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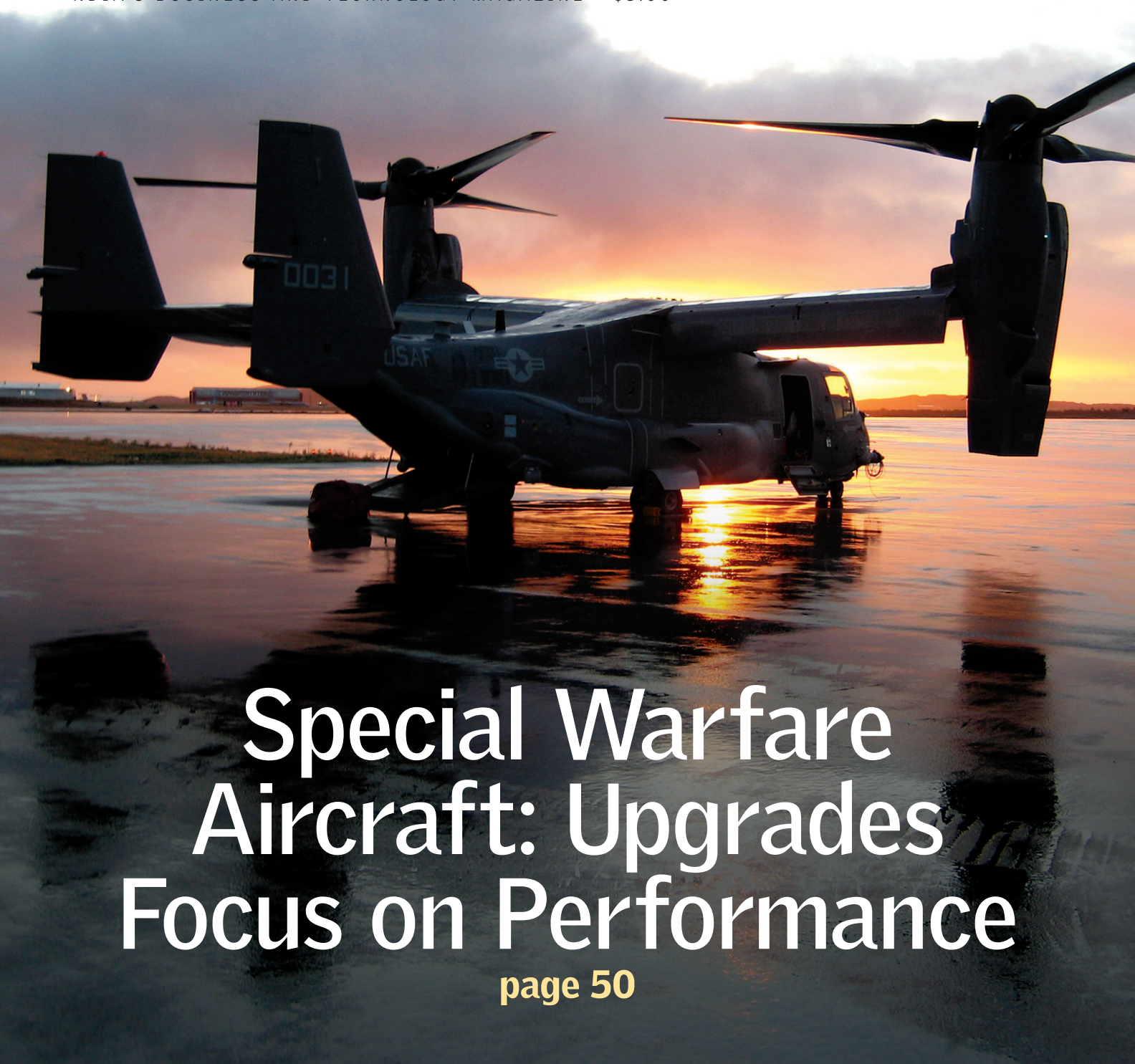

Special Warfare Aircraft: Upgrades Focus on Performance

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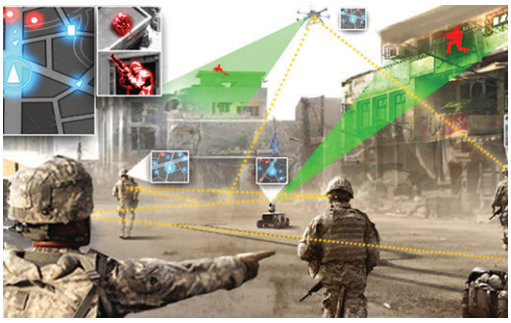
May 2016
NDIA'S BUSINESS AND TECHNOLOGY MAGAZINE
VOLUME C, NUMBER 750
WWW.NATIONALDEFENSEMAGAZINE.ORG



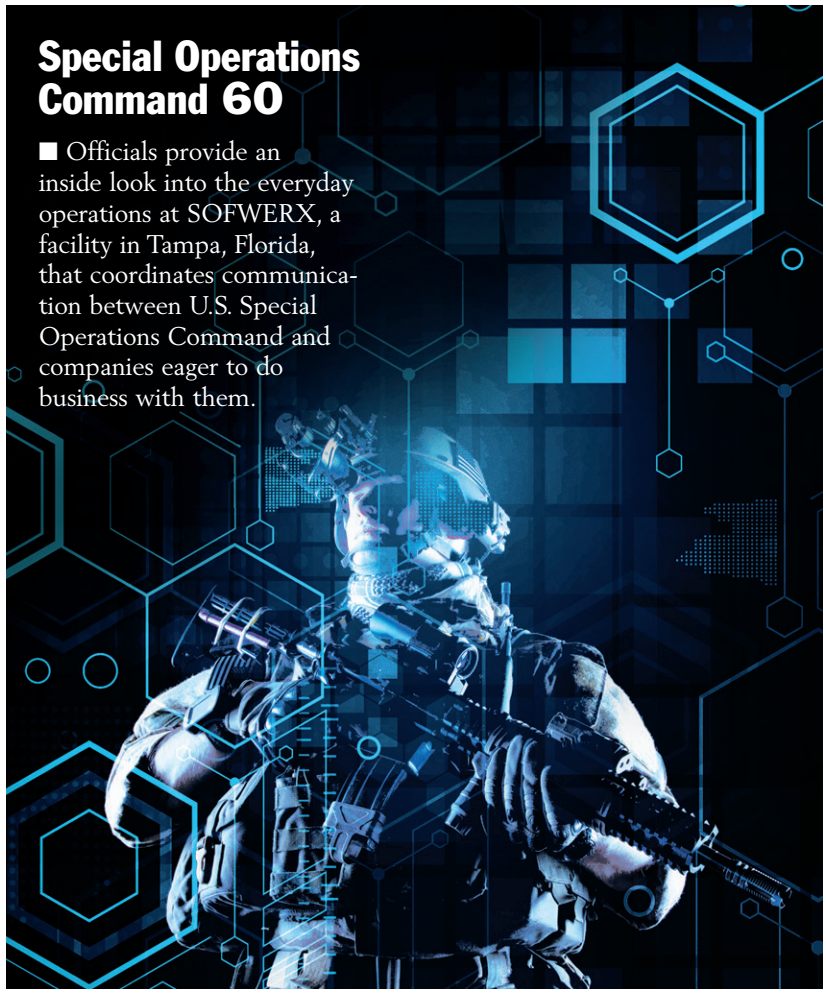
DARPA 42

■ The Defense Advanced Research Projects Agency has kicked off its Squad X program, which will provide soldiers and Marines with improved sensor technology in degraded environments. The agency has awarded contracts focused on four areas: precision engagement, non-kinetic engagement, squad sensing and squad autonomy.

Cover Story 50

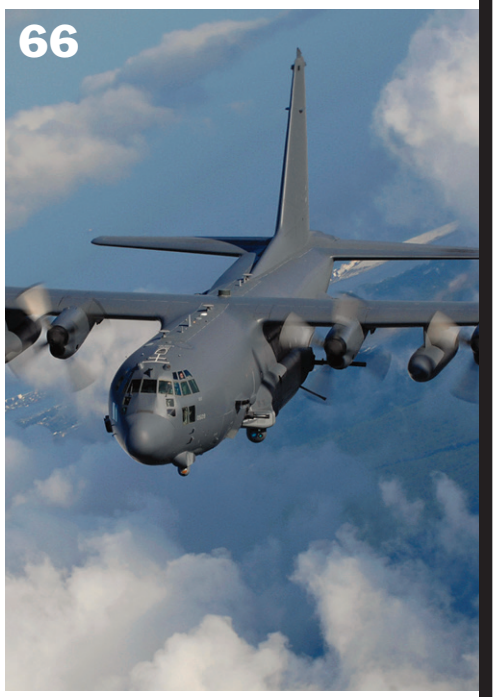
■ Air Force Special Operations Command has plans to upgrade its fleet of CV-22s in the early 2020s. These modifications include a modern radar, an engine filtration system and, potentially, additional guns and missiles.

Cover image: Air Force



Special Operations Command 60

■ Officials provide an inside look into the everyday operations at SOFWERX, a facility in Tampa, Florida, that coordinates communication between U.S. Special Operations Command and companies eager to do business with them.



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National DEFENSE MAY 2016
VOLUME C
NUMBER 750

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BPA WORLDWIDE **National Defense** (ISSN 0092–1491) is published monthly by the National Defense Industrial Association (NDIA), 2111 Wilson Blvd., Suite 400, Arlington, VA 22201–3061. TEL (703) 522–1820; FAX (703) 522–1885. **Advertising Sales:** Dino K. Pignotti, 2111 Wilson Blvd., Suite 400, Arlington, VA 22201–3061. TEL (703) 247–2541; FAX (703) 522–1885. The views expressed are those of the authors and do not necessarily reflect those of NDIA. **Membership rates** in the association are $40 annually; $15.00 is allocated to National Defense for a one-year association basic subscription and is non-deductible from dues. Annual rates for NDIA members: $40 U.S. and possessions; District of Columbia add 6 percent sales tax; $45 foreign. A six-week notice is required for change of address. Periodical postage paid at Arlington, VA and at additional mailing office. **POSTMASTER:** Send address changes to National DEFENSE, 2111 Wilson Blvd, Suite 400, Arlington, VA 22201–3061. The title National Defense is registered with the Library of Congress.

The Third Offset May Already Be Here

In the April edition of National Defense, I wrote about the third offset strategy being pursued by the Pentagon. Defense Secretary Chuck Hagel kicked off this effort in November 2014, and Deputy Defense Secretary Bob Work provided greater elaboration in early 2015.

The focus of my comments last month were that in seeking the emergence of the third offset from both traditional defense companies and those being approached by the Defense Department in non-traditional places, such as Silicon Valley, the Pentagon needed to carefully consider its existing policies on guiding and expensing independent research and development, and to have realistic expectations of the Defense Innovation Unit-Experimental office opened up in Silicon Valley.

At the moment, the strategy remains more a third offset aspiration, as the developments that will make it real — and result in its reflection somewhere in the defense budget and program — are still in the formative stages. Nonetheless, a presentation I recently attended reminded me of the value of attempting to stimulate such an effort.

> "The challenge of finding the next offset capability is not new."

This presentation from the Defense Department's policy shop contained a quote from Guilio Douhet, the 1920s Italian air power theorist, and one of the early advocates of strategic bombing — what we would call today "long-range strike" — that stated, "victory smiles upon those who anticipate changes in the character of war, not upon those who wait to adapt themselves after the changes occur." The briefing also reminded those in attendance that, "the future unveils itself slowly," and that the "most substantive changes may not be the most obvious."

Douhet's observation fits nicely with one made later by former Secretary of State Henry Kissinger regarding strategic concepts for the employment of nuclear weapons. As Kissinger noted, "the battlefield is a poor place for improvisation." Kissinger's thought, although later directed toward effectively utilizing what Work defined as the second offset, suggests the timelessness of Douhet's quote, and explains why the Defense Department is thinking about it nearly 100 years later.

It is worth giving further thought to the second observation, that major changes may not be the most obvious. An example would be GPS. In fact, GPS may well have been the "third offset" and we are now looking for the fourth. As originally conceived, the system was merely going to provide a globally available system for precise location of aircraft and ships. However, the development of inexpensive GPS receivers providing precise location data, in either the latitude-longitude or military grid reference systems, quickly pushed the capability down to the lowest level ground units.

Upon seeing the GPS system after Operation Desert Storm, a retired German general who had been a lieutenant in Field Marshall Erwin Rommel's Africa Corps, commented that its existence in 1941 would have doubled Rommel's combat power because on any given day "a third of the Africa Corps was lost in the Sahara." An Iraqi general famously commented after the war that his Republican Guards never expected an American attack from the west because, "every time we went out in the western desert we get lost."

Although little noticed when it arrived on the scene, particularly during Desert Storm, GPS has clearly been a game changer. It tells units down to the squad level their location, and can even be fused with intelligence information to offer a reasonably accurate picture of where the enemy is. It guides aircraft and ships as originally intended, but it also steers precision-guided weapons — even old gravity bombs when equipped with a GPS package. It has also made the wider use of unmanned air vehicles feasible.

So, GPS has been a huge change that unveiled itself slowly. In some ways the revelations continue, and likely will for some time. But the question still remains, what will the third offset actually be? Is it, perhaps, already with us and is as yet unrecognized?

There are many possibilities around, some that we see every day. It may reside in the cyber domain. Clearly the Chinese have invested considerably in this area, as have the Russians as demonstrated in the 2007 cyber attacks against Estonia. Moscow's next target, after its successful incorporation of Crimea, could be the Baltic States, attacked with some form of hybrid warfare including cyber, some have speculated. And commercially, there are growing concerns about cyber ransom attacks such as the ones that recently have targeted hospitals.

It is equally feasible that the next conflict will either be fought in, or waged with, some other means such as bionic or biometric weapons, or with nano capabilities. And there are continuing concerns expressed about possible attacks using small, dispersed undersea systems targeting the vast amount of critical infrastructure lying largely unprotected on the ocean floors, or space assets attacking equally vulnerable and vital assets orbiting overhead.

The challenge of finding the next offset capability is not new. Clearly Douhet was thinking about warfare in a newly discovered domain a century ago. The original founding of the National Defense Industrial Association as the Army Ordnance Association was motivated, in no small way, by the desire to develop U.S. capabilities for future conflict. But today's challenge is, perhaps, more daunting as new domains of potential conflict seem to be multiplying quickly rather than contracting slowly. As capabilities mature in one area, we need to be developing the immature ones that may be needed elsewhere.

Doing so requires an American defense capability that is agile, adaptive, clever and well-resourced. Our national capability today bears faint resemblance to that of a hundred years ago, and for that the founders of the association are due enormous credit.

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Defense Watch By Sandra I. Erwin

Survival of the Fittest in the Industrial Base

The drumbeat from Wall Street analysts has been pretty consistent on the defense industry: Top Pentagon contractors have weathered the post-war slump remarkably well, and their financial performance in fact has exceeded expectations.

But down in the lower echelons of the military supplier chain, the mood is not quite as upbeat. There has been no soft landing for many of the small and mid-size companies that sell equipment to the military, and the downturn has been especially tough on contractors whose livelihood for years was tied to war spending.

"It's a cold business," says Stephen Speakes, president and CEO of industrial equipment manufacturer Kalmar Rough Terrain Center, near San Antonio, Texas. A retired Army lieutenant general, Speakes oversaw military procurements during the war buildup and was hired by Kalmar in 2011, "when the good times were over."

The company is the U.S. subsidiary of Sweden's Kalmar. The Texas plant opened in 2009 to support the Army's gargantuan demand for forklifts and other specialized logistics vehicles to move cargo containers into warzones. Kalmar built about 1,000 "rough terrain container handlers" — nicknamed the "wretch" — that the Army ordered at a cost of nearly a billion dollars. Then, one day, sales stopped, and the company has struggled to stay afloat, Speakes tells National Defense. "We are trying to remake ourselves for the future. We tried to commercialize, but it's not easy."

It's always a bad day for a CEO when he has to let employees go, and Speakes has had many such days over the past year. A workforce of 200 is now down to 130, and more layoffs could follow if military contracts keep drying up.

Speakes was in Washington recently trying to convince Army leaders that they should allocate funds for repairs and upkeep of the wretch fleet so vehicles are ready for service if needed. The response from Army officials: We agree, but we have no money.

The idea that the Army would spend a billion bucks on new vehicles but not have the money to maintain them for later use baffles the mind of anyone who is unfamiliar with the ways of Pentagon procurements. And it illustrates the chaotic nature of war buildups. When contingency operations budgets topped $150 billion a year, the Army ordered all the hardware it needed to supply troops at war. Since 2008, spending on equipment has plunged about 74 percent. Over the past five years, the Army also has had to absorb steep cuts in personnel and training. In today's environment, problems like the condition of the wretch fleet don't enter the radar. So what if the fleet is not maintained and, a decade from now, another war breaks out? Overwhelmed by bigger concerns, these are not questions the Army wants to have to answer right now. In the meantime, suppliers like Kalmar have to find another way to survive.

"When your product stops being procured, you depend on mods," Speakes says. "The M1 Abrams tank has survived that way since the 1970s." Logistics vehicles, he laments, don't get that level of attention. "We buy them, use them and throw them away."

Speakes, nonetheless, insists he is hopeful. He believes the Army will come to its senses and put money into the wretch fleet. "It's too expensive to throw away. We could remake like new for $150,000 to $250,000 each, over 10 years, and extend the life of the fleet for 30 more years."

Another subtext to this discussion is the question of whether the Army, when not at war, should be concerned about the health of its suppliers. These industrial base hypotheticals spark much debate in Washington, and lawmakers occasionally bring up the subject during hearings when they become aware that jobs in their districts might be on the line.

Army leaders recently testified about the service's procurement programs. They laid out the wretched state of the service's finances, no pun intended.

"Due to resource constraints, we simply cannot modernize the entire force with the most modern equipment," Lt. Gen. Michael Williamson, principal military deputy for acquisitions, tells the Senate Armed Services Committee. To reduce expenses, he says, "we're divesting excess equipment across the entire Army to reduce and eliminate sustainment costs."

A shrinking modernization account, Williamson says, "continues to present significant challenges for the defense industrial base including our own organic industrial base."

The Army is trying to stay attuned to the state of the industry, Williamson assures lawmakers. "We're continuing to engage with our vendors on the aviation side as well as on the combat vehicle side. We are trying to give indications of what goes beyond '17 so that they can think through not only their workforce but also things like capital investment for their plant and for their facilities and also for their machinery. It is not something that we've taken lightly."

For companies like Kalmar, the end of massive war spending is hitting home. With no funding for the wretch in the latest Pentagon budget, the company is in a fight for survival. It is now competing for upcoming Army orders for up to 5,000 small forklifts that go inside shipping containers to grab items. The company also is investing in next-generation technology like software that can turn a conventional vehicle into an autonomous robot. "Metal is metal," Speakes says. "The real innovation is in the software design."

Defense Secretary Ashton Carter wants to partner with Silicon Valley, "but there's a lot of innovative companies and a heck of a lot of talent in America's heartland that do not get recognition from DoD leaders," says Speakes. "We are clinging to a fragile existence. That encourages innovation in a different way. For large companies, innovation is theoretical. We had to lay off 21 workers the day before Christmas. That's the reality."

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'If You're Not Fielding, You're Failing'

Retired Army Gen. Rick Lynch came to the National Defense Industrial Association's Ground Robotics Capabilities conference in Springfield, Virginia, on his own dime because he still cares about this life-saving technology.

As a former combatant commander who led troops in the bloodiest years of the Iraq War — who also has a master's degree in robotics from the Massachusetts Institute of Technology — he emerged before retirement as a forceful proponent of fielding ground robots. If the Army had fielded autonomous convoys, robotic combat vehicle wingmen, remote weapon stations and other such technologies, many of the soldiers in his command who lost their lives would have come home, he has said.

Melissa L. Flagg, deputy assistant secretary of defense at the office of the undersecretary of defense for acquisition, technology and logistics' research directorate, came to the conference to pinch-hit for her boss, Stephen Welby, one of the Defense Department's point men for the so-called "third offset strategy." The concept calls for a new wave of disruptive technology that will leapfrog the battlefield capabilities of peer competitors. Robotics and autonomy are two of the strategy's key technologies.

Flagg displayed a PowerPoint slide that showed these capabilities being fielded in the mid-2020s. Lynch had seen several similar slides at the conference and indeed, over the past 15 years, where ground robots on the battlefield are always seemingly a decade away on someone's technology roadmap.

This resulted in a testy exchange between the two, that not only speaks to the fundamental debate on ground robots, but applies to many of the so-called "weapons of the future," which are always not quite ready to be fielded — for one reason or another.

The discussion was as follows:

Lynch: "I hate slides like this so let me tell you why. As we speak, there are service members in harm's way across the world that don't need to be in harm's way. I commanded a division in combat where 153 of my soldiers died, 800 more came back in pieces and many of them were in places they didn't need to be because technology could have taken them out of harm's way.

"So my argument is always: we can do stuff sooner rather than later. The Germans had a robot on the beaches of Normandy in 1944. It has been out there before …"

Flagg: "That is why we have 'the present' on the chart. We're doing this stuff right now. I mean we've got helicopters we can send in to evacuate people autonomously right now. Some of that is an acceptance problem."

Lynch: "We're here to talk about ground robotics."

Flagg "Yup."

Lynch: "You see, I commanded the third division in combat, I commanded the 3rd Corps. And I praise the work we have done with unmanned aerial systems. All that stuff is great, but we don't have squat in ground robotics. We don't have squat. So things we're doing now are interesting to me but all that stuff on the right, we can move to the left if we simply say 'Hey, that's good enough.' So let me make my point and ask my question.

"In combat, Secretary [Robert] Gates came to visit us many times, and he finally realized we needed a new system to protect our soldiers. That's how we got the [mine-resistant ambush protected vehicle]. He facilitated the rapid acquisition of the MRAP and many of my soldiers were saved because they were in an MRAP, not in a tank, when they hit an [improvised explosive device].

"What we need is the DoD champion who says, 'Hey, we've got to get something out there now.' If we're not fielding, we're failing. We get something out there now and let them prove it over time. So the question is who is that DoD champion?"

> "Ground robots on the battlefield are always seemingly a decade away on someone's technology roadmap."

Flagg: Deputy Secretary of Defense "Bob Work is that DoD champion. He's out there every day saying it, and he has put money behind it. And we have four or five new demonstrations that we are putting together right now to try to fine tune some of this stuff from science to actual capability. But let's be clear. A lot of this stuff is still science. Just because you have a robot doesn't mean you have the smarts inside of it to do all these things on the right. So we can try. And we can put money behind it. And we can put all the smart people we have behind it, but I don't have magic fairy dust."

Lynch: "So we have to make sure we're clear. So I commanded the Army's digital brigade before digitization was cool. And what we did is we just put some untested systems in the hands of our soldiers and they told us what we needed to do to improve the capability. So we put it out there, and that's what we have to do in the world of …"

Flagg: "I said operators should be involved every step of the way on this. Every step of the way. I clearly agree with you — in violent agreement. But I can't field things that don't exist. The stuff that does, we can get out there. We are committed to increasing our prototyping and demonstration capabilities, to engaging operators, to making sure that they are actually going to use it when we send it out there. But I don't have innovation fairy dust. If you do, sell it to me. I would buy it for any price."

Lynch: "You know after I left the Army I ran a research institute for the [University of Texas] system. A lot of this stuff on the right exists. It may not be perfect. … But it exists. My argument has always been get it out there when it's good enough and let the service members use it and tell us what improvements need to be made."

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Managing Supplier-Related Corruption Risks

Recent regulatory developments have placed companies across all industry sectors on alert that supplier relationships must be proactively managed to avert corruption risks.

Increasingly, regulators in the United States and abroad are holding companies and executives accountable for the corrupt actions of their business partners. In 2015, the United Kingdom showed that its 2010 Bribery Act is not a paper tiger, for the first time levying fines against two firms for failing to prevent bribery. France recently announced sweeping legislative changes that will ramp up pressure on fighting corruption. Civil fines and criminal sentences continue to rise, even in countries that have historically demonstrated weak commitment to enforcement.

Companies in the defense sector operate in a particularly high-risk compliance theater when it comes to fighting corruption. Being in a heavily regulated industry with a myriad of security-related compliance exigencies, coupled with regular interaction with government officials and an increasingly competitive market, leaves defense contractors vulnerable to significant corruption risks. It's no wonder since the inception of the U.S. Foreign Corrupt Practices Act in 1977, nearly one in eight enforcement actions have involved companies from the aerospace and defense sectors.

Globalization and the use of outsourcing and offsets have increased defense contractors' dependency on suppliers. While this has led to efficiencies and access to new markets, it has also created additional legal, financial and reputational risks.

Large suppliers with worldwide locations, such as manufacturers of aircraft engines or avionics technology, are likely to have access to government officials and private business executives in countries where they are active. Many of these suppliers may have third parties working on their behalf to identify and compete for new business opportunities, and they often interact with public officials. So, how does a contractor manage the corruption risks associated with the activities of suppliers — and even with their suppliers' suppliers and third parties?

It is important to conduct appropriate due diligence on every supplier, its owners and key managers. This due diligence should include "hard" and "soft" checks. Hard checks require reviews of key documentation, such as the supplier's code of conduct and internal policies relevant to preventing, detecting and remedying corrupt behavior. Hard check questions would be:

- Does the supplier operate in countries ranked poorly in corruption indices?
- Does or will the supplier interact with government officials?
- Who are the supplier's actual owners, and do any of these have government affiliations or other red flags such as criminal records, strange legal structures, etc.?
- Is the supplier requesting unusual commercial terms such as payments into questionable foreign bank accounts?
- Is the supplier on any sanctions lists?
- Does anything suspicious show up on a basic company search such as Dun & Bradstreet?

"Soft" checks occur mostly in the form of discussions with a supplier's managers, employees, and even reference customers or other stakeholders like banks and other service providers. Personal conversations help detect whether a company's policy against corruption is actually reflected in its employees' commitment and behavior. Increasingly, regulators emphasize the importance of companies moving beyond the compliance scaffolding of laws, policies and tick-the-box training and communications, to a solid cultural foundation of integrity.

The results of an initial risk assessment should be used to structure a program of due diligence. Low-risk suppliers may require only basic, Internet-driven research, with some local inquiries into the reputation of the company and its owners or managers. High-risk suppliers — such as those in notoriously corrupt countries or those that have relationships with government officials — may, on the other hand, require more intense due diligence, including personal site visits and meetings.

Finally, knowing suppliers means knowing them on a continuous basis, not just at the time of contract execution. People and companies change, even over short periods. Continuous monitoring is, therefore, essential.

Relationships between suppliers and the contractor's managers must also be overseen. The line between what is or is not in the company's best interest can begin to blur under the influence of personal relationships. A sense of loyalty — or even indebtedness — can arise out of cozy relationships with suppliers.

Systems must be implemented to constantly monitor for potential conflicts of interest and misguided decision-making driven by personal, rather than company, needs and benefits. Some companies rotate accounts to different personnel in Purchasing every few years so that relationships with particular suppliers do not develop in ways that can skew good judgment.

It is also important to require employees to disclose and record all gifts, meals and entertainment offered and/or provided by suppliers. With a comprehensive overview of what suppliers are doing to develop relationships with people inside the company it is possible to better decipher the intent behind such activities and to take corrective action, if necessary.

Communications to employees and suppliers about when gifts, entertainment and hospitality may be offered and accepted must be clear. For example, a longstanding best practice is that no entertainment or gifts may be received from a supplier who is currently competing in a tender.

The underpinnings of an effective, best-practice supplier corruption risk mitigation process lie in clear policies and procedures, water-tight contract terms, effective controlling, and ultimately strict enforcement. But these tools are only optimally effective when applied to suppliers that have been thoroughly vetted and subjected to ongoing scrutiny to ensure they continue upholding high standards of ethical and legal conduct.

Jeffrey Thinnes, CEO and co-founder of JTI Inc. (www.jtiinc.net), is an international corruption and ethics expert. Contact him on Twitter @JeffThinnes and LinkedIn at linkedin.com/in/jeffrey-thinnes-0083718.

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 By Susan B. Cassidy

Implications of Cyber Clauses in Contracts

On Aug. 26 and Dec. 30, the Department of Defense issued interim rules that greatly expanded the obligations imposed on defense contractors for safeguarding covered defense information and for reporting cybersecurity incidents.

It is especially important for contractors to address compliance now because a government-wide federal acquisition rule is expected later this year and similar requirements are likely to be imposed outside of the Defense Department.

Here are some key issues for contractor consideration:

• Determine if covered defense information is present on IT systems: Under the interim rules, covered defense information is defined very broadly into four categories: controlled technical information; critical information; export controlled information; and a "catch all" provision that includes any information — marked or otherwise identified in the contract — that requires safeguarding or dissemination controls pursuant to "law, regulations and government-wide policies." Given the breadth of these definitions, it is likely that most contracts will have covered defense information associated with them, but such an analysis is the first step. Unless a contractor's IT systems are segregated between defense and commercial data, once a contractor accepts the Defense Federal Acquisition Regulation (DFARS) clause and covered defense information is present on its IT systems, the requirements of the interim rules will apply.

• Register for a Defense Department-approved medium assurance certificate: This is necessary to file a cyber incident report. Additional information about registration can be found at http://iase.disa.mil/pki/eca/Pages/index.aspx.

• Watch for modifications to existing contracts: Some defense contractors already have accepted the November 2013 version of the DFARS clause, which covered a narrower set of defense information and imposed different security controls than the NIST Special Publication (SP) 800-171 controls imposed by the interim rules. In the absence of a contract clause that expressly authorizes the contracting officer to revise, add or delete a clause without the contractor's consent, the Defense Department should not be able to impose the new DFARS clause unilaterally. That being said, once a contractor accepts the new version of the clause in just one agreement, it may be in the contractor's interest to amend earlier contracts so that its IT systems are not subject to differing security requirements.

• Assess IT security controls: The interim rules impose different requirements for contractor security controls depending on the type of system that is being provided to the government. If the contractor will be operating an IT system "on behalf of the government," the controls must either meet those specified in the systems requirement guide for cloud systems or the unique requirements specified in the contract for a non-cloud system. For internal contractor systems that contain covered defense information, contractors must meet the security controls specified in SP 800-171. On Dec. 30, the Defense Department extended the time period that contractors have to implement SP 800-171 security controls until December 2017. But within 30 days of each contract award, contractors must either notify the chief information officer of any SP 800-171 security requirements that will not be implemented at the time of contract award, or gain approval for alternative but equally effective security measures from an authorized representative of the CIO.

• Contractors should determine if their IT systems do not meet the requirements in SP 800-171. The eventual submission to the government will address the vulnerabilities and associated mitigation strategies of a contractor's IT systems. Given the significant legal risks that could result from a breach or other cybersecurity incident beyond contract performance issues, this document should be crafted under privilege and with great care. Such an analysis should avoid memorializing issues that might be of interest to U.S. regulators or potential third-party litigants. Further, to the extent that a subsequent cyber incident results from a vulnerability that was known to the contractor but not disclosed to the Defense Department, the document could subject a contractor to false statement, claim or breach allegations.

• Contractors should consider whether changes are needed to subcontracts, non-disclosure agreements and teaming agreements to address the requirements of the interim rules. These revisions should address security controls, reporting requirements, disclosure of contracting parties' data to the government following a cyber incident, and protection of covered defense information and prime contractor information in the event of a subcontractor's own cyber incident. The imposition of these obligations may affect a subcontractor's willingness to contract, and this may encourage contractors to develop a broader array of potential teaming partners.

• Contractors should evaluate their existing processes and procedures impacted by the interim rules. In so doing, they need to consider issues beyond the obvious technical challenges imposed by the DFARS requirements.

Among the areas that contractors should evaluate: Notifying the Defense Department within 30 days of award of a covered contract of any SP 800-1717 security controls that the contractor has not yet implemented, or any alternative security controls that the contractor has substituted for such controls; accepting clauses from the government or prime contractors; imposing subcontractor flow down requirements; evaluating data that must be produced in the event of a cyber incident; overseeing subcontractor cyber incidents to ensure protection of covered defense information and the prime contractor's proprietary data; updating non-disclosure and teaming agreements and subcontract templates; maintaining compliance with security requirements and tracking revisions to SP 800-171, 800-53 and SRG controls as applicable; and reporting of cyber incidents.

Susan B. Cassidy is a partner with Covington & Burling LLP in Washington, D.C. and specializes in government procurement law.

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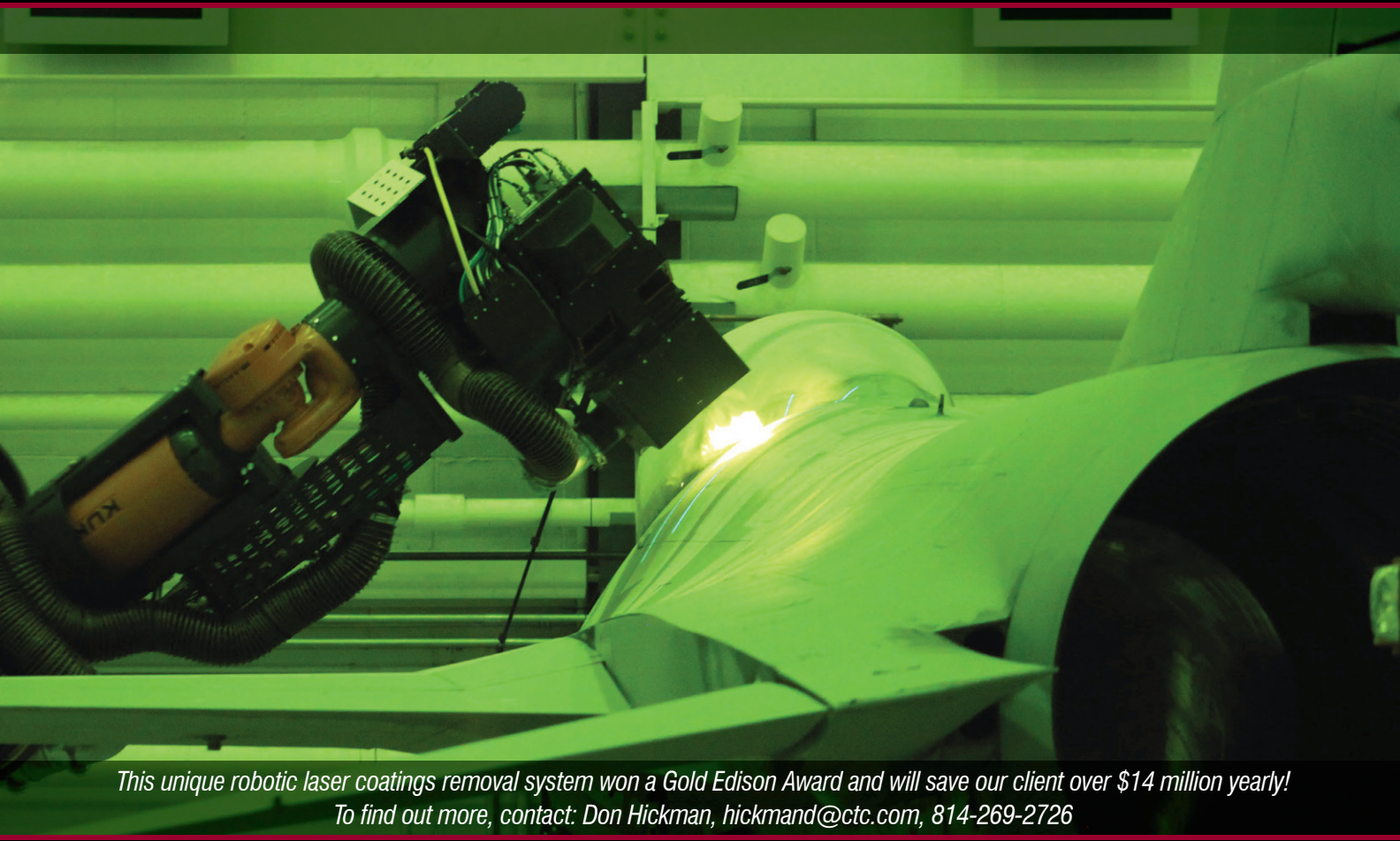

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Budget Matters By Jon Harper

GAO Warns About Next Phase of F-35 Program

A government watchdog warned Congress that lawmakers could have difficulty holding the Air Force accountable for controlling costs during follow-on modernization of the F-35.

The current joint strike fighter development effort is projected to end in 2017 when Block 3F developmental flight testing is completed, for a total development cost of $55 billion.

The first increment of follow-on modernization, Block 4, is expected to add new capabilities and correct deficiencies. But the Government Accountability Office said the Pentagon's plans could be problematic.

"Without setting up the modernization as a separate program with its own baseline and regular reporting as best practices recommend, it will be difficult for Congress to hold DoD accountable for achieving F-35 Block 4 cost, schedule and performance goals," Michael J. Sullivan, GAO's director of acquisition and sourcing management, told lawmakers recently.

"Although the requirements are not yet final and no official cost estimate has been developed for Block 4, DoD's fiscal year 2017 budget request indicates that the department expects to spend nearly $3 billion on these development efforts over the next six years," he testified before the House Armed Services subcommittee on tactical air and land forces.

As of March, the Pentagon's estimated total acquisition cost for the F-35 program is $379 billion, about $12 billion less than anticipated two years ago.

But the aircraft continues to face affordability challenges, Sullivan noted.

The program is expected to reach peak production rates in 2022, at which point the Defense Department expects to spend more than $14 billion a year, on average, over a 10-year period on the jets.

"When acquisition and sustainment funds are combined, annual funding requirements could easily approach $30 billion in some years," Sullivan said.

Budget constraints have compelled the Air Force to defer F-35 aircraft buys in recent years, a trend that could continue, he noted.

"The cost of extending the lives of current fighter aircraft and acquiring other major weapon systems, while continuing to produce and field new F-35 aircraft, poses significant affordability risks in a period of austere defense budgets," he said.

Todd Harrison, a defense budget expert at the Center for Strategic and International Studies, said the F-35 program could take a major hit in the next decade.

"I think the F-35 will be a big target for reductions in the early 2020s simply because it is a big program that is crowding out funding for other priorities," he said. "I would bet it does not reach the full level of production currently planned."

Lt. Gen. Christopher Bogdan, program executive officer for the F-35, presented an optimistic outlook.

"The program is making solid progress across the board," he told the subcommittee. "We are confident the F-35 team can … deliver on our commitments."

Bogdan anticipates the Joint Requirements Oversight Council will approve the follow-on modernization/Block 4 capabilities development document this summer.

"Work continues with the U.S. services and international partners to ensure the modernization program will be 'right-sized' for affordability and sustainability," he said.

Bogdan's office will ensure that separate cost, schedule, performance and earned-value data will be available to provide detailed insight into program execution, he said.

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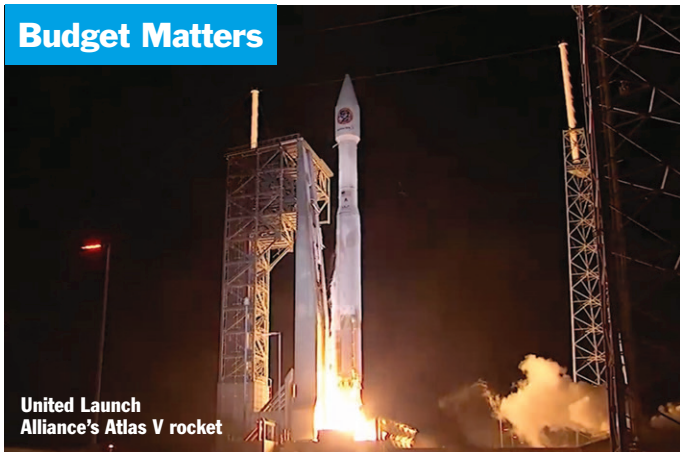

United Launch Alliance's Atlas V rocket

Analyst: Expect 'Big Spike' In Space Program Spending

■ The U.S. military's space acquisition budget could see a major increase in the coming years, said Michael Tierney, vice president of Jacques and Associates, a government consulting firm that represents clients in the national security space field.

Defense Department spending on space has dropped since 2011, he noted at a recent conference hosted by FiscalTrak and the Mitchell Institute for Aerospace Studies. Acquisition funding for space was $9.1 billion in 2011 but fell below $7 billion after the onset of sequestration. The Pentagon is requesting about $6.7 billion for space programs in fiscal year 2017, he said.

"This fiscal '17 number … is actually the low water mark of this period," he said. "We all know that the space budget is essentially cyclical and the replenishment decisions on major platforms are what drive the budget. By necessity, both strategic and just practically, I anticipate that we're going to see a spike in funding." The Air Force's 2017 budget request for space investment is about $5.5 billion, an increase of approximately $250 million relative to the 2016 budget.

Tierney said future space spending will be driven by several major platforms: the evolved expendable launch vehicle; advanced extremely high frequency communications satellites; wideband global Satcom; GPS; and the space-based infrared system.

"As the department looks at injecting things like resiliency into its architectures … I think a growing narrative that's coming out of the department and industry is that resiliency is going to be done at the major platform level," Tierney said.

This effort to combat threats in space is going to demand significant investments for each one of the major platforms, he said.

"The funding will necessarily need to spike," he said. "That's about tens and tens and tens of billions" of dollars in the coming years.

David Hardy, assistant deputy under secretary of the Air Force for space, said the Pentagon would have to make tough resourcing decisions when it comes to modernizing its capabilities.

"In terms of recapitalization over the long term … I've seen no indication that space is being lined up as a bill payer for some of that," he said. "But it's clearly understood … that we have to maintain our capability in all our domains, and it will just require hard decisions to be made unless we get a lot more relief than I think people expect to the topline budget."

Army Facing Budgetary 'Triple Whammy'

■ The Army is preparing to fight high-end adversaries, but budget cuts and other investment decisions have put it in a unique modernization hole, a defense analyst said in a recent report.

During the acquisition drawdown between fiscal years 2008 and 2015, total obligation authority for Army modernization fell 74 percent in real terms, from $90 billion to $24 billion. Meanwhile, procurement dropped 78 percent and research, development, test and evaluation funding declined 52 percent, according to Rhys McCormick, a researcher with the defense-industrial initiatives group at the Center for Strategic and International Studies.

"This … modernization drawdown is a triple whammy for the Army," he said in the report, "The Army Modernization Challenge: A Historical Perspective," released in March.

Compared with the post-Vietnam and post-Cold War drawdowns, the Army's modernization funding authority has taken a larger percentage cut this time around. The decline in RDT&E money is also steeper. Faced with smaller budgets, the service has elected to prioritize funding for readiness and force structure at the expense of modernization, McCormick said.

The triple-headed problem is compounded by the "lost decade" in Army acquisition in the 2000s, when a number of major procurement programs were canceled, including Future Combat Systems, he said.

"While the Army did field new platforms such as the [mine-resistant ambush protected vehicle], Stryker and Gray Eagle, it did not complete the large-scale procurement of new weapon systems as in previous drawdowns," he said. "Moreover, these acquisition programs were suited for meeting immediate wartime demands, not necessarily the future strategic operating environment."

Going forward, Army procurement efforts will encounter increasing competition for resources because the Defense Department is facing a modernization "bow wave" in the early 2020s. Meanwhile, not a single Army program made the list of the Pentagon's top 10 acquisition programs (measured by projected funding) leading up to the bow wave, McCormick noted.

"Even if the defense budget increases in the coming years, the Army will face stiff competition for that increase from the Air Force and Navy to fund the acquisition programs driving the modernization bow wave," he said. "The 'hollow' buildup of 2000 to 2008 and the unusually large reduction in R&D in this drawdown, means that the Army's recovery will be much more difficult than in previous drawdowns."

Help is not on the horizon, he said. "Continued failure to fund modernization will leave the United States with an Army unsuited to handle the future geostrategic environment. Yet, budgetary relief to modernization accounts remains unlikely for at least the near future."

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Artist's concept of Aurora's LightningStrike offering

X-Plane May Impact Future Vertical Lift Program

An aviation program within a top Defense Department laboratory could result in the development of new technologies and techniques that could be applied to the Army's future vertical lift program.

In March, the Defense Advanced Research Projects Agency announced that it had awarded a phase two contract for its vertical takeoff and landing experimental plane program to Aurora Flight Sciences.

The X-Plane, as it has been called, must have a top sustained flight speed of 300 to 400 knots. Additionally, it has to improve aircraft hover efficiency from 60 percent to 75 percent.

"The goals of the DARPA VTOL X-Plane program are to really explore technology advances that enable a balanced design between vertical takeoff and landing and high speed," said Tom Clancy, Aurora Flight Sciences' chief technology officer and the head of its unmanned division. "The basic paradigm that has been true for a long time in aviation is that helicopters hover really well and fixed-wing airplanes are good efficient cruise and high-speed flight [platforms]."

The X-Plane is meant to combine efficient hover with high-speed flight, he said. Aurora's offering, which it calls LightningStrike, is unmanned and features an electric distributed propulsion system that consists of "integrated, distributed ducted fans that, combined with the synchronous electric drive system, would enable the design's potentially revolutionary hover efficiency and high-speed forward flight," a company statement said. The first flight test is slated for 2018.

Technology developed by Aurora and DARPA could be used in the Army's forthcoming future vertical lift program, said Leslie Hyatt, product director for FVL at the Army's program executive office for aviation.

The Army intends to replace thousands of its aging helicopters in the 2030s with a new family of vertical takeoff and landing aircraft that could include light, medium, heavy and ultra-sized variants. Preceding the program is the joint multi-role technology demonstrator, which will help refine requirements for FVL. In 2014, the Army downselected the vendors from four to two — a Boeing-Sikorsky team offering the SB-1 Defiant and Bell Helicopter offering the V-280 Valor.

The JMR demonstrator will be required to fly at least 230 knots and is to be designed as the medium-variant of the FVL aircraft. Flight tests are slated for 2017.

"The Army is monitoring work being done in the DARPA X-Plane program," Hyatt said in a statement to National Defense. "The DARPA program is looking for ways to expand the speed, range and lift efficiency of VTOL aircraft. Technology advances that support increased capability in those areas is of great interest to the FVL program.

"As FVL requirements are refined and the DARPA project technology progresses, the Army will evaluate any potential technology that can be implemented in future VTOL designs," Hyatt said.

For now, Clancy said, it's too early to say which elements of the program could influence FVL. When a formal competition begins, Aurora might consider bidding its LightningStrike aircraft, he said.

"It depends on what the requirements are and how closely our solution could meet the requirements and how competitive it would be," he said. "Certainly we would look at it really, really hard. And we're very focused on opportunities to transition the technology and … leverage the performance that it provides."

Much of that decision will be based on the timing of the program, he said. "What we've got to offer for … FVL in the future will have something to do with when that time comes. If that time came today, this technology wouldn't be mature enough to be competitive. If that time comes in 10 years, it may well be the exact right answer."

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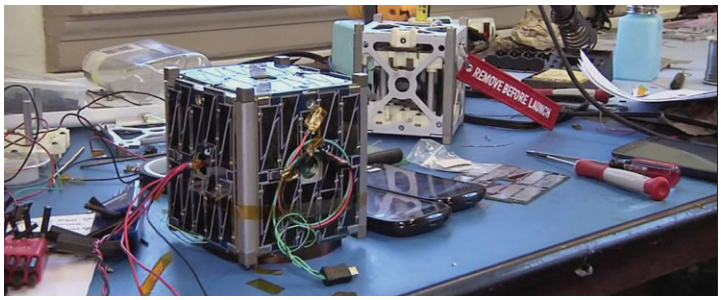

Air Force: Industry Should Develop Space Norms

■ As private companies, labs and universities continue to launch fleets of smaller satellites into space, they should work to develop de facto norms to aid collision avoidance efforts, Air Force officials said.

"I want industry to propose common sense solutions that will make it easier for everybody to know where everybody else is so we don't crash into each other," said Winston Beauchamp, the deputy under secretary of the Air Force for space. Companies are best equipped to establish those standards because they can determine what rules will be effective without diminishing their missions or business cases, he said.

Industry should look at creating norms for emitting signals or adding physical modifications to satellites that would make them easier to track, Beauchamp said.

"If you don't emit then there has to be some physical way to help people see you, especially as you get smaller and smaller," he noted. "There are a number of ways you could do that — putting reflectors on the corners of a CubeSat is one way to do it."

A CubeSat is a type of miniaturized satellite comprised of several small cubic units that has been popular among private companies and universities for research purposes. Each individual unit is a 10-centimeter cube typically weighing less than 1.33 kilograms, according to NASA. Educational institutions and non-profit organizations have been able to gain access to space through programs like NASA's CubeSat Launch Initiative. Selected projects are able to fly as auxiliary payloads on agency rocket launches or be deployed from the international space station.

Trend estimates of the CubeSat business show those numbers growing into the "multiple thousands," said Lt. Gen. Jay Raymond, Air Force deputy chief of staff for operations.

Currently, the Air Force monitors about 23,000 objects in space that are on average about 10 centimeters in size — roughly the size of a softball — and move at approximately 28,000 kilometers per hour, he noted.

"If you start having smaller objects, they're harder to track," he said. "If the proliferation of those objects continues, I think it's going to be important to have a conversation in the future on how best to develop some standards on how to be able to track those."

Estimates show that there are about half a million objects in space that are too small for the Air Force to track, Raymond said, and even a tiny object moving at 28,000 kilometers per hour can do significant damage.

— Allyson Versprille ▪ aversprille@ndia.org

Silicon Valley Exec: 'Innovation Isn't Magic'

■ As the Pentagon continues its push to reach out to high-tech companies around the country, one Silicon Valley executive said the government must be careful to not treat innovation as if it were a magic pill.

Air Force reservist Karen Courington, manager of product data operations at Facebook, said Defense Department Secretary Ashton Carter's efforts to court Silicon Valley companies are important. "A lot of people are noticing and I think there's a lot of energy there."

However, "innovation isn't magic," she said during a March panel discussion at the New America Foundation's Future of War conference in Washington, D.C. "I sometimes feel like the department is treating it as such."

When Pentagon officials come to Silicon Valley looking for new technology, they need to be specific about what is needed, she noted. "I think what we run the risk of, coming from Washington out to a place like Silicon Valley, is saying, 'We're looking for new tech' and people are kind of like, 'Well, as a means to what?'" she said.

Even referring to the Pentagon's much hyped "third offset" strategy — a plan to maintain the United States' military overmatch through investments in emerging technology such as autonomy — isn't specific enough, she said. "If you say 'third offset,' unfortunately, that might fall flat."

Last year, Carter established the Defense Innovation Unit – Experimental as a way to better tap into the work being done in Silicon Valley. In April, he announced the creation of a technology manufacturing hub that would develop new fibers and textiles, with the Pentagon pledging $75 million toward the effort.

Courington encouraged Defense Department officials to try to steer away from unnecessary processes and bureaucracy as it looks to field new systems. "What I've noticed in the tech community is there's not a lot of process, and process is a four letter word. So get rid of it, kill it, break rules where you can unless it's … illegal," she said.

Gen. David Goldfein, vice chief of staff of the Air Force, said while companies like Facebook answer to shareholders, the military has a responsibility to taxpayers.

"There, therefore, is a certain amount of oversight that we will always live with that may not be the same in Silicon Valley," he said during the panel discussion. "It's different pacing. You have the ability to perhaps move faster in Silicon Valley in some areas, and we're going to be more methodical here in terms of how we're going to move forward as we continue to report our process."

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Industry to Increase Output of Smart Munitions

■ Munitions manufacturers are ramping up production of precision-guided weapons as the Air Force continues to deplete its stock in the fight against the Islamic State.

"If you look at the weapons that we're using in theater, almost 100 percent of the weapons that we use are precision-guided, … either laser-guided or GPS-guided," said Lt. Gen. Jay Raymond, Air Force deputy chief of staff for operations.

As the service continues to employ those weapons against ISIL, there is some concern regarding shortages down the road, he said. "We clearly have what we need to accomplish the near-term efforts, but we're looking … to expand the procurement of those weapons for future needs."

Compounding the problem is the Air Force's practice of supplying allies, in addition to U.S. troops, with such munitions. "They are using those weapons as well, and … it's something that we're managing very closely," Raymond noted.

To meet the demand for more munitions, the service has spoken with manufacturers about increasing their capacity, he said.

The Air Force expects that Lockheed Martin will increase production of the Hellfire by roughly 30 percent and Boeing will double the production of the joint direct attack munition and nearly double the production of the small diameter bomb, service spokesperson Maj. Melissa Milner said in an email to National Defense.

As of late March, the Air Force had flown over half of the coalition's 87,000 sorties and conducted nearly 67 percent of almost 11,000 airstrikes against ISIL in Iraq and Syria, Raymond said. On average, the service conducts about 25 strikes a day.

"Airstrikes have destroyed more than $500 million in cash used by ISIL to pay their fighters and to fund their operations, reducing the salary of those fighters by about 50 percent," he said. "Additionally, our attacks on the fuel infrastructure have reduced their fuel revenue by approximately 30 percent."

Raymond's comments came about a month after Secretary of Defense Ashton Carter addressed the need for greater investments in precision-guided munitions. "We've recently been hitting ISIL with so many GPS-guided smart bombs and laser-guided rockets that we're starting to run low on the ones that we use against terrorists the most," he said during his remarks previewing the fiscal year 2017 defense budget request. "So we're investing $1.8 billion in FY17, to buy over 45,000 more of them."

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Raytheon to Assist in Upcoming Army Exercise

■ An advanced Raytheon training system will help facilitate a multinational training exercise led by U.S. Army Europe this summer.

Exercise Swift Response 16 — which takes place in Poland and runs from May through June — will be supported by Raytheon's joint multinational training center-instrumentation system (JMRC-IS).

"We can conduct live training events in one country, and we can virtually train other units physically separated by thousands of miles in the same virtual training environment," said Sandy Brown, director of program management at Raytheon's combat training centers and support mission division.

JMRC-IS is considered a "system of systems," she said. It includes mobile sensors, cameras, communication devices and computers that can track vehicles and soldiers during training scenarios. It is based in Hohenfels, Germany, and can be extended across borders to create expansive simulated battlefields, she said.

For Exercise Swift Response 16, a multinational airborne joint forcible entry training operation, Raytheon is preparing to fine-tune the system for the U.S. Army's specific needs.

"There are certain elements of the training exercise that we haven't performed before — multiple communications and setting up multiple joint operations centers. Instead of just having one we will do multiples and we can change those throughout the training rotation," she said.

Allied and coalition partner brigades can use JMRC-IS alongside the United States, a Raytheon spokesperson said.

U.S. soldiers participate in Exercise Swift Response 15.

In the past, the system has been used for exercises with Italy, Germany, Romania and Bulgaria. Raytheon is still waiting for a list of participating countries for Swift Response, Brown said.

The system was recently used during the Saber Junction 16 exercise that was held at the 7th Army Joint Multinational Training Command's Grafenwoehr training area in Germany in April. According to the Army, it was "designed to evaluate and certify the readiness of the 173rd [Airborne Brigade] to conduct unified land operations." The exercise included participants from more than a dozen NATO and European partner nations.

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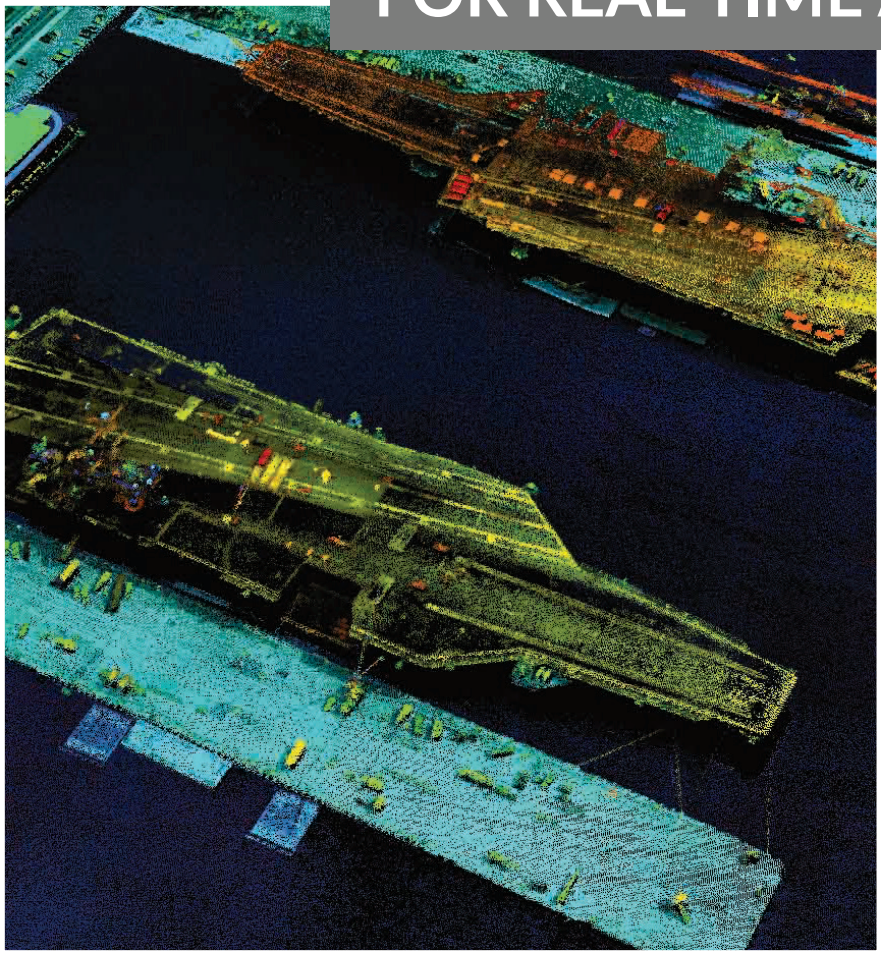

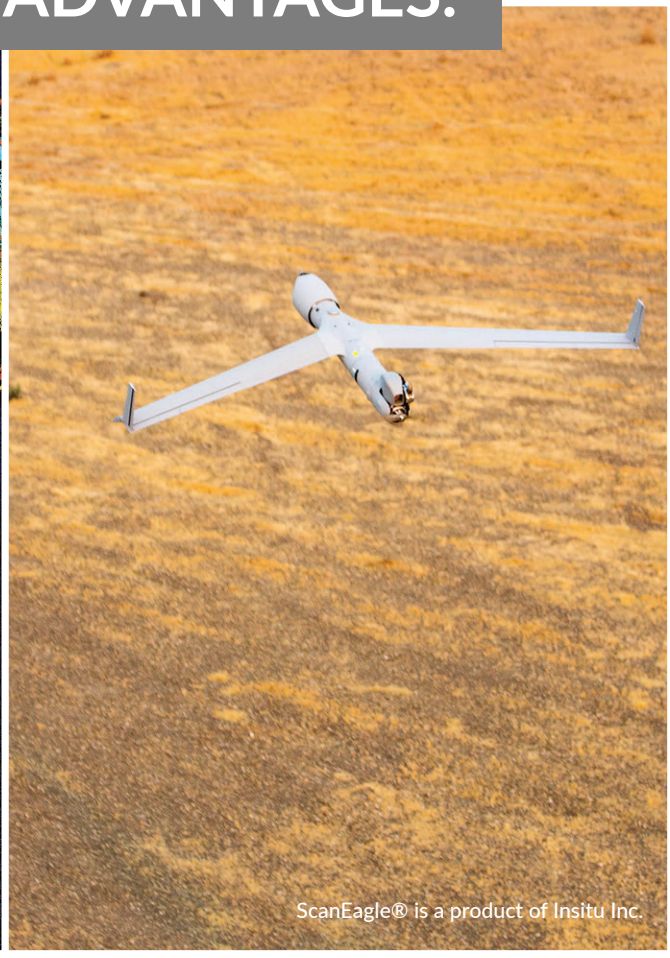

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Patriot Upgrade Could Attract New Customers

■ Several countries have expressed interest in procuring Raytheon's Patriot missile system after a showcase featured a number of upgrades, a company executive said.

During the March 17 test at the Army's White Sands Missile Range in New Mexico, the Patriot integrated air and missile defense system equipped with an enhanced suite of improvements known as post-deployment build 8 (PDB-8) "successfully detected, tracked and engaged a threat-representative ballistic missile target," a Raytheon press release said. It destroyed the target by first firing a Patriot Advanced Capability-3 missile segment enhancement interceptor and, seconds later, a Guidance Enhanced Missile-tactical ballistic missile interceptor.

The test demonstrated that PDB-8 will enable commanders to optimize the right mix of missiles to defeat a variety of threats, said Jeff Pinasco, director for integrated air and missile defense business development at Raytheon Integrated Defense Systems.

The upgrade includes modified software that improves Patriot's ability to destroy all threat categories and differentiate between friendly and enemy aircraft, he said in an email. There are also several hardware enhancements including a modern man station with new touch-screen technology and a processor with "significantly fewer parts, more computing power and reliability that is 40 percent higher than the old processor."

RAYTHEON

Currently there are 13 users in the "Patriot partnership" — the United States, Spain, the Netherlands, Germany, Greece, Israel, Saudi Arabia, the United Arab Emirates, Kuwait, Qatar, Japan, Taiwan and South Korea, Pinasco said. Each country has a say in system upgrades and contributes funding for those enhancements proportional to the number of fire units they have.

There were several potential customers that attended the recent test and expressed interest in the upgraded Patriot system including Poland, Turkey and Sweden, according to Raytheon.

Last spring, Poland announced that it had chosen to purchase Patriot over the Aster 30, a system manufactured by Eurosam, a European consortium that consists of the French and Italian branches of MBDA and the Thales Group, which is based in France. "The Polish government is currently negotiating the details of that procurement with the U.S. government, and Raytheon is supporting those discussions," Pinasco said.

Turkey is in the process of acquiring a new medium-range air and missile defense system and is currently developing a request for proposals. "Patriot is one of the systems that they're going to be evaluating," said Mike Nachshen, senior manager of integrated communications for Raytheon Integrated Defense Systems.

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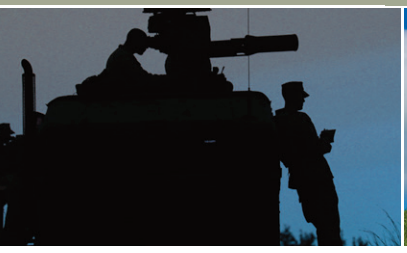

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Navy Combatants Can Defend Against Emerging Missile Threat

By Edward Lundquist

A growing Russian threat to surface ships in the European theater has prompted the U.S. Navy to upgrade its four guided-missile destroyers (DDGs) forward deployed to Rota, Spain. The multi-mission ships have a sophisticated ballistic missile defense capability as part of their Aegis weapon system.

The four DDGs comprise the forward-deployed naval forces, which support the European phased adaptive approach to defend Europe against ballistic missile threats from the Middle East. However, Russia views their presence, as well as the establishment of land-based Aegis ashore missile defense sites in Romania and Poland, as directed against Russia, and has increased its offensive capability in the region.

U.S. and NATO officials have warned that Russia has deployed capable offensive weapons in the region — including the annexed territory of Crimea — that pose a significant threat to naval forces operating in the Black Sea and Eastern Mediterranean. Those threats presumably include the Russian Kalibr and Iskander missiles.

The North Atlantic ocean, Norwegian, Baltic, Black and Mediterranean seas are the maritime flanks of the NATO alliance, said Adm. Mark Ferguson, commander of Naval Forces Europe and Africa, speaking at the Atlantic Council last October. "It is here we are observing the manifestation of a more aggressive, more capable Russian navy. It is a naval capability focused directly on addressing the perceived advantages of NATO navies. And they are signaling us and warning us that the maritime space is a contested domain.

"We have to be pacing these threats — both the asymmetric threats coming from the south, coming from the east, and then all the way up to the high-end threat coming from Russia," said Ferguson in a recent interview.

While the four ballistic missile defense DDGs are multi-mission combatants, they may find themselves focused on a mission to deal with exo-atmospheric threats. And they can be vulnerable to a range of threats that might otherwise warrant an escort to defend against anti-ship cruise missiles or other weapons.

As a means to improve the defensive capability of these ships, the Navy is adding the SeaRAM weapon system to help counter the emerging threat.

"We just put SeaRAM on the USS Porter, and you'll see that go on all of our forward-deployed ships," Ferguson said. "I'm committed to delivering additional lethality to our fleet."

According to Ferguson, SeaRAM complements the coverage of CIWS, or close-in weapon system. "I appreciate the efforts of the OPNAV staff and Naval Sea Systems Comand to give us the additional coverage on a short timeline."

SeaRAM is the combination of two U.S. Navy systems: the MK 15 CIWS and the MK 31 rolling airframe missile (RAM) guided-missile weapon system.

Ed Lester, Raytheon SeaRAM program manager, said the system "leverages the RAM and CIWS life cycle support infrastructure."

SeaRAM uses the same mount and fire control system, but substitutes the RAM launcher in place of the Vulcan chain gun of the CIWS. With one of each, the DDGs will have a greater ability to provide a layered self-defense against multiple high-performance, supersonic and subsonic threats.

The 11-missile RAM launcher assembly replaces one of the DDG's two Phalanx's 20 mm guns. The above-deck system has the same footprint and uses the same power as CIWS 1B. SeaRAM combines the RAM's accuracy, range and high maneuverability with the Phalanx Block 1B's high-resolution search-and-track sensor systems and rapid-response capability, said Rick Nelson, vice president of Raytheon Missile Systems in Tucson, Arizona.

Both CIWS 1B and SeaRAM are defensive systems. The 20 mm Vulcan gun system on Phalanx is the ship's last line of defense by automatically tracking and engaging threats that have penetrated the ship's other defenses. SeaRAM can do the same thing at longer ranges.

Although both RAM and SeaRAM have been installed on Navy ships, SeaRAM had not previously been integrated with a DDG or the Aegis combat system. RAM is installed on the Navy's amphibious ships and the Freedom-class variant of the littoral combat ship. SeaRAM is currently installed on the Independence-class variant of LCS. USS Coronado (LCS 4) fired a rolling airframe missile from its SeaRAM anti-ship defense system last August during a live-fire exercise at a test range off the California coast.

The installation on the USS Porter is

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the first for the class, and was performed by the Spanish shipyard Navantia in Rota. Post installation testing is being supported by Spain, a key NATO ally in the European missile defense mission.

The four DDGs in Rota have a deployment schedule that ensures that two of the four ships are deployed while the other two are in an upkeep period back in Rota where they undergo maintenance. The SeaRAM modernization will take place during one of their scheduled maintenance availabilities conducted by the Navantia shipyard, under the oversight of the Navy's forward-deployed regional maintenance center.

Following her installation — the first ever aboard a DDG — Porter accomplished all industrial installation, system testing and live-fire qualification events in Spain at Naval Station Rota and at the Spanish Ministry of Defense missile test range near Huelva.

"The crew of Porter spent weeks training to employ the new weapon system and develop the tactics, techniques and procedures to integrate SeaRAM into their combat system," said Cmdr. Andrew Bates, officer-in-charge of the Destroyer Squadron 60 detachment at Rota. "Following a highly successful structural test firing to validate the safety and integrity of the newly installed mount, Porter executed a series of tracking exercises that culminated in a flawless live-fire intercept of a drone target on March 4."

USS Porter undergoes repair and modernization at Naval Station Rota, Spain.

Cmdr. Joseph Saegert, officer-in-charge of the maintenance detachment at Rota, said test firing is part of a new weapons installation, to ensure it is safe to fire and serves to validate engineering calculations and the modeling and simulation.

Saegert credited the successful installation of SeaRAM aboard Porter to the Rota maintenance team. "In Spain, the maintenance team is everyone: from the regional maintenance center and our partner, Navantia; the Naval Supply Systems Command Fleet Logistics Center at Sigonella, Sicily; Commander Naval Surface Forces Atlantic; program executive office for integrated warfare systems; Naval Surface Warfare Center, Port Hueneme Division; Commander, Destroyer Squadron 60; and the Missile Defense Agency."

Following Porter, USS Carney (DDG-64), USS Ross (DDG-71) and USS Donald Cook (DDG-75) will receive SeaRAM.

Warfare tactics instructors at the naval surface and mine warfighting development center in San Diego created the doctrine and training syllabus to enable the crews to operate this new combination.

"The addition of this advanced weapon system to Porter's arsenal is extremely welcome," said Cmdr. Andria Slough, USS Porter's commanding officer. "It is a culmination of the cooperation of several program offices and agencies, both at sea and ashore, ensuring that out here on the front lines, we receive the capabilities we need, when we need them." ND

Edward Lundquist is a contributing writer.

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Former SOCOM Chief McRaven Aims to Put Texas On the Pentagon's Radar

By Sandra I. Erwin

Even the brightest minds at the Pentagon need all the help they can get as they grapple with increasingly baffling national security dilemmas. The U.S. military for the first time in decades faces the prospect of losing its technological edge vis-à-vis emerging powers. The U.S. government at large also is hobbled by a widening trust gap between its leaders and the younger generation.

These looming, complex challenges require fresh thinking and bold leadership, and that puts the burden on the nation's academic institutions to step up their game, says retired Adm. William H. McRaven, a former Navy SEAL and commander of U.S. Special Operations Command, now in his second year as chancellor of the University of Texas System.

While Silicon Valley gets all the attention from Washington these days as a beacon of innovation for a government that keeps falling behind the technology curve, institutions in the heartland often are overlooked. McRaven has set a goal to put the university's high-tech capabilities on the map, and in the process elevate the profile of academia as a fount of knowledge that should be tapped to solve national and global security problems.

"It is evident to me that Washington and all who address national security can benefit from multiple perspectives," McRaven told National Defense in a statement.

"Having spent a lifetime in the world of national security, I stay tuned in to the chaos in the world," he said. "The national security threats confronting us now are so varied, so complex and so serious, that they call for the brightest available minds to convene and collaborate in search of solutions."

UT officials who spoke with National Defense about McRaven's transition from the top echelons of the military's command structure to the head of a major university said he has been careful to avoid the perception that he would "militarize" the school. The sprawling UT System of 14 semi-autonomous institutions is best known for its medical knowhow. And it does have a strong track record of scoring government research contracts, including military projects — some of which date back to World War II. McRaven now wants to elevate the profile of UT in emerging defense-related disciplines like cybersecurity, biodefense and advanced manufacturing.

"The chancellor has been through an

University of Texas System Chancellor William H. McRaven (left) speaks with former CIA Director Porter Goss (middle) and current CIA Director John O. Brennan at the Clements Center for National Security.

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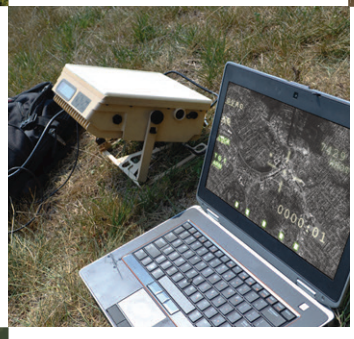

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interesting journey," said retired Maj. Gen. Tony Cucolo, a former commander of the Army's Third Infantry Division who is now McRaven's top aide. Along the way, Cucolo said in an interview, the chancellor decided that his role would be much larger than that of caretaker of the university system. He wants to help the state — which provides most of UT's funding — gain recognition as a hotbed of innovation.

Can Texas compete with Silicon Valley? Why not? pondered Cucolo. "There's incredible talent down here. We could make a national contribution."

Besides Cucolo, there are several other former political appointees, retired general officers and flag officers on the staff. Texas doesn't want to appear to be a military school but its leaders want to stay close to the pulse of government. The university has a large office of federal relations in Washington, D.C.

As it seeks to draw attention for its technology chops, Texas is benefiting from a surge of startup money and tech firms that are drawn to the state's academic resources. The challenge for leaders like McRaven is to tap his Washington network to direct the spotlight down south.

Galveston National Laboratory at the UT Medical Branch in Galveston, Texas

Defense Department funding accounted for $183.7 million of the University of Texas System's combined $2.7 billion in research expenditures in 2014, the most recent numbers available.

"Some of the most valuable defense-related technologies began at an academic research lab," said McRaven. "The UT System is a wise investment for the DoD." National security related research includes bioterrorism, military health, border security, shockwave injury, additive manufacturing, prosthetics, biosecurity, brain health and infection genomics.

"With more than 217,000 students and 20,000 faculty members, the UT System is the one of the largest public university systems in the nation. We have remarkable resources that will help bolster DoD's mission to keep America safe," he added. "I look forward to further collaboration with the DoD in the future on an array of projects."

McRaven sees UT's influence reaching international scale. "That's why we are establishing the UT Network for National Security, a system-wide alliance that will address the most vexing national security problems and raise them to national prominence," he said. "This alliance will convene world forums and write, discuss, debate and present solutions. It will be a network with much stronger ties to leaders and organizations in Washington and across the international community."

Today's problems require leadership beyond the Beltway, said McRaven. "Our security environment is changing at a rapid rate that's no longer linear." Higher education — with all its resources and intellectual capital — should play a prominent role as the nation seeks to solve complex national security issues, he added. "At the University of Texas, we are taking this challenge head on."

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and foreign policy hubs at UT Austin: the Robert S. Strauss Center for International Security and Law, and the Clements Center for National Security. Both are collaborating with the U.S. intelligence community on the "intelligence studies project." The Clements Center sponsors a national security fellows program.

UT San Antonio is home to the Institute for Cyber Security, which conducts basic and applied research with academia, government and industry. McRaven points out that the university is one of only 44 institutions in the United States designated as a National Center of Academic Excellence in information assurance and cyber defense by the National Security Agency and Department of Homeland Security.

Texas also wants to take a lead role in border security, McRaven said. The National Center for Border Security and Immigration at UT-El Paso studies areas such as protecting the nation's borders from terrorists and criminals, easing international trade and travel, and understanding the forces that lead foreigners to try to immigrate.

McRaven noted that the Galveston National Laboratory at the UT Medical Branch in Galveston, Texas, is the nation's only biosafety "level 4" research laboratory on an academic campus. UT Medical Branch hosts the National Biocontainment Training Center, which supports infectious disease scientists who need to work safely in high-containment research laboratories. The UTMB's Center for Biodefense and Emerging Infectious Diseases does work that could see a higher demand as bioterrorism becomes a bigger homeland security threat, said McRaven.

Scientists conduct research at the Galveston National Laboratory at UT Medical Branch in Galveston, Texas.

Texas is stepping up its outreach to the Defense Department at a time when the military laboratories are looking for an innovation boost and lack the funding to award research contracts to private-sector firms. The school is one of the nation's most active in a new Army Research Laboratory program called "open campus." The Adelphi, Maryland-based lab started the project in 2014 as an experiment to encourage collaboration with visiting researchers.

ARL Director Thomas Russell conceived the program soon after he took office and realized there was a chilly relationship between the lab and universities. "He challenged us to engage more," said Thomas Mulkern, who works at ARL's technology transfer office. The lab since 2013 has signed more than 200 "cooperative research and development agreements" with nearly 100 universities. In a single CRADA with the University of Texas, "We engage 16 of their campuses," Mulkern said. "They're getting insight and exposing their workforce to new opportunities."

UT officials said they are now involved in discussions with Department of Energy labs in hopes of signing more CRADAs. **ND**

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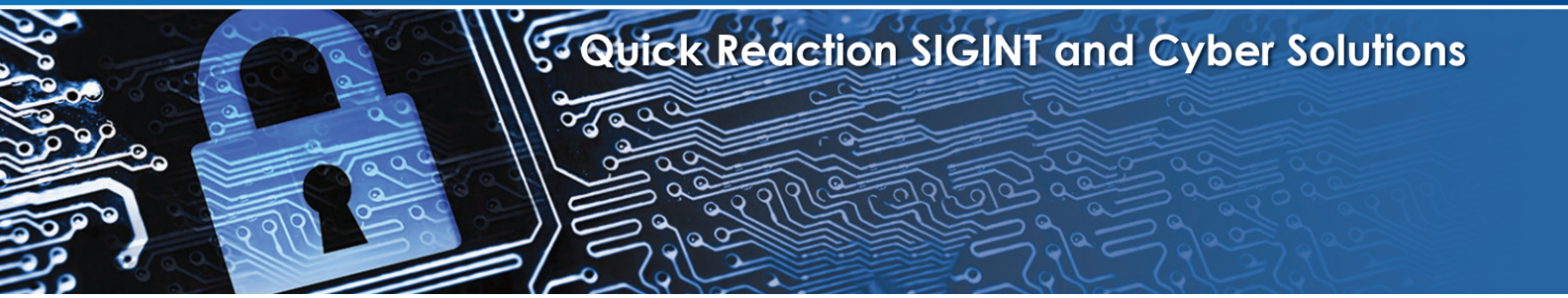

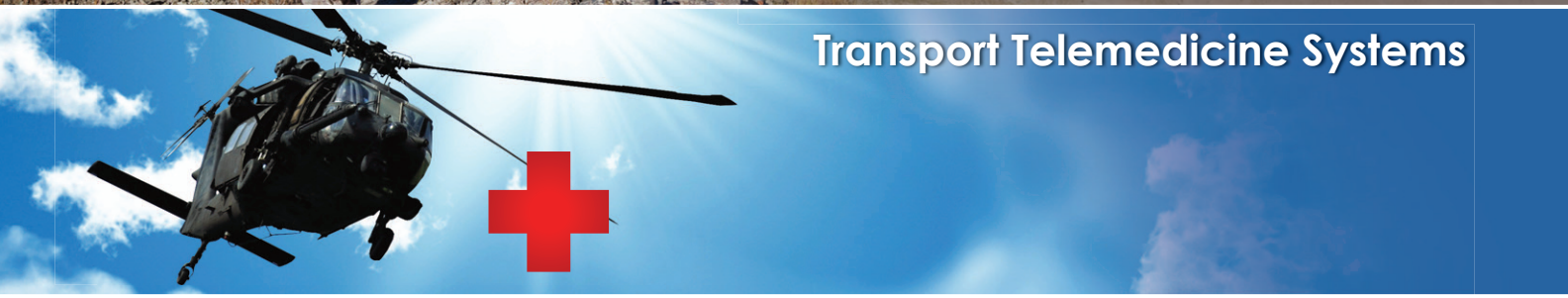

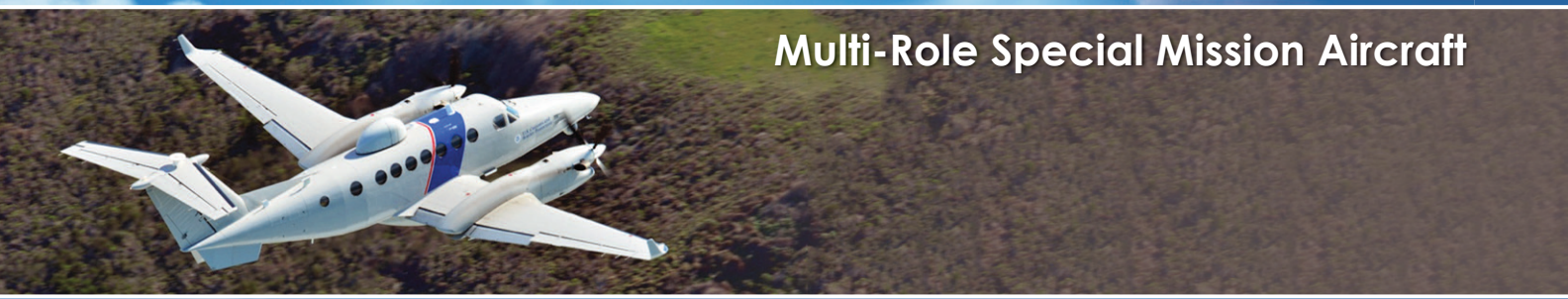

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Robotic Mules Remain in Development Limbo

By Stew Magnuson

Last year, the Army tested robotic mules in the snow in Alaska. Later, soldiers drove them through the jungles of Hawaii. Then they also were put through the paces in desert conditions at Fort Bliss, Texas.

Four semi-autonomous vehicles capable of carrying heavy loads for foot soldiers were even sent in 2011 to Afghanistan where they were employed in combat.

"And we've been doing demonstrations ever since," said Stu Hatfield, chief of the robotics branch, Department of the Army, G-8.

Robot proponents inside and outside the military are asking when the demonstrations will end and the fielding begin.

Known as the squad multipurpose equipment transport (SMET), it's an idea that emerged from the ashes of the Army's Future Combat System modernization program. After FCS was canceled in 2009, the Army continued to provide some funding for the concept, Hatfield said at the National Defense Industrial Association's Ground Robotics Capabilities conference.

"It's 2016 and we have been going at it a little while," he said, acknowledging that there has been some frustration that the idea is not moving forward. "We are looking forward to that being a new-start program," he added.

Lockheed Martin's squad mission support system

The Army has suffered from the problem of not knowing exactly what it wanted as far as a robot that can take the load off dismounted troops, he said.

"Requirements are still emerging," said Bryan McVeigh, project manager for force protection at program executive office combat support and combat service support. It will be McVeigh's job to field a SMET program of record, if he should ever be given the green light.

The Army's current plans call for the SMET to come in two or three sizes. Army Training and Doctrine Command is working on the requirements, with an engineering, manufacturing and development phase beginning about 2019 and lasting three years. They would be either tele-operated or fully autonomous, Scott Davis, program executive officer for combat support and combat service support, said at an industry conference in 2015.

McVeigh said: "Our challenge for SMET is that it is a workhorse. Do we want it to be just the ability to carry soldiers' equipment? There is a huge advantage to doing that."

But it can be so much more. It could do casualty evacuation. It can be armed and serve as a remote weapons station. The Army engineering community is considering placing a significant portion of its payload on the mule, he added.

"How do we make this a workhorse for all, understanding that we don't have enough money to pay for this and for it to go out to every unit out there?" McVeigh asked.

"There are some interesting acquisition approaches. How do we take a technology that is emerging and … fig-

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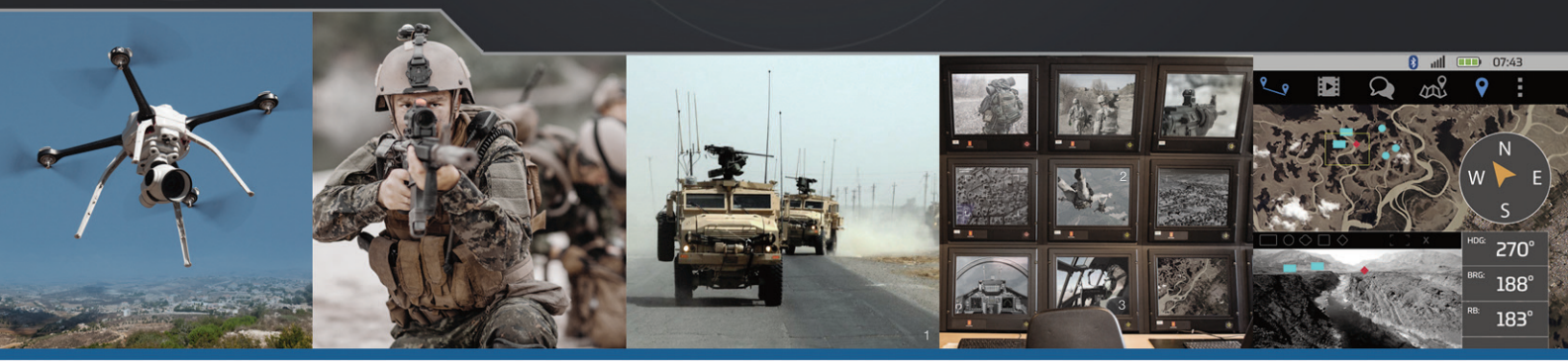

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ure out how we can move the bureaucracy along to make this work?" he said.

One idea is to field the robots in increments, with one brigade receiving a basic model and being allowed to use it. Then the program would take lessons learned from that unit's experience and apply them to a second increment. But instead of the first brigade receiving the upgraded model, it is given to a second brigade to use. The office wouldn't go back to improve the increment 1 model until a technology refresh is required.

This would be more affordable than the traditional "big bang" approach where hundreds of the mules are produced and fielded at once, he said.

After 15 years of acquiring robots in rapid acquisition programs, "the bureaucracy is reasserting itself," McVeigh said. It takes two years to produce a requirements document, and two more years to put a robot on contract. "That's four years when I need a tech refresh every five years," he said. "We can't keep doing things that way."

Col. Kurt "Travis" Thompson, chief of the Army's soldier requirements division, said "the bottom line is we have to get the capability out and into the hands and into the units so we can actually start moving forward."

The soldiers will figure out what the mule's limits are, what the capabilities are and what they need next, and then the Army can continue to spin out technologies from there and move forward, he said.

"But we've got to start somewhere," he added.

The question is what does the Army want this new platform to do? "At the end of the day, there is a minimum that you want them to do and then we'll figure out where that goes from there," Thompson said.

"The SMET is really a workhorse. What its limitations are is really limited by our imagination," he added.

Numerous demonstrations of models provided by various vendors have shown that some are too small to traverse rugged terrain and carry what is needed.

Others are too big. "Some can carry all the weight you need, but can't get it to where you want to go." It must fit in the back of a CH-47 or be sling loaded, Thompson said. There is a "happy medium" as far as size to do all these tasks, he said.

It will have to employ various payloads. "I don't know what all those payloads are right now," he added.

Standard soldier loads are a starting point. That is about 100 pounds of equipment for each member of a squad, who is expected to be self-sufficient for up to 72 hours. They can't march with those kinds of loads and be expected to win the fight, he said.

Soldiers don't walk for three consecutive days, though, and the SMET shouldn't be expected to be in motion all the time, he noted. Yet the vehicle should also be able to provide off-board power when troops are at rest so they can recharge their devices. That means the robot may have to recharge itself when idle.

"Soldiers don't walk for 72 hours, but when they're not walking, they are probably going to want to be charging. So it needs to be able to work continuously," Thompson said.

Transporting casualties is also high on the Army's list of what it wants the SMET to accomplish. It takes almost a squad to remove an injured soldier and his gear from the front line. It is disruptive to operations, he noted.

As for speed, it has to keep up with soldiers. "It doesn't have to be able to move ahead of them but it has to be

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able to move on pace with them, or at least close," Thompson said.

They must be semi-autonomous. They can follow soldiers using waypoint navigation, or work on a tether. There is no need for expensive software, at least in the early increments, he said. As soldiers use them and figure out the tactics, techniques and procedures (TTPs), there will be a call for more autonomy, he said.

"If you give them a capability, they will figure out really good TTPs. We've got to get our own capabilities out there, let the soldiers start using it, we'll figure out things between our increment 1 and increment 2, and then you will see a lot changes. Some of them will be high-tech changes and some of them will be easier," he said.

"I believe we have to get into this business. We have to get into it quick," Thompson added.

The Marine Corps has also been experimenting with robotic mules called the ground unmanned support surrogate (GUSS).

Dave Stone, robotic program officer at the Marine Corps Warfighting Lab's science and technology division, said the mule needs more autonomy so Marines don't have to operate a controller all the time.

Like the Army, the Marine Corps has put GUSS through numerous operational tests, but has yet to incorporate the technology into units. Many of the demonstrations centered on casualty evacuation, according to several Marine Corps and Navy produced stories published over the past four years.

Ground unmanned support surrogate

"GUSS is an extremely capable autonomous vehicle that can perceive and classify objects in a completely unstructured environment and in GPS-denied conditions. A technology like this could be instrumental in how the Marines of the future fight," said Naval Surface Warfare Center Dahlgren Division GUSS project lead Elizabeth Carlson in a Navy press release more than four years ago.

Stone said the lab is looking at a lighter tactical robotic controller system, in which a small computer is carried in a backpack and does the bulk of the processing. The Marine carries a small tablet that displays only the information on it that he needs.

"There are different levels of autonomy out there we can put in the field now. What we need to be working on then is the next step, the specific behaviors so we can establish a mission and have mission-level autonomy," Stone said.

Bob Sadowski, the Army's chief roboticist, said he is often asked why concepts such as robotic mules don't make it into the field faster.

Senior leaders are the catalyst, he said.

Industry can help by accepting some of the risk up front by doing early demos and experiments and "showing that your technology is actually ready," he said.

Even with a high technology readiness level, and with all the requirements documents in place, SMET will still need a champion to create a tipping point.

"When you have a senior leader walk in and say, 'I'm igniting the gasoline,' then you have that final ingredient," he said. **ND**

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DARPA Pursuing Technologies to Help Troops ID Enemies

By Yasmin Tadjdeh

As night falls, a small group of dismounted soldiers prowl a deserted city street. Small unmanned aerial vehicles buzz around them scanning for enemies. Robots follow them on the ground. Sensors attached to the troops' boots track their movements.

The Defense Advanced Research Projects Agency hopes this scene comes to fruition some day.

In December, DARPA kicked off its Squad X Core Technologies program as a way to provide dismounted soldiers and Marines with better situational awareness in treacherous and degraded environments.

The agency wants to "extend" and "enhance" a rifle squad's field of view, said Maj. Christopher Orlowski, DARPA program manager for Squad X. That could include augmenting their physical senses through acoustic or visual sensors.

Another part of the concept is to provide small unit leaders with increased time and space to make decisions, which will in turn help them shape and dominate their battle space, he told National Defense.

DARPA awarded nine phase-one contracts to industry including: Helios Remote Sensing Systems, Kitware, Leidos, Lockheed Martin, Raytheon, Scientific Systems Company Inc., Six3 Systems Inc., SoarTech and SRI International.

The companies will work in one of four research areas: precision engagement, non-kinetic engagement, squad sensing and squad autonomy.

For precision engagement, "what we're looking for there is actually guided munitions capabilities that could be fired from current weapons platforms," Orlowski said.

That includes the M2, M3 and M320 grenade launcher, he said. Companies may also propose a solution "where they would leverage the Picatinny rail systems that are on all M4s and M16s."

Under non-kinetic engagement the agency wants technology that can "disrupt enemy command and control, communications and use of unmanned assets at a squad-relevant operational pace," a DARPA press release said.

For squad sensing, the agency wants industry to produce systems that can detect potential threats out to 0.6 miles away.

"Squad sensing was focused on primarily detecting humans and unmanned systems within the environment and then determining whether or not those were threats," Orlowski said. Technology in this area could include multi-source data fusion.

For squad autonomy, the agency wants members to have "real-time knowledge of their own and teammates' locations to less than 20 feet (6 meters) in GPS-denied environments through collaboration with embedded unmanned air and ground systems," a DARPA press release said.

Military leaders have for years stressed the importance of hardening systems that could be affected by anti-access/area denial technology. Such weapons can knock out critical communication nodes leaving troops vulnerable.

Even if an enemy isn't tampering with network connections, soldiers can still face challenging conditions in many city environments in "urban canyons," where buildings degrade GPS-signals.

"In those environments with an urban canyon you just won't have line-of-sight to a GPS satellite. So we have to look at ways of operating potentially without it," Orlowski said. "If you've ever taken a run in … New York City, your GPS run app doesn't do really well."

Phase one will last for 12 months, he said. Following technology demonstrations, DARPA will then downselect to an

Squad X Core Technologies concept art

RAYTHEON

unspecified number of companies based on "performance and potential contribution to the DARPA mission."

Final demonstrations are slated for the August to October timeframe, he said. The agency has already evaluated the majority of the company's preliminary design reviews. Additionally, "some of the performers have demonstrated some subsystem capabilities either live or through simulation," he said.

During the final presentation, "the minimum goal is to demonstrate their capability relevant to about four soldiers and Marines in open, relatively not too complex terrain like in a city," he said.

Raytheon will be developing technology under the squad autonomy research area, said Dave Bossert, the company's Squad X program director.

The company is tasked with creating a system that can track the position of each squad member and hostile target less than 6 meters away in a GPS-denied environment, he said. "You have to do this with a [kit] … that's very similar to Nett Warrior," he said. Nett Warrior is an Army program that equips soldiers with technologies such as radios and wearable devices that give them digital processing and communications capability, he said.

Raytheon is able to add a device that weighs less than 350 grams, and is less than 200 cubic centimeters, to that array of wearables, he said. That system will then connect with unmanned air and ground vehicles to give soldiers better situational awareness in GPS-denied environments.

"This is not a platform development program. All we're doing is using surrogate UGVs and UAVs. What's really the innovation here is how do you utilize the autonomy of these devices," he said.

The company is working alongside two partner companies to develop its technology. Draper Labs and Torc Robotics are working on squad autonomy and Raytheon is developing the GPS-denied localization — which is knowing where soldiers and assets are — and acting as the overall integrator.

The robots are meant to act as junior squad members, Bossert said. "For example, if you had a private out on his first mission and [you] say, 'Go down that alleyway. Don't get shot. Don't get lost and tell me what you see when you get to the end.' … They want the robot to be able to do that."

DARPA awarded Raytheon $2.5 million for the phase one contract.

Kitware, an open-source software company based in Clifton Park, New York, was awarded a squad sensing contract.

Using information collected from off-the-shelf imagery and acoustic sensors, the company is developing software that will be able to rapidly analyze data, said Anthony Hoogs, senior director of computer vision at Kitware.

"In our vision, we are giving the soldiers a number of extra sets of eyes and ears that will be looking everywhere and listening everywhere around the squad all the time," he said.

Collecting intelligence, surveillance and reconnaissance information is important, but it provides no benefit to a soldier if it creates a cognitive overload for them, he said.

"If we put a bunch of video cameras in and around the squad then we would easily [and] immediately overwhelm the squad with data that they would not be able to use," he said. "You would have a squad member watching literally the TV on his wrist instead of actually defending himself and partici-

pating in the fire fight.

"It's only viable to have these video and audio sensors around if we can automatically process the data streams and boil those raw sensor feeds into actionable and salient information that the warfighter could use," he said.

Kitware is using GoPro cameras and commercial off-the-shelf acoustic sensors that can be fastened onto soldiers and onto any robotic elements in the squad, he said.

The company plans to pare down that information by using computer technology known as deep learning, which consists of advanced algorithms that can enable human-level accuracy in data analysis, he said.

Hoogs said he was pleased with the progress his company had made so far in the program, but noted that testing with unmanned air vehicles was being delayed because of Federal Aviation Administration red tape.

Kitware has applied for a certificate to conduct tests but has not yet had it approved, he said.

"The way the FAA has it set up even now, it's quite prohibitive for doing research in this paradigm. They don't allow significant modification of airframes or the payload or things like that before you have to get certified again," he said. "It adds a fair amount of schedule risk just because it's unpredictable and we're dependent on the FAA."

Hoogs said he was confident that Kitware would still be able to make its program milestones despite delays.

SoarTech, an Ann Arbor, Michigan-based artificial intelligence company, was also awarded a Squad X contract in the squad autonomy section.

SoarTech's work in the program includes two parts, localization and behaviors, said Jacob Crossman, chief engineer on SoarTech's Squad X project.

"Localization is just about being able to figure out where all the squad members are in time and where the robots are in time," he said. "We're working on some cool technology. It involves a boot-worn device that a soldier would wear and some sophisticated algorithms."

The company is partnering with the University of Michigan at Ann Arbor and a Maryland-based company called Robotic Research.

For the second part, SoarTech is teaming with a Pennsylvania-based company called Neya Systems to take a commercial off-the-shelf robot and equip it with autonomy software that can make it respond and react like a junior squad member based on where other members of the squad are, what information sensors are telling it and what the overarching mission is, he said.

Neya is building driving algorithms that would prevent an unmanned ground vehicle from crashing and ensure that it was driving effectively. SoarTech is developing technology that would allow the robot to make decisions, Crossman said.

In March, DARPA announced a new program known as Squad X Experimentation that would run concurrently with Squad X Core Technologies.

"The goal is to do system prototyping in the first phase, with system development in the second phase to develop an integrated squad system that allows a squad to conduct combined arms [operations] in multiple domains," Orlowski said. "We're defining those domains as the physical world, the electromagnetic spectrum and potentially cyberspace."

It is possible that Squad X Core Technologies participants could be part of Squad X Experimentation, he said. ND

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Battle Over Space Launch Heating Up

By Jon Harper

The fight over who will provide space launch services to the Air Force — and which rocket engine will be used to put payloads into orbit — is in full burn, pitting the Pentagon, Congress and members of industry against one another. The stakes are high, as the outcome will shape the Defense Department's acquisition path and the future of the launch market.

As tensions between Washington and Moscow continue to simmer, U.S. lawmakers have directed the Air Force to move away from using the Russian-made RD-180 engine in its evolved expendable launch vehicle (EELV) program.

"We are working diligently towards that objective … [but] there's a lot of work to be done by industry," said Maj. Gen. Roger Teague, director of space programs in the office of the assistant secretary for acquisition, during a budget briefing with reporters at the Pentagon. "To get off of that [RD-180] engine it's important that first our U.S. technical industrial base build itself back up."

Blue Origin — owned by Amazon.com founder Jeff Bezos — and Aerojet Rocketdyne are both developing engines that could compete to replace the RD-180 on United Launch Alliance's Atlas V rocket. ULA, a joint venture between Lockheed Martin and Boeing, has been the sole provider of space launch services for the Air Force's EELV program.

In March, Aerojet Rocketdyne was awarded a $115 million contract for development of its AR1 engine. Options for additional work could increase the total U.S. government investment to as much as $536 million.

The company is on track for certification and delivery in 2019, said Eileen Drake, president and CEO of Aerojet Rocketdyne. The AR1 will be less expensive than the RD-180, she told National Defense.

"Our ability to use past proven technologies along with additive manufacturing and a lot of the low-cost solutions that we've come up with has enabled us to … [offer] the lowest risk and the lowest cost to the taxpayer," she said.

Some analysts are skeptical that U.S. engines will match the RD-180 when it comes to cost and performance.

"I don't know that you're going to be able to do that cheaper than the Russians do," said Marco Caceres, director of space studies at the Teal Group, a defense and aerospace consultancy based in Fairfax, Virginia. "I don't think we're going to come up with an RD-180 equivalent."

It may not be feasible for U.S. industry to develop something with capabilities or cost points that are close to the RD-180 within the next five years, as the Air Force desires, he said.

United Launch Alliance is responsible for doing interface work for the AR1 and Blue Origin's BE-4. Brett Tobey, while recently serving as ULA's vice president of engineering, said the company favors Blue Origin when it comes to engine development.

"We're sitting here as a groom with two possible brides," he said. Blue Origin is "the super rich girl. And then we've got this poor girl over here — Aerojet Rocketdyne," he said during remarks at the University of Colorado Boulder in March.

AR1 engine concept art

"We're doing all this work for both of them, and the chances of Aerojet Rocketdyne coming in and beating the billionaire is pretty low," he said. "Politically we can't take, in advance, one of those paths … but basically we're putting a whole lot more energy into BE-4."

Blue Origin officials declined to be interviewed for this story.

The BE-4 is a new type of technology, whereas the AR1 represents a much more traditional engine design, Caceres noted. While Blue Origin's engine may ultimately be superior, it could present a greater risk of technical and program delays, he said.

In addition to funding engine development, the Air Force wants to make launch service investments via innovative public-private partnerships. The Air Force has requested money for this purpose in fiscal year 2017. Once new launch systems have been developed, estimated in the 2022 to 2023 timeframe, the Defense Department will transition to a strategy of sustained competition between domestic launch providers, said Lt. Gen. Samuel Greaves, commander of the Air Force's Space and Missile Systems Center, at a meeting in Washington, D.C.

But pursuing that strategy would require the approval of lawmakers. Air Force officials have complained about congressional restrictions that limit their ability to invest in launch system development.

"Assured access to space requires end-to-end space launch capability, not just the rocket engine," Greaves said. "It requires the engine and the rocket to work together.

"Simply put, just replacing the RD-180 engine will not deliver the same performance in the current design of any rocket. In fact, it may result in a system that delivers less payload to orbit at a higher cost."

Significant launch system development is needed to incorporate a new engine, he said, making a case that a public-private partnership in this effort would save money and reduce technical risk.

"We've got eight reference orbits that we need launch systems to service, and commercial providers don't normally service all eight of those reference orbits," he said. The Air Force needs to influence those designs early enough to ensure those systems deliver payloads to all of the desired orbits, he said.

But some officials are questioning the commercial viability of maintaining more than one launch service provider for national security space missions. Past failures to create competition for EELV launches have sowed doubt about the

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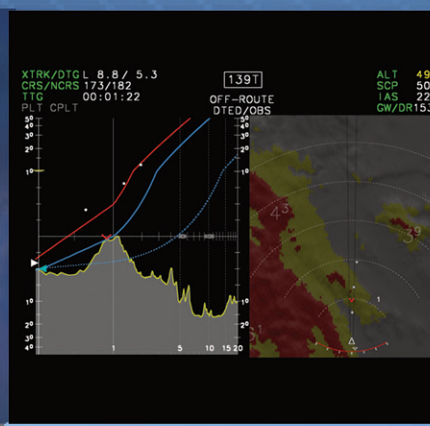

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Air Force's plan.

In the 2000s, the Air Force hoped that Lockheed Martin and Boeing would compete for EELV launch service contracts. But after arguing that there wasn't enough work to go around, the two companies joined hands and formed ULA, essentially creating a monopoly.

"The EELV problem that we had over a decade ago is happening all over again," said Rep. Mike Rogers, chairman of the House Armed Services subcommittee on strategic forces.

"History and current analysis are indicating that there is not likely enough market here for two providers to be commercially viable in the EELV class," the Alabama Republican said at a recent space budget forum. "This does not give me a lot of confidence in the Air Force's plan to underwrite the creation of a new commercially viable set of systems."

Rogers doesn't believe the risk of investing in the Pentagon's plan is worth the reward.

"I love the budding and innovative commercial space market as much as anybody does, but I'm not going to risk hundreds of millions or even billions of dollars of the taxpayers' money, and even more importantly, our assured access to space," he said. "I just don't want to take my foot off the pedal on getting American-made engines. Anything that diverts money away from that I'm against."

While the commercial market is growing, the U.S. military has unique satellite launch requirements, said Brian Weeden, a technical advisor at the Secure World Foundation, a Broomfield, Colorado-based research group that focuses on space issues.

They want to launch "really heavy and/or large things," he said. "If you solely rely on what the market demand is, probably you're going to get commercial launch companies that are flying cheaper, smaller rockets more often that ... can't service the national security customers."

Meanwhile, ULA is feeling pressure to compete with SpaceX, which is owned by Elon Musk, the technology visionary who also founded Tesla, a leading developer of electric self-driving cars.

"All of a sudden you have SpaceX come along and they kind of ruined the business — the monopoly for ULA," Caceres said. "They came up with … a viable rocket, the Falcon 9. And what's worse for ULA is the rocket is not only reliable, but it's extremely cheap from a cost standpoint."

United Launch Alliance has been under fire for not bidding on a GPS-3 satellite launch contract last year, declining an opportunity to compete with SpaceX. ULA has said that the decision was due to a shortage of RD-180 engines. The move upset lawmakers and Air Force officials who are trying to foster industry competition.

"The government was not happy with us not bidding that contract because they had felt that they'd bent over backwards to lean the field in our advantage," Tobey said, adding that ULA wanted to avoid "a cost shootout between us and SpaceX."

His remarks prompted a Defense Department Inspector General investigation and his resignation.

Tobey's "ill-advised statements do not reflect ULA's views or our relationship with our valuable suppliers. We welcome competition," ULA president and CEO Tory Bruno tweeted.

The U.S. government could potentially punish ULA for not bidding by taking away sole-sourced launches and competing them, Weeden said. But the Air Force has indicated that it is not inclined to cut launches from existing contracts.

"If you had a mortgage with a bank and … you say, 'Well, I need to take out a student loan to send my kid to college.' And you put it out for bid and your bank decided not to bid on that student loan, would you cancel your mortgage?" said deputy under secretary of the Air Force for space Winston Beauchamp during a recent discussion with reporters.

The Air Force inadvertently put ULA in a difficult position to compete on price because early in the EELV program the company was told to maximize reliability at the expense of minimizing costs, Weeden said. SpaceX wasn't under the same constraints when it designed the Falcon 9.

"We at SpaceX had the luxury … of starting with a vehicle design from scratch, a clean sheet of paper," said Gwynne Shotwell, president and chief operating officer of SpaceX, at the Satellite 2016 industry conference. "We could actually look at low-cost methods for rockets that also enhance reliability."

Analysts anticipate that costs will continue to come down as more launches occur in the years ahead. The company's development of reusable rockets could also enhance affordability, Shotwell said.

SpaceX's Falcon 9 is about half the price of anything that ULA is offering, Caceres said. "It will put pressure on ULA to come up with a much less expensive launch vehicle [but] they will probably never be able to match SpaceX — not in the near future — on price."

SpaceX plans to launch its Falcon Heavy variant later this year.

United Launch Alliance is working to develop a Vulcan rocket, which is expected to be less expensive than its Atlas V and Delta IV, but it won't be ready for many years, he noted.

Still, ULA won't be left for dead, analysts said. Air Force concerns about rocket reliability and availability are key factors that could help ULA's business case, Caceres noted. The company has a long track record of providing successful launch services for the EELV program, whereas SpaceX is the new kid on the block.

Reliability is a major worry because rocket failure could be disastrous in some cases due to the high cost of Air Force space systems. Unit costs for Defense Department satellites can range from $500 million to over $3 billion, according to the Government Accountability Office.

"If it took 10 years to build the satellite and a few billion dollars, it has got to work," Weeden said. "You can't just go to Home Depot and buy another one. … It's all you got."

Moreover, the Air Force doesn't want SpaceX to have a monopoly, analysts noted. If ULA struggles, the Pentagon could be forced to come to the rescue.

"If within a few years they're having problems then they would probably have to provide some sort of support," Caceres said. "The Air Force almost at any cost wants to maintain at least two separate launch vehicle lines. … I would expect that if that was in danger that the Air Force would do what it had to do."

SpaceX and ULA did not respond to interview requests.

The Pentagon is thinking about how to divvy up contracts between potential launch service providers to ensure that at least two will remain commercially viable.

"We're still evolving the strategy for that," said John C. McNellis, deputy assistant secretary of defense for space, strategic and intelligence systems, at a recent space talk hosted by the Air Force Association. "We are obviously having discussions with a variety of potential providers and what their unique business arrangements with us will be. And how that all integrates together is yet a subject to be fully decided." ND

Email your comments to jharper@ndia.org

CV-22 Ospreys Get Extra Upgrades for Special Operations

By Allyson Versprille

Air Force Special Operations Command plans to integrate several new technologies into its fleet of CV-22 Ospreys by the early 2020s that will enhance the aircraft's performance, an AFSOC official told National Defense.

The V-22 is an important platform that fills a unique niche, said Col. Steven Breeze, the deputy director of operations at AFSOC. It "is the first aircraft that I know of that has a similar speed to the C-130 but can land vertically," he said. "There's no other aircraft that can do that with the speed of the C-130 and the range of the C-130."

With a cruising speed of 241 knots — a max of about 270 knots — and a combat radius of 500 nautical miles with one internal auxiliary fuel tank, it enables special ops forces to carry out missions in one period of darkness, leading to fewer complications and greater operational success, Breeze said.

He pointed to the failure of Desert One in 1980, an attempt to rescue U.S. hostages in Iran, as a reason why having that ability is so important.

"We need a vertical lift platform that has the speed and the range in order to execute a mission such as Desert One, and the V-22 fits that profile perfectly," he said. "We could have done that entire mission with V-22s and pulled it off in one period of darkness."

Because the platform is so crucial for special operations, AFSOC is looking at ways it can improve the aircraft's performance.

To achieve that goal, the command has near-term plans to add both a new radar and an engine filtration system to the CV-22. AFSOC is also considering putting more weapons on the tilt-rotor platform.

The modern radar will replace the aircraft's existing terrain following and avoidance system. Such radars enable pilots to fly as low as 100 feet to the ground in challenging conditions — at night, in adverse weather and in high-threat environments — while lowering the probability of detection by enemy forces. "In other words, the pilots don't even have to look outside to fly at low altitudes and it keeps them safe," Breeze said.

The current system on the CV-22 is Raytheon's APQ-186. The command plans to replace the old radar with the company's APQ-187, also known as Silent Knight. The new system will include advances in terrain following and avoidance capabilities, and will be lighter and require less power than its predecessors.

AFSOC will benefit from using Raytheon's radar because it has similar form factors as the old one — which will minimize changes to the airframe — and because of the experience that the company brings to the table, said Rick Lemaster, director

ENHANCING THE CV-22

Radar: The plan is to replace the old terrain following and avoidance radar with Raytheon's Silent Knight.

Engine Filtration System: Air Force Special Operations Command plans to test a new filtration system that would improve engine performance.

Additional Weapons: The Naval Surface Warfare Center Dahlgren Division is conducting a study to determine the optimal weapon for the V-22.

PHOTO: AIR FORCE, ICONS: ISTOCK

of V-22 tilt-rotor global sales and marketing for vertical lift programs at Boeing. "Because Raytheon builds the current radar as well as this future radar, they have quite a bit of knowledge on what that current installation looks like and what they would have to do."

AFSOC anticipates that the Silent Knight retrofit kits will be available in the third quarter of fiscal year 2021. The command is looking to fit one to two CV-22s with the new system in fiscal year 2021. From fiscal years 2022 through 2027, it plans to retrofit eight to nine aircraft per year. However, that schedule is dependent on aircraft availability and the length of the other retrofits. Overall, the command hopes to have the new radar on all 51 CV-22s by fiscal year 2027.

An Osprey fires a BGM-176B Griffin B missile.

Silent Knight has already been tested and integrated on Army special operations helicopters — the MH-47G Chinook and the MH-60M Black Hawk, Lemaster noted.

"They're in production and they're putting those upgraded radars on the Army SOF helicopters," he said. "The thing that needs to happen is they need to do the integration testing and put the new radar on a CV-22." Because the aircraft flies twice as fast [as a traditional helicopter] and the radar will need to operate over that wider range of air speeds, there is a lot more testing that has to occur, he said.

The new filtration system that Air Force Special Operations Command hopes to field in three to four years will improve the performance of the Osprey's engine.

"The filter will increase the number of hours that the engine stays on the airplane," Breeze said. "For any aircraft, you always have to replace the engine after a certain number of hours because the health of that engine decreases over time." The dry environments that special ops forces often operate in accelerate that problem because aircraft engines are more likely to take in dust and sand.

Keeping that component on the platform longer will result in significant cost savings for the government, he noted.

Lemaster said the Bell-Boeing Osprey manufacturing team is under contract to develop the filtration system, which they refer to as the "inlet barrier filter" or the "improved inlet solution." The system is being built as a part of Bell's workshare at its facility in Fort Worth, Texas.

For the upgrade, a bypass filter will be placed on the end of the inlet to the engine, which will enable it to separate sand, dust and water, and stop those elements from leaking into the motor. "It's under development now. It's got to get through qualification testing, and then we'll be able to push it out and go retrofit all of the AFSOC airplanes," Lemaster said.

Breeze said testing will begin in 18 months to two years, and the command plans to field the system in the 2019 to 2020 timeframe.

The other significant modification under consideration for Air Force Special Operations Command's Osprey — though no final decisions have been made — is arming the platform with additional weapons.

The Naval Surface Warfare Center Dahlgren Division in Virginia is conducting a study to determine the optimal weapon for the V-22 and where that weapon should be placed in order to maximize coverage of the aircraft. The study, which began in 2015, is expected to continue through 2018. It will focus on guns and precision-guided munitions, according to Naval Air Systems Command.

"We currently do have a .50 caliber weapon on the tail, but we're just foreseeing that maybe in the future we may need some more protection," Breeze noted.

The ability to add precision-guided munitions to the V-22 has already been proven on two separate occasions.

In December 2014, an Osprey fired two Raytheon BGM-176B Griffin B missiles, marking the first time a forward-firing missile had been launched from the aircraft, according to a Raytheon press release.

Test crews shot the missiles, scoring direct hits from both hover mode and conversion mode at 110 knots, the release said.

During a demonstration with the Defense Advanced Research Projects Agency as part of its persistent close-air-support program, a Marine Corps Osprey fired a non-explosive version of a tube-launched Griffin missile. "Guided by a targeting laser, the missile hit exactly where directed and, had it been explosive, would have destroyed the target," a March 2015 DARPA press release said. During the test an AeroVironment Switchblade unmanned aerial system — which destroys targets kamikaze-style — was also successfully fired off the aircraft.

Placing additional weapons on the V-22 would complement other recent efforts to better protect the aircraft and its crews.

That need was realized in December 2013 during a mission in South Sudan. Three AFSOC V-22s were attempting to evacuate U.S. citizens from a United Nations compound in the embattled town of Bor. As the aircraft approached landing, they were assaulted with heavy gunfire, resulting in injuries to four Navy SEALs.

In March 2014, Air Force Special Operations Command issued a combat mission need statement for greater ballistic protection as a result of that operation. The outcome was the advanced ballistic stopping system developed by The Protective Group, a company that specializes in lightweight composite armor solutions. The final design consists of 66 armor panels that can be placed on the inside of the aircraft to protect against small arms fire.

"It's a roll on/roll off capability that you can configure depending on the mission set that you're conducting," Breeze said. The armor is being used on V-22s in the field today, he added. **ND**

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Special Operations Command Expresses Need for More V-22s

Air Force Special Operations Command is looking to add more V-22s to its inventory as a hedge against future accidents, its leader said recently.

Lt. Gen. Bradley Heithold, commander of AFSOC, said at an Air Force Association conference in February that he would like to acquire three additional Ospreys to keep in reserve before the production line ceases.

There is not much of an attrition reserve for Special Operations Command's fleet of 50 CV-22s, he said. "Before our production line slows down or goes cold, we should pursue the attrition reserve in the 50 airplanes and take it to 54."

The service has 51 aircraft funded through fiscal year 2016, according to the 2017 Defense Department budget request. Based on budget documents, the single CV-22 purchased in 2016 is intended to be a reserve platform. However, there are no other CV-22s requested within the Air Force's future years defense program, meaning the service would need to fund three extra platforms in order to meet the commander's goal.

Col. Steven Breeze, deputy director of operations at AFSOC, said having aircraft in attrition reserve is necessary because they will enable the command to quickly fill any gaps if an airplane crashes or can no longer fly for any given reason. "Hopefully we don't lose any in the future, but you can pretty much guess that you're probably going to lose an airplane or two, or maybe four."

AFSOC has already lost two of its V-22s in crashes — one in 2010 during a night raid in Afghanistan, and the other in 2012 during a training accident at Eglin Air Force Base, Florida.

The command isn't worried about the production line ceasing anytime soon, Breeze said, anticipating that the planned procurement of V-22 variants by the Navy and Marine Corps will keep the line running.

The Navy is purchasing the aircraft to replace its aging C-2A Greyhound turboprop aircraft used for carrier onboard delivery missions. Procurement is slated to begin in fiscal year 2018.

However, the 2017 budget request reflects slight reductions to both services' planned V-22 purchases over the next five years. The Marine Corps had originally intended to buy 18 V-22s in fiscal year 2017, but the budget request only includes 16. The Navy was going to purchase eight aircraft a year from 2018 to 2021, which was reduced to six a year in the future years defense program.

Both the Navy and Marine Corps are still expected to buy the full number of aircraft in their programs of record, 44 and 360 respectively, but some of those buys will be pushed to the right, said Rick Lemaster, director of V-22 tilt-rotor global sales and marketing for vertical lift programs at Boeing.

Bell and Boeing are working with the Defense Department to negotiate a third multiyear contract to extend deliveries of the aircraft to 2024. The team is hoping to reach quantities and cost savings similar to what was achieved through the second multiyear contract culminating in 2017, which would maintain aircraft production at the current rate of about 19 to 20 per year.

"WE SHOULD PURSUE THE ATTRITION RESERVE IN THE 50 AIRPLANES AND TAKE IT TO 54."

To fill the gap reflected in the budget request, the companies are hoping to nail down more foreign military sales.

In May, the U.S. State Department approved a potential $3 billion sale to Japan for up to 17 V-22 Ospreys. As of last summer, five of those aircraft were placed under contract. Boeing is hoping that Japan will choose to purchase more of them in multiyear 3, Lemaster said.

Israel, which has expressed interest in the past, is another potential customer.

Boeing is also targeting allies that — similar to the U.S. Navy — will need an aircraft like the V-22 for resupply missions on their carriers.

The Marine Corps has been engaging with some of those potential customers, performing capability tests and interoperability landings on their ships, Lemaster said. They include the United Kingdom, Italy, France, the Netherlands and South Korea. **— Allyson Versprille**

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The Enemy of Good Enough: A Different Way to Look at Emerging Technology

By Brig. Gen. Kirk W. Smith

Exactly when is technology ready for operational use? It depends on whom, and when, you ask. People will come up with an answer based on their perspective, a viewpoint informed by their environment.

Some say an advanced technology is ready when it meets the threshold requirements, or key performance parameters, specified in a validated requirement document. That assumes the requirements are known. In the case of KPPs, it assumes select requirements are absolute minimal necessities — without which a technology should not be fielded. Additionally, it should meet all the other key attributes. That's a good starting point, but it shouldn't necessarily be the final determination.

As far as documented requirements are concerned, one might ask, why is the minimum, or threshold, capability the minimum? Likewise, what does the objective capability mean? Is that the capability we would rather have if it were feasible? Is that the best we can expect to achieve from a technology? Is it all we're willing to pay for? Or is it the limit of our vision?

We generate requirements based on our experience. Generally, requirements are written to describe what we can't presently do, and what we would like to be able to do — essentially, where we see a capability gap. Right or wrong, requirements are also influenced by what we think technology can and can't achieve. In reality, the upper and lower limits of what a technology is operationally capable of can only be determined during operations.

Others may say an advanced technology is ready for use even when it has only limited value — perhaps just an incremental increase in a capability we don't currently possess, a cost improvement, reliability or ease of use — that replaces what we use now. What if it provides a capability that is totally different than what we have now — an additional capability? We are routinely asked if the added capability is worth the investment. To some, this leads to the notion of a need for cost-benefit analysis.

The pursuit of an undeniable positive cost benefit can often result in continuous investment in research and development, driven by the desire to make the solution perfect, which ultimately results in deferring operational use. Then, after long, drawn out investments in technology development, we think of other creative things the technology should be able to do before we field it, further delaying fielding.

> **"UAVS PROVIDE A LONG AND TORTUOUS EXAMPLE OF CHASING A MATCH BETWEEN MISSIONS AND ACCEPTABLE TECHNOLOGICAL CAPABILITY."**

DEFENSE DEPT.

Sometimes we find that after we have invested so much time, money and effort — and have still not "perfected" the solution — we are afraid to, or can no longer afford to, procure even one system. In the end, because we are unable to achieve a certain performance, we just walk away from a capability we could employ, never to use it.

Is it possible that we need to reconsider our vision and values when assessing technology readiness for use?

I submit that a new technology might be ready to use when it demonstrates it has utility. Can it do something that we can't presently do? If the answer is yes, more questions are likely. How much more? How much better? How valuable is it to be able to do that? Is it worth the investment?

Then it gets more interesting.

The next thing we get to decide is how we measure the value of having the additional capability. Sometimes we might be able to calculate a dollar value of benefit. But in our business that's rarely the case. We rate ourselves by the capabilities we possess. The value is normally in the form of our ability to do things, such as getting to an objective, saving lives, protecting an aircraft and crew, better precision, and deterring or disrupting adversaries. Without some pretty creative math, these benefits are difficult to quantify. So, for the case of this discussion, let's assume there is operational value in the capability.

Now there is an additional layer of value we must consider. We need to assess whether we should wait to use the technology until it can do more than it can presently do. If that is the decision, it assumes we are willing to forego today's utility in the hope that someday the technology will be more capable. What we would be doing is deferring a capability available today, while more is invested in the hope for additional unquantifiable benefit.

This brings us to unmanned aerial vehicles. UAVs provide a long and

tortuous example of chasing a match between missions and acceptable technological capability. For decades we toyed with the idea of fielding UAVs for various missions. Among the first modern day uses of unmanned air vehicle technology was the successful employment of the Lightning Bug in Southeast Asia. We then studied and considered the use of UAVs for about 30 years. A lot of technological advancement happened in those 30 years, most of which was not specifically for the purpose of advancing the capabilities of unmanned aircraft.

Partly as a result of those ancillary developments, we resurrected UAVs. We fielded them as the Gnat, then Predator, then armed Predator and Reaper, then Global Hawk. It has been a continuous spiral of learned requirements. It's interesting to note that the Global Hawk's operational requirement document and concept of operations were developed almost as Global Hawk was preparing to deploy to Tora Bora, which tells us the requirement documents were not driving fielding. At least one of its KPPs had not even been met.

In retrospect, we envisioned these UAVs to have limited capabilities: collection of intelligence, surveillance and reconnaissance. We now know the rest of the story, so far.

If we field a technology, even though it has not reached the limits of its capability, we may find it does things we can't be without. By fielding not quite fully mature capabilities, we may also find that we are moving the ball down the field both operationally and technologically. We can move the ball while achieving greater advantage over our adversaries.

The fielding of the joint surveillance target attack radar system, or JSTARS, is a good vignette. We deployed a developmental test aircraft, and the complementary ground stations, in support of Operation Desert Storm. Only four months earlier, the JSTARS development program had just conducted a successful operational fielding feasibility demonstration. In fact, we used JSTARS operationally in two theaters before the first production aircraft was even delivered in 1996. This is a great example of bringing a new technology to the battlefield that provided a capability we didn't even know we needed.

By simultaneously gaining operational experience and technology development, we can have operational capability while technology matures. Just as has been the case with UAVs, added capability has spurred development. Employing advanced technology stimulates technology development, and creates a spiral of ever-increasing potential capability.

Air Force Special Operations Command has a history of fielding burgeoning technology quickly and incrementally in an effort to get operationally relevant capabilities to the warfighter as soon as possible. That is our heritage and in our DNA.

Today we are exploring directed energy and off-board sensing, both technologies that may not have reached their full maturity yet. However, we feel the potential benefit is worth the effort. We don't even know yet what additional utility these potential game changers bring to the table, but we know the cost of not pursuing innovative approaches is stagnation, something we can't afford by any cost-benefit analysis.

This is not to say we should commit to every new bright idea. But we must continue to expand the envelope so that we advance the ball, increasing our operational advantage, while fostering further technology development. **ND**

Brig. Gen. Kirk W. Smith is director of strategic plans, programs and requirements at U.S. Air Force Special Operations Command.

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SOFWERX: Newest Acquisition Tool for Special Operators

By Stew Magnuson

TAMPA, Fla. — While its doors have only been open a few short months, SOFWERX, an institute designed to facilitate communication between the technology community and U.S. Special Operations Command, is already having a positive impact, its leaders said.

SOFWERX is located in the second oldest brick building in Tampa's historic Ybor City neighborhood. Once a hotel, its guests included a young war correspondent Winston Churchill and Col. Teddy Roosevelt, both on their way to wars in Cuba. Only last summer, the front of the building was a tattoo parlor, and the back a telemarketing company.

Today, the building houses rooms where outsiders can meet with SOCOM officials, workstations for those who want to collaborate on projects, and space set aside for rapid prototyping.

It's miles away from SOCOM headquarters at MacDill Air Force Base — both literally and figuratively, said its director, who was not permitted by SOCOM to use his name.

"People who are behind four strands of barb wire and security guards are tough to talk to," he said.

Once buzzed in through the front door, visitors are asked to sign into an iPad with their name and email. That's the only formality.

Inside, vendors, researchers, academics and citizens with good ideas can participate in a number of events designed to ease communication between the command and the public. If a technology is given a preliminary green light, there are 3D printers and other machines available for the prototypes.

That serves in stark contrast to the alternative means to contact the command — the technology and industry liaison office website — where ideas are submitted by email, then are passed around the acquisition enterprise. If it grabs a program manager's interest, the party is contacted for a meeting, said Tony Davis, SOCOM S&T director. The lucky ones then have to make an appointment and arrangements to pass through the heavy security at MacDill. The whole process can take three months.

"We are kind of trying to break down that model a little bit," said Davis.

"Sign in and get a badge. That's about it. It's really a nonthreatening environment. You didn't go through layers and layers of security to get to us," said the director.

The head of the technology and industry liaison office carves out one day per week to hold half-hour meetings with potential vendors at SOFWERX, as does the director of the small business liaison office. It has on occasion had walk-ins ring the buzzer and sit down with the staff to pitch ideas, the director said.

It is administered by the Doolittle Institute, which set up SOFWERX under a Partnership Intermediary Agreement (PIA). Congress created PIAs in order to facilitate communication in a neutral space between government agencies, the private sector, academia and the general public.

Davis said such agreements have not been used often despite being on the books for a decade. It took a lot of consultations with SOCOM's acquisition officers and attorneys to make SOFWERX a reality since they could find few precedents of agencies using the authority.

The idea was the brainchild of James "Hondo" Geurts, SOCOM's acquisition executive, and it follows a larger trend of the Defense Department pursing nontraditional vendors. Secretary of Defense Ashton Carter's outreach to Silicon Valley is a notable example.

"U.S. SOCOM doesn't need help with a lot of folks that they deal with in industry. They already have good partnerships. What we really want to look at is where we can try to influence with divergent thought and nontraditional players," the director said.

The idea — to borrow a term from the founder of Zappos Tony Hsieh — is to have a space where there is not necessarily a high return on investments, but a "high return on collision," the director said. In other words, people who don't normally meet, find each other in a common space and interact.

This has happened several times, he said. One company there to display its virtual reality goggles ran into researchers working on SOCOM's tactical assault light operator suit, and

SOFWERX is located in Tampa's historic Ybor City neighborhood.

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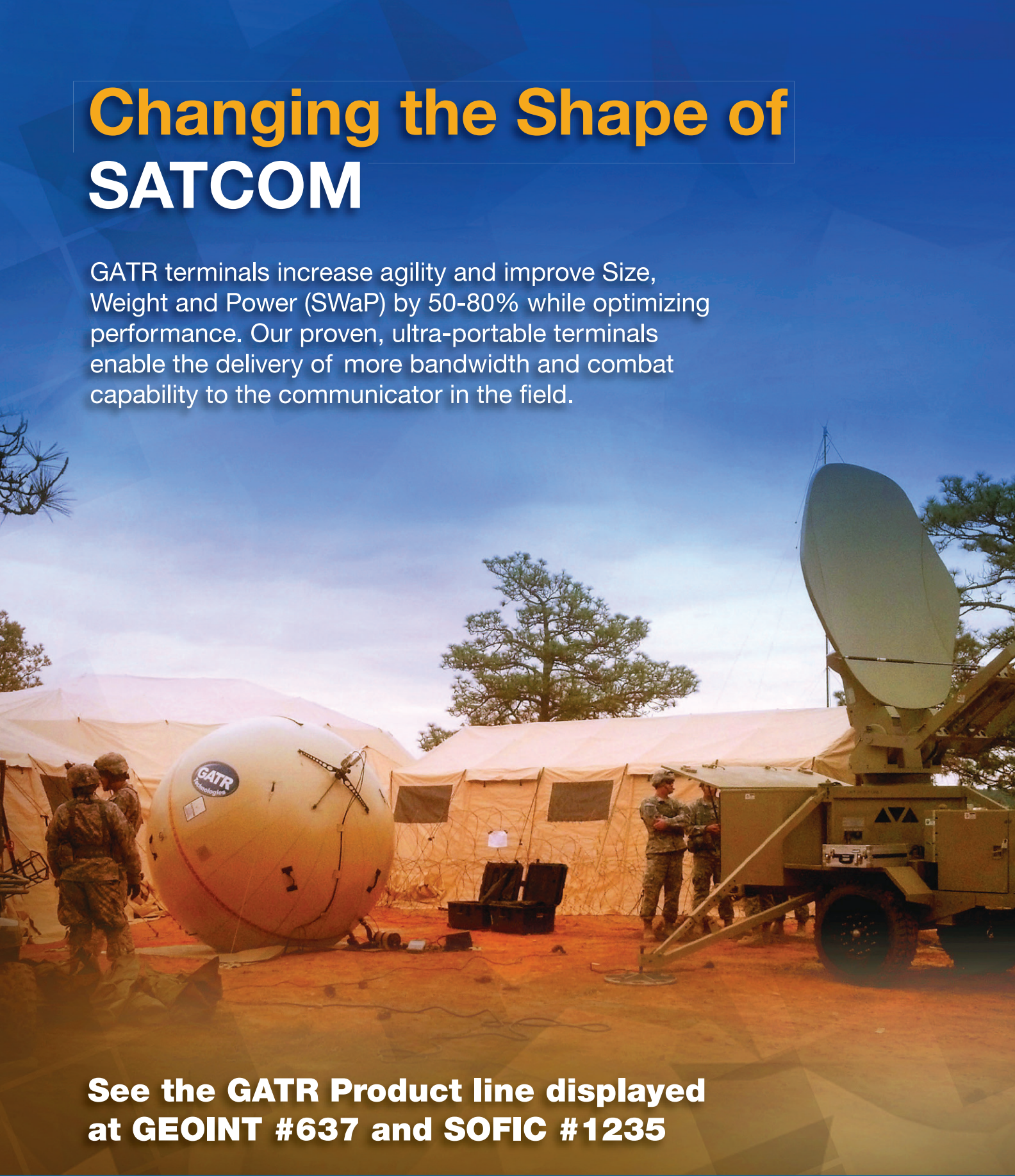

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exchanged ideas about how the so-called Iron Man suit's helmet could be improved.

"It's not enough in my mind to have a guy in the room say, 'Did you think about this a different way?' I would like to have a guy in the room that is also going, 'You guys shouldn't even be thinking about any of that at all. Look at this over here. This is going to completely bring you guys to your knees in four or five years. And you need to know about it now.'"

"WHEN YOU THINK OF TECHNOLOGY ... YOU REALLY DON'T THINK OF TAMPA. BUT WE REALLY HAVE A ROBUST TECHNOLOGY CENTER AND A ROBUST MANUFACTURING CENTER."

There are no cubicles, but standing workstations. SOCOM employees and industry members have come to use the space to get away from their offices.

A couple of times a week, there might be up to 75 people in the building for different projects and events, the director said. "Those people are talking to each other and creating collisions, coming up with ideas and thoughts on how to do things or how to do things differently."

Warfighter Council Wednesdays bring in active duty special operators, who come in to talk about some of their technology needs. They make lists of their priorities and they are "racked and stacked" so SOFWERX can go out and start looking for companies that may have solutions, Davis said.

"A lot of what special operations forces does is take something that is commercially available, kind of tweak it a little bit and field it as fast as they can. That's what keeps them fast and agile," the director said. SOFWERX is building an "eco-system" of experts it can call upon when needed, he added.

"Whenever SOCOM is looking for something … we will use our eco-system to reach out. I do believe, that not all, but some of what SOCOM needs are just one or two steps removed from us. Somebody knows somebody who knows somebody who can help solve some of the problems," the director said.

If the staff finds a technology that has potential, some basic prototyping can be done on site. The SOFWERX staff is small, but it has an engineer, information technology expert and other technicians there to help.

One such technology SOFWERX discovered was on a table in the workshop — an open source, 3D-printed robot that can fly and drive.

The Army Materiel Command's Communications-Electronics Research, Development and Engineering Center is taking one year to develop a 3D printed drone, the director said.

"This is an open source, 3D printed modular [system] that can be a rotary-wing, fixed-wing or ground robot. So with the same brain box I can get an airplane, a quadcopter or a rover." And since it is open source there are no export restrictions, meaning the three-in-one robot can be shared with SOCOM's international partners.

If a gadget being developed needs work beyond what SOFWERX can provide, local defense contractors or labs can be called in to help, he said.

Once the technology reaches a certain stage, it is "tossed back over the wire" to SOCOM, where it becomes a traditional acquisition program, he said.

The facility has space to do mini-industry days when program managers want to bring in a small crowd. For larger events, SOFWERX has an agreement with nearby Hillsborough Community College, which has auditoriums available, he said.

Much of the tooling machines for rapid prototyping will be moving to an annex called "DirtyWerx," which is located about five blocks away in a former autobody shop.

Not all of the expertise needed will be found in the places where SOCOM normally looks for help, Davis said. The hackathons SOFWERX has sponsored has brought in a few such participants.

A member of the last winning team, who came up with an algorithm needed to solve one of the contests, works for a local medical records company and has a decidedly negative view of the U.S. government. He "is an interesting person that we would have never had a relationship with before," Davis said.

Thunderdome Thursday brings in local businesspeople to share ideas.

Tampa is a hotbed of manufacturing and innovation, although it is mostly known for the medical industry. "When you think of technology, you think of Silicon Valley or Boston or other places. You really don't think of Tampa. But we really have a robust technology center and a robust manufacturing center," said the director.

"I think the value we give to the people from the community is we have interesting problems they haven't thought of before and it's challenging to them," Davis said.

The director added: "As we're partnering up with everybody, we are finding the ability to pull folks in here. Everybody seems to be willing to come in on an ad hoc basis whenever we need it." **ND**

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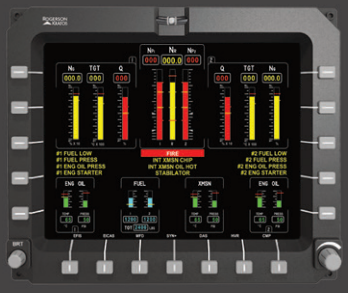

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Special Ops' 'Iron Man' Suit on Track for 2018

■ TAMPA, Fla. — One of Special Operations Command's highest profile technology development programs — the tactical assault light operator suit — is on track to debut in late 2018, a senior SOCOM official said.

The TALOS program began in 2013 at the behest of then SOCOM Commander Adm. William H. McRaven, who wanted more protection for commandos entering potentially dangerous buildings. He set a late 2018 deadline for the command's science and technology community to develop a working suit that could ward off bullets and bomb blasts.

Special operators who kicked down doors searching for terrorists were too vulnerable to small arms and bombs and lives had been lost, he said.

The press dubbed the project the Iron Man suit, and SOCOM's artist's renderings backed up the idea of a special operator covered from head to toe in thick armor.

Tony Davis, science and technology director at SOCOM, said the project is progressing and the 2018 deadline will be met.

"One of the big things in TALOS is how we do acquisitions faster," he said in an interview at the SOFWERX outreach center in Tampa's Ybor City neighborhood.

Part of that is putting all the right people in the room together to work on specific projects in what he called "technology sprints" that take weeks, rather than months, to solve a problem.

"A lot of what slows the services down — and what slowed us down — is that I can design a great product but then I have to ask a guy who works in another command or another state: 'What do you think of it?'"

Several blocks away in an annex called DirtyWerx, where SOCOM is doing rapid prototyping, a team including engineers, an active duty special operator and a seamstress were working on one such problem, a cooling system that will go between the suit and skin to ensure the suit wearer doesn't overheat. This involved a box-shaped pump and a series of tubes that will circulate cool water around the torso.

Such systems are used by racecar drivers and helicopter pilots, but they are sitting and can connect to a power source. TALOS users will be walking, bending down, doing a variety of movements and will have to carry an independent energy source, said the special operator team member working on the project, who could not reveal his name for security purposes.

Davis said there have been six technologies spun out of the TALOS program so far that are being used in other programs, and the cooling system could be a seventh. Chemical-biological protective suits are a potential application outside of the program, he noted.

Much of the first year of the program was spent understanding how and where to make tradeoffs, he said.

Power, for example, has been one of the major technological hurdles. The suit was first conceived as needing 5 kilowatts for a 12-hour mission and to run the entire time. After some trade analysis, one kilowatt for two hours was deemed more realistic.

"We have a pretty good backpack with one-kilowatt capability right now. It's a little bigger than we want. It's a little heavier than we want, but in two more years, both of those things are going to come down some. It's not going to be a huge issue," Davis said.

Another example is armor.

Armor weighs about six pounds per square foot, so covering a special operator from head to toe will require 600 pounds. Currently, special operators go into combat with 19 percent of their body covered.

"In between 19 percent and 100 percent, you have significant trade space," he said. For example, few lower arm wounds are life threatening. That area can be lightened up for fragmentation protection instead of the heavy duty armor put over the core or over the head that needs to ward off bullets.

"There are a lot more ways to make him survivable than just armor," he added.

TALOS operators will be assisted by an exoskeleton that will reduce the armor burden. Controlling that system is currently the "long pole" in the tent, Davis said. A powered exoskeleton has to run and jump and do the same motions as any commando.

"The control and actuation for that suit doesn't exist today. It's really immature compared to a lot of the other technologies, so we are investing a lot of time and effort into that right now," Davis said.

— Stew Magnuson

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Special Operations Gunships to Be Equipped With Improved Sensors

By Jon Harper

Air Force Special Operations Command plans to fly small, tactical off-board drones from its AC-130 gunships in combat for the first time later this year, which will give crews better views of the battlefield.

Tactical off-board sensing, or TOBS, is intended to improve AFSOC's targeting capabilities in poor weather or other challenging conditions.

Gunship crews spend a lot of time "looking at tops of clouds … [thinking], 'I wish the weather would clear. Damn, I'd like to shoot what's down there but damn I can't see it,'" said Lt. Gen. Bradley Heithold, commander of AFSOC, at a Special Operations/Low-Intensity Conflict conference hosted by the National Defense Industrial Association.

To solve the problem, commandos want to deploy unmanned aerial vehicles out of AC-130 gunships to provide critical intelligence, surveillance and reconnaissance support.

"The concept is to launch a UAV, get it below the weather and it functions … almost like a sensor on the airplane," Bill Lane, AFSOC's chief of strike and ISR requirements, said in a recent interview. "The crew puts a UAV in an orbit around a place over the target area and it flies itself. … It's more or less autonomous in an area that you tell it to go [to], and then you operate a sensor on the UAV just like you're operating your sensor on the airplane to identify targets."

AFSOC has tested TOBS technologies at training ranges, but the command is about to put them in the field. AFSOC plans to train AC-130 crews to use the technology and then deploy about four to six systems in the coming months, Lane said.

"We would like to send it downrange with the crews … to use on combat missions when the circumstances are right," he said.

The crews will help the command develop tactics, techniques and procedures and understand the technology better, he added.

U.S. commandos have been active in a number of warzones in the greater Middle East and elsewhere. Officials have not yet determined in which areas of operations the technology will be employed, Lane said.

Initially, AFSOC will utilize Raytheon's Coyote small UAV for the tactical off-board sensing mission.

"It's a system off-the-shelf that's already been developed," Lane said. "Contractors have already demonstrated it out of a common launch tube [like those on the AC-130]. It's something that we could very quickly integrate on the airplane, train crews and try to learn from."

But the Coyote is not the long-term solution that the Defense Department is seeking because it doesn't meet key performance requirements, said Jason Bowman, tactical off-board sensing program manager at the Air Force Research Laboratory, which is developing TOBS capabilities for special operators.

The Coyote has one-hour endurance, but AFSOC wants a UAV that can stay airborne for up to four hours.

Developing a higher-endurance system that can deploy from a common launch tube that's only six inches in diameter and 48 inches long is a complex technical challenge. To make it work, AFRL must overcome a formidable size, weight and power problem as it integrates technologies, Bowman said.

"It's a small tube for the capabilities that need to fit into it," he said. "I've got a … radio that needs to talk a long distance and send video, and it has all got to kind of fit in this tube and integrate with the gunship.

"Because that tube is so tiny, I can only fit a tiny wing in there. So I have much less wing area than a UAV of a similar size class, and so that creates an endurance challenge on top of the battery challenge."

The drone's radio needs to have extended range without sucking up too much battery power.

"If I put a big enough radio in there to

Initially, AFSOC will use Raytheon's Coyote small UAV on AC-130 gunships for the tactical off-board sensing mission.

AIR FORCE, RAYTHEON

get the distance I need, I'm going to lose my endurance. And if don't do that then I may not get the distance I need with the radio. So there's a lot of intertwined challenges that need to be solved," Bowman said.

Area I Inc., based in Kennesaw, Georgia, is building a drone that AFRL expects to meet the endurance requirements. Sensing technology is also improving, he noted.

Until recently, sensors that could be purchased for small UAVs were not up to snuff, he said.

"We are starting to see some really good improvement in the sensors. Are they ready for prime time yet? No, but they're getting there," he said.

The drones launched from the AC-130 need to be able to operate with some level of autonomy to minimize the burden on crew members.

"We're not trying to turn our crews into UAV pilots," said Maj. Trey Olman, chief of the unmanned ISR branch at AFSOC and a trained MQ-9 Reaper operator. "We want them to just be gunship crew members like they always are and have this just be another system that operates off their platform."

AFSOC believes the autonomy technology already exists to handle the types of flight profiles that tactical off-board sensing would require, he said.

Lane said the command is looking for "basically a software-driven autopilot" capability. "You tell it where you want it go and where you want it to orbit, and hit the button and then it goes to it."

AFSOC would like to be able to recover the drones after they perform their mission. During close-air support operations, "we may try to land them close to the friendly positions so they could be recovered only because we expect that this is … not going to be an insignificant cost," Lane said.

The UAVs could end up costing as much as $50,000 per copy. Therefore, the command hopes to be able to recover them in all training situations and in combat scenarios whenever possible, he said.

That might not always be feasible, he noted.

"In a combat situation where you have no friendlies on the ground, let's say it's an interdiction mission … you would launch this UAV, do your target identification and target strikes, and then it would be disposable. You would crash the UAV, basically," he said.

AFRL intends to push ahead as special operators learn from the upcoming employment of tactical off-board sensing capabilities in combat.

"We don't quite understand how to utilize this capability yet," Bowman said. "We need to build [concepts of operations] and [tactics, techniques and procedures] around it, which is going to influence some of my technology development and integration."

The lab is planning additional technology demonstrations. Officials are aiming to demo basic capabilities and integration toward the end of this calendar year. From there, they hope start a second increment in fiscal year 2017 that would support the eventual transition to operational capability later in the decade.

Lane anticipates the program transitioning to U.S. Special Operations Command's program executive office fixed wing at the beginning of fiscal year 2018. Requests for proposals from industry would come after that, he said.

"We'll know a lot more at that point — what our real requirements are and what we're looking for out of this system as we use the demonstrator," he said.

AFSOC hopes to have a "full-up production system" in the field for its gun-

ships in the 2019 to 2020 timeframe.

Heithold noted that tactical off-board sensing could contribute to aircraft survivability in areas with significant air defenses.

"It's awful hard to mask a C-130 gunship that's out there operating," he said. "You've got to be able to give the crew a fighting chance. … Give me an off-board sensor and let me throw it out there first. I've got standoff capabilities … with small diameter bombs. So I can penetrate, I can get to the threat with things like this."

Lane said off-board sensors could reduce the likelihood of civilian casualties or friendly fire incidents. And Heithold sees opportunities for them to contribute to airborne assaults.

There have been "scenarios that we've had to play out where we got all the way to the airfield to do an air land, and there's something on the airfield," he said. "Wouldn't it be nice to drop something out of one of my special ops airplanes that would give you … a picture of what you're about to approach and feed it back to our airplanes?"

AFSOC is interested in potentially employing the capability on other aircraft besides the AC-130, to include drones.

"Our remotely piloted aircraft — they have the same issues with weather," Lane said.

Reapers are not currently equipped with common launch tubes, but that doesn't mean they won't be able to utilize TOBS, he noted. Common launch tubes could potentially be integrated on the aircraft, or other launch methods might be used. The MQ-9 might also employ a different type of drone for tactical off-board sensing purposes than the one utilized by the AC-130. AFSOC is considering these possibilities, but the main focus now is on equipping the gunships, he said.

The off-board sensing technology could be applicable to any organization that conducts ISR with visual or infrared sensors in obscured conditions, according to Lane.

"If the weather has low ceilings and they don't want to fly their very expensive UAV that close to the ground, this kind of technology where you could launch a UAV from the mother ship would be very useful," he said. It could also be valuable for other strike aircraft, he added.

Bowman has been approached by Army and Navy program officials who are interested in TOBS.

"The technology, the way we've architected it, you can move it around between missions and platforms," he said.

Modularity is a key aim of the development effort, he noted. Certain pieces of the system will be platform or mission "agnostic," while others will be more tailored.

"I've got agnostic pieces coming to the gunship and I attach them to the gunship through gunship-specific interfaces," Bowman explained. "If you take it to an RPA, I would then not have to redo the whole system. I just have to redo interfaces to the mother ship, and that way it's a lot more flexible."

The lab is currently developing an interface control document for industry.

"We're going to make [that] available to any UAV vendor, and as long as they can match that interface it plugs right into the TOBS system," Bowman said. "If requirements change over time, AFSOC or another customer can hand that document to industry and say, 'Hey, I need a UAV that can do this now. By the way, here's the recipe for how to plug it into TOBS.'" ND

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Special Operators Seek New Social Media Tools

By Yasmin Tadjdeh

As terrorist organizations such as the Islamic State embrace social media, government entities are seeking to exploit open-source information to improve their own operational tactics.

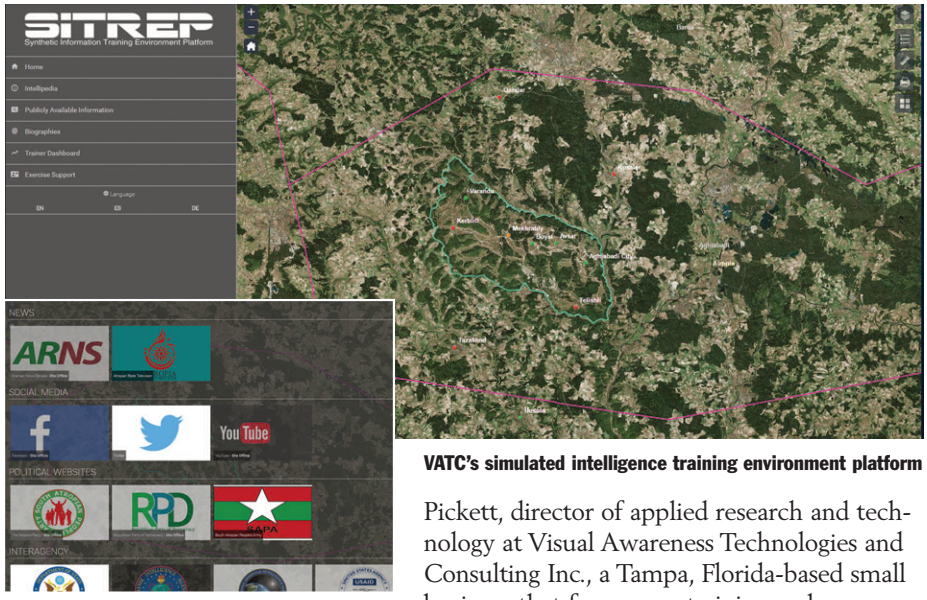
U.S. Special Operations Command is researching how it can use social media to mine critical intelligence data, said Army Gen. Joseph Votel, who at the time was serving as the commander of SOCOM.

"SOCOM is currently carrying out a series of technology demonstrations to assess innovative tools designed to detect previously unseen patterns in complex social media data; integrate and visualize vast information; and allow warfighters to sense, understand and respond to changes in the information environment in real time," he said during a hearing before the House Armed Services Committee in March.

Additionally, the command could also use social media to attempt to undermine the Islamic State's propaganda, he said.

"The ability to conduct effective messaging, as well as counter-messaging, will only grow in importance, given the evolving nature of conflicts," he said.

Industry is ready to help SOCOM better sift through social media posts to distill nuggets of information, said M. Shands Pickett, director of applied research and technology at Visual Awareness Technologies and Consulting Inc., a Tampa, Florida-based small business that focuses on training and operational solutions for special operations forces and other government organizations.



VATC's simulated intelligence training environment platform

Social media offers the military, and particularly SOCOM, a way to gauge how certain operations affect a local population, he said.

"What we saw throughout conventional forces, special operations forces and partner forces [in Afghanistan] is an inability to really understand how their operations were having an effect on the local population," he said.

During conventional operations, it is obvious when a military has won — tanks leave and soldiers surrender, he said. But "when you're operating in a … counterinsurgency environment or in a irregular warfare environment … the only way you know that is if the local population thinks that you've won … because they are determinant of your victory.

"With the proliferation of cell phones, even in areas like Afghanistan, you can get a pretty good sense of what people think about what you're doing," he said.

Earlier this year, VATC launched a special operations variant of its simulated intelligence training environment platform, or SITREP, to help SOCOM train its intelligence officers. The system works by pulling information from social media websites such as Twitter, Facebook or Instagram, and overlaying it with simulated operations.

"You're seeing all this data … of whether you are achieving the right effects or not achieving those effects, and then it allows you to attenuate your operations in order to improve," he said.

VATC can simulate a number of target areas around the world, including in Asia, South America and Africa. It also pulls information from social media platforms that are frequently used in certain regions. For example, in China a website known as Weibo is popular.

An intelligence officer can pull up SITREP on a non-classified Internet protocol router network and "it will bring up what looks like Twitter except for it's the scenario Twitter," he said. It's mixed with a synthetic environment that draws on real-world events "plus our scenario variables that we intro-

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duce. So it's realistic for the analyst. … It's not hokey."

For example, in one case study, special operators go into a village and conduct a direct action mission and detain a target. The program tells the users whether or not the locals in that area are supportive of this person based on social media data and what the effects of removing him would be.

The company has met with Special Operations Command and Naval Special Warfare Command to discuss the product, Pickett said.

SITREP was originally developed for the Joint Multiple National Readiness Center in Hohenfels, Germany, he said. It has been used in exercises since 2013. Because it was created to work alongside partner nations, it can be translated into languages such as French, Spanish and Serbian.

During the summer of 2015, VATC began work on developing a SOF variant. There is an "order of magnitude difference, because with a conventional force training audience you're focused on … the basics and you're getting an intel captain who may or may not have ever deployed," he said. "Working for a SOCOM audience, the customer is a lot more demanding in terms of the level of fidelity that we produce and also the level of realism that we can replicate."

Kitware, an open-source software company based in Clifton Park, New York, has developed technology that could be used by special operators to analyze images and videos on social media platforms.

"We can detect images or identify images that have military vehicles in them versus images that don't," said Anthony Hoogs, senior director of computer vision at the company. "It might be an image of someone smiling at the camera in the foreground but in the background there is a military vehicle. Or it could be soldiers taking pictures of themselves sitting on their tank."

Using a software system powered by a concept known as deep learning — advanced algorithms that can enable human-level accuracy in data analysis — analysts can quickly sift through large amounts of data, he said. The algorithms can pick up on camouflage paint on vehicles, or even recognize certain sizes and shapes.

"Deep learning has enabled a significant leap forward in accuracy of image understanding, so now it becomes much more conceivable to have automated analysis of just random media content in social media … and get something useful out of it," he said.

Images and videos make up most of the data on social media platforms but only recently has there been significant steps toward analyzing it, he said.

Images and videos "for the past couple of years have been, really just as far as the algorithms are concerned, mostly black boxes," he said. "But with better algorithms that have come along lately we can do more and we can tell whether a photo is an indoor scene or an outdoor one [or] has military content."

The system could help an analyst detect if certain people are involved with terrorist groups, he said.

"Most of the data in social media is not of intelligence value. It's a classic needle in the haystack problem," he said. "If you're asking your analyst to spend his precious time digging through social media to find something, then they have to have a very targeted search. What algorithms can do is a much more broad-based search."

Images are only one piece of the puzzle, he said.

"We're offering this imagery and video analysis piece of it. I think what really is required is a complete solution that also looks at the other two main aspects of this — so one is the text, the Twitter messages and so on that people are sending around, and then also there is a third dimension which is the network itself — so social network analysis and … who is friends with who and who is communicating with whom."

Kitware is looking for partners for that endeavor, but none have materialized so far, he said.

The U.S. State Department has been one of the most high-profile users of social media in its effort to undermine propaganda disseminated by the Islamic State, also known as ISIL or ISIS. In January, the department stood up the Global Engagement Center, which replaces the former Center for Strategic Counterterrorism Communications. Officials at the CSCC — who would reach out directly to ISIL-affiliated social media users and try to counter their message — was criticized by some as being ineffective and bogged down by bureaucratic red tape.

"This new center will shift our paradigm for countering violent extremist messaging. We will move away from a focus on direct messaging and toward an emphasis on empowering and enabling partners, governmental and non-governmental, across the globe," said Brett McGurk, special presidential envoy for the global coalition to counter ISIL at State. "We will also plan social media campaigns to provide fact-based content and information (such as testimony from defectors) that undermines ISIL propaganda."

But Muslim countries will have to take the lead on counter-

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ing these messages, McGurk said. The United Arab Emirates has been "key" in this effort and recently established the Sawab Center, which he described as a "24/7 counter-messaging platform."

"I visited the Sawab Center last year and was impressed with the dedication of the young Emirati citizens engaged in this campaign," he said. The organization has highlighted testimony from Islamic State defectors that is meant to shine a light on the brutal nature of the organization and what it is like to live under its rule.

Malaysia is also setting up a center that will focus on the Asia region, he said.

Jim Phillips, a senior research fellow for Middle Eastern affairs at the Heritage Foundation, a Washington, D.C.-based think tank, said regional partners are better equipped to handle messaging toward Islamic terrorist organizations.

"It's very difficult for the U.S. government to counter that kind of ideological and theological propaganda because first of all we are infidels" in ISIL supporters' eyes, he said. "We don't really have the standing to provide a damaging critique, so perhaps in some ways it's best to work through or work with Muslim governments or NGOs or experts that would have a greater facility in zeroing on some of the weaknesses of their theological arguments."

SITREP's simulated Twitter feed

Successes within the State Department's new effort can already be seen, McGurk said. "When ISIL was overtaking major cities, it had a successful messaging campaign — and our counter-campaign struggled. That is no longer the case. ISIL is increasingly on the defense. Its spokesman, Abu Mohammed al-Adnani, is no longer touting great victories but rather seeking to explain away defeats. There will be more defeats to come — on the ground and in cyberspace."

While the group used to claim it had its sight on places such as Rome, for example, it can no longer say that with credibility, McGurk said.

"The messaging gets a lot easier when we are making progress. If you are doing a messaging campaign for the Washington Redskins, it is easier when the team is winning than when the team is losing," he said.

The State Department is working closely with social media organizations such as Twitter, YouTube and Facebook, he said. Twitter recently closed 125,000 ISIL-affiliated accounts, he added. **ND**

Email your comments to ytadjdeh@ndia.org

'Hondo' Geurts Earns Perry Award

The National Defense Industrial Association affiliate, the Precision Strike Association, recently named James "Hondo" Geurts, U.S. Special Operations Command's director of acquisitions, as the recipient of the 20th annual William J. Perry Award.

Named after the former U.S. defense secretary, a renowned precision strike weapons advocate, the award honors the immediate and long-term impact that Geurts has had on the sector. It recognizes contributions to special operations capabilities.

Geurts was presented the award during a luncheon at the Precision Strike Association's annual program review, which was held in March in Springfield, Virginia.

2015 Perry award recipient Paul Kaminski, Geurts and PSA Chair Ken Masson

Geurts is responsible for all special operations forces research, development, acquisition and logistics programs.

"USSOCOM under Mr. Geurts' leadership continues to enhance the capabilities of the MQ-9 and AC gunships to ensure unparalleled [special operations forces] support in [an] increasingly challenging operational mission set. He is the embodiment of the precision strike credentials for the William J. Perry Award. The depth of Mr. Geurts' contributions to USSOCOM and the precision strike community is staggering and is in keeping with the highest standards set forth by Dr. Bill Perry," the award citation states.

Unable to attend the ceremony, Perry provided remarks via video. "No one can doubt the importance of precision strike in modern warfare, but special operations forces have special needs for urban operations and in minimizing collateral damage, so the challenges that Mr. Geurts faced were several fold," he said.

Perry added: "Geurts' achievements provide lessons the whole U.S. Department of Defense should look at as regards [to] how to achieve acquisition of vitally needed weapons in a more effective, streamlined and faster acquisition mode."

It marked the 20th consecutive year that the Perry Award was presented.

NDIA Signs Agreement With Estonian Defense Association

The National Defense Industrial Association signed a memorandum of understanding with the Estonian Defence Industry Association (EDIA) to promote mutual cooperation and collaboration between the two nations' defense industries.

Kuldar Väärsi, chairman of the EDIA management board, said cooperation with NDIA will open many new opportunities for collaboration with large international industries to produce innovative product development. Estonian defense companies are focusing on export markets, offering smart technologies, cyber and data security, border defense and modern military technology.

"Entering the U.S. market is not simple and the aim of the current cooperation document is to intensify the exchange of information between the defense industries of the two countries. This will give Estonian companies new export opportunities for their goods and services," said Väärsi.

The agreement was signed while Estonian defense industry companies joined the prime minister of the Republic of Estonia Taavi Rõivas during his visit to the United States in March.

Robotics Division Chair Receives Carnegie Science Honors

National Defense Industrial Association Robotics Division Chair Jorgen Pedersen has been named the 2016 recipient of the Carnegie Science Award in the Start-up Entrepreneur award category.

The Carnegie Science Center established the Carnegie Science Awards program in 1997 to recognize and promote outstanding science and technology achievements in Western Pennsylvania. The Carnegie Science Awards honors individuals and organizations whose contributions to the fields of science, technology and education have had an impact on the region's industrial, academic and environmental vitality.

Pedersen has served as chairman of the NDIA Robotics Division since September 2012. He is president, CEO and founder of RE2 Robotics.

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3-4 Procurement Division Education Symposium (Formerly Annual Acquisition Educational Seminar)
Washington, DC
www.ndia.org/meetings/6ACQ

3-5 59th Annual Fuze Conference
Charleston, SC
www.ndia.org/meetings/6560

9-11 Annual Tactical Wheeled Vehicles Conference
Reston, VA
www.ndia.org/meetings/6530

9-13 29th International Symposium on Ballistics
Edinburgh, Scotland
www.ndia.org/meetings/6210
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10 2016 Simulation & Training Community Forum
Fairborn, OH
www.ndia.org/meetings/61A0

10-11 Agile in Government Summit 2016
Washington, DC
www.afei.org/events/6A01
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11 New England Chapter Innovation Day
Lowell, MA
www.ndia.org/meetings/C086

12 2016 NDIA Annual Award Dinner & Eisenhower Award Presentation (Black Tie)
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16 Washington, D.C. Chapter Benefit Golf Outing for USO-Metro
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9 WID Service to The Flag Award Program & Reception
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14-15 Training and Simulation Industry Symposium (TSIS)
Orlando, FL
www.ndia.org/meetings/61T0
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JULY

11-12 Procurement Division Meeting
Washington, DC

14 7th Annual Integrated Air and Missile Defense Symposium
Laurel, MD
www.ndia.org/meetings/6100

22 Michigan Chapter Black Tie Dinner Meeting
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2-3 Global Explosive Ordnance Disposal (EOD) Symposium & Exhibition
Bethesda, MD
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2-3 Michigan Chapter Ground Vehicle Systems Engineering & Technology Symposium (GVSETS)
Novi, MI
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3-4 NDIA Annual CBRN Conference and Exhibition
Edgewood Arsenal, MD
www.ndia.org/meetings/6300

16 Trusted Microelectronics Workshop
Arlington, VA
www.ndia.org/meetings/687C

16-18 Tennessee Valley Chapter 19th Annual Space & Missile Defense Symposium
Huntsville, AL
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17-18 Joint Missions Symposium (Classified) DETAILS COMING SOON
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23-24 San Diego Chapter Navy Gold Coast Conference
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30-31 IPM Division Meeting
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30-Sept 1 DLA Land And Maritime Supplier Conference and Exposition
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SEPTEMBER

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19-21 Joint Undersea Warfare Technology Fall Conference
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OCTOBER

6 U.S.-UK-Australia-Canada Quadrilateral Conference
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12 TRIAD
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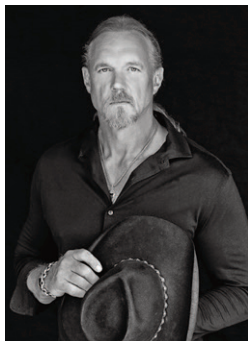

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