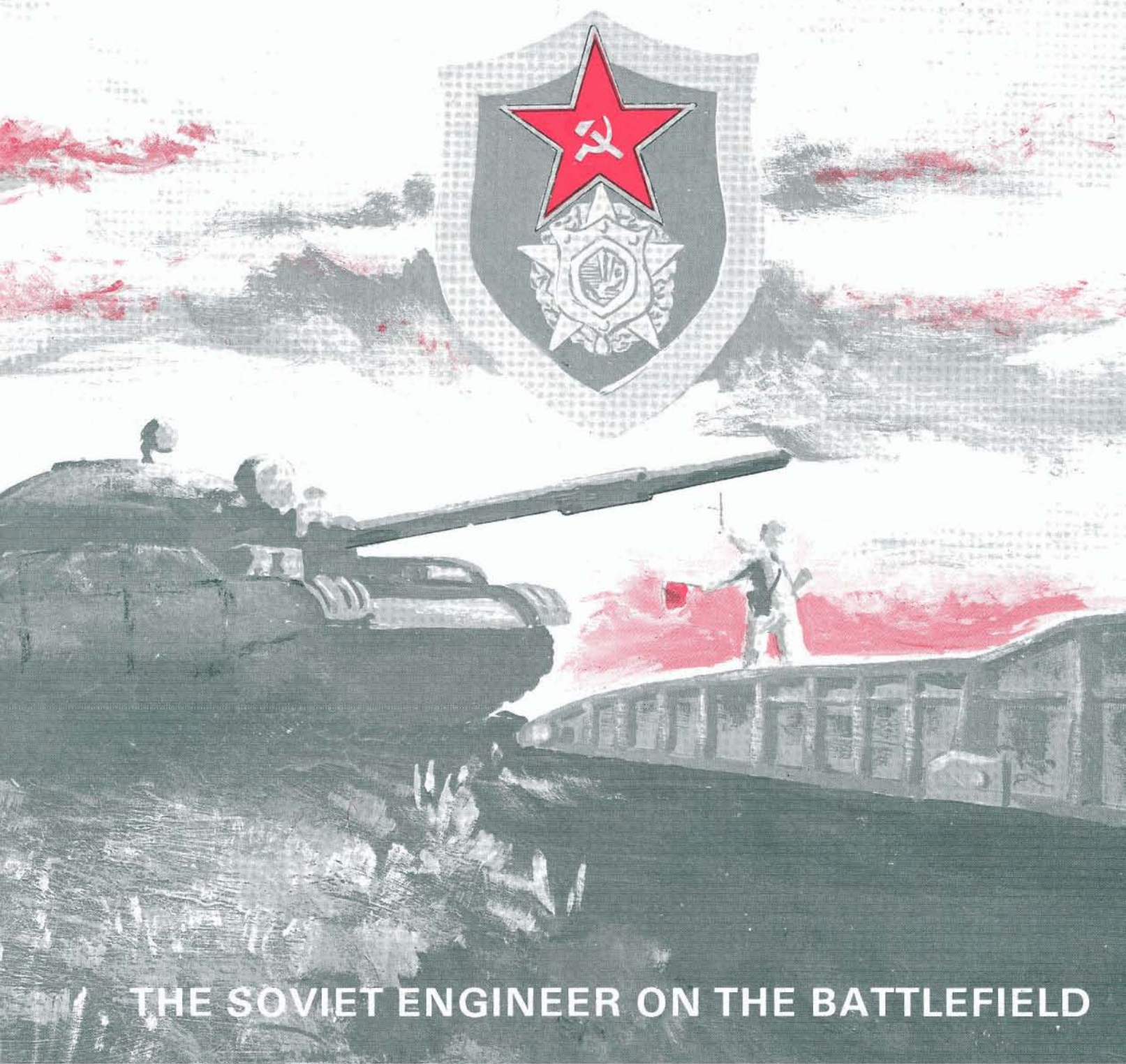
Engineer

THE MAGAZINE FOR ARMY ENGINEERS

Number 1, 1987



THE SOVIET ENGINEER ON THE BATTLEFIELD

A Personal Viewpoint

The Counter Obstacle Team

by CPT Frank J. Smith

Momentum is the key to success in the AirLand Battle. The combat engineer mission is to breach obstacle systems, continuously clearing the way for a rapid maneuver force initiative. This task becomes increasingly difficult as troops move through first echelon Threat forces into prepared, deliberate defenses. It's tough work, but a well-equipped, trained, and organized force can do it.

Unfortunately, we aren't ready to do that job today. Limited and outdated equipment and inadequate training programs—even at NTC—hamper engineer capability to accomplish this vital mission. And though Threat obstacle emplacement capabilities are perceived as powerful, few professionals fully appreciate Threat ability to create complex obstacle systems on the AirLand Battlefield.

A clearer picture of Threat doctrine and U.S. limitations can lead to only one conclusion: The Counter Obstacle Team (COT) concept must be adopted as AirLand Battle doctrine. Only then can the combined arms team be a combat effective force strong enough to break through complex obstacles and hold the offensive.

COMPLEX OBSTACLES—A SOVIET STRENGTH

Soviet doctrine dictates that a strong obstacle defense is the basis for a successful offense. A single lesson from history shows why. Using obstacles skillfully, the Soviets crippled the German offense at the Battle of Kursk, then took the offensive on the Eastern Front.

As this critical battle opened, the Germans attacked from the North and South, hoping to take the city in a pincer movement. On the first day, the northern pincer lost 200 tanks, 25,000 men, and its momentum. After a brief success, the southern pincer lost over 300 tanks. German progress halted short of Kursk, and the Soviets mounted their own offensive campaign.

How did the Russians do it? They stopped the attack with six integrated defensive belts defended by minefields and obstacles. Minefield density averaged 2,400 antitank and 2,700 antipersonnel mines per mile of front.

Current defensive doctrine

Threat philosophy has changed little since World War II. Echeloned forces, massed fires, shock, surprise, and complex obstacle systems are still typical of Threat defenses. Defenses range from hasty preparation for an imminent attack to prepared defenses along an entire front. The defense level depends upon METT-T.

Threat doctrine always aims to turn the defense around and mount a counterattack. Hasty defenses aim to repel or delay attackers. Expendable units hurl themselves at attacking forces that destroy or bypass hasty defenses. If Threat forces cannot regain the offensive, the prepared Threat posture is assumed.

Prepared defenses are echeloned in security, main defense area, and counterattack forces. Security forces present obstacles and direct fires to delay and deceive enemy forces. Main defense areas are complex belts of minefields, obstacles, and strongpoints designed to canalize and trap attacking forces in unfavorable terrain, where they can be destroyed by indirect and direct fires.

When the fires are lifted, expendable counterattack forces destroy the remaining enemy force. At the Battle of Kursk, the Soviets sacrificed an entire tank regiment in 3 hours in such a counterattack. Threat tactics are expensive—and effective.

AIRLAND BATTLE DOCTRINE

AirLand Battle doctrine dictates that only offensive battle leads to the complete destruction of enemy forces. To attain this goal, forces must concentrate on critical times and places, surprise the enemy, and maintain speed.

Typical scenarios require a mechanized engineer platoon to support a task force or maneuver battalion by continuously breaching lanes through obstacle systems. Since AirLand Battle doctrine offers few chances for deliberate operations, speed is essential. Assault breaches must be completed in minutes, so that maneuver units can move through obstacles quickly and continue the attack. Otherwise, maneuver forces lose momentum and risk being destroyed in place by enemy fires.

Stumbling blocks for U.S. mobility

Even in a best-case scenario for a full-strength engineer platoon with AVLBs and a CEV, engineers are ill-prepared to conduct assault breaches through the obstacle systems found in the Threat security zone and main defensive area.

Standard demolitions such as bangalore torpedos take too long to breach vehicle lanes through minefields. Line charges such as the M173 and M157 are not available for training. Moreover, these line charges will be available only in limited quantities during the first critical weeks of hostilities.

While AVLBs can span tank ditches, they cannot breach minefields. Current doctrine dictates that CEVs breach fortifications, wire obstacles, and rubble. With few exceptions, CEV crews are trained to do only those tasks, and are therefore unprepared to breach minefields.

The MCLIC, ROBAT, COV, rollers, and mine plows may one day

(continued on page 24)

Engineer

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On the Cover

Russian armor preparing to cross an MTU-20 assault bridge under CBR conditions. The insignia shown is the Soviet engineer troop patch.

Art: Jim Wilson

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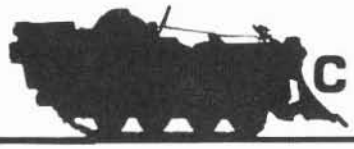
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CLEAR THE WAY

by MG Richard S. Kem, Commandant, U.S. Army Engineer School

Knowledge of Threat methods is vital to our readiness

As professional soldiers, we must be ready to go to war — today. We are not ready if we don't know how potential adversaries will fight. After the first bullet is fired, we will pay the price of every blind spot with lives.

In this issue of Engineer, we take a hard look at our counterparts in the Warsaw Pact and the Soviet Union. The Soviets set high standards for the doctrine, equipment, and organization of their forces. A study of their engineers gives us valuable information about the strengths and methods the Soviets will bring to the battlefield.

Let's consider the Warsaw Pact's strength. The Pact outnumbers NATO 2 to 1 in tanks, 2.2 to 1 in artillery and mortars, and 1.8 to 1 in APCs. These ratios do not give Pact forces the rule of thumb ratio—3 to 1—that the attacker needs to win. Soviet doctrine prefers the even heavier 8 to 1 ratio for attacking forces, anticipating the high losses inherent in offensive operations.

But even at current strength, the Warsaw Pact could mount a successful offensive. Presenting a mix of offensive thrusts and defensive operations across its front, the Pact could attain its desired force ratios in selected areas of attack. But this would require economy of force action in defensive sectors.

These defensive sectors could be the windows of opportunity we need to implement AirLand Battle doctrine — but only if we anticipate the Soviet defense and know how to breach it. We must also know the Soviets' offensive use of engineers in order to site our own obstacles for maximum effect. Knowledge of Threat methods is vital to our readiness.

Thorough knowledge of Soviet defense methods can help us to advise maneuver commanders on the best way to breach enemy obstacles. The engineer and his maneuver commander must develop battle drills for breaching in stride, or expect failure. This is why the Soviet capability to employ scatterable mines deserves our closest attention. It means that we may have to start breaching operations in our own assembly area and continue breaching through movement to contact and into the attack.

As engineers, you must understand the capabilities of Threat engineer equipment. You have to know the gap crossing and countermine capability of the motorized rifle regiment before you can evaluate the defensive potential of the sector your unit is defending. You must also know the numbers of different types of equipment and their places in the force structure. For example, you should know instantly that a position approached by two armored engineer tractors (IMRs) is a focus of attack, since each Soviet division has only two. In the heat of battle, this information must be in your head—there won't be time to look it up.

A firm grasp of Soviet doctrine can reveal enemy intentions and plans at a glance. If minefields are surface laid and contain no antipersonnel mines, and no work is being done, chances are the enemy will soon resume the attack. A sudden, unexplained halt in the attack followed by rapid digging in of vehicles by MDK-2 entrenchers, is a clear warning—expect a nuclear attack.

Some of you may think that the G-2/S-2 should be called upon for this kind of analysis. But as engineers, our valuable knowledge of engineer operations enables us to recognize enemy engineer courses of action. And if we know the enemy, our educated guesses are more accurate.

This issue acquaints you with our expected adversary—but more than that, it encourages you to know more about the Threat. Don't stop here. Go to your S-2s and examine studies and intelligence reports. Most of your units receive our Engineer School Periodic Intelligence Reports (PERINTREPS). Read, heed, and apply what you learn from them.

As Sun Tzu said in THE ART OF WAR—"Know yourself. Know your enemy. Then you will be victorious in a thousand battles."





by CSM Frank B. Gibert, U.S. Army Engineer School

What you can do—right now—to improve unit preparedness

Glance at this issue's cover—you see a lot of Soviet hardware. Examine the articles, and the army behind that hardware comes into focus. Read between the lines, and you catch a glimpse of the soldiers who are the Threat. Measure what you see against ***your*** soldiering, ***your*** army, ***your*** hardware. Are you ready to fight—and win?

First, consider the hardware. The descriptions in SFC Bunce's article "Soviet Engineer Equipment" (page 20) tell you what to look for, and what various pieces of equipment will do. Some items, like the towed mineplow (PMR), are similar to U.S. equipment in capabilities—and in limitations. Other items are specialized to work in unfamiliar ways, and you must use your imagination—not just your experience—to defeat them.

Think about your own hardware. Is your maintenance flawless? Are your operator skills top quality? Read this issue's article on AVLB/CEV readiness (page 32). Are you thoroughly familiar with every maintenance and training opportunity available to keep engineer equipment fully mission capable? Could you get the last ounce of speed and power if you needed it to stay with the momentum of a breaching operation?

Second, compare your assumptions about the Soviet Army with what you see on these pages. You won't meet a "best case" or "worst case" army on the battlefield—you'll be up against the real thing. The articles about historical development and current doctrine in the Soviet Army give you some valuable insights.

Pay close attention to the organization and methods of the specialized engineer detachments discussed here. Take note of the information about minefields and minelaying techniques described. Can your unit meet these units and overcome these obstacles? If not, what can you do—right now—to improve unit preparedness?

Third, take time to learn something about soldiering in the Warsaw Pact armies. The Soviet soldier is obedient, courageous, rigorously trained—and expendable. He routinely puts in 14-hour days, and is accustomed to intense, repetitive training.

It's easy to see where U.S. and Soviet military philosophies differ—we set a higher value on the individual lives of our soldiers and the quality of those lives. You can best show dedication to the lives of your soldiers through training. Confident, competent troops are ready to survive in battle—even against trained, dedicated opponents.

What can you change to make yourself and your leadership more effective?

The Soviets value unquestioning obedience. What about you? Maybe you ***do*** get obedience from your troops—but you can do better. Encourage them to "ask questions later." Listen to them for sound ideas.

The Soviets train unrelentingly. What about you? Set aside time to study Threat capabilities; schedule more training. Remember, squad-level training is the most important deterrence we have against superior numbers—and you can do more. Commit yourself to develop smart, safe trainers and establish realistic training environments. Make after-action reviews an effective part of your leadership style and your development of subordinates.

The Soviets are ready to spend lives for victory. What about you? In combat our lives will be on the line—Be ready! Make sure your unit is trained to go into battle with a better-than-even chance for victory—confident and competent because they know you have made them the "Best they can be."

CSM Frank B. Gibert is Command Sergeant Major of the U.S. Army Engineer School. He comes to the school from HHC of the 7th Transportation Group, Ft. Eustis. CSM Gibert has held numerous assignments as an Army Engineer Diver in the United States, Germany, and Korea. He holds a B.S. in Physical Education from Bowling Green State University. CSM Gibert's military education includes training in salvage diving, deep sea diving, marine engineering, air transportability, and systems analysis. He is also a graduate of the NCOES Faculty Development Course and the U.S. Army Sergeants Major Academy.

School News

Department of Military Logistics (DML)

Logistics Branch Moves:

The Logistics Branch, DML, was transferred to Department of Combined Arms on 1 October 1986. Under a memorandum of understanding signed by the directors of both units, the table of distribution and allowances was moved intact from the 809th to the 554th Battalion.

The Logistics Branch is now DCA's Combat Logistics Division, with separate logistics and maintenance management branches. CPT Cynthia Guiten is the Chief of the Logistics Branch. CW4 Pedro Arroyo is the Chief of the Maintenance Management Branch.

These units are responsible for providing logistics and maintenance management training for officers attending EOAC and EOBC, and to noncommissioned officers attending ANCOC.

52F Branch Trains on AGPU:

Resident training in aviation ground power units (AGPU) for BNCOC 52F20 students began 20 February 1987. In the past, the 52F Branch sent personnel to aviation units in the field to receive this training. AIT Training in AGPU for 52F10 students will began in October 1987. This training meets the need created by the possible future addition of 52F personnel to aviation units.

Defense Mapping School (DMS)

Reach Out and Teach Someone:

Mobile Training Teams (MTTs) provide Defense Mapping School instruction around the world. Recent MTTs have included analytical photogrammetric positioning system (APPS) training aboard Navy aircraft carriers and terrain analysis training in Active Army and Reserve units.

During 1987, DMS's scheduled MTTs to PACOM (in the spring) and EUCOM (in the fall) will export the 5-day Mapping, Charting, and Geodesy Staff Officer Course (MCGSOC) and the 4-day Introduction to Digital MC&G Data Course. The primary target audience is nontopographic staff/action officers (topographic customers), but others are welcome. These MTTs can be tailored to specific needs in each theater by adding MICROFIX-T, APPS, or other subjects. Make your need known early; contact your local topographic officer or the DMS registrar, AV 354-2383, commercial (703) 664-2383.

Department of Combined Arms (DCA)

Commandant's Writing Awards Presented:

The first Commandant's Award for Excellence in Writing was presented to CPT John McElree, EOAC class 7/86, on 12 October 1986. The second award was given to CPT Kenneth Bunning, USMC, on 5 December 1986. CPT Edward Ching, EOAC class 9/86, received the third award on 30 January 1987. Sponsored by the Association of the United States Army, the award is a plaque given to the advanced course student who produces the best research paper on the topic of his choice.

New Training-New Manuals:

Engineer lieutenants will face the myriad challenges posed by the Brigade Engineer better prepared, thanks to recent doctrinal changes in training and doctrinal writing efforts made by the Tactics, Training, and Doctrine Division of DCA. On the training side, 39 hours of instruction on engineer and manuever tactics have been added to the EOBC and grouped with existing lessons to form a 118-hour module known as "Task Force Engineer." This, coupled with new efforts in doctrinal literature, will give the Engineer lieutenant many of the tools necessary to be both a platoon leader and battalion staff officer.

Additionally, DCA is developing two new manuals to address needs from the field. FC 5-102-1, *Transition to Defense*, covers the critical period of transition in which the engineer is faced with multiple requirements and little time to complete them. FC 90-13-1, *Obstacle Breaching Procedures*, bridges the gap between FC 90-13, *Counterobstacle and River Crossing Operations*, and engineer drills.

Thoughts from a Distinguished Engineer:

The booklet *Reflections: General Bruce C. Clarke's Thoughts on Creating Outstanding Units*, an anthology assembled from the many works of General Bruce C. Clarke, former Commander in Chief, USAREUR, is now available from DCA. To order a copy, contact: Director, Department of Combined Arms, USAES, ATTN: ATZA-TC-C, Fort Belvoir, VA 22060-5341. For more information on the availability of this book, contact Department of Combined Arms, AV 354-4991, commercial (703) 664-4991.

Department of Military Engineering (DME)

Dynamite and TNT Stores to be Depleted:

The Army is no longer procuring military dynamite and TNT. Procurement of C-4 will be continued to meet all engineer needs.

School News

Directorate of Training and Doctrine (DOTD)

Manuals Being Developed:

Field circulars for FM 5-71-100, *Engineer Operations in Support of Close Combat Heavy Forces*, and FM 5-71-101, *Engineer Operations in Support of Close Combat Light Forces*, are scheduled to be published in FY 88. FM 5-100-16, *Engineer Operations, Echelons Above Corps*, currently being developed by DME, will be out in field circular format during 4th quarter FY 87, with the FM to be fielded in FY 88.

Directorate of Combat Developments (DCD)

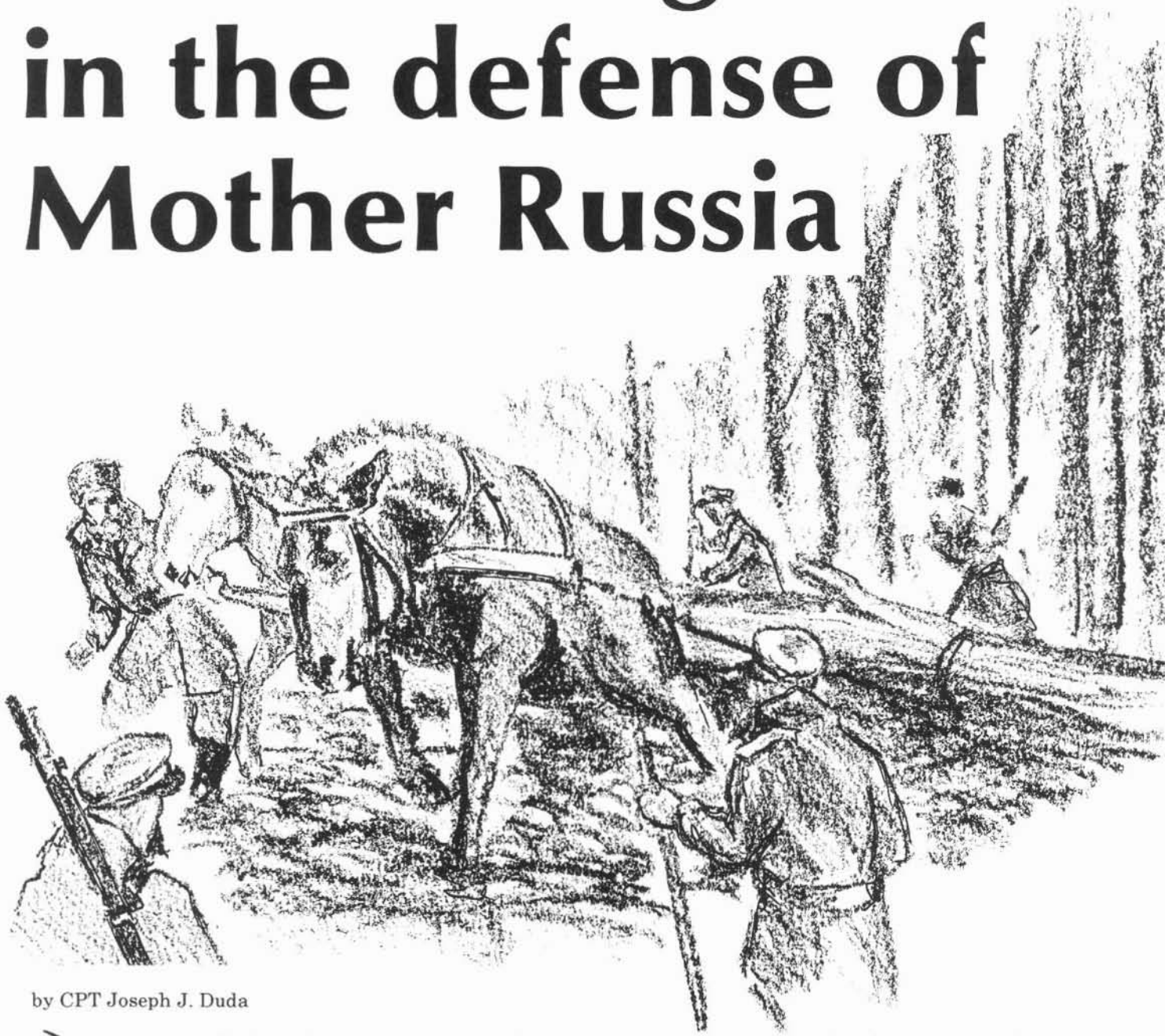
Engineer Functional Area Assessment Update:

After fine-tuning at the 8 January Proponent/ARSTAF briefing, the 1987 Engineer Functional Area Assessment was presented to the Army Vice Chief of Staff on 29 January 1987. In addition to representatives of the USAES, the briefing was attended by representatives from HQDA, TRADOC, AMC, National Guard Bureau, Chief of Army Reserves, and other MACOMs.

As a result of this FAA, 52 issues involving equipment shortages, MOS structure imbalances, and unit conversions will be worked on by the Engineer School and the various MACOMS, and progress on resolving these issues will be tracked at quarterly in-progress reviews. The Engineer School was also directed to conduct a systems program review (SPR).

A complete list of the issues, and actions to resolve them, is available. To receive this list and any other information on this FAA, contact LTC Robert McDonald, Department of Combined Arms, ATZA-CDO, Fort Belvoir, VA 22060, AV 354-3182, commercial (703) 664-31824.

Combat engineers in the defense of Mother Russia



by CPT Joseph J. Duda

In the eyes of Soviet military leaders, combat engineering is a vital asset to the national defense, both in the past and in current conflicts. Historical material in the Soviet military report, *Combat Engineer Support,* portrays military engineers as a significant factor in military successes.[1] This important manual argues that Russian and Soviet engineers have adapted and modernized to ensure victories and strengthen defenses ever since the time of Ivan the Terrible.

In itself, this view yields valuable insight into Soviet doctrinal attitudes. It reveals a Soviet belief that military leaders have a history they mean to maintain—a history of continual, flexible progress toward mastery over the evolving military situation.

PRE-SOVIET PERIOD

Since their borders lack natural defensive features, the Russians learned early to use defensive techniques and linear terrain fortifications on a large scale. Under Peter the Great (1689-1725), combat engineering became a structural element of the Russian Army. Tsar Peter commissioned the first sapper company in 1713, and in 1716, he approved definite engineer and sapper missions. He also provided for military engineer training of officers in the field forces.

During the war against Sweden (1700-1721), Russian military engineers proved their worth, building an impregnable camp at Grodno and impressive fortifications at Kronstadt. At Poltava, their technical innovations in defensive fortifications ensured a Russian victory.

Military engineering did its part in ripening the French for attrition on Russian soil during the War of 1812, as Russian fortifications exhausted and bled Napoleon's forces at Borodino. Later, Baron Henri Jomini ruefully commented: "Russia is a country which it is easy to get into, but very difficult to get out of."[2]

In the Crimean war, Colonel Franz Todleben's military engineers surrounded Sevastopol with rifle trenches and used electrically detonated mines to harass the enemy. Although the Russians were unable to break the siege, these fortifications held the British and French at bay for 11 months.[3]

Despite radical changes after 1917, the Soviets continued to put the powerful lessons of defensive military engineering to good use in securing their borders against 20th century invaders.

THE SOVIET PERIOD

In *Combat Engineer Support*, General-Colonel Kolibernov divides the development of the theory and practice of modern engineer support into three periods, each of which saw refinement of engineer support to combined arms warfare. These are—

- The Consolidation of Bolshevik Control (1920 to June 1941).
- The Great Patriotic War (June 22, 1941 to May 9, 1945).
- The Postwar Period.

Consolidation of Bolshevik Control

The lessons of World War I and the Civil War with the White forces influenced Soviet military engineering during the Consolidation of Bolshevik Control. In 1920, the future Marshal of the Soviet Union, M. N. Tukhachevskiy, emphasized the importance of engineer achievements to the Workers' and Peasants' Red Army, saying in *Engineer Support of Operations*, "The senior commander, in order to maintain full freedom of maneuver, must turn his main attention and apply his best forces and means to the conduct of military engineer affairs."[4]

By 1941, the Soviets had excellent theories on the engineer support of battle. However, they were deficient in equipment and training.

Later, Germany and the Soviets cooperated on military matters under the 1922 Treaty of Rapallo. Many Soviet officers attended German staff courses before Hitler's ascent to power in 1933. Although Stalin later executed many of these officers, the interchange of tactical ideas retained an influence. As a result, Soviet combat engineers developed techniques for employing antitank obstacles—small, flat explosive charges that could break the treads of armored vehicles.

The Red Army modernized its combat equipment as the nation industrialized in the 1930s. Its field regulation of 1936 defined engineer mobility, countermobility, and survivability tasks and areas of responsibility for different level commanders. Equipment produced to support these missions included several types of antitank mines, demolition charges, excavators, and trenching machines.

In the Spanish Civil War (1936-1939) and the Soviet-Finnish War (1939-1940), the Soviets experimented with military engineer support, developing prototypes of protective structures and several camouflage methods. As World War II approached, many of these innovations were still under development.

The Great Patriotic War

By 1941, the Soviets had excellent theories on the engineer support of battle. However, they were deficient in equipment and training. When the Germans attacked, pushing the Soviets back to the outskirts of Moscow and Leningrad, engineer support was carried out "partially and with inadequate skill." Still, engineer obstacles and support played a significant role in turning the tide of the Nazi onslaught.

On November 28, 1941, the Supreme High Command issued an order criticizing inadequate organization in engineer support of combat operations, complaining that "a significant number of regiments and divisions do not know the elementary laws and methods of individual fortifications and engineer preparation of positions." The primary engineer support missions in the defense were defined as follows:

- Prepare field defensive areas and positions.
- Emplace obstacles.
- Prepare troop maneuver routes.

The Soviets employed their restructured battalion defensive area at Kursk. There, when "forces employed deep echelon defense, the systems of trenches...permitted the successful repulse of the most powerful enemy groups, and thereafter, the changeover to an all-out counteroffensive."[5]

Colonel H. R. Dingler of the German General Staff called the Soviets "masters at digging in and erecting field foritifications. They are infallible at discovering positions which are essential for future operations."[6]

On July 2, 1943, the Supreme High Command issued the order *On the Employment and Neutralization of Mine Obstacles*. It stated: "Unfortunately, despite two years of war experience, combined arms commanders still have not learned to correctly employ mines, and our engineer troops have not learned to secretly and quickly lay and breach minefields."[7] These deficiencies resulted in several innovations in Soviet combat engineering.

To combat enemy tanks, the Soviets established mobile antitank reserves, including combat engineer

units supplied with antitank mines. They also created mobile obstacle detachments (POZ) at the regiment and division level. In regiments, fully manned POZs included a platoon of combat engineers, a wheeled vehicle, and 100 antitank mines. In divisions, they included a company of combat engineers, 2 vehicles, and 300 antitank mines.

These detachments increased the combat effectiveness of obstacles and antitank artillery weapons. The Soviets also produced mine-clearing devices for tanks and a bangalore torpedo, the UZ-1, which cleared a path up to 6 meters wide. Small sapper elements that accomplished many mobility missions are also especially interesting. Kolibernov notes that these combat support elements were predecessors of the current Mobility Support Detachment (OOD).

The major engineer support missions in the offensive were—

- Prepare assembly areas.
- Clear and control passages in friendly and enemy obstacles.
- Provide close support of tanks in the attack.
- Establish and maintain crossing sites at water obstacles.
- Prepare routes for moving artillery and second echelon forces.
- Prepare obstacles for repulsing counterattacks.
- Fortify lines of advance.

THE POSTWAR PERIOD

Soviet combat engineer texts divide the postwar period into two phases. The first extends from V-E day to 1953. The second extends from 1953 to the present.

The goal is to perfect engineer support of battle in modern combined arms operations.

In the first postwar phase, the Soviets reorganized engineer support and troop training based on the experiences of the Great Patriotic War. Offensives were to start from close contact with the enemy. The goal was to perfect engineer support of battle in modern combined arms operations. Engineer support missions were—

- Fortify defensive areas, positions, and assembly areas for offensive operations.
- Breach obstacles at the forward edge and to the depth of enemy positions.
- Create and maintain crossing sites at water obstacles.

The second postwar phase, called the "second revolution in military affairs," saw the Soviets adapt combat engineer support to the nuclear battlefield.[8] It was assumed that offensives would rarely begin with close enemy contact, and rear forces would come forward to begin the offensive. Engineer troops were to clear the way, allowing a rapid advance and preventing delays that could make forces vulnerable to weapons of mass destruction.

The Soviets sought both new engineer equipment and task organizations to accomplish engineer missions on the nuclear battlefield. The primary missions became—

- Create fortifications to protect forces from the effects of nuclear weapons.
- Eliminate aftereffects of nuclear explosions.
- Prepare routes of advance through areas of mass destruction and radioactive contamination.

These complex tasks require coordination of engineer troops with civil defense troops.[9]

Soviet engineer troops are reportedly ready to perform these tasks. The Ministry of Defense paper, *Red Star,* often carries articles about the heroic exploits of combat engineers in Afghanistan. This strong focus on engineer troops at work in current battle situations shows a sober awareness that success demands further adaptation of engineer techniques and superb engineer support to combined arms operations.

CPT Joseph J. Duda is assigned to the U.S. Army Russian Institute under the FAO training program for the Soviet and East European area specialty. He served with the 7th Engineer Brigade in Germany and the Engineer School Center and Training Brigades at Fort Belvoir. He is a registered professional engineer in Virginia.

Notes

[1] E. S. Kolibernov, V. I. Kornev, and A. A. Soskov, *Combat Engineer Support,* Military Pub. Hs., Moscow, p. 4. Unless otherwise noted, all direct quotations are from this source.

[2] Crane Brinton, Gordon A. Craig, and Felix Gilbert, *Makers of Modern Strategy,* edited by Edward M. Earle, Princeton University Press, NJ, pp. 77-92.

[3] Kolibernov et al., *Combat Engineer Support,* and Ian Hogg, *The History of Fortification,* St. Martin's Press, NY, NY, pp. 148-62.

[4] Harriet Fast Scott and William F. Scott, *The Armed Forces of the USSR,* 3d ed., Westview Press, Boulder, CO, p. 11.

[5] Scott and Scott, p. 11.

[6] F. W. von Mellenthin, *Panzer Battles,* Ballantine, NY, NY, p. 195.

[7] *Red Army Field Regulations of 1943,* trans. by Foreign Broadcast Information Service, JPRS-UMA-85-006, January 17, 1985.

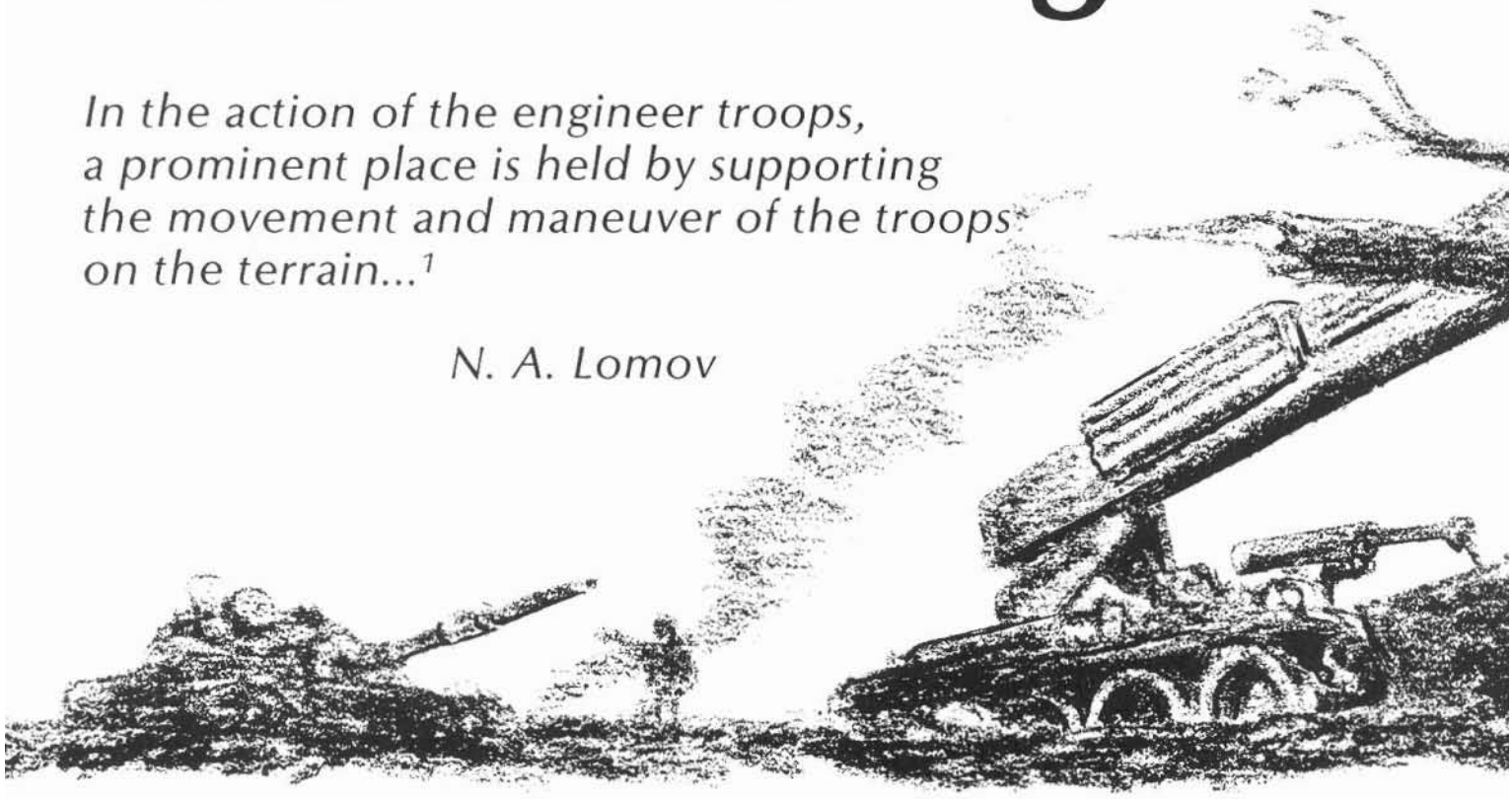
[8] William E. Odom, "Soviet Force Posture: Dilemmas and Directions," *Problems of Communism,* July-August 1985, pp. 1-14. LTG Odom describes the three revolutions in military thought which stimulated changes throughout the Soviet system. Although not directed to specifics of Soviet combat engineering, the article shows how the Soviets respond to new developments in technology and other factors affecting military power.

[9] Scott and Scott, pp. 265-66, 367, discuss current organization and missions of Soviet engineer troops.

The Soviet engineer

In the action of the engineer troops, a prominent place is held by supporting the movement and maneuver of the troops on the terrain...[1]

N. A. Lomov



by SFC Peter L. Bunce

The Soviet view of the modern battlefield is no different from our own: like us, they see a lethal, fast-moving, dangerous environment. Speed, mass, breadth, surprise, and depth in the attack remain primary tenets of Soviet battle doctrine. Even though scenarios admit the possibility of conventional warfare, the brevity of nuclear battlefield time frames still rules. The Soviets expect to conduct war principally at the operational level, and to make high speed offensives the *tour de force* of their operational art.

High-speed offensives rely on simple, easily executed tactics. On the modern battlefield, such tactics depend upon ample engineer support. This article explores the use of engineer elements in the Soviet Army's ground forces.

ORGANIZATION

Engineers in the Red Army

Engineer troops in the Soviet military structure are independent of the service branches, reporting directly to the Minister of Defense. Engineers maintain their own military schools system for officers. The Higher Military and Military Command schools are equivalent to a combined West Point and officer basic course. The Military Academy is roughly equivalent to a combined officer advanced course and CAS3. Still another technical engineering school offers a five-year curriculum.

The engineers provide support "for combat operations of all services and service branches" and "are subdivided into general (combat engineer) and special categories (pontoon and bridge, assault crossing, highway, works service, camouflage, construction, and others)." Engineer units may be components of ground force units or assigned "to an army, front, supreme command reserve, navy, air, or one of the other services of the armed forces."[2]

In the ground forces, one engineer company supports each division's four maneuver regiments, and one engineer battalion supports the division. Bridging and assault crossing units excepted, Soviet engineer units are equipment- and personnel-holding units whose subordinate elements are task-organized into specialized engineer detachments.

The divisional engineer battalion

The divisional engineer battalion consists of a headquarters company and four line companies: a sapper company, an engineer road company, a pontoon bridge company, and an assault crossing company. The battalion's structure and organic equipment are shown in the table.

The regimental engineer company

The regimental engineer company is a divisional engineer battalion, without bridging or assault crossing elements. It has a headquarters and services platoon, a sapper minelayer platoon, a road-bridge platoon, and two sapper platoons mounted in personnel carriers.[3]

Engineer detachments

Except for bridging and assault crossing units, both regimental engineer companies and divisional engineer battalions organize their

on the battlefield



subordinate elements in the same way. The major detachments are the Movement Support Detachment (OOD), the Engineer Reconnaissance Patrol (IRD), the Reconnaissance/Obstacle-Clearing Detachment (OR), and the Mobile Obstacle Detachment (POZ).[4]

The OOD is usually built around a road company. It moves 1 to 2 hours ahead of the main force, reconnoiters the main march route, removes mines and similar obstacles, bridges water obstacles, and marks routes along each main axis of advance.

The IRD is often attached to other reconnaissance elements to scout routes of march and estimate requirements for removing obstacles.

The OR essentially performs the mission of the OOD and the IRD, although it can operate as part of an OOD.

The POZ is formed by divisional and regimental level engineers around minelayer platoons, sometimes reinforced by sappers: the POZ often works with the Antitank Reserve, especially in the offensive.

Based on scales of equipment, it appears that the divisional engineer

Divisional Engineer Battalion

Unit	Equipment
Headquarters company	
Reconnaissance platoon	
Sapper company	
Headquarters platoon:	Mine plows, mine rollers, dozer blades
Minelayer platoon:	Three GMZ self-propelled mine plows
Sapper platoons (2):	Armored personnel carriers
Road company	
Road platoons (2):	BAT-dozers, TMM truck-mounted scissor bridges, AVLBs, IMR engineer vehicles
Bridge construction platoon:	Bridging elements, crane
Field fortification platoon:	BTM or MDK ditch diggers
Pontoon bridge company:	Half-set of PMP ribbon bridge, 118 meters of class-60 bridge, longer elements with lower classifications, or rafts of various sizes
Assault crossing company:	Twelve K-61/PTS/PTS-M tracked amphibious transporters
Platoon:	Three GSP-ferry sets (or two platoons, six GSP sets in tank divisions)

Source: Isby, David C., *Weapons and Tactics of the Soviet Army* (London: Jane's, 1981), p. 331.

battalion is more capable of deploying both an OOD and an IRD, while the regimental engineer company is more likely to use an OR.[5]

Employment of engineers in battle

As the basic tactical unit of the Soviet ground forces, the regiment has its own organic engineer support. At division level, the Soviet commander can use his engineer elements to support the main axis of his advance, thus reinforcing his main area of interest without requiring reinforcement from the Army. In turn, the Army can use its engineer units to reinforce its own major axis.

Engineers in the attack

The employment of engineer detachments is keyed to the Soviet preference for tactical and strategic surprise. The aim is to attack when opposing units are not in defensive positions, and to attack from the march. Thus neither side has the benefits of the defense, and must fight the Soviets' preferred type of combat, the meeting engagement.[6]

Engineer support is designed to maintain the momentum of the Soviet advance. The division deploys its OODs and IRDs along its major axis of advance, and the regiments put out their ORs along their major axes. Depending on enemy opposition, the OODs and ORs operate as far in advance of the major elements of the units as possible, preferably with or ahead of the marching unit's advance guards. The ORs also remove obstacles to flanking or enveloping attacks.[7]

During the advance or attack, the POZ, often teamed with the antitank reserve, is usually placed centrally in the unit's deployment—between the first and second echelons. It counters threats to the unit's flanks by quickly deploying antitank minefields covered by the antitank missiles or guns of the antitank reserve.[8]

Engineers in the defense

Engineer elements are integrated into the combined arms operation in the defense. Much OOD and OR equipment can be used to reinforce defenses, although the POZ is responsible for defensive minefields and demolitions while still being available, with the antitank reserve, to block penetrations into unit defensive positions.[9] (See "Soviet Countermobility Operations," p. 14.)

River-crossing operations

Each Soviet division has both a pontoon bridge company and an assault crossing company. Most Soviet armies also have pontoon bridge regiments and assault crossing battalions. A typical pontoon bridge regiment can put in six times the amount of bridging the divisional engineer battalion can, while the assault crossing battalion normally musters 3 dozen tracked amphibians and up to 2 dozen GSP ferries.[10]

The Soviets exercise their bridging capability often, and large river crossings are often a highlight of major exercises. In Druzhba 84, held in Poland, engineers accompanied forward detachments to the water obstacle. The commander decided to force the river obstacle under the cover of night. "In a very short time both shores of a deep water obstacle were linked by a pontoon bridge. The fording operation by mechanized and armored subunits and artillery lasted several hours."[11]

An assault river crossing from the march, the preferred method, starts as forward detachments of the marching regiments and divisions arrive at the water obstacle, where they immediately attempt to seize bridges "and other operating crossings." Advance guards then arrive. They destroy enemy units, screen approaches, and attempt to force a crossing, primarily with amphibious personnel carriers on the move to develop the attack in depth. Pontoon bridge subunits, moving with the forward detachments, start building bridges as soon as the opposite bank has been seized and small arms fire is no longer a serious danger.

The unit main body approaches the water obstacles at maximum speed, its high crossing rate hastened by amphibious transporters and ferries. Tanks usually do not snorkle the water obstacle.[12]

In a deliberate river crossing, engineers prepare roads and crossing sites, loading points for amphibious transporters, preparation sites for snorkeling tanks, and points for unloading bridging. Most personnel carriers cross the river while artillery preparation is still raining down on the far bank. At the same time, tanks prepare to snorkel the water obstacles.

As personnel carriers begin to secure the far bank, tanks follow underwater. Engineer subunits accompany the forward elements and, as they advance, begin to prepare the far bank for bridging and ferrying. As soon as the far bank is secure enough, bridge units hit the water. The operation then proceeds like the assault from the march.[13]

Extraordinarily elaborate preparations are a matter of record. Expatriate Soviet officer Viktor Suvorov's book ***The Liberators***

Notes

[1] N. A. Lomov (ed.), *Scientific and Technical Progress and the Revolution in Military Affairs*, Moscow, 1973 (translated and published by the U.S. Air Force, 1975), p. 106.

[2] Harriet Fast Scott and William F. Scott, *The Armed Forces of the USSR*, 3d ed., Westview Press, Boulder, CO, 1984, pp. 265-66.

[3] David C. Isby, *Weapons and Tactics of the Soviet Army*, Jane's, London, 1981, p. 331.

[4] Ibid, pp. 327-29.

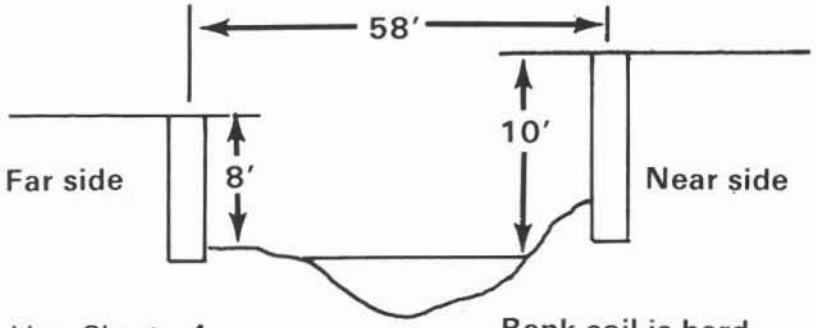
[5] Peter L. Bunce, "The Soviet Reaction to a Flank Threat," *Armor*, November-December 1985, pp. 28-29.

[6] Charles Dick, "Concepts of Operation: Organization, Plans, and Prospects," and Christopher Donnelly, "The Face of the Future Battlefield," lectures presented at the Royal United Services Institute for Defense Studies, 1 March 1984. From unofficial notes by the author.

Engineer Problem

During a bridge reconnaissance, you gather the appropriate information needed to design a Bailey bridge. The required crossing classification is 60 traffic. Determine the following:

1. **Initial bridge length.**
2. **Construction type.**
3. **Initial grillage type.**
4. **Roller clearance.**
5. **New bridge length.**
6. **New truss type.**



REFERENCE: FM 5-277, Bailey Bridge, Chapter 4

Bank soil is hard consolidated clay.

Problem/Solution submitted by CPT Steven W. Chandler, Department of Military Engineering.

reports that in a river-crossing exercise, on the Dnepr in 1967, the Soviets actually paved the river. In fact, steel mesh was placed on the river bed and concrete panels formed corridors across the river bank. The panels prevented snorkeling tanks from becoming disoriented. The steel mesh on the river bottom was used to support the large number of tanks (5,187) expected to cross the river.[14]

This feat, propaganda ploy though it may have been, was nevertheless an impressive engineer achievement. Other exercises, such as Druzhba 84, suggest that Soviet river-crossing methods are effective.

Soviet engineering troops are perhaps the world's largest and most lavishly supported engineer corps. They are a critical force multiplier in the high-speed offensive, the centerpiece of Soviet operational art. Well-supported with a variety of specialized engineer equipment and fielded in greater force than most of their Western counterparts, Soviet engineering troops are formidable opponents on the modern battlefield.

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[7] Isby, p. 331.

[8] Bunce, pp. 28-29.

[9] Isby, p. 329.

[10] Isby, p. 331.

[11] "Warsaw Pact Exercise in Poland," *Jane's Defense Weekly*, 18 August, 1984, pp. 230-31.

[12] A. A. Sidorenko, *The Offensive*, Moscow, 1970 (translated and published by the U.S. Air Force, 1976), pp. 194-95.

[13] Sidorenko, pp. 197-99.

[14] Viktor Suvorov, *The Liberators*, Hamish Hamilton, London, 1981, p. 70.



Soviet countermobility operations

by COL Frederick E. Parker, III

As a Soviet force prepares to mount an assault, units move forward to form-up areas. Each subelement commander's initial activity is to identify defensive positions for his weapon systems. Crews and engineer equipment operators begin to dig defilade positions for weapons; they keep digging until the assault begins. In the form-up area, the commander develops a fire plan and chooses locations for engineer obstacles. The unit now has fall-back defensive positions and a detailed plan to be used if the initial attack fails. As part of the fire plan, engineer obstacle sites are chosen along the avenue of advance to deny mobility to opposing forces.

This typical countermobility operation is an integral part of the planning and execution of all aspects of Soviet operations.

Soviet engineer obstacles

Engineer obstacles include any actions taken to inflict losses and to delay and impede movement in all types of battles. Their obstructive effect is directed against land forces, watercraft, and helicopters. In the attack and in meeting engagements, Threat obstacles cover forward areas and flanks, repel counterattacks, and strengthen captured positions.

In the defense, where they cover strong points and reinforce natural obstacles, engineer obstacles have added importance—here, the ability to make more extensive use of them is a major advantage.

Emplaced obstacles repel the enemy, reduce the tempo of the attack, and impede enemy operations. They are built to conform to terrain, current weather conditions, and prevailing climatic conditions. Designed to remain firm against enemy fire power and breaching efforts, obstacles must allow the attack force to remain mobile and must work as an integral part of the fire plan.

Explosive obstacles are created by means of high explosives, liquid explosives, and mines. Nonexplosive obstacles, such as wire obstacles, earth works, abatis, and dragons' teeth, are constructed.

Mixed minefields, discussed at length below, are the primary obstacle used by Soviet forces in combined arms battle. They can be quickly emplaced, and they are difficult to breach. In front of protective positions and entrenchments, they automatically create effective combined obstacles.

Obstacle complexes—natural and engineer obstacles clustered in a relatively small area—deny use of critical avenues of approach. An engineer company may prepare a system of obstacle complexes on avenues of approach up to 30 kilometers long, particularly on constricted roadways. The company starts at the front and works toward the rear. At naturally constricted areas, obstacle complexes tie the natural obstacle to a series of point obstacles such as road craters, bridge demolitions, off-route mines, and small minefields that block approaches and bypasses.

Antitank (AT) ditches may be mechanically dug after all survivability positions are prepared. In some terrains, antitank ditches are created by use of explosives. This method is used in the hard ground of clay/rock desert areas, in frigid northern regions, and in coastal areas, where such ditches are less vulnerable to wave action than mines.

Mixed minefields

Since mixed minefields are the most commonly encountered Threat obstacle, they deserve close examination. Threat mixed minefields differ from their U.S. counterparts, in which antitank and antipersonnel (AP) mines are often placed in the same minefield. Instead, the Soviets lay a mixture of antitank and antipersonnel fields. Antipersonnel fields, laid in front of Soviet forces and antitank minefields, are intended to strip the infantry and engineer breaching elements from attacking enemy tank forces.

The basic characteristics of mixed

minefields are their density and their mine outlay. In Soviet minefield doctrine, the term density is used to express the amount of position frontage protected by minefield obstacles, in meters. Mine outlay expresses the number of mines per kilometer of minefield.

Soviet minefields do not form a long, thin line. They are a series of short interrelated obstacles placed across tank approaches. Some Soviet authors indicate that spacing between minefields should prevent attacking tank platoons from clearing the gap, but that friendly movement should be possible to units that know where the gaps are.

Typical antitank minefield

Front	200 - 300 meters
Depth	60 - 120 meters
Distance between rows	20 - 40 meters
Number of rows	3 - 4 meters
Distance between mines	4 - 6 for antitank mines 9 - 12 for antihull mines
Outlay "normal"	550 - 750 antitrack mines
Outlay "increased effectiveness"	1,000 + antitrack 500 + antihull
Probability of destruction "normal"	approximately 0.57 antitrack (750/km) approximately 0.85 antihull (400/km)

Typical antipersonnel minefield

Front	30 - 300 meters
Depth	10 - 50 meters
Distance between rows	5 meters or more
Distance beween mines	1 meter for high explosive, 2 times lethal radius for fragmentation
Outlay "normal"	2,000 - 3,000 for high explosive 100 - 300 for fragmentation
Outlay "increased effectiveness"	2 - 3 times normal
Probability of destruction	0.15 to 1.2 for HE (2,000/km) 0.1 to 0.15 for Frag (100/km)

Minefield laying methods

The mixed minefield may be laid by hand, machine, or remote means, and is always covered by fire. Mixed minefields are emplaced by both engineers and combined arms elements. Engineers and remote minelaying systems are responsible for minefields in front of the forward edge of battle and on primary avenues into formations. Combat arms elements emplace obstacles to cover positions and occupied areas.

Whenever possible, minefields are emplaced at night in order to achieve surprise throughout the defense. Combat arms units hand emplace minefields in front of the forward edge of their position. In contact, antitank minefields are emplaced using a mine cord laid perpendicular to the front. When the unit is not in contact with the enemy, mine cords are laid parallel to the front. A trench is dug to establish a starting line for minelaying. Combat arms crews may also use a pace method.

A temporary combat formation known as the mobile obstacle construction detachment (POZ) is an important Soviet engineer force element. This is a platoon-sized to company-sized element with minelaying equipment and logistics vehicles that carry explosives and mines. A typical regimental POZ with three towed mineplows (PMR) carries 1,200 AT mines, 2,000 AP mines, 3 tons of high explosives, and 10 to 20 shaped charges. The POZ's load may be greater under some circumstances.

The POZ creates obstacle complexes and defensive obstacles, and lays mines during battle. While it acts independently to establish obstacles in defensive preparations, the POZ usually works with the antitank reserve during a battle. Potential obstacle emplacement locations are designated for the POZ at each halt during movement. The detachment receives straightforward orders—"place an antitank minefield from that barn to that clump of trees."

Engineer-sapper units emplace mines beyond the forward edge of battle positions. Mechanical minelayers, trucks, armored vehicles, and helicopters with chutes supplement hand emplacement. Mechanical minelayers work at rates of 600 buried mines per hour to 2,500 surface-laid mines per hour. Thus a POZ equipped with three minelayers could, in 15 minutes, lay a buried minefield covering 1 kilometer or surface lay a similar minefield in 5 minutes.

The Soviet obstacle defense is characteristically deep, and extends into their rear area. On dangerous avenues of approach, obstacles are emplaced by remote means or by inserted obstacle detachments, partisans, or special operations teams. Terrain and combat situation always dictate the method for mining and the distance between rows. False minefields may conceal minefield locations and obstacle systems.

Armies that oppose Soviet or Soviet-trained forces can expect to meet obstacle systems that enhance natural obstacles and show the imaginative use of explosives and mines.

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AirLand Battle Doctrine —the Red Army responds



by CPT F. Michael Real
and Penelope Schmitt

After watching the Red Army operate under a first strike doctrine for more than three decades, western analysts saw a change. In 1979, the Frunze Academy launched a major study of defensive operations. At the same time, the Soviets suddenly fielded new combat engineer equipment, including heavy earthmoving vehicles and scatterable mine systems. Why?

The recent appearance of the Soviet Manual *Engineer Support of Combat in Special Conditions*[1] suggests an answer. It formulates the Soviet engineer response to U.S. AirLand Battle Doctrine and to NATO's Follow on Forces Attack concept. Like AirLand Battle doctrine, FOFA calls for strikes behind the enemy forward edge of the battle area. The goal—destroy or cripple opposing armies before they can fully commit their forces to an attack.[2]

The Red Army Response

The Soviet prescription for successful attack requires heavily massed forces. It defines a 3 to 1 ratio of superiority as minimal. But the Soviets now appear to want ratios of up to 8 to 1 to assure success—they expect heavy losses on the AirLand Battlefield.

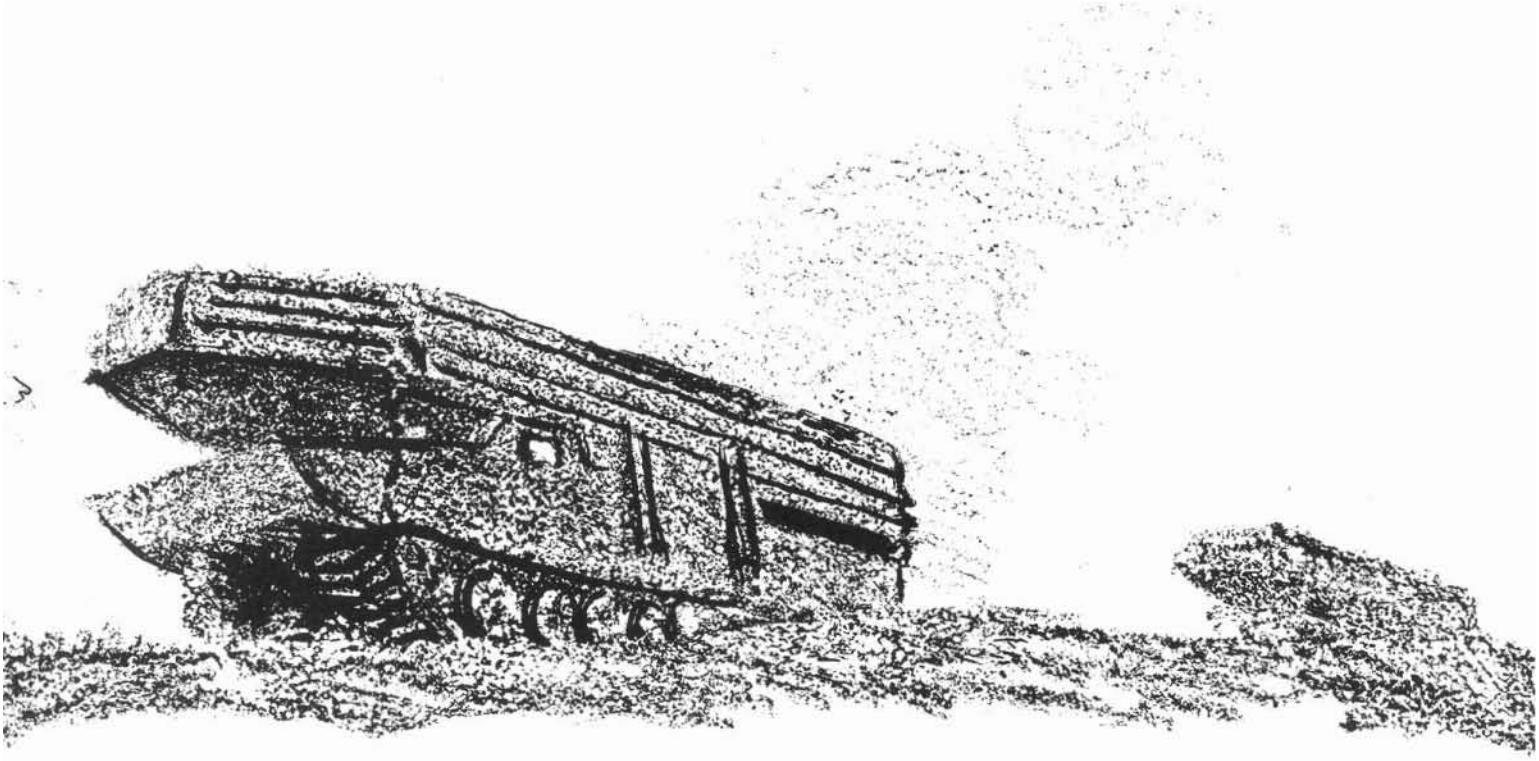
Warsaw Pact materiel superiority over NATO forces actually runs at a ratio of only 2 to 1. Attacks must be concentrated if the Soviets are to achieve desired strength. Elsewhere on the front, the Soviets must economize, relying on defenses to prevent an enemy breakthrough.

To maintain the attack on the AirLand Battlefield, the Soviets see an urgent need to preserve mobility. "Under these conditions it is expedient to echelon forces and means of reconnaissance, to overcome obstacles throughout the entire depth of the troop formations, and to ensure constant readiness for employment. It is also necessary to quickly neutralize the enemy's remote mining with artillery fire and air strikes."[3]

Among Soviet countermeasures, the most important is the tactic of deploying scatterable mine systems (FASCAM) against reconnaissance, communications, command, and control systems (C^3). Since C^3 assets are critical to coordinating a combined arms attack, protecting them must now be a top priority task.[4]

The Red Army is also taking steps to enhance the survivability of attacking elements. More traffic control personnel are being fielded to guide troops and vehicles through areas infested with remotely delivered mines. More elaborate camouflage, deployments concentrated in radar dead space, and heavier terrain fortifications can also be expected.

Troops may be more dispersed, and armor is unlikely to be openly



deployed in columns in the rear areas. Tactics to protect armored vehicles and self-propelled weapons reportedly include setting small fires along advance routes, to draw heat-seeking munitions away from their intended targets.[5]

The Engineers' Role

The Soviets are building an increased engineer capability to fight the AirLand Battle. In the past, Red Army doctrine has placed engineers squarely in the front lines. In rear areas, engineer tasks centered on water supply and logistical mobility. Now Soviet concern for survivability, mobility, and countermobility in depth calls for combat engineer presence through the entire battle area. This includes—

- Greatly increased earthmoving and entrenching capabilities to enable armor and troops to dig in as a defense against deep strike munitions.
- Increased countermine assets in response to FASCAM, deployed around assembly and supply areas and lines of communication to counter FASCAM and other rear area obstacles.
- Highly mobile engineer teams available to support gap-crossing sites throughout the battle area, and stockpiles of structural assets near all likely crossing sites to respond to expected accurate, deep strikes against bridge and crossing sites.

Implications for the West

The message is this—the Soviets are on to us. They are moving to adopt strategies and weapon systems similar to our own. They are diagnosing our tactics to invent defenses that can degrade our effectiveness—and countermeasures that can cripple an attack.

On the positive side, AirLand Battle doctrine is causing the Warsaw Pact armies to invest heavily in defensive equipment, personnel, and strategy for the first time in 30 years.

But the Soviets have consistently found ways to restructure and redeploy their assets in order to counter powerful enemies. If we are to maintain the offensive strategy inherent in AirLand Battle doctrine, we can't let our tactics become stale formulas, or assume that our defenses are impregnable.

Today, we hold the initiative. Only continued inventiveness will allow us to keep it.

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Penelope Schmitt is Features Editor for ENGINEER.

Notes

[1] *Engineer Support of Combat in Special Conditions*, 1985; translated from Russian by U.S. Army Foreign Science and Technology Center, FSTC-HT-1024-85 (August 1986).

[2] Sally Stoecker, "Soviets Plan Countermeasures to FOFA," *International Defense Review*, November 1986, p. 1607.

[3] *Engineer Support of Combat in Special Conditions*, p. 175.

[4] For a recent discussion of this issue, see MG Thomas S. Swalm, USAF, "AirLand Battle Doctrine and the C^{3}CM Strategy," *AirLand Bulletin* No. 86-4, 31 December 1986, pp. 6-10.

[5] Stoecker, p. 1608.

Water supply to Soviet ground forces



by Dr. Donald E. Nease

Conflicts are won as much by knowledge of the enemy as by force of arms. Although this primary principle of military education is often invoked, we seldom give Threat combat service support activities the scrutiny they deserve. A moment's reflection makes it clear that support is vital to the success of any mission, and should draw as much attention as we give, say, the Soviet second echelon. An important and often neglected aspect of such support is water supply. Disrupting or degrading this essential supply could severely impede a Threat offensive.

USING WATER

Water is of the utmost importance to combat units. An adult's normal physiological water requirement is about 3 liters a day, but the body may demand 10 to 12 liters to do stressful work in high ambient temperatures.

The Soviets reflect these needs in precise water-use norms. For combat personnel, their norm is 10 liters per day; in high temperatures, 15 liters. A division may use up to 150,000 liters of drinking water daily. Under adverse conditions—especially in contaminated or arid areas—water is issued at the minimum rates of 2.5 liters per person (for no more than 5 days in moderate conditions) and 4 liters (for no more than 3 days in hot weather).

The Soviet consumption norm for sanitation and bathing is 45 liters per person per day. A division will use 675,000 liters per day for these processes.

Impotable water can be used to decontaminate and disinfect weapons, equipment, and supplies. The Soviets have developed detailed water norms for these tasks, ranging from .5 liters for cleaning an assault rifle with damp cloths to 600 to 1,000 liters to decontaminate a vehicle with a water jet.

Amounts needed for simple washing and vehicle supply include 75 liters to wash a wheeled vehicle and an estimated 1.5 liters a day to keep its radiator filled.

SUPPLYING WATER

Soviet water supply doctrine covers both potable and impotable water, and states that the threat of "enemy use of mass destruction weapons" (NBC weapons) creates an urgent need to hold adequate supplies in both water-abundant regions and desert and semiarid areas. This doctrine indicates preparedness for large-scale contamination of open water reservoirs and other sources.

Tasks that support water supply to troops in the field are divided among various units. Reconnaissance and acquisition of water sources and water purification are performed by the unit's organic engineer component. At regimental level, this means a company of about 60; at division level, a battalion; and at army level, a regiment.

Equipping the water supply point and distributing water are engineer functions. The chief of the Chemical Service and the Senior Regimental Surgeon maintain constant dosimetric, chemical, and sanitary control over water quality. The NBC instructor, dosimetry officer, and chief paramedical officer (Feldsher) of the battalion monitor water sources. These organizations often conduct water reconnaissance activities. The using units must protect and maintain their water distribution points and equipment.

Water supply and distribution points

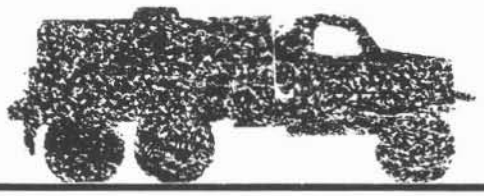
Water supply points at water sources are often set up close to the battalion. Detachments that operate separately from the main forces receive water and hot food at the same time. In the defense, it is considered expedient to put supply points in the various company or battery areas, inside or near the defensive perimeter. When arid conditions, scarcity, or contamination make it impossible for battalions to have individual water supply points, troops receive water from water distribution points. These supplies of transported water reserves are located in or near the regimental area.

Criteria for selecting a water supply point include not only the quantity and quality of the water, but also the availability of sidings, suitable roads, and protective and camouflaging terrain. Soldiers set up a sanitized protective zone with a radius of 50 to 100 meters around each point. Markers and/or signs indicate the points, distribution locations, and access routes. Control posts are set up on the approaches.

On rivers and streams, water distribution has these priorities: water supply points, bath facilities, water for animals, and vehicle washing. Bunkers and trenches protect personnel and equipment near the supply point, and all equipment is camouflaged.

Drilling for water

Soviet doctrine encourages use of





surface water and existing water networks because of the ease of supply. When these sources are unavailable, the army is fully prepared to drill for water.

Three drills available in the Soviet inventory are the MsChak-15, UDV-15, and UDV-20. All are auger-type power drills operated by two men. Each can extract water at a depth of 15 meters. These drills have a special tap for breaking rock and a built-in filter and piston pump that makes newly-drilled wells productive immediately.

The MsChak-15 can be set up in 1.5 to 2.5 hours by two soldiers, and can extract 1,300 liters per hour. The UDV-15 can be emplaced in 1 to 2 hours by two people and will produce 2,000 liters per hour. The UDV-20 can extract water at a rate of 1,800 to 2,000 liters per hour.

Pumping equipment

The Soviets use several pumps. The small tubular pump, MTK-2M, can be used for ground water up to 7 meters below the surface, pumping water 10 to 20 meters above the surface. The pump can be set up by three or four men in 3 to 4 hours; it extracts 1,300 liters per hour.

For open basins or wells with a maximum depth of 6 meters, the Soviets use the BKE-4 pump, its capacity is 2,400 to 3,600 liters per hour. Two soldiers can set up this pump in 20 minutes.

The M-600 motor pump is used to pump water from large basins. Its 12-horsepower engine pumps 3,600 liters per hour with a crew of two.

The KPN piston pump can pump 5,000 liters per hour from shafts over 150 millimeters in diameter. Its workable depth is 90 meters.

Storage equipment

For water storage, Soviet forces use flat containers of rubberized fabric with the designations RDV-5000, RDV-3000, RDV-1500, RDV-100, and RDV-12. The numbers indicate liter capacity. The 5,000- and 3,000-liter tanks are protected with attached covers, while the necks of the smaller tanks are tied for protection.

These tanks are disinfected and set up at water distribution points in enclosed sites on level areas cleared of objects that might puncture the fabric. If extended storage is planned, troops cover the soil beneath the tanks with boards, straw, and rushes.

Other water-holding devices in the Soviet inventory include the AVTS-28 tank trailer (2,800 liters), RTS-1200 tank cistern (1,200 liters) RE-6000 tank (6,000 liters), BTR-100 tank (100 liters), and RB-12.5 backpack wineskin (12.5 liters).

Purifying water

To keep water potable over an extended period, it is chlorinated up to 0.8 to 1.2 milligrams per liter. Boiled water can be stored for a day, then it must be boiled again or chlorinated. To distill water, the Soviets use the POU and POU-4, each of which can produce 300 liters per hour of fresh water. The OPS, a truck-mounted distiller, can produce 1,800 liters per hour. Each of these devices requires a set-up time of 90 to 120 minutes.

The MAFS-1 automatic filtration station is one of several items the Soviets use to purify ground and surface water. This purification system can supply up to 2,000 cubic meters per hour and requires a five-man crew and driver. Water is pumped from the source to rubberized fabric tanks where coagulation and sedimentation take place. It is then pumped to the MAFS-1 unit where it is filtered, decontaminated by activated carbon and/or ion exchange, chlorinated, dechlorinated if necessary, and then stored in other rubberized fabric tanks for distribution.

The MAFS-2 can purify water uncontaminated by radioactivity at a rate of 8,000 liters per hour and radioactive contaminated water at a rate of 4,000 liters per hour. The MAFS-3 is a truck-mounted filtration station which can purify naturally, chemically, and radioactively contaminated water. Assembled on a truck and two-axle trailer, the MAFS-3 consists of a filter, 2 dechlorinators, 3 M-600 motor pumps, RDV-5000 rubberized tanks, instruments, and filtering agents. Production rates are 7,000 to 8,000 liters per hour.

Clearly Soviet water supply doctrine plans meticulously for the tactical problems related to water supply just as they have for other combat service support functions. In the Soviet Army nothing is left to chance. However, war is often ruled by the unanticipated. It seems likely that the realities of battle could upset these rigid norms and jeopardize Threat operations. This is NATO's challenge.

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SOVIET ENGINEER EQUIPMENT

by SFC Peter L. Bunce

Soviet engineer units are lightly manned compared to U.S. units. Regimental engineer companies have 60 to 70 officers and men; divisional engineer battalions in tank divisions have about 30 officers and 400 men.[1] This compares to about 150 in a U.S. Army engineer company and about 900 in a divisional combat engineer battalion.

Equipment makes up the difference—Soviet engineer units have more machines, and they are highly specialized (see the table).[2] This article reviews the characteristics of newer and important systems in the Soviet engineer components.

TMM—heavy truck-mounted bridge. The TMM has advantages over the AVLB, which the Soviets also field. The TMM functions on softer ground and spans wider gaps than AVLBs. (The British Chieftain Mk. 6 spans the widest gap for an AVLB—20-meters). The truck-mounted TMM is lighter, and still puts out a class 60 bridge. TMM sections can be joined to form a 40-meter span—the job takes 45 to 60 minutes in daylight, 60 to 80 minutes at night. Each regimental engineer company has a four-vehicle set, each divisional engineer battalion has two (six per division total).

GMZ—self-propelled, armored mineplow vehicle. Based on the SA-4 GANEF chassis, the GMZ carries 208 antitank mines. It can bury four mines a minute, 4 to 5.5 meters apart. It reloads in 12 to 15 minutes. The GMZ is held by sapper companies in divisional engineer battalions.[3] GMZs are the core of divisional POZs, and probably work closely with divisional antitank assests like the MT-12 100 millimeter antitank gun.

IPR—underwater reconnaissance vehicle. Apparently based on the 2S1 122-millimeter, self-propelled howitzer chassis, the IPR is thought to have internal ballast tanks and cowled propellers that enable it to move across the bottom of water obstacles. Its 10-meter snorkel and pennants allow it to mark lanes. The power operated shovel-like device on the hull front may enable it to take river-bed and bank samples. No basis of issue is yet known, but IPRs might be used in the reconnaissance platoons of divisional engineer battalion headquarters companies.[4]

UR-77—tracked self-propelled line charge vehicle. Rocket-propelled line charges are a rapid mine-clearing method; the best known of these is the British Giant Viper. The UR-77 is a dedicated line-charge vehicle that appears to be based on a 2S1 chassis. A photograph published in 1983 in Steven J. Zaloga's *Soviet Tank Today* shows a 2S1-like vehicle with a rocket-propelled line charge being fired, apparently in Czech service. If this is the UR-77, it may replace the BTR-50K line charge first identified in 1974.[5]

Force Modernization

The recent appearance of the MT-T tracked transporter has led to a number of new engineer vehicles. The MT-T has the T-64 tank suspension and the late model T-72 engine. It appears to be a heavy artillery prime mover, like the older AT-T family. A new BAT-2 combat dozer (replacing BAT and BAT-M), a new PTS-2 tracked amphibian (replacing MDK-2 and MDK-2M) have already appeared with the MT-T as foundation.[6] Since the IMR combat engineer tractor is based on the obsolescent T-55 chassis, an IMR-2 may reasonably be expected to appear before long.

A new bridge family, the Amphibious Bridging System (Tracked) or ABS(T) recently appeared in the Group of Soviet Forces, Germany (GSFG). Dual pontoons mounted on a tracked amphibian chassis fold out before the vehicle enters the water, where it can link up with other ABS(T) units to form bridges or rafts.[7] The ABS(T) may be a replacement for the PMP ribbon bridge, the GSP heavy ferry, or both.

Clearly, the Soviet engineer forces

Notes

[1] David C. Isby, *Weapons and Tactics of the Soviet Army*, Jane's, London, 1981, p. 331.

[2] Isby, pp. 331-43.

[3] "GMZ Tracked Minelayer," *Jane's Defense Weekly*, vol. 2, no. 5, 11 August 1984, p. 187.

[4] "IPR Amphibious Engineer Vehicle," *Jane's Defense Weekly*, vol. 3, no. 3, 19 January 1985, p. 99.

[5] "New Soviet Transporters," *Jane's Defense Weekly*, vol. 6, no. 1, 12 July 1986, pp. 18-19. Stephen J. Zaloga, *Soviet Tanks Today*, Tanks Illustrated No. 4, Arms and Armor Press, London, 1983, p. 42.

[6] "New Soviet Transporters."

[7] "New Soviet Amphibious Bridging System," *Jane's Defense Weekly*, vol. 6, no. 2, 19 July 1986, p. 70.

field an impressive array of specialized equipment. Some of the systems offer capabilities not matched by the NATO armies' engineer assets. The challenge to the west is manifold. We must ensure that our current inventory of equipment can be used to its full capacity. We must design, test, and deploy new systems to enhance the engineer contribution on the AirLand battlefield. And we must field a capable, well-trained engineer force that mans well-maintained and skillfully operated equipment.

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Comparison of Soviet and NATO Specialized Engineer Equipment (less militarized civilian equipment)

Type Equipment	Soviet	US	British	West Germany	French
Armored Vehicle Launched	MTU-20/MTU	M60A1 AVLB	Chieftain AVLB Mk. 6	Biber	AMX-13 AVLB/PAA
Truck Launched Bridge	TMM/KMM				
Armored Engineer Tractor	IMR	COV (prototype)	FV180 CET	Pioniere-panzer 1/2	VCG/EBG
Combat Engineer Vehicle (Demo Gun)		M728 CEV	Centurion Mk. 5 AVRE		
Ditching Machine (Narrow)	BTM-3/BTM-TMG				
Ditching Machine (Wide)	MDK-2M/MDK-3				
Combat Dozer	BAT-M/BAT-2	M9 ACE			
Wheeled Dozer	PKT			ZD-3000	
Floating Pontoon Bridge	PMP	Ribbon Bridge		Ribbon Bridge	PFM
Self-propelled Ferry	GSP				CEFA
Tracked Amphibious Transporter	K-61/PTS-M/ PTS-2				
Self-propelled Bridge/Ferry	ABS(T)	MAB	M2		MAF-1/2
Underwater Reconnaissance Vehicle	IPR				
Vehicle-mounted Mine Detector	DIM/DIM-3				
Towed Mine Plow	PMR-3	M57	Bar Mine Plough		
Self-propelled Mineplow	GMZ				
Self-propelled Line-charge Vehicle	BTR-50K/UR-77				
Towed/Dragged Line Charge		M57	Giant Viper		
Helicopter Minelayers	HIP Mine Chutes	M56			
Mine Scatter System		M128 GEMSS	Ranger	M548GA1 MiWS	
Mine Roller System	KMT-5	Tank-mounted Mine Roller			
Mine Plow System	KMT-4/6	Track-width Mine Plow	Mine Plough		
Tank-mounted Dozer Blade	BTU	M60A3 Dozer	Chieftain Dozer		

The one-hour minefield

a rapid drill for combat engineers or mechanized infantry

by CPT Philip L. Reed

The maneuver force commander points to a spot on his map. "We need an obstacle here," he tells the engineer. Their objective—to block the primary high-speed armor avenue of approach into the force—can best be met by a large minefield.

But there are problems. This engineer has never seen a helicopter-delivered M56 mine dispenser. His battalion's M57 mine plow is useless in mud or frozen ground. Besides, it's rusted and parts aren't available. Those high tech mine systems he was taught at school aren't available either. The reality? His platoon must lay mines by hand, and doing the job according to doctrine takes time—lots of time.

Combat engineers must meet such problems with methods that bring them up to speed with the maneuver forces concept of mobile armor warfare. The rapid minefield-laying drill that follows is a response developed by personnel of B Company, 16th Engineer Battalion. It gives any mech/armor division rapid mining capability. Using this method, troops in M113 armored personnel carriers can emplace multiple belts of surface-laid antitank mines.

THE TASK

Emplace a 1,000-meter front minefield in 1 hour or less

Conditions. Day or night. Any environment. Driver track commander (TC) buttoned up. Mission received and troop leading procedures initiated. Given a mechanized combat engineer platoon and its organic assets.

Standards. Minefield front, 100 meters. Minimum linear density .5,0,0 (at least one antitank (AT) mine per 2 meters of front). Rows must be a minimum of 8 meters apart at every point, and minefields must be marked on all four sides (NATO requirements). Minefield must be emplaced within 1 hour of arrival at the target site.

Resources. Four M113 APCs with radios, each manned by a driver, TC, and two mine handlers, and supplied with 145 M15 heavy AT mines, a 10-meter length of rope, cargo tie-down netting, DR-8 spool with 1,500 meters minefield marking tape, and minefield marking poles and signs (20 each), and a 3-pound hammer from the hand emplaceable minefield marking set (HEMMS).

PREPARE

Load vehicles

The engineer platoon assembles at the engineer company forward supply point (FSP), and prepares the platoon APCs. All equipment normally carried inside the vehicles, including seats, is removed.

Arm, place on safe, and load the 145 M15 heavy AT mines in each vehicle. Stack the mines along the right side wall and the front wall behind the driver and engine compartment. Secure the mines with netting, if available. Careful stacking and driver awareness reduces the risk of mines slipping during movement.

Once the APCs are manned, remaining platoon personnel and equipment remain with the engineer company FSP, or proceed to construct other obstacles.

Perform reconnaissance

The platoon leader may conduct a reconnaissance of the target area in one of the platoon's other vehicles or conduct the recon when the platoon arrives at the target rally point (RP).

Make a final check

In addition to the spool and other optional minefield marking materials, the crew must have the 10-meter length of rope to trail behind the APC, measuring the distance between mines.

Move

The platoon moves to the rally point near the target, conducts final checks, and deploys to the minefield edge. The orientation and limits of the minefield are determined by the leader's initial recon.

EMPLACE THE MINEFIELD

Step One: Position the vehicles

Keying from vehicle 1 (platoon leader), vehicles 2, 3, and 4 follow at a 20- to 30-meter interval, then turn and halt (figure 1). Remember, the minimum distance between rows at any single point is 8 meters.

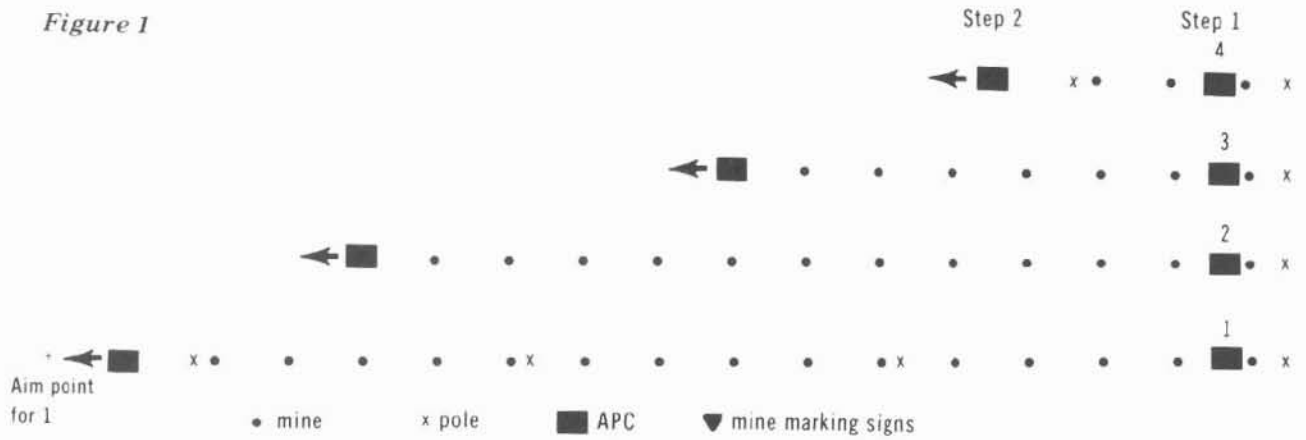
At the halt, without commands, a soldier in each APC emplaces one pole, drops the 10-meter rope (tied to the towing pintle) from the rear door, arms and lays the first mine. Each mine is placed by a mine handler sitting just inside the rear hatch. The ramp always remains in the closed position.

Step Two: Lay mines

Platoon leader in APC 1 slowly drives forward, (2 to 3 miles per hour). Other APCs follow, keeping the 20- to 30-meter interval. Each vehicle places its next mine when the end of the trailing rope reaches the previously emplaced mine. Perfect alignment is not necessary or desired. Drivers of vehicles 2, 3, and 4 align from the vehicle to the driver's left.

Vehicles 1 and 4 place intermediate poles approximately 50 meters apart, depending upon terrain (figure 1). This marks the front and rear edge of the minefield and is necessary for later marking. These poles, along with the end poles, identify the minefield limits in high grass or darkness. When necessary, directional lights from a HEMMS can be attached to the poles.

Figure 1



Step Three: Mark

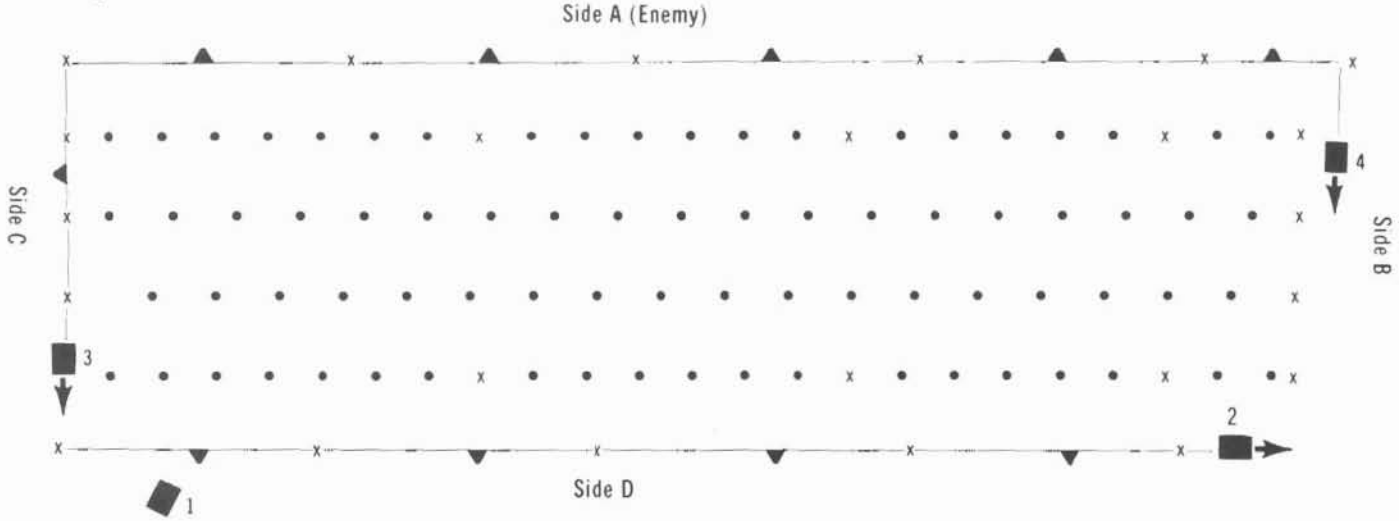
When the APCs reach the far side of the minefield, the platoon leader halts, waits for all other vehicles to come on line and halt, then orders "MARK." All four APCs then place one pole.

The platoon leader in vehicle 1 moves to the best position for observing the other vehicles, and records the minefield on DA Form 1355, Minefield Record.

Vehicle 2 moves and marks side D (figure 2); vehicle 3 marks side C; and vehicle 4 marks sides A and B. A fence is thus created by planting a pole, attaching marking tape to the poles, and slowly driving forward while reeling out tape. The APC halts to emplace minefield marking signs on the tape at 50-meter intervals. The handlers never dismount.

Drivers and TCs watch the minefield boundaries to ensure the fence is offset 15 to 20 meters.

Figure 2



(Continued on next page)

TRAINING NOTES

If there is enemy contact during emplacement, all vehicles exit the minefield, driving straight ahead, and assemble at the platoon RP.

To counter Soviet line charges and breaching techniques, lay multiple belts, thus extending minefield depth.

Install antipersonnel mines later, if time and situation permit. The M21 heavy antitank mine (tilt rod) is not usable for this method, because it must be buried. Tilt rod mines can be emplaced later if the situation permits.

To make lanes and gaps, halt the vehicles and place marking poles, or dismount later and clear mines from the lane by hand.

Testing has shown that mines do not fall in neat rows as would be expected. Variations of speed, terrain, intermediate marking, and driver visibility ensure a random dispersion of mines and, more important, at least one AT mine per 2 meters of front.

SUCCESS IN THE FIELD

This drill was tested for 4 months culminating in a 14-day operational test at Hohenfels Training Area in March 1984. The results were excellent. Troops could emplace and mark extended front minefields during periods of limited visibility, regardless of ground conditions. Units used concrete mines about the size and weight of the M15 AT mine. Surface-laid mines proved hard for buttoned-up armored vehicles to detect in tall grass, at night, or—painted white—in snow.

This simple method uses only TOE equipment and requires no modifications or fabrications. Experienced teams can do the job in under 20 minutes. When time is short and an obstacle is urgently needed, this method may be the answer.

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A Personal Viewpoint (continued from inside front cover)

increase minefield breaching capabilities; however, all these systems are developmental. Defense budget constraints may put them on hold for several years.

Small wonder maneuver units at the NTC are often destroyed while negotiating obstacles. As they are now organized, engineers can't effectively conduct assault breaches with current equipment.

Current doctrine dictates that assault breaches will be made by coordinated and rehearsed actions of task-organized support, assault, and breaching forces. Yet these forces are not currently task-organized into a standard obstacle breaching team (the Counter Obstacle Team).

THE COUNTER OBSTACLE TEAM CONCEPT

The Counter Obstacle Team is a combined arms force made up of assault, support, and breaching forces.* In a typical COT scenario, an attacking task force is led by scouts, followed by an armor company, the breaching force, and successive maneuver units. The size and types of units are METT-T dependent.

Obstacles are reconnoitered by scouts. If no bypass is available, then maneuver forces assume various roles. The lead tank company becomes an assault force and secures the far side by direct fire. The second maneuver unit (in this case the mechanized infantry company) becomes a support force providing overwatch fires for the breaching force. The breaching force is commanded by an engineer platoon leader or the tank company XO. This task organization must be automatic and precise. It can only be achieved if the assault, support, and breach forces are predesignated, well-rehearsed, and ready to be task-organized into the COT.

The COT ably negotiates complex obstacle systems with current organizations and equipment. Using a CEV for assault breaches, AVLBs for tank ditch crossings, and three engineer squads, the engineer platoon can function successfully. However, the CEV is not a minefield-breaching panacea. More able engineer equipment is needed if the COT concept is to be fully exploited.

The engineer slice of the entire Counter Obstacle Team can easily accommodate equipment currently in development. As the ACE, MCLIC, COV, ROBAT, rollers, and mine plows become available to augment the COT, the makeup of its engineer component can be adjusted to fit METT-T.

The combined arms team is currently ill-prepared to negotiate complex obstacle systems in stride. The Counter Obstacle Team concept, achievable to a limited degree with current assets, is an effective method of obstacle reduction. No time should be wasted—if we adopt the COT concept as AirLand Battle doctrine, we can make engineer mobility forces combat ready TODAY.

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* The COT concept (or a resemblance thereof) has been used by the following organizations: 17th Engr Bn, 2d AD, Fort Hood; 16th Engr Bn, 1st AD;, Federal republic of Germany (FRG); 12th Engr Bn, 8th ID, FRG; 23d Engr Bn, 3d AD, FRG; 10th Engr Bn, 3d ID, FRG.

Past in Review (continued from page 37)

in the 46th Army part of the Southwestern Front. In the area of the LXVI Rifle Corps, 12th Army massed some 300 combat engineers with the first assault detachments.

THIRD PERIOD 1944 to 1945: Expanding Offensive Operations

In the final year of the war, Soviet engineers refined and expanded their reconnaissance and crossing operations.

Crossing the Narew and the Oder

To prepare the Narew crossing, engineers assessed German defenses, collected data on enemy crossings, and searched for suitable crossing points. They passed their findings to the armies along with aerial photos of the western bank.

Using this information, the 48th Army's chief of engineer troops issued a diagram of the Narew to corps and divisions and assigned engineer reconnaissance subunits to specific areas. Reconnaissance platoons from the 399th and 73d Rifle Divisions detected minefields and barbed wire and marked possible approaches to the river.

Meanwhile, four engineer reconnaissance platoons from the 57th Combat Engineer Brigade and a platoon of the 104th Ponton Bridge Battalion, under covering fire, surveyed the river for both a low-water and a floating bridge site, and for raft crossings. Close and continuous cooperation between the chief of the engineer troops and the chief of the Army intelligence section ensured the operation's success.

During the Berlin Operation, combat engineers in the Second Belorussian Front Zone studied two channels and a swampy flood plain of the Oder. They found crossings and concealed approach routes, set up a network of observation posts, and swept for minefields. They made 41 measurements of both channels, established 67 bridges, crossings, and fords, and discovered 23 minefields and 11 pillboxes. As a result, they provided 19 routes for troops and 8 canals for moving rafting equipment to the West Oder.

Conducting deep reconnaissance

Behind-the-lines reconnaissance was standard in the engineer repertoire of support to the Soviet offensive, and the latter period of the war saw engineers intensify their scrutiny of enemy defensive lines. As successful operations opened the way, commanders began to send combined arms and engineer reconnaissance groups deeper into enemy positions.

To prepare for the Uman-Botosani Operation (4 to 9 March 1944), the staff of the engineer troops of the 27th Army, Second Ukrainian Front, sent out a reconnaissance group from the 6th Assault Combat Engineer Brigade. This unit penetrated over 15 kilometers behind enemy lines and found 6 fords and 26 bridges for troop crossings.

Such activities were essential to the massive offensives of 1944 and 1945, like the Bagration or Oder-Vistula operations, which featured high rates of advance. In these months, the Soviets proved their ability to take full advantage of weaknesses in enemy defenses by penetrating lines and carefully preparing for the advance. The success of Soviet exploitation and pursuit depended on accurate engineer intelligence.

Exploiting mobility

Motor and air-dropped mobile engineer reconnaissance units also proved valuable. In the Vistula-Oder Operation (January and February 1945), motorized combined arms and engineer reconnaisance subunits moved ahead of advancing troops to capture and hold crossings until forward detachments arrived.

Similar operations took place elsewhere. The 13th Army reconnoitered with mobile engineer detachments along the First Ukrainian Front, while chasing the enemy to the Oder. Before other forces arrived, a detachment of two truck-mounted companies from the 281st and 282d Combat Engineer Battalions reached the river with 13 pontons and set up crossings.

LEARNING FROM THE PAST

By the end of the war, the Soviets had reorganized and integrated engineers as an effective component of their combined arms team. While the war continually expanded in scope and pace, the Russians expanded engineer effectiveness and added, refined, and elaborated techniques. They mastered river-reconnaissance procedures. They used engineer troops for in-depth reconnaissance of positions behind water obstacles. They exploited aerial photography data. They cooperated closely with combined arms teams for successful river crossings. Repeatedly, the Soviets demonstrated a capacity to identify opportunities and exploit them to the fullest.

The current edition of the Soviet's *Combat Engineer Support* bases doctrine on these successful methods, illustrating each doctrinal principle with examples from the various battles. United States Army Field Manual 90-13, *River Crossing Operations,* 1978, lays out essentially the same doctrine for United States Engineers. However, the U.S. manual does not draw on the excellent resource offered by historical examples.

Our soldiers could usefully supplement FM 90-13 by studying both Allied operations and the engineer operations that led the Soviet advance across Europe. Such study would enrich U.S. engineers' practical knowledge of operations on similar terrain. It would teach another lesson too: the Soviet Army's record of imaginative, flexible, engineer responsiveness in the Great Patriotic War demands our close attention.

Note: Additional readings on Soviet Engineers can be found in the "Military Affairs" subseries, in the USSR Reports series prepared by Joint Publications Research Service (JPRS) and Foreign Broadcast Information Service (FBIS). These are available through NTIS and post/school libraries. Peter Vigor's *Soviet Blitzkrieg Theory* gives a useful picture of Soviet military doctrine and thinking.

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Testing engineer equipment at Fort Knox



The counter obstacle vehicle breaches an antitank ditch.

by LTC David S. Barber

"... and testing was conducted at Fort Knox, Kentucky." You've seen this phrase many times in articles about new engineer equipment. But why is the Home of Armor testing engineer equipment?

Engineer user testing at Fort Knox serves a vital function in the acquisition process. It gives the decision maker and the combat developers information on how a typical engineer unit and engineer soldiers will use a new system on the battlefield.

Both concept evaluation program tests (CEPs) and operational tests (OTs) are conducted by engineer officers and NCOs in the Armor and Engineer Board. These majors, captains, E7s, and E8s ensure that all the issues of the tests are completely and candidly addressed.

The test schedule is arduous. A typical test lasts two or three months, and test days may be 24 hours long. Proper test execution requires extensive coordination for troop support, facilities, supplies, vehicles, testing areas, and ranges. Recent TOE troop experience is desirable for both the officers and NCOs. They must lead and motivate their soldiers, acting as company commanders and first sergeants during the tests.

Soldiers are a key part of user testing, since their performance indicates the system's utility on the battlefield. Their comments and suggestions about systems weigh heavily, and are included in the test report.

Realistic Testing Available at Knox

Although not collocated with the Engineer School, Fort Knox is an excellent testing environment. The 194th Armored Brigade provides invaluable support, and can offer a combined arms scenario for testing. Also at Fort Knox are the 19th Engineer Battalion (Corps Combat), the 522d Engineer Company (organic to the 194th), and the 13th Engineer Company (Construction Support).

These units have supported engineer testing by providing player troops, constructing obstacles, and performing other engineer missions. They also supply TOE vehicles such as the M-1 and M60A3 tanks, Bradley fighting vehicles, heavy expanded mobility tactical trucks (HEMTT), and high mobility multipurpose wheel vehicles (HMMWV).

Fort Knox contributes the organic capabilities of the combined Boards as well. The Armor and Engineer Board's carpentry, metal, electrical, and machine shops can fabricate many items to support testing. In fact, the remote obstacle breaching assault tank (ROBAT) was first fabricated at the board, and its concept demonstrated in 1981.

User goals are the standard

Fort Knox's tests are based on user goals. They are designed to reduce the risk surrounding the decision to acquire or reject equipment or systems. Does a badly needed item constantly break down?—then it is more a liability than an asset. What if the equipment can do the job, but is so complex that many soldiers cannot operate or maintain it? The decision maker must determine whether equipment can be fielded or must undergo more development. Millions of procurement dollars are at stake, as are urgent needs for equipment in the field.

User tests at Fort Knox put typical TOE soldiers into a new system, then examine its performance in scenarios that replicate combat missions. In such settings, the unforeseen often begins to occur.

Here's a typical instance: During

a mine-dispensing test, a radio remote control device failed to perform as expected. When normal maintenance procedures couldn't correct the problem, the contractor took the item for repair. The fault proved to be mud on the remote control device. The contractor's recommendation?—*inform all test players that the device must be kept free from dirt and mud!* Since dirt and mud can't be eliminated from the battlefield, only two choices remained: redesign the item to function properly in field conditions, or reject it as unusable.

The Concept Evaluation Program

The CEP test determines whether a system actually works as envisioned. It should occur early in the acquisition cycle. Prototype equipment can be modified if testing indicates the need for changes. The concept of employment can be altered if different scenarios point to better methods.

When soldiers are brought into the CEP, equipment can be designed and modified to fit their capabilities, enabling them to make the equipment yield its expected performance. Contractor representatives often train troops on the new systems. Thus the contractor can easily



Sappers of the 522d Engineer Company use the auger attachment to bore holes for cratering charges, in tests of the Canadian M113 specially equipped vehicle.

Engineer soldiers in MOPP 4 test procedures for mounting the GEMSS Flipper on an M113 APC.





A COV breaches steel obstacles during a concept evaluation test.

identify minimum standards for the system and write them into the requirements document that will support funding for the project.

Last spring, a CEP was conducted for the counterobstacle vehicle (COV). Combat engineers are acutely aware of the need for such a vehicle. The capability to breach complex or compound obstacles consisting of mines, ditches, wire, and urban rubble from a protected platform has long been desired. However, the type of vehicle and appropriate attachments, crew size, and operation were still unknowns.

Working closely with engineers and technicians from Belvoir Research, Development, and Engineering Center, a CEP was conducted at Fort Knox in 1986. The prototype vehicle demonstrated that a compound obstacle could be successfully breached from a closed-hatch armored vehicle. The prototype also proved able to construct vehicle fighting positions, tank ditches, and combat trails through heavily wooded areas.

The CEP showed, however, that major design modifications are needed to improve visibility from the COV and to deal with its 74-ton weight. The Directorate of Combat Developments, USAES, is evaluating the results of this and other tests to determine the exact configuration required.

A CEP can also be used to evaluate a concept developed by another country. Last July, a modified Canadian M113 specially equipped vehicle (SEV) underwent CEP testing. To increase sapper efficiency, especially at the squad level, Canadian engineers have modified their M113 squad APC by adding hydraulic tools. The tools are powered by a hydraulic pump that works on direct drive from the M113's engine. Using the power tools, squads can complete engineer missions in a shorter time with less manpower.

The Operational Test

The OT is designed to test the operational suitability, military utility, and operational effectiveness of a system—in other words, the hardware, software, training, maintenance, and logistics of the system. The OT test is a dress rehearsal that usually occurs just before a type classification decision is made. System development should be mature by this time, and any modification must be made on the actual production model.

The GEMSS auxiliary mine dispensing system (FLIPPER) test completed in March 1986 shows the benefits of an OT. The test was designed to verify the reliability, availability, and maintainability (RAM) characteristics of the system. The RAM tells the decision maker how much of the time the system will be available to the unit and how often it will be down for maintenance.

Each test followed the mission profile conceived by the Directorate of Combat Developments, USAES. In this case, the tests required FLIPPER to dispense 360 to 400 mines in three belts 1,000 meters long. Missions were conducted in MOPP 4, cold weather clothing, and normal field uniform, both in daylight and at night. Four different vehicles were used: the M113 APC, 5- and 2½-ton trucks, and the M548 tracked cargo carrier. Inert mines replaced actual M74 and M75 GEMSS mines.

After two weeks, numerous failures of the flywheel and tire assembly brought the tests to a halt. The material developer, US Army Armament Research and Development Command (ARDC), designed a new assembly and rushed it to Fort Knox. With the new assembly, over 12,000 mines were launched without a failure, and the reliability criteria were met.

The testing programs at Fort Knox thus make the Home of Armor an excellent combined arms testing ground that ensures adequate realism, and affords the opportunity to test new systems in both developmental and fine-tuning stages.

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Countermine operations in El Salvador

by MAJ James K. Waters

Vietnam taught us that mine and countermine operations don't always involve large barriers, sophisticated equipment, and highly trained emplacing and breaching teams. Instead, the enemy may harass and demoralize opponents with randomly placed mines and booby traps.

We changed to meet the countermine threat in Vietnam—changed tactical techniques, individual training, and equipment use. Unit leaders learned to disperse troops and select routes carefully. Soldiers learned to identify mines. Combat engineers learned to use existing equipment to locate mines. We met the Threat.

Today, countering small mines in a low intensity conflict must again become a priority. This article reviews a success in combat development—the countermine effort of the Republic of El Salvador Armed Forces (ESAF). Cooperation between ESAF and the United States Southern Command (USSOUTHCOM) has been the key to success. The results?—guerrilla mine warfare is less effective, and ESAF ground tactical operations are more successful.

Assessing the Threat

Salvadoran guerrillas find many uses for mines and booby traps—they employ them to terrorize civilians, deny access to guerrilla base camps, warn of approaching troops, restrict enemy movements, and slow or disrupt operations.

Most guerrilla-fabricated mines are made from materials like sheet metal, wood, plastic pipe, and commercially available chemicals.



Salvadoran trainer demonstrating mine sweeping to ESAF troops.



SFC Mark Goode inspects a White 6000 commercial metal detector with Salvadoran trainees.

Fabricators use a metallic blasting cap detonation system. It is unsophisticated, but extremely effective. So effective, in fact, that mines and booby traps account for 80 percent of ESAF casualties. Hundreds of civilians have also been killed, crippled, or maimed.

It is worth noting that captured guerrilla documents on mine and booby-trap employment were originally prepared in Hanoi—the guerillas still heed lessons taught by their Vietnamese comrades. Unfortunately, some countermine lessons we learned in the Vietnam conflict have faded from our institutional memory. To recapture these lessons, USSOUTHCOM planners used earlier versions of current manuals as a basis for ESAF doctrine, training, and force structure.

The Countermine Response

Cooperation between ESAF, USSOUTHCOM, Troop Support Command (TROSCOM), U.S. Army South, and the U.S. Military Group in El Salvador resulted in a successful countermine program for El Salvador.

A TROSCOM study identified equipment that could enhance ESAF's countermine ability. The TROSCOM team found that U.S. Army mine detectors (AN/PRS-7/8 and AN/PSS 11) could do the job, but required extensive maintenance. Since nearly all mines and booby traps used by the guerrillas contained some metal, TROSCOM suggested a commercial metal detector. The White 6000 detector proved a reliable, low-cost tool for detecting mines, and the Salvadoran government bought a supply on the open market.

The TROSCOM team also recommended protective clothing. Natick Laboratories, which develops U.S. Army individual clothing and equipment, quickly produced overboots designed to reduce blast effects, Kevlar "blast chaps" to reduce fragmentation wounds to the legs and torso, and clear-lensed goggles for eye protection (dark lenses obscure trip wires). Nearly all this gear is available from commercial sources.

Because the protective clothing weighs up to fourteen pounds, it is worn only when soldiers are sweeping areas known to be mined. Unless intelligence reports the presence of mines and booby traps, units rely on visual cues during routine patrolling operations.

The USSOUTHCOM provided training for the countermine program. U.S. Army South designed and produced realistic guerrilla-style mines and instructional charts, and the U.S. Military Group in El Salvador coached host country soldiers to become trainers. The trained ESAF officers and NCOs then returned to their units ready to teach mine recognition and self protection.

One ESAF infantry battalion took the lead as a test bed unit. This unit received intensive training on countermine operations and advanced patrolling techniques. Each company organized, trained, and equipped a three-man countermine team.

The team's operating concept is simple—When the unit enters a suspect area, the team is called forward and begins to sweep for mines. As mines are detected, they are marked and destroyed in place. No attempt is made to recover the mines—they are usually booby-trapped. These teams also use the metal detectors to locate hidden caches of supplies, weapons, and ammunition.

To gain an important psychological point, government forces have severely restricted their own use of pressure sensitive mines. The Salvadoran government informs citizens of the dangers and indiscriminate nature of guerrilla mines and booby traps, using radio and

Regimental Update

Former Engineer Named DMOC:

On 12 February 1987, letters were sent to the 353 Active and Reserve Component (USAR and ARNG) commanders of engineer commands, brigades, groups, battalions, and separate companies requesting nominations for Distinguished Members of the Corps (DMOC). The letters, signed by the Chief of Engineers, LTG Elvin R. Heiberg, III, requested one officer (active or retired) and/or one enlisted (active or retired) from each of the above-mentioned units be nominated as DMOC of the Corps of Engineers. DMOC nominees must have served in the Corps.

DMOC activities, spelled out in AR 600-82, *The U.S. Army Regimental System*, are ceremonial in nature and are intended to promote and enhance the history and traditions of the Corps. Examples of DMOC activities include: participating in award ceremonies, speaking on history and traditions at dinings-in, and other similar functions.

On 10 March 1987, at Fort Belvoir, Virginia, on the occasion of his farewell address to Engineer Officer students and faculty, General (USA Retired) Bruce C. Clarke was designated as the Corps of Engineers' first Distinguished Member. The presentation was made by the Corps' Honorary Colonel, LTG (USA Retired) Frederick J. Clarke. Participating in the ceremony were MG Richard S. Kem, USAES Commandant, and the Corps' Honorary Sergeant Major, Sergeant Major of the Army (USA, Retired) Leon L. Van Autreve. General Clarke, who was commissioned a second lieutenant of engineers in 1925, was cited for his long and close relationship with the Engineer School, as well as his distinguished career as a soldier, leader, and a statesman.

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television stations and newspapers. In response, civilians have begun directing police to mines and booby traps.

Perhaps the best means of limiting guerrilla mine warfare is interdiction of component materials or finished mines before emplacement. Thus, gathering information on mines is part of the intelligence collection effort. Both battalion and brigade intelligence officers emphasize enemy mine capability as an essential element of information (EEI). Police and military patrols are alert for this information. Police watch local markets to detect purchases of raw materials that might be used to construct mines and booby traps. Informers are also useful—on one occasion, an informer uncovered a cache of more than six hundred mines.

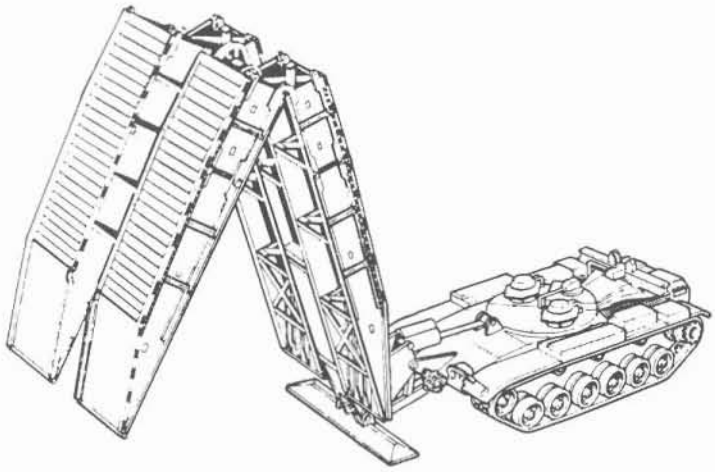
Results

The effectiveness of this countermine program is evident in the increased confidence and aggressiveness of units trained and equipped to fight the countermine battle. Test bed battalion soldiers now operate with little or no fear of enemy mines and booby traps. Casualties have fallen by nearly a third—only 5 injuries occurred in the last month of 1986. Moreover, the guerrillas seem to have lost prestige in the eyes of the civilian community.

The Salvadoran project has produced a wealth of information and technical data on countermine measures and equipment. The lessons learned in El Salvador can be applied in other areas of low intensity conflict. Both the host country and the United States are winners. The guerrillas are losing—losing prestige, losing ground, losing popular support.

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AVLBs/CEVs—Upgrading the Fleets

by MAJ William R. Fast

THE CHALLENGE

Both the M728 combat engineer vehicle (CEV) and the armored vehicle launched bridge (AVLB) have been fielded for more than 20 years, and will continue to support M60A3TTS tanks in reserve components well past their 30-year mark.

Yet these systems now strain to keep pace in maneuvers with the M1 Abrams tank and the Bradley fighting vehicle. They also have logistic problems. Fleets compete with newer equipment for maintenance support, and face directed reductions in PLL/ASL—parts, that is.

For 10 years AVLB/CEV readiness rates have often been below the M60-series tank. In today's Army of Excellence, this cannot continue.

TAKING ACTION

The Army intends to improve and maintain both systems until replacements are fielded. At the urging of the U.S. Army Engineer School, the AVLB and CEV are now readiness report pacing items in engineer companies. They are also targeted for an all-out readiness offensive in the Army Materiel Command.

Tank-Automotive Command (TACOM) and Armament, Munitions, and Chemical Command (AMCCOM) are fixing systemic wholesale level problems with the AVLB/CEV systems, while the Army Logistics Assistance Community helps engineer units solve immediate readiness problems. Their goal?—achieve and maintain the systems at 90 percent fully mission capable.

In 1984, the U.S. Army Materiel Command's Materiel Readiness Support Activity conducted a fielded system assessment of both the AVLB and CEV. Their findings, with ideas from a joint TACOM, Engineer School, and Ordnance School readiness working group, are the foundation of the readiness offensive. Several programs are now upgrading AVLB/CEV assets. They are—

Modification application plan (MAP)

By FY 1989, modification kits and application funds are expected to be available for applying compatible M48/M60-series tank improvements to AVLBs/CEVs. These modifications, shown in the table, enhance survivability, safe operability, and maintainability.

Overhaul program

Depot-level deficiencies qualify many AVLBs/CEVs for overhaul. TACOM's Combat Vehicle Evaluation Team identifies candidates in annual visits to each installation or major command. This year, TACOM programed ten AVLBs and twelve CEVs for overhaul in CONUS and USAREUR. To ensure responsive replacement, future overhaul schedules were designed to minimize overhaul turnaround time.

Request for assistance program

Some commands intensively manage equipment deadlined for over 30 days. TACOM's Director for Readiness validates and expedites repair parts to support this effort. Requests for assistance may be sent directly to Director of Readiness at TACOM by message, letter, or telephone. The supporting logistics assistance office will provide TACOM's response within 5 working days.

Other improvements

Improved training. Three military occupational specialties (MOS) are primarily responsible for operating and maintaining the systems. They

Product Improvements

Popular Name	Application on: AVLB	CEV
Clean Air	x	x
Armored Top Loading Air Cleaners	x	x
RISE Engine (IDS)*	x	x
Engine Smoke	x	x
Smoke Grenade Launcher Adapter Hardware	x	x
Driver's Night Viewer	x	x
Improved Vision Cupola	x	
Passive Night Vision		x
M240 Machine Gun (IDS)		x
Second Magnetic Brake (IDS)		x
AN/VSS-3A Searchlight		x
Automatic Fire Extinguisher System	x	x
Laser Protection	x	x
Secure Lighting (Unit)*	x	

*Improvements are applied by depot-level teams at installation or unit locations. Exceptions are unit-level maintenance *(Unit),* and *IDS* for intermediate direct support. TACOM depot maintenance division and installation modification work order coordinators cooperate to schedule modifications.

are MOS 12F, *Engineer Tracked Vehicle Crewman;* MOS 63Y, *Tracked Vehicle Mechanic;* and MOS 45N, M60A1/A3, *Turret Mechanic.* In addition to normal training patterns, improved instruction for these MOSs includes—

MOS 12F: The Engineer School offers a CEV skill performance aid for all crew positions. The Project Manager, Training Devices, will release CEV video disk gunnery simulators to the field in January 1988.

MOS 63Y: Beginning in FY 1988, mechanics will get 5 more weeks of training in basic automotive maintenance. This training should improve their ability to troubleshoot and diagnose problems.

MOS 45N: The Ordnance School is preparing an exportable training package for CEV turret repair.

Better technical manuals. All AVLB technical manuals have been revised to reflect product improvements through the MAP (see the table). Scissors bridge manuals will be revised in the near future. CEV maintenance manuals are now revised, and a total revision of CEV repair parts manuals has begun.

Improved bridge serviceability and repair. Until the scissors bridge technical manual is revised, a general repair procedure has been issued to field units. Depot-level repair procedures are being developed to return unserviceable panels and components to stock. The bridge will probably become reportable as a component of the AVLB under the next revision of AR 700-138, *Army Logistics Readiness and Sustainability.* This will give the bridge needed visibility at all levels of management.

Faster spares acquisition. Secondary spares for both the AVLB hydraulic launcher system and the scissors bridge were part of the Army's FY 1986 procurement of launcher mechanisms and bridges for the AVLB conversion program. This measure reduced costs and improved prospects for receiving quality items on time.

Uniform AVLB fleets. Many Active Army units have both M48A5 and M60A1 AVLBs on hand. Their suspension systems and automotive controls differ. To reduce logistical problems, AVLB fleets should be uniform at battalion level. Where possible, assets should be transferred to achieve uniformity. The TACOM AVLB Item Manager now coordinates issues of newly converted or overhauled AVLBs to avoid mixing the fleets.

Enhancing technical assistance. Selected TACOM logistics assistance representatives (LARs) in CONUS recently trained on AVLB/CEV operation and maintenance so they could better serve their units. In AMCCOM, they already monitor the status of M728 CEV turrets and provide unit-level assistance. Units should report any nonmission-capable supply parts requisitions to the supporting LAR. Maintenance assistance is only a phone call away.

COMMAND RESPONSIBILITY

Until now, we've focused on management efforts to improve AVLB/CEV readiness. There is, of course, another key player—the commander. Without command emphasis, efforts of AMC and TRADOC will be in vain.

Monthly reports by LARs show that readiness degradation is often caused by inadequate training and discipline. Here are the findings:

- Drivers and crews inadequately trained.

- AVLB/CEV operated with incomplete crew.
- Inadequate inspection of automotive systems.
- Improper use of diagnostic tools and gages.
- Poor troubleshooting, resulting in incorrect use of parts.
- Overworking vehicles, especially speeding or overusing CEV's blade.
- Infrequent operation and failure to exercise hydraulic systems regularly.
- Failure to perform organizational and support maintenance.

These deficiencies have been brought to the attention of the service schools. Still, increased emphasis on proper operation and maintenance procedures is needed at all levels.

THE FUTURE

Although new equipment is projected for the mid-1990s, the AVLB and CEV may have to fill the gap until the year 2000. Improvements in training, maintenance, supply, and command emphasis are keys to readiness. The 90-percent fully mission-capable goal can be met only if all concerned address their areas of responsibility. All engineer soldiers are challenged to do their part to keep the AVLB and CEV ready.

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Engineer Solution

1. Initial bridge length: Add the gap, safety setbacks, and roller clearances. Remember, since a panel is 10 feet long, the bridge must be built in 10-foot increments.

Gap		58 feet
Safety setbacks (prepared abutments)	Near side	3.5 feet
	Far side	3.5 feet
Initial roller clearance	Near side	2.5 feet
	Far side	2.5 feet

Initial bridge length

58 + 3.5 + 3.5 + 2.5 + 2.5 = 70 feet

2. Construction type:

Design load classification	60W/60T
Construction type	Double-single (DS)

3. Initial grillage type: Determine the actual soil bearing capacity (SBC). You may have to round down to a selected value. Note, always use grillage type 1 at a minimum.

	Actual SBC	Selected SBC	Grillage Type
Near side	5	3.5	1
Far side	5	3.5	1

4. Roller clearance: Determine the distance from the center of clearance of the rocking roller to the center of clearance of the base plate.

Near side	4.5 feet
Far side	4.5 feet

5. New bridge length: Remember, since a panel is 10 feet long, the bridge length must be rounded up to the nearest 10 feet.

58 + 3.5 + 3.5 + 4.5 + 4.5 = 74 feet or 80 feet

6. New truss type:

Triple-single (TS)

News & Notes

Composite bridge under development

The TROSCOM Fort Belvoir Research and Development Center has awarded a $6.1 million contract to Foster & Miller, Inc., of Waltham, MA, for the design, fabrication, and testing of a module, composite-material bridge which will be erected three times as fast, using far less manpower and equipment, as the dry gap bridge now used by the Army.

Composite materials are the new lightweight, high-strength materials of aramid fibers, carbon, and epoxy that have been used successfully in space and aircraft, as well as skis, tennis rackets, and the Army's new helmet.

In this design, composites will be used in the top and bottom chords, tensile tie rods, and traversing beam. A filament-wound, high-stability truss chord, made of high-modulus graphite fiber and epoxy resins, will form the main stress-carrying member and enable the bridge to support 70 tons over gaps 180 feet wide.

Use of these composites will result in a bridge 27 percent longer than the current standard medium girder bridge, but weighing 40 percent less. It will also cut necessary manpower from 33 to 6 and transportation needs from 14 trucks to 3 modified trucks.

The 60-foot modules of the future bridge will be carried and launched by trucks equipped with rollers and cranes. Each module will weigh 7½ tons and measure 20 feet by 7½ feet by 180 inches when folded for transport.

When they arrive at the site, the modules will be rotated 90 degrees and expanded. Because of their unique design, they will expand in two dimensions, providing bridge sections 60 feet long, 15 feet wide, and 80 inches deep. Joined by steel pins, the complete bridge will then be pushed across the traversing beam by a crane on one of the transports. Six men will complete the operation in 45 minutes, compared to the thirty men working 3 hours it now takes to erect the main girder bridge.

The contract calls for 240 feet of the experimental bridging to be delivered to the Center in 1989.

Solar energy technology counters battlefield detection

Troop Support Command's Research and Development Center, as part of its responsibility as the Army's leading laboratory for camouflage, has found a way to use solar energy technology to protect Army equipment from detection by thermal sensors.

Working in the Center's Counter-surveillance and Deception Division, Richard Bulova developed the idea of using black oxides of nickel or chrome, substances used in solar collection panels, to reduce the amount of heat emitted by the exhaust systems of Army vehicles.

"I started working on this about a year and a half ago while I was doing some infrared studies," Bulova recalled. "I noticed that the easiest thing to find on a vehicle was its exhaust system. Enemy sensors could pick it up and use it to target or identify the vehicle. Then, I came across an article about the composites used as solar energy collectors. They retained heat rather than radiating it into the atmosphere. I got the idea of using them to plate vehicle exhausts."

Bulova started the work with the composites as part of the Center's in-house laboratory independent research (ILIR) program. Last year, as the first step, the Center awarded a contract to plate the exhausts of six 2½-ton trucks with black nickel. The tests have shown measurable reduction in the amount of heat given off by the trucks, which has persisted for over a year. Bulova estimates that it may be possible to reduce a vehicle's detectability by 200 percent. Evaluation will continue with three additional trucks this year.

Vendors have estimated that significant protection against detection could be provided for as little as $30 per vehicle.

Bulova recommends that Tank Automotive Command begin a product improvement program to incorporate these coatings into their standards where possible. He also recommends that the Center evaluate equipment currently under development for possible applications of this treatment.

Career Notes

NCO and Enlisted Soldiers Branch

MOS 51C Eliminated

All personnel holding MOS 51C, Structures Specialist, were converted to 51B, Carpentry-Masonry Specialist, in October 1986. Letters explaining the Army's rationale for this change were mailed in December 1986 and January 1987. Commanders and personnel officers should also have received these letters. If you are affected by this change and have not received your letter or desire further information, contact Enlisted Branch, MILPERCEN, AV 221-8329, commercial (202) 325-8329.

Enlisted Branch Hotline

For enlisted engineer career advice, call the Enlisted Engineer Branch hotline—AV 221-7150, commerical (703) 325-7150. When you are asked for the number of the person you are calling, dial 325-7710. Following the instructions you recieve, leave your full name and social security number. Your career advisor will respond the next day during normal office hours.

Changes in PCS Policy

In October 1986, the Army announced changes to its policy on permanent change-of-station moves. The primary focus of these changes is the reduction of PCS moves from one CONUS installation to another. Although other policy changes will soon be announced, it is anticipated that most CONUS personnel requirements will be filled by soldiers returning from overseas. Increased time-on-station requirements will slow down PCS moves. Overseas commands still have priority, so CONUS-based personnel volunteering for overseas assignments are unaffected.

Upcoming issues of ENGINEER may have a new look, as we make format changes to comply with new DA and TRADOC guidelines for professional publications. Our mission—to inform U.S. Army Engineers of current developments and emerging doctrine—will not change. Forthcoming issues will address—

- ***General engineering support***
- ***Engineer support to facilities***
- ***Engineers in ARNG components***
- ***Low intensity conflict***
- ***Mine/countermine warfare***

We invite your contributions and your comments.

Soviet engineer support to river-crossing operations in the Great Patriotic War

by
Dr. Barry W. Fowle
Office of History, OCE

Much current Soviet combat engineering doctrine was forged in the crucible of the Great Patriotic War against Nazi Germany. As they defended their homeland, consolidated their forces, and drove home their offensive, the Soviets continuously revised doctrine and tactics.

The lessons of the war underpin Soviet doctrine today for good reason—they show a history of success. The Soviets answered the challenge of war flexibly and creatively even under difficult circumstances. They developed responsive, efficient organizational structures, and they added effective techniques to their repertoire as they fought. Just as the Russians continue to study the history of their achievements, we should attend to the lessons they value.

FIRST PERIOD
June 1941 to November 1942: Reorganizing

When the Germans invaded in 1941, the Soviet Army was ill-prepared to direct and conduct engineer combat operations in support of combined arms warfare. Nonengineer commanders often wasted engineer resources.

The Russians acted quickly to improve their situation, showing a capacity to respond flexibly under stress. Even as the Germans drove deep into their territory, they created an organizational structure that gave engineer officers more control over engineer forces.

The chief of Soviet Army engineer troops became a Deputy People's Commissar of Defense. Chiefs of engineer troops were appointed deputy commanders of fronts (Army groups), and staffs were set up for engineer troops in the fronts and subordinate armies. Once engineer officers took charge of engineer troops, they used resources skillfully and flexibly to support combined arms operations.

SECOND PERIOD
November 1942 to January 1944: Gaining Experience

After major successes at Stalingrad and Kursk, the Soviets pressed their strategic initiative across the many rivers that lay in the path of their drive toward Germany. Soviet Army engineers now acquired vast experience in assault crossings of major waterways.

Reconnaissance methods

As the army moved, principles for using and controlling engineer troops changed. Basic engineer resources were attached to combined arms formations and units, and a new engineer brigade organization improved command and control. The reorganized engineer staffs included reconnaissance specialists and an engineer plan for reconnoitering water obstacles.

Reconnaissance was a step-by-step operation. First, engineers studied maps, photos, and information from local residents, partisans, and prisoners. As troops approached a river, engineers determined its width, depth, current speed, and bottom conditions. They then chose crossing sites, gathered information on existing crossing structures, studied approach routes, and identified local crossing equipment and supplies of wood.

As Soviet engineers began to plan large-scale crossings, their reconnaissance expanded to take in entire operational areas. Each front collected information on rivers and passed it to subordinate units. Continuous movement through operational areas was now supported by comprehensive engineer plans that covered all rivers and major terrain features.

Crossing the Dnepr

The September 1943 crossing of the Dnepr proceeded with staged reconnaissance. First, the front's engineer troop staff compiled a file describing the river in the zones of the planned crossing. This file was issued to engineer troop staffs of the 6th and 12th Armies.

At this level, engineers reconnoitered both the river and the enemy. In the 6th Army zone, reconnaissance was made by subunits of the 62d Field Engineer and the 5th Ponton Bridge Brigades. Subunits of the 4th Ponton Bridge, the 11th Assault, and the 62d Field Engineer Brigades, and the 8th Ponton Bridge Regiment did the work for the 12th Army zone.

In the zone of the 7th Guards Army of the Steppe Front, engineers took an additional step. Because demolition of the Dnepropetrovsk hydropower plant had diverted the Dnepr's channel in 1941, aerial photography and air reconnaissance examined the channel's new course.

As a final preparatory step, engineers chose sites for three floating bridges and one low-water bridge. They also pinpointed enemy positions and established routes for moving troops to crossings.

Combat engineers served in the forefront of the Dnepr crossing. A squad of engineers opened minefields on the far side of the river with the support of submachine gunners

(continued on page 25)

