



By The ENFORCE XXI Task Force Team

Essayons! The word has never meant more than it does today. The U.S. Army engineer force is rapidly entering one of the most dynamic periods of its existence, in terms of doctrine, training, leader development, organization, materiel, and soldiers (DTLOMS). As the Army faces the challenges of a changing strategic and geopolitical environment, engineers will play an instrumental role in war and operations other than war (OOTW). Modernizing the engineer force by leveraging technology is the key to providing better support to the maneuver forces' control of battle space. This is essential under our national military strategy, which emphasizes winning decisively, swiftly, and with minimal expenditure of national resources. This is the new standard. We have demonstrated that we can fight at a level that quickly overwhelms our opponents.

Force XXI will be the world's preeminent joint land fighting force, and the way it fights will determine the nature of postindustrial warfare. Engineers will

be at the vanguard of this movement. The Force XXI concept, the Army of the 21st century, is defined by five characteristics:

- Doctrinal flexibility
- Strategic mobility
- Tailorability and modularity
- Joint and multinational connectivity
- Versatility to function in war and OOTW

The 1995 ENFORCE XXI conference at Fort Leonard Wood reinforces to our senior leaders that the engineer force has its azimuth set correctly and embodies these characteristics. ENFORCE XXI describes a vision showing how engineers will meet the challenges of the 21st century.

To ensure that engineers maintain an integral role in the combined arms Army of the future, the U.S. Army Engineer Center's vision remains focused on two areas—doctrine and modernization. To ensure victory over any land force, engineers must use modernization

overmatch to dominate maneuver, win the information war, and protect the force on a multidimensional battlefield. Force modernization initiatives now being fielded, and others on the near horizon, will ensure that engineer forces are key players.

In a radical departure from previous conferences, ENFORCE XXI features demonstrations and displays that allow senior leaders to witness the lethality, survivability, and functionality of our new equipment, using four operational environments:

- Early-entry/lodgment
- Heavy/light
- Own the water
- Mounted/battle command

Early-Entry/Lodgement Operations

The ability to rapidly mobilize, deploy anywhere in the world, and execute missions ranging from nation assistance to large-scale combat operations

means that our early-entry forces must be versatile as well as lethal and survivable. With the emphasis on versatility, any tailorable early-entry force will probably include engineers. In most OOTW missions, engineers will remain the units of choice. To continue to meet this demand, the supporting engineer force must expand its versatility, while growing lighter and reaching deeper, without sacrificing lethality and survivability. We must cultivate third-wave technology to achieve this end state.

ENFORCE XXI demonstrations show that engineers will remain vital to early-entry operations. The conference presents more than 20 new and developmental pieces of engineer equipment designed to improve and enhance reconnaissance operations, airfield seizure and cordonment (counter-mobility), airfield clearance (mobility), and the infrastructure enhancement (sustainment).

The engineer mission, reduced to its essential nature, remains one of terrain exploitation. Using and enhancing the terrain's advantages and disadvantages

defines the engineer's charge. Engineers transform terrain by making it mobile, protective, and liveable to friendly forces, while enhancing its lethality to the enemy. To do that requires information about the environment—engineer intelligence. Advancements in technology have greatly enhanced the engineer's ability to collect accurate, real-time terrain data and will potentially alter the engineer's role in combined arms reconnaissance.

During the early-entry demonstration, two remotely controlled vehicles with video cameras and digitized collection software transmit live footage and data back to planners. Additionally, two handheld systems—the terrain reconnaissance tool (TRT) and the Vector map—give engineers the ability to laser and digitally record significant terrain information with Global Positioning System (GPS) accuracy. This data-collection capability transforms intelligence gathering and enhances the engineer force as a combat multiplier.

Early-entry operations are often initiated with airborne operations. For clearing flight landing strips

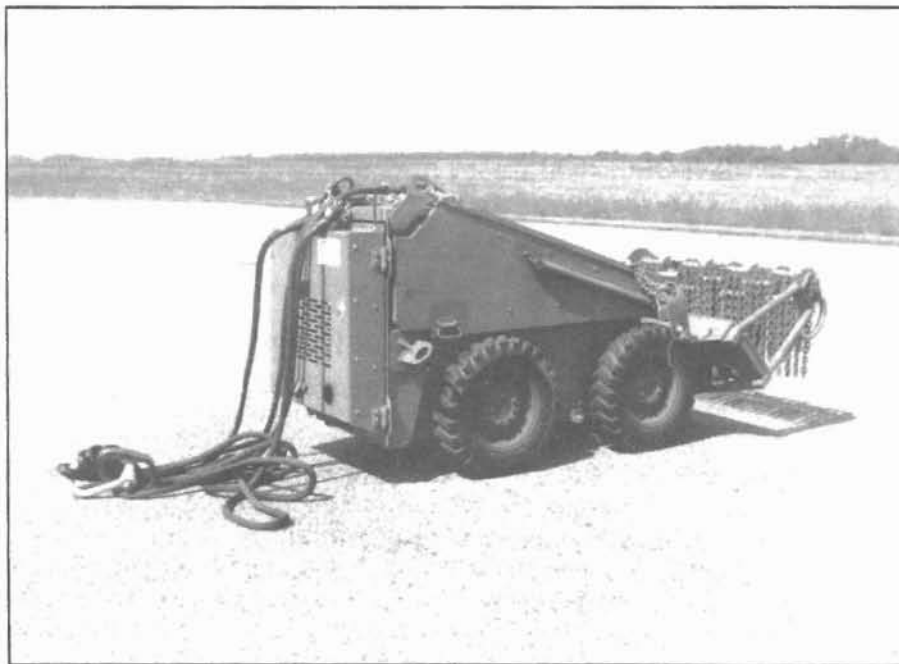
(FLS), engineers will have new equipment to find and remove mines or unexploded ordnance (UXO) and to repair any damage. New mine-detection equipment, such as the remote HMMWV and infrared camera (Infracam)/close-in, man-portable mine detector (CIMMD), allows engineers to locate mines and UXO faster, with fewer false detections and far less risk to soldiers. Operators will wear new countermine protective gear for additional survivability.

Instead of detonating UXO in-place, which would damage the FLS, robots will move the UXO to a disposal site. A remote excavator will move larger UXO, such as unexploded bombs, and a remote-controlled robot called the mini-flail will sweep mines off the FLS. Engineer paratroopers will have new earth-moving, transport, and compaction equipment to repair bomb craters and open the FLS to traffic.

Another phase of early-entry/lodgement operations is infrastructure enhancement. Within the last five years, engineers have repeatedly demonstrated their vital role in repairing and improving a nation's infrastructure. Sustainment engineering capabilities will improve with new construction equipment now being fielded: a GPS dozer, a laser-plane grader, an improved K-Span building, Unimat, an improved theater construction management system van, and improved soil binders.

Heavy/Light Operations

The heavy/light ENFORCE XXI demonstration showcases some warfighting systems and capabilities that engineers of the 21st century will have for military operations on urbanized terrain (MOUT). These systems will provide key enhancements to mounted and dismounted warfighting in terms of survivability, mobility, situational



A mini-flail rigged for helicopter flight testing.

awareness, battle command, and operational tempo.

Before an actual deployment, a task force staff can train inexpensively using realistic computer simulations. One such simulation is JANUS, an interactive, two-sided computer simulation that allows opposing forces to simultaneously execute their missions and respond with counter maneuvers. JANUS permits a task force commander and his staff to synchronize the battlefield operating systems and test the tactics, techniques, and procedures they would employ during a mission. The battlefield or area of operations is accurately depicted on the computer screen, including all terrain features, roads, and contour lines. A recent addition to the JANUS software accurately simulates built-up areas and urban fighting, which provides a commander and his staff alternatives to costly full-scale exercises.

The unmanned aerial vehicle (UAV) Pointer, a remote-controlled reconnaissance tool similar to a large model airplane, provides a video feed to a commander on the ground and lets him see an area he may soon encounter. This en-route intelligence provides real-time, crucial information about an objective or axis of advance without warning the enemy of an impending attack. The UAV Pointer and the Airborne Standoff Minefield Detection System (ASTAMIDS) can also identify actual minefield locations, enabling a commander to confirm or deny templated enemy positions and obstacle locations and to change his plan if necessary.

Once the support force obscures the enemy's air defense weapons, the preferred technique for entering a MOUT environment is a vertical insertion. Sappers and infantrymen rappel onto rooftops and, using demolitions to create openings, enter the buildings from above. Newly developed kevlar blanket placed over the charge enables soldiers



Photo courtesy HU Ford & Associates

UAV Pointer provides real-time video feed en route to the objective to confirm or deny enemy positions. It allows the commander to maneuver his forces as required.

to remain close to the charge and rush into the room below immediately after the explosion.

The Ferret, an unmanned MOUT mine-clearing/UXO-clearing vehicle, will eliminate risks associated with a detailed room-to-room clearing. It will decrease the need to send soldiers into unfamiliar buildings that may be booby-trapped. Once inside a building, the robot provides real-time video feeds to an operator positioned safely outside. The robot detects thermal signatures associated with the presence of mines or explosive charges and conducts reconnaissance for mines and booby traps, subsequently marking or neutralizing them. Personnel at Fort Leonard Wood have also successfully tested the Ferret in clearing an underground tunnel.

Engineers will have several new breaching aids to assist follow-on vehicles entering towns. The Anti-personnel Obstacle-Breaching System (APOBS), which is a man-portable line charge, and the

extended range grapnel (ERG) are two emerging technologies that will enhance the breaching fundamental of reduction. The previously mentioned mini-flail is a breaching asset that detonates or destroys all known antipersonnel mines, buried or surface-laid. It creates a lane quickly and improves engineer survivability on the battlefield.

The Panther, an obstacle breacher, and the Badger, a mine detector, are examples of robotics technology that the Engineer School's engineer vehicle teleoperation (EVT) program is developing. A major requirement of robotics technology is that it must not interfere with the host vehicle's normal, manned operation. A second requirement is that, when operated in the unmanned mode, the robotics technology must allow a remote operator to perform vehicle functions compatible with manned operation.

Designed specifically for an OOTW environment, the Panther

is a remote-controlled "battering ram" that effectively reduces road-blocks. This unmanned M-60 chassis with a rubble-clearing blade is an unobtrusive obstacle-breaching vehicle that the local populace will not view as threatening. In an armed conflict, however, the unmanned CEV can accomplish the same mission while also providing offensive capabilities.

Behind the front-line engineers will come the Badger, an unmanned, ground-vehicle, mine-detection system that operates on a 900-series, 5-ton chassis or on a HMMWV. It will detect mines and mark and proof lanes while carrying a mine-neutralization team. This recent generation of the Thermal Mine-Avoidance System (TMAS) was successfully tested in Operation Restore Hope and effectively detects buried mines along main supply routes. The system greatly enhances the speed, accuracy, and survivability with which sappers clear a route or proof a lane through a minefield. Stand-off mine-detection capabilities will bring engineer countermine operations into synch with the Age of Technology.

Sappers will soon travel in relative luxury in the mobile tactical light vehicle (MTLV), the "stretch" M113A3. It carries a complete squad with all its equipment, eliminating the need for a trailer. The armored vehicle-launched bridge (AVLB) super sport, an interim fix before fielding the heavy assault bridge (HAB), provides engineers a mobility asset that keeps pace with Force XXI units.

The explosive formed penetrator (EFP), which is a disc-shaped, tripod-mounted, projectile explosive charge that penetrates reinforced concrete, is an ideal weapon for destroying bridge piers and abutments. The shoulder-fired bunker defeat munition (BDM) can blow an initial hole in reinforced concrete for entering buildings. It can also blow adjacent walls to create covered mobility

routes through built-up areas for dismounted soldiers.

The newest mine in the Army's arsenal is the selectable, lightweight attack munition (SLAM). It is a hand-emplaced, antimateriel, antivehicle munition that is compact, effective, and readily usable by strategic offensive forces and sappers. SLAM's EFP warhead, which can penetrate 40 millimeters of homogeneous steel, has four methods of detonation: pressure, tension-release, command, or time delay.

Recent experiences in Kafji and Kuwait City indicate that the CEV is still the vehicle of choice for engineers in a MOUT environment. A survivable breaching asset, the CEV effectively reduces barrier obstacles, fortifications, and strongpoints. With changes to existing hydraulics and electrical systems improving its performance tremendously, the CEV will continue to be an effective combat multiplier into the 21st century.

Own-the-Water Operations

Technological developments will significantly impact our approach to river-crossing operations in the next century. As the Army's mobility experts, engineers must quickly negotiate water obstacles and cross a maneuver force. Modern technology will increase the likelihood of success during all phases of a river-crossing operation.

The Army's ability to exploit enhanced night-vision technology is critical to successful river-crossing operations. Modern technological advances being exploited at the Dismounted Battlespace Battle Laboratory and the Night Vision Laboratory are bringing several night-vision devices to Army units. High-intensity, infrared light-emitting devices, such as Black Lights and Phoenix infrared markers, will greatly assist

engineers and crossing forces on both near and far shores. These devices can either provide infrared illumination in such areas as engineer regulating points or be employed as markers to facilitate command and control at crossing sites.

Advances in night-vision technology are included in the equipment of the 21st century "land warrior." Its thermal capability gives soldiers the ability to see and engage targets out to the maximum effective range of their weapons system. Additionally, aerial vehicles equipped with an infrared standoff mine-detection capability will significantly increase our ability to detect threat minefields along water obstacles before troops cross them.

Advanced technology is also improving engineer reconnaissance efforts and river-crossing planning. Nonstandard terrain-visualization products, such as satellite multispectral imagery, will help engineers with intelligence preparation of the battlefield (IPB)/engineer battlefield assessment (EBA) products and the final crossing overlay. The Integrated Meteorological System (IMETS) further enhances the planning process by analyzing the effects of weather conditions. The engineer light diving team (ELDT), assigned at the corps level, will be task organized to the crossing support forces. The team will provide detailed reconnaissance information about river and bank conditions at potential crossing sites, as well as information about obstacles and threat forces along the exit bank. The UAV Pointer, mounted with either a daylight or a night-vision camera, facilitates 24-hour real-time intelligence collection. This timely intelligence allows the maneuver commander to verify the threat situation and establish force-oriented objectives within the bridgehead.

During the advance-to-the-river phase of a river-crossing operation, the ELDT will mark the far shore



A HEMTT-based improved common bridge transporter from a corps multirole bridge company recovers a ribbon bridge bay.

using infrared markers and destroy underwater obstacles using demolitions primed with the modernized demolitions initiator (MDI). The ELDT will maintain constant communications with the crossing-force engineer using a dual underwater-land communications system.

The assaulting forces will cross the river using advanced systems. The first wave will use jet skis, which are fast and highly maneuverable, to provide immediate local security and suppress enemy small-arms fire before the remaining assault forces cross the river. The second assault wave will cross in Zodiac assault boats powered by the Improved Marine Amphibious Reconnaissance System (IMARS). To protect the assault force, the Advanced Precision Aerial Delivery System (APADS), a steerable parachute system controlled either remotely or with preprogrammed flight paths in its integral GPS, can deploy wide-area mines (WAM) to prevent threat

direct-fire systems from repositioning along the far shore.

After securing the exit bank objectives, rafting will begin with the HEMTT-based improved common bridge transporter (ICBT) launching ribbon bays into the water. The ICBT employs the Palletized Loading System (PLS), which can carry either cargo or a ribbon bay. To speed up preparation of the exit bank, one of the first vehicles across will be the Deuce, a rubber-tracked dozer. It gives crossing force engineers a mobile and effective earth-moving asset that has more speed and flexibility than steel-tracked dozer equipment. Both the ICBT and the Deuce are integral to the engineer multirole bridge company (MRBC), which is organized to provide crossing support to Force XXI.

Mounted/Battle Command Operations

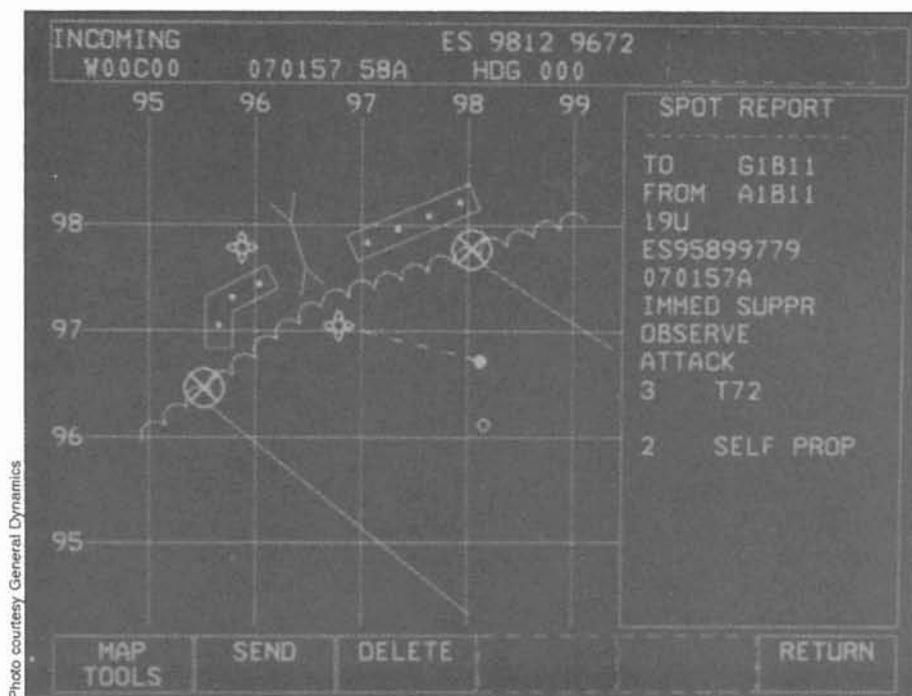
The ENFORCE XXI Battle Command demonstration highlights the combined arms

digital battlefield and its impact on engineer operations. The battlefields of the 21st century will be characterized by real-time data, improved command and control, and the enhanced lethality, tempo, and survivability of the mounted combined arms force.

A digitized combined arms force will plan, prepare, and execute combat operations by employing third-wave technology and newly developed battlefield systems. Emerging technologies will improve lethality, survivability, and tempo in five key areas:

- Better, faster access to intelligence data
- Improved situational awareness/combat identification
- Enhanced battle command
- Improved synchronization of direct and indirect fires
- Improved force protection

For example, the Intervehicular Information System (IVIS) is a



An IVIS display screen

digital system that assists commanders in making timely and appropriate decisions. IVIS may become the chosen digital system used in all types of combat, combat support, and combat service support vehicles. Commanders can use this tool to better visualize the battlefield and execute a synchronized plan. With the IVIS screen, a commander can track the positioning of his forces in relation to the terrain and the enemy and can maneuver to mass and fight at the decisive place and time.

IVIS will also improve the engineers' ability to conduct combined arms breaching operations. At the National Training Center, friendly forces frequently struggle to achieve a synchronized breaching operation, which is a tenet of breaching that must be met to be successful. IVIS will assist key elements in a brigade or task force as they maneuver and apply their battlefield function at the critical time. IVIS will assist the commander and other key players in executing a synchronized breach plan. Situation awareness is critical to developing synergy on

the battlefield. IVIS can help create conditions that will allow a brigade's total combat power to mass at the breach and the point of penetration.

Timely and accurate information is power. Future commanders must assimilate battlefield information and make tactical decisions using advanced technology. Engineer commanders in mounted warfare must understand digitization and how to integrate and synchronize engineer operations on a digital battlefield.

Looking Ahead

ENFORCE XXI provides a new concept and a new design for the engineer force to help it meet the needs of a volatile and ever-changing world. The concept is centered around quality soldiers and leaders whose full potential is more closely realized through information-age technologies and rigorous and relevant training and leader development. These technological advances demand a 21st century soldier equal to the sophisticated systems of the future.

Soldiers will remain the most important element of the force, for it is through quality soldiers that the full power of technology will be realized.

The engineers of the 21st century will be prepared to face the full spectrum of operational environments. They will design organizations and develop capabilities to allow the force to rapidly tailor and expand, strategically deploy, and effectively employ as part of a combined arms, joint and multinational team that achieves decisive results in future wars and OOTW.

The bottom line is that engineers will lead the way in equipment modernization needed to survive on increasingly lethal and fluid battlefields. Our smaller, more lethal, and more flexible force will ensure that its training contributes to the wide variety of missions in which it might be employed. The total engineer force must remain doctrinally sound and materially ready. Engineer challenges of the future are to continue to know the doctrine, make terrain an asset and a weapon, embrace and exploit new technology, and remain an integral part of the combined arms team. 

The ENFORCE XXI Task Force Team are all members of the Directorate of Training within the U.S. Army Engineer School. This combined arms team is comprised of:

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