the OCT and Officer Qualification Inventory (OQI). (Females don't need the OCT and OQI.)

—Accept a three-year service obligation.

—Meet fitness standards.

—Meet weight standards.

—US citizens must have a favorable National Agency Check and non-citizens must have a favorable background investigation.

Graduates of the 14-week BIOCC at Fort Benning, GA, are commissioned as second lieutenants.

Applications for BIOCC class 2-81, scheduled to begin January 4, 1981 and graduate April 14, must be submitted by October 17, 1980. The cutoff date for submissions for class 3-81, scheduled for April 19, 1981 to July 22, is January 16, 1981.

Interested soldiers should contact their local personnel office for further details on eligibility and application.

WEIGHT ALLOWANCES

Officers and senior NCOs going on accompanied tours to certain areas in Germany are now able to ship more household goods.

Some soldiers are provided housing and furnishings by the Air Force. Due to a shortage of furnishings, E-7s and above assigned to Kaiserslautern, Ramstein, Landstuhl, and Sembach are now authorized the full joint Travel Regulations weight allowances for their grades.

Junior soldiers assigned to these locations and all grades assigned to most other areas in Germany are still limited in weight allowances authorized.

Soldiers should contact their local transportation office for details.

E-8 BOARD SLATED

An E-8 promotion board is slated to meet at Fort Benjamin Harrison, IN, in late October to select more than 3,000 master sergeants. Eligible E-7s on active duty with a date of rank (DOR) between November 1, 1975 and July 31, 1977 will be considered in the primary zone.

THE SCHOOL SOLUTION

EQUIPMENT

The M1A1 breaching kit contains one 15.24-meter section. Since the battlefield is 200 meters deep, you determine that 14 kits are required for the footpath. You have 20 kits, so there is no problem with the footpath.

The M157 breaching kit contains one 90-meter section. Since a one-lane vehicle path requires twice the number of kits as a footpath, and since four kits would clear only 180 meters, you determine that six kits are required to breach at least 200 meters. Again, sufficient equipment is available to accomplish the mission.

PERSONNEL

Since 3.5 to 4.5 man-hours are required to clear 100 meters with each M1A1 kit, it follows that 7 to 9 hours are required to clear a 200-meter footpath. Likewise, since 6 to 8 man-hours are required for each M157 kit, 36 to 48 man-hours are required for six kits. The total time required to clear a footpath and a one-lane vehicle path through the minefield is 43 to 57 man-hours. Since you have only four men and 10 hours in which to accomplish the mission, you should request additional personnel assets. At least two additional squad members are required to insure maximum efficiency and mission accomplishment.

OFFICER CAREER INFO

SCHOOLING CHANGES

The Department of the Army is changing the way officers are selected for Command and Staff College (CSC) level training, according to US Army Military Personnel Center (MILPERCEN) officials.

The Officer Personnel Management System (OPMS) changes, approved by Army Chief of Staff General Edward C. Meyer last April, also established a new Combined Arms and Services Staff School (CAS3) for training staff officers.

A new year group selection method will be used to select officers to attend CSC level training, according to DA personnel officials. The selection process will begin in academic year 1982-83 with officers competing within their own year groups for selection. Officials added that a two to three year transition period will be needed to implement the new selection plan.

Officials say captains in a non-promotable status, officers between their 8th and 11th years of commissioned service (YOS) will be eligible for selection to attend CSC during their 9th and 14th YOS.

Each of the four year groups will be allowed a certain amount of seats for each CSC class. MILPERCEN officials say allocations will be: 15 percent to the year group in the 8th YOS, 15 percent for the 9th YOS, and 35 percent each for the 10th and 11th YOS.

DA will continue using the present 8-15 YOS selection system until 1983 while the new CSC selection plan is being phased in.

CSC selections between 1982 and 1983 for officers with 12-15 YOS will be based on how many of those officers have already attended CSC, officials say.

The mission of the new CAS3 is to provide active duty and reserve component officers training to serve as staff officers with Army field units. The CAS3 will teach officers what staffs do, what staffs are, and how staffs operate. Student officers will use their knowledge and skills in various simulated staff situations.

Officials added that the CAS3 program will be broken down into two phases. Presently, officials plan to include 120 hours of CAS3 resident instruction and a six-hour exam. Officers will then attend the resident CAS3 course TDY in their 7th, 8th, or 9th YOS. All officers must participate in the program and officers completing the nonresident phase will attend the resident CAS3 course. The nonresident course phase will be tested by the first three resident CAS3 classes before being put into the field.

The first CAS3 course is scheduled during FY 81 at Fort Leavenworth, KA., and about 120 officers will attend. Officials say that when the resident course is fully in gear in FY 85, about 1,200 officers will receive that training each year.

The exact length of the CAS3 resident course is under study by the US Army Training and Doctrine Command (TRADOC), Fort Monroe, VA. TRADOC is also studying the possibility of holding resident CAS3 courses at other locations.

Graduates of CAS3 may be picked to attend either CSC level training, Senior Service College, or both, officials say.

Other parts of the officer education system are also being studied, according to officials. These include expanding officer basic courses and developing military qualification standards. TRADOC is also preparing pre-command courses and specialty courses for officers in place of officer advanced courses.

SENIOR RATERS AND THE NEW OER

Increasing the role of senior officers in the evaluation process is one of the major objectives of the new Officer Evaluation Reporting System (OERS).

The new system focuses attention on senior raters and charges them with the difficult duty of balancing their obligations to the rated officer with their obligations to the Army. Senior raters must prepare fair and honest evaluations which give each rated officer credit for his achievements and potential. At the same time, they must provide sufficiently realistic and discriminating evaluations to allow Department of the Army career managers and selection boards to make intelligent personnel management decisions.

Overall, senior raters appear to be accepting this added responsibility. There are, however, a few raters who are claiming that all of their officers are in the top 1, 2 or 3 percent of the Army. A senior rater runs the risk of losing credibility with selection boards with this type of inflated profile. In this regard, all officers, especially senior raters, should review the briefing given to selection boards on the new OER. Copies of this briefing were sent to MACOM commanders last April.

Another method the Army uses to emphasize the importance of the senior rater's responsibilities is the publication of the Senior Rater Profile Report (DA Form 67-8-2). Beginning this month, this report will be published annually and will show the rating history of each Army officer who has senior rated at least five different officers. A copy of this report will be sent to the senior rater and another copy will be placed in the performance section of the Official Military Personnel File (OMPF) alongside all of the senior rater's other performance documents. This is being done to highlight the fact that the evaluation of subordinates is one of the most important responsibilities of senior officers because of its impact on the selection of the future Army leaders. Therefore, the extent to which a senior rater fulfills this responsibility is in itself an indication of his or her performance.

SERVICE OBLIGATION

Officers who have been officially alerted for an assignment involving an active service obligation, and don't wish to accept the obligation, must request separation within 30 days of the alert.

Failure to follow the 30 day submission criteria will result in the officer being required to comply with assignment orders and the service obligation.

This policy also applies to Officer Advanced Course assignments and the Officer Advanced Course Advanced Assignment program. It does not pertain to officers selected for Command and General Staff College-Level and Staff Services College-Level schooling, including Warrant Officer Senior Courses.

For more information on elgibility and submission requirements, check AR 635-100 and 635-120 or call AUTOVON 221-7680/7889/8118.

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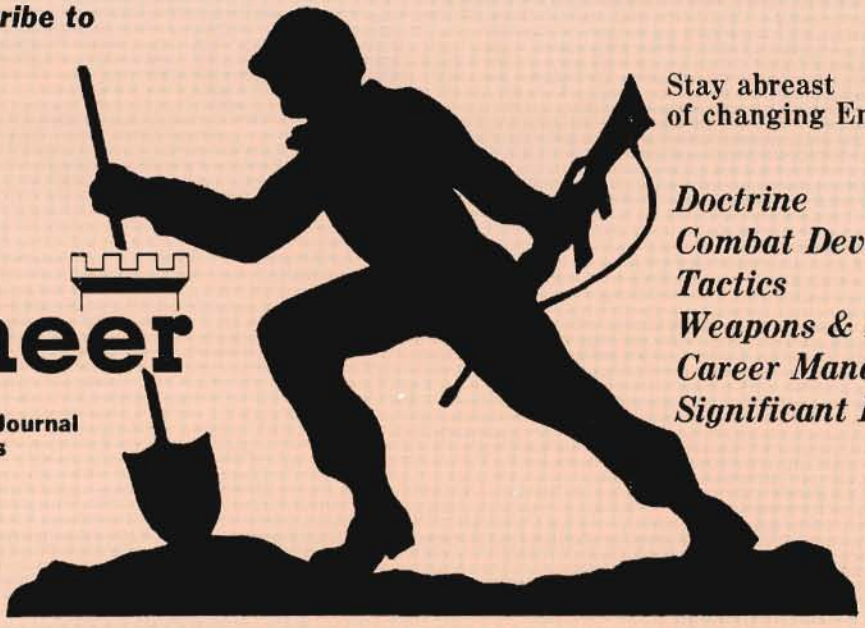

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General Edward C. Meyer
Chief of Staff of the Army