National DEFENSE

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Correction: An article on page 51 of the December 2015 issue of National Defense Magazine "WID Appoints 2016 Leaders," incorrectly stated that Women In Defense President Amy S. Courter was a retired Air Force officer. She is an active member in the Civil Air Patrol, the official USAF auxiliary.

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Turning Point Coming for National Security

The national security landscape has seen significant change over the past five years. The number of deployed forces declined by more than 60 percent from 2011 to the start of 2016, and the Budget Control Act of 2011 ushered in a period of uncertainty.

Meanwhile, the global security landscape grew more unsteady. However, I believe the beginning of 2016 will be seen as a positive turning point.

My tenure as the National Defense Industrial Association board chair began in November, and I want to take a moment to introduce myself. I started my career in national security as an Army civil servant, then served 14 years as a professional staff member with the Senate Committee on Appropriations, and have worked in industry for the past seven years.

The new year brings many reasons for optimism along with opportunities at NDIA. There were some significant events in 2015 that indicate positive steps toward the future. Congress and the president came to a two-year budget agreement just after the start of the fiscal year. This deal ended months of partisan bickering and ensures a stable budget through 2017. While the deal requires the Department of Defense to revise its plans during the next two years, it represents growth in the overall budget by about 5 percent over sequestration funding levels and a $20 billion increase over 2015.

That represents a starting point for a discussion toward a long-term deal that could put an end to the recent budgetary uncertainty. It better reflects the global security environment where threats may quickly emerge and change. Such a deal is vital as reminders emerge of the myriad national security challenges that the nation faces around the world on a near daily basis.

As I write this, I'm watching the aftermath from recent terrorist attacks in Paris, the taking down of a Russian airliner in Egypt, attacks in Africa and continuing chaos in Syria and Iraq. A long-term deal should ensure that U.S. military forces and the intelligence community remain well trained and equipped so they can respond in a moment's notice to these global threats.

The nation must also work to regain its technological edge against regional threats such as Russia and China. Potential adversaries are focusing on developing military capabilities that counter traditional U.S. advantages, meaning that future operations will demand highly survivable, long-range systems that are able to adapt and incorporate new technologies.

To prepare for future military operations, the nation must reinvigorate a research-and-development agenda that will nurture new military technologies. Senior defense leaders have begun an effort to develop new systems that will give

> "We aim to have an impact on long-term stability in the defense budget and an acquisition process that is not only more responsive but is capable of delivering the innovation that the military needs into the future."

U.S. forces a distinct advantage against any possible adversary. Deputy Defense Secretary Robert Work often calls for new prototyping efforts and recently noted that one of the key features of innovation is human-machine collaboration. The U.S. defense industrial base stands ready to provide these next-generation technologies.

It is this industrial base that has worked alongside its customers to ensure that the U.S. military has been better equipped than any other nation since the end of World War II. In the coming year, NDIA will continue to engage with national security leaders to enhance industry's ability to innovate. The 2016 National Defense Authorization Act included several positive steps in this direction, and the association's "Pathway to Transformation" report proved to be a valuable resource in the development and adoption of many of the new policy provisions in the NDAA.

The NDAA establishes an advisory panel to review all acquisition regulations and provide recommendations to streamline the system while also taking action to speed up processes for items that are critical to national security. It calls for steps to increase senior defense leaders' understanding of military and commercial research and development. The 2016 NDAA increases the responsibilities of the military service chiefs in the acquisition process recognizing them as the primary customers of new systems. These early incremental steps will improve the Defense Department and industry's ability to work together to field new military capabilities.

Congressional leaders recognize that the 2016 NDAA is only one step in the acquisition reform process. In order to ensure that the acquisition system continues to deliver the best military systems in the world, it must be continuously evaluated and improved. Many hurdles still stand in the way of rapidly delivering to U.S. forces the superior technologies they need for a changing world. NDIA will continue to play a critical role in this engagement with congressional and Pentagon leaders toward the next steps in this process.

In closing, 2015 saw some steps to a predictable defense planning cycle with stable funding through 2017 along with an improving acquisition system that is growing somewhat more responsive.

It is for these reasons that I am optimistic, but I know that much work remains to be done. NDIA will continue to remain engaged as a representative and advocate for the entirety of the defense industrial base. We aim to have an impact on long-term stability in the defense budget and an acquisition process that is not only more responsive but is capable of delivering the innovation that the military needs into the future.

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The Rise of the Machines? ... Not So Fast

Robots working in tandem with troops are said to be the next big thing in defense technology.

"We believe we are at an inflection point in artificial intelligence and autonomy," said Deputy Defense Secretary Bob Work. "So how might we use that as an advantage?"

Different forms of "human-machine collaboration" are practiced today in many national security programs, but the Pentagon wants to take it to new levels. Super-smart machines could give human commanders an edge in areas where the Pentagon fears it is becoming outmatched such as cyber and space warfare. "You're going to have to have a learning machine that helps you solve that problem right away," Work said. To be sure, machines will not be unleashed unsupervised but will "help humans make better decisions faster."

Although there is ample proof that autonomous systems are here and advancing at warp speed — witness self-driving cars and aircraft — reality hasn't quite caught up with Work's vision.

The military historically has been a technology pioneer, but it is not ready yet for the robotics revolution. A team of Pentagon scientists spoke about this last month during a House Armed Services Committee hearing.

"These innovations in autonomy need to be nurtured and introduced in a manner which will gain the trust of our sailors and Marines and the public we are here to protect," said Frank Kelley, deputy assistant secretary of the Navy for unmanned systems. "Realizing the vision of a fully integrated unmanned and manned force will depend as much on significant military cultural evolution as on the technology innovations," he added. "We have to change the way we think to evolve the way we fight."

Kelley said, "Autonomy is not a solved problem. There is much work to be done before we can realize our vision."

Further, the military has a "moral imperative to ensure that in addition to the technology innovation, we develop an ethical, legal and policy framework for how we will employ unmanned and autonomous systems."

It is remarkable, Kelley said, that "our young people are really concerned about the ethical and moral implications of how these unmanned systems are going to be used. … At the end of the day, it's going to be a commander who will be accountable for how these systems are used."

Commercial companies every day come out with gee whiz robots and eye-watering systems that are run by artificial brains, but the military is a customer with unique needs that civilian technologists don't quite understand, said Jonathan Bornstein, chief of the autonomous system division in the Army Research Lab. "Commercial usage generally focuses on benign, permissive and structured environments. The military must design for adversarial, highly dynamic and structured environments," he said. "Significantly advancing autonomy technology, taking machines from tool to teammate, will require technology advancement beyond what is available today."

The Pentagon's complex procurement process also creates obstacles to buying emerging technology with which the military is unfamiliar. "It's very difficult to write requirements for a revolutionary technology in which you have no experience," observed Greg Zacharias, Air Force chief scientist. Years of prototyping and experiments will be necessary before autonomous systems can transition from the lab to the field.

Companies in the robotics industry are enthused by the prospect of bigger Pentagon investments. Currently only a tiny fraction of the Defense Department's $65 billion a year research-and-development budget is spent on robotics. There are signs that spending will grow, said Jorgen Pedersen, president and CEO of RE2 Robotics. The problem is that most of the money is being spent on robots the military already knows and operates rather than groundbreaking new capabilities.

"Autonomy is always a scary word," Pedersen said. The Army has been working on several projects that could bring unprecedented human-machine teaming to the force but there is no clear path to take these technologies further in the procurement process. "The military is good at buying equipment that they know how to use. But they're slow to adopt the newer capability that they are not familiar with," he said.

Robots that have been widely used by combat engineers and bomb squads are being acquired in larger numbers. "But what's not coming online are programs of record for autonomy or for manned-unmanned teaming," Pedersen said. These are still in the labs and probably will stay there until the military figures out how to use the technology. "In order for this to really take hold, and for industry to make the investment, they need programs of record," he said. "A demonstration alone isn't motivating to industry. A roadmap between R&D and procurement is what will get the industry excited."

A perfect opportunity for the Army to introduce autonomy is the "squad multipurpose equipment transport" — a budding concept to use robots to move troops and supplies. It is not completely autonomous because it follows the squad leader. "It's not necessarily thinking for itself but has enough autonomy to move independently and provide a service to the soldier. That would be a good case of 'crawl before you walk.'"

The thinking at the Pentagon is that commercial companies will develop cutting-edge robotics systems at their expense and the military will be able to leverage the private investment. That could happen, but don't count on it, said Pedersen. "Industry will always invest. But whether they invest in the exact solution DoD wants is unlikely." The Defense Department will have to fund the R&D if it expects military-specific solutions. "If you're looking for generic solutions you can leverage the investments from other markets. The industry is not going to invest in something only one market will use."

Even if the technology advances, there is no certainty the military will accept it. "For whatever reasons, people expect more from robots than they do from humans," said Pedersen. "A human can make a mistake but a robot can't. Our society has this preconception that robots need to be perfect."

Email your comments to serwin@ndia.org

Technology Tomorrow By Stew Magnuson

More Learning, Less Testing to Boost STEM

If the nation wants to create a healthy stream of science, engineering, technology and math graduates to fill the 21st century jobs of the future, maybe it ought to scrap its 18th century educational system.

Congress may have taken one small step in that direction recently when it passed legislation to replace the No Child Left Behind Act — eight years after it was due to be reauthorized.

Education is a hot button issue and just about everyone has an opinion on what works and what doesn't. For those who haven't been paying attention, the U.S educational system went mad over the past 15 years doubling down on a model of teaching children invented at the dawn of the industrial age. The teachers, standing before rows and rows of children, stuff them full of facts and figures, test them, then move them along to the next grade — kind of like a Model-T in a Ford factory. No Child Left Behind, which called for accountability from schools, doubled-down on this antiquated system, especially the testing part.

Art, civics, history, music and perhaps worst of all, physical education got the short shrift in classrooms as educators were forced to "teach to the test" covering core topics, or possibly lose their jobs.

All along, smart people who had devoted their lives to studying the health, well being and education of children were sounding alarms about this misguided movement. Elementary schools canceled recesses so students could devote more time to their book learning. School days have become about as long as an adult's work day. After dinner, some kids have homework that lasts well beyond a reasonable bedtime.

The new Every Student Succeeds Act will allow states to take more control of their education systems, but unfortunately leaves in place much of the incessant testing.

About the same time as schools were trying to implement No Child Left Behind, another alarm was being sounded. The nation was not going to be competitive in STEM fields if it didn't graduate enough talented students. There are shortages of qualified personnel in some of these fields, and defense companies in particular must not only find personnel who are clearable, they compete for the same pool of talent with other industries.

Nurturing new scientists, technicians, mathematicians and engineers is an important and worthy endeavor for companies, and society in general.

Defense companies large and small have spent millions of dollars and volunteered their employees' valuable time to help schools and universities bring along the next-generation workforce.

A small survey taken of defense and aerospace companies conducted by The Economist business intelligence unit in 2011, "Talent Strategies and the Competitiveness of the U.S. Aerospace and Defense Industry," found that few of the companies interviewed had any concrete evidence that their money was being invested wisely.

Education is a research-oriented field, and along with spending money on STEM programs, defense companies should begin funding some studies to find out if their programs are effective.

Meanwhile, there are many common sense practices to consider, especially when it comes to inspiring students to love science and math at an early age.

For one, stop sacrificing recess, physical education, music and art on the belief that "more is more" when it comes to math and reading. It isn't.

Kids need to move around periodically, and they will later concentrate better when they are allowed to do so. Those who cheer when they hear schools canceled recess or P.E. to devote more time to math are misguided, and there are numerous studies to back this up.

Besides, tell a kid that recess has been canceled to devote more time for math drills ahead of a standardized test. That's a sure way to create a generation of children who hate numbers.

Kids need unstructured playtime with as little adult supervision as possible. Not only do they learn valuable social skills that serve them their whole lives — including in the workplace — they return to class more focused.

As Fred Rogers, aka Mr. Rogers, said: "Play is often talked about as if it were a relief from serious learning. But for children play is serious learning. Play is really the work of childhood."

Another no-brainer for companies looking to invest in STEM in the local districts: make sure every kindergarten has a few sets of wooden blocks. They cost about $20 for a set of 250.

Most baby boomers remember simple, but valuable learning tools such as blocks, Tinker Toys and Lincoln Logs. But as Ann Gadzikowski, author of "Creating a Beautiful Mess: Ten Essential Play Experiences for a Joyous Childhood," writes, wooden blocks, and the trial and error kids find building mini-structures, have all but disappeared in classrooms.

Children "learn science concepts involved in structural engineering, but they also develop the ability to solve problems through failure," she writes.

Another classic exercise is to give a small group of children an egg, tell them they have to somehow throw it off a 20-foot wall without it breaking and let them puzzle out ways to accomplish this on their own. This is student-centered learning, and an example of a way to get out of the 18th century mindset.

Defense companies may also consider propping up underfunded local school music programs. It may seem counter-intuitive for STEM, but as University of Michigan-Dearborn associate professor of mathematics Thomas M. Fiore wrote in his paper "Music and Mathematics," the two are "intricately related." Studying music and wiring the brain to understand math go hand in hand.

These are just a few suggestions for young children, who are natural-born scientists and engineers. They have an innate wonder of how the world works.

The defense and aerospace workers of the 21st century will need more than expertise in STEM fields. They will need to be creative, critical thinkers, and they will need to know how to work in teams to solve problems. Most of this can be learned in our schools, but little of it will show up on a standardized test.

Email your comments to smagnuson@ndia.org

Executives: Be Wary of Export Regulations

One of the important legal requirements facing defense contractors is compliance with International Traffic in Arms Regulations and export controls.

ITAR are the Department of State rules that govern the defense industry's exports. Companion controls promulgated by the Department of Commerce's bureau of industry and security, known as the Export Administration Regulations, spell out the rules to export commercial and dual-use items.

These apply beyond export transactions to include many domestic activities of U.S. defense firms — they can apply even if the company's only customer is the U.S. government.

Due to the potential civil and criminal liability involved, it is imperative for defense firms to understand these laws and have procedures to comply with them.

Export laws create legal risk not just for corporate entities but also for their officers and directors in their personal capacities as well.

One recent case exemplifies this risk for individual officers and directors. A South Carolina company and two of its executives were charged with export control violations in connection with the sale of armored vehicles to the United Arab Emirates and other countries.

According to charging documents, the U.S. company and its two UAE affiliates transferred U.S.-origin vehicles retrofitted with ballistic steel and bulletproof glass to the UAE and other countries in at least nine instances in violation of U.S. export laws. The alleged violations include exporting the controlled vehicles to Canada with knowledge that the vehicles would be re-exported to other countries without the requisite re-export authorization, and the re-export of U.S.-origin vehicles from the UAE to other destinations without requisite re-export authorization.

What is noteworthy in the case is that the company's chief executive officer and a vice president were also charged in their individual capacities. Charges against the individuals included causing, aiding and abetting unlicensed transfers and a false statement to the bureau in violation of the Export Administration Regulations. The individuals each had separate charging letters, enforcement orders, settlement agreements and penalties.

The parties — entities and individuals — agreed to a total of $3.5 million in penalties, of which $1.5 million was suspended subject to the respondents not committing further export violations during a three-year probationary period.

This case is yet another example of U.S. government officials pursuing claims against individuals as additional leverage in enforcing the export laws. Other recent cases involving persons individually charged for export violations resulted in prison sentences in addition to fines. In some cases, the individuals were acting in their capacities as employees or officers of exporting companies, and in others they were acting alone.

In one instance, the employee was a senior export compliance officer and empowered official of a major U.S. defense contractor. Many of the cases against individuals are criminal prosecutions with significant financial penalties and prison sentences.

In tandem with this, the Justice Department issued its widely publicized memorandum, "Individual Accountability for Corporate Wrongdoing," Sept. 9, 2015, stating its intention to increase focus on the prosecution of individuals within corporations who are responsible for culpable conduct.

There are a number of steps that officers and directors can take to protect themselves from personal liability for ITAR violations. One of the most important is the adoption of ITAR compliance programs — written policies and procedures within their companies for complying with export laws.

Compliance programs can help reduce the occurrence of ITAR violations and can help "mitigate" or reduce penalties in case a violation occurs. Compliance programs also help demonstrate that officers and directors are fulfilling their fiduciary duties to shareholders by adopting proper procedures for corporate legal compliance, and can be useful in defending shareholder derivative suits that may arise following export violations.

Another step to reduce liability is conducting ITAR compliance audits. These are internal company reviews in which the company looks at its past business activities to assess if they were in compliance with export control requirements and to identify any prior violations. This can be valuable in identifying any weaknesses in the company's compliance practices and for "cleaning up" any past violations.

Compliance audits are an excellent way for the company to spot any problems in advance and deal with them before a government agency or federal prosecutor does.

There are also other recommended steps for the company's compliance staff as part of their normal export compliance activities. These protect not just the company but the individuals involved as well.

They include: proper classification of products being exported; compliance with export licensing requirements including licensing conditions and provisos; employee training; proper agreement administration for technical assistance agreements, manufacturing license agreements and other authorizations; screening against prohibited parties, countries and prohibited end-uses; compliance with export recordkeeping requirements; and taking prompt remedial action in the event of suspected violations.

Taken together, these steps provide the formal structure and process for a company to protect against export control violations. They also provide a firm foundation to protect the company's officers and directors from personal liability.

Thomas McVey is the chair of the international practice group at Williams Mullen. He advises clients on the legal requirements under ITAR, the Export Administration Regulations and other international defense transactions. This article contains general, condensed summaries of actual legal matters, statutes and opinions for information purposes. It is not intended and should not be construed as legal advice.

Defense Increases Scrutiny of Supply Chain

The Defense Department has offered some clarification on how it plans to deal with suppliers that pose potential security risks.

The department issued a final rule amending the Defense Federal Acquisition Regulation Supplement and clarifying the scope of the government's ability to evaluate and exclude contractors that represent "supply chain risks" in solicitations and contracts — specifically those that involve the development or delivery of information technology products and services in national security systems. In general, these are systems used by an agency or a government contractor for intelligence missions, command and control of military forces, or cryptologic.

The final rule presents some positive developments for contractors, as it clarifies that the Defense Department's exclusion authority is limited to procurement of national security systems, and establishes that exclusion decisions apply on a procurement-by-procurement basis. The final rule, however, leaves contractors without any significant protections to ensure they are not improperly precluded from doing business with the department.

The amendments implement Section 806 of the 2011 National Defense Authorization Act and give DoD the authority to take action to exclude IT contractors or withhold consent to subcontract if the department determines that a contractor or subcontractor presents a supply chain risk.

A "supply chain risk" could be a U.S. adversary being able to sabotage or subvert the design, integrity, manufacturing, production, distribution, installation, operation or maintenance of a national security system.

Based on the sensitive nature of these systems, the government's desire to protect the defense supply chain is understandable. Of concern to contractors is the lack of procedural protections that would give them a seat at the table when exclusion decisions are being made. DoD may take Section 806 actions without providing pre- or post-exclusion notice to or engaging in dialogue with contractors.

DoD declined to implement these potential contractor protections in the final rule, implicitly suggesting that such protections were unnecessary — because Section 806 exclusions would be made on a case-by-case basis — or impossible, because national security considerations limit the department's ability to communicate with the contractor.

The final rule affirms that Section 806 actions are not reviewable in a bid protest before the Government Accountability Office or in any federal court. The lack of procedural protections led commentators to the interim rule to suggest that contractors could be effectively excluded from DoD procurements without advance notice or an opportunity to object.

Defense officials attempted to address this de facto debarment concern by clarifying that each Section 806 decision to exclude is done on a procurement-by-procurement basis. Nevertheless, multiple exclusions without an opportunity to object or address the government's concerns could effectively result in a blanket exclusion.

A Section 806 action may only be approved by high-ranking officials such as the secretaries of the military departments or the most senior procurement officials within those departments. The authorized official must provide written notice to congressional defense and intelligence committees and to other agencies responsible for procurement that may carry the same or similar supply chain risks.

Notably, the DoD authority under Section 806 expires Sept. 30, 2018, and the department is required to issue a report by Jan. 1, 2017, that addresses the effectiveness of the Section 806 actions and the frequency with which the department exercises this authority. Although this reporting obligation provides some limited oversight of DoD's determinations, the final rule leaves contractors without any recourse against exclusions from procurements due to perceived supply chain risk.

The final rule adds an "evaluation factor" to assess supply chain risk when making procurement decisions for IT products and services related to national security systems. The rule itself contains no further clarifications as to how it will be implemented but DoD indicated that DFARS procedures, guidance and information are forthcoming. Until this guidance is provided, it remains unclear how supply chain risk will be assessed and scored in a contractor's proposal.
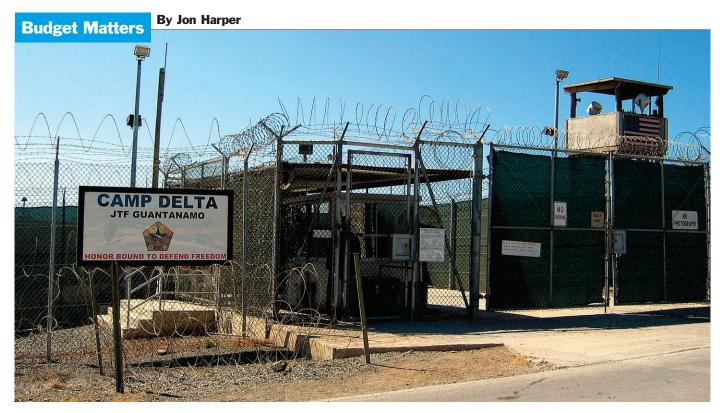
Finally, the rule imposes on contractors an ongoing obligation to "mitigate supply chain risk" and encourages contracting officers to consider imposing a "government consent" requirement for all subcontracts. DoD did not offer guidance on the means of mitigating supply chain risk, but instead explained that it is working with industry to promulgate best practices.

In the meantime, contractors should seek to document their processes for vetting subcontractors, especially those operating in regions or industries prone to presenting a supply chain risk. Contractors should consider including subcontractors in their initial proposal so that any increased use of the subcontractor consent clause will not impact their ability to use their preferred teammates.

The implications of the final rule could be significant. Contractors subject to a Section 806 action could be excluded from a procurement without notice or an opportunity to be heard, an impartial review of the decision, or an opportunity to take corrective action. Given the lack of procedural protections, contractors should seek an open dialogue with the relevant contracting authorities. Although such communications will not necessarily increase the procedural protections afforded to contractors, they could help to preemptively address the department's supply chain concerns.

Contractors must address a new supply chain risk evaluation factor and satisfy an ongoing obligation to "mitigate supply chain risk" without guidance on how such measures should be realized.

Susan Cassidy is a partner in the government contracts group, Roger Zakheim is counsel in the public policy and government affairs group and Alex Hastings is an associate in the government contracts group at the law firm of Covington & Burling LLP.

Fight Over Gitmo Detainees Coming to a Head

As President Barack Obama continues to push for the closure of the U.S. military detention facility at Guantanamo Bay, Cuba, before he leaves office, government cost data is stirring discussions about where to house detainees.

In fiscal year 2015, the Defense Department spent approximately $400 million to operate the detention facility at "Gitmo," including associated base support, military commissions, periodic review services and personnel costs, according to Navy Cmdr. Gary Ross, a Defense Department spokesman.

That averages out to a cost of approximately $3 million per detainee. In comparison, each federal prisoner cost taxpayers $30,000 on average in fiscal year 2014, according to the Bureau of Prisons.

The high price tag for housing detainees at Gitmo has become a talking point for those who support the closure of the facility and the transfer of detainees to the United States.

"We are spending millions of dollars per detainee, and it's not necessary for us to keep our people safe," Obama told reporters during a recent trip to Asia.

Shortly after taking office in 2009, he ordered the facility to be "promptly" closed. But logistical and political roadblocks have kept it open as the administration has searched for alternative locations to send detainees.

The administration's proposal to transfer the prisoners to facilities in the United States has met sharp resistance from lawmakers. The fiscal year 2016 National Defense Authorization Act barred money from being spent for this purpose. Members of Congress have called on Obama to provide a detailed plan for shuttering Gitmo. As of press time, the White House has yet to deliver it.

"The administration continues to work diligently on completing the plan to safely and responsibly close the detention facility at Guantanamo Bay," Ross said in an email.

When asked about costs associated with closing the facility, Ross said: "We are currently working to refine additional cost estimates for different aspects of detainee operations."

Some observers believe Obama has the authority to unilaterally close Gitmo without Congress' approval, arguing that the NDAA restriction is unconstitutional.

"The determination on where to hold detainees is a tactical judgment at the very core of the president's role as commander in chief, equivalent to decisions on the disposition of troops and the use of equipment," Gregory Craig, former White House counsel, and Cliff Sloan, former special envoy for Guantanamo closure, wrote in a recent op-ed in The Washington Post.

"If Congress is unable or unwilling to work with him, Obama should use his exclusive authority as commander in chief to … shutter the notorious facility, and end this blight on American values and national security," they said.

Obama recently indicated that he views the restrictions as potentially encroaching on his executive authority under the Constitution.

"In the event that the restrictions … operate in a manner that violates these constitutional principles, my administration will implement them in a manner that avoids the constitutional conflict," he said in a statement after signing the fiscal year 2016 NDAA.

As of press time, there were 107 detainees remaining at Gitmo. A spokesman for the National Security Council did not respond to emails asking whether Obama plans to close the facility and transfer the remaining prisoners via executive order before he leaves office in January 2017, even if Congress does not authorize the move.

DEFENSE DEPT.

Budget Deal Won't End Defense Funding Debate

■ Powerful lawmakers will seek a higher topline for defense than what was agreed upon in the recent Bipartisan Budget Act of 2015, according to a senior congressional staffer.

The pact lifted sequestration caps and increased base funding levels for defense — including defense-related programs not administered by the Defense Department — to $551 billion in fiscal year 2017, with an additional $59 billion for overseas contingency operations.

"With respect to Congress … I think that where we will end up as we begin the budgeting for next year is probably fighting about moving that topline up," said Christian Brose, staff director for the Senate Armed Services Committee, during a recent panel discussion at the Center for Strategic and International Studies.

Observers can expect the chairmen of the Senate and House Armed Services Committees — Sen. John McCain, R-Ariz., and Rep. Mac Thornberry, R-Texas — to "absolutely be arguing for greater funding for defense" for fiscal year 2017, Brose said.

Election year politics and world events like the terrorist attacks in Paris could fuel arguments for more military spending, panelists said.

Brose anticipates that defense hawks will win out.

"These [budget] fights that we've been having are coming out increasingly in favor of those who believe we need more defense spending," he noted. "That's ultimately what we saw this year, and I'm sure that will continue in the next year."

Other panelists didn't expect a major breach of the bipartisan budget framework.

"There are many voices in Congress that will say, 'Stick to the deal,'" said former Defense Department Comptroller Tina Jonas. "My prediction is we will come up someplace around … the marks in the budget deal at the end of next year, [with] maybe a little fudging here or there."

The president's budget request for fiscal year 2017, expected to be released in February, will likely adhere to the agreement, said Steve Kosiak, former associate director for defense and international affairs at the Office of Management and Budget.

"I expect they will submit a budget that at its core is consistent with the budget agreement," he said. It's possible that the White House will ask for more supplemental funding, but "it's less likely than it was when they did it … [in the past] because this is a deal they really negotiated. It's not something that the Hill negotiated and they signed up to."

Modernization 'Slowdowns' Anticipated in FY 2017

■ Unless it receives additional funding, the Defense Department will likely tap the brakes on some modernization programs in fiscal year 2017, the Pentagon comptroller said recently.

The department has to find a way to close the $14 billion gap between the amount of topline funding it had been planning for and the lower level mandated by the recently passed Bipartisan Budget Act of 2015.

"There will probably be some slowdowns in some modernization programs," Defense Department Comptroller Mike McCord said recently during remarks at the Center for Strategic and International Studies.

Cutbacks can be expected in "a few places," he said. McCord did not identify which programs will be hit, but noted that the new long-range strike bomber program will experience a slip due to "its own schedule dynamics" because the contract award was delayed.

"We are near the end of program review" for the fiscal year 2017 budget request, he said. "We have a couple more issues to discuss [and] to finalize," including the details of overseas contingency operations funding.

Tina Jonas, who served as Pentagon comptroller during the George W. Bush administration, said large acquisition programs such as the F-35 could be subject to slowdowns.

"Those are the ones that are going to be first and foremost on the programmers and budgeters minds," she said during a panel discussion at CSIS.

Todd Harrison, a budget expert at CSIS, said the Defense Department probably would not be able to put the affected programs completely back on track after 2017.

"For the most part, when you slip it you're not going to be able to make it up," he said. "There are cases where you can add more money, more resources [at a later date] but … I don't anticipate that we will be making" up for lost time.

The Pentagon expects to receive about $525 billion in base funding in fiscal year 2017 plus $59 billion for overseas contingency operations, McCord said. Programmatic funding requests will be submitted with the rest of the president's budget slated to be released in early February.

Email your comments to jharper@ndia.org

Fragmented Cyber Legislation Hinders Military

The patchwork of legislation that allows the U.S. military and government to perform cyber operations is too disjointed to enable an effective and swift response, a former Army officer said.

"We've got to deal with four different pieces of legislation in order to conduct a well-coordinated cyber response or cyber defense," said Jeff Schilling, chief security officer at Armor Defense, a cloud security company based in Richardson, Texas. He is also the former chief of current operations for U.S. Army Cyber Command.

Schilling pointed to Title 10, Title 50, Title 18 and Title 32 of the United States Code as the four pieces of legislation that govern allowable actions when operating in cyber space.

Title 10 allows the U.S. military to conduct cyber attacks and take advantage of an adversary's vulnerabilities; Title 50 enables the United States to collect cyber intelligence or conduct cyber espionage on foreign countries for the sake of national security; Title 18 enables law enforcement officials to conduct cyber investigations and do surveillance on criminals and actors who are trying to conduct cyber espionage against the United States; and Title 32 outlines the role of the National Guard, he said.

The National Guard has a unique ability to deal with cyber threats because of its dual state and federal roles. It also works closely with the civilian community, which could provide an advantage over other military branches in the cyber sphere, experts have said.

This environment of fragmented responsibilities and capabilities makes dealing with network attacks difficult, according to Schilling.

"At the crux of the problem … is trying to bring together all of these different U.S. titles and having a cohesive plan both to protect ourselves as well as conduct offensive cyber operations going forward," he said.

At the same time, adversaries are not constrained by bureaucratic policies. "The threat actors don't have to go between different titles. They have very little, if any, constraints or restraints for conducting cyber operations, which allows them to be much more agile," he noted. "They have the advantage in the fact that they can seamlessly transition from doing espionage to attacking and also using information" to protect themselves.

Schilling said he is not hopeful for comprehensive legislation under the current Congress. "They're having a hard enough time getting the CISPA — the Cyber Intelligence Sharing and Protection Act — passed because while there are fans in both parties of the legislation, the privacy groups are against it." Mistrust among those organizations has worsened since the Edward Snowden National Security Agency leaks, he said.

CISPA is a proposed law in the House that would allow for the sharing of Internet traffic information and threat signatures between the government and private industry. The bill was passed in the House in 2013, but failed in the Senate.

A related bill — the Cybersecurity Information Sharing Act — recently passed in the Senate. It offers similar protections for companies that share information with the government.

Schilling said information sharing between the government and industry is a good first step but will not be a "game changer" when it comes to getting ahead of the threat. "I believe this is a baby step in the right direction. However, I am seeing there is little political will in D.C. to go much further to really build a comprehensive strategy," he added.

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Garment Maker Touts New Hot Weather Uniform

■ As the United States military eyes the Asia-Pacific region, one manufacturer has designed a new fabric that breathes in hot weather and jungle conditions.

"We developed this product that was specifically designed for [the] jungle but we actually found out that it was good in arid environments, hot environments," said Jason Rodriguez, marketing communications manager at W. L. Gore & Associates' military fabrics division.

Earlier this year it unveiled the product, which is part of its line of advanced combat fabrics. It provides high air permeability and it dries faster than standard battle dress uniforms, he said.

It was developed after Gore saw "a theater shift from Iraq and Afghanistan to the jungle," and noticed increased military training in the Asia-Pacific region. The Pentagon has said it intends to pivot to the region in the coming years.

The fabric — which incorporates nylon, cotton and expanded polytetrafluoroethylene, a highly resistant polymer — has been tested at about 80 degrees Fahrenheit with 80 percent humidity, Rodriguez said.

As for higher temperatures, "we understand that some of those [operational] areas could potentially be warmer and my guess is if it's a hotter environment and less humid, chances are it's going to dry faster," he said.

"Gear and materials and fabrics have come a long way since" the Vietnam War when soldiers largely wore cotton-based clothing, he said. "Those guys were wearing cotton where it just absorbed a lot of moisture, and it never really dried fast."

Gore, working with a company called Outdoor Research, developed a commercially available blouse and trouser garment known as Muzzle Brake using the fabric.

The companies would like to sell the garments to U.S. Special Operations Command, Rodriguez said.

"We look at the Special Operations community as the engines of innovation," he said. They "are really the ones that get all the cool stuff, the ones that actually adopt products that will then be adopted by the larger services like the Marine Corps and the Army."

The garment will be more expensive than a standard uniform, he said. Commercially, the shirt sells for $300 and the pants for $384. They come in sizes small to XXL. Rodriguez noted that the price could come down if a customer wanted to buy a larger quantity under a contract.

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MQ-9 Reaper

Civilian Sector Could Lure Military Drone Pilots

■ The Air Force has been suffering a shortage of unmanned aerial vehicle pilots and is looking to contractors operating government-owned systems as a way to address that problem. However, a senior official said those more lucrative civilian jobs could potentially entice airmen to retire.

Contractor pilots "do great work," said Gen. Herbert "Hawk" Carlisle, the commander of Air Combat Command. Both the contracted company and the service "do a very good job of vetting the talent and quality of these folks," he noted, adding that the majority are former military.

However, there are drawbacks to expanding the use of private contractors that could poach military talent. "One of the concerns I have is I'm trying to build an enterprise in the United States Air Force and there are very lucrative civilian jobs for these young men and women," said Carlisle. But "I would like to keep them in my Air Force."

Over the last decade the service has been operating at surge capacity with its MQ-1 Predators and MQ-9 Reapers, according to officials. In order to meet combatant command requirements, the service increased combat air patrols for Predators and Reapers nine times in the last eight years, and has sustained those operations to date. These actions have resulted in the current strain on the service's pilots.

The objective of contracting some of the work out to private companies is to enhance Air Force capabilities where they are needed most, Carlisle said.

"We're using [contractor pilots] in an ISR role, and we are taking advantage of trying to provide more capability to combatant commanders," he said. This is especially important as the demand signal continues to grow with U.S. operations in Afghanistan, Yemen, Libya and Africa as well as the campaign to counter the Islamic State, he noted.

Another way the Air Force is looking to reduce strain on its remotely piloted aircraft pilots is by decreasing the number of combat air patrols, according to Lt. Gen. Robert Otto, Air Force deputy chief of staff for intelligence, surveillance and reconnaissance. At a conference in October he said many of the pilots are getting burnt out after working 12-hour shifts, six days a week. To address that problem the service reduced the number of combat air patrols from 65 to 60 within the Air Force. Over time the number will be built back up with the Army contributing 16 patrols and contractors flying government-owned aircraft adding 10 more. This will raise the total amount of daily combat air patrols to 86, providing significant capability, Otto said.

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A soldier launches a Raven surveillance drone.

Drone Glut Leading to Data Storage Issues

■ Over the past decade and a half, unmanned aerial vehicles have been used extensively to collect intelligence, surveillance and reconnaissance information. That has led to an enormous — and growing — amount of data that government officials must sort through and securely store. One company has proposed what it says is a better and cheaper way to manage it.

There is a colossal amount of drone "data that has to be stored and has to be kept," said Brian Houston, vice president of engineering for Hitachi Data Systems Federal, a Reston, Virginia-based IT company. "It's not just that the agencies are flying a drone flight today and three years down the road that data is null and void. No, they're going to go back and want to be able to keep that online."

This glut of information is in part due to an increase in UAV flights, as well as high-resolution cameras and better sensors, he said. A single drone flight can produce up to 400 terabytes of data, he added.

Currently, many agencies have multiple databases that act as silos for video imagery, audio or sensory data. Additionally, much of it is kept on physical tapes, which can often degrade over time or during data migrations, he said. Hitachi's digital system consolidates that data into one unit and employs a tiered process that prioritizes an agency's information using a durable, field-deployed Blu-ray optical storage system, Houston said.

"Think of it as a Blu-ray jukebox — so you have 200 drives inside this one little cabinet and every drive has a certain amount of data on it and it grows exponentially," he said.

When data originally comes in, it would be kept at the highest and most prioritized tier, he said. But as the data ages, it goes down to a lower tier, he said. "At the same time, we're never taking it offline, we're never spinning it off." Through metadata tagging, users can search for specific pieces of information, he said.

It is a more efficient alternative to tape-based storage, he noted. Currently, some agencies have to switch out tape for preservation purposes about every two years, he said. But "there is a loss with tape. … It's just a fundamental nature of the technology."

With Hitachi's digital system, users don't have to worry about that potential loss of data and the information can be easily migrated to other databases, he said.

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Agency Provides Open Data for Disaster Response

■ The government's leading agency for geospatial intelligence is looking to make more information publicly available during disaster relief operations, said one official.

The National Geospatial-Intelligence Agency is responsible for obtaining, analyzing and distributing geospatial intelligence data to assist policymakers, intelligence professionals and military personnel providing humanitarian assistance. However, at times it has been difficult for the agency to disseminate its entire store of unclassified data to aid service members and other first responders in disaster relief efforts because of legal policies and use restrictions, said John Goolgasian, director of NGA's source operations and management directorate.

Under new leadership, the agency is looking to address that problem and embrace more open information sharing, he said.

"Our current director, [Robert] Cardillo, has embraced open — open data, open technology," Goolgasian said at an industry conference. Cardillo questioned the agency's lack of polices for making unclassified information available to the public in disaster scenarios, wanting to shift from a model of only providing data in limited areas or controlled networks behind firewalls, Goolgasian noted.

"He pushed us beyond our comfort zone last year to see what we could do for helping with the Ebola crisis in Africa," he said, and the problem was not a lack of shareable information.

"What we discovered wasn't so much that we didn't have a lot of unclassified data," Goolgasian explained. "It was how we restricted access to that and how we purchased that data." Much of the unclassified data that was bought or leased came with use restrictions, he said.

NGA buys data and imagery from commercial satellite operators.

The agency has started to work through those issues, and last year it set up a public-facing website in an unprecedented move, providing unrestricted online access to images and data to help mitigate the effects of natural disasters. The webpage currently has three portals addressing different global crises including the Ebola outbreak in Arica, the earthquake in Nepal and climate change in the Arctic.

"In these areas we placed all kinds of data — unclassified imagery, virtual imagery, all kinds of mapping and charting products and, what we in the past would hold close, analytic assessments," Goolgasian said.

To aid its own analytic assessments during the earthquake in Nepal, the agency partnered with DigitalGlobe, a provider of commercial high-resolution satellite images, to use crowdsourcing to allow local residents to map damaged areas of the country.

"We leveraged the power of the Internet, and DigitalGlobe put up a website and made their imagery available for free on their website and [added] capabilities for anyone in the public to go in and start mapping out damaged areas," he said. "Then we reposted that information and made it available on our website."

Providing more open data is emerging as the norm for future crises, Goolgasian said.

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ARMY

Training and Doctrine Command Launches App Store

■ This fall, U.S. Army Training and Doctrine Command presented its own app store where soldiers could find a wide range of documents and training materials easily and securely, said command officials.

"The Army had aspirations to find a location … where soldiers and Department of the Army civilians could find doctrinally sound mobile applications and living doctrine," said Lt. Col. Joseph Harris, TRADOC capability manager for mobile learning, also known as TCM-M.

A doctrinally sound application is one that has been properly vetted by a schoolhouse or a responsible party, he said.

Additionally, the apps are "free of malicious code or intent. It's not going to harm" a user's device or network.

The app — which is known as the TRADOC Application Gateway (TAG) — is available on Apple, Android and Windows devices, he added. Soldiers can access the app by using their Army knowledge online login name and password, or their common access card. There are plans to make the app available to the public sometime in the next year, Harris said.

By downloading TAG, users are able to access other apps within it. There are currently 115 apps, but there are plans for 150 by January, said Ray Shinol, chief technical integrator for TRADOC capability manager-Army Training Information Systems.

Harris said: "We're building more and more apps every day. … We want to be that one stop shop for soldiers."

TRADOC wants soldiers and individual commands to submit their own apps. The process for vetting one, depending on the complexity, can take a few weeks to a year, said Matt MacLaughlin, senior mobile instructional design specialist for TCM-M.

"The way that our process works is if a soldier out on the field has created a mobile application … [he would submit it] to us through an email account and then we would run it through the due diligence to make sure that it was vetted and validated before it was released," he said. "If everything works out well, then that one can go out and be approved by us."

In late fiscal year 2016, TRADOC will begin sending teams out to commands and bases to train small groups of personnel, most likely Department of the Army civilians, on the basics of mobile app development, Harris said.

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ARMY

Defense Department Assuming Growing Cyber Security Role

By Stephanie Meloni

Cyber attacks are among the most significant imminent threats facing the United States' critical infrastructure. A catastrophic intrusion could affect power plants, water systems or nuclear assets.

The Defense Department sees cyber as a domain that spans air, land, sea and space, but it struggles with how to handle it as a warfighting domain to best protect the nation. DoD has responsibilities to protect U.S. critical infrastructure, with a significant focus on collaboration with the defense industrial base.

The department is taking steps to protect critical infrastructure with a particular focus on cyber resiliency and targeting threats. It also will increase cyber security information sharing with civilian agencies. The Department of Homeland Security, the National Institute of Standards and Technology, the General Services Administration and the Defense Department are collaborating on the software and supply chain assurance forum to strengthen cyber security via supply chain risk management.

DoD will coordinate with the Office of Personnel Management, DHS, the Department of Justice and other non-defense agencies to review the security clearance process, particularly as it relates to information security, and modernizing security controls on the actual systems themselves with an eye toward preventing insider threats.

DoD has taken steps recently toward enhancing critical infrastructure protection. The Defense Security Service is in the process of standing up the Defense Insider Threat Management and Analysis Center, with the idea of analyzing DoD employee data to predict, and ultimately prevent, insider attacks.

The continuous evaluation program also aims to mine data for insider threats as an improvement to the security clearance process. Although the organization was formed to respond to

> "Further definitions of cyber warfare are still needed for DoD to establish an effective cyber deterrence strategy."

violent insider attacks, analysis will extend to looking at cyber espionage threats across the globe.

The Pentagon continues to plan out response scenarios, coordinating with other agencies tasked with critical infrastructure protection, as it continues to develop the department's cyber strategy. The White House's pact with China to stop state-sponsored cyber attacks on the United States is another potential way to prevent threats as the government works to determine consequences for cyber espionage. It remains to be seen if this will deter foreign hacking.

The U.S. government is also exploring sanctions as a cyber deterrent. Last December's Sony email hack ultimately required government intervention because of concerns that not responding would imply future attacks would face no consequences. The White House imposed new financial sanctions on North Korea after an investigation suggested its involvement in the breach.

Sanctions, of course, won't work on non-state actors. This underscores DoD's difficulty in knowing exactly how to respond commensurately to an attack, particularly when the perpetrators are unknown. Defense and other government officials are still not sure their response to the Sony attack would prevent a devastating attack on, say, a sole-source supplier of sensitive military equipment.

Along with planning cyber response scenarios, the Pentagon is attempting to strengthen cyber protection through information sharing with civilian agencies and defense contractors. Recognizing the susceptibility of industry partners to cyber espionage and data breaches, DoD recently updated requirements to centralize cyber security via the Defense Federal Acquisition Regulation supplement, or DFARS.

This update should strengthen the defense industrial base cyber security and information assurance program that started back in 2011 and is intended to facilitate information sharing between DoD and industry about cyber threats. The new regulations require contractors to report cyber incidents via the cyber incident reporting and cyber threat information-sharing portal.

The DFARS interim ruling was issued Aug. 26 and will affect both prime and subcontractors that handle "covered defense information." The new ruling loosely defines what constitutes both a breach and covered defense information, which is incredibly problematic for contractors. First, the expanded definition of covered defense information raises more questions than answers about what information needs to be protected,

as almost any piece of data on a contractor's network might meet these vague definitions. Second, the same issue extends to the DFARS definition of what constitutes a data breach. With the definition expanded, contractors are left to interpret that on their own, which could result in non-compliance.

Though this regulation outlines how cyber incident reporting must occur, it does not address the most important piece, which is how this information should be protected. That guidance will not be issued until the final ruling.
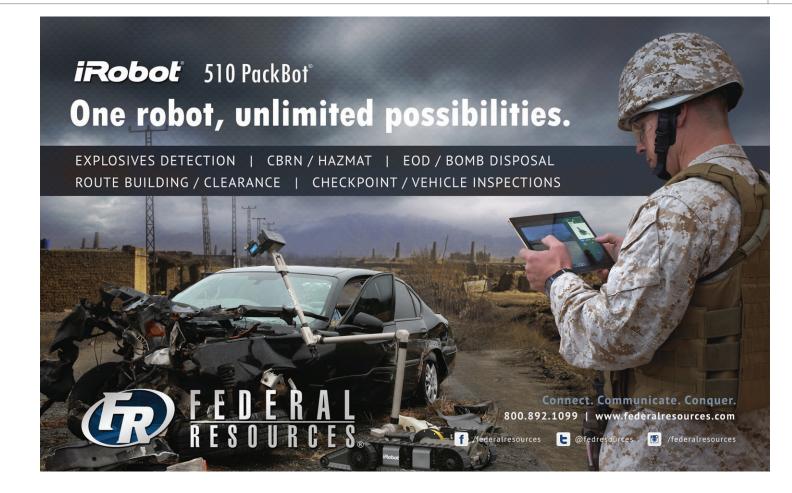
Lawmakers recognize the urgency and are faced with tough challenges to update not only laws and regulations, but also the actual facilities and installations remaining under DoD's purview. The DFARS update was issued prior to a proposed rule for comment, which is unusual, and demonstrates the government's desire to move forward quickly with a strategy to improve cyber incident reporting.

As far as updating infrastructure facilities, physical updates to the buildings to offset the effects of a cyber attack — like installing pressure relief values — is the easy part. Cyber requires a multi-faceted strategy looking at both prevention and responsive action. Cyber

protection for critical infrastructure still requires better, more defined legislation and a legal framework for information protection. Information sharing about cyber incidents can potentially help prevent future attacks, and will help to figure out the best way to protect information as it moves around a contractor's network.

Finally, further definitions of cyber warfare are still needed for DoD to establish an effective cyber deterrence strategy. Only after officials are able to clearly determine what constitutes an attack can they determine the appropriate response. DoD needs to continuously update its strategy in order to stay ahead of adversaries. Sharing information about cyber breaches, best practices for information protection and risk management, and legislative momentum to update legacy systems and infrastructure will be critical to strengthen cyber posture for critical infrastructure protection. **ND**

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What Happens When the Feds Decide an Invention Is 'Secret?'

By Kate S. Gaudry and James Golladay

It is widely understood that the U.S. government has an interest in maintaining the secrecy of sensitive information, including capabilities and activities of the intelligence agencies and military departments.

But it may be surprising to learn that the government also has the authority to tell individuals that their own knowledge — even commercially valuable knowledge — must be kept secret.

The Invention Secrecy Act provides authority for keeping inventions secret if the publication or disclosure of the invention would be detrimental to national security. Unauthorized publication, disclosure or foreign filing of the subject matter of designated patent application can result in abandonment of the application and additionally subject the person publishing or disclosing the subject matter to penalties, which can include a fine of up to $10,000 or imprisonment for up to two years, or both.

These protections are implemented via "secrecy orders," issued by the commissioner of patents upon review of the patent application by the United States Patent and Trademark Office and other designated agencies. The secrecy orders

> "Overall, the data indicates that secrecy orders — particularly in recent years — are not commonly issued."

must typically be renewed each year, except during wartime or designated national emergency, and broadly apply to the subject matter of the invention, not just to the patent application itself. The orders restrict disclosure or publication of the invention in any form.

The secrecy order process typically follows one of two paths. The first path includes inventions known to be classified. The applicant is typically aware, prior to filing, that the application will be subjected to a secrecy order and is well versed in the proper procedures and expected outcomes.

The second, more surprising, path involves the government making an independent decision that the subject matter of an application should be subjected to secrecy order — even if it has no relation to the government or government funding. This involves an initial review by the office and a subsequent review by a designated agency. Data released by the USPTO suggests that between 2010-2014 about 80 applications from private applicants, with no government funding or affiliation, were subjected to secrecy orders. This is out of a total of over 560 new secrecy orders during that time.

An applicant can seek compensation from the department that caused the order to be issued. After a secrecy order is lifted, a patent can issue on the application — assuming other statutory criteria are satisfied — and the patentee can proceed with commercializing the invention.

This system is less than optimal in many situations. If an examiner maintains rejections of a particular application, prosecution fees will continue to accumulate, with no possibility of compensation and/or prospect of subsequent patent issuance. Further, continuing advances in technology may render an application eventually allowed to issue as a patent as being far less valuable than it would have been if a timely issuance would have occurred. The non-disclosure requirements can also hamstring necessary development, testing and financing for companies' inventions while such orders are in effect.

The owner of an application that has been placed under a secrecy order can pursue administrative appeals of the designation via petition through the USPTO or to the secretary of com-

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merce if the petition is denied.

Secrecy order petitioning processes are not well known to the average patent practitioner. An applicant may find it particularly challenging to find a qualified practitioner prepared to take on such administrative appeals.

To date, few empirical studies have focused on the use of secrecy orders. Are these applications — for which prosecution specifics are at least temporarily hidden from public review — less likely to overcome rejections?

After a request under the Freedom of Information Act to understand the prevalence and prosecution effects of secrecy orders was submitted, we first examined the number of applications from each fiscal filing year across the last half of a century. Less than 1,000 applications filed in each fiscal year are subjected to a secrecy order. Even in the years associated with the highest number of applications, these still account for less than 1 percent of the filed applications.

The number of patent applications subjected to secrecy orders peaked between the 1980s and early 1990s, with over 750 applications being designated secret.

Among the applications filed before fiscal year 2013, 60 percent were patented or had received a notice of allowability — indicating that the application would be allowed to issue as a patent but for the secrecy order.

Overall, the data indicates that secrecy orders — particularly in recent years — are not commonly issued. Further, prosecution statistics suggest that applications are not subjected to a stricter examination standard.

Secrecy order applications are more likely to remain in the pending limbo, and pending secrecy-order applications have lower office action counts as compared to other pending applications.
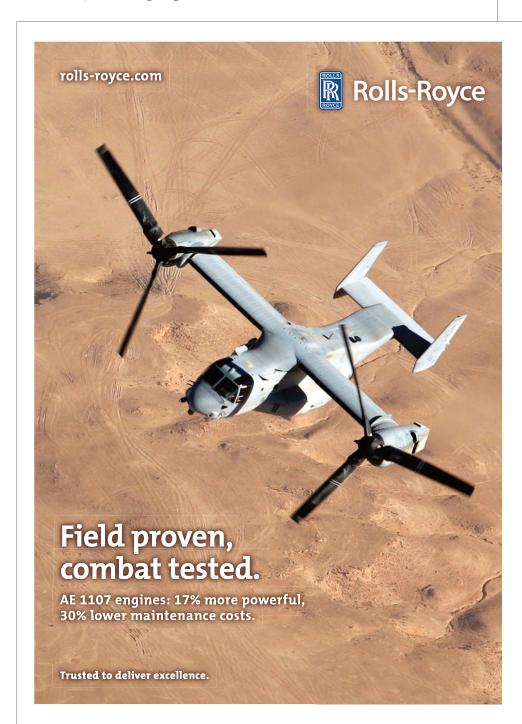
Despite indications that secrecy orders are rare and examination seemingly normal, the effect may still be dramatically negative. The non-disclosure requirement may impede business operation, as such secrecy may make it difficult to hire new employees, improve a company's innovations, conduct public testing and attract investors.

For example, Juliet Marine Systems is pursuing claims against the U.S. government in the Court of Federal Claims for these types of damages. The subject matter in Juliet's patents pertained to a specialized small waterplane and twin hull watercraft design. In this instance, secrecy orders had been applied to several of Juliet's patent applications for 15 months. All of the applications did end up issuing as patents within about five years of their initial filing. Nonetheless, Juliet argued that they still suffered significant harm, including stalling the development of their prototype, subsequent development of related technology and the growth of the company.

The likelihood of Juliet, or any similarly situated plaintiff, receiving reasonable compensation for such damages is questionable, at best. As noted by one observer, "calculating a figure that represents lost commercial gain due to obsolescence and inability to license an invention will be impossible to accurately and concretely quantify." This can be further complicated when trying to perform discovery related to proving damages in a maze of classified information. **ND**

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China Taking Steps to Make Aircraft Carrier Fully Operational

By Stew Magnuson

The Chinese navy, after running a series of arrested landing tests on its only aircraft carrier, is preparing to deploy it with an air wing aboard. In addition, up to two more flattops are under construction, the media has reported.

The carriers are part of a master plan to transform the nation from a "continental power" to a "maritime power," experts at a recent Heritage Foundation discussion said.

"China is more engaged in blue waters and will be more so as time goes on," said retired Adm. James Fallon, former Navy vice chief of operations and commander of U.S. Pacific Command.

China purchased an unfinished carrier from Ukraine in 1998 and — after many years of construction and outfitting the aircraft — commissioned it as the Liaoning in 2012. After sailing it and conducting a series of flight tests, it may go operational with a wing of Shenyang J-15 Flying Shark fighters as early as this year, according to Ronald O'Rourke, specialist in naval affairs at the Congressional Research Service.

The Liaoning is conventionally powered with a full-load displacement of 60,000 tons, and may accommodate a

mix of 30 to 36 fixed- and rotary-wing aircraft, O'Rourke wrote in a November report, "China Naval Modernization: Implications for U.S. Navy Capabilities."

There are many key differences between the Liaoning and its U.S. Nimitz-class counterparts. For one, it is not nuclear powered. And its aircraft, because they launch from a ramp rather than a catapult system, will not have a long range or be able to carry a heavy payload.

By comparison, the Nimitz-class carriers feature a 100,000 ton fully loaded displacement, can accommodate 60 plus aircraft and since they are nuclear fueled, have long cruising endurance, O'Rourke noted.

"Some observers have referred to the Liaoning as China's 'starter carrier,'" O'Rourke wrote.

Fallon said of the Liaoning: "It has got a very limited capability, but it looks good, sounds good, flies a big flag. They are going to steam it around and make the best of it, but the most important aspect of it is training their people on how to use this capability. Are they going to build more? Sure," he said.

How the nation intends to use the aircraft carrier is unknown.

The annual Defense Department report to Congress, "Military and Security Developments Involving the People's Republic of China: 2015," said, "The Liaoning is … best suited to fleet air defense missions, extending air cover over a fleet operating far from land-based coverage."

It "will likely continue to play a significant role in training China's carrier pilots, deck crews and developing tactics that will be used with later, more capable carriers," the report said.

Abraham Denmark, deputy assistant secretary of defense for East Asia, said in a speech at the foundation that China's rapid militarization continues with a large number of forces lined up against Taiwan.

"China is preparing for potential conflict in the Taiwan Strait as it remains the primary driver of military investments," he said.

But observers have noted that aircraft carriers would be of little use in a conflict with Taiwan. The island is well within range of airbases on the Chinese mainland.

Fallon said China's move into waters far from its homeland is natural for a nation aspiring to retake its place in the world order. In his conversations with Chinese leaders, they see the nation as a former global power, and the last two centuries — when it was controlled by foreign interests — as a momentary blip in its 5,000-year history.

"They are resuming, in their view, their rightful place," he said.

Plus, they are engaged in global trade.

"They have interests around the world. Their economic engine requires fuel. Their natural resources in the main are not coming from inside China," he said.

Seth Cropsey, director for the Center for American Seapower at the Hudson Institute, a Washington, D.C.-based think tank, said: "Although China's current aircraft carrier cannot match the capability of an American Nimitz-class — to say nothing of the Ford [class] — there is no reason to doubt that China is

The Liaoning aircraft carrier

capable of constructing a full-deck super carrier in the foreseeable future."

Press reports and satellite imagery available to the public suggests that China is at least building one more carrier, and possibly a second.

O'Rourke, citing Defense Department reports, said China is pursuing indigenous aircraft carrier production and "could build multiple aircraft carriers over the next 15 years."

The first Chinese-made carrier could be launched as early as this year, Peter W. Singer and Jeffrey Lin reported in Popular Science. Studying photos in open sources, the authors concluded that the next carrier being built is at the Dalian Shipyard and will also feature a "ski slope" launching system. They speculated that future Chinese carriers would feature a catapult launch system and be nuclear powered.

A Taiwanese government report leaked to the media said there was a third carrier being built in Shanghai.

Retired Adm. Arun Prakash, India's former chief of the Navy and chairman of the chiefs of staff, said his country did the same thing as China by buying a Russian second-hand carrier. The main difference is that India let Russia complete the modernization work.

"You have to give [the Chinese] credit for that. They undertook this fairly challenging task by themselves," he said.

"This is going to be a learning experience for them. Give them 10 or 15 years and they will probably get on top of it. The next carrier might be nuclear powered," Prakash said.

Retired Vice Adm. David Shackleton, former chief of the Australian Navy, said aircraft carriers can change the perception of how the world sees China. In 1907, the U.S. Navy sent 16 battle ships and all of its supporting elements around the world, which made a big change in the way outsiders saw America as a country.

"China is using its Navy in a similar manner," he said. Along with protecting its trade routes, the service is consciously professionalizing itself. Global deployments are difficult to do right and require new skills in logistics, intelligence and communication support that it doesn't have to have close to home, he said.

"A navy of global reach and power projection with abilities such as pos-

The J-15 Flying Shark fighter is based on the Russian Su-33 (above).

sessed by America, is not built overnight. It is a long and very difficult journey with many expensive lessons learned," Shackleton said.

"China wants to be taken seriously," he added. "And it particularly wants to be taken seriously by America."

The ship is only part of the equation, Prakash noted. The aircraft is the other. O'Rourke said the Liaoning demonstrated carrier-based landings with J-15 prototypes. The aircraft, allegedly reverse engineered from a Russian Su-33 carrier fighter without permission, has recently gone into serial production after about eight prototypes were used to conduct tests. While it has a combat radius of 750 miles when taking off from land, that is severely limited in carrier operations because the ramp system doesn't give the aircraft enough airspeed and lift. That also restricts the amount of munitions it can carry.

It features domestically produced engines, weapons, radar and avionics. The program began in 2006, and by 2009 China had its first prototype.

Prakash said: "They had to do something innovative and challenging and they seem to have succeeded."

Some of the aircraft's harshest critics have come from within China. A 2013 article in the Sina Military Network publication criticized the J-15 for not being able to carry the types of air-to-air munitions needed to go toe-to-toe with opposition aircraft, as first reported in Defense News. Its effective range without carrier-based aerial refueling is a mere 75 miles. It also doesn't have room for an electronic counter-measure pod. The SMN article called the Flying Shark a "flopping fish."

For these reasons, the Chinese are keenly interested in developing a catapult launching system, analysts said.

Shackleton pointed out that China is playing "the long game." It is rapidly boosting its Navy ship numbers and setting up a string of seaports from Asia to

East Africa.

Meanwhile, projections have the U.S. Navy reducing its ship numbers throughout the following decades. This is something the Chinese know well.

China "can take as much time as it wants to reach parity [with the U.S. Navy]," Shackleton said.

O'Rourke wrote that "aircraft carriers could be particularly valuable to China for projecting an image of China as a major world power, because aircraft carriers are viewed by many as symbols of major world power status."

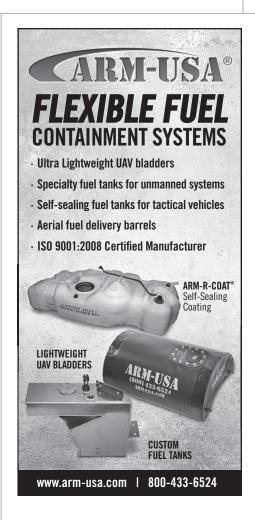What are China's intentions with its aircraft carriers?

"I'm not sure the Chinese know the answer to that question," Cropsey said.

There is more power in having additional hardware. The nation can have more diplomatic influence and an increased ability to shape events, he said.

"China views the last couple of hundred years as an aberration, and increasing its muscle at sea is one important form to try reversing that," he added.

"Exactly how it's going to be used, we'll wait and see," he said. ND

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YEVGENY PASHNIN

Defense Industry Developing Systems to Defeat Enemy Drones

By Yasmin Tadjdeh

Unmanned aircraft that were once owned exclusively by advanced militaries are now commercially available. Experts have warned that an unmanned aerial system flown by an adversary could easily have explosives or other hazardous payloads strapped onto them. But knocking out a potentially dangerous aircraft isn't always the best answer, especially if it is near bystanders, they said.

Experts and company executives envision a future where new technology employed by the military or government agencies could spot rogue or hostile drones, identify them and even commandeer or stop them mid-air.

For less than $500, hobbyists can easily purchase a UAV that has enough capability to do damage, said Doug Booth, director of business development for Lockheed Martin's cyber solutions division.

Group 1 drones — small systems that weigh less than 20 pounds — are readily available to the general public and can pack a punch if weaponized, he said.

"It can't carry real heavy payloads, but you're talking five to six pounds," he said. "It can fly for an hour or two depending on the battery or gas you put in it, and it may not have real high-end imagery payloads but it does have a significant camera capability."

Commercially available unmanned aerial systems could be used to collect intelligence, surveillance and reconnaissance information. Further, they could easily be used as an airborne improvised explosive device, he added.

"That's the threat that we're concerned about," he said. "Talking with customers, it is one of the highest threats, one of the highest concerns that they have right now."

There have been many high profile mishaps with drones, including when a UAV crashed in front of German Chancellor Angela Merkel in September or when a remotely piloted aircraft fell onto the lawn of the White House in early 2015, Booth said.
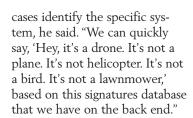
"What this says is … there's no means to control this platform. It's a Class 1. It's able to fly wherever it wants with payloads and there doesn't seem to be a great system to control … and defeat them," he said. That led Lockheed to begin developing Icarus about a year ago, he said.

The system can detect, identify and defeat Group 1 UAVs, he said. The package consists of three parts. The front-end component is a suite of sensors with radio frequency, acoustic and imagery detectors. "Those three sensors we believe are very capable to sense and detect that there is a drone in the area," Booth said.

Those sensors feed information to a database where radio frequency, acoustic and imagery signatures are stored. That enables the company to quickly detect a UAV and in some cases identify the specific system, he said. "We can quickly say, 'Hey, it's a drone. It's not a plane. It's not helicopter. It's not a bird. It's not a lawnmower,' based on this signatures database that we have on the back end."

The last component is a cyber, non-kinetic payload that can "defeat" the UAV, he said. The system can "drop the unit out of the sky," disable some onboard payloads such as cameras or it can take control of the system.

"If something is flying in … a crowded area where there are a lot of people, you may not want to just drop it right there because it could still cause harm," he said. "Probably what you want to do is take control of it and fly it to a safe area, like maybe a bomb box."

Icarus is a ground-based system that can be mounted around a perimeter or fastened onto a vehicle. It has also been tested on Lockheed Martin-built UAVs but the acoustic sensor's capability can be degraded in such a scenario.

"It doesn't always work well. You might have some interference from an acoustics perspective, because a UAV is also noisy itself," he said. "If you're talking about drone-on-drone type of combat you may not want to use that sensor."

Lockheed decided to invest in non-kinetic, counter-UAV technology after talks with U.S. military officials, Booth said. They described such technology as a priority.

Peter Singer, a strategist and senior fellow who focuses on

Icarus

robotics at the New America Foundation, a Washington, D.C. think tank, said at least 86 countries have UAV capabilities.

"The once virtual monopoly that the U.S. had on drones is long gone," he said. "You have a wide variety of non-state actors that have shown off the capability from ISIS to Hezbollah. Indeed, the Iraq/Syria war is interesting in that every single one of the conflict actors — whether it's the U.S. to the Syrian government to ISIS — have all flown drones at some point."

In this new landscape, the military and industry are seeking a variety of ways to counter the threat, he said.

Battelle recently showed off its DroneDefender system that can stop a UAV.

"The DroneDefender is a man-portable, lightweight, very easy to operate … non-kinetic, counter-UAS … solution for

the challenge that many of our government agencies are facing with the prolific commercial drone market increasing," said Dan Stamm, project lead for DroneDefender.

The system works by disrupting the control link between a remotely located pilot and the UAV.

"It basically makes the drone think that it has gone out of range from the pilot, and so the drone enters into a standard safety protocol," he said. These protocols can either make the system hover in place, land "gracefully" or return to its operator. It doesn't cause any permanent damage to the system, he added.

Alex Morrow, technical director for DroneDefender, said the system cannot commandeer the drone and cannot choose which three safety protocols it will apply. "That's completely up to the manufacturer of the drone and the drone pilot."

While other systems, like Icarus, can control a UAV, DroneDefender engineers purposely avoided that aspect, Stamm said.

"We are aware of some alternatives and are considering how we might include those in future development options, but that is something we have purposely stayed away from," he said. "We see that as a reasonably high level of added complexity … and the goal for our system is to make it light, very low complexity, very low level of training required and very inexpensive relative to competing systems."

No price data has been released yet, but Battelle is trying to keep the system inexpensive to match the low cost of many Group 1 unmanned aircraft, Stamm said.

DroneDefender is targeted toward federal agencies and the military. The general public cannot operate it without a license from the Federal Communications Commission. So far, demonstrations of the system have been conducted by federal agencies on federal property.

Kelley Sayler, an associate fellow at the Center for a New American Security, a Washington, D.C. think tank, said the U.S. military's work with non-kinetic systems is still in its infancy.

The military is just beginning to think about how it can "defend against drones and the threats posed by drones," she said. "I think definitely the military is looking at non-kinetic systems … disrupting the communication links with the operator, targeting GPS."

The non-kinetic option is "preferable particularly when you're thinking about civilian environments where there are a lot of civilians around [and] you don't want parts flying off of a drone," Sayler said.

Additionally, preserving the system would help during an investigation to see who the system belonged to, she said.

However, non-kinetic solutions won't be the best option for every scenario, she said. They wouldn't be effective against a system that is switching from direct line of sight communications with an operator to inertial navigation. Inertial navigation is when all sensors are on board the system and it isn't communicating externally, she explained.

"That's going to be a real challenge in the future," she said. "If you're looking at a non-kinetic option like signals jamming, GPS jamming, it's just not going to be effective."

Most hobbyists' drones use GPS navigation or direct line of sight communications, but systems that are built by hand or tinkered with could use gyroscopes or other forms of inertial navigation.

"It's not something you're going to be able to use for the entire flight of the drone — you would still need a communications link — but it is something that you could switch over to for … the last minute of the flight or so and the drone will drift some from the initial destination. … But if it's not extremely important to have precision in that flight, it's definitely still an option," she said.

Singer said it still remains to be seen if non-kinetic options will take off. More demonstrations are needed.

"Can you get the same capability from a 50-caliber machine gun?" he asked. "We will see a wide mix of high-tech and low-tech responses to this." **ND**

DroneDefender

Navy's Long-Endurance Underwater Drone to Begin Deep-Ocean Navigation

By Yasmin Tadjdeh

The Office of Naval Research's long-endurance unmanned underwater vehicle will soon begin deep-ocean navigation testing, according to the head of the office.

The large-displacement unmanned undersea vehicle, also known as the LDUUV, will embark on deep-ocean navigation testing — which is measured as traversing 900 to 1,100 nautical miles autonomously — as early as this spring, said Rear Adm. Mathias Winter, chief of ONR.

"We're really excited about LDUUV," he said at a recent conference hosted by the Association for Unmanned Vehicle Systems International.

The system has been in the works for years. It is being designed as an underwater vehicle that can travel across oceans for long periods of time without refueling.

Unmanned underwater vehicle development is a budding area of research, Secretary of the Navy Ray Mabus recently said. Finding ways to increase the endurance of such systems is of particular concern, he noted.

"Our UUVs need to be able to stay out for months at a time allowing them to observe large areas for a long period [of time] without interruption and without degradation," he said.

Mabus pointed to ONR's large-displacement unmanned undersea vehicle as one example of work the service is doing in endurance.

Winter said: LDUUV has "been a phenomenal exploration and experimentation bed that has allowed us to focus on advances of power and energy, of reliability and of autonomy and autonomous maneuvering."

ONR wants the system to be able to operate underwater for decades, he said. "Persistence is absolutely key and that persistence is about being able to stay where you need to be when you need to be there," he said.

Besides deep-ocean testing, LDUUV's next milestone is the integration of new sensors and payloads.

The Navy plans to deploy LDUUVs from a dedicated unmanned under-sea vehicle squadron on an independent mission no later than 2020, Mabus said.

Simply put, UUVs can be thought of as USB sticks, Winter said. They are merely platforms that can have payloads attached to them.

"We put a very large majority of our focus … [on] that USB stick maneuverability — the autonomy of it, the reliability of it, and the power and energy to ensure that the persistence of our UUVs are being tamed," he said.

Besides LDUUV, the Office of Naval Research is working on other systems such as the Ghost Swimmer, a stealthy autonomous underwater vehicle that resembles a fish that can be used for intelligence, surveillance and reconnaissance missions, clandestine sensor positioning and as a communication relay in denied areas.
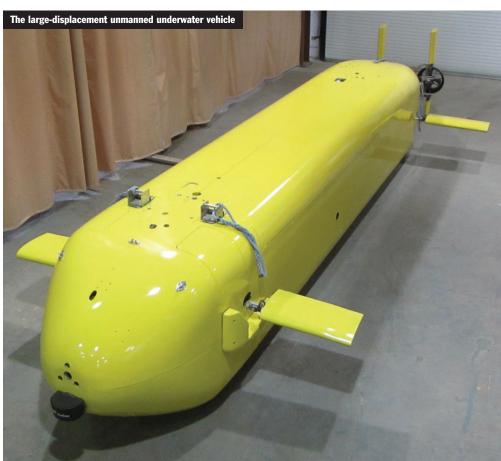
"Our Naval Research laboratory scientists studied the maneuvering and the lifestyles and the capabilities of fish," he said. "We were able to transition that … [into a] USB stick that … maneuvers, operates and sounds like nature."

While scientists have tried to create systems that emulate fish before, ONR's Ghost Swimmer is a "breakthrough" because of the work its engineers did in basic, applied and advanced material research, and new molecules and structures that were used to withstand pressures on the system's hull, Winter said.

The vehicle — which has affectionately been called "Silent Nemo" — can operate at 2 knots for 25 nautical miles while carrying 40 pounds of payload and still sound natural, he said. It is currently in the fleet undergoing tests with sailors. "We're learning from them as we always do," he said.

Mabus said the Navy also wants systems that can be used in multiple domains. During his remarks at the AUVSI conference, the secretary showed off a quadcopter known as the Kraken, a reference to the mythical sea monster that terrified sailors centuries

The large-displacement unmanned underwater vehicle

ago. The system, which is low-cost and 3D-printed, can lurk underwater for long periods of time and then "pop up" when instructed to do so, he said. "It's pretty cool," he added.

Bryan Clark, a senior fellow at the Center for Strategic and Budgetary Assessments, a Washington, D.C.-based think tank, said unmanned undersea vehicles will be "really important to the future of undersea warfare."

"You're going to see an enormous upsurge in interest on the part of militaries and industrial users, commercial users that are looking for resources underwater or protecting infrastructure they've developed underwater," he said.

Industry is at the cusp of a new generation of systems that will have increased power and propulsion technology, he added.

Some systems "are just now making it through the science and technology [phase] that I think are going to offer the ability to have very small drones with very long endurance, and they're relatively cheap," he said. There are a few companies that are developing small systems that have the ability to traverse hundreds of miles of ocean and cost less than $10,000, he said.

If industry can continue to develop less expensive and more advanced systems, that will bode well for their increased utility in the military and commercial sectors, he said. Commercial companies will be keen to use the systems to monitor their coastal or deep-sea infrastructure, he said.

On the military side, the systems will be used for increased surveillance purposes, he noted.

"Now you're seeing the UUVs being introduced into more mainstream Navy operations undersea, so submarines are deploying UUVs and now recovering UUVs to go act as an augmentation to their sensors," he said.

Unmanned underwater vehicles have, as of late, largely been used for surveying the underwater environment, Clark said. But soon they will take on a larger role and be able to track and hunt enemy submarines, he said.

"They can't attack them, but they can track and monitor submarine operations and then even send communications back to a home office when they find something," he said. "You can use that as a trip wire if you will."

The next step will be arming UUVs,

he said. They could be placed at "chokepoints" on the ocean floor, scan for enemy subs and shoot them. These types of systems are a few years away, he said.

In "maybe five years, you're going to have some of these systems at least be available in a prototype form," he said. "You're going to have the ability to have payloads that you can put on the bottom [of the sea] that could have a missile on them if you wanted to … or have the ability for them to engage military targets like ships and submarines either autonomously or with some kind of person in the loop."

The underwater drone would be able to report back to a user for authorization before launching a strike, he said. This would be aided by the improvement of underwater communications, Clark said.

UUVs can send data via acoustic signals for long distance communications or light for shorter distances, he said. "You can create a network of communications where your long-haul communications are acoustic, your short-haul communications are light-based and then you have got getaways to RF [radio frequency] buoys or via a ship," he said.

Because radio frequency signals cannot be used undersea, communication systems below the surface of the ocean will never be as fast as those in the air, he said.

"It's slower than air warfare, so it's not like in air combat where you've got seconds literally to make a decision as whether to shoot or not. Here would be, you've got minutes to make that decision, maybe tens of minutes," he said.

Peter W. Singer, a strategist and senior fellow at the New America Foundation, a Washington, D.C. think tank, said UUVs will be a critical part of undersea warfare in the future, but there are still obstacles.

Acquisition will be one issue, he noted. "It's a classic story of how do you move projects from science experiments and prototypes and making them actual programs of records," he said. "We're not there yet."

"It's not just about what can the technology do, it's acceptance within that military organization, the culture that

The Ghost Swimmer

plays in it," he said. "So far, much like in the air, unmanned systems have been viewed as a supplement to manned systems — it's something the manned system can bring into battle potentially, not as a replacement — and when it starts to become a replacement that's when you start to get the controversy."

Despite some obstacles still in the way of development, scientists are pursuing a number of different technologies, he said. The size, shape and form of UUVs are diversifying. Some are employing new power technologies, which feed off tidal forces or energy differentials on the ocean floor, he said.

Military strategists are also thinking of new ways to use the systems, including employing them in swarms — a concept where many small, inexpensive systems can overpower one large, sophisticated target, he said.

Over the past year, the Navy has put a spotlight on the development of its unmanned systems. Mabus said in late October that such technology will play a large role in future service operations. "As we look to the future, unmanned systems will continue to be a viable and growing area of our military and our capabilities," he said.

In 2015 Mabus announced the creation of a deputy assistant secretary position for unmanned systems as well as a new directorate within the office of the chief of naval operations for such systems.

"The change to the organization is a reflection of the priority that we're placing on this emerging capability and how critical it is that we have cohesive leadership for unmanned programs," Mabus said. **ND**

Email your comments to ytadjdeh@ndia.org

Army to Integrate Ground Robots Into Forces

By Stew Magnuson

After years of using rapidly fielded, but temporary ground robots in its forces, the Army will soon roll out plans to make them a permanent part of its arsenal.

That not only includes small, tele-operated robots that have been used for reconnaissance, bomb disposal and a variety of other tasks, but making current vehicle fleets autonomous, said Paul Rogers, director of the Army Tank Automotive Research Development and Engineering Center.

The Army Training and Doctrine Command is working on the requirements documents while TARDEC is producing a technology roadmap. The two efforts will be completed within the first few months of 2016, he said at an Association for Unmanned Vehicle Systems International conference.

"I think you will see that we are laying out a continuum on how to get from promising technology to fielded capability. We are doing it in an informed way and a way that will hopefully shape how we are going to use technology in the future," Rogers said.

The ultimate goal is to deploy systems that give soldiers an advantage on the battlefield, he said.

"We are looking for disruptive advantages or differential advantages. We are not looking to field ground robots," he added.

Army thinkers believe that autonomy and robots can give troops these advantages in the field. There is an average of three service members supporting each soldier that is fighting on the battlefield. "If we can leverage autonomy and autonomy can fulfill the promise that we think it does, maybe we can reduce that ratio," Rogers said.

The TARDEC and TRADOC documents will serve as a roadmap and provide requirements across all domains, he said. These domains include communications, space, cyber and air. They all have crucial roles to play if ground robots are to be successful, he said.

"Just leaving it at the ground domain is short sighted," he said. Space and communications are vital for linking to robots. Cyber security must be built in to ensure adversaries can't interfere with the vehicles. Air assets will be needed for coordinating aviation and ground robot teaming, he added.

Scott Davis, program executive officer for combat support and combat service support, said the Army in the near term will be kicking off programs for three ground robot systems, a common controller and appliqués that can be added to existing vehicles to provide various levels of autonomy.

As far as autonomous vehicles, the Army will start with tactical wheeled vehicles used for moving supplies.

The first effort will be "driver assist" features found in many consumer cars today such as indicators that tell drivers when there is another vehicle in blind spots. TARDEC is currently doing market research to inform it about the state of the art in commercial vehicles, Davis said.

The next level might be drive-by-wire features where the operator can take his hands off the wheel during long stretches then take over again during difficult maneuvers such as backing up, or in challenging environments like congested cities, he said.

After that would come leader-follower concepts where the first truck in a convoy has a driver and the others behind it are unmanned.

Possibly 30 years down the road, the goal would be to have complete end-to-end autonomy where trucks are loaded and unloaded by robots at ports and the convoys travel without any humans in the vehicles, Davis said.

The appliqués would feature open standards so new software and autonomy can be added to existing systems in an evolutionary fashion, Davis said.

The appliqués could also go on fighting vehicles and tanks. An unmanned robotic wingman would accompany other manned vehicles in a battle formation. That doesn't mean tanks firing autonomously, he noted. Defense Department policy remains in place that a human must make the decision to fire weapons.

Rogers said: "Give me a vehicle that can be tele-operated at 60 miles per hour over very complex terrain with a stabilized weapons system, and I will show you a differential advantage."

TARDEC recently conducted an experiment attempting such a feat, but found that it couldn't be done digitally because of latency issues. The connection speeds weren't fast enough. Digital cameras were swapped out with analog systems, which worked much better, he added.

Robotic vehicles operating in "complex terrain" has been an issue. TARDEC has successfully demonstrated driverless trucks and leader-follower appliqués on flat, smooth roads going back almost a decade, he said. The problem is that the roads the Army must traverse aren't always in good shape.

Lt. Col. Cory Berg, product manager for appliqué and large unmanned ground systems at PEO combat support and combat service support, said the first round of driver assist software is just "the appetizer to the main course, which is autonomous convoy operations."

The Army will hold an industry day sometime in the first few months of 2016 to talk about its requirements. Unlike most PowerPoint laden industry days, his office will be bringing a heavy expanded mobility tactical truck so participants can see what they will have to insert their appliqué kits into, he said.

Davis said that TARDEC must walk a fine line when it comes to writing robotic and autonomy requirements. The idea is to not be too specific, keeping it to what the Army wants to achieve and in what kind of environments.

"It takes a very long time to get through the [acquisition] process. ... Meanwhile, new technologies may come along that fit and can be incorporated," Davis said. Engineering change proposals do allow them to add innovative technologies that come along in the rapidly advancing field of robotics.

The program executive office has also begun a "robotic enhancement program," which allows it to purchase new technologies from robot makers and try them out in operational environments. The purpose isn't necessarily to ultimately buy new equipment, but to let the Army know the state of the art so it can inform the requirements process. It is based on the soldier enhancement program administered by PEO soldier.

Companies twice per year can submit

An autonomous convoy demonstration.

proposals. A council of colonels vets them and chooses which technologies are of interest. Six were chosen in the program's first round and they will be undergoing operational tests this year.

"Having something like that is going to be critically important for us to stay on top of the latest technology," Davis said.

The Army is also kicking off three new programs next year, including two robotic systems for mounted and dismounted troops, and a squad mission support vehicle later in the decade, Davis said.

The man-transportable robotic system mark II is envisioned for explosive ordnance disposal and other missions and can be transported in a tactical wheeled vehicle. The Army will release a request for proposals in the second quarter of 2016, he said.

An RFP for common robotic system-individual for dismounted troops will come in the first quarter of 2017. It should weigh less than 25 pounds, which includes the controller, he said.

The Army is also looking to field a common controller for these robots and small unmanned aerial vehicles used at lower echelons. Weight is the biggest physical challenge to creating it, he said. It must have an open architecture in order to link to several kinds of robotic systems and robust security to ensure that they don't fall prey to hackers.

This isn't the first time the Army has attempted to field a common controller, he noted.

"We've tried it a couple of times. It has always been a big challenge," Davis said.

The Army is also moving out on a small vehicle, the squad mission equipment transport, which is designed to carry equipment for dismounted troops in rough terrain. Davis said it will probably come in two or three sizes. TRADOC is working on the requirements, with an engineering, manufacturing and development phase beginning about 2019 and lasting three years. They would be either tele-operated or fully autonomous. The Marine Corps is pursuing a similar system.

The Army has conducted a series of six exercises at Fort Benning, Georgia, and Fort Bliss, Texas, using squad mission equipment transport robots from six vendors to evaluate their capabilities.

Kent Massey, director of advanced programs at robot maker HDT Global, said such systems are ideal for light infantry who are expected to accomplish a 12-mile march in about three hours. A rifle company will just about fill up a C-17, which may have to land near an objective without bringing along light tactical wheeled vehicles.

The soldiers are carrying 100 pounds "and that really doesn't work," he said.

Squad multi-purpose equipment transport robots could fit into the transport aircraft and allow the soldiers to arrive at their objective without being exhausted from the hike.

Two of the experimental vehicles can carry 72 hours worth of water, food and ammunition along with rucksacks for one platoon. It can also have room to spare for some exportable power and a radio. Additionally, they can also carry direct or indirect fire systems as well as perform casualty evacuation, he said.

But the systems are far from ready. Massey showed a series of photos of broken or tipped over robots at the experiments. "Tele-operated vehicles have a nasty habit of rolling over," he said.

As the experiments took on increasingly rougher terrain, half of the vendors' robots broke down and had to be towed back, he said. Suspensions, axels and pivot points snapped.

There are no "specifications" that can adequately address these kinds of conditions, and soldiers will inevitably overload the vehicles, he noted.

"If we as an industry design these robots to the requirements, we will fail. The robots will fail in the field. They have to be so much stronger," he said.

Tele-operated squad support robots tend to roll over because it is hard for the soldier to get a feel of where he is going.

Autonomy will be key in making these systems work, Massey said. As will be the noise factor. Some systems are louder than others, which is a problem when soldiers want to be stealthy. They prefer tracked vehicles for better mobility, but they are noisier, he added.

Despite these problems, such vehicles check off a lot of boxes for expeditionary, light infantry units. It gives them better range, endurance and lethality, he said. **ND**

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Special Operations Equipment Plugs Into The Digital Revolution

By Sandra I. Erwin

U.S. Air Force elite forces known as "special tactics airmen" will be going to war with a modern suite of portable electronics, including a newly developed system that guides fighter jets to enemy targets.

Devices and mobile apps that have been years in the making are being tested and could be ready for field use in the coming months, said officials from the U.S. Air Force Special Operations Command, based at Hurlburt Field, Florida.

AFSOC expects to deploy four new pieces of equipment as part of the "battlefield air operations" kit program — a smaller and more advanced tactical computer, a miniaturized weather sensor, a digital close-air support system and a wearable antenna for covert communications.

The systems are part of what AFSOC calls the "battlefield airman kit."

The United States has a force of about 1,000 battlefield airmen. They are a mix of special operators but also conventional Air Force tactical air controllers — who deploy with ground forces to help identify targets — and personnel recovery "pararescue" troops. AFSOC's ground-warfare airmen are called "special tactics airmen."

The upcoming additions to the airman kit are part of a broader effort that started in 2005. A fratricide incident in 2001 compelled then-Secretary of the Air Force James Roche to set up a dedicated program office to develop digital close-air support technology for combat controllers and tactical air control party airmen who serve as the pilot's eyes and ears.

The military describes this technology as "machine-to-machine" data exchange between joint tactical controllers on the ground and strike aircraft flying over target areas.

The new systems are smaller, lighter and more commercial-like than the existing gear, officials said.

A wearable computer called the Android tactical assault kit that already has been fielded to AFSOC units displays moving maps, and overlays the

Android tactical assault kit screenshot

positions of friendly forces.

A more complex system that is derived from commercial technology but customized for military use is the modernized "digitally aided strike suite." The tablet computer has cutting edge software to translate different radio message formats used by ground and air crews. Officials tout this system as a potential breakthrough that could help prevent friendly fire. Instead of the operator having to make radio calls and transmit coordinates, the wearable device does it digitally.

"This was developed by our special products office," Capt. Gabriel Brown, chief of battlefield airmen requirements, told National Defense in a recent interview.

The technology in this market has moved fast, he said. "Instead of having lengthy communications with aircraft, we can get the target information blasted off so it can be digested, and as soon as aircraft gets overhead they can begin striking."

In the past, operators on the ground used radios to pass "nine line" briefs with target coordinates by voice to the cockpit. The digital system eliminates errors from manual keyboarding. This is "first of its kind, leading edge technology," Brown said. "The guy on the ground has a small wearable device to transmit information to aircraft," he said. Prototypes delivered in recent months were used in exercises with NATO allies and cleared initial tests, he said. "It was able to pass a series of message formats near flawlessly to other nations' aircraft and our own U.S. platforms."

The system can be set up in various modes depending on the rules of engagement, "so the right people can help make the decision to strike," Brown noted. The data can be programmed so it's screened by a command center if the rules of engagement require validation of the target by higher authorities.

Digital close-air support systems have been around for years, but the latest generation is technologically leaps ahead in terms of size, computing power and operator usability, Brown said. "In the past, systems were larger, heavier, bulkier, with

AIR FORCE

A U.S. Air Force combat controller

too many buttons to push and too many cables. They were vehicle mounted, whereas now they are backpack size." With small but powerful tablet computers and targeting optics, "We can wrap this together and get very accurate coordinates. We're somewhere we haven't been before."

The upgraded targeting technology is being introduced at a time of growing concerns in the Air Force at large about conducting air strikes over confusing battlefields. The ongoing air campaign against the Islamic State in Iraq and Syria has tested the capabilities of ground controllers, said Air Force Gen. Herbert J. "Hawk" Carlisle, commander of Air Combat Command. "Our battlefield airmen and their ability to get better at targeting" are essential to the success of the war against ISIL, Carlisle said last month during a meeting with reporters in Washington, D.C.

"We are looking to get much better at targeting to minimize collateral damage," Carlisle said. "Our ability to get the intelligence, get the appropriate targets" has improved, he added. The trend is moving toward "machine-to-machine" systems to take advantage of "all the information we get from all the platforms," he said.

Along with the new digital close-air support tablets, battlefield airmen will have handheld Link 16 radios which are smaller versions of the digital radios that are widely used to transfer targeting information into a readily available aircraft architecture. "That's a key point of where we are in the cutting edge of technology," said Brown. Kits that used to weigh 150 to 200 pounds and drew heavy power have shrunk considerably and will ease the logistics burden. "We do a lot of dismounted operations," he said. "We need reduced size, weight and power on all our equipment."

Battlefield airmen are trained to carry from 65 pounds to 100 pounds on their backs during deployments. With the new gear, their packs would be slimmed

Battlefield Airmen Technology

Toughpad FZ-M1 tablet with M2M software suite

SADL radio (MicroLight shown)

Tactical ROVER-e & Tactical ROVER-p

Secure GPS (SAASM)

PLRF15C Pocket range finder

PRC-152A radio

U.S. SPECIAL OPERATIONS COMMAND SPECIAL TACTICS AIRMEN CAREER FIELDS

- Air Liaison Officer
- Combat Rescue Officer
- Special Tactics Officer
- Enlisted Combat Controller
- Enlisted Tactical Air Control Party
- Enlisted Pararescue
- Enlisted Special Operations Weather Team

down to 50 pounds. These units typically deploy in small teams, along with other special operations units such as Army Green Berets and Navy SEALs.

AFSOC operators are especially enthusiastic about the soon-to-be-fielded micro-weather sensor that weighs just 3.5 pounds, compared to current gear that approaches 100 pounds. The device could be especially handy for pilots who fly in mountainous areas like Afghanistan where there are no weather stations.

The solar-powered sensors are made by Physical Optics Corp., in Torrance, California.

"The company is leaning forward and spending their own dollars to set up the manufacturing, banking on the prospect of a successful user operational assessment," said Brown. Users are impressed by how small this system is compared to the current one. "It does everything that the larger weather system does."

U.S. special operations forces are known for acquiring systems faster and more efficiently than the larger military services. The battlefield airman program, though, has to follow the procurement rules just like any other, Brown said. "Some pieces move slower than others."

Now that wearable computers are becoming more mainstream in the force, AFSOC wants to continue to develop new apps, said Ray Heath, battlefield airmen senior program analyst. An Android tactical survey kit, for instance, is being tested as a tool to help assess a drop-zone or landing area. "We are also looking at apps for jumpmasters to determine the best location to land," Heath said. Weather crews have requested an "avalanche calculation" app.

AFSOC soon will start deliveries of a wearable antenna that will be embedded into the backpack fabric. This would eliminate protruding radio antennas that make easy targets for enemy snipers. Another version of the antenna was integrated in the waistband of the body armor. An upcoming military utility assessment will test them head to head against regular antennas. If they work as promised, they may be adopted more widely across U.S. Special Operations Command, officials said. The goal is not to replace conventional antennas but to supplement them.

Wearable antennas in the past have been rejected by users for being cumbersome and prone to cable snagging. The latest models are stealthier, Heath said. "Users think it's a good idea to have low visibility. They had concerns about where the antenna is placed and how it will affect the human performance." **ND**

Email your comments to serwin@ndia.org

Affordable Surveillance a Priority for Special Operations

By Allyson Versprille

U.S. Special Operations Command is looking to add more affordable surveillance, intelligence and reconnaissance systems to its inventory, the head of acquisition and procurement said.

"Affordable ISR is a need," said James Geurts during a National Defense Industrial Association breakfast. "We've got great ISR, but the demand always outpaces the capability," and the platforms can be expensive.

The unit cost for an MQ-9 Reaper armed surveillance drone is $64.2 million in fiscal year 2006 dollars. A unit includes four aircraft, sensors, ground control stations and communication systems, according to an Air Force fact sheet.

The current approach to unmanned aerial systems is not scalable over the long term when it comes to affordability, he later told National Defense in an interview. "We have many more sensing requirements than we could ever afford to put large, very exquisitely capable [unmanned aerial systems] against."

The command is looking for a full range of capabilities, from simple to sophisticated, that would allow the special operator to apply the right tool to the right mission in a more affordable way, Geurts said. "I envision the full range from something you can put in your hand or your pocket, something you can put in your backpack, something you can put in the trunk of your vehicle, something that" needs a runway.

Everything is being considered — from a macro-sized unmanned aerial vehicle weighing 20 pounds or less, up to an MQ-9 sized capability, which weighs 4,900 pounds without a payload, he said.

Part of the command's ISR strategy is to continue to drive down the price of large systems while looking for more readily producible, easier to operate platforms that would enable special operations forces to put more sensors on the battlefield and work better with allies, Geurts said. U.S. relations with international partners have become increasingly important in dealing with threats posed by adversaries and terrorist groups like the Islamic State.

There are other advantages to using less expensive systems, he said. They "could be quieter. They could be more discreet. They could operate in smaller

TERN concept art

spaces — all those would address challenges we may have with just a fleet of large, very exquisitely capable, but not always as flexible" systems.

A need that goes hand-in-hand with wider use of small unmanned aerial systems is sensor miniaturization, Geurts said. "There are a number of existing smaller UAS out there so we're also looking at how do I miniaturize sensors, how do I continue to push towards MQ-9-like capabilities on smaller platforms?"

Another challenge with sensors is that many come with the UAV built around them as opposed to having platforms with "plug-and-play" architectures that can be altered by adding or removing

them, he said. "Modularity, miniaturization [and] plug-and-play architectures allow us to more affordably tailor the payloads on the aircraft for the mission we have as opposed to buying a different aircraft for every different sensing mission."

Modularity in these systems is also important because it enables special operations forces to work in a multitude of environments, he added. They are "widely deployed in countries all over the world and environments all over the world, so we've got to make sure our capabilities can be useful in tropical canopy jungles, in wide maritime environments, all the way up to Arctic environments."

Systems that SOCOM builds need to be flexible, adaptable and proficient. "If I can have some aircraft in a variety of sizes, from handheld to the larger MQ-9 and higher, and I can transition sensors in there as I need for the mission, now that becomes scalable, affordable," Geurts said.

However, the platform itself is not the only way that SOCOM is looking to save money. "I'm looking at affordability from a couple different directions," the acquisition chief said. "One is certainly budget affordability, but there's also affordability in how much infrastructure does it take to operate and how many people have to operate it."

Determining the best way to process and analyze data once it comes off ISR platforms is a huge cost driver that many observers forget about, Geurts said. Manpower has a significant price tag, and SOCOM is looking at how a machine can perform automatic processing duties to reduce the workload on service members, he said.

Gen. Herbert "Hawk" Carlisle, commander of Air Combat Command, said the question of how to use data that is off boarded from unmanned aerial systems is the greatest ISR problem, not affordability. "The biggest challenge we face is how much data we get off the

systems," he said. "How do we get all of that information … even from the platforms that are not designated primarily ISR but have great ISR capabilities" such as the F-22 and the F-35?

The military needs to more effectively take advantage of the abundance of data and find smarter ways to sift through it, he noted. "How much of it falls to the cutting room floor that we never get a chance to look at because there's so much of it?"

Another key problem is determining how to best share that information with allies, Carlisle noted. "In many cases, it's a question of how do you take the data you get and make it available at a classification level that they can use and is of value to them."

Special operations forces are looking for solutions to these problems in military labs.

Pamela Melroy, deputy director of the tactical technology office at the Defense Advanced Research Projects Agency, said the lab's tactically exploited reconnaissance node (TERN) program could address the growing need for more affordable intelligence, surveillance and reconnaissance.

"We really think that TERN, because … you don't need a forward operating base, is incredibly powerful in that area," Melroy said at an Association for Unmanned Vehicle Systems International conference.

The objective for TERN, which is a joint effort between DARPA and the Office of Naval Research, is to develop a medium-altitude, long-endurance unmanned aerial system that can launch off the decks of small vessels such as littoral combat ships or guided missile destroyers, Melroy said.

The agency envisions TERN being used to provide persistent surveillance from any ship anywhere in the world.

"It allows us to extend our ISR capability over a much greater percentage of the world without worrying about forward operating bases," which come with their own set of challenges, Melroy said.

The program is entering its third and final phase. In the previous phase, two companies — Northrop Grumman and AeroVironment — were awarded $19 million contracts. In September 2015, AeroVironment announced that it had not been selected for a phase three contract. As of press time, DARPA had not confirmed that Northrop was the

winner of the contract, which would require the company to build a full-scale demonstrator. A DARPA spokesperson said the agency anticipates a contract announcement in early 2016, if not sooner.

Melroy said affordable ISR is not just a special operations requirement but is a need across all four services.

Affordable intelligence, surveillance and reconnaissance becomes more important as the military enters new battle spaces, she said. "I think especially in denied areas, it's incredibly important."

The Air Force Research Laboratory is also addressing this need. The programs it has in place are meant to make ISR operations "more agile, affordable and responsive in a changing environment," said William Baldygo, ISR deputy capability lead for the lab's sensors directorate.

The "agile manufacturing for ISR" program is developing a sensor pod for aircraft called "AgilePod." It "is being designed and built using new techniques to save costs, and its reconfigurable design allows for more flexible and efficient use by potentially mounting several sensors in one pod," he said in an email. In production this unit would be expected to cost about 30 percent less than a traditional pod, he added.

AgilePod is currently being built and an initial flight demonstration is planned for 2016, Baldygo said. "The potential benefits to the warfighter include improved readiness of equipment, faster turnaround time leading to a higher sortie rate and additional multi-INT [multi-intelligence] ISR collection due to the multiple sensor capability."

The "low cost attritable airframe technologies" program is a separate project investigating the use of small drones as ISR assets. While the aircraft "is intended to be reusable, the main design feature is that it should be cheap enough so that it would not be a major blow if one were lost," he said. The challenge for the program is achieving higher performance in these smaller, low-cost systems while still maintaining affordability, he noted. "This kind of aircraft would be extremely useful for intelligence collection in hostile or potentially hostile airspace."

To address the challenge of maximizing the information that is off boarded

by UAVs — an issue raised by both Carlisle and Geurts — the laboratory created an experimental program with a three-step process for identifying emerging concepts and technologies related to intelligence exploitation, according to Baldygo.

Program personnel first collect data on current user practices and identify areas for improvement, develop capabilities to fill the gaps, and then evaluate the new technology in real-world scenarios. The process "can prevent wasted time and effort on projects that are not ready yet or that the warfighter does not need," he said. "It is also possible to find fairly low-cost solutions and make sure that they are widely used."

In addition to the service labs, SOCOM is asking private companies to develop solutions to address this requirement. "We're doing a number of CRADAS — cooperative R&D agreements — which allows an industry partner who's working on a potential sensor or element of this to bring it to us early in their development cycle," Geurts said. It is one of the best ways to work with those companies, he added. "We get to see something early in the process and provide our feedback, [and] the industry partner gets to get our feedback early in the design so they can take that into consideration as they mature their product to bring it to market."

SOCOM currently has an agreement in place with Draper Laboratory, a nonprofit research-and-development company. "In an effort to capitalize on existing size, weight and power for unmanned aerial systems, Draper worked with SOCOM to help determine the art of the possible by conducting an evaluation on potential solutions" for drone imaging devices, said Navy Lt. Cmdr. Matthew Allen, a spokesperson for the command.

Draper was provided with information regarding technical challenges associated with smaller UAVs and the operational uses for those systems on the battlefield.

"These exchanges under the CRADA led to SOCOM investment into a developmental effort to build a UAS imager that will have the potential to reduce the volume and weight and still maintain similar capability" to larger systems, he said. ND

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Marines Prepare to Fight at Sea, On the Ground, From the Air

By Jon Harper

After more than a decade of slogging counterinsurgency warfare, the Marine Corps is preparing for the conflicts of the future. But the service is still trying to figure out how it will execute its operating concepts and counter emerging threats.

In the coming decades, Marines can expect to fight from the sea, among the littorals and in megacities, service officials said at a recent expeditionary warfare conference in Portsmouth, Virginia, hosted by the National Defense Industrial Association.

"We fought in Iraq and we fought in Afghanistan. … It was ugly and hard but I would argue that it's not going to be as tough as [what] we're going to face in the future," said Brig.

Gen. J.D. Alford, commanding general of the Marine Corps Warfighting Laboratory's futures directorate.

A key threat that must be dealt with is growing anti-access/area denial capabilities being developed by potential adversaries, officials said. Those include anti-ship missiles, advanced fighter jets and air defense systems that could complicate U.S. maritime operations.

"Our Navy ships are being pushed farther and farther from the coast line," Alford noted. "We won't have the joint force there doing anything for us. The joint force will come [but] they expect us to create a hole for them. … How do we do that?"

The Marine Corps is laboring to develop a long-term solution to that problem, said Col. Cliff Weinstein, director of the

Marines disembark from an MV-22 Osprey on the flight deck of the USS Bonhomme Richard.

concepts and plans division at the warfighting laboratory.

"As soon as we come up with an interim answer, our adversaries … already have a solution to that or a counter to that, so we're really struggling," he said.

The Marine Corps must be capable of eliminating the anti-access threat, Alford said. "That's our mission as a Corps [is to do what's necessary to] … get the ships in closer to the coast so we can bring in real combat power."

The stealthy joint strike fighter could be called upon to lead the initial assault in such an environment.

"We've got the F-35, the invisible airplane that's going to punch a hole" by taking out enemy radar and other assets, Alford said while outlining a potential scenario. "Right behind it will be [other aircraft] … carrying a bunch of stuff to bomb heavy. Right behind that is a flight of MV-22s carrying a … company landing team. That's the kind of concept that we're trying to experiment with, that we're trying to develop."

Intelligence, surveillance and reconnaissance tools will be critical for finding and destroying enemy forces, he noted.

The Corps still needs to flesh out how it will employ the joint strike fighter, Pentagon officials said.

"We are doing well on the details of the technical integration of what it will take to launch, recover and communicate

F-35B

with the aircraft, but … I'm not sure we have it fully digested how the F-35 is going to change how we operate," said Marine Maj. Gen. Chris Owens, director of expeditionary warfare in the office of the chief of naval operations.

"It's going to bring command and control, ISR [and] electronic warfare capabilities to the amphibious fleet that never existed there before. But we're going to have to be able to exploit them and the information that that aircraft will provide," he added.

As potential adversaries develop their own anti-satellite, cyber and electronic warfare capabilities, U.S. forces must find ways to operate effectively in communications and computer systems-degraded environments, officials noted. That will be a key focus of exercises in 2016, Alford said.

"We're working on both the offense and defensive side" of electronic warfare, he said in an interview with National Defense. "We need to be able to do it to the enemy. So how do you reduce our [electronic] signature and highlight their signature … in particular in an urban environment where [electronic systems] are everywhere?

"I can't sit here and say we've got an answer to that prob-

lem, because we don't," he added.

The U.S. national security apparatus also needs to flesh out the different authorities needed for engaging in information warfare, he noted.

When operating ashore, Marines will need to be prepared to sustain themselves, Alford said.

"We've been spoiled in the last 14 years when we've fought from FOBs [forward operating bases]," he said. In the future "we're not going to have a FOB. … Our FOB is going to be 100 miles out to sea on a ship."

In the Pacific, Marines must be able to operate on small islands and remote places, he said. Troops might need to generate their own water and power, and forage for food or other supplies as a means of lessening logistical requirements.

"What does 21st century foraging look like?" he asked. "How do we reduce the footprint that we need to pull from that ship that's 100 miles away? We've got to think about those things."

As urbanization continues across the developing world, the Marine Corps could be faced with combat in megacities where more than 10 million people live. That would be very different than fighting in Baghdad, Alford said.

"We used to talk about the three-block and the four-block war," he said. "Now we're talking about the four-floor war, from the rooftops [of high rise buildings] to the middle to the bottom floor into the underground."

"You might be evacuating people off the roof; you might be doing some kind of security or detain ops in the middle of it on the 20th floor; down in the first and second floor you might be in full-up combat; and then you have to go down into the basement [or] underground into the sewer systems and into the subway systems to fight," he explained.

Even non-state actors are using sophisticated subterranean networks to move and hide weapons and protect themselves from airpower, noted Col. Jeff Holt, director of the Marine Corps Warfighting Laboratory's experiments division.

China, Russia and North Korea protect their assets in underground tunnels and facilities, as does the Islamic State terrorist group. "Eventually we're going to see this on the battlefield and face it," he said.

Another challenging aspect of operating in a large urban environment is the risk of civilian casualties. Such warfare might not be limited to the type of counterinsurgency fighting that the U.S. military encountered in Iraq and Afghanistan. "It could be full-up combat amongst the people," Alford said. "That's a wicked problem."

The Corps is not well prepared for megacity battles, he noted.

"Are we training for that? The answer is no," he said. "Are we developing the right equipment to fight in that environment? There's a question mark."

On the maritime side, the service is trying to determine which platforms could be used to carry out a variety of operations.

The Corps is "looking at alternative ships, alternative platforms for different ways to deploy and employ our Marines," said Jeff Tomczak, deputy director of the science and technology division at the warfighting laboratory. Many of the ships in the U.S. fleet weren't designed for the types of missions that the Corps will need to perform in the future, he said.

Some vessels don't have connectors that can move Marines from ship to shore, or appropriate landing areas for rotary wing aircraft, he noted. "In these experiments that we're doing … we exercise those different systems that are out there that the Navy brings to bear and try to find out the weaknesses."

In the future, the Marine Corps has the option of operating from afloat forward staging bases. The launch pads could support the deployment of troops or unmanned aerial vehicles, said Navy Capt. Bryon Johnson, head of the amphibious warfare branch in the office of the chief of naval operations.

The sea services are also looking at expanding the roles of auxiliary ships at the "lower end" of the spectrum of military operations. "Why not leverage that capability?" Johnson asked. "You don't need to take a $1 billion warship away from a combatant commander tasking to do a small, low-level mission" like a minor theater security cooperation engagement.

At a time when naval forces are stretched thin, the Marine Corps needs to take advantage of the expeditionary capabilities of international partners, defense officials said. One possible option would be to deploy the MV-22 on allies' ships, Johnson noted.

Wargaming with larger units will be a focus going forward, Alford said. Over the past 14 years, the warfighting laboratory has experimented with rifle company or infantry battalion-size units. In the future, those types of activities will involve all components of the Marine air-ground task force (MAGTF), he said.

The Corps envisions conducting distributed operations to overwhelm the enemy. Making squads more lethal and enabling them to carry out support functions at a lower level is a key task, Alford said.

"You bring more mass by distributing those squads and hitting multiple areas at the same time," he said. "How do they bring their own fires? How do they call [in] fires from the MAGTF? How do we make that squad leader a [joint tactical air controller] or at least a … joint fires officer? All of those issues we're wrestling with."

The service plans to conduct more exercises as it refines its operating ideas. The 31st Marine Expeditionary Unit has been selected as an experimental force for this purpose. "It's really now just starting to come together," Alford said. "The experimentation that we're going to do as we move forward is, I believe, still the most important part" of developing these concepts. **ND**

Email your comments to jharper@ndia.org

Marine air-ground task force

Marine Corps Develops Equipment Wish List

By Jon Harper

The Marine Corps is looking for new capabilities as it prepares to return to its amphibious roots and operate in more challenging environments.

Intelligence, surveillance and reconnaissance assets will be critical, including unmanned aerial vehicles of varying types and sizes, service officials said.

In addition to Group 1 UAVs that weigh less than 20 pounds, the Corps also needs larger, long-endurance drones to support its operations, said Brig. Gen. J.D. Alford, commanding general of the Marine Corps Warfighting Laboratory's futures directorate.

"[I want] something that stays up a long, long time, has lots of lookers/listeners, and can kill somebody when I need it to," he said at a recent National Defense Industrial Association conference. "We need help with that, and I know we've got some people working on systems that come from the sea or otherwise."

The Office of Naval Research — which develops cutting edge technologies for both the Navy and Marine Corps — has teamed up with the Defense Advanced Research Projects Agency on the tactically exploited reconnaissance node (TERN) program.

The goal of TERN is to develop a medium-altitude, long-endurance Group 4 unmanned aerial system — weighing more than 1,320 pounds — that can launch and recover from small ships or possibly even rooftops.

"It doesn't need a runway, it's vertical launch and recovery," said Jeff Tomczak, deputy director of the science and technology division at the warfighting laboratory. "When you have a Group 4 UAS that can launch from an amphib that has long-duration [and can] potentially carry weapons, ISR, stay on station a long time — that opens up the door to a lot of possibilities."

Lethal drones that are easily man-portable would also be useful for the warfighter, officials said. A Marine needs an ISR asset "in his pocket" that can kill something from the air after he launches it, Alford said.

Marine Capt. Benjamin Brewster, who recently completed an assignment as a field testing officer, said he would like an "Android-type device" with a government-owned mapping app "that steps into my UAS architecture that I have over me, whether … that's a Group 1 that I take out of my backpack and throw up in the air and it creates a local network within the area I'm operating in, or whether that ties into some sort of Group 5 UAS that's pulling off larger-band, full-motion video down to my device."

Equipping units with quadcopters that could potentially carry weapons would be useful in urban areas, officials said. But they noted that aerial systems aren't a silver bullet, which is why the Marine Corps is also interested in ground robots and other intelligence-gathering tools.

LCAC 100 concept

"If you have compartmentalized microenvironments within a city … you can't just fly a helicopter over [it] or a satellite or a singular reconnaissance method to get all the information you need," said Col. Cliff Weinstein, head of the concepts and plans division at the warfighting laboratory. "You have many different types of technologies that may have to be leveraged for inside buildings … [or] the subterranean environment."
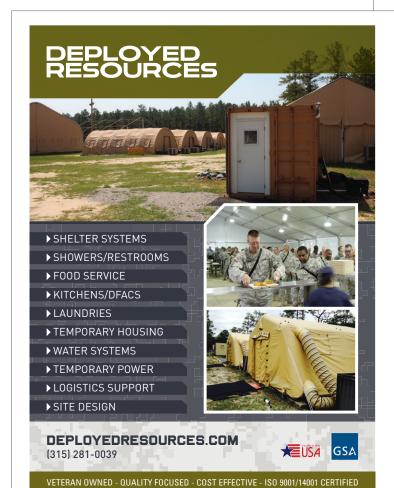
Another high-tech capability that the Marine Corps is pursuing is autonomy and manned-unmanned teaming. Alford has visited robotics companies to examine their products.

"I saw a lot of cool stuff [but] most of it is not what we want or need," he said. "It's too heavy, it's too expensive, it takes too many batteries … and the average squad would just put a claymore on it and blow it up to get rid of it."

It would be ideal if "I could put a robot in my pocket and throw it on top of a building … [or] I could hook a very small piece of gear onto an ATV or a Humvee and it would follow me autonomously," he said. "That's what I need."

The Corps is looking to put "fifth domain" weapons like cyber and electromagnetic warfare devices in the hands of

TEXTRON SYSTEMS

The LX(R) amphibious transport dock is likely to be a derivative of the San Antonio-class LPD.

infantrymen, officials said.

"How do you get those offensive capabilities into the hands of those grunts? That's where we struggle," said Col. Jeff Holt, director of the experiments division at the warfighting laboratory. "I haven't seen anything that could be carried at a very small level … [or] integrated into our existing organic weapons."

The Corps is interested in potentially developing grenade launchers that can emit an electromagnetic pulse — a "non-kinetic option" for taking down adversaries' systems, he said.

Enemies are acquiring "unmanned kamikazes" that could be used to swarm Marines, and developing tools to counter them is imperative for the Corps, officials said.

"We do have a focused effort right now because [unmanned aerial systems] appear to be posing the greatest threat," Tomczak said. The service needs "the ability to detect, track, identify what it is that is out there, and then take the appropriate action, whether it be kinetic, whether it be jamming the signal or whether it be through different means to protect Marines."

The services are also developing counter-UAS capabilities and they have conducted joint exercises known as "Black Dart" to explore ways to deal with the emerging threat. Lasers, electromagnetic weapons or projectiles could be potential solutions to the enemy drone problem, officials said.

The sea services are also looking to add capabilities to existing platforms, including arming the MV-22 Osprey troop transport aircraft.

"It's a little bit frustrating," said Navy Capt. Mike McMillan, commander of amphibious squadron 8. "We put machine guns on biplanes in 1916, [but] we still haven't been able to put a viable weapon system on the V-22. I believe that we will move forward in that area" and enable the aircraft to "self escort" once they are armed.

Enhancing the capabilities of the littoral combat ship to enable it to

TECHNOLOGY WANTED

- **Various sized UAVs for intelligence, surveillance and reconaissance**
- **Man-portable lethal drones**
- **Quadcopters that could potentially carry weapons**
- **Directed energy weapons**
- **Weapon system on the V-22**
- **Robots and autonomous systems**
- **LX(R) amphibious transport dock**
- **New ship-to-shore connectors**
- **Amphibious combat vehicle**

perform more missions — including hauling troops — is under consideration. An "alternative platform payloads council" has been formed within the office of the chief of naval operations to examine that and other issues, said Navy Capt. Bryon Johnson, head of the office's amphibious warfare branch.

"Right now we're focusing on some of the technical enablers that we could put on board LCS that will enable it to do multiple mission support," he said. Officials are thinking about expanding the vessel's berthing capability so that it can carry more Marines, he added.

As the U.S. military rebalances to the Pacific region, the Department of the Navy is pushing to recapitalize its amphibious ship fleet. The primary mission of such vessels is to transport Marines and their equipment. The current inventory stands at 30. By fiscal year 2020, the sea services expect it to increase to 33, with deliveries of two additional San Antonio-class amphibious transport docks and an America-class amphibious assault ship.

The Navy also intends to move forward with the LX(R) amphibious transport dock. The vessel is likely to be a derivative of the San Antonio-class LPD, officials said. A capability development document has been submitted to the joint staff, and the Navy plans to award a competitive lead ship design/construction contract in fiscal year 2020. The delivery of the first LX(R)s is planned for fiscal year 2026, with 10 more expected to follow.

The Navy and Marine Corps would like to have 38 amphibious ships, but budget constraints make that a tall order, said Maj. Gen. Chris Owens, director of expeditionary warfare within the office of the chief of naval operations.

In addition to larger transports, the sea services need more connectors to bring Marines to the fight. The Navy is investing money in sustaining and extending the service life of the legacy landing craft air cushion fleet. It aims to accelerate plans to acquire new LCAC

100s in the 2020s as well as new landing craft utility ships. The LCU 1700, also known as the surface connector X replacement, is expected to be a "modified repeat" of the legacy design, officials said. In November, Naval Sea Systems Command sent out a request for information to industry regarding potential LCU 1700 capabilities.

"The connectors are and always will be our bottleneck for getting stuff ship to shore," Owens said. "We will never have enough."

"I would like to see [a ship] that will haul additional connectors to the fight," he added. Owens noted that the military has a seagoing ferry that can haul five LCACs, but he would like a vessel that can handle 15. "That would ease the bottleneck in getting a mobilized, mechanized force ashore and be able to continue on to the objective once it gets ashore and not wait on the beach for the refuelers to arrive and the sustainment to follow it."

To help Marines storm the beaches, the Corps is moving forward with its amphibious combat vehicle program. The service recently announced a downselect to two vendors — BAE

Systems and SAIC. The two companies were awarded contracts to build 13 prototypes. The first delivery is expected by the fall of 2016, when testing and evaluation is slated to begin.

"We're going to focus on the swim capability," John Garner, program manager for advanced amphibious assault, told reporters when the downselect was announced. The ACV 1.1 is expected to be transportable by connectors and have the same swimming ability as the legacy amphibious assault vehicles, which can travel in water at speeds up to 10 nautical miles per hour.

The Corps will also test the ACV 1.1's ground mobility and carry capabilities, as well as its armor. The service is looking for the platform to provide protection from improvised explosive devices, similar to the mine-resistant ambush protected vehicles that earned fame during the Iraq War.

The final winner of the low-rate initial production contract will be decided in early 2018, with initial operating capability expected by the end of 2020, the Marine Corps said in a news release announcing the downselect. The service expects to field 204 ACV 1.1s by the

summer of 2023.

The testing phase for the ACV 1.1 will inform requirements for the follow-on ACV 1.2, officials said. The Corps wants the latter to be capable of being launched and recovered from ships independently. Initial operating capability for ACV 1.2 is expected in late 2023, Garner said. The service plans to buy 490 of them, with a mix of personnel, command-and-control and recovery variants.

The Marine Corps ultimately seeks amphibious combat vehicles that can be launched from ships beyond the horizon, swim at high speed toward a landing area, and continue to fight on land with enough armor to protect troops from IEDs and other threats.

The sea services are focused on keeping program costs under control and ship deliveries on schedule, Owens said. "I'm confident that we have a good plan, a good program for replacing our amphibious ships and our connectors, but keeping it on track is going to be the challenge" due to budget constraints and other potential hurdles. **ND**

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