ARMY MATERIEL

Paving the Way to the Army's Future

Story by Heike Hasenauer

"If a soldier shoots it, drives it, flies it, wears it or eats it, the U.S. Army Materiel Command provides it."

COMMAND

Officials at the Army's largest command — the one responsible for providing virtually everything soldiers need to survive in battle and contingency operations around the world — have long claimed that "if a soldier shoots it, drives it, flies it, wears it or eats it, the U.S. Army Materiel Command provides it."

The organization encompasses eight major subordinate commands and includes research, development and engineering centers; the Army Research Laboratory; and depots, arsenals and ammunition plants dispersed over some 150 locations in 40 states and 38 countries, said spokeswoman Tansill Johnson.

AMC not only maintains prepositioned stocks ashore and afloat around the world, it is also the Defense Department's executive agent for all conventional ammunition; for nuclear, biological and chemical defense; and for the armed services' petroleum pipelines.

Developing, buying and maintaining everything in the Army's inventory, from a soldier's BDU uniform and boots to tanks, missiles and aircraft, is what AMC is all about.

"We're involved in everything the Army does, every day," said AMC commander GEN Paul J. Kern.

In a recent interview, Kern spoke about the impact of Sept. 11 on AMC, the Army's materiel requirements and the command's major technology and development thrusts for a transforming Army.

AMC's Immediate Reaction

Just as the events of Sept. 11 "galvanized the nation into action against terrorist threats, they did the same thing to the Army Materiel Command," Kern said.

AMC immediately responded to the attacks by "preparing for the readiness of the rest of the Army," he added. "That required all of our subordinate commands to increase their output — everything from small-arms ammunition to detection gear for biological-chemical agents and the kinds of things that might be consumed in an atypical kind of deployment."

The U.S. Army Tank-automotive and Armaments Command focused on automotive and armor components, Kern said. "Our Aviation and Missile Command focused on support to the aviation community and our air defense system. And our Communications-Electronics Command worked on communications gear."

When the Pentagon had to be rebuilt, CECOM supported the program executive officers to rebuild the vital communications infrastructure that had been destroyed, he said. CECOM also sent equipment to the World Trade Center to help search-and-rescue teams find survivors by locating their cellular phone signals. And the agency also provided radar-scanning equipment, which gave precise locations of buildings that were still moving as a result of the explosions.

Supporting the War in Afghanistan

"As we took offensive action in Afghanistan, we sent logistics support elements overseas, which included both military and Department of the Army civilians and contractors," Kern said. They were spread throughout many countries in Central Asia, providing technical support and day-to-day living support for the soldiers

SGT Michelle Labriel

The AH-64 Apache attack helicopter *(above)* and the vehicles represented in a convoy in Kosovo *(right)* are among the many types of equipment AMC provides.

AMC's Lake City Army Ammunition Plant makes small-arms ammunition for use by all of the nation's armed services.

who were deploying there. "And we were vitally involved in delivering Force Provider-type quarters to Afghanistan."

AMC also prepared pipelines and shipped them to Afghanistan, "so we'd be prepared if we had to move fuel around to different locations," Kern said. "Additionally, we reworked our prepositioned equipment to improve readiness. All the prepositioned sets of equipment, either in warehouses or afloat, are under our Operations Support Command at Rock Island, Ill."

As U.S. forces started consuming ammunition, AMC ramped up shipments from its ammunition-production plants. To date, AMC's Operations Support Command has shipped more than 18,700 tons of ammunition in support of Operation Enduring Freedom, Kern added. At the same time, McAlester Army Ammunition Plant, Okla., received additional orders from

To date, AMC's Operations Support Command has shipped more than 18,700 tons of ammunition in support of Operation Enduring Freedom.

Rebuilding and upgrading the Army's legacy systems — such as these M1 Abrams tanks being modernized at Anniston Army Depot, Ala. — ensures the Army's readiness as it transitions to the objective force.

AMC's Rock Island Arsenal in Illinois has a state-of-the-art foundry that can cast the complex metal parts used in many Army systems.

the Air Force and Navy for high-explosive bombs, representing a 50-percent increase in production.

Chemical-Biological Response

When anthrax was detected in federal office buildings in the nation's capital and at postal facilities, AMC representatives were very much involved in the detection and cleanup work, Kern said.

"I can't think of a single part of the Army Materiel Command that wasn't directly involved or impacted by 9-11," he said. "I could add to our involvement all the force-protection issues we had to handle within AMC, particularly in our chemical storage sites, which are very sensitive areas."

Research on Target

"Our research efforts, which in September 2001 were very much central to the transformation of the Army, received much more scrutiny as a result of Sept. 11 and were determined to be right on the mark with what we should be doing," Kern said.

University research, conducted in partnership with AMC, was focused on many areas, such as nanotechnologies, Kern said. The Army Research Office at Research Triangle Park, N.C., selected the Massachusetts Institute of Technology as a nano-researcher, with research directed specifically toward soldier-survivability related products.

Ongoing research also "fit into the chemical-biological protection of our individual soldiers," Kern said. Additionally, AMCOM, at Redstone Arsenal, Ala., had been working on the technologies that allow Hellfire missiles to be launched from Predator unmanned aerial vehicles, a tactic used in the war against terrorism in Afghanistan.

"Everyone agreed the work we were doing was focused on the right areas," Kern said. After Sept. 11, AMC's technology research and development efforts became more visibly important, especially those that will contribute toward products in the following areas:

Chemical-biological detection devices.

"We've been doing a lot of research in that area to downsize and improve early detection equipment," Kern said. Much of the early detection equipment parked around the Pentagon today was built in Edgewood, Md., by the Soldier Biological Chemical Command to support early detection of chemical-

SGT Tom Bradbury

The Stryker infantry carrier — such as this one rolling off a C-130 during an exercise at the National Training Center — is another AMC success story.

These experimental unmanned vehicles have undergone demonstration trials managed by the ARL as part of DOD's Joint Robotics Program.

biological hazards.

More reliable, deployable and agile ground capabilities. "We need them, whether in a smaller tracked or wheeled vehicle than the Army's current 70-ton platforms, or a pervasive communications network," Kern said. The latter, known as C4ISR, will give soldiers a situational understanding of the battlefield and allow them to operate in diverse places.

Working to Reduce "Fratricide"

"The research work we do in providing better situational awareness for our soldiers is part of the process to reduce 'fratricide,'" Kern said.

It's a combination of research that provides awareness information and interrogation devices that provide a signal and a response between "friendly" and "unfriendly" forces, Kern said, "much as aircraft transponders have done for years."

Meantime, to help prevent "fratricide," the Army uses improved optics and night-vision devices that are high fidelity, allowing soldiers to more easily recognize what they're looking at under all conditions, he said.

Developing Technologies

"I'm very excited about the kinds of things I see coming," Kern added. "We really have skipped a generation of equipment fielding. So our soldiers today are fighting with equipment that is good, but relatively old. And the changes that will take place are going to be very significant as we move forward."

About the recent cancellation of the Army's Crusader heavy artillery program, Kern said: "The argument people are making now is that tube artillery is something of the past. Many in the Army don't believe that. But a lot of the capability that we have in artillery today will be moving to the shorter-range mortars, and more missiles.

"I think we'll see those in larger quantities. At the same time, we'll try to find a way to capture the technology of Crusader in something that's more mobile and lighter weight, and which will fit into the future combat-system class of vehicles," he said.

Kern cited some of the following as near-term, major technology changes for the Army:

Computing.

"It will be pervasive on the battlefield, in ways that we don't even conceive of today," Kern said. "There will not just be a desktop or laptop computer, but almost every device will have a processor attached to it to help the user understand the environment. Consequently, equipment will work more efficiently."

Soldier protection.

"We're going to be improving the protection of our soldiers, not by adding hundreds of millimeters of rolled homogeneous armor," Kern

In this artist's depiction, unmanned vehicles, similar to those under development, support soldiers engaged in clearing an urban area.

Among the Army Research Laboratory's areas of expertise is lighter-weight personnel protective armor intended to defeat emerging ballistic threats.

said, "but by looking at new molecular structures that are much stronger and much lighter. Those include ceramics and composites, and replicating the spider silk capability."

The latter would give the Defense Department a material much stronger than steel and very lightweight, which could be spun into fiber or woven into armor plate, Kern said.

Improved power generation.
"We'll be looking at power generation from a lot of different aspects," he said, "because electrical-power consumption is one of the greatest areas of growth on the battlefield.

"When I joined the Army we had a flashlight and a radio. Today, soldiers have lasers, night-vision equipment, multiple communications devices and computing devices, all of which consume electrical power," Kern said.

"We're looking at fuel cells, microturbines, high-efficiency batteries and lithium-ion batteries," he continued. "We're looking at electronic suspensions on our vehicles that could give us tremendous increases in cross-country speed on large vehicles. We're looking at hybrid-electric vehicles and transitioning combinations of these different power sources to much more fuel-efficient ways of generating both automotive power and electrical power on the battlefield."

Robotics.
"Robots will have great import on the future battlefield," Kern said. "The science today is maturing from small-scale robots that can go through urban terrain, buildings and tunnels, to large-scale robots that can carry sensors and weapons." Initially, they might follow other vehicles around, but ultimately they could lead systems autonomously, he said.

Objective Force Warrior is a science-and-technology initiative intended to make future soldiers more effective while ensuring their survival on increasingly lethal battlefields.
Sarah Underhill

Electro-thermal-chemical weapons.
Future weapons may also benefit from electrical power, Kern said. "We'll see these type of weapons mature to give the same lethality to a 105-caliber munition as a 120mm.

Penetrators and specialized warheads and missiles.
"We're looking at various novel penetrators and warheads — and missiles that may be carried for vertical launch and act more like artillery pieces. We're also looking at a commonality of missiles, so that components can be put together to provide both aviation platforms and ground platforms, thereby reducing production, maintenance and spare-parts costs," Kern said.

Unmanned systems.
What Kerns calls "a whole new research area," would provide both ground and air platforms to complement those we're fielding today with the tactical unmanned aerial vehicle and Hunter UAV. They'll include very small individual systems to very large ones, he said.

Sensor-to-shooter capability.
"The Comanche helicopter, which has been in development, will bring a new sensor-to-shooter capability when it

"There's almost no end to the list of developing ideas and technologies, and the ability to make soldiers more lethal and survivable fighters," Kern said.

goes into production," Kern said. It would bring ground- and vertically launched missiles together with sensors, night-vision precision and radar from ground and air platforms, to locate and fight with fires from other services as well as with fires from other Army platforms. The high-tech equipment could be incorporated into a Navy platform at sea or an Air Force platform high above the Earth.

The RAH-66 Comanche — the Army's next-generation reconnaissance/attack helicopter — is now undergoing extensive testing and is scheduled to be fielded in 2009.

Mobile networking.
"The Army's ability to provide mobile networking capability will be sought after by everyone once they realize the breakthroughs we've made in mobile networks," Kern said. "Everybody's used to cellular phones that require communications towers. We've built systems that are independent of those towers."

Nanotechnology.
The technology means "doing things at the atomic level," Kern said.

It could be applied to micro-machinery in which a mechanical machine's components, gears and levers, for example, are manufactured on the atomic scale, via printed circuits rather than by big machines.

"That's one level of nano-technology," Kern said. "The other is the microbiological level, where we can actually 'grow' machinery.

"You get into a whole other set of nanotechnologies with nanotubes, which are very tiny tubular devices, which you can grow," Kern said. Nanotubes are built around atomic, molecular structures, as opposed to big, bulky things that you can see.

"They have the same strength and elasticity as many of our steel and composite structures today," Kern said. "But when you produce devices using nanotubes you can reduce hundreds of pounds to 20 or 30. Bullet-proofing and environmental conditioning can be woven, literally, into the fabric of the clothes you're wearing."

The technology could also allow commanders to monitor their soldier's physiology, so they'll know when someone's falling asleep or whether an injury is lethal or minor.

Handling and packaging equipment.
AMC is looking at ways to reduce the logistical footprint by reducing the number of people needed to move things from ship to air or air to ground, Kern said.

"There's almost no end to the list of developing ideas and technologies, and the ability to make soldiers more lethal and survivable fighters," Kern said. The Army's future, largely with AMC's support, promises to see the evolution of Land Warrior and Objective Force Warrior, vehicles that may be autonomous robots, and 10- or 20-ton wheeled or tracked vehicles that have the same protection as a 70-ton M1A1 Abrams tank.

"The individual soldier will probably see the most remarkable changes," said Kern, "as we provide higher protection, more capable individual equipment — from rifles to night-vision gear, to survivability helmets and protective vests, which are capable of stopping bullets, not just shrapnel. At the same time, environmental protection will allow us to operate in high-threat chemical and biological environments, regardless of heat, cold or dust conditions."

Army Transformation

Army Transformation is on target, Kern said. The events of Sept. 11 heightened everybody's sense of urgency, so the work has been progressing well, despite the interruptions of the terrorist activities.

"The lead system integrator for Army Future Combat Systems, working with our laboratories and the Defense Advanced Research Projects Agency, has amassed a tremendous number of technical options, which will be reviewed this fall by the Army and presented to the secretary of defense for a decision next spring," Kern said.

He said choosing which technologies to develop and field will be the biggest challenge, because there are so many ways to package capabilities for the greatest effect.

"We've been blessed over the years with very high quality, dedicated civilians in the Army Materiel Command who have provided the tools that contributed toward ending the Cold War and putting down Saddam Hussein," Kern said. "We have the same opportunities now to use ever-advancing technology against the Taliban and al Qaeda in the war on terrorism." □

The AMC Team

THE U.S. Army Materiel Command's list of technological pursuits and developments is far too extensive to adequately cover here, so Soldiers selected portions of technology research areas submitted to us by several of AMC's major subordinate commands and research-and-development centers to provide snapshots of some of their current activities.

Natick Soldier Center

Objective Force Warrior

CHAMELEON-like BDUs; medical body sensors; see-through, heads-up displays; and lightweight weapons with advanced fire control. They're all on the NSC's list of things to do in cooperation with other Army agencies.

The Objective Force Warrior Advanced Technology Demonstration, scheduled for fielding as Land Warrior Block III in 2010, is a lightweight, fully integrated combat system for individual soldiers. It will incorporate numerous equipment improvements, from protective gear and small arms to networked communications and intelligence-gathering equipment.

OFW will build on current capabilities and new technologies to upgrade the Land Warrior version 1.0, slated for fielding in 2004.

OFW will include a single combat uniform system that protects soldiers from chemical and biological agents, ballistic threats and wet weather. It will cool soldiers in the summer and warm them in the winter, with a microclimate cooling system built into the fabric. And enhanced camouflage, which changes with the environment, will reduce a soldier's chances of being spotted by the enemy.

Additionally, OFW could include body sensors that would not only keep track of the individual's physical status, such as heart rate and body temperature, but permit medics to provide preventive care and perform "remote" triage on the battlefield.

Soldiers will also wear a helmet with a see-through, heads-up display that could show video and thermal imaging and integrated sensory enhancements, networked with information from manned and unmanned ground and aerial vehicles for collaborative situational understanding.

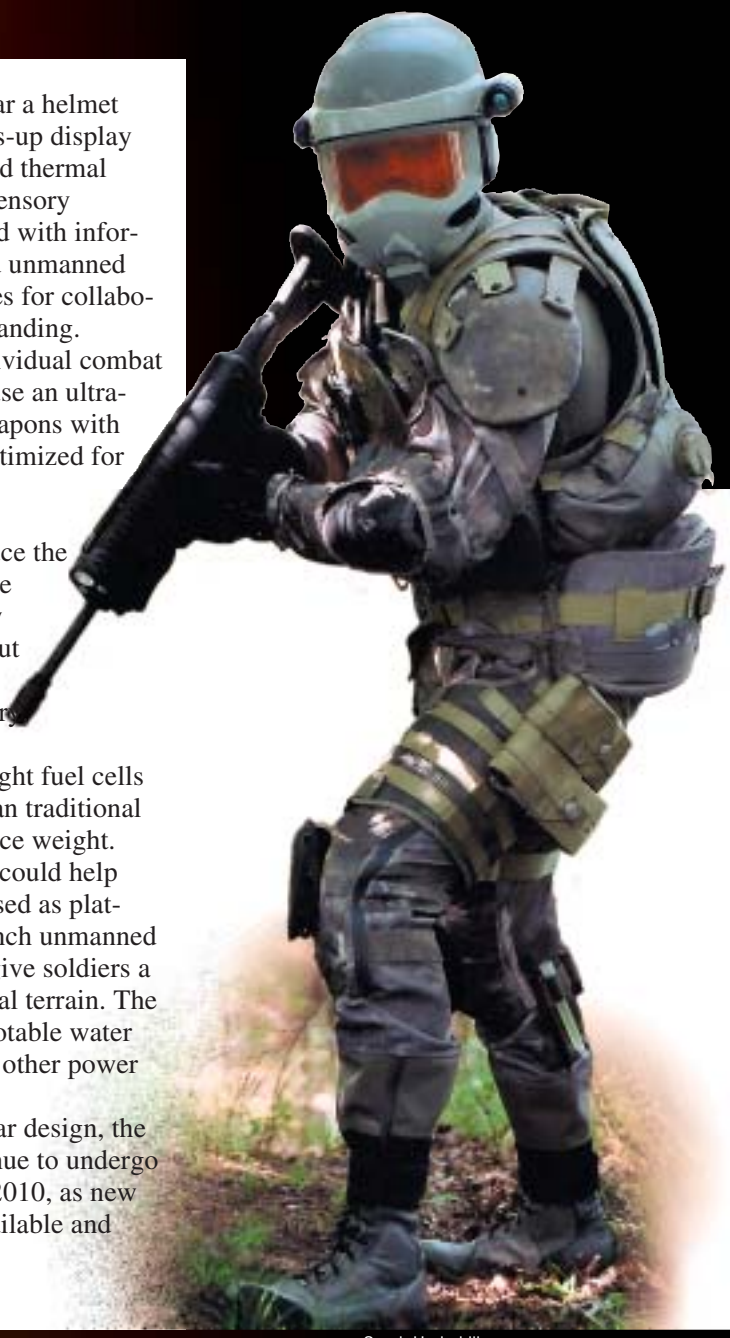
For the utmost in individual combat strength, soldiers could use an ultra-lightweight family of weapons with advanced fire control, optimized for urban combat.

The OFW program is focusing on ways to reduce the weight soldiers carry. The initial weight for the new OFW system will be about 50 pounds, about half of what today's soldiers carry.

Alternative power sources, such as lightweight fuel cells that are longer lasting than traditional batteries, could also reduce weight.

And robotic "mules" could help carry equipment, or be used as platforms from which to launch unmanned aerial vehicles that will give soldiers a birds-eye view of the local terrain. The mule could also purify potable water and recharge batteries or other power sources.

Because of its modular design, the OFW concept will continue to undergo major upgrades beyond 2010, as new technologies become available and practical. □



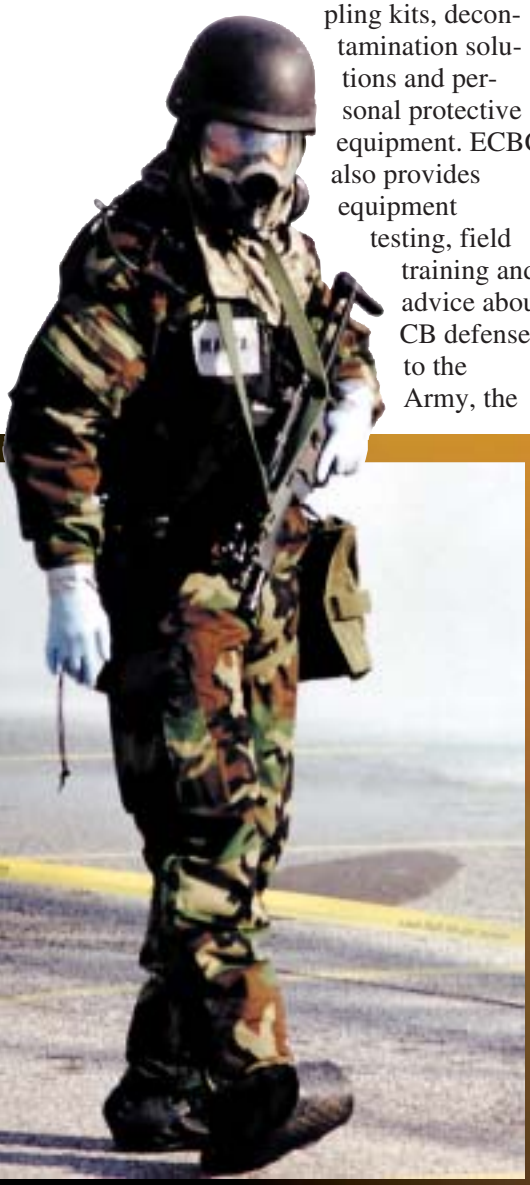
Sarah Underhill

Edgewood Chemical Biological Center

Chemical-Biological Defense

THE words "homeland defense" entered widespread use after Sept. 11, but the Edgewood Chemical Biological Center at Aberdeen Proving Ground, Md., has been readying U.S. service members for incidents involving weapons of mass destruction since 1917.

The center develops chemical and biological agent detectors and sampling kits, decontamination solutions and personal protective equipment. ECBC also provides equipment testing, field training and advice about CB defense to the Army, the private sector, and government agencies.



AMC's ECBC is working to improve chemical-biological protective equipment by testing the effectiveness of masks, respirators and other protective clothing.

Long focused on research and development to provide protection against chemical agents, ECBC is working to enhance its ability to provide protection against biological-warfare threats.

In the mid 1990s the Army designed, built and fielded the military's first biological-weapon detection system — the Biological Integrated Detection System — to monitor, sample, detect and identify biological-warfare agents. BIDS consists of a vehicle-mounted shelter equipped with a biological detection "suite." The latter contains technologies to detect large areas that have been contaminated.

The Humvee-mounted Biological Integrated Detection System can confirm a biological attack, identify the agent used and capture a sample for later analysis.

Today, the Joint Biological Point Detection System, ECBC's third generation biological detection system, is used by all U.S. military forces. In the wake of the Sept. 11 attacks, the center is using the system to protect high-priority U.S. defense sites.

Other Army Materiel Command elements are also working on biological-agent detection and protection. The Army Research Laboratory, working with AMC's Soldier and Biological Chemical Command, among others, has developed a highly sensitive hand-held device to detect the "top ten" biological-agent threats to soldiers.

Thanks to nanotechnology, which can put molecules together one by one, the "ticket," as it's called, is easy to use, requires no power and gives far fewer false positives than other devices. Most importantly, it provides almost immediate feedback, even when concentrations are very low. At a 2001 field trial it beat out all other hand-held devices in detecting anthrax and ricin toxin.

The Natick Soldier Center is also researching and testing the next generation of lightweight material for use in CB protective clothing. In particular, the center is working on selectively permeable membrane technology, a lightweight, flexible polymer material that protects against highly toxic compounds, including CB agents, by blocking the agent instead of absorbing it.

The material would also make protective over-garments much lighter,

and allow moisture vapor from sweat to escape and cool the body.

Through its National Protection Center, the NSC is also looking at leveraging this technology for use by first responders.

The ECBC is also a leader in developing decontamination solutions, particularly those that are environmentally safe and affordable. ECBC has patented the Edgewood Enzymatic Decon System, whereby neutralizing enzymes can be added to water, or any water-based application system in which CB agents may have been released, to quickly neutralize agents, including nerve gas and pesticides.

ECBC also provides vital training in the field to soldiers and civilian organizations on weapons of mass destruction. In 1996 ECBC added protecting the homeland to its mission and, since then, has trained more than 28,000 first responders in 105 communities across the country as part of Congress' Domestic Preparedness Program. □

The selectively permeable membrane used in this protective uniform blocks chemical and biological agents.

ARL is developing such diverse systems as an electromagnetic gun prototype *(above)* and components for microturbines *(below)*.

Army Research Laboratory

ENGINEERS and scientists at ARL, headquartered in Adelphi, Md., provide the research needed to develop technologies that will allow soldiers to dominate land warfare. At the same time, they improve the equipment soldiers use today.

Microturbines

The technology areas in which they're working include microturbine engines to replace batteries. The same technology that's used to make computer chips is used to fabricate microturbines roughly the size of a sugar cube. The Massachusetts Institute of Technology is working with ARL, through the Army Research Office in North Carolina, to develop the power source that could potentially provide five to 10 times more energy than batteries operating the same piece of equipment could supply — with increased life and less weight.

Ballistic Protection, Electromagnetic Gun and Robots

ARL is also developing ballistic-protection technologies for Soldier and Biological Chemical Command systems. The lab's efforts are aimed at producing prototype personnel armor systems that can defeat emerging ballistic threats.

Other areas of ARL research are geared toward development of an electromagnetic gun that could be integrated with electric-vehicle propulsion and armor systems to provide an efficient, highly mobile and deployable ground maneuver force, and unmanned ground vehicles — robots — to perform high-risk missions.

The robots will also expand a unit's capabilities by increasing situational awareness, providing remote fires on demand and reducing the logistics burden by reducing the number of combat vehicles needed on the battlefield. □

AMCOM's refinements of the Multiple Launch Rocket System have extended the range, precision and lethality of the already highly effective weapon.

U.S. Army Aviation and Missile Command

Bunker Buster

TO give soldiers who are deployed with the Stryker brigade combat teams maximum firepower while the mobile gun variant of the interim armored vehicle is being fielded, the U.S. Army Aviation and Missile Command's Research, Development and Engineering Center, or AMRDEC, in Huntsville, Ala., teamed with the Close Combat Missile Systems Program Office to produce the TOW Bunker Buster system.

Based on the proven TOW-2A, it pairs a high-explosive warhead with a fuze delay assembly to ensure that the warhead penetrates the target before detonating.

Guided MLRS

One of the stars of Operation Desert Storm was a relatively low-cost, unguided rocket system. The Multiple-Launch Rocket System can fire 12 rockets, each carrying 644 bomblets. The MLRS was so effective, and elicited such fear from Iraqi soldiers, that they dubbed it "steel rain." Even so, the U.S. feared it could be overmatched by the longer-range Iraqi artillery systems, bringing a Congressional mandate for an extended-range MLRS.

The MLRS Project Office developed a longer-range version, trading payload for increased propellant. But, extending the range of the MLRS also meant that the bomblets dispersed over a greater area, increasing the chances for collateral damage. The only way to increase the precision of the rockets was to incorporate a guidance system. And the big problem was how to add guidance without increasing the cost to the point that the economical MLRS became just as expensive as precision-guided missiles.

An AMRDEC engineer determined that a new inertial-measurement unit, coupled with small stabilizers and a global-positioning system, would allow the GMLRS to fly twice as far as the previous version and hit a target within two meters.

Battlefield Highly Immersive Environment

The ultimate test of a new weapon system is how it performs in the hands of the soldier. Unfortunately, such testing often comes too late to

AMCOM provides simulators, such as this UH-60 system, to both train aviators and to develop cockpit systems and procedures.

influence the system's development. Since early modifications are less costly than those done later, waiting until a system is fielded makes changes prohibitively expensive and forces soldiers to adapt to the system instead of the system adapting to the soldier.

AMRDEC's Advanced Prototyping and Experimentation Laboratory has adopted the Army's Simulation and Modeling for Acquisition, Requirements and Training, or SMART, program.

Through SMART, soldiers — using weapon and aviation simulators in the Battlefield Highly Immersive Environment (that can be linked with other research activities, U.S. Army Training and Doctrine Command battle labs and national training centers) — can experience how the developing system would function in an actual battlefield environment and provide valuable critiques. □

Among the systems ARDEC is working on is the new lightweight 155mm howitzer, seen here being prepared for action during an evaluation exercise.

Armament Research, Development and Engineering Center

ARDEC, at Picatinny Arsenal, N.J., is working on a number of new weapon systems that will support the interim and objective forces. Among those will be the joint lightweight 155mm towed howitzer.

Lightweight Howitzer

Weighing approximately 9,000 pounds, the lightweight 155mm will replace all M-198 howitzers in the Army inventory. In three minutes or less the XM-777 will be ready to fire as many as four rounds per minute up to distances of 30 kilometers.

In other research areas, ARDEC is working toward development of:

- An integrated airburst weapon system. Equipped with two barrels, one that will fire 20mm air-bursting munitions and the other that will use standard 5.56mm small-arms ammunition, the XM-29 will have a range of up to 1,000 meters, greater lethality than the M-16 and M-4, and complete day-night capability.

- A new, long-range sniper rifle, the XM-107. It will replace the 20-year old M-82A3 that is currently used by the U.S. military services. Army snipers equipped with the XM-107 will be able to hit targets more than a mile away.

- A weapon for the future multi-role armament and ammunition system. The lightweight MRAAS would fire direct and indirect munitions out to 50 kilometers. It would include a multi-purpose, extended-range projectile, smart cargo round and a multi-purpose smart warhead.

- A mobile, unmanned 120mm mortar system that will be controlled remotely by objective-force soldiers. Weighing between 4,000 and 6,000 pounds, it could be directed to change its location to confuse the enemy.

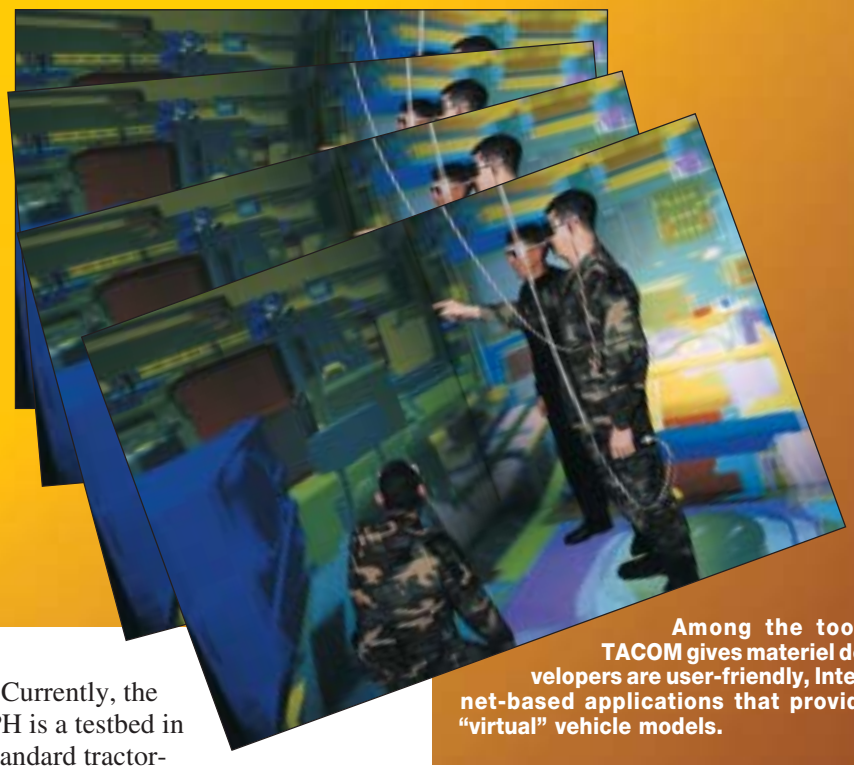
- The Precision Guided Mortar Munition. A 120mm laser-guided mortar with extended range, PGMM will be more survivable than current mortars and is intended to defeat the enemy faster with less collateral damage. □

Tank-automotive and Armaments Command

Advanced Collaboration Environment

WHILE TACOM's Advanced Collaboration Environment isn't quite as "real" yet as Star Trek's "holodeck," it's every bit as interactive, say TACOM engineers and scientists in Warren, Mich. The ACE helped developers of the Stryker interim armored vehicle solve system-design problems early on by allowing soldiers, designers and contractors to work on a "virtual" vehicle in real time.

Together in a 3-D room, they were able to "walk" around the vehicle, move its parts and recommend changes on the spot.



Among the tools TACOM gives materiel developers are user-friendly, Internet-based applications that provide "virtual" vehicle models.

Mobile Parts Hospital

TACOM engineers are also working on the Mobile Parts Hospital, something like the Star Trek replicator the crew uses to make food and other items. The Army version would allow soldiers to make replacement parts immediately, wherever they're deployed.

Currently, the MPH is a testbed in a standard tractor-trailer. It's equipped with a vertical milling machine, modified to also serve as a lathe; a laser sinter machine, which converts powdered rubber, metal, plastics and ceramics into actual parts; and a laser scanner.

It's also connected to satellites, various computer networks, Web-based technologies and cellular phones. So, if a soldier needs to manufacture a hose for a downed Humvee, for example, engineering data for the part is relayed over one of the on-board communications systems to the MPH. The data is fed into the sintering machine, and powdered rubber is transformed into a hose.

Soldiers would also be able to create parts by scanning a broken part, receiving its engineering data, and feeding the information into the system.

As the program evolves, the MPH will be housed in a container for rapid shipment. □

Personnel involved in developing the Stryker can evaluate "virtual" designs at TACOM's Advanced Collaborative Environments laboratory.

U.S. Army Communications-Electronics Command

LOCATED at Fort Monmouth, N.J., CECOM is AMC's lead organization for developing communications and electronics gear. Its Research, Development and Engineering Center is responsible for developing key C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) technologies that will allow soldiers to "see" what's happening before the enemy does, process that information and respond quickly.

RDEC is responsible for 42 of the Army's 186 ongoing Science and Technology Objectives and nine of its 18 Advanced Technology Demonstration programs, which will provide soldiers needed capabilities in intelligence, electronic warfare information operations, sensor technologies and battlefield communications.

The latter includes electronic counter-countermeasures capability and information security systems, and advanced battlefield visualization technologies.

A special-projects office integrates technologies being developed and tested at CECOM's various facilities. The centerpiece of that effort is a C4ISR virtual test bed that can evaluate the capabilities of emerging technologies. Other RDECs, industry, and university laboratories can also connect to the test bed through a CECOM-managed digital network.

Technologies being tested include layered sensors that provide a wide-angle view of the battlefield. Some sensors will combine highly automated command-and-control functions while on the move. Others will assist in precision indirect fires. Sensors will also help soldiers communicate with unmanned ground vehicles. □

CECOM is involved in developing communications technologies for individual soldiers — such as the Objective Force Warrior — as well as for major weapon systems.