

Marine Corps Sees Cargo UAVs as the Future of Logistics in Distributed Operations



140318-N-P0203-138 QUANTICO, Va. (Mar. 18, 2014) A Kamen K-Max helicopter equipped with the Autonomous Aerial Cargo Utility System (AACUS) lifts off during an Office of Naval Research (ONR) demonstration held at the Marine Corps Base Quantico, Va., as part of the Autonomous Aerial Cargo Utility System (AACUS) program. AACUS consists of a sensor and software package that when integrated into rotary wing aircraft enables autonomous, unmanned flight allowing the Marine Corps to rapidly resupply forces on the front lines as an alternative to dangerous convoys, manned aircraft or air drops in all weather conditions. (U.S. Navy photo by John F. Williams/Released)

WASHINGTON – The Marine Corps plans to continue experimentation with its two K-Max cargo unmanned aerial vehicles (CUAVs) and hopes to procure more to add to experimentation in logistics for distributed operations.

“We see this as the future of distributed operations in how we logistically supply ourselves,” said Lt. Gen. Steven R. Rudder, the Marine Corps’ deputy commandant for aviation, responding to a question about an unfunded requirement for \$18 million for the K-Max unmanned cargo helicopter from Rep. Joe Courtney (D-Connecticut) during an April 4 hearing of the Tactical Air and Ground Forces subcommittee of the House Armed Services Committee.

The Marine Corps owns two CQ-24A K-Max unmanned helicopters and deployed them to Afghanistan in 2011 through 2014 as an experiment in logistics to forward operating bases. Operated by contractors, they transported 4.5 million pounds of cargo, much of which would otherwise have been transported by 900

convoys of trucks through territory subject to ambush and improvised explosive devices.

“We endeavored to make them a program of record and are still working down that road,” Rudder said. “But we were not able to secure funding to get that flying in the fleet for test and operational usage for experimentation. We have since been able to secure funding for a cooperative research and development contract that we’re working with [the K-Max vendor].

“In the next few weeks [the two CUAVs] are going to be trucked back to Connecticut, and we’re going to give them to the vendor to let them work through a couple different things,” Rudder added. “One is autonomous logistics delivery. There are certain things you want on call but there are other things that you need going autonomously. The K-Max, with its lift capability and the way we conceive distributed operations in the future, if we get those airplanes, we’re going to configure them [the same] as we’re configuring a test vehicle in Connecticut with autonomy, which will allow them to have terrain-following radar and, [with] a push of a button, it will take the cargo to a particular point that was programmed in, drop that cargo and do it all day long. We’ve seen efficiencies with this over time.

“With the money we have funded right now – to do those two aircraft that we own – we will bring those back from Connecticut, hopefully by the end of next summer, to begin experimenting in [Marine Corps Air Station] Yuma [Arizona] and [Marine Corps Air-Ground Combat Center] Twentynine Palms [California], but the emphasis right now is to create a few more air vehicles so we can expand this usage,” he said.

Marine Pilots Killed in AH-1Z Helicopter Crash; First Naval Aviation Loss of 2019

ARLINGTON, Va. – The loss of a Marine Corps AH-1Z helicopter March 30 was the first crash of a U.S. naval aviation aircraft since the beginning of the calendar year.

Two Marine pilots were killed when the AH-1Z Viper helicopter gunship crashed in the vicinity of Yuma, Arizona, at about 8:45 p.m. March 30, according to a Marine Corps release.

“Both pilots were conducting a routine training mission as part of the Weapons and Tactics Instructor course 2-19,” the release said.

The training was being conducted by Marine Aviation Weapons and Tactics Squadron One based at Marine Corps Air Station Yuma. The helicopter was assigned to a Marine helicopter light attack squadron, but the identity of the specific squadron has not been released.

An AH-1Z carries a crew of two.

The cause of the crash is under investigation. The names of the deceased pilots have been withheld pending notification of their next of kin.

Marines Perform ‘Arduous’

Evaluation of New Grenade Launcher



MARINE CORPS BASE QUANTICO, Virginia –The Marine Corps plans to introduce a new weapon intended to enhance the lethality of infantry Marines on the battlefield, the Marine corps Systems Command said in a March 26 release.

The M320A1 is a grenade launcher that can be employed as a stand-alone weapon or mounted onto another, such as the M27 Infantry Automatic Rifle. Scheduled to be fielded in fiscal year 2020, the system will give fleet Marines the ability to engage with enemies near and far, day or night.

“The M320A1 will provide good range and accuracy, making the infantry squad more lethal,” said Lt. Col. Tim Hough, program manager for infantry weapons in Marine Corps Systems Command’s Ground Combat Element Systems.

The functionality of the M320A1 makes it unique, Hough said. Its ability to be used as a stand-alone or in conjunction with a firearm should help warfighters combat enemy forces. The weapon will replace the M203 grenade launcher that is currently employed by Marines.

“The mounted version of the M320A1 is a capability we’re currently working on so that Marines have that option should they want it,” Hough added.

Before the Marine Air-Ground Task Force receives the M320A1, the Corps must draft technical documents for the weapon. These publications provide Marines with further information about the system.

In early March, Ground Combat Elements Systems collaborated with fleet maintenance Marines and logisticians from Albany,

Georgia, to conduct various analyses to determine provisioning, sustainment and new equipment training requirements for the system.

The first evaluation was a Level of Repair Analysis, or LORA. A LORA determines when a system component will be replaced, repaired or discarded. This process provides information that helps operational forces fix the weapon should it break.

The LORA establishes the tools required to perform a task, test equipment needed to fix the product and the facilities to house the operation.

“It’s important to do the LORA now in a deliberate fashion so that we don’t do our work in front of the customer,” Hough said. “And it ensures the system they get is ready to go, helping them understand the maintenance that must be done.”

The second evaluation was a Job Training Analysis, which provides the operational forces with a training package that instructs them on proper use of the system to efficiently engage adversaries on the battlefield.

“This process helps us ensure this weapon is both sustainable and maintainable at the operator and Marine Corps-wide level,” said Capt. Nick Berger, project officer in infantry weapons at MCSC. “It sets conditions for us to field the weapon.”

Sustainability is key in any systems-acquisition process. The goal of the LORA and Job Training Analysis is to ensure the operator and maintenance technical publications of a system are accurate, which reduces operational ambivalence and improves the grenade launcher’s sustainability.

The LORA is an ongoing process that continues throughout the lifecycle of the M320A1 to establish sustainability, Hough said. After fielding the M320A1, the Corps will monitor the system to ensure it is functioning properly.

During this time, the program office will make any adjustments and updates necessary.

“We’re looking to have the new equipment training and fielding complete prior to fourth quarter of [fiscal 2019] to ensure they can be used and maintained properly once they hit the fleet,” said Berger.

The analyses, which occurred over the course of a week, were no easy task.

“This was an extensive and arduous process,” Hough said. “We scheduled three days for the LORA – all day – so you’re looking at about 24 hours of work for the LORA. And that doesn’t include reviews, briefs and refinements to the package.”

However, at the end of the week, Hough expressed gratitude for all parties involved in the M320A1 analyses, which he called a success. He said the tasks could not have been completed without the help of several key individuals.

“I will tell you what’s noteworthy is working with our contract support, the outside agencies and the deliberate efforts by our team – specifically Capt. Nick Berger and Steve Fetherolf, who is a logistician,” Hough said. “Those two have made a significant effort to get this together and move forward.”

Berger also expressed pride about the accomplishments of the analyses.

“This week has been a success,” he said. “We got the system in Marines’ hands, worked out the kinks and began to understand how we’re going to use this moving forward.”

Proposed 2020 Budget Promises Major Funding for Marine Aviation and Ground Combat Programs, Hurricane Repair



The fiscal year 2020 national defense budget unveiled March 12 provides substantial funding for the Marine Corps' major aviation and ground combat programs and promises help in repairing the heavy damage inflicted on its East Coast bases by hurricanes last year.

The proposed defense funding would buy 10 more fifth-generation F-35B strike fighters for the Marines, six CH-53K heavy lift helicopters, 56 Amphibious Combat Vehicles to replace the aged AAV-7s, additional Joint Light Tactical Vehicles, the advanced Ground/Air Task Oriented Radar, HIMARS rocket artillery systems and an early attempt to provide defenses against unmanned aerial vehicles.

Despite a robust Navy shipbuilding fund that would buy 12 ships and two large unmanned vessels, the proposed \$205.6 billion total Department of the Navy (DON) budget does nothing to advance the Marines' decades-long quest for 38 amphibious combat ships, holding the gator fleet at the current 33 ships. The five-year budget plan shows the next America-class amphibious assault ship, LHA-9, would not be bought until fiscal 2024, despite an urgent appeal by the amphibious shipbuilding coalition to avoid an eight-year construction gap that could wreak havoc on the shipyard.

The total proposed Marine Corps funding of \$45.9 billion provides for an end-strength increase of only 100, for a total of 186,200 active-duty Marines, and holds the Marine Corps

Reserves at the current 38,500. But that small gain in personnel is in keeping with Marine Corps Commandant Gen. Robert B. Neller's goal of focusing his resources on accelerated improvements in modernization and combat readiness, rather than more people.

And within the stable end-strength numbers are substantial changes in specialties, with some shifts from basic ground combat capabilities to "Marines with special skills," including special operations, and intelligence, electronic, information and cyberwarfare, the DON's budget book said. That reflects Neller's drive to produce "a more experienced, better trained and more capable force," the budget said.

Those personnel realignments are in response to the U.S. military's overall shift from nearly two decades of anti-terrorism and counter-insurgency fighting to preparing for the return of great power competition against peer adversaries.

Keel Laid on Future USS Bougainville



PASCAGOULA, Miss. – The keel-laying and authentication ceremony for the future USS Bougainville (LHA 8) was held March 14 at the Huntington Ingalls Industries (HII) Pascagoula shipyard, the Naval Sea Systems command said in a release.

The ship's sponsor, Ellyn Dunford, authenticated the keel by having her initials welded into the keel plate.

Traditionally, keel laying marks the first step in ship construction. However, with today's advanced modular

shipbuilding, the keel-laying ceremony now recognizes the joining together of a ship's components and is a major milestone in the ship's construction. Fabrication of Bougainville began in October.

"We are honored to have Ellyn Dunford with us today to commemorate this milestone," said Tom Rivers, Amphibious Warfare program manager, PEO Ships. "The production team has made steady progress and we look forward to bringing the next generation of amphibious capabilities to Navy and Marine Corps warfighters."

The future USS Bougainville is the third ship of the America (LHA 6) class of amphibious assault ships built to facilitate forward presence and power projection. LHA 8 is the first Flight I ship of the America class with a reincorporated well deck to increase operational flexibility while maximizing the aviation capability inherent on the Flight 0 ships, USS America and the future USS Tripoli.

Designed to support the Marine Corps tenets of Operational Maneuver from the Sea and Ship-to-Objective Maneuver, America class ships are capable of rapid combat power buildup ashore the America class accommodates the Marine Corps' Air Combat Element, including F-35B Joint Strike Fighter and MV-22 Osprey, essential to maintaining power projection, air superiority and theater logistics.

HII's Pascagoula shipyard also is in production on Tripoli (LHA 7), the guided-missile destroyers Delbert D. Black (DDG 119), Lenah H. Sutcliffe Higbee (DDG 123), Jack H. Lucas (DDG 125), and amphibious transport dock ships, Fort Lauderdale (LPD 28) and Richard M. McCool Jr. (LPD 29). The shipyard also is

under contract for six Flight III Arleigh Burke class destroyers awarded as part of the fiscal 2018-2022 multiyear procurement.

Corps Committed to National Defense Strategy While Continuing to Fill Traditional Missions, Commandant Tells Defense Forum



WASHINGTON – Although the Marine Corps is responding to the National Defense Strategy’s focus on preparing for the return to great power competition, “we still have to operate across the full range of military operations,” the Marines’ top officer said March 13.

While the potential risk from a major regional fight against a peer competitor is high, it’s hard to say what is the probability of that occurring, Marine Corps Commandant Gen. Robert B. Neller said.

“How much of your force do you focus on that? How much of your force do you focus on the day-to-day capacity” for missions such as humanitarian assistance, disaster relief, crisis response, Neller asked rhetorically.

In addition to explaining the major changes in training the Corps is making to prepare for a possible high-end conflict against a great power rival, Neller noted that the counter-insurgency, counter-terrorism fights the Marines have been

waging for 18 years “is still going to go on.” The “physical caliphate” created by the ISIS extremist in Iraq and Syria may be about to be eliminated, “but ISIS is not going to go away.”

“Ninety percent of what we do will not be against peer competitors, it will be against somebody else,” Neller told the audience at the McAleese/Credit Suisse defense forum.

Working from that conclusion, Neller made a strong argument for the amphibious force, which he said was “the capability that allows you to do 80 to 90 percent of everything you do day to day,” to get where needed, to do exercises with allies and friends, to establish strong presence and to go ashore if needed without worrying about sovereignty issues.

With a strong amphibious fleet “you can operate across nearly 90 percent of the range of military operations,” up to a high-end conflict. “At the end of the day, it gives the nation one of two forcible entry capabilities,” he said. The other being an Army airborne assault.

“I think the value it brings to the nation is incredibly important.”

The question then is how many amphibious ships are needed, what capabilities they have, and that debate is going on, Neller added.

Asked his reaction to the fact that the Navy’s requested fiscal 2020 shipbuilding budget, which would buy 12 ships, does not contain any amphibs and there are only three in the five-year budget plan that seeks 51 ships, Neller said: “We know we have to compete against other capabilities.”

He said the Marines would have liked to have the first amphibious transport dock (LPD) Flight II, which will replace the aged and low-capability dock landing ships, moved forward. The LPD is planned for fiscal 2021. Neller said he would “make my case as best I can” to the House Armed Services Seapower

and

Projection Forces subcommittee chairman, U.S. Rep. Joe Courtney (D-Conn.), and the subcommittee's ranking member, U.S. Rep. Rob Wittman (R-Va.).

The budget plan also delays the next amphibious assault ship, LHA-9, until 2024, despite concerns from the amphibious shipbuilding industry that the delay would make it difficult to maintain skilled workers and suppliers.

Asked in a separate session with reporters about the low priority for amphibs, Chief of Naval Operations Adm. John M. Richardson said the shipbuilding budget reflected "warfighting priorities." And he said the LHA-9 "is good where it is."

Neller described in considerable detail what the Marines are doing to prepare for a potential high-end fight, including developing capabilities to engage in information warfare, offensive and defensive cyber, training to operate in an information-denied environment and conducting intense force-on-force exercises. The Corps also is seeking better long-range, precision-fire weapons, air and missile defenses and the capability to help the Navy fight for sea control against a peer adversary.

He also said he did not ask for an increase in personnel because "I want to be able to train the Marines I have" and did not want to grow the force during a time of rising budgets and then "have people who don't have the gear they need" if funding was cut.

House Panel's Dissatisfaction With President on Afghanistan, Syria, Africa Cuts Across Party Lines

Members of the House Armed Services Committee expressed bipartisan concern and opposition to President Donald Trump's policies and statements on Afghanistan, Syria and Africa, with Republicans and Democrats throwing critical questions and opinions at the commanders of those crucial areas on March 7.

The criticism started at the top, with committee Chairman Adam Smith (D-Wash.) saying the "decisions by the administration appear to be uninformed, without the consultation of senior leaders in the [Defense Department] and – importantly – without consulting our allies and partners," which "are clearly impacting our alliances and partnerships."

U.S. Rep. Mac Thornberry of Texas, the top Republican, said he "shared" Smith's concerns about "where we are going from now" in the fight against the ISIS extremists in Syria and Iraq. "We need to keep pressure on the terrorist networks," despite the liberation of most of the ISIS territory, Thornberry said.

That line of questions and statements continued down to the most junior members of the panel, many of whom are veterans of those conflicts.

Army Gen. Joseph Votel, commander of U.S. Central Command, and Marine Corps Gen. Thomas Waldhauser, commander of Africa Command, tried to strike a positive tone in assessing conditions in their areas of responsibility, but conceded under the persistent questioning that some of the president's decisions and statements could have negative effects.

Votel, who is set to relinquish his command later this month, was particularly concerned about the president's repeated declarations that ISIS has been defeated in Syria and Iraq, which justified major reductions in U.S. forces there.

While noting that the U.S.-led coalition had reduced ISIS' self-proclaimed caliphate from 243,000 square miles to less than one mile, "the fight against violent extremists is far from over," Votel said.

What we are seeing now is not a surrender of ISIS" in the shrinking pocket of land in Syria, but "a calculated decision" to protect its fighters "while waiting for a chance to re-emerge," he said.

Votel, who has said he was not consulted before Trump declared ISIS beaten and ordered all U.S. forces withdrawn from Syria, said he is proceeding with a phased withdrawal of his forces with a primary focus of protecting the small number who now are expected to remain.

Asked how the Russians reacted to Trump's decision to leave Syria, Votel said it was "positive" as the Russians believed they would be "filling the vacuum" and perpetuating their relations with Syrian President Bashar Assad.

Votel said he was "confident" that the small U.S. force, now expected to be about 400, that Trump later decided to retain in Syria could keep ISIS from regaining ground. But, he added, it would be "not just U.S. forces, but our partners."

Asked if he agreed with the president's decision to remove most U.S. forces from Syria and at least half of its troops from Afghanistan, Votel said, "most of us would say these decisions have to be based on conditions at that time."

As for Afghanistan, he said his advice would be that any decision on forces "should be done in full consultation with our partners." He added: "We have not received any orders to

withdraw" forces from Afghanistan.

Pressed repeatedly about the negotiations with the Taliban, conducted by Zalmay Khalilzad with no involvement by the Afghan government, Votel said those talks are in the early stages and any agreement would have to be made by Kabul. U.S. goals in the negotiations are to protect U.S. interests and ensure the security of the Afghan government.

Waldhauser was more sanguine about the troop reductions ordered in his command, noting that his initial instructions were to withdraw about 10 percent of his counter-terrorism forces, which are primarily special operations personnel, while keeping the 6,000 conventional troops advising and assisting local forces. Those troops would be distributed based on the status of efforts to improve the capabilities of local forces, he said.

Asked if he considered that enough of a force, he said, "adequate."

EA-6B Prowler Naval Electronic Attack Aircraft Set for Retirement



CHERRY POINT, N.C. (Feb. 28, 2019) Two U.S. Marine Corps EA-6B Prowlers assigned to Marine Tactical Electronic Warfare Squadron (VMAQ) 2, fly off the coast of North Carolina, Feb 28, 2019.

ARLINGTON, Va. –The Northrop Grumman EA-6B Prowler electronic attack aircraft will be retired from naval service on March 8

in ceremonies at Marine Corps Air Station Cherry Point, N.C.

The last squadron to operate the Prowler, Marine Tactical Electronic Warfare Squadron Two (VMAQ-2) will say farewell to its last two –which reportedly are bound for museums–of six Prowlers as the squadron is deactivated.

VMAQ-2 returned to Cherry Point in November from its final deployment at a base in the Central Command area of responsibility.

VMAQ-2 is the last of four VMAQ squadrons to operate the Prowler. The other three squadrons –VMAQ-1, VMAQ-3 and VMAQ-4, two of which were formed from detachments of VMAQ-2 and one of which became a fleet replacement training squadron (VMAQT-1) until it was no longer needed –have been deactivated, one each year –over the past three years.

The VMAQ squadrons have deployed their EA-6Bs to numerous bases and aircraft carriers over their service, providing electronic jamming and attack in support of joint forces, including participation in combat operations in Libya, Kuwait, Iraq, Syria, Bosnia, Serbia, Kosovo and Afghanistan.

The Marine Corps is not fielding a direct replacement for the EA-6B, instead relying on other platforms like the F-35B, organic electronic warfare systems such as the Intrepid Tiger pod and the Navy's electronic attack squadrons.

The Navy retired the EA-6B from operational squadron service in 2015. The Prowler entered combat during 1972 over North Vietnam and served in numerous conflicts and crises since, most notably in Operations El Dorado Canyon, Desert Storm, Southern Watch, Allied Force, Desert Fox, Enduring Freedom and Iraqi Freedom. The service now flies the EA-18G Growler electronic attack aircraft from aircraft carriers and in expeditionary roles from land bases to support joint forces.

Marine Corps Seeks Ideas, Information for Optical Communication Transmission System



A U.S. Marine with Special Purpose Marine Air-Ground Task Force-Crisis Response-Africa performs a radio check during a training event with German soldiers in Seedorf, Germany, Dec. 6, 2018. This event, which focused on infantry tactics and maneuvers, marked the first time U.S. Marines have trained with German Fallschirmjäger Regiment-31. SPMAGTF-CR-AF is a rotational force deployed to conduct crisis-response and theater-security operations in Europe and Africa. (U.S. Marine Corps photo by Sgt. Katelyn Hunter)

MARINE CORPS BASE QUANTICO, Va. –Marine Corps Systems Command (MCSC) has released a Request for Information (RFI) to identify a nondevelopmental solution to provide a complete Line of Sight (LOS) Optical Communication Transmission System (OTCS), the command said in a March 5 release

.According to the RFI, released on the Federal Business Opportunities website, the OCTS system must be capable of providing a high-bandwidth transmission path used for voice, video and data communications

.For program officials, this capability will consolidate capabilities into a complete LOS transmission capability

."The adage, 'Move, shoot, communicate' hasn't changed, but how we communicate is rapidly changing," said Maj. Eric Holmes, MCSC project officer. "Given the rapid pace of innovation in technology, the Marine Corps is currently

evaluating maturing capabilities.

"Optical communications support greater bandwidth and provide additional relief for frequency allocations in an already constrained spectrum

. "The Marine Corps is turning to industry to help rapidly develop and field this technology to protect vital command and control emissions from advanced adversaries," Holmes said. Responses to the RFI must be received by 1 p.m. on March 19.

Marine Warfighting Lab Develops Roadmap on Robotic Experiments



Recognizing the impact that the rapidly expanding capabilities of robotic systems will have in all the warfighting domains, the Marine Corps Warfighting Laboratory (MCWL) has developed a draft roadmap to prioritize its experimentation on the most immediate threats in a resource-constrained environment.

"We prioritize based on the perceived threat. ... And the biggest threat right now is to the infantry squad," said Jeff Tomczac, the deputy director of the science and technology division at MCWL.

The roadmap emphasizes interoperability, modularity and providing "enhancements" to the squads, because "we don't want to go after something that will be a liability. You want a battle buddy and you want something that is as good or better

than what you have,” Tomczac said in a conference call with two reporters.

In the quest for interoperability, MCWL has created the Tactical Robotic Controller, “the universal controller for all the unmanned, robotic, or autonomous systems that we experiment with,” for air, ground, water surface and subsurface systems, he said.

To illustrate the scope of that controller, Tomczac said, “we have an effort down in Norfolk with our connectors. It’s an LCM-8, a Mike boat, that is now fully autonomous.” They are working with the landing craft because “we see an important role for autonomy,” with surface connectors, Tomczac said.

The Marine Corps is working with the U.S. Army on the controller “to create a set of standards that industry is going to have to adhere to for different robotic systems,” he said.

Tomczac said MCWL is working closely with the Army on other programs, which is important because the Army can buy systems in larger numbers, which increases the support for programs and reduces the cost for the Marines.

The need for a common controller has been recognized for years, he said, “otherwise your squad leader can have 10 different controllers in his pocket for each different type of system out there.”

The infantry squads already are operating a small quadcopter unmanned aerial system.

Part of the focus on interoperability is to ensure the various robotic systems can communicate with each other, know where the others are and “can work sometimes in tandem.”

The MCWL strategy also emphasizes “working on systems that are modular, so you can put systems on, take them off, depending

on the mission, depending on what you want to do," he said.

An example of that is a current program called the Expeditionary Modular Autonomous Vehicle (EMAV), which is a tracked, flattop vehicle, that can carry up to 7,000 pounds of supplies or infantry gear, Tomczac said. It also "allows us to put on different types of sensors, communications equipment, different kinds of weapons."

It also can carry casualties from the battle line to a safe area or aid station, with only one Marine ensuring the wounded are "taken care of and protected," rather than the two or more Marines needed to manually transport a casualty, he said. The unwounded Marine then "can return with supplies, ammunition and gear."

MCWL has two EMAVs, will get two more shortly and has asked for another 10, which "will go out to an operational unit to conduct an extended user evaluation," to help refine the requirements to move the prototypes into a program of record for acquisition, he explained.

MCWL already has deployed the vehicle multiple times with operational units for limited evaluations, mounting sensors and even weapons on it, he said.

The EMAV can be controlled by an operator or programmed to make runs between supply spots and infantry Marines forward. But the emphasis is on using artificial intelligence and machine learning to develop greater autonomy, Tomczac said.

However, when the robotic system is armed, "the goal is always a man in the loop. A man will make the decision whether an engagement occurs," he said.

While MCWL works toward new robotic systems, Marine explosive ordnance disposal specialists and engineers already are using five unmanned ground systems, which range from a 600-pound ordnance neutralizer down to the Ultra-Light Robot, a seven-

pound remote sensor that can be thrown into a room or sent into a tunnel to look for enemy soldiers or improvised explosive devices.