OCTOBER 2016

National DEFENSE

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Clinton, Trump on Spending Priorities

FUTURE ARMY

How the next wave of technology will change the battlefield

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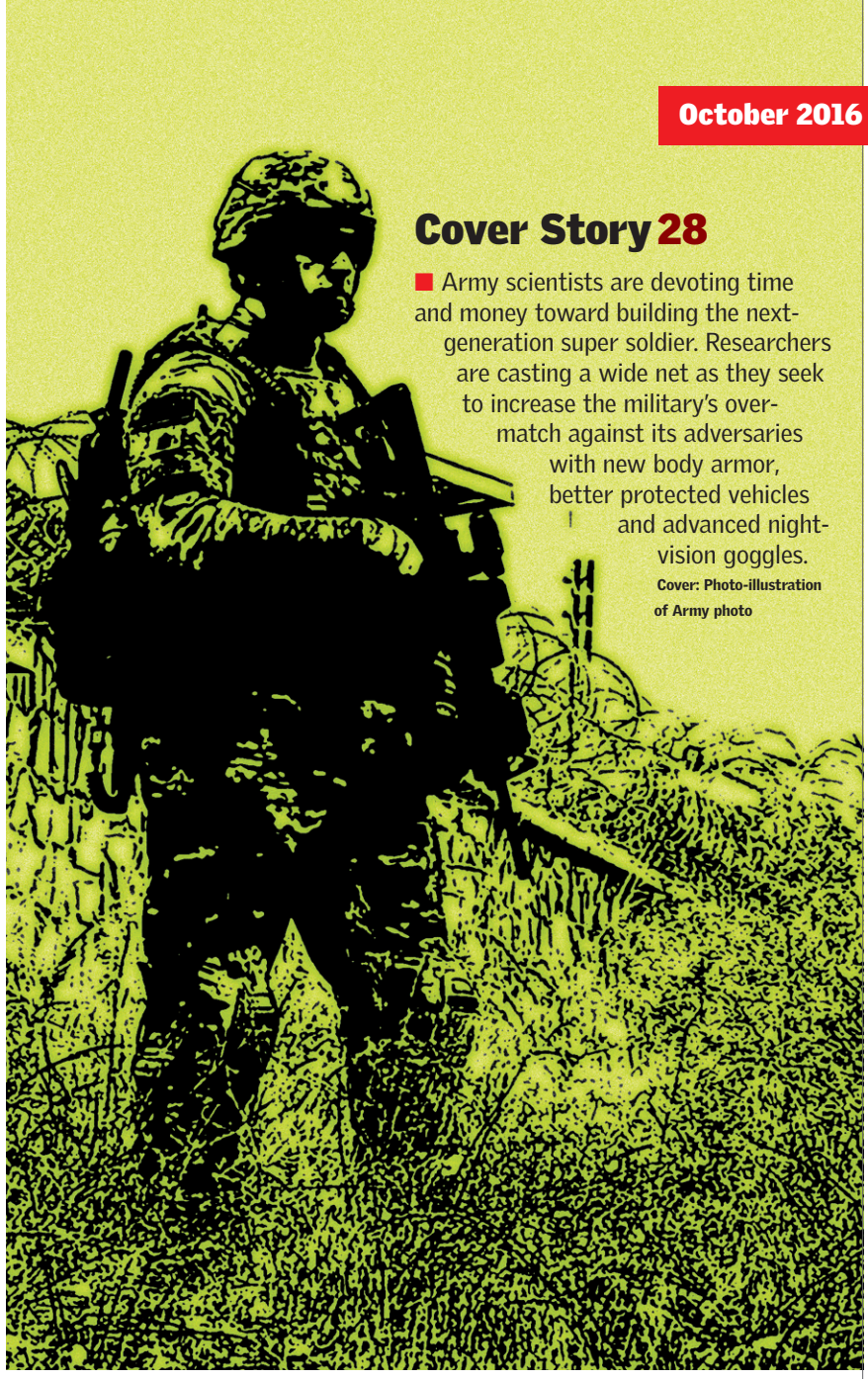
Election 14

■ As the U.S. presidential election heats up, former Secretary of State Hillary Clinton and businessman Donald Trump are beginning to unveil their military funding plans. It is expected that both, if elected, would push for higher levels of defense spending, but specific program details remain murky.

Underwater Drones 26

■ To give the Navy increased situational awareness, officials want to create networks of multi-domain drones. Connecting land, sea and air assets will extend a sailor's eyes and ears more affordably than sending in a manned vessel.



Cover Story 28

■ Army scientists are devoting time and money toward building the next-generation super soldier. Researchers are casting a wide net as they seek to increase the military's over-match against its adversaries with new body armor, better protected vehicles and advanced night-vision goggles.

Cover: Photo-illustration of Army photo

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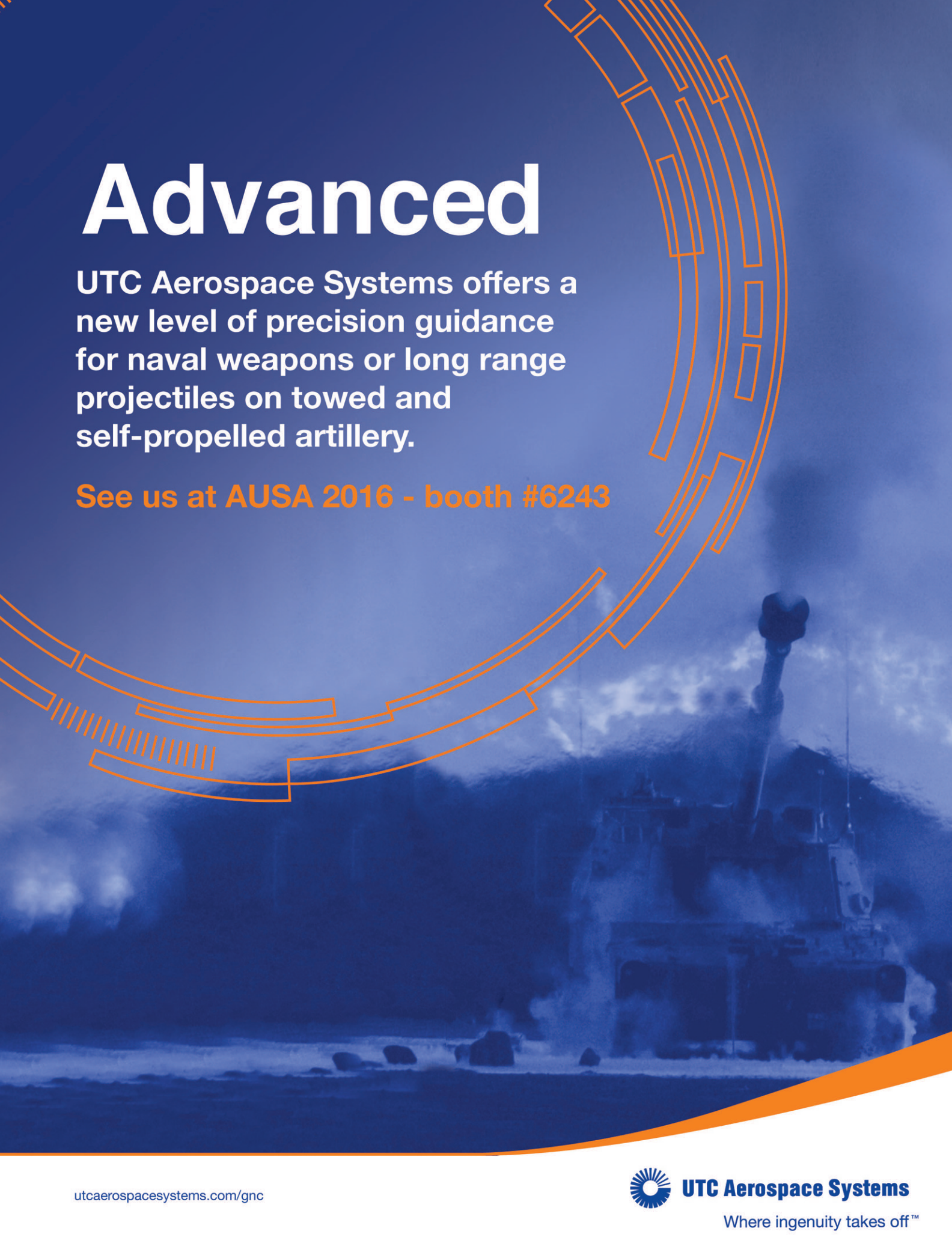
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By Craig R. McKinley

Slow Pace of Modernization a Vicious Cycle

Last month, I discussed the national security challenges that will be inherited by the new president upon taking office in January. I stated that they were, indeed, daunting problems — and they are.

And although the new president is commander-in-chief of the armed forces, an enumerated power provided in the constitution, the choices to be made will be shaped by and presented by the new Pentagon leadership team. I hope both campaigns have begun serious efforts to identify this leadership, one that will truly have to hit the ground running to repackage the fiscal year 2018 budget submission that will certainly be left "on the table" for them.

Whoever this leadership is, from whatever party, it will encounter two distinct but related problems: readiness and modernization. Let's consider some recent comments about readiness first.

Retired Air Force Lt. Gen. David Deptula, dean of the Air Force Association's Mitchell Institute, stated that, "Twenty-five years of continuous combat, coupled with budget instability and lower-than-needed top lines, has made the Air Force the smallest, oldest and the least ready in its history."

Deptula, who played a central role in planning the highly successful Operation Desert Storm air campaign, noted that today's Air Force has one-third fewer personnel and 60 percent fewer combat fighter squadrons. Moreover, the squadrons themselves have 25 percent fewer aircraft.

The Marine Corps has a similar problem. Deputy Commandant for Aviation Lt. Gen. Jon Davis has stated that due to a shortage of combat-ready aircraft, Marine pilots, particularly fighter pilots, are not getting the flight hours they need to be fully trained and ready.

These problems are occurring at a time when our air forces are being heavily used in the fight against the Islamic State, while continuing other missions around the world. In short, we have the old story compounding itself: fewer people, in fewer units, are being asked to do more to meet the current threat, in aircraft that are — in Deptula's words — increasingly "geriatric." In fact, the average age of the Air Force's combat aircraft inventory has more than doubled from 12 to 25 years. How many of us are comfortable driving to work in a car built in 1991?

As for the Navy, Chief of Naval Operations Adm. John Richardson testified before Congress in the spring that the sea service is facing readiness problems as it returns to "great power competition" for the first time in 25 years. China and Russia are increasingly challenging the United States as it seeks to keep sea lanes open for trade. In that light, the Navy is taking a second look at whether its goal of maintaining a fleet of 308 ships will be enough.

Meanwhile, the Navy is still catching up on depot work that suffered as a result of sequestration and hiring freezes.

Readiness is, therefore, an immediate concern. But the underlying problem is the slow pace of the modernization programs that will provide new equipment and reduce the average age of the inventory — for combat vehicles and ships as well as aircraft.

When the Reagan administration took office, it launched a military build-up that was essentially a modernization increase. It moved quickly to procure the systems that were being developed in the Carter administration. During its first five years in office, in constant terms the Reagan defense team kept personnel costs relatively flat, but increased expenditures on modernization, which is research and development plus procurement, by over 60 percent. When Desert Storm came, that war was fought with a new, very fresh capital stock. Our problem today is that the Desert Storm equipment is now a quarter-century old, exists in fewer numbers, and has been used with greater intensity over the past decade.

Clearly, something has to give. Intensely deploying steadily aging equipment without steadily replacing it is unsustainable.

> "The next U.S. government leader has a major decision to make."

But projected budgets out to 2021 do suggest that this dilemma will not be addressed. The current budget projections for 2011 — when we largely left Iraq — to 2021 show a planned 20 percent constant dollar reduction in modernization. And, keep in mind that these figures, taken from the 2017 Pentagon budget, reflect levels exceeding those allowed by the Budget Control Act caps. This expenditure profile will inevitably keep us on the current pathway of decreasing readiness, combined with increasing equipment age, which will lead to further loss of readiness. This is indisputably a vicious cycle that has to be confronted.

So, there is the basic challenge for the new administration. The Budget Control Act caps do not adequately provide for a defense effort that is aligned with the current strategic environment, one with serious challenges posed by non-state actors, such as the Islamic State, and disturbing potentials and trends of state actors such as Russia and China.

Following its seizure of Crimea, Russia has been described as on a path that is "revisionist and reckless," while other recent reports suggest that China may be shifting to a posture that will be more aggressive in an effort to sustain economic growth, increase market share and secure access to essential raw materials.

The next U.S. government leader has a major decision to make: are we going to recognize and adjust to this environment, or let it continue in its current direction and hope for the best?

This is a most difficult decision having dimensions of equal gravity in the areas of military policy, strategy development, budget formulation and industrial readiness and capacity. It is relatively easy to describe the problem, as many have, but it's much more difficult to craft a solution. I hope the next administration is up to the task.

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 By Sandra I. Erwin

Political Headwinds in Foreign Arms Market

The nation's top defense companies have huge stakes in foreign military sales. Some of the most auspicious markets for U.S. weapon systems have been the Middle East and Turkey, and although there is so far no clear evidence that this will change, there could be cause for concern.

Industry watchers have begun to raise questions about the ramifications of political unrest in Turkey on big-ticket weapons deals. "I know there's been a lot of churn in Turkey recently, but it still remains a very valued NATO partner for us and it's an essential security partner in that region for the United States and for our allies," Lockheed Martin CEO Marillyn Hewson told industry analysts in July.

Turkey is one of the company's largest non-U.S. buyers of the F-35 fifth-generation fighter. "We have not seen any indication that it will impact the F-35 or any of our other programs," she said. Lockheed-owned Sikorsky Aircraft recently signed a deal with Turkey to manufacture an indigenous version of the Black Hawk helicopter.

Bloomberg Government estimated that since 2012, Turkey has sought $1.1 billion worth of U.S. military hardware through the foreign military sales program.

Although Lockheed's and other U.S. defense companies' business in Turkey is not in jeopardy, foreign policy experts see headwinds. One concern is the state of the Turkish armed forces — currently deeply divided and demoralized following a failed attempt to oust democratically elected President Erdogan. A distracted military and rising anti-Americanism are issues to watch, said Aaron Stein, senior fellow at the Atlantic Council's Rafik Hariri Center for the Middle East.

To be sure, there is almost no chance that Turkey will drop out of the F-35 program or scale back its plan to buy 100 aircraft, Stein said in an interview. But there are other reasons for U.S. companies to worry. One is the likely pushback from U.S. lawmakers who may increasingly frown on arms sales to a country that, despite being a NATO ally and a home of U.S. nuclear weapons, is showing increasing anti-Americanism.

Another hurdle for U.S. industry are Turkey's growing demands for technology sharing and intellectual property as conditions for weapons sales. Aside from the current political situation, "U.S. companies are always at a disadvantage because of our strict export control laws," says Stein. "Turkey wants to buy American but also wants American intellectual property." U.S. restrictions on technology share will drive Turkey to buy European or Chinese equipment that comes with fewer controls even if it is less technologically advanced.

Loren Thompson, an industry consultant with the Lexington Institute, said the climate for American firms in Turkey is "difficult" but common security challenges will overpower other concerns. "In the end, the United States and Turkey need each other too much for them not to get along." He surmised that the F-35 program is not at risk because Turkey has substantive economic interest in buying those planes. "If Turkey has the F-35, it can defeat any power including Russia."

Sales of U.S. weaponry, meanwhile, have hit a rough patch in the Middle East. A bipartisan group of 64 House members recently urged President Obama to delay plans to sell more than a billion dollars in weapons to Saudi Arabia over concerns about the country's war in Yemen.

The defense industry also is watching developments in the deal signed by Boeing more than two years ago to supply fighter jets to Qatar and Kuwait. Lobbyists and congressional supporters have pleaded with the administration to approve the sale, arguing that Boeing's production line cannot stay open indefinitely without foreign orders. The Defense and State Departments signed off on the estimated $7 billion sale of 36 F-15E fighter jets to Qatar and 24 F/A-18E/F Super Hornets to Kuwait. Boeing officials have been told for months that the deal has stalled at the National Security Council until a new security and military-aid agreement is reached with Israel.

Israel presumably is OK with the sale of U.S. fighters to Kuwait but has strong reservations about the Qatar deal. Defense executives were surprised by the delay in approving the Boeing deal considering how active the Obama White House has been in promoting U.S. hardware overseas.

"It's definitely a significant shift in approach for the administration compared to its aggressive pursuit of sales to the region in prior years," said analyst William Hartung, of the Center for International Policy. "It's of huge concern to Boeing, of course, given their need to extend the F-18 production line for as long as possible."

But the jobs argument does not appear to be winning here, even in an election year, said Thompson, who noted that Boeing contributes to his think tank.

Obama pledged to increase aid to Israel to reassure lawmakers that were hostile to the 2015 Iran nuclear deal. But aside from the prime concern to protect Israel's qualitative military advantage in the region, the White House has to also take into account that Gulf nations need air power to deter Iran, Thompson said. If the United States doesn't move quickly to approve these fighter sales, the Gulf nations could back out and start shopping for European aircraft. That would hurt U.S. industry, Thompson said. "If we don't sell F-15s and F-16s, that would seem like we are ceding that entire market to Europe."

Any loss of market share in the Middle East would be a setback for American companies that are increasingly dependent on exports. In 2010, only 17 percent of defense equipment manufactured in the United States was exported. By 2015, it jumped to 34 percent, the consulting firm Avascent estimated. The Middle East region collectively spent $13.5 billion on combat aircraft since 2010 and is projected to spend an additional $30.5 billion through 2020.

The situation in Turkey and the dilly-dallying on Boeing's fighter sales, although unrelated, offer further evidence that, no matter how much advocacy the U.S. government does on behalf of American companies, the defense business shifts according to the political winds.

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By Stew Magnuson

The Human Factor in Autonomous Machines

Who hasn't cursed at their car when it failed to start? It wouldn't even be considered an unusual sight to see someone kicking a broken-down vehicle on the side of the road in an angry fit.

In the military world, there are the explosive ordnance disposal technicians who name their robots and give them funerals when "they sacrifice their lives" on the battlefield.

Even if they do inspire both love and hate, these are just machines — inanimate objects with no feelings at all.

And we all know that. Humans on the other hand are emotional beings and sometimes these feelings extend to the machines in our everyday lives.

The Defense Science Board recently released a report that addressed autonomous systems in the military. One of its main conclusions was that for the technology to make inroads and be accepted, users must "trust" the machines.

Autonomy has been singled out as a key component of the third offset strategy, which intends to deliver leap-ahead battlefield technologies. There is a lot of food for thought in the report on how members of the military may interact with these autonomous systems.

"Trust is complex and multidimensional," the Defense Science Board Summer Study on Autonomy stated. "The individual making the decision to deploy a system on a given mission must trust the system."

And, as the report points out, trust is something that is earned. Those who are designing autonomous systems have to produce something that inspires confidence.

These military systems aren't conveyor belts automatically sorting out packages in a benign setting for UPS. These are machines intended for battlefields, and a failure to work as advertised could cost lives, the report said.

Trust taps into human emotions in ways that strip us down to basic instincts. An ineffective interface is one of the many potential barriers to building confidence in machines, the report said.

There is the famous case of male German BMW owners who complained about their first-generation GPS devices because they didn't want to take directions from an artificial female voice.

Yet computer-generated voices in the commercial world tend to be female and as pleasant as possible: think Siri or those frustrating automated customer service calls to a bank.

Is that the right tone for artificial intelligence in the heat of battle, or will a soldier respond better to a voice more akin to his or her drill sergeant from boot camp?

Trustworthiness also depends on reliability. If the machine doesn't work, how can a soldier, sailor, airmen or Marine be expected to hand over a task to it that may mean life or death?

"Establishing trustworthiness of the system at design time and providing adequate indicator capabilities so that inevitable context-based variations in operational trustworthiness can be assessed and dealt with at run-time is essential. Not only for the operator and the commander, but also for designers, testers, policy and lawmakers and the American public," the study said in a rather convoluted passage.

In translation, machines are not infallible. They will not always work perfectly. They may in many cases outperform their human counterparts. A self-driving vehicle on a city street may follow every law and never be distracted. It could drive flawlessly 99.99 percent of the time. But there is always that .01 percent when something goes wrong. Is that one incident enough to lose trust in self-driving cars?

Now take that example and transfer it to a battlefield and the robotic wingman concept. A commander has several tanks in its formation with no human operators. But in this case, there is a thinking enemy determined to defeat these unmanned vehicles. The adversary could go the traditional route and blow up the individual tanks. Better yet, he could launch a cyber attack and cause the tank to malfunction, thus making the commander lose confidence in the whole system.

Another key barrier to trust spelled out in the report includes a lack of human sensing and thinking by the machine. "Because an autonomous system may have different sensors and data sources than any of its human teammates, it may be operating on different contextual assumptions of the operational environment," the report said.

There may also be a lack of self-awareness on the part of the machine. It may not be aware of ice building up on a wing, that its GPS is being spoofed or that its batteries are running low.

Poor understanding of common goals is another potential pitfall. The machine must know what the human is trying to achieve. Accidents happen when the operator wants to do one action, and the machine is attempting to execute another.

One of the most controversial uses of autonomy in the military is in the realm of command and control, but it is also the one with the biggest potential benefits, the report stated.

Time is of the essence in fast-paced battlefields where every second matters, and autonomous systems can reduce tasks such as target selection and mission assignments. They can gather and sort through data in seconds where that task may have previously taken hours or days.

"While commanders understand they could benefit from better organized, more current and more accurate information enabled by [the] application of autonomy to warfighting, they also voice significant concerns," the report said.

To build trust, the machine interfaces will have to be able to "explain and justify" to commanders how it reached its battlefield recommendations, the report said.

One of the key messages of the study is that engineers, researchers and technologists creating autonomous systems must carefully design them to inspire confidence in us emotional humans.

Otherwise, their users may end up kicking them in an angry fit. And that would not be good.

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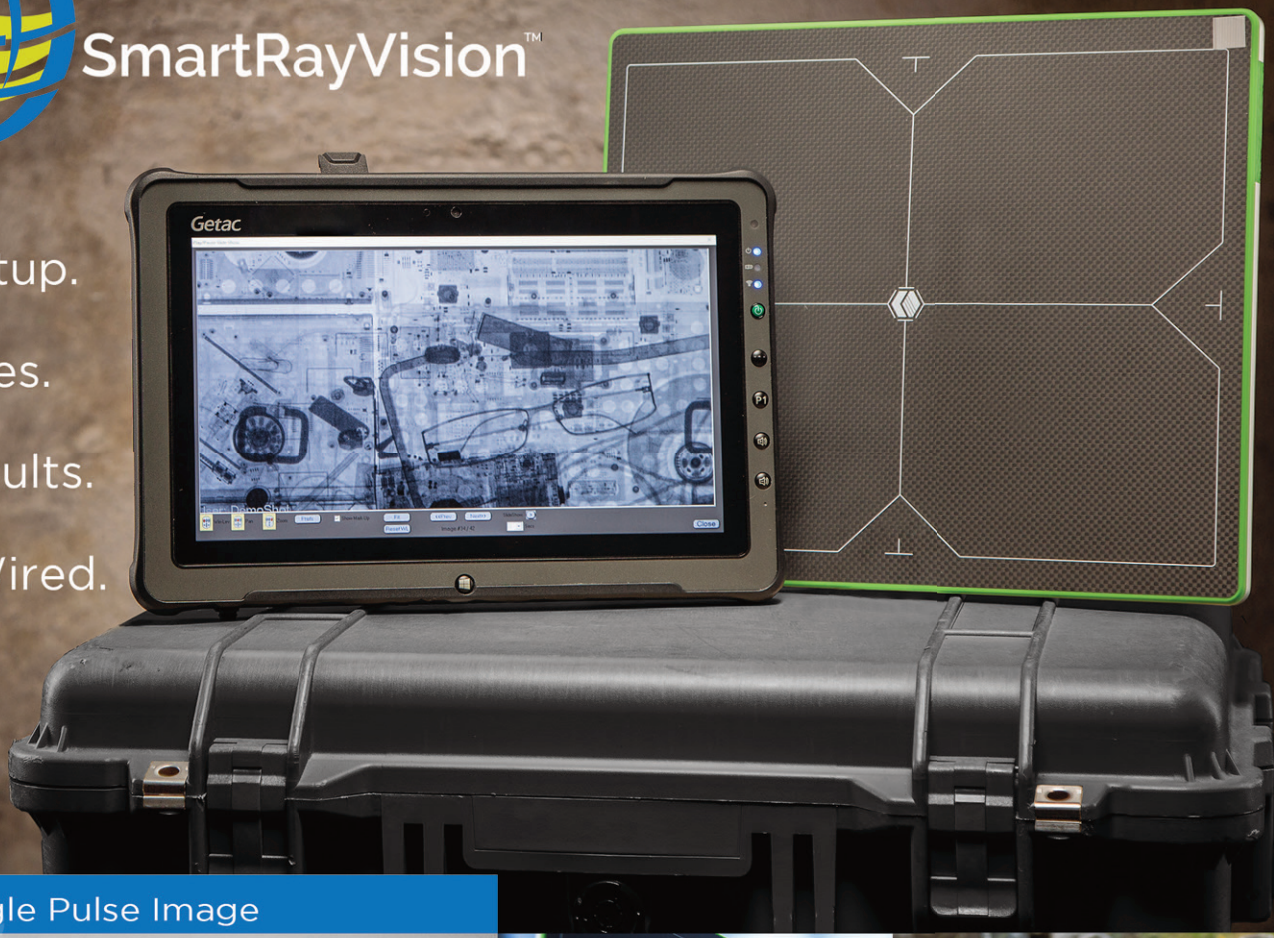

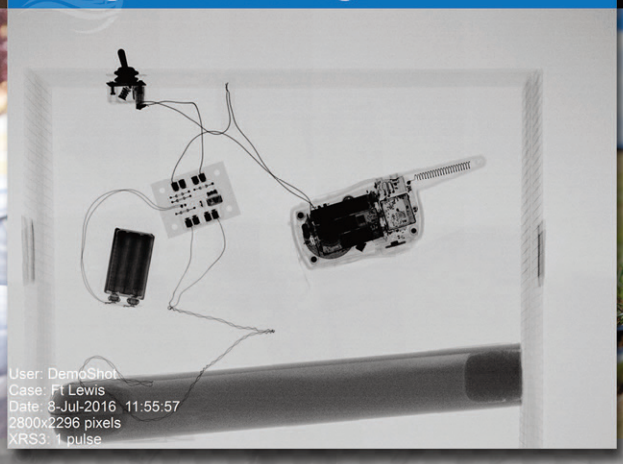

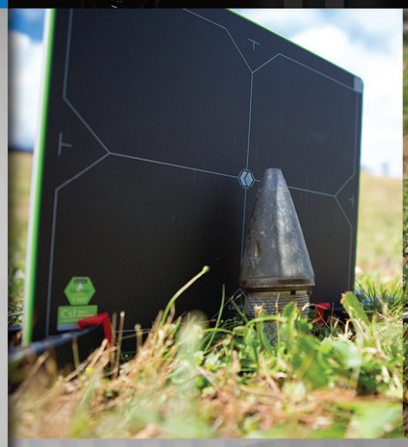

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Ethics Corner By Brianna L. Elsmore

New Issues Regarding False Claims Act

There were two recent developments regarding the False Claims Act that will likely have a significant impact on the defense contractor community.

First, the Supreme Court June 16 issued a decision in Universal Health Services v. United States ex rel. Escobar in which it determined that under some circumstances, a contractor may be found liable for a violation of the FCA under the "implied certification theory." Second, as of Aug. 1, civil penalties for each FCA violation nearly doubled.

The act imposes liability on "anyone who knowingly presents … a false or fraudulent claim" to the government for payment. See 31 U.S.C. § 3729(a)(1)(A). It defines "knowingly" as actual knowledge, deliberate ignorance, or a reckless disregard for the truth. See 31 U.S.C. § 3729(b)(1).

Since the term "anyone" is used, liability under the act can apply to subcontractors as well as prime contractors. Therefore, if a subcontractor submits a false or fraudulent claim to its prime contractor and it believes the prime will submit the claim to the government for payment, the government can hold the subcontractor liable under the FCA.

Liability even attaches to the subcontractor if the prime never submits the fraudulent claim to the government. Prime contractors can also be liable for the actions of subcontractors if it knows the subcontractor submitted a false or fraudulent claim and it presents this claim to the government for payment.

The act does not define "false" or "fraudulent" so this is where the Supreme Court stepped in. Universal Health Services Inc. provided counseling services and submitted claims for payment to Medicaid for services it provided. Universal, however, did not comply with Massachusetts Medicaid regulations regarding staff qualifications and licensing requirements for these services. The Department of Justice argued that by submitting claims for payment, Universal represented that it was entitled to payment and had complied with all material and legal requirements for these services. Since Universal did not comply with all the legal requirements, Justice argued, under the implied certification theory, that its claim was misleading and fraudulent and thereby a violation of the False Claims Act. Universal argued that none of the regulations it violated were Medicaid payment conditions, and it did not certify compliance with all material and legal requirements merely by submitting a claim for payment.

The Supreme Court came down in the middle of these two positions. It determined that a contractor may be subject to FCA liability under the implied certification theory, when: the claim does more than simply request payment, "but also makes specific representations about the goods or services provided" and the representation is a "misleading half-truth" because it failed to disclose noncompliance with some requirement that is "material" to the government.

The Supreme Court did not define the term "material" but remanded the case to the lower court to resolve this issue. In developing some guidance, the court determined that just because the government states a requirement is material, does not mean it is, and just because the government does not say a requirement is material, does not mean that it is immaterial. Therefore, more litigation will follow before this issue is fully resolved.

This warrants another look at penalties. Penalties for FCA violations increased per claim from $5,500-$11,000 to $10,781.40-$21,562.80. Contractors are also liable for three times the amount of damages suffered by the government due to the violation. The Justice Department recovered over $3.5 billion from FCA cases in fiscal year 2015. For contractors that perform even a small volume of government contracts, these penalties and damages can add up very quickly. Violation of the act is also a basis for debarment. Therefore, a contractor may be required to pay large fines but not have the ability to engage in future business with its main client, the government.

The Supreme Court decision indicates that a FCA violation will not result from every single noncompliance issue. However, the decision also does not tell us specifically which ones will result in a violation. So, what can a contractor do to protect itself from violations? Maintain a strong culture of compliance.

Developing or maintaining a culture of compliance starts at the top. Executives and senior management must be fully engaged in the compliance process and insist that their company comply with all federal statutes, regulations and contract terms, especially payment terms. Senior management should also ensure that their company has effective policies and procedures regarding compliance matters, provides sufficient training to employees, and maintains an open-door policy allowing employees to report compliance issues.

Since the government may find prime contractors liable under the FCA for deliberate or willful ignorance, it is also prudent for prime contractors to monitor closely subcontractor compliance. Prime contractors should routinely audit subcontractors to ensure compliance with representations and certifications and other contractual requirements. For example, if the prime's contract requires compliance with the Buy American Act or specifies a part manufactured by an original equipment manufacturer, the prime should require its subcontractor to provide documentation proving the part complies with the requirement.

Finally, accurate and complete documentation is necessary to avoid and defend against FCA claims. If a company cannot provide a document demonstrating that it complied with all the legal and contractual requirements of a contract, then it will be extremely difficult to defend against an FCA charge. The maintenance of accurate time keeping and costs accounts are also critical in many government contracts.

Brianna L. Elsmore is an attorney in Battelle Memorial Institute's Office of Corporate Legal Services and practices in the areas of government and commercial contracts as well as ethics and compliance.

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By Herbert L. Fenster

Pondering the End of Nation Building

In a speech delivered Aug. 15, presidential candidate Donald Trump made the following statement: "If I become president, the era of nation building will be brought to a very swift and decisive end."

For the defense industry, the statement requires a closer look. What is "nation building?" And what are the potential implications for contractors if this comes to pass? It also might be appropriate to determine what "era" the statement was referring to and whether industry has been a part of the nation building activity.

It's fair to say that within the Defense Department, the term "nation building" has not enjoyed any particular popularity since it — and the function — was employed by the War Department at the conclusion of World War II. Remarkably perhaps, the rebuilding of the two enemies, Germany and Japan, was readily considered part of the function of "occupation" and the enormous success of the effort in both of those nations made an everlasting change in both their fates and the fate of the world at large. But it is unfortunately necessary to remember that nation building in those instances was an integral part of "occupation."

Like it or not, it is also fair to say that nation building has been a component of nearly every major military engagement the United States has undertaken since the War Department became the Department of Defense in 1949. It was a material part of the restoration and advancement of the South Korean economy during and after those war years and for some succeeding decades. Nation building, largely unseen and surely unappreciated, was a component of the presence of the Defense Department in Vietnam for a full decade. The contribution to infrastructure made by the Defense Department, the Corps of Engineers/Navy and the now-forgotten industry joint venture "RMBJ" — Raymond, Morrison-Knudson, Brown & Root and JA Jones — enabled the rapid redevelopment of South Vietnam after withdrawal.

By the beginning of the Iraq War in 2003, it had become essential to the foundational thinking within the department that "nation building" is a term tied at the hip to another term that has been struggling for survival for the last five decades — "stability operations." By November 2005, the struggle within the building to recognize, plan for, and execute "StabOps" and to accord it the human and material assets that it needs had led then Deputy Secretary of Defense Gordon R. England to issue DoD Directive 3000.05, mandating the creation within the department of all of the functions necessary to carry on stability, security, transition and reconstruction, or SSTR.

On the ground in Iraq, and in the dogma and doctrine intended by the directive, the implementation was intended to be an integrated effort to rebuild Iraq's infrastructure, restore its oil-producing revenue capabilities and even attend to its political and social needs. While there was not visible evidence contemporaneously of this intent, it was clearly a part of the then-classified 1990s "Polo Step" plan to defeat al-Qaida in Afghanistan.

Necessary to the success of nation building/SSTR in Iraq — and elsewhere in the world at that time and now — was a finely structured and executed planning capability shared equally between the Defense and State Departments. It would appear that State wanted no part of this initiative and the warring between the Pentagon and the Harry S. Truman Building at Foggy Bottom meant that SSTR in Iraq would assuredly be a gigantic failure. Meanwhile, the means by which nation building was to advance within the Defense Department was also subject to purposeful sabotage.

Within years of its issuance, the directive was reduced to an "instruction" and the developmental assets that were needed to make the fundamental changes in force structure never appeared and were carefully bypassed. That is the condition that exists today. The transition and reconstruction has been abandoned and the entire subject has been relegated to the Army as nothing more than an intellectual exercise.

However, it remains clear that the negative experiences of Iraq and, increasingly, Afghanistan are demonstrating that nation building, StabOps, SSTR are imperatives to any substantial engagement that the United States may have in the future. In the 21st century, it does not simply invade-battle-leave: there is no such thing as a quick "Mission Accomplished." Warfare itself has been transmogrified from the classic "battlefield" to an asymmetry that puts the kinetics on city streets. The "T" and "R" become essentials in this environment.

Tied closely together with SSTR itself is the literal support of our troops and civilians committed to any engagement. To support the 200,000 plus troops in Iraq in an all-volunteer military and in a prolonged asymmetric environment, conducted over a full decade, DoD called upon its then recently invented Logistics Civil Augmentation Program, or LOGAP, process. Contracts were awarded to KBR — the successor to the Brown & Root of the Vietnam War — and then Fluor and Dyncorp. It was no coincidence that these companies maintain logistical and project management capabilities all over the world.

But there were other major players involved, particularly in the nation building elements of the engagement. These included a large number of the nation's major global engineering and construction companies. A look at the 50 largest defense contractors in the core years of the Iraq engagement reveals that, due in substantial part to the war, they had heavily intruded into the traditional weapons systems market. In fact, the largest single DoD contract in the history of the nation was the LOGCAP III contract to KBR that supported the troops during the critical years of the Iraq War.

Will the United States really abandon nation building? The growing need for the U.S. presence in the Middle East, North Africa and Sub-Saharan Africa, among many other places in the world, compels a conclusion that the "era" of "nation building" is just beginning and not at an end.

Herbert L. Fenster is senior of counsel at Covington & Burling LLP, Washington, D.C.

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Clinton vs. Trump: Implications for Defense

Defense analysts expect that Hillary Clinton or Donald Trump would push for higher levels of defense spending if elected president, but it's less clear which programs would benefit or suffer during their tenure in the Oval Office.

Both candidates have said they want to increase Pentagon funding beyond the amounts set by the Budget Control Act caps, which are slated to go back into effect in fiscal year 2018.

On her campaign website, Clinton called for "ending the sequester for both defense and non-defense spending in a balanced way."

She would also prioritize "defense reform initiatives, curbing runaway cost growth in areas like health care and acquisition, and stretching every dollar."

Trump has heavily criticized the Obama administration's national security policies and described the current state of the military as a "disaster."

"I'm going to make our military so big, so powerful, so strong that nobody — absolutely nobody is going to mess with us," he said in a short video on his campaign website.

When it comes to topline spending, Michael O'Hanlon, co-director of the Center on 21st Century Security and Intelligence at the Brookings Institution, said there might not be much daylight between the Democratic and Republican nominees.

"Both would like to argue that they're [planning on] improving the military," he said at a recent conference, noting that he supports Clinton in this election cycle.

"I would expect either one of those two potential presidents to spend a bit more than we're spending now [and] to advocate a military a bit larger and more expensive than the one President Obama favors."

For fiscal year 2017, the Obama administration requested $524 billion for the Pentagon's base budget, and an additional $59 billion for overseas contingency operations accounts, which are not included in the base budget or Defense Department budget projections. The five-year defense plan includes base budget spending of $557 billion in 2018, $565 billion in 2019, $570 billion in 2020 and $585 billion in 2021.

Those spending levels would exceed the Budget Control Act caps by about $113 billion over the course of the future years defense program, according to Todd Harrison, director of defense budget analysis at the Center for Strategic and International Studies.

"The BCA is probably the biggest challenge that the next administration faces, not just for defense, because it's for the non-defense side of the budget as well," he said during a recent meeting with reporters.

The future of military readiness, force posture and modernization "all depend on what you do with the Budget Control Act and the budget caps," he added.

Roman Schweizer, a defense sector analyst at Cowen and Company, said funding the Pentagon at the maximum level allowed by the caps is a "worst case scenario."

"Given the range of global threats, we do not believe a cut below the BCA defense numbers is politically feasible for any White House or Congress," he wrote in a recent note to investors.

Schweizer is somewhat bullish about the outlook for defense contractors.

"We believe geopolitical turmoil will support increased global defense spending and provide growth for U.S. defense firms through increased DoD modernization and foreign military sales," he said. "Under either Clinton or Trump, we expect U.S. defense spending to increase."

In the coming years, Schweizer expects the Pentagon to receive less money than the toplines in the latest future years defense program, but more than the current law would allow under the Budget Control Act.

Neither the Clinton campaign press office nor the Trump campaign press office have responded to emails asking how much the candidates would seek to spend on the military if elected.

How individual programs would fare is also difficult to determine, analysts said.

"We are cautious about the outlook for some programs in a delayed FY18 budget due to the possibility of new White House priorities," Schweizer said. "We have maintained a positive outlook on many major acquisition programs — F-35, B-21, KC-46A, [Ohio-class replacement] and others — despite their technology, manufacturing or budgetary challenges, but a new administration could seek to alter, delay or curtail some of these programs."

During a recent speech at the Union League in Philadelphia, Trump proposed increasing the size of the Navy to 350 surface

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ships and submarines. But aside from modernizing cruisers and buying an unspecified number of destroyers with ballistic missile defense capabilities, he offered no other details about which types of ships he would want to procure.

That lack of specifics makes it difficult to estimate how much additional spending would be needed to achieve those goals, Harrison told National Defense.

"He said things like a 350-ship Navy. Well what kind of ships?" Harrison said. "An aircraft carrier — they're $12 billion each. A littoral combat ship — they're more like $600 million each. So it makes a big difference what kind of ships are in the 350-ship Navy and how quickly you try to get to that."

In his speech, Trump said he would increase the size of the Air Force's fighter inventory to 1,200 aircraft. The Air Force currently has more than 1,900 fighters in its total inventory (including the A-10), with approximately 1,140 designated for mission assignments. Trump did not say which fighter models he would favor purchasing.

On the personnel side, the businessman said he would boost the size of the active duty Army to 540,000 soldiers, and increase the number of Marine Corps battalions from 23 to 36.

It's still unclear how committed Trump is to his latest force structure proposal, given his tendency to change his stance on various issues, Harrison said. Trump prides himself on being a "negotiator."

"We're just not sure what his real position is," Harrison said. "It seems like he may be trying to moderate his position a bit to appeal to more traditional defense hawks within the Republican Party."

In his Union League speech, Trump identified cyber and missile defense as priority areas for investment, but did not provide dollar amounts.

Given existing threats, Harrison expects that cyber and missile defense spending would grow regardless of who wins the election. But the allocation of funding for missile defense could differ significantly.

"You could see a shift in emphasis under Trump back towards more national missile defense systems," Harrison said. "I would expect that a Clinton administration would probably continue the [Obama administration's] emphasis on theater missile defense systems."

Schweizer noted that programs related to the Pentagon's third offset strategy — which seeks to leverage cutting-edge technologies to stay ahead of advanced adversaries — could fare well under a Clinton administration.

On her campaign website, the former secretary of state said she would invest in innovation and military capabilities that would enable the United States to counter "21st century threats."

Personnel continuity at high levels of the Defense Department — which is much more likely under a Clinton administration — could help sustain the momentum of the offset initiative, Schweizer said.

"We could easily see Deputy Defense Secretary Bob Work — the chief catalyst for the offset — staying on for some period of time to manage the transition and keep him in a role to continue to press and protect" the effort, he said.

It isn't clear how a Trump victory would impact the offset, he added.

"I'm going to make our military so big, so powerful, so strong..."

"Ending the sequester for both defense and non-defense spending in a balanced way."

As of press time, Clinton had not offered much detail about her plans for force posture or future weapon systems.

"I don't expect that we're going to get much more detail from either campaign, quite frankly, because at this point … it doesn't look like that is what the election is going to really turn on," Harrison said.

Regardless of who takes over the Oval Office, the president's ability to pick winners and losers among military programs would be limited by Congress, noted Chris Higgins, a defense industry analyst at Morningstar.

Trump has been critical of the F-35 joint strike fighter program, which has suffered major schedule delays and cost overruns. But he would have difficulty killing it or severely curtailing it, Higgins said.

"Almost every state in the union is involved in this program," he said in a recent Morningstar report. "A candidate like Trump comes out and makes statements against the F-35 program … but Congress is standing there saying, 'Well, I have jobs in my district that are tied to this program.' Setting aside whether it's a good program or not, they have a vested interest in this, and that constrains any administration."

Schweizer said lawmakers could rein in the mercurial Trump if he tried to implement a radical defense reform effort. "We would expect senior Republicans in Congress would prevent a Trump Pentagon from breaking too much glass."

Budget gridlock could continue in the coming years regardless of who occupies the White House.

With Republicans expected to retain control of the House and Democrats in a position to retake control of the Senate, both presidential candidates would likely face challenges in dealing with a divided or potentially hostile Congress, analysts noted.

"There's a difference between what I think they would like to do and what they're going to be able to do" if elected, said Christopher Preble, vice president for defense and foreign policy studies at the Cato Institute.

Republican and Democratic politicians have been at loggerheads over whether to increase non-military spending. If Trump wins, Democrats in the Senate would likely block efforts to increase military spending without proportional increases in non-defense spending. Clinton would similarly be constrained by lawmakers, analysts said.

"Politically I think Democrats are pretty wedded to the dollar for dollar increase in defense and non-defense," Harrison said. "I would not expect Hillary to change that."

If Republicans retain control of the House or have enough members in the Senate to filibuster, they would be in a position to thwart tax increases and more spending on domestic programs if Clinton wins, Preble said during a recent discussion with reporters.

Harrison said: "Unless one party sweeps in this election … you're going to have to negotiate, you're going to have to compromise to get a grand bargain budget deal. And I don't think that's likely to happen. The parties are still too far apart on these issues."

Email comments to jharper@ndia.org

A Harpoon missile is fired off the USS Coronado.

NAVY

Industry Prepares for New Navy Missile Program

Three major defense contractors are poised to vie for a pending Navy contract that would increase the littoral combat ship's survivability by equipping it with a powerful, long-range missile.

Last fall, Director of Surface Warfare Rear Adm. Peter Fanta indicated that there was a need to equip the LCS with an over-the-horizon missile capability and signaled that the service would look for a mature, commercial-off-the-shelf technology to fill the gap. The system would fit into the Navy's "distributed lethality" concept.

A request for proposals for the over-the-horizon missile program is slated for release by the end of the year, according to a Navy spokesperson. Boeing, Lockheed Martin and a Raytheon-Kongsberg team are expected to compete.

Boeing's Harpoon system — which the company plans to offer for the missile program — was tested in July on board the USS Coronado, an Independence-class LCS, during the Navy's Rim of the Pacific exercise, said Jim Brooks, director of Boeing Cruise Missile Systems.

"[We] went out to RIMPAC to do a firing that was fundamentally to demonstrate the integration of Harpoon onto LCS and to show it could be safely employed. That was successful," he said. "They were able to fire the missile. Everything worked on the ship as expected and it allows them to deploy to the Pacific later this year."

The service used a Harpoon Block 1C missile that was already in its inventory as well as one of its own launch systems, he said. The test was put together within a few months, he added.

"We've built over 7,500 Harpoons, about half of those for the U.S. Navy and half for our 29 international partners and allies. That really gives us a broad base to draw from, not only in terms of integration of Harpoon on new platforms, but also that infrastructure across the world that helps to support Har-

poon," he said.

The Navy is currently implementing the Block 2 version of Harpoon on the F/A-18 and P-8. That will give the system a network-enabled capability, he said.

With the Harpoon, Boeing is focusing on "incremental innovation," Brooks said. When the RFP is released for the over-the-horizon missile, the company plans to offer the Navy its Harpoon Block 2 Extended Range variant, he said.

"What we're doing with the extended range variant is adding capability," he said. "It's a continued evolution of that product line, and so that will give us the ability at very long ranges tying into that network to defeat those threats."

Enhancements include the doubling of the missile's range to more than 134 nautical miles and the inclusion of a data link, he said.

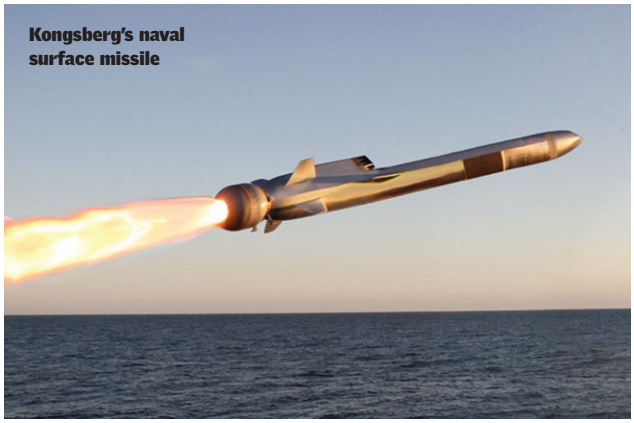
"It's all about being affordable. It's easier and more effective to upgrade the systems that you have than to go buy new ones. By doing that it's going to be half the cost of acquiring a new system," he said

There are also life cycle savings because of the Harpoon's existing infrastructure, he said.

The Raytheon-Kongsberg team plans to submit Kongsberg's naval surface missile to the competition when the RFP is released, which is expected to be by November, said Gary Holst, senior director of naval surface warfare at Kongsberg.

NSM — a dual-purpose anti-ship and land-attack missile — was developed by the Norwegian military to breach advanced air defenses, he added.

"When the Norwegians were building their missile corvettes and their multi-mission Aegis frigates, they looked for an anti-shipping missile to equip those. They checked what was on the international market and were actually underwhelmed by most of the capabilities that existed," he said. "Most of them were '70s vintage technologies. Most of them were active seekers which announced their arrival into the target area."



Kongsberg's naval surface missile

KONGSBERG

Norway opted to leverage its experience in electro-optical and infrared technologies and develop its own missile from scratch. The result of that effort is NSM, and the system was put into operational service in the Norwegian Navy in 2012, Holst said.

"It's ready now. It's in production. It's a mature, advanced missile," he said. "But most importantly for the Navy is … [it fills] the critical warfighting gap that they have in surface strike."

The Navy could save 10 years of development and $1 billion or more in development costs if NSM is selected, he said.

One of the system's most useful features is its "facial recognition" capability, which can be used in congested areas of the sea, Holst said.

"Adversaries today we postulate will try to mingle among merchant ships, try to compound the targeting problem to locate them and certainly strike them," he said. "We have a missile that can differentiate between ships and determine what its actual target is. It just brings a step-level increase in capability and confidence in employing the weapon that others do not have."

The companies recently announced that they would begin building the system in the United States, said Greg Pilon, manager of business development for Raytheon's precision standoff strike mission area. Final assembly, integration and testing of NSM would take place in Tucson, Arizona. Launchers would be manufactured in Louisville, Kentucky.

NSM was tested on the USS Coronado in Southern California in the fall of 2014. It struck a moving maritime target at a range that exceeded 100 miles, Holst said. The Navy had planned to test the NSM on board the USS Freedom this year, but it was recently postponed due to a lack of funding, according to a Navy spokeswoman.

"The Navy is evaluating options for NSM installation pending congressional action on the above threshold reprogramming request for that effort," said service spokeswoman Lt. Kara Yingling. The request was submitted in May. Three committees endorsed the requirement, but the proposed funding source was denied. One committee has deferred the request, she said.

Without disclosing details of the postponement, the Raytheon-Kongsberg team said in a statement that it was eager to again demonstrate NSM's capabilities on an LCS.

Lockheed Martin plans to enter its long-range anti-ship missile into the competition, said Scott Callaway, the company's LRASM surface-launch director.

Based on a request for information the Navy released in 2015, "we believe we have a highly effective solution that meets the U.S. Navy's goal of arming the LCS and the frigate with a formidable anti-surface warfare weapon," he said in an email. "LRASM is an affordable, highly survivable, long-range anti-ship weapon that meets the expected schedule requirements."

The system — which has a range of 200 nautical miles — has already demonstrated multi-platform capabilities through a series of flight tests, he said.

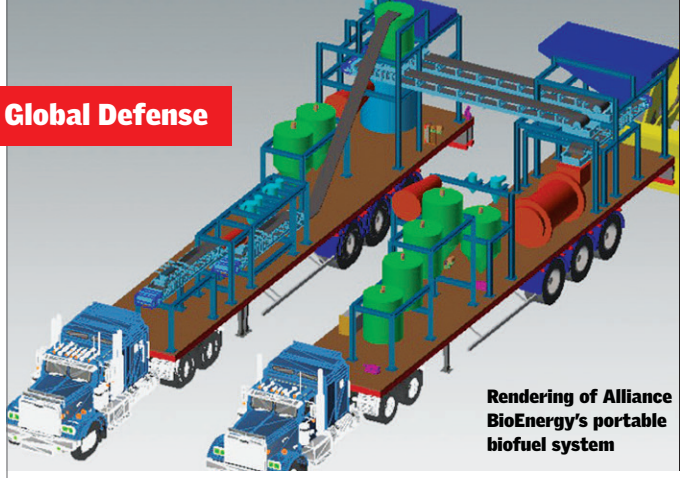
"LRASM's combination of long range, survivability and lethality would provide surface ships with the ability to prosecute nearly all enemy combatant ships," he said.

The company has been investing in risk reduction efforts on the surface-launch variant of LRASM, he said. The system is maturing "at a pace that could arm the fleet in a fraction of the time normally required for new systems."

The surface-launch variant of LRASM has greater than 90 percent commonality with the air-launched version, which is already a program of record with the Navy, he noted.

"Only minor modifications to the back end of the missile are needed to allow the MK-114 booster to attach to the missile," he said. "The topside launcher for LRASM is already being designed and will incorporate all of the features needed for integration onto various surface ships without vertical launch system capabilities."

— Yasmin Tadjdeh ▪ ytadjdeh@ndia.org



Rendering of Alliance BioEnergy's portable biofuel system

Low-Cost Biofuel Process Could Serve U.S. Military

■ The U.S. military could benefit from a new process for creating biofuel that is portable, speedy and cost-efficient, said a company executive.

Alliance BioEnergy Plus Inc., a Florida-based company that specializes in cellulose — or plant fiber — conversion, has created a mechanical process for converting organic matter into sugars and oils in minutes to produce diesel and jet fuel.

The cellulose-to-sugar (CTS) process could prove beneficial for Navy ships and military ground vehicles, enabling them to be fueled while in transit at a manageable cost, said BioEnergy president Daniel de Liege. "Our system is modular and very portable, and could be placed on the back of a truck or a very large unit," he said.

He noted the drawbacks that have kept biofuels from being a prominent fuel supply for the services in the past. These include fixed land-based production facilities, inefficient processes and burdensome transportation requirements for use anywhere beyond the production facility.

"We literally could be in shipping containers, installed in refueling oilers and actually processed at sea," De Liege said. Fleet waste could be used or genetically modified algae could be grown on the side of a ship to be converted into fuel, he said.

BioEnergy has submitted an application to the Department of Energy to develop a jet fuel demonstration facility in Florida, De Liege said. The facility could be developed within 24 months, he said. "Once the facility is commissioned, we would start the process of doing demonstrations" for the military, he said.

The cost savings could be significant. BioEnergy's current projections show that it could produce fuel at 50 percent or less per gallon than current biofuel prices, De Liege said. The process can manufacture diesel fuel for about $1.10 per gallon, and jet fuel for under $2 a gallon. Conventional biofuels can cost between $3.50 and $5 per gallon, he said.

The University of Central Florida's Blair Research Group developed the CTS process over the past seven years, and BioEnergy holds the exclusive rights to the patent, De Liege said.

— Vivienne Machi ▪ vmachi@ndia.org

NATO Investing Heavily In Defense Technology

■ NATO plans to invest nearly $3.9 billion in defense technology between now and 2019, according to a recent press release.

The investments focus on strengthening NATO's cyber and air defense, satellite communications, response force, and command-and-control for complex multinational operations, the release said. The first contracts include a major program for NATO satellite communications worth nearly $1.7 billion, a new acquisition for advanced software and more air defenses.

"Today's technological change is driven by industry. … We are engaging industry early on to ensure we tap into that creativity," said NATO Communications and Information Agency General Manager Koen Gijbers in the press release. "NATO will only be resilient if we embrace and can do continuous, rapid innovation."

This year saw NATO allies' defense expenditures increase for the first time since 2009, according to the release.

The investments are likely linked to NATO's efforts to deter increased aggression from Russia, said Thomas Karako, a missile defense analyst at the Center for Strategic and International Studies in Washington, D.C.

Germany is investing in a medium extended air defense system.

ALLIANCE/MEADS INTL.

"Back in 2010, missile defense [investment] was almost exclusively about Iran," he said. But it is clear that NATO has "seized on the Russia problem," he added.

There are numerous possible solutions to the overall ballistic and cruise missile threat posed by Russia towards the Baltic states and other NATO allies, but Karako said the answer will likely be tiered and multinational.

"We're already seeing some activity here, with the announcements by the Germans and the Dutch of some rotational deployments into the Baltics," he said. The Netherlands recently decided to modernize its existing Patriot air-and-missile defense systems, and Poland plans to invest in it as well. Meanwhile, Germany continues to invest in Lockheed Martin's medium extended air defense system.

Other U.S. and non-U.S. lower-tier programs, such as short-range air defense/anti-aircraft weapons, could also be used, Karako said.

NATO Communications and Information Agency documents show contract opportunities are open for a new initiative called Project Triton, which is meant to improve the functionality of NATO's maritime command-and-control operations. Other opportunities include a bid to replace the submarine broadcast control authority communications equipment, and to boost the command-and-control of chemical, biological, radiological and nuclear defense, as well as for a next-generation electronic warfare system.

— Vivienne Machi ▪ vmachi@ndia.org

Attempted Coup Fallout Perturbs U.S.-Turkey Relations

The aftermath of a failed coup attempt on Turkey's government earlier this year could have ramifications for U.S.-Turkey military relations, an expert said.

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On July 15, a faction within the Turkish armed forces staged a coup against Turkish state institutions, attempting to take over areas of Ankara, Istanbul and elsewhere. Over 300 people were killed and more than 2,100 injured before the attempt was stifled by forces loyal to Turkish President Recep Tayyip Erdogan and his government.

Since the attempted coup, Erdogan has purged government institutions of individuals he views as disloyal, including over 3,700 ranking military officers, according to Turkish Defense Minister Fikri Isik.

This removal of key military officials could have implications for Turkey's relationship with the United States and other Western allies, said Aaron Stein, a senior fellow at the Atlantic Council's Rafik Hariri Center for the Middle East.

Tensions could rise between pro-NATO and anti-NATO Turkish government officials, he said. "Things will get prickly between the two sides, which will mirror the overarching diplomatic problems that are taking place."

Policies that were under discussion up until the fallout have been "completely upset," Stein said.

This includes areas where the two countries could cooperate regarding the Syrian civil war, especially related to the Syrian Kurds, who are allied with the United States.

Military procurement is also expected to take a hit, Stein said. The naval and helicopter market areas are vulnerable. "The prime minister has to make the final approval of big-ticket purchases, [but he] is now stuck doing other things," he said.

U.S. defense contractors were gearing up to compete for Turkey's plan to build new frigates. Additionally, Sikorsky had efforts in place to build the S-70 medium transport/utility helicopter in Turkey, Stein said.

"These are big-ticket items that all of a sudden have a toxic political environment in Turkey," he said. Plans for the country to purchase the F-35 Lightning II joint strike fighter appear unaffected by the coup changes, Stein said.

The coup will not interrupt the United States' efforts to combat the Islamic State, he said.

— Vivienne Machi ▪ vmachi@ndia.org

Foreign Military Sales Essential to U.S. Defense

Congressional Perspective

By Rep. Vicky Hartzler

It is widely accepted that the foreign military sales process has a critical impact on U.S. national security. Our nation reaps the benefits from interoperability with foreign partners and the multilateral trust it builds.

In addition to this vital role that foreign military sales, or FMS, play in our collective defense, there is another, equally compelling reason why it is critically important. Foreign military sales save the Department of Defense, and therefore the U.S. taxpayer, staggering amounts of money.

In joint operations with our allies when we are all employing the same equipment, there's another aspect of interoperability that's important to note: Every fighter aircraft, surface combatant, vehicle and weapon system that our partners have purchased from the United States to stand with us in combat is one that the United States didn't have to buy itself.

As I mentioned in a National Defense op-ed last month, the United States and the United Kingdom both operate P-8 maritime surveillance aircraft to protect the North Sea against Russian encroachment. Instead of the United States embarking on this mission by itself, the United Kingdom shares this responsibility with us. They share the cost burden with us to accomplish the mission.

Every opportunity for cost savings must be realized given today's tightened fiscal realities. While the Bipartisan Budget Act of 2015 provided the Defense Department temporary relief from sequestration, we're not out of the woods.

Reckless, arbitrary cuts loom in the future, and our men and women in uniform still face a readiness crisis today. As we continue to ask our military to do more with less, it's important that we act on a solution that can stretch defense dollars further.

The most recent omnibus reprogramming action the Pentagon sent to Capitol Hill clearly demonstrated savings due to foreign military sales. Multiple programs across the Army, Navy and Air Force saw lower production costs, efficiencies gained and reduced costs for future modernization as a result of more foreign sales than expected. It is simple economics — economies of scale are achieved when orders increase and the individual unit price decreases.

The Pentagon doesn't just realize these savings as an afterthought. In fact, they plan for them in the annual budget cycle as well. Each of the services makes assumptions about production lines being open in their business case analyses and budget predictions.

For example, when the Navy budgeted for its procurement of F/A-18 Super Hornet fighter aircraft in the "future years defense program," it assumed Boeing's production lines in St. Louis, Missouri, would be open and ready to roll out more aircraft at a predictable price in fiscal year 2018. That production line was safe to be assumed open because of a sale of F/A-18 variants to Kuwait.

However, the Obama administration continues to stall on the Kuwait sale, which threatens that production line. Without an order to fill, that St. Louis production line would be forced to close. The Navy would have no choice but to fill a critical requirement by paying a premium to reopen the production line, rehire and retrain employees, reestablish a supplier base and then wait the requisite time to ramp up to full-scale production.

> "When the U.S. sells defense equipment to our international partners, it provides stability and cost savings for our own domestic use."

Everything from the Super Hornet's radar and sensor systems to the composite frame of the aircraft relies on sales for continuity. Ultimately, when the United States sells defense equipment to our international partners, it provides stability and cost savings for our own domestic use and efforts in efficiency.

Our country faces continually evolving external threats. Russia and China unpredictably seek to expand their influence, and non-state actors like the Islamic State in Iraq and Syria drive new requirements.

We also face a range of self-imposed internal threats. The Department of Defense requires levels of funding proportional to the results we expect from it. In recent years, however, expectations have risen while funding levels have reached dangerous lows.

We must adapt, and we must act on solutions that can ease this strain. Finding new approaches to facilitate foreign military sales — to increase interoperability and to save valuable taxpayer dollars — is critical to our national security. **ND**

Rep. Vicky Hartzler, R-Mo., serves on the House Armed Services, Agriculture and Budget Committees. In the 114th Congress she was named chairwoman of the oversight and investigations subcommittee of the Armed Services Committee to oversee the administration's defense policies.

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Drones: The Next Evolution of Low-Tech Terror

Commentary

By Ben Lerner

The wave of jihadist terrorist attacks on soft targets throughout Western Europe and the United States in recent months have a common tactical thread running through them.

All of them — whether the shooting attack at the Orlando nightclub, the use of a truck to viciously mow down bystanders at a Bastille Day celebration in Nice or the use of an ax to attack passengers on a train in Germany — are examples of what analysts previously have referred to as "low-tech terrorism." They involve simpler, less-elaborate and lower-budget weapons and planning.

Adding to this is the fact that the targets are not confined to a short list of high-profile, iconic structures like the World Trade Center, but rather expanded to any publicly accessible location where a group may gather, simplifying the planning even further.

From a tactical perspective, these attacks are also notable because the terrorists had to be physically present at the target in order to attack it, and in some cases were present prior to the attack, to conduct reconnaissance in advance. In other words, what the terrorists have lacked thus far is the advantage of evasiveness — the ability to carry out or provide critical support for an attack without actually being on site.

There is reason to be concerned that drones may soon fill that gap, and add an additional layer of complexity as law enforcement and other domestic security services try to tackle the low-tech terrorism threat.

Small drones, flown for commercial or recreational purposes, are now available throughout the world, and are relatively inexpensive to obtain or build from component parts. The U.S. military has noted that groups like the Islamic State have already configured them to carry small explosives and act as aerial improvised explosive devices against ground forces in the Middle East. That threat can migrate easily into the homeland security space, where a drone could be flown with precision to detonate in a specific place, without someone having to walk or drive toward a crowd and risk possibly being thwarted by security personnel.

There have been other ominous warnings of the possibilities in this regard far from the battlefields of Iraq. Back in 2013, a member of the German Pirate Party, in an apparent attempt to make a political statement about drone surveillance, managed to remotely pilot a small aircraft through a crowd at an outdoor rally in Germany, landing it near the podium in front of Chancellor Angela Merkel and other high-level German government officials. In that particular instance, the perpetrator was arrested in a structure nearby after the drone had already landed. Similarly, a drone operator protesting Japan's nuclear energy policy landed a drone containing radioactive material on the roof of the Japanese prime minister's office.

A drone that is not weaponized can still add significant value to those looking to gather intelligence from afar before carrying out an attack or receive real-time targeting information during one.

While the military has not yet seen groups like the Islamic State engage in the large-scale use of drones as flying bombs, it has been using unmanned aerial vehicles for image-gathering operations to guide and augment other kinds of attacks, like showing the optimal routes for car bombs, or studying Iraqi troop positioning and responses. Its use of drones, both as an IED delivery system and as an intelligence-surveillance-reconnaissance tool, has become enough of an issue for the U.S. military that the Defense Department last month asked Congress to provide an additional $20 million to the Pentagon's Joint Improvised-Threat Defeat Agency to continue tackling this challenge.

It's a reasonable bet that non-state actors like ISIL and others, cognizant of the advantages that drones provide and already making use of them on foreign battlefields, are looking at how to use them here.

> "A drone could be flown with precision to detonate in a specific place."

While there is growing recognition of this risk, more needs to be done. Recently, the Department of Homeland Security announced it has identified counter-drone technology solutions as one of several first responder "capabilities gaps," and will host an event this October that will enable personnel in New York City to experiment with various solutions being offered by the private sector.

Given the availability of drones and the demonstrated terrorist intent and capability to use them, efforts to develop and field counter-drone technologies suitable for populated environments need to be encouraged and expedited.

Additionally, law enforcement should give serious thought as to how to enlist the general public's help in preventing such an attack. It's one thing to apply "see something, say something" to people acting suspiciously or unclaimed packages, but it may be harder for the average person to articulate whether something seems off about the presence or flight path of a drone, especially in settings where their legitimate use is permitted.

It has often been the case that bad guys can innovate much faster than good guys can respond. In the case of terrorist use of drones, we may have an opportunity to put measures in place before something happens in the United States. But officials need to move fast. **ND**

Ben Lerner is vice president for government relations at the Center for Security Policy.

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Insider Threats: New Challenge For Cleared Contractors

Legal Viewpoint **By Laura Jehl and Garen Dodge**

The Defense Department in May issued Conforming Change 2 of the National Industrial Security Operating Manual.

NISPOM Change 2 requires all U.S. government contractors who need access to U.S. classified information to implement an insider threat program that will gather, integrate and report relevant information related to potential or actual insider threats among cleared employees by Nov. 30.

Insider threats — a growing phenomenon — arise when employees or contractors exploit legitimate access to an organization's data for unauthorized or malicious purposes. Much of the impetus for the new rule appears to be a valid concern about large-scale thefts of classified data, as exemplified by Edward Snowden's release of a vast trove of sensitive documents stolen from the U.S. National Security Agency.

Under the new rule, affected contractors must determine how to "identify and report relevant and credible information that may be indicative of an insider threat, deter cleared employees from becoming insider threats, detect those who pose an actual risk to classified information and mitigate the risk of an insider incident."

The rule requires in-house legal, information security and human resources departments to collect and share information related to the 13 personnel security adjudicative guidelines, monitor access — and attempted access — to classified databases, and establish an insider threat training program to educate employees on how to identify potential insider threats. Any suspected compromise of classified information must be immediately reported to the Defense Security Service.

On its face, the broad language of the rule — which mandates reporting of "relevant and credible information" that "may be" indicative of "potential or actual" threats — appears to argue in favor of over — rather than under-reporting of unusual behaviors or personal factors. Simply put, if an employee's conduct or statements, whether inside or out of the office, raises "credible" red flags, DSS must be notified. But the rule is short on specifics as to exactly what kinds of conduct or statements would indicate a potential insider threat, and silent as to how to determine what kind of information, and from what source, would be considered "relevant and credible."

Contractors subject to the new rule will need to think carefully about how to balance their compliance obligation with employee workplace rights and civil liberties; and consider how to distinguish between employees who are merely disgruntled and those who pose a serious threat.

In considering which employees may present a risk of malicious misconduct, contractors should be alert to signs that individuals are motivated by any of the following factors: financial gain; ideology; loyalty or allegiance to another company, country or group; revenge; vulnerability to blackmail; ego and thrill-seeking; and substance abuse or

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In addition, the FBI has detailed behavioral indicators of insider threats, including inappropriately seeking proprietary or classified information, taking confidential materials home, remote access to a computer network at odd times, disregard of company policies regarding software or hardware, or unreported foreign contacts or travel.

Information that an employee has demonstrated any of these indicators — especially if combined with a potentially damaging motivation — should be shared among the legal, human resources and information security representatives, and likely reported to DSS.

The new rule places contractors in a difficult position, and is likely to lead to litigation. For example, if a contractor errs on the side of reporting an employee, and that employee loses his or her clearance, it is likely that the contractor will get a letter from that employee's attorney. It is unclear if there is any type of defense available to the contractor for acting under color of this new requirement. Vendors may want to seek written clarification from their Defense Department contracting officer.

Contractors should begin to anticipate such workplace scenarios by adopting policies on filing reports with the company. For example, what is the procedure when one employee makes an allegation regarding another employee, but that allegation proves to be false, or is motivated by some improper purpose? What assurances should the contractor give in a whistle-blowing context that there will be no retaliation for filing a complaint? Should there be any workplace consequence where one employee, based on friendship or loyalty, shields a coworker's potential or actual threatening actions?

> "Much of the impetus for the new rule appears to be a valid concern about large-scale thefts of classified data."

While NISPOM Change 2 is primarily focused on insider threats regarding the exposure of classified information, the rule also seems to contemplate a contractor's increased vigilance regarding the threat of violent or destructive conduct by employees.

A contractor's action so motivated could put it in violation of the Americans with Disabilities Act. That federal law protects employees with both physical and mental health disabilities, permitting an employer to take an employment action where the individual at issue poses a "direct threat to the health or safety of other individuals in the workplace." The Equal Employment Opportunity Commission defines "direct threat" as a "significant risk of substantial harm to the health or safety of the individual or others" and provide that employers must determine whether an individual poses a "direct threat" by making "an individualized assessment of the individual's present ability to safely perform the essential functions of the job."

Factors to be considered in this individualized assessment include: The duration of the risk; the nature and severity of the potential harm; the likelihood that the potential harm will occur; and the imminence of the potential harm.

Thus, it appears that this new rule encourages contractors to act based on factors that fall short of what the ADA allows.

The rapidly approaching deadline means that contractors should begin preparing their insider threat program plans now.

As a first step, the company's existing policies and procedures relevant to insider threats should be reviewed for compliance with NISPOM.

Relevant policies include: pre-employment screening; protection of IT systems and classified networks; physical security of facilities; ownership and sharing of company intellectual property; reporting of grievances and risk behaviors; and protecting against false reports, retaliation for reports, and implementing penalties for non-reporting of serious security issues.

In reviewing and drafting these policies, affected contractors should balance the need to protect the company from damaging data theft with the obligation to respect the rights of their employees.

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Navy Seeking Interoperability Between Multi-Domain Robots

By Yasmin Tadjdeh

NEWPORT, R.I. — In Rhode Island's Narragansett Bay, unmanned underwater vehicles cruised under the sea. One surfaced to launch a drone into the air. Another examined the ocean floor.

It was here in August at the Naval Undersea Warfare Center's Newport division that engineers, industry and academia experimented with a variety of unmanned systems.

The Annual Naval Technology Exercise — or ANTX 2016 — was "designed to demonstrate future naval technologies in action today," said Rear Adm. Moises DelToro III, commander of the Naval Undersea Warfare Center.

Government and industry scientists were able to evaluate new technology at the research-and-development level before the systems become militarized and are integrated at the operational level, DelToro said during a speech.

ANTX 2016 focused on cross-domain communication between unmanned systems, he said. It also featured more than 300 personnel and 30 companies.

Mary Wohlgemuth, technical director at the center, said the Narragansett Bay test facility offered scientists and engineers an "ideal low-cost environment" to evaluate their systems.

Unmanned underwater vehicles have gained increased attention within the Defense Department. The Navy already employs a variety of systems. However, unless the military can connect UUVs to other unmanned vehicles, including aerial platforms, their utility won't be fully realized, said Patrick Kelley, director of cybersecurity for undersea warfare systems at NUWC Newport.

"Our focus is connecting what we would term all of the domains — the undersea, the surface and the air," he told National Defense. "We certainly see a time where ubiquitously there are different types of unmanned vehicles and sensors that are being connected and … [a] man in the loop on a platform, such as a submarine, is able to collaborate with and control all" of them.

That capability would give military officials increased situational awareness and serve as a force multiplier, he added.

"One of the very important things for the United States' submarine force is extending the reach of our platforms," he said. "What we know we need to do because of the size of the ocean, and the demand signals on the submarines, is give them … the ability to reach out farther than they can today with the sensors that are on the platform."

UUVs could be launched from submarines, surface ships or piers, he said.

During four occasions at the exercise, the scientists flew an AeroVironment-built Blackwing small unmanned aerial vehicle over the bay. SandShark UUVs that were submerged then surfaced, connected with the UAV and transmitted data, Kelley said. The Blackwing would then relay information to a submarine combat control system.

A Bell 407, acting as a surrogate Fire Scout autonomous helicopter, drops a replica torpedo during the ANTX exercise.

NORTHROP GRUMMAN

"The operator is actually able to see, operate and control the aerial vehicle as well as issue commands and control the undersea vehicle," he said.

The Navy wanted to discover how many vehicles a single operator or vessel could operate, he added. "Ideally, you would like to have one platform be able to interact and control some large number of vehicles that are in their surrounding area, which could be a very, very large area."

The ANTX experiments showed that an operator can control two to three vehicles at one time, Kelley said.

"Getting to dozens is probably sometime away. The vehicles need to get smarter and more autonomous on their own," he said.

The Bluefin-21, a heavyweight UUV, acted as a mother ship during the demonstration and deployed four SandSharks, said Tracy Howard, director of undersea programs at General Dynamics.

"The nice thing is you've got the modularity of the large vehicle to put multiple small vehicles in it, and you've got small vehicles that are easily reconfigured. They are expendable vehicles," he said.

The endurance of the Bluefin-21 is about 24 hours and the SandShark is about eight hours, he said. "You really have a capability that can linger in an area for longer periods of times by combining these systems."

"This is one example of a concept that could be useful in an operational environment where … you may not have superiority of the air, but if you put a small bot, a UAV out there, it's virtually undetectable," he added. "You can capitalize on that."

Northrop Grumman was also present at ANTX and conducted an anti-submarine warfare experiment using cross-domain communications from subsurface drones, unmanned surface vehicles and aerial assets, said Jim Pilkington, program manager for advanced systems at the company's autonomy division.

During the demonstration, a REMUS 600 autonomous underwater vehicle was able to connect with a Liquid Robotics' Wave Glider unmanned surface vehicle. The Wave Glider then communicated with a Bell 407 helicopter, which was acting as a Fire Scout surrogate, he said.

The data was then processed and fused into a target solution on board the aircraft and relayed to an operator who could then launch a simulated air-to-surface torpedo that would engage a target, he said.

"The vision is subsurface to surface to air to space," he said, noting that the Wave Gliders are connected via an Iridium satellite link because they are designed to be at sea for a year at a time.

Being able to connect the systems, process the data and put information into the hands of warfighters is critical, Pilkington said.

It is important to take the "workload away from operators looking down a soda straw trying to coalesce a target solution over miles of ocean," he said. "We can have fleets organized along a coastline or in a battle space. Our vision is we kind of view it as the sanctuary — a maritime sanctuary."

If industry can get the automation right, it can have unmanned surface vehicles out on the water for a year, high-altitude aerial drones flying for 36 hours and medium-altitude UAVs aloft for 12 hours. "Operators are not getting burned out but the work is getting done," he said.

Lockheed Martin also conducted experiments at the event. The company, working alongside industry partners such as OceanAero, brought an autonomous underwater vehicle known as the Marlin to the exercise. The system, equipped with a canister, was able to launch a Vector Hawk unmanned aerial vehicle.

"We use compressed air to launch that out," said Douglas Prince, who works at Lockheed's undersea systems business development division.

The system flew missions varying from 45 to 70 minutes duration, he said. The UAV had a camera fastened to it that collected video and streamed it down to the Submaran, which acted as a communications gateway.

OceanAero is the manufacturer of the Submaran, an autonomous surface vehicle with a satellite communication link so information relayed to it can be sent over-the-horizon, Prince added.

Because the Marlin has an acoustic sensor, the Submaran could connect with it while it was below the sea, command it to surface and then launch the Vector Hawk, he said. Once the UAV had been launched, it could be recovered by boat and then reloaded into the canister.

The Marlin autonomous underwater vehicle

The unmanned aerial system weighs less than six pounds, said Steven Fortson, who works at Lockheed Martin's unmanned systems division. It is powered by a lithium-ion battery and is equipped with an electro-optic infrared payload.

"It can operate … as an all-weather air data system," he said. "It can fly in rain which is kind of unique for small UAS. It can fly in … blinding snow conditions."

OceanAero's Submaran has the capability to dive 10 meters, said Eric Patten, president and CEO of the company. The system uses wind for propulsion, and has a maximum speed of 5.5 knots. The system carries a kilowatt of power on board, which is replenished by solar energy.

Cross-domain communication between unmanned vehicles will be critical for the Navy going forward, Patten said. The air, water, surface interface "has been a barrier for a long, long time," he said.

"Being able to talk across the domains and being able to do that not only with vessels, but with unmanned vessels — now we're starting to add some sort of increased capability," he said.

No matter how advanced autonomy gets, however, there will always be a need for a human in the loop, Patten said.

"The important part is to have that manned-unmanned interface," he said. "Part of this exercise here was the command and control across domains. So you keep the man in the loop and you're using these vehicles to go and do the dull, dirty and dangerous work."

Three members of Congress — Sen. Sheldon Whitehouse, D-R.I., Sen. Chris Murphy, D-Conn. and Rep. David Cicilline, D-R.I. — spoke at the exercise.

Murphy, who recently visited the Arctic during the Navy's Ice Exercise in March, said developing new unmanned underwater vehicle technology would be critical as adversaries beef up their spending on defense.

"We are watching some of our competitor nations making big investments in their Arctic fleets, both on top of the sea and underneath it," he said. "I saw firsthand all of the new capabilities that we will need … as we head into a quarter century in which the Arctic is going to be up for grabs, in which there is going to be more navigation, there's going to be more undersea activity than ever before.

"The advancements we are making here are going to help," he added.

Whitehouse noted that rising sea levels would create a host of issues for the United States and countries around the world going forward.

It will affect "countries like Bangladesh and Vietnam, which have enormous coastal tidal areas, and countries like the Maldives, which are likely to disappear if the predictions come true," he said. "All of that creates a strategic hazard for our country that we have to address, and the opportunity for technology to go deeper and farther without having to have human control" is important. **ND**

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YASMIN TADJDEH

Pentagon's Robotic Exosuit Program Making Strides

By Jon Harper

Scientists and engineers are pushing forward a cutting-edge U.S. military robotics project that could reduce war fighter fatigue and ward off injuries.

The Warrior Web program, spearheaded by the Defense Advanced Research Projects Agency, aims to significantly lower the "metabolic cost" — or energy expenditure — of troops operating in the field, and reduce the physiological burden of the gear that they carry, which can exceed 100 pounds.

To accomplish this, the Defense Department and the private sector are developing soft robotic exosuits that are designed to provide power and torque to critical body joints.

"The basic idea is … we use textile components to anchor it to the body, anchor it at the calf, anchor to the thigh, the waist belt, the foot," explained Conor Walsh, a leading robotics expert at Harvard University's Wyss Institute for Biologically Inspired Engineering, which has received DARPA funding to work on Warrior Web technology.

"Then what we want to do is use cables to apply force … [and] give some assistance to the joints in a way that doesn't add a lot of weight or a lot of mass to the legs of the wearer," he added.

Sensors on the system monitor the movement of the user and control the timing of the cables, he said. They give commands to a microprocessor that tells motors when they should pull in order to apply assistance to the wearer.

The initiative began in 2011. Since then, at least 15 Warrior Web prototypes have been tested in laboratories and outdoor settings, according to Mike LaFiandra, chief of the Army Research Laboratory's dismounted warrior branch, human research and engineering directorate.

DARPA has partnered closely with the lab and the Army's Natick Soldier Research, Development and Engineering Center to advance the program.

Demonstrations were conducted in April at Aberdeen Proving Ground, Maryland.

"Some of the systems didn't fair very well and some of them were great," LaFiandra said.

Additional tests and demonstrations have been conducted at Natick, the U.S. Military Academy at West Point, New York, and academic institutions such as Harvard. More are slated for later this year, and the spring and summer of 2017.

"There's still research that needs to be done there but for the first time, we've been showing a reduction in metabolic cost with soldiers carrying heavier loads wearing a Warrior Web-type system," LaFiandra said.

The amount of reduction depends on the individual wearing the suit, but researchers have seen greater than 10 percent in some cases, he said.

Walsh said the goal is to achieve a reduction of 25 percent or more. "The exciting thing is that you're able to now kind of say … it's possible to make it easier for a healthy person to walk when carrying a load," he said. "Now we're kind of at this next juncture … to say, 'How do we make the benefit as big as possible?'"

Army Chief of Staff Gen. Mark Milley is bullish about the potential of robotic exosuits.

"They're not ready for prime time today but … I think within 10 years things like that are going to be very, very possible on the battlefield," he said at a recent conference.

Major technological and engineering hurdles must be surmounted before the technology would be ready for fielding.

Power requirements are a key consideration, said Henry Girolamo, the lead for emerging concepts and technologies at Natick's warfighting directorate.

Gear that dismounted soldiers carry, such as radios, already require a lot of juice, he noted.

"If you introduce something like an exosuit that consumes a big power budget, it's just going to take away from what they need to have in power for the rest of their electronics" and force them to carry more batteries, he said.

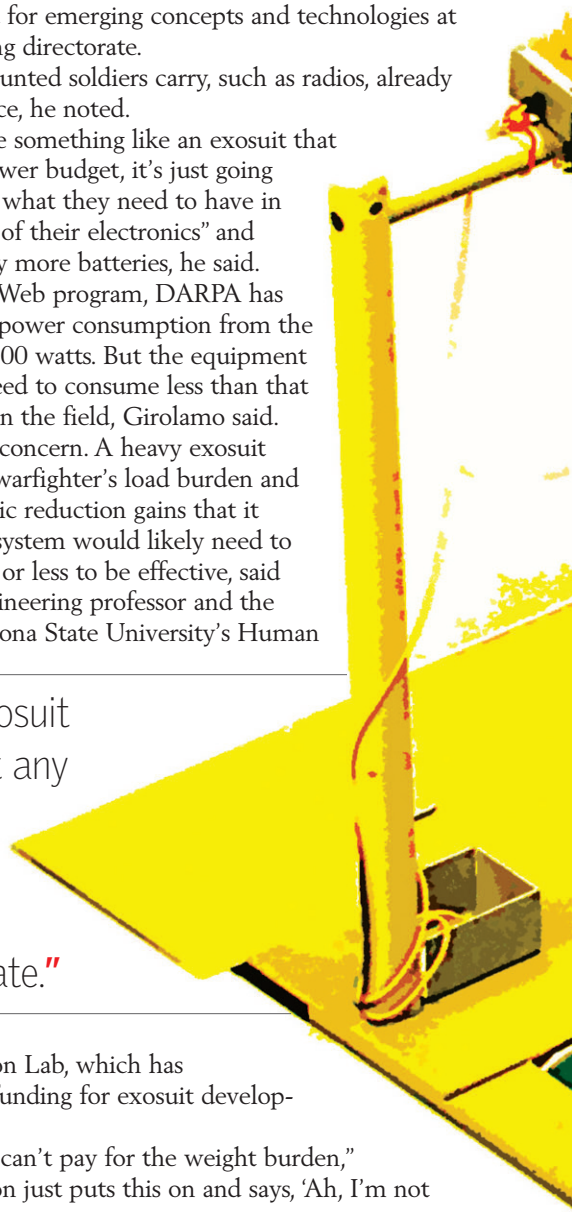
For the Warrior Web program, DARPA has set the maximum power consumption from the battery source at 100 watts. But the equipment would probably need to consume less than that for it to be viable in the field, Girolamo said.

Weight is also a concern. A heavy exosuit would add to the warfighter's load burden and offset any metabolic reduction gains that it could generate. A system would likely need to weigh 6 kilograms or less to be effective, said Tom Sugar, an engineering professor and the co-founder of Arizona State University's Human Machine Integration Lab, which has received DARPA funding for exosuit development.

> "A heavy exosuit would offset any metabolic reduction gains that it could generate."

"Otherwise you can't pay for the weight burden," he said. "The person just puts this on and says, 'Ah, I'm not going to carry it.'"

A heavy emphasis over the last three years has been on



DARPA

Army researchers evaluate DARPA's soft exosuit prototype.

making systems offset their weight penalty to provide a net benefit to the wearer, he added.

The gear must also work in concert with the user to facilitate ease of motion.

"A lot of the wearable robots out there make it feel like you're walking through a swimming pool," Sugar said. "For probably 95 percent of the systems, your metabolic cost goes up wearing these things."

Human-machine interface and control systems are areas where major improvement is needed, experts said.

Scientists and engineers need to better understand how to "make the robot move more like a person moves so that you can have even greater reductions in metabolic cost and greater improvements in performance," LaFiandra said.

Sophisticated computer algorithms, and adaptive sensing and control technologies could enable the systems to know exactly where to put the strength augmentation to different muscles and different joint areas for maximum effect, Girolamo said.

"It requires a lot of software to make it learn exactly how the human is performing," he said.

The exosuits also need to be adaptable to most soldiers.

"Sizing comes into play because no human is the same," Girolamo said. "You need to fit a large percentile perfectly. There needs to be adjustability. There needs to be comfort factors considered."

"There are going to be improvements that are going to have to be made to the system going forward so that the user says, 'Oh, this doesn't feel comfortable,' [and] turns a little knob or touches a key pad and there's a little app … where they can make it adjustable specifically to them," he added.

The equipment must also be fairly quiet and easy to don and doff, he noted. Project officials want "quick disconnects" for different pieces of the suit so that it can be rapidly removed during combat if necessary.

The technology also needs to be rugged and capable of surviving in bad weather and other challenging operating conditions, experts noted.

The location and shape of other soldier equipment such as body armor and weaponry must also be taken into account, so that the exosuits don't get in the way of other important gear, Girolamo said.

The systems being developed for Warrior Web are different than what is envisioned by Special Operations Command for its tactical assault light operator suit project, experts said.

TALOS is intended to provide head-to-toe armor protection for commandos who kick in the door during house raids or lead other dangerous missions. Media have dubbed the technology the "Iron Man suit" after the fictional superhero.

In contrast, the Warrior Web technology is designed to be worn on the lower body and not serve as a substitute for traditional body armor.

The TALOS project is "an order of magnitude different because you've got a huge helmet, you've got armor plates in the arms, chest, legs," Sugar said. "In that sense that's a more complicated system. … Everyone wants to build these giant exosuits, but if you build a system that just gives you the right amount of power at the right time it will work much better because you've got to pay this weight penalty."

DARPA funding has been critical to pushing the technology forward, Girolamo said, noting that the Army is more reluc-

ARMY, WYSS INSTITUTE (GRAPHIC)

Wyss Institute's Exosuit System

The soft exosuit uses a combination of sensors, including a hyperelastic strain sensor (1) and sensors around the wearer's hip, calf and ankle (2)-(5), all secured by straps. Flexible membranes cover sensors and straps (6).

tant to invest large sums of cash in high-risk projects.

"We're very fortunate that DARPA has invested as much money in this [Warrior Web] program as they have because if it were up to the services to fund this, it would be probably unaffordable," he said. "Research would be certainly limited and the time to get to where we are would be significantly longer."

DARPA declined to make any of their Warrior Web program officials available for an interview.

The project will likely move into a transition phase sometime in fiscal year 2017, Girolamo said.

"It will still be continuing as a DARPA program but we are also looking to start making Army investments into it beginning with the control algorithms … and some of the integration aspects in laboratory settings and experiment settings so that we can start to have a little bit more feedback in terms of what the Army will need," he said.

The main goal of the DARPA program has been proof of concept. Looking ahead, the Army Research Lab will conduct additional research to address knowledge gaps, and Natick will focus on equipment development.

"There's a lot more refinement that needs to go into that capability to make it be acceptable to the actual performers," Girolamo said. "They get it to a certain level and we have to be there as their partner to bridge the capability to make it adaptable and compatible" for soldiers.

"The proof of principle is that it has mitigated metabolics in the user community and that it has the potential to mitigate musculoskeletal injury going forward," he added. "It's up to us to work it the rest of the way for the user community and with the acquisition community."

Army officials recently held a preliminary design review of a Wyss Institute robotic system and discussed improvements that could be made. The metabolic reduction numbers "looked good," and a limited user evaluation is slated for spring 2017, Girolamo said.

Walsh expects to demonstrate the "optimized version" of his team's prototype suit next summer.

Development efforts undertaken thus far have put Army scientists and engineers in a strong position to take the project to the next level, Girolamo said.

"That amount of work that has already been done has mitigated the need for massive expenditures to streamline it going forward," he said.

The focus over the next several years will be on improving algorithms, system integration and power reduction, as well as human factors and biomechanics evolution. This will be done in concert with users in the development loop and the acquisition community, he said.

Experts are optimistic about the outlook for the technology.

"It's promising based on what we see right now," Girolamo said. "The proof is going to be in overcoming some of the challenges that we're not currently focused on. … These things are all doable, it's just going to take time and experimentation to achieve it."

Girolamo and LaFiandra said a fieldable system could be ready within a decade.

"Frankly it depends on the priority that's put on it," LaFiandra said. "If it is deemed a high priority and there are a lot of resources put toward it, I think it could be fielded even sooner." ND

Email comments to jharper@ndia.org

Army Pursuing Alternatives To Heavy Vehicle Armor

By Jon Harper

In the face of growing threats to ground vehicles, the Defense Department is teaming with industry and academia to pursue alternatives to traditional armor systems. The Pentagon is chasing a range of cutting-edge technologies that could enhance survivability without sacrificing mobility.

U.S. military officials have been sounding the alarm about the need for a new approach.

"The problem we're seeing now is with the proliferation of [anti-tank guided missiles] and chemical energy munitions, shaped charges, etc. … it's much easier to develop new ways to penetrate the armor" of U.S. military vehicles, Gen. David Perkins, commander of Army Training and Doctrine Command said at a recent conference.

The Army is now on the losing side of the cost curve because adversaries can enhance their attack capabilities faster and cheaper than the United States can add heavier armor to its vehicles, he noted.

The Army has "got to think of a different way to protect," he said.

In November, the Army Tank Automotive Research, Development and Engineering Center will host a ground vehicle survivability training symposium at Fort Benning, Georgia. The confab is expected to cover a wide range of technologies that could improve vehicle survivability and mobility including: advanced materials; manufacturing techniques and design methodologies; active blast mitigation systems; physical and electronic decoy and deception applications; hit avoidance and active protection technologies; and concepts that address threats posed by unconventional weapons or delivery systems.

"The overarching attempt of that is to bring together government, industry and academia for technical training … to provide a technical foundation across Army acquisition and ground vehicle survivability" offices, said Erik Kallio, assistant associate director of ground system survivability at TARDEC.

Classified sessions will involve a "deep dive" into ground vehicle survivability, he said.

Army requirements and acquisition communities will be represented to ensure that everyone is on the same page, he noted. The intent is to hold more of these symposia annually or biennially. The meetings will inform the overall ground vehicle survivability technical strategy, he said.

While the gatherings won't lead directly to requests for proposals, "understanding where the marketplace is indirectly informs future requirements," he added.

A key technology on the Army's radar is active protection systems, or APS, which are designed to intercept incoming enemy warheads and projectiles before they are able to land a fatal blow.

"To break that direct tie between weight and protection, there is an increasing emphasis on looking at active

M2A2 Bradley Fighting vehicle

ARMY

systems," Kallio said. "If you actively intercept a threat before it makes a terminal engagement with the vehicle, you can potentially take on or protect against larger threats without putting more weight on the vehicle."

Active protection systems are one of the Army's highest acquisition priorities, service officials have said.

The service is now involved in the installation and characterization of active protection systems on Abrams, Bradley and Stryker platforms, according to Ashley Givens, spokeswoman for program executive office ground combat systems. The effort "helps the Army understand various space claims and power budget issues caused by the addition of the systems. That work is currently ongoing," she said in an email.

The development of modular active protection systems, known as MAPS, is another project that is the Army science and technology community's "cornerstone" APS effort, Givens said.

But the service is looking at more mature systems for potential near-term fielding.

"To establish more immediate options that might address more urgent operational needs while we work towards an objective capability, we intend to install and characterize a range of matured and improved commercial APS solutions across the ground combat portfolio," Givens said.

"By prototyping these integration activities cooperatively with Army S&T, potential APS vendors and our platform installers, we will be able to posture the Army with solutions that can be more rapidly installed and greatly reduce both acquisition and operational risk," she added.

The Army is pursuing an expedited non-developmental item approach in parallel with the MAPS effort to obtain a "kittable" active protection system installation package to potentially accelerate fielding should an urgent need arise, Givens said.

"This approach allows the Army to assess current maturity, performance, integration risks and determine requirements to transition the [non-developmental] solutions to potentially support a future operational need or program of record," she said.

Fiscal year 2018 will be a decision point where off-the-shelf technologies either enter the process for accelerated acquisition or the APS installation kit is shelved for potential future use, she said.

Examinations of active protection systems are slated for the coming months. "Over the course of the winter and into spring we will be working through the series of demonstrations … which will take mature systems and install them on our vehicles and do assessments," Kallio said.

The modular active protection system would take longer to acquire, officials said. It is slated for a technology readiness level 6 demonstration in 2019, which would entail testing a prototype in a realistic environment such as a high-fidelity lab or a simulated operational scenario.

The ultimate goal is to use open standards to integrate industry subsystems. "The open factor is to take the best of breed components and … make a working system from them," Kallio said. A modular system could theoretically be incorporated on any ground combat vehicle, he noted.

In addition to attempting to thwart anti-tank missiles, the Army is now turning its attention toward potential solutions for the growing threat posed by directed energy weapons.

The Army already has active programs dealing with laser protection for sensors, he said. "We're just starting to have a look at directed energy … for anti-materiel" attacks by high-energy weapons that could destroy or damage vehicles, he said.

"It's a threat that hasn't proliferated yet but we're cognizant of it," he added.

TARDEC is also monitoring the progress of the Defense Advanced Research Projects Agency's Ground X-Vehicle Technology program. The Army hosted agency officials for a GXV-T workshop earlier this year.

"We look to other organizations to primarily do the technology maturation when things are less mature, and then we do the vehicle integration, the specific developments needed to put it on a ground vehicle," Kallio said. "We're tracking DARPA's developments just like our other partners."

DARPA is pursuing new technologies to improve vehicle survivability and mobility.

"For the past 100 years of mechanized warfare, protection for ground-based armored fighting vehicles and their occupants has boiled down almost exclusively to a simple equation — more armor equals more protection," DARPA said in a fact sheet about the GXV-T program.

But due to increasing threats, "the U.S. military is now at a point where … innovative and disruptive solutions are necessary to ensure the operational viability of the next generation of armored fighting vehicles."

Areas of interest include: "radically" enhanced mobility and the ability to traverse diverse terrain; autonomously avoiding incoming threats with technologies such as active repositioning of armor in real time; crew augmentation through improved situational awareness and automation of key crew functions; and the reduction of visible, infrared, acoustic and electromagnetic signatures.

Technical goals of the program are: decreasing vehicle size and weight by 50 percent; reducing onboard crew needed to operate vehicle by 50 percent; increasing vehicle speed by 100 percent; and accessing 95 percent of terrain.

DARPA declined to provide addition-

al comments or details about the program beyond what has been publicly released.

The agency has awarded GXV-T contracts to at least eight organizations including Raytheon BBN Technologies.

BBN is developing a system that would enable 360-degree situational awareness for vehicle crews and potentially eliminate the need for windows. It utilizes light detection and ranging surveying technology.


Ground X-Vehicle concept artwork

"We're using essentially LiDAR to … create a 3D model of the world, and then we're overlaying essentially textures from multiple cameras onto that scene," said David Diller, BBN senior scientist and program manager.

"Then you can really view the world from wherever you want to view the world. You're not stuck viewing the world just from the location of a camera or the location of a window," he said.

Diller compared the technology to a popular driving app.

"Think Google Street View where you're able to move down the street and see the environment from multiple perspectives," he said. "But imagine doing that in real time … [where you can] pan and tilt and zoom."

The technology is designed to use cameras and other sensors to collect information from the visible and infrared spectrum. "We're essentially looking to fuse the imagery, the data such that you can get a better view of what's going on in an easier way," Diller said.

The ability to get a grid location for a particular target could be integrated and potentially linked with Raytheon's Boomerang shot detection system, he added.

The company completed phase 1 of the proof of concept effort this summer, and has already started phase 2. It is expected to be completed by the end of June 2017.

DARPA recently awarded a contract to United Kingdom-based QinetiQ to take its electric hub-drive technology from a concept design phase into the building and testing phase, to include the production of two fully working units.

QinetiQ's system replaces the multiple gearboxes, differentials and drive shafts found on conventional vehicle drive systems with compact, high-powered electric motors contained completely within the wheels.

"This approach dramatically reduces overall platform weight and opens up new design possibilities that improve safety and increase performance," the company said in a press release.

Using an electric hub drive enables greater suspension movement, said John Mackey, head of engineering within QinetiQ's research services division.

"You can move the vehicle up and down, which is a big survivability advantage if you're worried about blasts," he said. "You could actually move the vehicle much higher in the air if you're suspicious of [improvised explosive devices] and things on the road."

Eliminating pieces of the mechanical drive system means fewer vehicle parts that could act as shrapnel against crew members in the event that the vehicle gets hit. It could also provide more design options, he noted.

"Because you haven't got so many things coming through the hull, if you get a blast there's less likelihood of something being driven into the vehicle," he said. "You can really sort of optimize the whole structure to protect the crew … [by] getting rid of a lot of clutter."

The hybrid system includes a battery that could provide a power boost and enable more rapid acceleration. Additionally, driving in battery mode could make the vehicle stealthier, he said.

"You also have a silent movement capability depending on the size of your battery," he said. "If you're running on the batteries the vehicles are incredibly quiet" like commercial electric vehicles. "People don't hear them coming."

Carnegie Mellon University is also working on GXV-T to develop a system that could enable a vehicle to switch from wheel drive to track drive — and vice versa — "on the fly."

"Imagine now if you have a vehicle that had wheels that allowed you to go really fast on highways or on prepared terrains … yet when it got into other situations where the terrain was very soft … you could change its configuration to become a tracked vehicle without somebody going there and changing the locomotion elements," said Dimi Apostolopoulos, senior systems scientist at Carnegie Mellon's Robotics Institute.

"If you have something that will switch this from one mode to the other you can get the benefits from each one of these types of locomotion elements," he added. "The value to the warfighter is that … you can go from prepared terrains and roads and semi-rugged terrain to … sand and marsh and mud and swamps and things like that where tracks work better."

The dual-mode technology could potentially enable U.S. military vehicles to go around enemy forces if they wanted to avoid a fight. It could also enable them to more quickly get from point A to point B, Apostolopoulos said.

Kallio said TARDEC was planning to host officials from DARPA's tactical technology office in the coming months to see where things stand with GXV-T-related technologies. **ND**

Email comments to jharper@ndia.org

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U.S. Army photo

The Concept for Advanced Military Explosion-mitigating Land Demonstrator (CAMEL) is a new, nontraditional U.S. Army ground vehicle survivability demonstrator. CTC welded the hull for contractor Pratt & Miller.

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Industry Tackling Body Armor Burden with New Materials

By Vivienne Machi

Body armor weight has been an issue for soldiers for decades, but as lawmakers and the military push to decrease the load, scientists, academics and the defense industry are developing technologies that create lighter vests, buoyant plates and more comfortable fabrics.

The Army has been working to develop the next-generation "soldier protection system," which would equip troops with lighter body armor, along with upgraded equipment including health sensors and new protective eyewear.

"The most immediate need for body armor right now is weight reduction," said Lt. Col. Kathy Brown, product manager for soldier protective equipment for the Army program executive office soldier. "There is a big emphasis on trying to lighten the soldiers' load, and also to make sure that we have adequate protection and a great fit."

The multimillion-dollar program includes the vital torso protection system (VTPS), which features lighter-weight protective inserts and side ballistic inserts. The VTPS achieves between seven and 14 percent reduced weight, Brown said. The manufacturers include BAE Systems and Ceradyne.

The torso and extremity protection portion includes a new soft armor modular scalable vest, improved outer tactical vests for both male and female soldiers, a blast pelvic protector and a ballistic combat shirt. Contractors including KDH Defense Systems, Point Blank Enterprises and Revision Military Ltd. are developing those components.

The system also includes a modular, scalable head protection system that is 5 percent lighter than current headgear, and new ballistic protective eyewear that will benefit soldiers in varying light conditions.

An integrated sensor system that would measure heart rate, temperature and hydration levels, has not yet become a program of record and is still in the engineering and development phase, Brown said.

The soldier protection system is expected to provide troops with 10 percent overall weight reduction while maintaining or improving current ballistic capabilities, according to documents.

Lawmakers are pushing for the system to achieve a 20 percent reduction in weight, according to congressional reports.

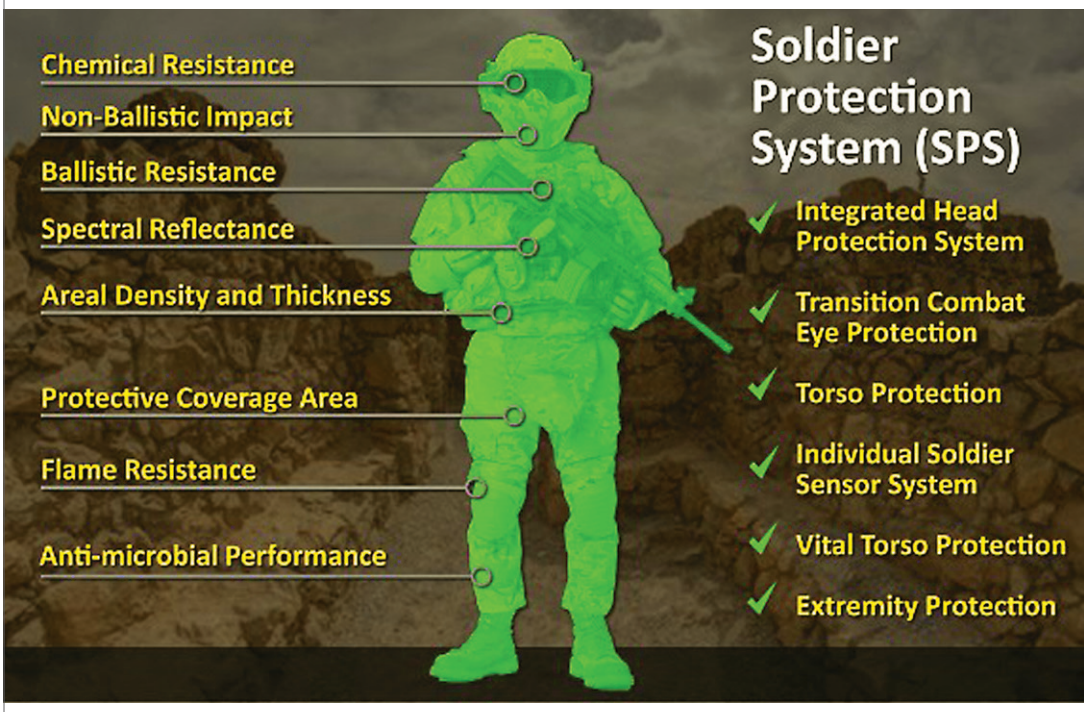
"A goal of doubling the current SPS [soldier protection system] requirement (a 20 percent reduction in weight while maintaining or improving current ballistic capabilities) would ensure that soldiers have the most advanced hard armor possible to better address emerging and future threats," the House Armed Services Committee report for the 2017 National Defense Authorization Act read.

Optimizing mobility and functionality while ensuring the soldier can still perform the mission is crucial, Brown said. The impetus for developing the female variant of the improved outer tactical vest, which includes eight new sizes, came from feedback received by PEO soldier, she said.

The soft armor vest, tactical vest, head protection system and ballistic combat eyewear projects are scheduled for full-rate production in fiscal year 2017, while the sensor system is expected to become a program of record in fiscal year 2018, Brown said.

But the solution isn't merely to decrease the weight of one component of body armor. As the level and type of threat facing the warfighter has evolved, manufacturers like Honeywell have had to adjust their products to expand protection and counterbalance an increase in equipment needs, said Lori Wagner, special projects leader at the company.

"We're covering more of the body now," she said. "Before, you had the vest and the helmets, then you added the plates. Now, you've got the blast pelvic protector, groin protection, side protection and the neck."



Honeywell produces Spectra shields made with its patented fiber technology, which can be up to 60 percent stronger than other body armor fibers, Wagner said. Spectra shields are used across the services in small arms protective inserts (SAPI), soft armor vests, helmets and shields, and the company is consistently working to make them lighter, she said.

"The Army just achieved a significant weight improvement where they got 15 percent [reduced weight] out of the vest components, and they just announced that they want another 20 percent reduction in weight," she said. "It's a constant far-reaching target for us, but over the years, we were

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able to show a marked improvement."

Comfort and flexibility have become bigger priorities for body armor.

Engineers at the Naval Research Laboratory have developed a flexible, buoyant body armor prototype in a project funded by the rapid reaction technology office (RRTO), under the deputy assistant secretary of defense for emerging capability and prototyping. The office, which has overseen the project's development for over a year, focuses on proof of principle prototypes and demonstrations of emerging technologies for joint applications, according to its deputy director, Marine Corps Lt. Col. Andrew Winthrop. It typically completes projects in less than two years, he said.

The prototype can take multiple hits and was shown in testing to provide equivalent protection with a 50-percent weight reduction over existing small arms protective insert designs, according to the RRTO.

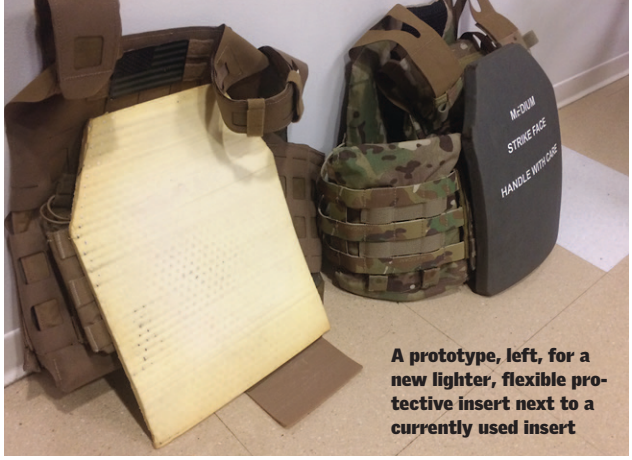
The plate is made out of layers of industrial ceramic spheres that are encapsulated within closed foam in the body plates so they are better able to withstand multiple hits, Winthrop said. The technology, first developed at the Naval Research Laboratory, allows the armor to be more flexible than normal SAPI plates and neutrally buoyant, Winthrop said.

"We want to meet or exceed what we currently have, with more flexible options," he said.

The prototype is meant to address several shortcomings in body armor design, including weight, mobility and ballistic resistance.

There are also safety concerns for maritime operations. Winthrop related a story about a number of Marines who drowned in Anbar province, Iraq, in 2006 — the sole survivor is alive because he was trained as a lifeguard and knew how to get rid of his heavy gear in the water.

Initial testing for the flexible buoyant body armor has shown promise. The National Institute of Justice standard defines ballistic resistance of body armor, and a Level 4 — the highest rating — indicates that the armor can withstand an armor-piercing bullet shot up to 2,880 feet per second. Current SAPI plates have a Level 4 rating, and the new plates have been shown to withstand multiple armor-piercing shots up to 3,000 feet per second in testing, Winthrop said.



A prototype, left, for a new lighter, flexible protective insert next to a currently used insert

"If you take a shot on the SAPI plates, you're going to feel it," Winthrop said.

Multi-shot testing was conducted at the Naval Surface Warfare Center in Dahlgren, Virginia, less than a year ago. Further refinement and testing is currently taking place at the Naval Postgraduate School in Monterey, California.

Work is also being done at Harvard University to produce a protective fiber that could deliver the same ballistic protection as current high-performance bulletproof materials, but would be significantly lighter and more comfortable.

Army Reserve Lt. Col. Kit Parker, a bioengineering professor at Harvard who has served multiple tours of duty in Afghanistan, is developing a next-generation nanofiber that can be used to design lighter-weight body armor.

Current body armor "doesn't breathe. It's pretty heavy," he said. "If I could cut the weight in half, that's an extraordinary thing." When he was deployed, he was carrying over 100 pounds of armor and equipment, and suffered back issues due to the weight, he said.

"This war is a chronic condition, and we keep doing multiple tours, and eventually, bodies are going to start giving out," he said. "You're hoping it doesn't give out on the battlefield, and then you hope it doesn't give out before your grandchildren are born."

Parker and his team in the Harvard Materials Research Science and Engineering Center are working to mitigate "the wear and tear" on soldiers' bodies from carrying lots of protective gear and equipment. They have developed a technology similar to that of a cotton candy machine that spins raw Kevlar manufactured by DuPont, and other materials into softer, lighter nanofibers, he said.

The product could also be used to develop protective undergarment groin protection for soldiers, Parker said.

"Three hundred-plus soldiers have lost all or part of their genitalia because of" improvised explosive devices, he said. "Imagine spandex-type flexible shorts that have ballistic protection, or a lightweight Kevlar cup that a man could wear for protection."

Parker's team receives funding from a National Science Foundation grant to the Materials Research Science and Engineering Center. The team has yet to conduct ballistic testing for the nanofiber, and is currently looking for partners to commercialize the technology and develop prototypes.

Wagner has seen comfort become a bigger priority for the military as it works with Honeywell to outfit soldiers.

"They spend a lot of time in the evaluation of products and in the user experience before they will even accept a design," she said.

Even further into the future, soldiers could be wearing customizable, tailor-made body armor, Wagner said. The military has discussed the idea of "complex suits of armor, where the soldier can determine what type of environment they will be in, and take the best components they need for that mission and still have a light, accessible armor system," she said.

That could mean more components to wear and carry, such as layers in cold weather, or having special appliqués added to helmets that serve a specific need, like rifle shot protection versus ballistic fragmentation protection. Or maybe the war fighter needs rifle round protection for the torso, but fragmentation protection for the extremities, she said.

"For us at Honeywell, that means we have to design a portfolio of … flexible, modifiable materials that meet those requirements or combine those requirements," she said.

Lowering the weight of individual pieces of body armor while accounting for the weight of new and additional equipment remains a complex challenge for the industry to meet, she said. **ND**

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Army Stands Up Office to Develop New Capabilities

By Yasmin Tadjdeh

The warnings from government officials have been dire: Adversaries around the globe are beefing up their defense spending and eating away at the technological edge the United States has enjoyed for decades.

Defense Department leaders have responded by standing up a slew of organizations across the Pentagon aimed at cutting red tape and rapidly acquiring new technology and capabilities.

The latest effort is the Army's rapid capabilities office, which was established in late August. The RCO "will expedite the acquisition of select capabilities to meet soldiers' immediate and near-term needs and serve as the breeding ground for ideas that enable a more agile and innovative acquisitions process," said Secretary of the Army Eric Fanning.

The office will initially focus on the execution of rapid prototyping and equipping within the areas of electronic warfare, cyber, survivability and position navigation, he said.

"We're not embarking on creating new systems or new platforms. We're not focused on building a new helicopter, but we would turn to this office if some capability on an existing helicopter is no longer sufficient," he said during an event hosted by Bloomberg Government in Washington, D.C.

With many threats around the world, now seemed like the perfect time to focus on a new way to acquire equipment, he said.

"It's clear as we watch our adversaries that they have studied our capabilities. They have looked for vulnerabilities. They've embarked on ambitious modernization efforts to narrow the technological gap between our forces," he said.

"For our commanders in the field today, and from exercises I've observed in my travels with the Army, it's clear that … the Army's overmatch against a potential adversary is not what it once was and it's not where it needs to be," he said.

The office will have a short chain of command, which will make it more agile and responsive in meeting operational demands, he said. It will have a board of directors, which Fanning will chair. Members include the Army's acquisition executive, Katrina McFarland, and Army Chief of Staff Gen. Mark Milley.

"[We] mean it when we say, 'rapid.' We're not aiming for the perfect solution that will field to the entire Army 15 or 20 years down the line," Fanning said. "We have great programs already working to do that. This office is closing on capability gaps where we know there are technologies out there today that can make a difference, inside the Army or out."

The office's board of directors was expected to meet in mid-September, RCO Director Douglas Wiltsie said in August.

RCO differs significantly from the Army's already established Rapid Equipping Force, Wiltsie said. The REF does "very little modification," he said. The RCO "will do some level of development, mostly integration pieces." Additionally, the REF's "sweet spot" is delivering a technology within a day to a year of receiving a request, he said. The RCO, on the other hand, is focused on addressing a capability within one to five years.

Timelines can be problematic when differentiating organizations, said Andrew Hunter, director of the Defense-Industrial Initiatives Group at the Center for Strategic and International Studies, a Washington, D.C.-based think tank.

"The timeframe issue can be a little tricky," he said. Modifications are often needed with many of the commercial-off-the-shelf items the government buys.

"It's just the nature of the military art that things that were designed originally for commercial operations require a little … something extra when you want to put them into a military context for a variety of reasons," he said.

"There tends to be a little bit of development and then … when you get through all the rigmarole of testing and everything, the timeframes can start to blur together between the … less–than-a-year and the one-to-five-year timelines. I think they are not as clean and distinct as they would want them to be in all cases," he said.

McFarland was mum on details about specific budget figures for the office. Army acquisition leaders have asked for flexibility in how much and what type of funding it will use to support the effort.

"We're not going to state at this time how and what money we're going to have because we're still working that, but we believe that we are going to have the adequate resources from the Army and within the Army to do that," she said.

However, she noted that she was looking at the "two-digit level right now for the immediate start," which could be up to $99 million.

Analysts said they expected that there was enough groundswell within the Pentagon and Army that the RCO could secure a revenue source.

"Given the priority that it has got within the leadership, I don't anticipate they're going to have real challenges with funding," Hunter said. "My sense, from what they were sort of essentially hinting at, is it's a little bit pre-decisional. They haven't briefed the Hill. They are obviously going to get it started with funding they already have at hand, which probably means some sort of a reprogramming."

Paul Scharre, director of the 20YY Future of Warfare Initiative at the Center for a New American Security, a Washington, D.C.-based think tank, didn't expect an uphill battle in Congress to secure funding.

"There is support on the Hill," he said. Sen. John McCain, R-Ariz., chairman of the Senate Armed Services Committee,

has already discussed the importance of rapid acquisition processes in the Pentagon, he said.

"The money is where the rubber meets the road," Scharre said. "The Department of Defense's budget isn't going to get bigger to accommodate this new process, so the money is going to have to come from somewhere. It's going to have to come from within the Army's budget."

While the service will have to make offsets, rapid acquisition efforts are usually not extremely expensive, said Mark Cancian, senior adviser at CSIS' international security program.

"You're not talking about pushing in billions of dollars," he said.

The RCO effort could make a real difference for the Army, Hunter said. The fact that there is widespread support from service leadership is "indicative of the fact that it's going to have an impact," he said.

"That's always a key piece of the puzzle in making … sure there is actual follow through in implementation," Hunter added.

Rapid acquisition organizations play an essential "translation function" between senior leadership and parts of the bureaucracy, he said. Hunter previously led the Pentagon's joint rapid acquisition cell.

Offices like the RCO will also be important as the military responds to evolving threats around the world, Scharre said.

"It's really important for responding to things like many of the innovations we're seeing Russia employing in the Ukraine in terms of precision fires, electronic warfare and drones," he said. The current acquisition process, which can sometimes take seven to 10 years, is "just too slow for the world we live in today," he said.

While the office is a step in the right direction for the Army, service leaders must make sure that they don't take away process where it is needed, Cancian said.

"To make this rapid acquisition process work, the Army and all of the services are really going to have to limit what they try to do to systems that are really ready for rapid acquisition and not try to expand the authority to systems that need a development cycle and would be more appropriate for the regular acquisition program," he said.

Pushing through a technology or capability that was not ripe for rapid acquisition "could endanger the whole thing and the Congress would get angry and pare back on it and they would be back to where they were before," he said.

It's important that the Pentagon doesn't forgo important steps in the acquisition process, such as operational testing for certain technologies, he said.

"For mature technology in a relatively mature system or subsystem, that's not a problem but the Army … has to be very careful they don't push something out in the field that turns out to have needed this kind of operational testing," he said. "Back in the '80s when the services didn't do that, they ended up with systems out on the field that needed a lot of upgrades and fixes."

Standing up an office like the RCO will help the Army better address innovation in the future, Scharre said. That is needed following acquisition failures during the wars in Iraq and Afghanistan. He pointed to the procurement of mine-resistant ambush protected vehicles, which the Pentagon fielded in the thousands at a cost of billions of dollars to respond to the growing improvised explosive device threat.

"The delay in bringing MRAPs on the field is a horrible stain on the department's bureaucratic processes and frankly leadership," he said. "When it comes to … the acquisition of the systems, once the secretary of defense made it a priority, industry was able to produce the MRAPs and get them to theater relatively quickly. But the requirements process failed and it failed miserably and initial requests from the field languished for two years inside the Pentagon before they bubbled up to the secretary of defense.

"That's a failure of adaptation and innovation inside the department. We can't have an innovative organization if it requires the secretary … personally intervening every time the department needs to adapt," he said.

With the rapid capabilities office being stood up so close to the end of President Obama's time in office, there is a question of whether it can endure in a new administration. Cancian said he didn't foresee that it would be an issue.

"There is a very broad interest in rapid acquisition and in innovation that will transcend the change of administration, whether it's Republican or Democrat," he said. "Both of them have talked a lot about innovation so … that would be of interest to both parties and a new administration no matter who" is the next president.

Besides standing up the RCO, the Army has made acquisition reform a top issue. In August, Army Materiel Command and Training and Doctrine Command conducted the third iteration of the Army Innovation Summit. The two-day event, which was held in Williamsburg, Virginia, focused on fostering more collaboration among the Army, the Defense Department, industry and academia.

"This year we initiated the innovation campaign on behalf of the U.S. Army to facilitate evaluation, feedback and … collaboration across the materiel enterprise because that's what we need to ensure that our soldiers … continue to be the best equipped fighting force the world has ever known," said Gen. Dennis Via, commander of AMC.

Innovation cannot be achieved all at once, but is an evolving process that will require the military to work alongside industry and academia, he said.

Gen. David Perkins, TRADOC commander, said innovation requires collaboration. "Generally speaking, the number one characteristic of an organization that has a high rate of innovation is that they have a high rate of collaboration," he said. "The people that innovate the most aren't necessarily the people that put in the most money and [research and development] and all." ND

Email comments to ytadjdeh@ndia.org

DEFENSE DEPT.

New Chem-Bio Protective Ensemble in the Works

By Stew Magnuson

The office in charge of chemical and biological protection is gearing up to replace the protective ensemble service members wear when weapons of mass destruction are employed.

Users want more flexibility to don different layers of protection depending on the circumstances. But to do this, they also need better sensors to tell them what types of threats are coming their way, officials said at a recent conference.

Synthetic biology and advances in chemistry mean there are new potential hazards on battlefields. Even mustard gas, first used 101 years ago in World War I, has reappeared, they said.

"The threat changes for us constantly. Every year I think we add more things to the list and we very seldom take anything off the list," said Douglas Bryce, joint program executive officer for chemical and biological defense.

The protective gear soldiers, sailors, airmen and Marines wear today has not undergone a major upgrade since the late 1990s. The goal is to begin fielding new protective suits by 2020 or 2021.

The office is working to complete an analysis of alternatives for the uniform integrated protection ensemble increment 2 (UIPEI2), which will replace the joint service lightweight integrated suit technology, Bryce said in an interview at the National Defense Industrial Association's Chemical-Biological-Radiological and Nuclear Defense Conference at Aberdeen Proving Ground, Maryland.

The office has been in the field interviewing users as to what they want in an ensemble. Different jobs in the military require different iterations of the gear, so there will be versions for infantry, flight and armored vehicles crews, for example.

The office is looking at a layered concept, which would mean adding various garments depending on how severe the threat is, or it may stick with the traditional one-suit approach, Bryce said.

The ensemble must "address everything we need to do to protect soldiers, sailors, airmen and Marines no matter what their mission or function is," he said. And since chemical and biological agents are so different in their nature, "that's a tall order," he added.

There has been a great deal of research and development and new technologies emerging since the last suit was designed two decades ago. The new gear should take advantage of these, he said.

"It's more about whether we can reduce operational burden if you put it on," he said. That is a more complex challenge than simply stating that it should be more comfortable, or less hot to wear. It's about, "how do I shoot, communicate and maneuver in a suit?" he said.

A layered approach might start with an undergarment for low threat levels and progress with more protection — and maybe even a poncho if the danger was liquefied and another layer was needed.

"There are many different concepts we could use or you could just do a suit. It all depends on the user community and what their mission is," he said.

"We have been out several months talking to warfighters from all the services asking them, 'what do you do and what would you do in this environment and what do we need to work on to let you do your mission, yet protect you?'" he said.

The office is not taking a conservative approach as the case has been with many acquisition programs of late, where only high technology readiness levels are acceptable. Bryce said the program manager can "push the boundaries." Game-changing technologies, like self-decontamination — where the protective clothing can rid itself of toxic chemicals or biological agents — are on the table, he said.

The office recently kicked off a challenge prize with $150,000 worth of award money seeking innovative ideas from outside the traditional vendors.

Army Capt. Stephen Gerry, assistant product manager for the UIPEI2, said, "We don't get a lot of non-traditional solvers out there who have potential ideas that we could use so we wanted to try a different avenue where we could reach more people — academia, guys who work on stuff in their basements, veterans — anybody who might have a good idea."

The "Proof: The ChemBio Suit Design Challenge" had a one-day meeting in Boston where potential contestants were allowed to try on the old suits to see just how bulky and hot they are. More than 100 participated. The deadline for submissions is Oct. 31 with winners announced Jan. 31.

Army Col. Scott Estes, deputy director of the joint requirements office for chemical, biological, radiological and nuclear defense, said the effort to

A decontamination exercise takes place at Aberdeen Proving Ground, Maryland.

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replace the old suit will inevitably run into the same problem seen in many joint programs, namely different services with varying and competing requirements.

The services look at the same data and come up with different numbers as far as the level of protection needed, he said. The office asked: what is the real threat today from chemical agents and what is the suit that is needed? "We hoped to have one number. We didn't get that," he said.

The services and combatant commands are all advocating for their needs, all with competing demands and desires. "And what it tends to drive you to is not the lowest common denominator solution … it tends to drive us to the highest common denominator, and usually what that means is the highest cost," he said.

Interviews at the conference with some of those potential users highlighted some of the conflicting ideas of what the next suit should be.

Brig. Gen. William King III, commander of the 20th chemical-biological-radiological-nuclear-explosive command, said he would like to see the layered approach.

"If I am going in and doing decontamination, I am probably going to need that full protection layering. But I don't need all of that all of the time. If I'm just doing a reconnaissance and I don't suspect to be actively seeing something, probably a single light layer" would be more appropriate, he said. The light layer would buy time for the soldier to don something more robust, he added.

King's troops are trained to move toward chem-bio incidents to perform their missions rather than maneuver away. There are big differences in the amount of protection needed depending on whether it is a biological agent, or chemical clouds such as sarin, or mustard gas. The former would call for lighter protection and the latter the heaviest. The same could be said for agents that are liquid or gas, he pointed out.

Col. Jay Reckard, chief of the full dimension protection division at Army headquarters, advocated for high protection at all times. Sensors designed to detect chem-bio agents can fail. And in a world of synthetic biology, vaccines will never be able to protect against all the biological threats.

"I'm a believer in vaccinations, but the way biological agents can be manipulated now, you can never have a vaccination that protects you against everything," he said.

"The soldier must have a level of protection that allows him to continue to operate," he said.

Better comfort, breathability and reductions in the heat burden are all good for the new suit, but he would rather have something with a longer shelf life.

Unused suits can expire after 10 to 15 years, and replacing them is a great expense.

"Unused suits can expire after 10 to 15 years..."

"Having something with a long shelf life would be beneficial to the Army," he said.

For Marines, mobility is a key metric, Chief Warrant Officer Jason Groves, CBRN defense officer at the Marine Corps' combat development and integration office, said during a panel discussion.

"Thermal burdens are pretty much a fact of life when you are in combat and in battle gear. You're going to be hot. But what's more important is mobility," he said.

"Everything hung on a Marine now has to be vetted for load effects," he said.

Estes stressed ease of use. The simpler it is to put the ensemble on, the safer its user will be. It reduces the chance that he or she will make a mistake and reduces training time, he added.

Lt. Cmdr. Blake Burket, shore action officer at the office of the chief of naval operations, said a shipboard environment is quite different from land operations. During wartime, ships are at sea and aircraft are carrying out sorties. And they may come back contaminated. They have to be decontaminated and personnel may have to be safely brought inside for medical treatment.

And then there is the environment: hot, humid, salty and mixed with high winds. Plus, Navy personnel do go ashore to handle cargo, explosive ordnance disposal and Seabee missions.

The Navy needs some kind of sensors that can fly or sail ahead of a ship or ships to warn them if it is about to encounter some kind of potentially hazardous cloud, he added. A Navy ship inadvertently went through a radioactive plume in 2011 after the Fukushima Daiichi nuclear disaster, he noted.

A second piece of the protection puzzle the joint office is working on centers on such sensors. Knowing what kinds of weapons of mass destruction agents threaten U.S. forces is vital, said Bryce.

The integrated early warning concept calls for fused data from a variety of different origins, whether they are sensors or intelligence reports. Sensors could be deployed in an array ahead of U.S. forces or away from bases to provide early warning, Bryce said.

Estes said commanders want more time to make decisions. "They want information quicker. … We don't know we have a problem until people start coming down sick. Usually, when that part happens, you're what they call 'late to need.' The horse has left the barn."

Wearable sensors might be a better way to get that early warning so treatment could be provided more quickly, he said.

King said, "Why can't I in real time monitor and assess and inform my decision-making processes so I can set the stage or set the forces for what we need to do? There is some effort to get at that. This is a capability gap that we have to get over sooner rather than later."

Bryce said the joint office is attempting to solve this problem: "We are already working on each of the pieces. It's now a matter of — how do you bring them all together and integrate them as a system — that is left to be done."

Meanwhile, Estes and several others at the conference lamented the fact that the CBRN community has not utilized robots as sensors or for other purposes.

The effort to integrate them into operations "has been stuck in neutral," even though sending them into hazardous environments rather than humans is a wno-brainer, Estes said. There has been a "lack of demand signal" for them, although he predicted that would soon change.

"I think we are about to crest that wave and we'll be off at the races," he said. **ND**

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New Products Improving Night Vision Goggles for Troops

By Stew Magnuson

The mantra in the world of night vision technology has always been to reduce the size and weight and power consumption of the devices worn in the field.

Researchers are making inroads solving those problems and more, as they not only make goggles, gun sights and monoculars lighter, but work to improve the users' visual range.

"We think size, weight and power will always be on the roadmap as to where night vision is going but where we really start to see benefits creep in is when we mirror human biology as closely as possible," said Aaron Cole, a scientist at the Naval Surface Warfare Center's Crane Division in Indiana.

Cole began with an idea in 2008 to double the standard military night vision goggle's field of view from 40 degrees to 80 degrees, which is much closer to what humans see. The goal was to reduce the so-called "soda straw" views seen in current devices.

"With the narrow 40-degree soda straw view, you really have to move your head left and right. You have no depth perception. You can't do basic things like stick a hypodermic needle in your buddy's arm, cut a wire if you're trying to disarm a bomb or notice basic things like a change in elevation when you're running around," said Cole in an interview.

It's not only about seeing more, he explained. Humans rely on secondary cues in order to determine where they are in space. And these secondary cues come from the periphery of one's vision. Looking straight ahead, everything is in focus. But a hand grasping a tool coming from the blurrier side view, either right or left, helps the brain to guide it.

"What we really wanted to do was copy the human eye as best as possible to give the user the most familiar reference point when using a night vision goggle," he said.

Crane took Cole's idea and set him up with Kent Electronics Corp. of Sugar Land, Texas, which won a small business innovation research contract to help flesh out the idea. Together, they took the idea from a technology readiness level 1 to TRL 9 in six years, meaning the new "wide field of view night vision goggle" is now ready to be fielded in large quantities.

The "secret sauce" that Cole came up with to earn him a co-patent on the technology was curving the image a certain way as it entered the image tube and curving it again as it leaves.

After transitioning the goggle to a rapid innovation contract, officials decided the best course was to retrofit existing night vision systems rather than starting from scratch with an all-new device. It took standard PVS-15 goggles, replaced the lenses, and along with some other adjustments, returned them with the wider field of view. Prototypes were sent to battlefields for user evaluations.

"We have been getting a lot of positive feedback," said Brenda Flanagin, assistant program manager of visual augmentation systems, at Crane.

The Air Force, Special Operations Command and Marine Corps Forces Special Operations Command were among those who tested the revamped goggles. Some of them were used during firefights. Cole said feedback indicated that they were an improvement in 90 percent of the day-to-day tasks carried out in combat.

"It's already in the form factor users know and are comfortable with," Cole said. The retrofitted goggles also reduced size, weight and power consumption by 40 percent system wide.

The Navy gave the green-light to go ahead with the program, and has signed a $48 million contract with Kent Electronics to retrofit up to 1,200 units. The first two orders totaling 555 goggles were expected to go out in September and October. Navy explosive ordnance disposal units and riverine squadrons will receive the first batches.

They are available to any

An airman tests his night-vision goggles.

DEFENSE DEPT.

U.S. military organization that has the requirements and funding in place, Flanagin said. She estimated that there are some 1,300 PVS-15 goggles being used across the U.S. military at any time. So the challenge for Kent Electronics is to turn orders around quickly so they can be returned back to the field as soon as possible. It costs about $9,000 to retrofit one goggle.

Donald Reago Jr., director of the Communications-Electronics Research, Development and Engineering Center's night vision and electronic sensors directorate at Fort Belvoir, Virginia, said all the service's labs devoted to night vision keep tabs on each other's projects and they have all pursued wider field of view.

The Army might be interested in the Navy's wide field of view retrofits for certain tasks, while some soldiers may actually prefer the 40-degree field of view, but with better resolution, he said.

"There are a lot of different technical things that need to be factored into a final application," he said.

Meanwhile, the directorate continues to work on reducing the size, weight and power issue while seeking to add capabilities, such as the fusion of image intensified goggles, which enhance ambient light, and infrared, which picks up heat signatures.

Night vision technology is proliferating throughout the world, and it's the directorate's goal to stay a step or two ahead of what rivals can provide to their troops.

"Our responsibility is to continue to keep our forces' technological advantage … and we are using every tool of innovation that we can," he said.

The resolution and sensitivity of image-intensified goggles have improved over the past decade along with the ability to add thermal signatures, which can help troops pick out targets "but at the same weight of traditional goggles," he said.

The directorate is working on connecting rifle sights and goggles, so the soldier can see through the sight without placing it against his or her eye.

Defense companies also continue to push the boundaries of night vision technology. Darrell Hackler, night vision senior director of global business development at Harris Corp., said, "Things are exciting in the night vision world. The capabilities are expanding and we are able to give the soldier more infor-

Traditional 40-degree view

New and improved 80-degree view

NAVY

Harris' F50-32 goggles

mation that he needs."

Ten years ago there were some organizations that had no night vision, even within the U.S. military. That has changed, he said.

"We have been listening to the customers to try to determine what they didn't like about the systems they have been using up to this point. And it really comes down to size, weight and power. They want everything smaller, they want everything lighter and want to reduce the battery load that they carry around," he said.

To that end, Harris is introducing in October the F50-32 goggle that reduces the weight from its predecessor from 700 grams to 500 grams. Getting the weight below that mark was the sweet spot customers most often mentioned.

"To get below 500 grams, a lot of the manufacturers have had to strip off a lot of the stuff soldiers have traditionally had in their night vision devices," he said. Harris wanted to shave off those 200 grams and maintain all the features.

"That was a difficult task. The image tubes themselves, which is really the magic behind being able to see at night, are pretty heavy. They are clad in some type of metal and there is a lot of glass and things like that. Those properties have significant weight to them," he said.

Along with the lighter weight, the goggles have some new features, including the ability to rotate one of the lenses out of the way, leaving one eye free to look around without the night vision.

"Soldiers seem to like that function because a lot time when you have night vision systems on, you don't want to stow it up on your helmet, you just need to move it out of the way of your eye," he said.

The rotated lens automatically turns off when moved up and comes back on when returned.

Users also now have the option of white light instead of the classic green. It's simply a matter of swapping in white phosphorous rather than green phosphorous, he said. There is no scientific evidence that one provides a clearer image over the other, Hackler said. It's a matter of personal preference.

It also has an adjustable, rather than a fixed diaptor, which is the small wheel that adjusts to an individual's eyesight. It's the same device found on common binoculars. EOD and medics like this feature because it allows them to get close-in, he said.

As far as energy, one AA battery should last a whole night, he said. It can be placed in the device itself, or fed by a powerpack placed in the back of the helmet to balance out the weight.

"We're not finished reducing size, weight and power," Hackler said. Harris is continuing to look for improvements. It wants to shorten the length of the image tubes, which changes the center of gravity of the head.

Harris is also taking its expertise in the radio communications realm and marrying it with its night vision business, which it acquired when it merged with ITT/Exelis in 2015.

"The next phase is bringing augmented reality into the night vision device and being able to display information in the goggle," he said. That might include compass settings, GPS waypoints, battlefield information and target reference points that can be pushed through a communications backbone.

"What we don't want the soldier to have to do is take his eyes off the battlefield to collect information that is readily available. Now, he can see that information in his goggle," he said.

These capabilities are possible now. It's a matter of militaries knowing they are available to them and their requirements. The system is also tailorable. Some organizations may only want a compass reading in their goggles, for example, or to mark a wounded soldier for a waypoint.

Reago said the Army is also working along these lines. "Our next generation of kids today, who will be our next generation of soldiers, they are very used to having a flood of information available to them all the time." Gamers are accustomed to having "heads-up" information they can act on.

The directorate wants to take already available information and project it as augmented reality in a 3D image.

"We believe that this will allow the soldiers of the future to dramatically outthink the enemy," he said.

This fused information could be accomplished by adding the data to the goggles, or into a display screen shaped like a visor that is placed on the helmet. The directorate is pursuing both concepts, he said.

Night vision imagery will also be part of a larger movement toward multifunctional cameras, which is intended to reduce the number of sensors on the battlefield by putting them all together in one box, he said.

The next technological leap that will enable much of this is a switch from the current analog systems to digital processing inside the device. This goal has been pursued for more than a decade, and Reago said the changeover is still about five years off, but they are beginning to produce prototypes.

"This is a more natural path toward fusion than the work we have been doing to date," he said. "We are finally starting to see the fruits of this."

Cole said fusion of multispectral band imagery into the devices is the future with the ability to see far more than the infrared or image intensified images. That might include short-wave, mid-wave and long-wave infrared, he said.

"In the end, we hope our warfighters enjoy a completely unobstructed field of view just as they would looking through their eye, but with the ability to see in multispectral domains," he said.

That might even include radio frequencies. A soldier may one day be able to spot cell phone transmissions through his or her goggle.

"That might be 50 years down the road," he added. **ND**

Email comments to smagnuson@ndia.org

HARRIS

Army Expands Use of Cognitive Development Training Tools

By Kristen Torres

A wave of new simulation technologies is helping Army personnel improve their cognitive skills so they can make better decisions faster during battles.

"We are taking a neuroscience approach to simulation exercises," said Alison Rubin, executive vice president of business development at Conflict Kinetics. "We teach your mind to take an image in quicker; your body to align with your decisions quicker; and your central nervous system to react in the appropriate way."

Conflict Kinetics focuses on short, intense, purpose-built drills. Through its synthetic marksmanship training program, it is able to replicate the physical and ocular challenges of combat, according to Rubin.

"By putting all these components together, we concentrate on achieving better situational awareness and better decision making," she added.

Conflict Kinetics, which focuses on virtual small arms training, was one of several vendors who took part in the Capitol Hill Modeling and Simulation Exposition, sponsored by the National Training and Simulation Association.

The company has gunfighter gyms located in the greater Washington, D.C., area and Virginia Beach, Virginia. The walls are lined with three 8-by-12-foot screens with targets flying down at the shooter from all angles. Training goals range from identifying biases when targeting enemy fighters and improving reaction time for shooters of all levels.

"When you're in a threat situation you've got to be trained for much more than just weapon shooting," she said. "We teach in a chaotic situation to help [soldiers] make better decisions out in the field."

By teaching soldiers and commanders how to deal with stress and calmly approach high-risk situations, Rubin said both groups will be better equipped with the thought processes necessary to decide whether to use lethal force while in the field or while making leadership decisions from a base.

"Our program has an incredible return on investment — the metrics prove it. We reduce all expenses associated with live fire training while still providing real world effects and scenarios," Rubin said.

Soldiers trained by the company have shown up to 300 percent improvements in peripheral target acquisition after a single session, according to Rubin.

Modeling and simulation training systems like Conflict Kinetics' SMT collect metric evaluations to track decision-making to be extracted by users for individual analysis.

"Our metric evaluation is extremely rich," Rubin said. "We track about 70 data points per movement at any given time during the exercises, allowing us to include biometrics in our system as well."

Time and budget constraints remain an important concern for military officials. Virtual training simulations like the ones provided by Conflict Kinetics allow the military to train its soldiers and commanders at a quicker rate without the live-fire costs, she added.

VT MÄK, which also offers tools for simulation, training and visualization, is offering video-game style training programs, where soldiers and staff members are able to use controllers — like wheels, joysticks and model guns — to perform tasks onscreen. Customers can make use of the platform to model various areas of expertise, such as playing the role of squad leader, training drivers and flight simulations.

"If customers have 3D models they want to use instead of ours, they can go ahead and plug their own data into the system," said Daniel Williams, business development executive of VT MÄK. "It can be set up for use with the Oculus but it can also be a virtual game played with a joy stick — there's room for customization."

The company's command staff training combines user-friendly features with the capabilities of large-scale threat situations, helping trainees make stronger battlefield decisions. Operations can be conducted at all levels — from the squad leader to the brigade commander — and gives officers the opportunity to experience the subsequent effects of their decisions on troops in the warzone.

"You can simulate and work out a decision to a specific situation by saying 'OK, how do I react and what do my forces need to do in response to my decision?'" Williams said. "The goal is to decide how to best respond and plan better for any given scenario. You have to ask, 'Where should I have my forces deployed so if something like this happens [in real life] we can be in the right places at the right times?'"

VT MÄK's focus is now shifting toward unmanned aerial vehicle training.

"We're working with Boeing and exploring what the logistics and training involved are for managing a UAV system and simulating that experience realistically," Williams said. "Flight simulators

A soldier trains at the Conflict Kinetics Gunfighter Gym.

DEFENSE DEPT.

can be multimillion dollar ventures, so we're creating specialized hardware to use with something like the Oculus to recreate that experience."

Williams said the company aims to reduce time in flight simulators to help military branches save both time and money. He sees virtual flight simulation training as a beneficial augmentation to the actual thing, at least until trainees can graduate to being in a real aircraft or tank.

"We have seen an upswing in the last few years where more and more troops are coming home with a discussion on how prepared they were," Williams said. "If we can save money by putting someone in a virtual situation instead of in the field, let's do it."

But money isn't the only reason officials are moving toward a virtual training environment. As cyber threats continue to increase in risk and probability, the need for experienced info-tech personnel has also risen.

Ingenia Services, a modeling and simulations training company providing engineering and management services to the Department of Defense, developed a tool that allows it to simulate various cyber attack effects in a secure manner.

"Conducting an actual cyber attack as a training exercise can potentially damage the software," said Derek Bryan, senior experimentation analyst at Ingenia. "By carrying out an attack simulation, we can do it in a secure manner and reverse the effects in seconds, whereas in real attacks you may never know where the malware actually ends up."

Ingenia's system allows operators to experience the conditions under a realistic cyber attack and come up with ways to work around it. Trainees using the program have to find alternative solutions to complete the mission, even with communication and visual services disrupted. The metrics gleened by Ingenia allow officials to see how well personnel performed with and without a cyber disruption.

"What we're aiming to teach is alternative ways to continue a mission even when certain aspects are compromised," Bryan said. "Whether operators need to change communication paths, switch to voice communication or another alternative form, we are all about giving them an arm to experience what a cyber degraded atmosphere is like."

"We are taking a neuroscience approach to simulation exercises."

The Army is also adapting its cyber training programs to teach personnel how to leverage existing cyber components in the field to their advantage by hacking onsite technology.

"We're looking at how a team on the ground could leverage cyber forces if they had them at their disposal," said Lt. Col. Brett Lindberg, a research scientist at the Army Cyber Institute. "We want to explore how to hook cyber forces alongside traditional Army maneuver forces on the ground." For example, using an existing traffic camera to get a picture of a situation on the ground, or hacking into street lamps to turn lights off.

The demo created by Lindberg's team is in its research stage. He predicted that five or 10 years from now, cyber forces will be serving on the ground — alongside the infantry.

"The military is trying to keep up with technology and training a new generation of soldiers who are used to having screens around them all the time," Lindberg said. "We're not doing this to train anybody specific right now, but we're trying to look at when this becomes a need and how we will train a cyber active force into traditional Army kinetic operations."

The fear of another "black swan" event — an extremely difficult to predict situation — post 9/11 has pushed the military further in its attempt to be as prepared as possible. By leveraging modeling and simulation environments, Lindberg said "we will have the organizational and mental capacity" to deal with the unknown. The only way to be able to act against unpredicted events is if the military has the internal ability to react to them, he added.

The defense and modeling simulation and coordination office, housed under the Department of Defense, has begun to codify data farming — using a high performance computer to run a simulation thousands of times — to analyze possible outliers, or anomalies, within a given situation, said Gary Horne, a participant in NATO MSG-124, a cyber defense group contributing to the development of improved decision support to NATO forces.

By more fully understanding the landscape of possibilities, the hope is that the findings will allow decision makers to reduce surprise, he added.

"In the past we would throw out the outlier information because a simulation could only be performed once or twice," said Horne. "With the technology now available, we can run scenarios thousands of times and we realized that the stuff we used to throw out can be really useful in determining the occurrence of a black swan."

Horne's group uses data farming to collect information on possible situational outcomes, but also on weapon systems like the Gunslinger — an automatic response firing weapon. The group observed six different characteristics of the system to determine what aspect of the weapon system the military should invest money in.

"We used a scenario and manipulated all six different characteristics separately," Horne said. "What we found was that survivability was the most important thing about the weapon. Without that, those in the vehicle are put at risk."

The team continues to use data farming to manipulate all possibilities of a catastrophic cyber event. Horne is hopeful that the process will help prepare cyber forces with the ability to be better equipped when faced with a cyber attack.

"Data farming as a methodology is very, very useful. After 9/11, everyone thought it was obvious that the terrorists would fly an airplane into a building — but nobody expected it. Data farming helps us reduce the amount of time we have to work from hindsight," he said.

Rep. Randy Forbes, R-Va., in a speech at the exposition, said: "We can no longer afford to do the testing we need without modeling and simulation. We cannot train our warfighters and other individuals without a high risk training process — and we can't do that without the modeling and simulation piece." ND

Email comments to serwin@ndia.org

ISTOCK

President, CEO McKinley Announces Retirement

Retired Air Force Gen. Craig McKinley, National Defense Industrial Association president and CEO, announced he will retire at the end of the year, concluding a two-year term as the leader of the nation's largest and longest-standing defense industry association.

"After 42 years in the Air Force and leading associations that serve as conduits for collaboration between government and industry, the time is right to transfer leadership of NDIA to a new generation and shift my focus to a series of personal and philanthropic endeavors," said McKinley. "I look forward to working closely with the NDIA board of directors as we search for and transition to my successor, and will continue to provide counsel and guidance in issues impacting our defense and national security."

McKinley took the helm of NDIA in January 2015, and worked vigorously to advance issues for both industry and government during a period of challenging fiscal times in the defense space. During his tenure at NDIA, he led the development of a new strategic direction and improved NDIA's relationships with industry stakeholders and government officials. He departs the organization on extremely strong financial footing, with assets totaling more than $56 million, with 1,600 member companies, 27 nationwide chapters, 36 divisions and 85,000 individual members.

"We have been honored to work alongside Craig for the past two years. He has led a distinguished career, and his vision and leadership have contributed significantly to NDIA's new strategic direction," said Sid Ashworth, NDIA board chair. "We wish him the absolute best as he transitions into retirement and look forward to his sage counsel as we conduct the search for his successor."

Following his retirement, McKinley will continue to serve as an advisor on defense industry and government related issues, and will continue to serve on corporate and nonprofit boards. NDIA has retained Korn Ferry to facilitate its search for a new president and CEO.

CHAPTER NEWS

Arthur D. Siirila (right) was installed July 22 as president of the Michigan chapter at its 72nd Annual dinner meeting in Grosse Pointe Shores, Michigan. The event was attended by over 200 members, including retired Air Force Gen. Craig McKinley, NDIA president and CEO (left).

RON WARREN/CONTRIBUTED

NDIA Appoints Zemek, Klein to Executive Roles

The National Defense Industrial Association has appointed two senior professionals to lead the policy and events teams.

As vice president of policy, Alexander Frank "Alex" Zemek will be responsible for developing and promoting strategic policy objectives that advance innovative solutions to national defense needs, and encourage continued collaboration between government and industry.

"Our national security challenges are evolving, and so are the needs of the defense community. Alex brings with him a tremendous amount of experience and knowledge, and we are very fortunate to have his talent on the team," said NDIA President and CEO retired Air Force Gen. Craig McKinley.

"I am excited to join NDIA, particularly at this critical juncture for our nation's national security. The policies promoted by NDIA are at the vanguard for America's defense through industry engagement and technology development," said Zemek.

He joins NDIA with nearly 16 years of experience in defense, intelligence and foreign affairs. He holds a bachelor's degree with honors in history from Yale University and a master's in strategic security studies with a focus in counterterrorism from the National Defense University's College of International Security Affairs. He also attended the Massachusetts Institute of Technology Seminar XXI on foreign politics and international relations.

Zemek is a recipient of numerous governmental awards, including the Secretary of Defense Medal for Exceptional Public Service, Secretary of Defense Global War on Terrorism Service Medal, and the U.S. Department of State Meritorious Honor and Superior Honor Awards.

As vice president of meetings and events, Christine Klein will lead NDIA's best-in-class department that brings together industry stakeholders, academia and government officials to encourage ongoing collaboration that provides forward-thinking solutions to address current and future challenges in defense and national security.

"Christine is a seasoned leader who brings a tremendous amount of event management experience and a proven record of serving the needs of target audiences," said McKinley. "Under Christine's leadership, NDIA's events will continue to serve as trusted venues of information and collaboration."

Klein joins NDIA with more than 20 years experience in planning meetings, events and conferences as well as exhibits and sponsorships. She has run her own event management business and previously served as the managing director of meetings for the American Institute of Architects and vice president of meetings and business partnerships at the Institute of Food Technologists.

OCTOBER

6 U.S.-UK-Canada-Australia Quadrilateral Conference
Arlington, VA
www.ndia.org/meetings/7570
See our ad on p. 54

6 C4ISR Breakfast Featuring Lt. Col. Gregory Griffin, USA
Alexandria, VA
www.ndia.org/meetings/792A

11-12 Procurement Division Meeting
Washington, DC
www.ndia.org/meetings/7PC1

11-13 21st Annual Expeditionary Warfare Conference
Portsmouth, VA
www.ndia.org/meetings/7700
See our ad on p. 53

12 TRIAD
Chantilly, VA
www.ndia.org/meetings/714T

18-19 NDIA Great Lakes Chapter Annual Meeting
Oshkosh, WI
www.ndia-greatlakes.org

19 S&ET Executive Breakfast Featuring Maj. Gen. Robert McMurry, Commander, AFRL
Washington, DC
http://www.ndia.org/meetings/772A

19-20 Manufacturing Division Meeting
Washington, DC
http://www.ndia.org/meetings/719A

20-21 2016 AIA/NDIA Technical Data Rights Forum
Arlington, VA
www.ndia.org/meetings/7PD1

21 Health Affairs Biodefense Summit
DETAILS COMING SOON
Washington, DC
www.ndia.org/meetings/731A

21 NDIA Washington, DC Chapter ROTC Scholarship Lunch
Arlington, VA
www.ndia.org/washdc

24-27 19th Annual Systems Engineering Conference
Springfield, VA
www.ndia.org/meetings/7870
See our ad on p. 54

25 Executive National Security Forum on the Security Cooperation Enterprise
DETAILS COMING SOON
Washington, DC
https://7LD1.eventbrite.com

25-26 San Diego Chapter Fall Defense and Industry Forum
San Diego, CA

25-27 Precision Strike Technology Symposium (PSTS-16)
SECRET//NOFORN Classification Level
Laurel, MD
www.precisionstrike.org
See our ad on p. 54

28 Fall ADAPT Breakfast Meeting
AFEI
Arlington, VA
www.afei.org/events/7A20

31-Nov 2 28th Annual Integrated Program Management Workshop
Bethesda, MD
www.ndia.org/meetings/7IPM
See our ad on p. 54

NOVEMBER

1-2 Gulf Coast Chapter 42nd Air Armament Symposium
Fort Walton Beach, FL

2-3 How Washington Works® – Navigating the DOD
Reston, VA
www.ndia.org/meetings/743A

3 Picatinny Chapter Annual 36th Firepower Awards Luncheon
Randolph, NJ

8-10 Aircraft Survivability Symposium 2016
Monterey, CA
www.ndia.org/meetings/7940
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10 CyberForwardDC
McLean, VA
www.cyberforwarddc.org
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14-16 2016 Joint Annual NDIA/AIA Fall Industrial Security Committee Conference
San Antonio, TX
www.ndia.org/meetings/7ISF

15 Cybersecurity For Advanced Manufacturing Workshop
DETAILS COMING SOON
Arlington, VA

28-Dec 2 I/ITSEC 2016
Orlando, FL
www.iitsec.org
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DECEMBER

1 S&ET Executive Breakfast Featuring Dr. Melissa Flagg, Deputy Assistant Secretary of Defense for Research
Washington, DC
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6 Combating Terrorism Technical Support Office (CTTSO) APBI
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13-14 NDIA Mastering Business Development Workshop
Los Angeles, CA
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FEBRUARY '17

14-16 28th Annual SO/LIC Symposium & Exhibition
Bethesda North Marriott Hotel & Conference Center
North Bethesda, MD
www.ndia.org/meetings/7880
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MARCH '17

6-10 Pacific Operational Science & Technology Conference
Honolulu, HI

27-29 Munitions Executive Summit
Parsippany, NJ

7-8 2017 Human Systems Conference
Springfield, VA
www.ndia.org/meetings/7350

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2017 DSAM course schedule
- January 23-27, 2017
  Annapolis, MD - Event #702A
- March 27 – 31, 2017
  Chicago, IL - Event #702B
- June 5 – 9, 2017
  Westlake, CA - Event #702C

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- LtGen Robert "Whaler" Walsh, USMC, CG, MCCDC, and CG, CD&I
- LtGen John Wissler, USMC, Commander, COMMARFORCOM

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- acquisition reform
- on-going and proposed future export control changes

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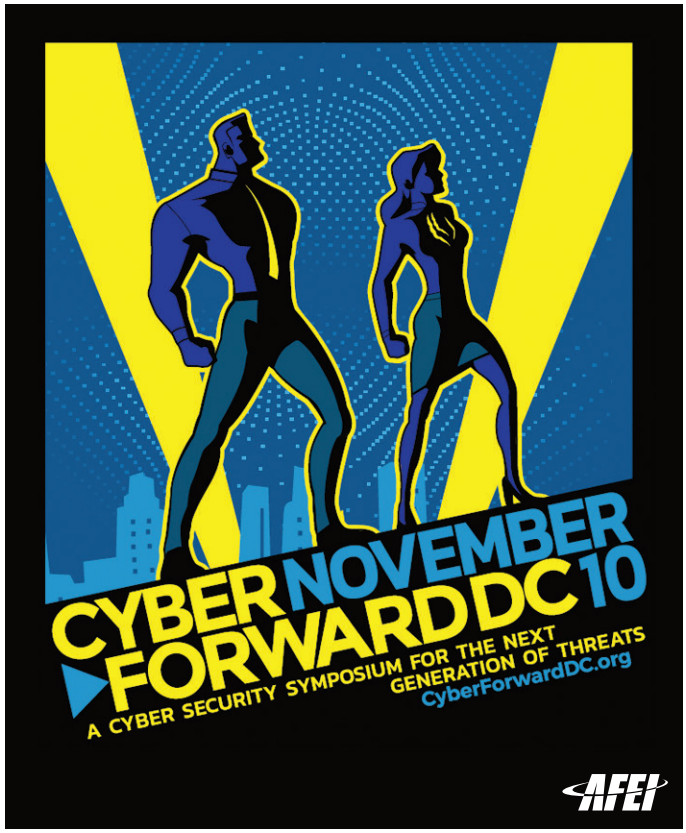

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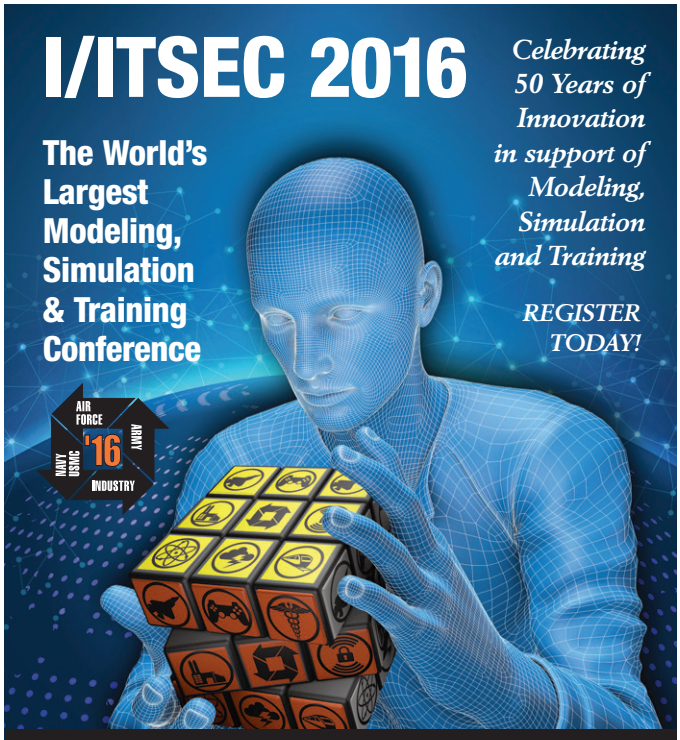

Orlando, FL ▪ November 28-December 2, 2016
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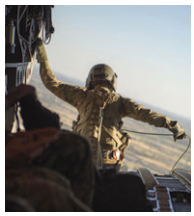
28th Annual SO/LIC Symposium & Exhibition

Special Operations Forces Requirements in Coalition and Interagency Conflict



Invited speakers include:
- GEN Raymond Thomas, USA, Commander, USSOCOM
- LTG Mike Nagata, USA, Director for Strategic Operational Planning, National Counterterrorism Center

Panels include:
- Five Eyes
- Component Commanders
- SOC Commanders
- Special Law Enforcement Special Mission Units

N. Bethesda, MD ▪ February 14-16, 2017
www.ndia.org/meetings/7880

Next Month

Battlefield 2030

■ Predicting what kinds of wars to prepare for has always been a guessing game in the Pentagon — but one with high stakes. For its annual research-and-development issue, National Defense looks at four global trends the U.S. military will need to prepare for by the year 2030: fighting in urban environments; fighting in anti-access/area denied battle zones; fighting in a world with a changing climate and; fighting in the ultimate high-ground — space. While 2030 may seem a long ways off, the time to begin developing new technologies to prepare for conflict in these environments is now.

LRSO

■ As the Defense Department gears up to modernize its nuclear arsenal, the Air Force has released a solicitation to industry for a long-range standoff weapon, known as LRSO. While Pentagon officials and other advocates identify LRSO as a critical capability, critics question the necessity and affordability of a new nuclear cruise missile program.

Insider Threats

■ More than three years after the Edward Snowden and National Security Agency scandal, the Defense Department is preparing to implement a new policy that would require industry to establish a program to detect, deter and mitigate insider threats. In our next issue, National Defense examines how this new regulation is being implemented and if it can help keep national security secrets secure.

National DEFENSE

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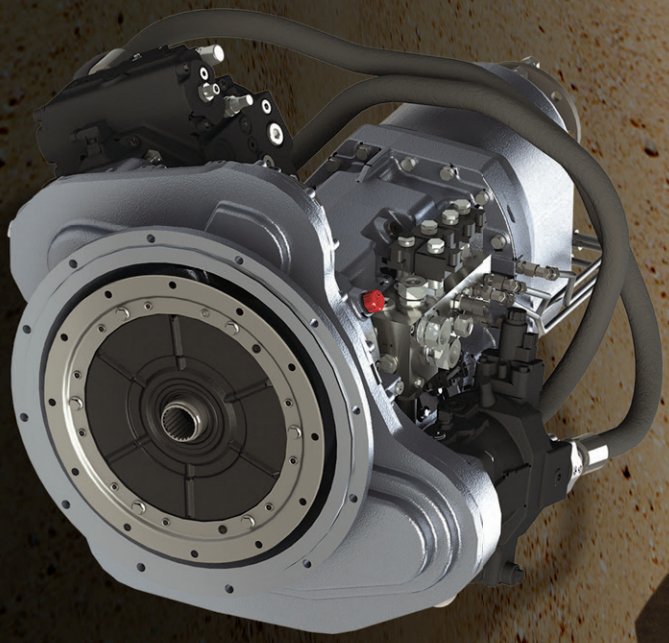

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