Unmanned Systems Sentinel

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Thanks to Robin Alexander, Mark Rindler and John Coffey for providing several of the below articles. 29 APR 2016

Please keep in mind that in most instances the below summaries are excerpts from the original article. The full articles can be viewed at the accompanying hyper-links. The inclusion of these links does not represent an endorsement of the organization, service, or product. Immediately below are this edition's highlights with links to the respective articles:

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NAVY/USMC:

Navy Plans MQ-XX Stingray with Only ISR, Tanking Capability; Marines Testing MQ-8C Fire Scout on Amphibs

CAPITOL HILL – The Navy is sticking to its plans to field an unmanned MQ-XX Stingray platform with just tanking and surveillance capabilities to start with, while the Marine Corps is experimenting with the MQ-8C Fire Scout to help inform its path forward for amphibious assault ship-based unmanned aviation, officials said Wednesday.

Despite the House Armed Services Committee making clear in its version of the Fiscal Year 2017 defense bill that lawmakers want long-range strike included as a capability – a HASC staffer said the committee is in the "encouraging phase" and will not this year force the Navy's hand by withholding money – the Navy is not interested in starting out with strike as a primary mission.

Director of Air Warfare (OPNAV N98) Rear Adm. Mike Manazir said at a Senate Armed Services Committee hearing that the MQ-XX, formerly known as the Carrier Based Aerial Refueling System, would only include tanking and intelligence, surveillance and reconnaissance (ISR) as primary missions.

Manazir said "the United States Navy has been anxious to get an unmanned capability onto our CVNs for quite a while. Back in 2009 actually, (then-Chief of Naval Operations Adm. Gary) Roughead pounded a table in a secure space and said 'I want unmanned on a carrier by 2018.' And that started a series of conversations in the Pentagon about unmanned capability on the aircraft carrier."

With the need and the momentum to get an unmanned system fielded quickly, the Navy will only consider non-developmental ISR systems, Manazir said, and will only include ISR and tanking missions at first because "we can accommodate those two missions on an unmanned system coming off the aircraft carrier more rapidly."

Manazir said the X-47B Unmanned Combat Air System Demonstrator (UCAS-D) proved that an unmanned aircraft could take off from and land on a carrier and refuel in the air.

"We got everything out of that platform that we need, now what we've got to do is show we can use a platform to do two basic meat-and-potato missions on the aircraft carrier using the MQ-XX," he told the senators.

"And that will also provide a platform for us to go forward and do additional more advanced capabilities in the future," he said, which could include long-range strike eventually.

Asked if the Marine Corps was also interested in the MQ-XX program, Deputy Commandant of the Marine Corps for Aviation Lt. Gen. Jon Davis told the committee that "we have tremendous interest," but the Marines would likely need a different design than the Navy. The Marines would operate their unmanned ISR platform from a big-deck amphibious ship, which has a shorter runway than an aircraft carrier and does not have the carrier's sophisticated launch and recovery system.

Instead, Davis said the Marines envision that perhaps an unmanned vertical lift aircraft might meet the service's needs. To that end, the Marine Corps has borrowed some MQ-8C Fire Scouts from the Navy to begin testing on the big-decks. Davis said he believes the Marine Corps may want a Group 4 or 5 unmanned aerial system (UAS) – which are larger and have longer range and endurance – that could conduct ISR and fires missions, but the details are still being decided.

"We've got a requirements document study that's going on at Quantico to go tell us exactly what they want us to go pursue, but there are several projects out there that give us a long-range, long-duration, multi-mission platform for UAS," he said.

"We think UAS can deliver people, can deliver ordnance, can deliver fires, can deliver surveillance, all those things. So we're looking for a wide aperture for what we can do with these platforms in the future."

The Marine Corps currently operates the RQ-21 Blackjack from its ships, but that system – a smaller Group 3 system – is launched from a small catapult and recovered by hooking onto a tether, all of which limit the payloads that can be put on the aircraft, Davis said.

https://news.usni.org/2016/04/20/navy-plans-mq-xx-stingray-with-only-isr-tanking-capability-marines-testing-mq-8c-fire-scout-on-amphibs

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Environmental assessment for potential Navy drone base may be finished this summer

NORFOLK (Tribune News Service) — Results could be ready by late summer of an environmental assessment that could help determine where the Navy will locate its East Coast hub for a surveillance drone that's under development, the Navy said Wednesday.

The service is considering locating four MQ-4C Triton drones at NASA's Wallops Flight Facility on the Eastern Shore, but Virginia is competing with Key West Naval Air Station and Mayport Naval Air Station in Florida. Environmental assessments for each installation are under way and could be ready for public comment by late June, according to Ted Brown, Fleet Forces Command spokesman.

The Triton is about 48 feet long with a wingspan of about 131 feet. Brown said no adverse environmental impacts are anticipated.

The Navy eventually wants to have five home bases for the Triton, one each on the East Coast and West Coast and in Europe, the Middle East and Asia. The Navy wants the fleet to reach about 70 aircraft.

The Triton can stay airborne for 30 hours, fly at altitudes higher than 10 miles and reach speeds in excess of 350 mph. The drone will be equipped with sensors that provide a 360-degree view and allow ships to be tracked by gathering information on their location, speed and classification, according to a Defense Department report.

Virginia is hoping to tap into an emerging market for drones by spending $4 million to build a 3,000-foot runway for unmanned aircraft at Wallops. State, federal and local officials are lobbying for the high-tech aircraft to be located in Virginia.

The East Coast hub would be a permanent duty station for up to 400 personnel and their families, providing an economic boost to the Chincoteague area.

The hub also would support rotational deployments of personnel and aircraft outside the continental United States, the Navy said in a statement.

Military construction projects in support of the home basing would begin in the 2017 fiscal year, according to the Navy.

http://www.stripes.com/news/us/environmental-assessment-for-potential-navy-drone-base-may-be-finished-this-summer-1.405473

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First UAV Command Center Installed on Carrier

SAN DIEGO — USS Carl Vinson marked a milestone April 13 after installing the first unmanned aerial vehicle (UAV) command center aboard an aircraft carrier, a spokesman for the carrier said in an April 20 release.

Capt. Beau Duarte, program manager of Unmanned Carrier Aviation Program Office (PMA-268), inspected the site and recognized Carl Vinson Sailors instrumental in the security, logistics and installation of the UAV suite.

"This marks the start of a phased implementation of the MQ-XX system on an aircraft carrier," Duarte said. "The lessons learned and ground-breaking work done here will go on to inform and influence future installations on other aircraft carriers."

The work was performed during USS Carl Vinson's recent Planned Incremental Availability. The completion of all phases of installation is scheduled for 2022.

"We are carving out precious real estate on board the carrier, knowing that the carrier of the future will have manned and unmanned systems on it," said Capt. Karl Thomas, Carl Vinson's commanding officer. "This suite is an incremental step necessary to extend performance, efficiency and enhance safety of aerial refueling and reconnaissance missions that are expending valuable flight hours on our strike-fighter aircraft, the F/A-18 Echoes and Foxtrots."

The MQ-XX program will deliver a high-endurance unmanned aircraft that will replace today's F/A-18E/F aircraft in its role as the aerial tanker for the Navy's carrier air wing, thus preserving the strike fighter's flight hours for its primary mission. It will also leverage the range and payload capacity of high-endurance unmanned aircraft to provide critically needed, persistent, sea-based ISR capability in support of the carrier strike group and the Joint Forces Commander. The MQ-XX is scheduled to be operational in the mid-2020s.

"Having a UAV asset that provides persistent, potentially 24/7, surveillance coverage for the strike group is a game changer," said Rear Adm. James Loeblein, commander, Carrier Strike Group One. "Putting additional ISR capacity into the warfare commander's hands increases the flexibility and warfare capability of the entire strike group."

http://www.seapowermagazine.org/stories/20160421-uav.html

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ARMY:

House Draft Policy Bill Aims to Kill Off JLENS

WASHINGTON — The Army's runaway blimp's prospects of survival are looking grim as the House Armed Services Committee chairman's mark of the fiscal 2017 defense policy bill rolled out Friday with a punishing cut to the program.

Texas Republican Rep. Mac Thornberry's mark includes a drastic reduction in funding for the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor system (JLENS). The bill would fund the program at only $2.5 million. The Army's 2017 budget request asked for $45 million.

The lack of funding all but spells out the killing of the program, which comes as no surprise as congressional support for JLENS has taken a nosedive since the Raytheon-made tethered aerostat broke free from its mooring in Maryland and floated into Pennsylvania, dragging its tether and causing several power outages before it landed in a field and was deflated by state troopers who open fired at it.

The Army supports continuing the program and tried to get additional funding to keep the aerostat, capable of tracking swarming boats and vehicles as well as cruise missiles, floating above Aberdeen Proving Ground, Maryland. The service asked for $27.2 million in a reprogramming document to continue the JLENS system's three-year operational exercise on track but was quickly shot down by the Senate Appropriations Committee. Congress cut most of JLENS' funding in 2016 too.

Amid Lack of Congressional Support, Army Hopes for 2017 JLENS Funding

The lack of funding in 2016 means the Army has to store the system this year rather than continue its operational exercise meant to determine whether JLENS should be fielded and additional systems should be procured.

http://www.defensenews.com/story/defense/land/2016/04/22/house-draft-policy-bill-aims-kill-off-jlens/83396128/

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Army Conceptualizing Framework for UAS 'Ecosystem'

WASHINGTON — The Army is conceptualizing an "ecosystem" framework tying all future unmanned aircraft systems together on the battlefield, according to the service's Training and Doctrine Command capability manager for UAS.

A draft document outlining initial capabilities that establishes what is needed for a family of UAS in the 2020 to 2035 time frame and beyond is circulating through the Army staff, Col. Thomas von Eschenbach told Defense News.

A key piece of the capabilities document would establish what the service is calling "a scalable control interface" that simplifies the coordination of UAS on the battlefield and is easy to use. Most Army UAS types have separate control stations.

The most important part of establishing a family of systems for the future is "how we [are] defining not necessarily what unmanned systems do," von Eschenbach said, "but it really defines for us how we want to operate unmanned systems from that scalable control interface. I think that was a thing that was missing in the past, what we didn't really think about."

Beyond that the Army is still considering what UAS it needs in the battlefield of the future, what it will want these UAS to do to meet its missions in a more expeditionary and access-denied environment and what technology is out there to bring more capability to the aircraft.

“In terms of where the Army’s headed, it’s not entirely clear at this point because if you look at what the Army’s investing in, it’s not much in unmanned systems,” Phil Finnegan, a defense analyst at the Teal Group, said. “There’s a little bit going into Shadow [UAS] for a new engine, but they just finished procurement of Gray Eagle. There doesn’t seem to be much interest in purchases of the mini-systems that Aerovironment does.”

Von Eschenbach said the Army is taking the time to think deeply about what it needs for UAS in the future and to learn through experimentation.

The service started off using UAS for ISR because they were well-suited for that kind of mission, von Eschenbach said. “It was long-range, long-endurance with some very simple technology that has grown and as we see technology kind of enabling us to shrink those components lighter, you are able now to start to explore and discuss what else can our unmanned systems do and do we want to pursue that and expand that into the Army missions.”

Here’s a deeper look at what the Army is considering for its future UAS.

Runway Independence

There’s little doubt the Army will have to operate in places where it can’t rely on protected runways, or runways at all. “I don’t want to be on runways anymore,” Maj. Gen. Michael Lundy, retired commander of the Army Aviation Center of Excellence at Fort Rucker, Alabama, said at a recent event in Arlington, Virginia, prior to his retirement.

For Lundy that seemed to mean a vertical-takeoff and landing (VTOL) capability that is more survivable; has a reduced signature, making it less detectable; and requires fewer people to run UAS. He noted that “speed is not that big of a deal.”

The idea of the Army moving toward VTOL UAS options is a big shift from the recent past when the service has struggled to develop the capability. The Army has shelved VTOL UAS several times following some embarrassing failures.

The Army’s Boeing-made A-160 Hummingbird VTOL UAS, with an expensive, state-of-the-art Defense Advanced Research Projects Agency camera on it, crashed in California in 2012, which didn’t bode well for the program. The crash marked its third in two years. Adding to its bad track record, there were also reports of a fire on the A-160 assembly line.

The Army canceled its plan to deploy the A-160 to Afghanistan shortly after the 2012 incident.

The service also considered procuring Northrop Grumman’s Fire Scout UAS program, but then lost interest in it and canceled the program.

Acknowledging the Army’s struggle with VTOL UAS, von Eschenbach said, “that is the challenge. How do you get something that has this long endurance, long time in the air that also has the ability to do a vertical takeoff and landing and that is probably a very difficult challenge to overcome.”

The Army is closely watching a DARPA effort to develop VTOL UAS capability. DARPA selected last month Aurora Flight Sciences to build its unmanned X-plan that will take off and land vertically. Renderings of the design — LightningStrike — show that it is far from a typical VTOL design. The team has 24 months to develop the aircraft.

Von Eschenbach said that if something like DARPA's design is a game-changer, the Army will do what it can to get the capability.

Yet the Army is willing to look at trade-offs. “If it’s short-takeoff and landing versus VTOL, what does that mean? And certainly we will take a look at it and then at that point in time we will entertain what is in the realm of the possible and affordable,” he said.

Gen. David Perkins, Army Training and Doctrine Command commander, said that VTOL isn’t the only solution to achieve runway independence. “VTOL is one of them, but there are other things out there,” he said. “There’s the proverbial catch it in a net, things with parachutes, there are other ways of doing it. It’s challenging, that is why we are tied to a runway. That is actually the hardest part, that is why we haven’t solved that yet.”

Cargo Resupply

For large-scale operations in ground combat, Army Chief of Staff Gen. Mark Milley has said that cargo resupply using unmanned systems is particularly promising.

Yet, Lundy was lukewarm at a recent conference when it came to giving UAS the resupply mission in the near-term. He noted the Army seldom flies purely cargo missions and said, “I can’t have an unmanned cargo aircraft moving soldiers."

Lundy’s sentiment is indicative of the Army’s more sideline approach to unmanned aerial cargo resupply.

The Army has done and continues to test cargo resupply capabilities as well as other possibilities, like casualty extraction, for Lockheed Martin’s K-MAX VTOL UAS, but when it came down to testing its ability in theater, the Marine Corp took the reins.

Jon McMillen, who leads Lockheed’s business development for K-MAX, said that aircraft returned from Afghanistan after 33 months in mid-2014 having hauled 4.5 million pounds of cargo and flying over 1,900 sorties.

Despite a hard landing that took one of the two K-MAX aircraft out of commission for a time, the entire deployment “surprised a lot of people in how well it performed,” McMillen said.

The Marine Corps is continuing to study the K-MAX’s utility to inform a future program and the Army has followed along in the process and continues to watch the effort, according to McMillen.

The Big Battlefield Picture

No matter what UAS is on the battlefield performing whatever mission it's ultimately assigned, operating them has to be simpler and has to be better coordinated, von Eschenbach stressed.

That's where the scalable control interface comes in so that UAS operators can control any UAS on the battlefield wherever they are. Operators would be able to fly UAS and operate payloads while sitting in the back of a moving vehicle, for instance, von Eschenbach said.

Operators will no longer be tied to elaborate and heavy ground control stations that prohibit easy movement in the field and only work in uncontested environments where the station is protected.

The new interface would also improve data dissemination coming from UAS to the right decision-makers on the ground and to troops who need the information to conduct missions.

Essentially, the operator would maintain "the heartbeat of the unmanned systems" in an operational picture, he added.

http://www.defensenews.com/story/defense/land/army-aviation/2016/04/26/army-conceptualizing-framework-uas-ecosystem/83382122/

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Counter-Drone Prototype Put to Test at Army NIE

FORT BLISS, Texas — A prototype to counter unmanned aircraft systems (C-UAS) using capabilities already in the Army inventory is now being put to the test at the service's Network Integration Evaluation (NIE).

The NIE is a soldier-led evaluation that assesses how to integrate programs of record into and progress the Army's tactical network. The evaluation, set to take place at Fort Bliss, Texas, over two weeks starting at the beginning of May, includes testing how well the C-UAS Mobile Integrated Capability (CMIC) works within the network and how it fares in the hands of soldiers.

The Army acknowledges the UAS threat will only grow as the systems become increasingly affordable and can be obtained through a few simple clicks on the Internet.

Using the C-UAS CMIC, "we can put a capability in soldiers' hands using existing equipment that they have, so really what we are doing is we are taking existing programs of record and re-purposing it to give the ability to counter those UAS," he said.

To make its prototype, the Army selected a vehicle already used by the service's fire support teams, the Q-53 Counterfire Target Acquisition Radar System and the Lightweight Laser Designator Rangefinder (LLDR).

The only piece of new equipment is Northrop Grumman's Venom mast, which transmits Q-53 radar information and supports the LLDR.

The Army added the capability to track air vehicle threats to the Q-53 radar, which traditionally tracks rockets, artillery and mortars.

The radar will detect a threat, send a signal to the vehicle — through the mast, up to the LLDR — which will slew on the target. The system is connected to the Army's command and control systems. A soldier can then decide how to take out the target, according to Cochran.

The Army's C-UAS CMIC system is an example of what Pentagon officials and members of Congress alike want to see more — using what it has in innovative ways and taking the initiative to rapidly develop prototypes.

House Armed Services Committee Chairman Rep. Mac Thornberry's fiscal 2017 markup of the defense policy bill proposes giving each service the ability through dedicated funding to experiment more with prototypes and rapidly deploy weapon system components and other technologies without requiring those programs to be tied to existing major programs.

http://www.defensenews.com/story/defense/show-daily/aaaa/2016/04/28/counter-uas-prototype-put-test-nie/83638706/

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USAF:

NATIONAL AIR SPACE:

Piedmont Virginia Community College received approval from the Federal Aviation Authority

Charlottesville, Va.—Piedmont Virginia Community College has received approval from the Federal Aviation Authority (FAA) to conduct research and development of aircraft and sensors, including unmanned aerial vehicles, for public safety. The Blanket COA (Certificate of Waiver or Authorization) is a first in the nation from the FAA and reflects positively on the ongoing efforts of PVCC in supporting the effective integration of small Unmanned Aerial Systems (sUAS) in emergency response. The COA will allow agencies and third-party operators to test aircraft and sensors during scenario based incidents.

The PVCC curriculum incorporates sUAS pilot training, technical training on sUAS and use-case scenarios to integrate the sUAS technology in simulated emergencies.

"The agencies can select the scenarios that are most appropriate for the type of emergencies they will encounter, which makes the training more meaningful," said Valerie Palamountain, dean of Workforce Services at PVCC. "In addition, data collected during the scenarios will be used to improve the deployment of sUAS technology in public safety."

The value of the use of sUAS in public safety is phenomenal. PVCC's innovative and impressive program will undoubtedly enable public safety to implement sUAS operations safely and effectively," Werner said.

"It is a great opportunity to work with PVCC, members of the community and the sUAS industry in creating the first, comprehensive curriculum for incident response in the U.S. and providing the means to conduct research and development of aircraft and sensors that will be utilized by those that need them most," said Goodbar.

PVCC will offer its first class on May 9 at the college's Main Campus at 501 College Drive in Charlottesville. Manufacturers and vendors are invited to test and develop sUAS for public safety integration through their COA.

http://www.cvilletomorrow.org/news/article/23595-pvcc-approved-to-conduct-drone/

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Committee Boosts Funding for Drone Research

Mississippi State University Plays Key Role in Unmanned Aircraft Systems R&D Funded in Senate FY2017 Appropriations Bill

WASHINGTON, D.C. — U.S. Senator Thad Cochran (R-Miss.) reported that the Senate Appropriations Committee has approved increased FY2017 funding to boost research into the integration of unmanned aircraft systems (UAS) in the national air space, a mission of the Federal Aviation Administration center of excellence led by Mississippi State University.

Cochran is chairman of the Senate Appropriations Committee, which today approved the FY2017 Transportation, Housing and Urban Development, and Related Agencies (THUD) Appropriations Bill, which contains funding for UAS research, transportation and aviation priorities, and housing programs for vulnerable populations, including homeless veterans and youths. The measure was approved 30-0.

"This Senate bill strives to responsibly determine where to use limited taxpayer funding to improve the nation's infrastructure, promote community economic growth and address housing needs," Cochran said.

Cochran worked to increase the Federal Aviation Administration (FAA) UAS research account to $17.6 million in the THUD appropriations bill. The bill would direct $10 million of that funding to support the work of the FAA Unmanned Aerial Systems Center of Excellence (COE). The program received $5.0 million in federal funding FY2016, which was matched by private sector funds. The FY2017 funding will generate similar private sector investment.

"The growing use and greater potential for unmanned aircraft systems has created new areas of research into how to integrate these aircraft into the national airspace effectively and safely," Cochran said. "Mississippi State, with its many university and private sector partners, is playing an important role in making sure that this integration goes well."

The COE is a public-private partnership headed by a consortium led by Mississippi State in coordination with 21 other leading universities with expertise in UAS research and development. The FAA Re-

authorization Bill approved by the Senate on Tuesday includes a Cochran amendment to strengthen COE efforts by preventing duplicative research efforts.

The FY2017 THUD Appropriations Bill is now available for consideration by the full Senate.

http://politicalnews.me/?id=38448&keys=DRONE-RESEARCH-UAS-FAA

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Senate Bill Reinforces Federal Control Over Drones

Legislation passed by the U.S. Senate could pave the way for the commercial deployment of drones in the national airspace, besides addressing safety issues by, for example, providing for a pilot that would find ways to lock down errant drones if they are close to airports.

The new rules in the Federal Aviation Administration Reauthorization Act of 2016, passed by a vote of 95-3, reflect the opportunities seen in the country for the use of drones both for commercial and other applications such as in emergencies. They also highlight privacy and safety concerns about the reckless use of consumer drones by hobbyists.

Referring to an object, believed to be a drone, hitting a British Airways plane landing in Heathrow airport on Sunday, Senator Bill Nelson, a Democrat from Florida, said that if a drone is sucked into a jet engine, it could certainly render the engine inoperable and might start an explosion. The current bill proposes a pilot program to develop and test technologies to intercept or shut down drones when they are near airports.

“Safety rules are urgently needed, and the inclusion of key provisions to require manufacturer safeguards and give the FAA clear authority to set rules for recreational use is a big step forward,” said Senator Dianne Feinstein, a Democrat from California, who has included some of the provisions of the Consumer Drone Safety Act, she proposed last year, in the new bill.

The legislation, which now goes to the House of Representatives for consideration, has been largely welcomed by drone user organizations. The Small UAV Coalition, an advocacy group representing small drone users, said in a statement that the bill creates a pathway for companies to leverage small drones to deliver products to consumers, and points approvingly to steps proposed to promote beyond visual line-of-sight and night-time operations.

The FAA released draft rules in February last year for the operation of commercial drones of less than 55 pounds (25 kilograms) that would limit their flight altitude to 500 feet (152 meters) during daylight and within line of sight of the operator. But the final rules for the devices, also referred to as Unmanned Aircraft Systems, have been delayed.

“While Congress addresses reauthorization, the FAA needs to use all available means to finalize the small UAS rule immediately, and without any further delays,” said Brian Wynne, president and CEO of the Association for Unmanned Vehicle Systems International (AUVSI), in a statement. “Once this

happens, we will have an established regulatory framework for UAS that will allow for more widespread commercial use of the technology."

The legislation still has some controversial points, including a provision that gives the FAA rules preemption over local and state laws governing the use of drones. A number of states have already enacted or plan laws for drones, creating a "patchwork quilt" of differing rules, according to the FAA, which in a note in December warned that "a navigable airspace free from inconsistent state and local restrictions is essential to the maintenance of a safe and sound air transportation system."

The bill proposes that states cannot enact a law relating to the "design, manufacture, testing, licensing, registration, certification, operation, or maintenance of an unmanned aircraft system, including airspace, altitude, flight paths, equipment or technology requirements, purpose of operations, and pilot, operator, and observer qualifications, training, and certification."

Feinstein has opposed these provisions that would block state and local drone safety laws. The senator said on Tuesday in a statement that she has secured a commitment from the bill sponsors Nelson and John Thune, a Republican from South Dakota, to work with her to address the issue when the bill is negotiated with the House of Representatives.

http://www.uasvision.com/2016/04/22/senate-bill-reinforces-federal-control-over-drones/?utm_source=Newsletter&utm_campaign=e7680211c5-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-e7680211c5-297560805

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Canada Working on UAS Regulations

In 2015, Canada released a Notice of Proposed Amendment ("NPA"), proposing a new risk-based regulatory framework for small unmanned aircraft systems ("sUAS") that weigh less than 55 pounds (25 kg) and are operated within visual line-of-sight ("VLOS"). Although Canada and the U.S. have engaged to coordinate UAS activities and committed to establishing a mechanism to share experiences to align regulatory approaches (to the extent practical), the NPA sets forth a more complex framework for sUAS operations at various risk levels and may offer more flexibility to commercial users. The final rules are expected to be released this year.

Currently, Canada regulates non-recreational sUAS operations through exemptions to Canadian Aviation Regulations' Special Flight Operation Certificates ("SFOC") requirements. All exemptions expire on December 21, 2016. Recognizing the economic and research potential, as well as the safety and privacy issues of sUAS operations, Transport Canada's Canadian Aviation Regulations Advisory Council ("CARAC") proposed rules for all sUAS operations within VLOS regardless of the purpose of the operation (i.e., recreational or non-recreational). UAS operations not be covered by the proposed rules will still need an SFOC or an applicable exemption to operate.

The NPA proposes regulating sUAS in three operational categories depending on the risk involved: (1) complex operations; (2) limited operations; and (3) very small UAS operations.

Complex Operations. With the highest risk, “Complex Operations” – operations in built-up areas and close to airports – would require the following:

For operators – registration with Transport Canada (“TC”), an adequate management organization, flight supervision, pilot training programs, security procedures, maintenance control systems, operations manuals, and standard operating procedures.

For sUAS – registration and marking, as well as compliance with design standards in flight performance, structure, design and construction, propulsion, systems and equipment (i.e., navigation), sense-and-avoid systems, launch and recovery systems, payloads, and manuals and documentation. The proposed rules would not require type certificates, production approvals, or flight authority.

For pilots – a permit and compliance with age, medical, knowledge, experience, and skill requirements.

For operations – VLOS through unaided vision, giving way to manned aircraft, prohibited operation in certain classes of airspace, coordination with air traffic control, visual observer(s), liability insurance, aircraft lighting for night operations, permission from the property owners of the takeoff and recovery location, maintaining an altitude of less than 400 feet, and compliance with minimum lateral distance requirements.

Limited Operations. For operations in geographic locations with less risk (“Limited Operations”), TC is examining similar rules to Complex Operations, but TC would not require a pilot’s permit and medical certification. The operations would be further limited to daytime only, a maximum of 87 knots, certain classes of airspace, 5nm away from built-up areas, a certain distance from aerodromes (e.g., 5nm or 11nm), and a maximum altitude of 300 feet.

Very Small UAS. For very small UAS operations, the operators would still need to meet certain characteristics (e.g., control and supervision, training, security, maintenance, manuals, and procedures) that are commensurate with the operation and operator’s organization. TC is also considering pilot knowledge-based testing requirements and operating limitations similar to those for Limited Operations, but very small UAS operators would be able to operate within 5nm of built-up areas and would not need insurance.

Model Aircraft. CARAC also requested comments on a “carve-out” for recreational operators of UAS, and is considering two options for categorizing “model aircraft”:

A person operating as an aeromodelling organization member (e.g., a Model Aeronautics Association of Canada member) who follows the organization’s guidelines would be exempt from the rules; or

TC would not consider sUAS with camera payloads (excluding first person view devices) to be model aircraft and would be subject to the proposed rules.

Compared to U.S.-Proposed Rules. The differences between Canada's proposed approach and the ongoing U.S. proposed rulemaking are easily recognizable. At this point, the U.S. has proposed a one-size fits all approach to sUAS operators and operations that pose the least amount of risk, but has created a committee to develop recommendations for new rules to govern "micro" UAS under 4.4 pounds. On the other hand, Canada proposes different regulations for sUAS operations that have varying levels of risk. In addition, the U.S. has not proposed rules permitting operations at night (permitted under TC's Complex Operations rules), design standards for UAS (proposed for TC's Complex and Limited Operations rules), or pilot permitting or medical certificate requirements. However, the U.S. proposed rules do not apply to recreationally used sUAS, which are already governed by FAA policies.

http://www.uasvision.com/2016/04/22/canada-working-on-uas-regulations/?utm_source=Newsletter&utm_campaign=e7680211c5-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-e7680211c5-297560805

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Small Unmanned Aircraft and Air Traffic Management Technology Assessment

Modern Technology Solutions, Inc. (MTSI), an engineering services and technology solutions provider for the defense industry, intelligence community, and commercial markets, in cooperation with industry partners PrecisionHawk, international unmanned aerial vehicle (UAV) market leader, and Texas A&M University Corpus Christi, have successfully completed multi-aircraft testing of PrecisionHawk's Low Altitude Traffic and Airspace Safety (LATAS) platform at the small unmanned aircraft system (sUAS) test site at Port Mansfield. The traffic management demonstration and integration was funded and managed by the Department of Homeland Security Science and Technology Directorate's Borders and Maritime Security Division.

The testing took place over a two week period and included four unmanned aircraft and two manned aircraft demonstrating Air Traffic Management (ATM) technologies for pilot situational awareness in a total of 38 flown missions. The goal was to assess the current effectiveness of available technologies providing cloud-processed sUAS position reporting and crowd-based aircraft data sourcing.

"Essential to these tests was the employment of cloud processed cellular 4G-LTE position reports integrated in to a single airspace picture with crowd based ADS-B and airspace and traffic data," said Paul Evans, MTSI Senior Engineer. "Bringing these data pieces together for situational awareness purposes, in a live web application environment, allowed MTSI to assess the potential utility and scalability for future cooperative sUAS and manned aircraft operations. Further, it provided the opportunity to compare LATAS to traditional cooperative position reporting methods."

Aircraft position reports (GPS, ADS-B and IFF Mode C) were presented in real-time through the LATAS web application, which accurately alerted the sUAS pilots of approaching air traffic and any risk of entering geo-fenced restricted air space.

“This technology assessment further validates that there are effective solutions for entities, like the Department of Homeland Security, to safely operate manned and unmanned aircraft in a shared airspace today,” said Tyler Collins, Vice President of LATAS at PrecisionHawk. “We believe that by pulling together and testing multiple layers of technology, we have the foundation for enabling wide spread drone integration in a real world setting in the very near future.”

http://www.businesswire.com/news/home/20160425005907/en/MTSI-Completes-Small-Unmanned-Aircraft-Air-Traffic

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PUBLIC SAFETY:

Drone Geo-Fencing Proposal Passes the Senate

U.S. Senator Charles E. Schumer today announced that a requirement to develop new safety standards for drones – that could include technology like geo-fencing that would keep drones away from sensitive areas -- passed the Senate 95-3 as part of the FAA Re-authorization Bill. Schumer helped lead the charge to include the drone safety language in the Federal Aviation Administration (FAA) Re-authorization Bill and cited this past weekend’s drone collision with a British Airways jet when making his final push for the geo-fencing proposal that has now passed.

“The drone that just crashed into a British Airways plane showed us yet again, there is no time to waste in getting geo-fencing technology off the ground here in the U.S.,” said U.S. Senator Charles Schumer.“Now that this drone-safety language has passed in the FAA bill, geo-fencing drone technology could soon be installed on every new drone, helping to stop them from flying near airports and other sensitive areas, while still allowing hobbyists to fly them in safe places.”

The bill would require the FAA, in collaboration with industry and other stakeholders, to establish new safety standards for drones that Schumer says should support geo-fencing technology. In developing the standards, the FAA is required to consider technologies related to geographic limitations and altitude limitations, like geo-fencing and other similar technologies. Geo-fending could help to prevent drones from flying into “No Fly Drone Zones,” like airports, the Pentagon, major parades, large sporting events—such as the U.S. Open---and even planes themselves.

Geo-fencing or other similar technology, which Schumer has long-advocated for, limits where unauthorized drones can fly through the installation of built-in software, firmware and GPS tracking in the device. The technology helps take human error out of the equation. Manufacturers are already experimenting with placing this type of technology in their drones, however, Schumer said that all manufacturers should be required to take all reasonable steps to implement the software right away. Schumer said that, with this legislation, geo-fencing could be one step closer to becoming a requirement for drones.

Drones are unmanned aircraft systems (UAS) that fall under three categories denoted by the Federal Aviation Authority (FAA): civil, public and model aircraft. The public unmanned aircraft systems are used by government agencies, law enforcement agencies and research institutions to aid in their operations. Schumer said that drones are an incredibly important technology, and are helpful in collecting data, aiding with border patrol operations, agriculture, training the military and more.

The civil unmanned aircraft systems and the model aircraft systems provide opportunities for civilians to use drones recreationally, and for drones to be used for research and development. Schumer supports the use of drones under all of these categories, but said that there must be clear limits to their usage when privacy and safety are threatened. Schumer noted that drones have commercial applications that make them useful in terms of agricultural development, real estate sales and search and rescue missions. Specifically, drones can help farmers monitor their crops more effectively and may help realtors sell real estate by providing better photographs of for-sale properties. Drones can also aid in search and rescue missions by locating missing individuals. Schumer said that there are innumerable benefits to drone technology, however, there are also consequences to the lack of regulation.

The FAA is charged with developing general, binding rules for integrating drones into the national airspace. In light of a number of near-misses at New York City airports as well as numerous privacy concerns over the years, Schumer has long been an advocate for clearer guidelines on drone use. Since the FAA Modernization and Reform Act was passed in 2012 and established "a special rule for model aircraft," Schumer has urged the FAA to release its proposed rule, which would distinguish between hobby and commercial drones, and outline the legal and illegal uses of commercial drones. On February 15th, the FAA released its draft rule on drones; Schumer said this was a good first step towards airspace safety, however, geo-fencing or other similar technological requirements are still necessary to improve the safety of our skies.

According to the FAA, reported pilot sightings of unmanned aircrafts have increased over the past year from a total of 238 in 2014 to more than 650 by August 9th2015. Schumer said that these drone sightings are extremely troubling because a collision could put hundreds of airplane passengers and pilots in real danger. There have been several reported near-misses involving drones and airplanes in the New York metro area, impacting all three major airports.

https://www.schumer.senate.gov/newsroom/press-releases/after-schumers-urging-drone-geo-fencing-proposal-passes-the-senate-newtechnology-could-prohibit-drones-from-flying-near-airports-sensitive-areas-sporting-events-and-above-500ft

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Drone risk in sharper focus

If the reported drone collision with an airplane over California in January (which did not damage the Cessna 188 involved) was a nearly silent precursor, another reported drone strike over London on April 17 was a shot heard around the world.

A British Airways Airbus A320 on final approach to London's Heathrow Airport reported striking what the crew believed to be a drone, though a post-flight inspection found no damage significant enough to delay the following flight. The Telegraph, citing a government minister, reported April 21 that there was no damage done to the airliner at all, and the investigation had not ruled out the possibility that a "plastic bag" had been struck. If it was a drone, and if the drone hit one of the engines, rather than the nose of the airliner, it might well have ended with a failed engine and emergency landing, or possibly worse. The details of a worst-case scenario remain largely unknown.

U.S. government agencies and academic institutions are working hard to model the risk posed by drones of various sizes in a scientifically sound way, and testing traffic management and related systems designed to prevent such collisions in the first place. That work is well underway, and a technological traffic management solution was tested for the first time on a large scale April 19.

As drones proliferate virtually everywhere—a boom driven by advancing technology that puts a quadcopter in easy reach of virtually any consumer—efforts to educate those consumers have taken on a sense of urgency. Answering critical questions about risk, mitigation, and regulation has also been a priority for many in and out of government, here and abroad, as drones proliferate.

"We're confident that UAS are enough of a threat to manned aircraft that they should remain a safe distance from airports and seaports," said retired U.S. Air Force Maj. Gen. James Poss, leader of a collaboration between the FAA and various universities studying a drone safety and management.

"Keep in mind," Poss wrote in an email exchange, "the bulk of our research is devoted to making sure collisions never happen."

Poss is the executive director of the Alliance for System Safety of UAS through Research Excellence (ASSURE), which is also the FAA Center of Excellence for Unmanned Aircraft Systems and is working in conjunction with NASA, private industry, and a long list of research institutions to manage the influx of unmanned aircraft into the National Airspace System. Funded through a 2014 congressional appropriation, ASSURE is collaborating with the NASA Unmanned Aircraft System Traffic Management program on technology to prevent collisions such as the suspected drone strike by the British Airways flight. (There had by April 19 been no official confirmation that the object that the A320 struck was actually a drone, and the incident remained under investigation.)

Tom Aldag, director of research and development at the Wichita State University National Institute for Aviation Research, one of the many ASSURE collaborators, is right in the thick of that. He also flies a Cessna 182 and occasionally patrols pipelines, so, "I'm down in the weeds" with more than a purely academic interest in the topic, he said in a telephone interview.

"It is a concern," Aldag said, noting that while commercial drone operators are probably "going to do exactly what they're supposed to do, the rogue operator, we can never do anything about. They're going to do what they're going to do."

Aldag hopes that the public will take safety to heart and utilize the many available resources to learn the rules and where not to fly. (This includes the Know Before You Fly campaign, which is also a collaborative effort involving the FAA and various groups including AOPA, as well as private sector efforts by AirMap and others).

He said research teams from four universities are meanwhile working to validate a computer model that simulates collisions between the most common consumer drones (a quadcopter and a small fixed-wing model) and narrow-body airliners, business jets, and a turbofan engine. Validating the model (and the simulated collisions it supports) requires setting up real-world collisions, which can become prohibitively expensive, so the team has worked its way up from a metal plate sensor previously used to measure the energy in birdshot, and will continue to compare simulated and actual collisions with actual aircraft parts and components. They're still working on finding an affordable turbofan that can be destroyed for science.

"The really cool thing about the approach that we're taking, especially if we can get these tests and make sure that the models are accurate, we'll be able to translate it into general aviation, ag, helicopter … different scenarios," Aldag said. "That's the real value of simulation versus testing … testing gives you (just) one data point."

Even when Aldag's team reports its initial simulation results to the FAA in September, further development will be required to model the effects of a drone collision on GA aircraft. One element of the equation not yet included, Aldag said, is the lithium polymer battery that powers nearly all consumer drones. Lithium polymer batteries are well-known for volatility if damaged, and can burn at temperatures exceeding 1,400 degrees Fahrenheit, a condition known as thermal runaway, and a potential failure scenario that has bedeviled electric vehicle makers for years. A rapidly combusting LiPo battery would be an obviously unwelcome addition to any aircraft cockpit or cabin, should a drone penetrate the windshield.

"That battery really could misbehave once it gets damaged," Aldag agreed. "We've proposed to look at that next year."

"I don't want to sound cavalier," Aldag said of his relative lack of concern. "There's still a lot of airspace, there's still a lot of UAS operators who are doing what they are supposed to do. That's what I count on."

Managing traffic

Two days after the Heathrow incident, dozens of drones took to the air at six test sites around the country, the first multi-site, real-world test of the technology being developed under the NASA UTM program (in collaboration and coordination with ASSURE). The test was coordinated through the NASA Ames Research Center in California, and included both actual flights and flights that were designed to be aborted as the drone operator submitted flight plan details to a system created to vet drone flight plans for safety and potential conflicts. Once airborne, the drones flying at FAA test sites in Alaska, Maryland, Nevada, New York, Texas, and Virginia were to continue testing a variety of apps and displays that will eventually become central to a traffic management system that tracks the location of drones using

cellular and Automatic Dependent Surveillance-Broadcast (ADS-B) technology, and helps pilots and controllers maintain safe separation.

"NASA is building UTM and ASSURE is following up with FAA research to prove that UTM is a safe and viable airspace management system," Poss wrote. "ASSURE will prove that on the range and in labs first, then test it out in real world low altitude hubs dedicated to realistic, market based scenarios. Our first hubs will be for precision agriculture and maritime UAS operations, followed by disaster response/news gathering, linear infrastructure inspection (oil pipes, power lines, highways, railroads, etc.) and others."

Poss said that another line of defense is also being actively developed: technology that allows a remote system or the drone itself to detect and avoid other aircraft. ASSURE is "also just about to launch a major research effort to detect rogue UAS activity around airports. Preventing collisions is the key. Tom is correct; if everyone follows the rules the risk is minimal."

Calculating risk

The April 17 collision may have been Britain's first, but it was most likely not the world's first. Listed in an FAA spreadsheet released in March containing the latest 582 drone sighting reports collected by the agency from pilots and ground observers, a pilot flying a Cessna 188 Jan. 2 over Modesto, California, reported hitting a drone, though no damage was done to the Cessna. (The pilot told officials he believed the drone hit one of the aircraft's tires.) A media report from Costa Rica published in November described a drone collision with a Cessna 172 flown by a student pilot over San José, a strike that damaged the Cessna's wing, though the airplane landed safely. That collision was reported two months after that country's aviation authorities released new regulations limiting drones to 400 feet agl, and imposing licensing and training requirements for operators.

Three collisions in six months (assuming that all three involved a drone) suggests the actual risk may be higher than calculated by researchers at George Mason University who looked at bird strike data and applied some statistical modeling to calculate risk. They concluded the risk of a drone collision resulting in damage or injury is extremely small:

"We find in general that small UAS under 2kg pose a negligible risk to the safety of the national airspace," the authors wrote. "One damaging incident will occur no more than every 1.87 million years of 2kg UAS flight time. We further estimate that 6.12×10^{-8} collisions that cause an injury or fatality to passengers on board an aircraft will occur every 100,000 hours of 2kg UAS flight time, or once every 187 million years of operation. This appears to be an acceptable risk to the airspace."

The actual risk posed by misguided drones has proved challenging to calculate.

Dallas Brooks, director of the Raspet Flight Research Laboratory at Mississippi State University and the ASSURE associate director of research, told attendees at the International Drone Conference and Exposition in Las Vegas in September that computer models have been developed and refined for airspace that is covered by radar, a comparatively straightforward task (particularly for the minds at the Massachusetts Institute of Technology), but that researchers continue to search for data and

information about the many flights (including many general aviation flights) that take place outside of radar coverage by virtue of location or altitude.

Brooks said in September that he thought it was likely that drones large enough to pose a risk to other aircraft will, within a few years, have the technology on board (or on the ground) to detect and avoid other aircraft.

"Hopefully we're going to get to that intersection," Brooks said.

http://www.aopa.org/News-and-Video/All-News/2016/April/20/Airliner-strikes-drone?WT.mc_id=160422epilot&WT.mc_sect=news

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CDT Supports Draft NTIA Consensus Document for Drone Operations

In 1946, the Supreme Court declared that our airspace is a "public highway" when it considered the case of military planes taking off and landing alarmingly close to the Causby family's chicken farm. Fast forward to today, seventy years later, and it's clear that the highway is about to become more crowded and closer to home than ever before, thanks to the rapidly increasing commercial and private use of unmanned aircraft systems (UAS) – or "drones."

It's easy to imagine the exciting possibilities that these flying robots will bring to the table. For example, it's likely that seeing drones buzzing around with packages will soon become as common as seeing a UPS truck or a pizza delivery guy. With drones, first responders to a disaster area will be able to arrive at the scene within minutes, and farmers will have easier, more efficient means to tend to their crops. On the other hand, the privacy concerns that come with drones – some of which are very small, armed with cameras, and nearly silent – are obviously real. In fact, some people are so concerned about the prospect of drones hovering ominously close to their property, and possibly filming their every move, that they've resorted to shooting them out of the sky.

In order to reconcile the exciting possibilities of drone operations with these privacy concerns, last year President Obama called on interested stakeholders to establish best practices for "privacy, accountability, and transparency issues" regarding UAS. Today, the National Telecommunications and Information Administration (NTIA) announced that a group consisting of members of civil society (including CDT), trade groups, and companies has created a comprehensive consensus document.

This consensus document has been months in the making and, while not perfect, represents a significant step forward for individuals' privacy as it relates to drone operations. There are areas where it does not go as far as CDT wanted when it comes to safeguarding privacy – in fact, we still believe the best practices are those that we proposed in December 2015. However, the document presents a sensible approach to protecting individuals from drone operators' potentially widespread, invasive surveillance capabilities while, at the same time, preserving the First Amendment. We support it.

Like CDT's best practices, these best practices borrow from many of the Fair Information Practice Principles (FIPPs). They restrict persistent and continuous collection of data about individuals, which will help prevent drones from creating a real-life "1984" society, in which surveillance follows us around every corner we turn and through every open window we pass by. In addition, the best practices require drone operators to minimize operations over or within private property without consent of the property owner or the appropriate legal authority. They ban using data, without consent and not pursuant to a contract, for determining eligibility for employment, credit, or health care, unless doing so is expressly permitted by law. They require drone operators to have a detailed data collection policy, to limit data collection to what is outlined in that policy, and to avoid retaining data longer than reasonably necessary. Moreover, the best practices encourage drone operators to give people control over data that concerns them by establishing a process for people to request access to and deletion or de-identification of data.

As a result, the consensus document fills a huge void that currently exists in the law. In large part, this is because the document encourages ethical practices that the law cannot mandate. The FAA Reauthorization bill recently passed in the Senate and many state laws do not include limits on the use, sharing, and retention of data collected by drones because doing so would raise legitimate First Amendment concerns. In addition, nothing in the FAA Re-authorization bill requires minimization of operations over or within private property, nor is there a restriction on persistent and continuous collection of data on individuals.

Nor do other codes of conduct come close to the protections afforded by this new consensus document. The FAA's final privacy requirements for UAS test sites and the DOJ's policy guidance only require a heightened degree of transparency, and are extremely bare-bones compared to the consensus document. The Mid Atlantic drones test site policy ties its protections to whether or not a person has a "reasonable expectation of privacy," a legal term of art for an expectation that generally ends the moment you walk out your front door or open a window. In contrast, the consensus document ties protections to whether the information collected identifies or can be linked to a particular person. The document's best practices even go beyond some of the stronger drones best practice recommendations in place throughout the rest of the world – for example, neither the European Parliament drones recommendations nor the Canadian government recommendations include specific limits on data use and retention, and they do not include restrictions on marketing and using data for employment, credit, or healthcare eligibility.

Overall, the best practices reflect a commitment to privacy while being mindful of the First Amendment and of the challenges that this nascent industry will face as it moves forward. We are pleased to join with key stakeholders including Amazon, the Association for Unmanned Vehicle Systems International, the Consumer Technology Association, CTIA – the Wireless Association, the Future of Privacy Forum, New America's Open Technology Institute, PrecisionHawk, the Small UAV Coalition, and X (formerly Google[x]) in endorsing a document aimed at encouraging drone operators to behave ethically, respectfully, and responsibly from the start.

https://cdt.org/blog/cdt-supports-draft-ntia-consensus-document-for-drone-operations/

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Bomb-sniffing drone technology

Drones may soon have the capability to save thousands of lives each year by detecting terrorists' improvised explosive devices and active land mines from long-ago wars thanks to innovative technology developed at UW-Madison.

The proven detection technology that also can detect chemical and nuclear weapons and drugs was successfully miniaturized and designed to fly on small unmanned aircraft by Fusion Technology Lab graduate students about five months ago, according to Jerry Kulcinski, an emeritus professor of nuclear engineering and the lab's director.

The centerpiece of the system is a fusion device that paints a target area with neutrons. Then sensors look for gamma rays or other particles with the signatures of specific materials such as explosives or a nuclear device. It's the same technology used at security checkpoints to scan luggage and shipping containers in airports, but the breakthrough for the UW-Madison scientists was making the radiation source small enough to mount on a drone.

That added mobility makes the technology a potential game-changer: Military convoys could be alerted to roadside bombs. Rescuers could dig directly toward people buried by earthquake rubble. Valuable mineral deposits could be mapped.

Kulcinski, an internationally renowned scientist and longtime adviser for NASA, believes it'll take about a year to get the system into the field — if they can find a company to buy it or fund it to completion.

"In a very practical manner, I think this can be a tremendous tool," said Col. John W. Weidner, who helps manage the U.S. Department of Energy's National Nuclear Security Administration. "From what I've read, its applications are only limited by the imagination of the user."

Weidner, who is part of a team that manages the U.S. nuclear weapons stockpile, envisioned scenarios where the United Nations would use the drones in Syria after hostilities end there to verify whether all its chemical weapons were destroyed, or in Iran to determine whether that country is making nuclear weapons.

"I see all sorts of different opportunities if this can be adopted by the appropriate agencies in our government," he said. "Intelligence agencies could find in a relatively passive, relatively quiet, no-person way what materials are in particular locations. That could be very powerful to them."

It also is expected to be less expensive than many of the technologies the U.S. military and law enforcement agencies are using to detect explosives, Weidner said.

Instead of spending money for expensive tracked vehicles that roll up to a suspicious package, identify and maybe detonate it, military and police agencies "can fly a drone over it, irradiate it and find out it's

full of flour," said Weidner, who has degrees in nuclear engineering and medical physics from UW-Madison.

Questions on radiation, capability

Because the breakthrough was so recent, there has been little time for critical assessment of the technology, but early concerns center on its use of radiation and possible limitations in detecting nuclear materials.

Kulcinski said radiation levels will be minimal — a person spending an hour in a target area would absorb about the same amount of radiation as a traveler who spends 10 minutes on an airliner flying at 30,000 feet. As a precaution, Kulcinski said, all drone operations will need to include efforts to ensure people are not in the irradiated area.

A demonstration of the drones' capabilities is needed before anybody can get excited about them, and their ability to locate nuclear weapons shielded by lead or steel will be the ultimate test of the new technology, said Matthew McKinzie, a nuclear physicist for the Natural Resources Defense Council, a New York-based environmental group. Like Kulcinski and Weidner, McKinzie worked earlier in his career at Los Alamos National Laboratory in New Mexico.

"Detection of illicit materials is a really difficult problem, especially for the most dangerous nuclear material, which is highly enriched uranium. The radiation signal can be concealed very effectively. And an improvised nuclear device, a terrorist's nuclear weapon, can be made most simply with highly enriched uranium. In my mind that's the toughest case. I think that's the greatest challenge for that system: Can it address that threat?" McKinzie said.

Weidner is hoping a government agency will pay for a demonstration of the technology to help Kulcinski and the graduate students sell it to a private interest like a drone manufacturer.

There are known limitations to the technology. For one, the neutrons from the miniaturized source can only detect explosives buried less than three to six feet below the surface.

"One of the ways to get around the drones is to bury (explosives) very deep, but if you bury them very deep they won't create the damage they'd create if they were a foot or so below the ground," Kulcinski said. "So if you can get the bad guys to bury everything six feet down, then you're making some progress."

The Navy was hoping the drones could locate mines deep in the ocean, but the hydrogen in water slows down the neutrons and neutralizes the technology. "Unless the mine is within three feet of the surface of the water, we can't detect them," Kulcinski said.

The drones need to fly relatively close to the ground, so Kulcinski expects some to be shot down if they are in a combat area. "It'll be like being at a duck hunt. That's going to happen," he said. "But if the bad guys are shooting them down, you know that's an indication that there are problems in that area to worry about, and you act accordingly."

Exciting possibilities

The potential applications of the drones are broad and exciting.

Kulcinski says they could be used to help rid the world of the scourge of unexploded landmines in current or former war zones. Nearly 50 million mines lurk in 60 countries, and they kill about 10,000 people per year and leave large portions of land unused, according to the American Nuclear Society.

“Sometimes they lay (mines or IEDs) out in rectangular arrays, sometimes they put them in triangular arrays, sometimes they throw them out in random. So if you fly across a minefield you can light up the mines and say, ‘This is what the field looks like.’ Now if you go in there and get this one, you can get the rest of them,’ ” Kulcinski said.

Japan is interested in using the technology prior to, and during, the 2020 Summer Olympics in Tokyo, Kulcinski said. One of their focuses is on detecting backpack explosives, which create a unique problem for researchers.

“Now you have a human tied to a backpack, so you have to be careful how much radiation (neutrons) you use,” he said.

The drones’ non-military applications include mapping mineral deposits near the surface of areas like mountains or deep valleys previously unreachable by humans, according to Kulcinski. Weidner said the drones could also locate people trapped in a coal mine or buried alive under rubble following an explosion or a natural disaster such as an earthquake.

Kulcinski said there are also applications for the drones to help prospect on the moon for new energy sources, including the rare fuel needed for fusion power. Aaron Olson, a Madison native and Ph.D. candidate who is part of the fusion technology team, received a scholarship from NASA for his work in that area.

The miniaturized neutron source technology also will work in stationary situations like airports or other public areas that might be attractive targets for terrorists, Kulcinski said. “If we had a low-intensity neutron source in that hall at the Brussels airport, we could have detected those bombs without hurting anybody,” he added.

Enormous stakes

Weidner praised the students for recognizing the potential of marrying their miniaturized fusion source with a new, extremely efficient power technology called rectennas that can replace the drones’ heavy battery packs that limit their flying time. The problem the rectennas solved: The slimmed-down neutron source was still heavy enough that it needed a power source on the ground — mounted on a Humvee, for example. The rectenna technology is used to beam energy to the neutron source via radio waves.

“That synergy of those technologies is what makes this, to me, so intriguing,” Weidner said. “The students’ creativity to come up with this confluence of new developments, I really give them credit for having that foresight.”

He also credited Kulcinski, who does not take a salary from UW-Madison, for his dedication to his students. “One of these days you’d think he’d want to leave it all behind so he could spend more time playing with his grandchildren,” Weidner said.

http://host.madison.com/wsj/news/local/education/university/bomb-sniffing-drone-technology-developed-at-uw-could-become-nightmare/article_498e9cb0-f638-5a91-8899-40be16ab6d29.html

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Drones’ New Mission: Save the Forests

Nearly a million acres of Douglas fir trees in the Pacific Northwest are dying of a disease that is spreading rapidly throughout the region.

Douglas firs are among the most important tree species for carbon sequestration, foot soldiers in the fight against climate change. Sick trees stop growing and absorbing carbon, reducing their effectiveness. The disease, called Swiss needle cast, also threatens the recovery of two endangered birds, the northern spotted owl and the marbled murrelet. Both species prefer to nest in old-growth Douglas firs. Many of the trees set aside for these rare birds are suffering from the disease.

The future of these forests—and those around the world—may depend on new technologies like those being developed in Wing’s Lab at Oregon State University here.

Unmanned aerial vehicle technology has come a long way in four years, and experts expect that drones will get even better in the decade to come. Yet, even as the use of drones expands, several technical challenges and roadblocks threaten researchers’ ability to make the most of them. Will they be solved in time to make a difference for the planet’s forests?

http://www.uasvision.com/2016/04/22/drones-new-mission-save-the-forests/?utm_source=Newsletter&utm_campaign=e7680211c5-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-e7680211c5-297560805

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Membership in the Center for Unmanned Aircraft Systems

Textron Systems Unmanned Systems, a Textron Inc. business, announced today its participation in the Center for Unmanned Aircraft Systems (C-UAS). Founded in 2012, the C-UAS is part of the National Science Foundation's (NSF) Industry/University Cooperative Research Center program. The center,

which is the only National Science Foundation-funded unmanned aircraft systems (UAS) research organization, is designed to link the research and development needs of industry with university research capabilities.

"We are excited to have Textron Systems join C-UAS," says Center Director Tim McLain. "We will benefit greatly from their perspectives and experience as we define and work on research problems of critical importance to the UAS industry."

Textron Systems brings its vast experience as a designer, manufacturer, operator, maintainer and trainer for UAS technologies to C-UAS. Textron Systems' unmanned aircraft systems include the expeditionary and highly reliable Aerosonde™ Small Unmanned Aircraft System, as well as the Shadow® Tactical Unmanned Aircraft System (TUAS), which alone has amassed nearly one million flight hours. The company currently uses these UAS platforms for military, civil and commercial applications around the world. Textron Systems also is a leader within the unmanned command and control domain with products such as the Universal Ground Control Station (UGCS), which is being fielded by the U.S. Army as the common control station for Textron Systems' Shadow TUAS, as well as other non-Textron UAS.

"With more than one million UAS flight hours across our platforms, and more than 30 years of experience as a UAS manufacturer, operator and maintainer, Textron Systems is excited to share this unique perspective with the membership of the C-UAS," says Textron Systems Unmanned Systems Senior Vice President and General Manager Bill Irby. "Textron Systems is committed to advancing research within the UAS industry, and we are proud to use our experience to make significant thought leadership contributions to the organization's efforts."

http://m.marketwired.com/press-release/textron-systems-announces-membership-in-the-center-for-unmanned-aircraft-systems-nyse-txt-2117832.htm

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NOAA Flying high to measure gravity: Humans optional

Did you know the Earth's gravity is different depending on where you are? Variations in its size, shape, and mass distribution can cause slight variations in the strength of gravity's pull.

Measuring these variations in gravity helps scientists create a height measurement system based on where water will flow. Having these measurements will help prepare for floods, sea level rise, and other emergencies — making our coastal communities more resilient and aiding a number of diverse industries such as agriculture, construction, transportation and urban planning.

And they're exploring a pilot program -- but without a pilot. NOAA's Unmanned Aircraft Systems Program worked through NOAA's Small Business Innovation Research Program to test unmanned aircraft systems for gravity measurements. SBIR funds high-risk, high-reward projects that not only help NOAA to meet its mission, but also open up new markets for industry. To do just that, NOAA's National Geodetic Survey is in the middle of a 15-year effort called Gravity for the Redefinition for the American

Vertical Datum, orGRAV-D. Its goal is to increase the accuracy of today's elevation measurements with more precise data obtained through measuring gravity nationwide. NGS scientists are collecting gravity data from all over the country with aircraft.

Aurora Flight Sciences in Manassas, Virginia, was awarded the broadly competed project. This month, Aurora tested this technology, demonstrating the potential to conduct regular unmanned flights with NOAA instruments. The test flights represent one of the first times an unmanned aircraft system was evaluated for measuring gravity.

With 50 percent of the nation already measured through piloted airplanes, NGS now hopes to include unmanned aircraft as a tool to reach remote locations more efficiently, at lower costs and with less environmental impact.

NGS plans to complete the GRAV-D project in 2022. This will bring about big benefits, with an estimated $522 million in annual economic benefits and approximately $240 million saved from improved floodplain mapping alone.

http://www.noaa.gov/flying-high-measure-gravity-humans-optional

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SENSORS/APPLICATIONS:

Scientists will let Hurricanes Destroy these Drones to Gather Storm Data

While scientists have gotten a lot better at estimating the strength of a hurricane before it hits land, they still don't fully understand how hurricanes form. While satellite measurements can give meteorologists a pretty good picture of the atmospheric temperature and precipitation within a hurricane, sometimes the resolution is still "too coarse" to help researchers understand how storms form and mature, says Robbie Hood, the director of NOAA's Unmanned Aircraft Systems Program.This especially true in the vital area just above the water. Now the National Oceanic and Atmospheric Association (NOAA) plans to use inexpensive drones to fly into the most active part of the storm and let them be destroyed by it, in order to better predict how a hurricane will progress. Hood presented an overview of the program on Saturday at the annual AAAS conference in Washington, D.C.

The National Oceanic and Atmospheric Association (NOAA) plans to use inexpensive drones to fly into the most active part of the storm and let them be destroyed. In the past, researchers have used the dropwindsonde, a sensor attached to a parachute, to estimate wind speeds at the Tropical Cyclone Boundary Layer, right above the water. These fall quickly into the water, giving scientists a lot of information about the vertical conditions of the storm on the way down, but only a brief glimpse into the conditions at the surface — which are most essential to their predictions.

"The hope for the UAS drones flying at low altitudes is that they can provide more detailed information than a satellite of the lowest layer of the atmosphere above the ocean while covering a broader horizontal range than a dropsonde," Hood says. Now NOAA is starting to use two models of drones: The

Raytheon Coyote and the Piasecki Whimbrel. Both can be launched from a manned aircraft. Once they're released, the drones have wings that pop out that enable them to fly in the high-intensity winds.

The Coyote is designed to fly for up to an hour. Using radio communication, they transmit data from inside the hurricane to the aircraft that launched them.

They transmit data from inside the hurricane to the aircraft that launched them.

These two drones join NOAA's growing fleet for weather detection; over the past five years, NOAA has partnered with NASA to use the Global Hawk drone to detect storm-forming conditions all across the Atlantic. There are a few others designed to observe storms for longer durations, but for the moment NOAA is putting more resources into this "expendable" drone design, Hood says.

The Coyote and Whimbrel are still under development (the Whimbrel hasn't even had its first test flight yet), and NOAA hopes to assess whether the data they can provide is more valuable than that of other drones, especially when cost and feasibility are taken into account. If the drones' development continues as expected, the final step will be for NOAA to conduct an environmental assessment to ensure that these handful of disposable hurricane drones don't contribute significantly to ocean trash, once they've fulfilled their mission.

http://www.popsci.com/scientists-use-drones-to-better-understand-how-hurricanes-form

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A $250 LIDAR with 40m Range

If you're building a drone or robot you're gonna need it to know where it's at and where it's going. For that, you'll need to pack it with some sensors, and when it comes to reliable, low-cost navigation sensors, it's hard to beat LIDAR. It has sharp resolution, especially when compared to sonar; LIDAR beats light and time-of-flight sensors in both terms of range and the fact that the latter often don't work well outside; and camera-vision based systems are too unpredictable for reliable navigation.

The problem with LIDAR is that it's not cheap. An affordable 2D unit with a 10m range can set you back at least $1,000. At least, this was the problem. Scanse, a California- base startup is breaking onto the sensor scene with a new 2D LIDAR that is both much, much cheaper than alternatives, and promises to be much better as well.

Sweep, Scanse's offering, goes for just $250, and the spinning LIDAR sensor packs an impressive range of 40 meters, even outdoors.

https://www.youtube.com/watch?v=AAiO24xIeo4#action=share

Sweep works with a new kind of LIDAR sensor from a company called PulsedLight. It works in a novel way that is "based on a new time of flight ranging method, which involves sending out laser pulses that are made up of a series of micro pulses. These micro pulses act as a kind of light based checksum, which

allows the sensor to more easily correlate returning light to the known pattern, and achieve a phase difference measurement," explains Scanse's co-founder Tson Messori.

The new method, he says, allows the sensor to use lower-power components, "which contributes to its low cost." This also helps increase the range greatly.

Sweep is still a work in progress, and it will be some time before it's ready to ship. But when it does, it could seriously help hobbyists create some cool tech.

http://i-hls.com/2016/04/sweep-a-250-lidar-with-40m-range/?utm_source=Israel+Homeland+Security+%28iHLS%29&utm_campaign=55e324a93f-ENGLISH_DYNAMIC&utm_medium=email&utm_term=0_8ee2e16ed1-55e324a93f-89865369&mc_cid=55e324a93f&mc_eid=532334b8e8

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Shape-Shifting Aerial, Underwater Drones

The U.S. Air Force is funding research at Cornell University that could lead to the development of a miniature, shape-shifting drone able to scan its surroundings from the sky or beneath the sea.

The drone will have wings made of a composite material part silicone and part metal — moving closer to the liquid metal envisioned in such science-fiction films as, "Terminator 2: Judgement Day."

At the heart of the research effort isn't a robo-killer, but a robo-fish.

"The driving vision behind this is the puffin," Ilse Van Meerbeek, a Cornell mechanical engineering graduate student working on the project, told LiveScience.com. "It can fly through the air then shorten its wings and dive into the water. Without this ability its wings would break.

"The Air Force is interested, because they want to be able to develop morphing wings for small aircraft," she added. "Being able to do this without moving parts is appealing because then fewer parts can break."

The morphing material was described by the Cornell group in a paper published in the journal Advanced Materials in February. The research team said the composite was created by dipping the silicone foam into the molten metal and then placing it in a vacuum so the metal is sucked into the foam's pores as the air is removed.

Not only can the material shift shapes, but it can self-assemble and self-heal.

The researchers told LiveScience that if two pieces of the material are placed side-by-side and heated, the metal melts and fuses the parts back together with only a slight loss in mechanical strength.

http://www.defensetech.org/2016/04/18/air-force-wants-shape-shifting-aerial-underwater-drone/

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One-of-a-kind wind tunnel for birds that paves the way for better drones

Most people look at a pigeon and see a chubby, common, boring bird. A “rat with wings,” in common New Yorker parlance. When David Lentink watches a pigeon dart around a building and land perfectly in its roost, however, he sees the future of robotic flight.

Stanford assistant professor David Lentink uses a wind tunnel to probe the mysteries of flight.

Lentink, an assistant professor of mechanical engineering at Stanford, has been studying birds in flight for years, with an eye toward applying the tricks birds use to navigate changing conditions in the real world to design better aerial robots. Most of the insights he and his colleagues have gained so far have resulted from painstaking study, involving calculations of wing force dynamics inspired by footage captured in the wild.

Now, with the construction of one of the most advanced bird wind tunnels in the world, Lentink hopes to reveal even more of the magic of bird flight.

With the recent boom in drone use, it’s easy to forget that the robots frequently fail in windy conditions. Consider flying a drone down an “urban canyon” like Fifth Avenue in New York City. Turbulence varies wildly from the middle of the “canyon” to alongside the skyscrapers, and obstacles like traffic lights pop up frequently. Now, throw in a few dozen drones fighting for position like the taxis below. It’s a nightmare for drone operators.

“But you look up, and you’ll see a pigeon swoop by casually. It has no problem stabilizing itself, flying around corners, dodging cables and landing on a perch,” Lentink said. “It’s just something we haven’t accomplished in robotics yet. We need to study birds up close so we can figure out what their secret is to flying so stably under such difficult conditions, and apply that to aerial robotic design.”

Cruising speed for birds

The new wind tunnel works like a super tricked-out treadmill for birds. The wind-flow, generated by a fan roughly the size of a Volkswagen Beetle, is super smooth: Turbulence checks in around .015 percent, less than half of any other bird wind tunnel in the world. This allows the researchers to study how birds fly in smooth-flowing air such as that found at higher altitudes.

Such conditions aren’t typical closer to the ground, particularly around trees and buildings, though, so the tunnel is fitted with a “turbulence generating system,” a series of computer-controlled wind vanes that can precisely simulate different turbulence patterns, creating up to 50 percent turbulence. In this state, the flow moves almost equally randomly in all directions, making it very unpredictable for the bird.

Wind speed is also highly tunable. The lovebirds, parrotlets, and hummingbirds that Lentink’s lab studies typically cruise around 7 meters/second, which the engineers can match perfectly to study sustained

flight. They will occasionally crank the flow up to 15 m/s, which simulates a strong wind, maxing out at 20 m/s for large birds.

Lentink is fiercely protective of his birds, and said this would be the maximum speed he would consider letting larger birds fly to keep them comfortable. The tunnel can blow much faster, however, with speeds up to 50 m/s for the prototype drones he plans to test in the tunnel.

Nearly two meters long, the six-sided windowed observation section of the tunnel provides Lentink and his students a variety of ways to study bird flight. They currently zero in on specific aspects of birds' wing beats, using high speed cameras as well as motion capture techniques more commonly utilized in Hollywood films, recording wing motion millisecond by millisecond. They then translate these measurements to precise calculations of the force dynamics experienced along the birds' wings and in the surrounding air. Later this summer, Lentink expects to introduce two fluoroscopes to the mix, which will allow researchers to "see inside" the bird and visualize the exact muscular-skeletal movements it makes in different flight maneuvers.

Once his team has trained enough birds, Lentink plans to fly entire flocks in the tunnel to determine how turbulence created by one bird's wing beats affects a nearby bird, and how they maneuver for position. Both of these measurements will provide critical foundational information for a future sky packed with drones.

Using the information gleaned from bird flights, Lentink envisions using the tunnel as a test-bed for new aerial robot designs. In addition to establishing better maneuverability controls for common quad-copter designs, he's particularly interested in building bird-like, winged robots that quickly morph their wing shape in order to maintain stability in turbulent air flows.

Learning avian tricks

"Ever since Otto Lilienthal and the Wright Brothers studied birds to invent their airplanes, engineers have relied on talking with biologists to learn the tricks birds us," said Lentink, who is a member of Stanford Bio-X. Although the wind tunnel will enable engineers to develop safer and more reliable drones that fly in urban environments as well as birds do, Lentink stressed that it is not only an engineering facility. It is a top-notch biology lab that meets and exceeds all animal research standards enabled by the very best technology Stanford offers.

"Our bird tunnel is really unique, and I'm incredibly thankful to my colleagues and the School of Engineering who thought it was an awesome idea to enable engineering students to study how birds fly to develop better flying robots and made this possible," Lentink said. "The facility has been built with great care by people within the School of Engineering, and I'm really excited about the opportunity to study bird flight up close with engineering students who bring different interests ranging from bio-mechanics to fluid mechanics to aeronautics in our team of engineers and biologists."

The wind tunnel was paid for by Stanford. The various measurement systems were acquired with support from the Air Force, Navy, Army, Human Frontiers Science Program, and Stanford Bio-X program.

https://news.stanford.edu/2016/04/22/stanford-engineers-build-one-kind-wind-tunnel-birds-paves-way-better-drones/

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World's first brain-controlled drone race

Drone races are nothing new. But while they started as an ad-hoc activity within the drone community, the sport has now taken on a life of its own with highly elaborate events and a partnership with ESPN.

Similarly, brain-computer interface (BCI) technology isn't totally new. And while the technology is still young, advances are being made in labs across the country, and some paralyzed patients have already been able to use the technology to control prosthetic limbs.

But utilizing this BCI technology to connect your brain to a drone? That is definitely new.

Last week, University of Florida did this for the first time by using BCI software to control a group of DJI Phantom drones. And while the drones didn't exactly zoom by, 16 pilots used their brainwaves to fly drones down a 10-yard indoor course.

Fair warning, the racing itself is fairly mundane. But who cares because they are drones controlled by YOUR BRAIN!

So how exactly does this tech work?

Pilots don electroencephalogram headsets that are calibrated to each wearer's brain. For example, neuron activity will be recorded when the wearer is told to think about pushing something forward. This activity is then bound to the forward stick on the drone's controller, so future similar neuron activity will move the drone forward.

Essentially, it's the same thing as when you bind new keyboard commands when playing a video game for the first time, just using brain waves instead of keyboard keys.

As you can tell from the video, brain-controlled drones aren't exactly ready for the raceway. But as the technology progresses, expect to see BCI start to integrate itself into our daily activities and lives.

http://techcrunch.com/2016/04/25/university-of-florida-held-the-worlds-first-brain-controlled-drone-race/

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New drone battery stores more energy than a Tesla

When it comes to a drone's life, it's all in the battery. Battery power dictates how much weight a drone can carry (and how big of an Amazon Prime delivery it can make), and how far it can go.

South Korean battery maker Kokam on Tuesday announced a battery for military, commercial and industrial drones, which has an energy density of 265 watt-hours per kilogram. The typical drone battery has an energy density between 150 and 200 Wh/kg.

For comparison, Tesla Motors Inc. TSLA, -0.52% uses Panasonic cells with about 210 Wh/kg for its vehicles — which Kokam notes is 20% less energy density than its battery.

“In other words, drones with our battery will have 20% longer operating time, more space and less weight than if they used the Panasonic battery used in Teslas,” said Ike Hong, vice president of Kokam’s Power Solutions Division.

The advancement means drones will be able to fly for longer periods of time while having a smaller, more lightweight battery.

“Military, commercial and industrial customers want unmanned systems with longer operating times and more capabilities, without sacrificing reliability or performance,” Hong said.

Kokam’s clients include Trimble, which makes drones focused on the agriculture market, and Eca Group, which focuses primarily on drones for the defence and security sector.

Kokam has 260 employees and was established in 1989. It has powered the world’s first fully electric submarine and the Deepsea Challenger, the submarine used by filmmaker James Cameron to reach the deepest known point on Earth.

http://www.marketwatch.com/story/this-new-drone-battery-stores-more-energy-than-a-tesla-2016-04-26

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New modifiable drone can help researchers scan the changing Antarctic ice shelf

Measuring how the polar ice caps change over time is crucial to understanding the effects of our warming climate — but doing so is no easy task. The process often involves flying radar-outfitted planes through the Arctic and Antarctic to scan the regions' glaciers up close. The weather in these regions is often unpredictable, so piloting planes through the poles can be stressful and risky.

That's why a group of aerospace engineers have created a drone that's better suited to the task. It's called the Tiburon, and it's made by the Houston-based company Intuitive Machines. The Tiburon is an unmanned aerial vehicle (UAV) weighing up to 55 pounds that can carry radar instruments to scan the caps for researchers, relieving pilots from the dangerous feat.

It's not the first drone to aid with research in Earth's arctic areas; unmanned vehicles have been flying in these frigid regions for years. But what sets the Tiburon apart is its versatility, according to its manufacturers. The drone can be used for more than just scanning polar caps; its instruments can be swapped to conduct research in different regions and for different purposes. It can fly over crops to look

for diseased plant life, for instance, or to inspect oil and gas lines to make sure there are no trees growing over an important pipe. "Each one of those different scenarios requires a completely different sensor package," said Kevin Bass, the lead for mechatronics at the company. "Our airframe has the ability to change out sensor packages."

One of those sensor packages includes radar and lidar instruments that can provide detailed information about the changing state of the polar ice caps. Intuitive Machines has already teamed up with the University of Texas Institute for Geophysics to use the Tiburon to help with the study of climate change's effects in the Antarctic. UTIG is continuously checking the thickness of the ice sheet near the pole, as well as studying the topography of the ground beneath the ice.

Typically, UTIG has used a radar-outfitted Douglas DC-3 propeller plane to study the Antarctic ice sheet in depth, which costs $3,000 an hour to fly. It's cheaper to use the Tiburon for the same task, according to Joe Bibby, director of art and marketing at Intuitive Machines, though the company isn't sharing exact prices just yet. Bibby says the costs will be somewhere between 30 to 40 percent less than the DC-3. Additionally, the drone can perform more scans over a shorter period of time than the plane, and UTIG could potentially perform multiple scans at once with numerous aircraft working in sync, increasing the area of coverage. But perhaps the Tiburon's biggest benefit is keeping pilots out of terrible weather in the Antarctic.

The Tiburon's origins are somewhat unique, as the vehicle is the brainchild of former NASA scientists. Intuitive Machines was started in 2013 by Steve Altemus, the former deputy director of NASA's Johnson Space Center; he recruited a number of other ex-NASA employees and scientists to come up with engineering solutions in the realms of space and air travel. Recently the company used their spaceflight expertise to develop a vehicle that could carry samples from the International Space Station to Earth in less than 24 hours. Think same-day delivery, but from space.

Now, with the Tiburon, Intuitive Machines wants something that can stay in the air for extended periods of time and perform a range of different tasks for research purposes. "We're steering away from any kind of weaponized version, but we are interested in surveillance," said Bibby. "We're really focused on agriculture, oil and gas, and other science applications." The Tiburon’s creators also want the drone to surpass the world record for the longest continuous air time for a small unmanned vehicle, which is currently set at 54 hours and 27 minutes. "We’re looking to take that world record and beat 55 hours of time in the air," said Bass. Ultimately, the goal is to get to 60 hours.

The Tiburon still has a way to go before it can fully aid pilots in the Antarctic. Its missions have been short, as the drone's fuel tank can't hold enough yet to keep the UAV in the air for more than 55 hours. And the Tiburon still has to be piloted remotely as the engineers at Intuitive Machines improve the drone's autonomous flight software.

Although Tiburon may not be the first research drone of its kind — the University of Colorado has used similar-sized UAVs to measure temperatures around the Antarctic ice shelf — it highlights the expanding market for UAV capabilities. "This is a fascinating example of harsh and forbidding environments where you're able to use unmanned technology to survey wide swaths of area," said Adam Lisberg, the

communications director for drone manufacturer DJI. "You can do it with the fraction of the cost, effort, and risk in putting occupied human aircraft in that type of environment. It's one of a million different uses you're going to see as the technology matures."

http://www.theverge.com/2016/4/27/11464822/tiburon-radar-research-drone-uav

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COUNTER UAS:

SkySafe Takes Control of Rogue Drones

Grant Jordan and his co-founders are announcing the public launch of SkySafe, a drone protection startup that wants to help facilities secure critical airspace. After graduating from MIT with a degree in computer science, Jordan spent four years at the United States Air Force acquiring a particular set of skills, skills that make him very dangerous to drones like this. "I worked on counter drone systems, and got a taste for everything out there. Giant laser systems, for example."

Setting drones on fire while they are in still in flight is pretty cool. "I have seen them in person and they are amazing. But they don't apply well to the civilian world.

The company also revealed that it had raised a $3 million round of funding led by Andreessen Horowitz. While Jordan wouldn't discuss the exact techniques the company uses in detail, the company claims it can identify drone; distinguish authorized units from rogue ones; track the location of the drone operator; and if needed, take control of the drone — disabling it or bringing it in safely for a landing.

"We don't just detect, we do the intercept side," says Jordan. "We fully take control of the drone from the operator, it sees us as the legitimate controller, and we can move it to a safe location and land it." SkySafe can "spoof" the drone to hijack control, a technique that was demonstrated on commercial drones way back in 2012, and has been used by drug cartels against border patrol drone flown by the Department of Homeland Security.

Military-grade drones attempt to prevent jamming or spoofing of their signal by cycling through different frequencies and adding high-level encryption to their signal. But that isn't something most commercial drone makers can consider. "The manufactures know it's an issue. They're not going to advertise it as an issue," said Michael Buscher, CEO of Vanguard Industries, in an interview with Defense One. "It becomes cost-prohibitive. They're not going to, all of a sudden, put it in their aircraft because it does drive the price up."

Some drone makers were skeptical the technology would work as advertised. "I get asked about these "drone defense" startups all the time (there are lots of them) and to be honest I haven't seen any technology that can actually identify and block all drones," wrote Chris Anderson, CEO of 3D Robotics. "Also, drones by definition can be autonomous, which means that they don't have to emit any radio signals at all when in autonomous mode." He thinks the best solution is better protection from within the drone. "The majority of bad behaviour is actually by operators who are more ill-informed than ill-

intentioned, and we're optimistic that our new built-in safeguards will vastly reduce the number of incidents."

SkySafe's investors say it's reasonable to expect that, if the company's technology proves popular, manufacturers will try to build drones that can't be affected by it. "Like all security, it's a cat and mouse game," said Chris Dixon, the general partner at Andreessen Horowitz who spearheaded this investment. Drone manufacturers were less sanguine about SkySafe's plans. "We can't respond to particular claims from a company we don't know, with technology we haven't seen, from a video we haven't verified," said a DJI spokesperson. "That said, any company that plans to bring down a drone by physical or electromagnetic interference is planning to violate federal aviation law or federal communications law and may increase the safety risk for individuals on the ground. DJI believes that any unmanned technology company should operate within the bounds of the law."

To start, SkySafe is hoping to sell its technology to customers who already have regulatory control of their airspace — prisons, power plants, airports, and the like. Jordan says he sees his company's work as an extension of the work being done by startups like Airmap.io, which recently partnered with 850 of the largest airports around the US to share data between drone operators and air traffic controllers. "Airmap is doing the trusted reporting, the backend piece. We are the front end, the enforcement." SkySafe's position is that it's better to down a drone than for one to collide with an airplane. "We love the fact that the drone industry is taking off. We want it to keep growing," says Jordan. "One bad incident could ruin that."

http://www.uasvision.com/2016/04/21/skysafe-takes-control-of-rogue-drones/?utm_source=Newsletter&utm_campaign=40d121791e-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-40d121791e-297560805

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INTERNATIONAL:

COMMENTARY:

The future of America's aircraft carriers? Floating drone factories

Earlier this month, the British Royal Navy ship HMS Protector made history. An ice patrol ship, Protector sailed the frigid waters off Antarctica. But instead of using a helicopter to scout an ice-free route, the Protector had an unlikely helper — a drone

And not just any drone: a 3D printed drone that was manufactured onboard the ship itself. The tiny remote controlled airplane, steered by a laptop and buzzing along at speeds of up to 60 miles an hour, could be an unlikely savior of the largest warships ever to sail: aircraft carriers.

A symbol of American military primacy since the end of World War II, there are currently 10 aircraft carriers serving with the U.S. Navy. Each carries approximately 70 aircraft capable of bringing more firepower than the armed forces of entire countries. They are, in fact, a capability no other country can currently equal.

Still, all is not well in the world of aircraft carriers. Every major weapons system becomes obsolete over time and just as the carrier took over from the battleship, technological advances have made these ships obsolete, some pundits say. China is pursuing so-called "anti-access, area denial" technologies that it hopes will make large parts of the Pacific too dangerous for aircraft carriers.

Chief among these is a network of sensors and bases, capped off with the Dong Feng-26 "carrier killer" ballistic missile. Launched from bases in China, the DF-26 was designed to attack aircraft carriers, plunging through the atmosphere at hypersonic speeds and punching through their steel decks. The DF-26 and weapons like them are notoriously hard to shoot down.

The latest, USS Gerald R. Ford, cost a whopping $17.5 billion to research, develop, and produce. That doesn't include the $6 billion cost of the aircraft that will fly off it and a similar cost for the destroyers, cruisers, and supply ships that will sail with a typical carrier battle group. All in all, the Ford's carrier battle group will easily cost somewhere around $30 billion.

The aircraft carrier is indeed embattled. But is its time over? Maybe not. The aircraft carrier's greatest strength, which has allowed it to remain relevant for the last 70 years, is the fact that it carries airplanes — and airplanes can be adapted to a wide variety of missions. Carriers can launch nuclear weapons, sink submarines, destroy enemy fleets, and bring relief supplies to disaster-stricken zones. It's a versatility unmatched by any other ship

As aviation technology marches on, much of it makes its way onto carrier flight decks. In 2013 and 2014 the Navy's experimental X-47B unmanned carrier aircraft performed takeoffs, landings, and aerial refuelings. The Navy is talking about producing its first operational drone, the MQ-25 Stingray. More drones will follow, and it's not farfetched to think of a day when none of the aircraft on a carrier actually carry any pilots.

Meanwhile, 3D printers can now print steel, aluminum, and titanium, and there's no reason why the technology, scaled larger, couldn't be used to create larger drones. A 3D printer capable of making aircraft fuselages, coupled with stores of pre-assembled aircraft components would enable the ship to build its own combat drones. The carrier becomes not just a floating airport, but a floating airplane factory.

Drones and 3D printing are two technologies that will keep carriers relevant. Drones are cheaper than manned aircraft and the infrastructure — including the human infrastructure — is also less expensive. The ability to reconfigure a carrier's drone fleet, from slow-moving attack jets that could bomb the Islamic State to stealthy, long-range bombers that could out-range carrier killing missiles, would keep carriers flexible and more versatile than ever.

The technology will change the way wars are fought. It takes months or even years to build an airplane, meaning that in wartime once reserves are exhausted planes cannot quickly be replaced. Using 3D printing, carriers could self-replenish their aircraft inventories in wartime, replacing combat losses with fresh drones. Combat aircraft would go from being a precious resource to actually being somewhat disposable — and capable of being built in large numbers.

The aircraft carrier is indeed embattled, but carriers are versatile enough to keep them in service likely for decades to come. The real threat is carriers pricing themselves out of existence, and more needs to be done to keep costs down. Technologies are on the horizon that will keep carriers relevant and affordable — but we will pursue them only if we recognize that costs are growing out of hand. The tiny drone printed and assembled on the HMS Protector is just a sneak peak at things to come.

http://theweek.com/articles/619455/future-americas-aircraft-carriers-floating-drone-factories

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Autonomous warships get smarter

2016 is shaping up to be the year of the robot warship

Two trends are converging: the development of highly autonomous unmanned surface ships that can function individually, and the development of swarm control systems that enable flotillas of unmanned ships to operate as a cohesive formation, again with minimal human intervention.

The first of these occurred in April in Portland, Oregon, when the Defense Advanced Research Projects Agency and the Navy christened a large robotic submarine hunter called the Anti-Submarine Warfare Continuous Trail Unmanned Vessel. ACTUV is a 132-foot-long unmanned surface vessel designed to detect and track ultra-quiet diesel submarines.

In September comes a demonstration of Unmanned Surface Vessel Swarm, an Office of Naval Research project to create groups of small boats that can function as a team. The first demonstration was held in August 2014 on the James River in Virginia when five small, unmanned boats showcased the Control Architecture for Robotic Agent Command and Sensing (CARACaS) system. The CARACaS-controlled boats escorted a high-value naval target and swarmed any remote-controlled "enemy" vessels that approached the convoy.

This time, the boats will be capable of a lot more, according to Robert Brizzolare, an experimental physicist who is ONR's program officer for USV development. In 2014, the swarm boats had autonomy, but not coordination. "Each CARACaS on each boat made its own decisions in a vacuum," Brizzolare recalled.

Each USV knew its position and the position of the other boats, so they could maintain their assigned stations relative to the ship under escort. "But if one USV had to break off to investigate something, the

other boats were not smart enough at that time to be able to compensate in their positions," Brizzolare said.

More sophisticated CARACaS algorithms will enable the boats in the second demonstration to "negotiate" over which boats will perform what task. "For example, if there's a threat vessel in the area, the boats can collectively decide which of the USVs is going to investigate it," Brizzolare said.

Equally important is a new collaborative ability to plan routes.

"That allows them to take into account each other's position, so they don't get too close to each other and risk a collision," Brizzolare said. "They can also maintain better formations. If they're escorting a high-value unit, and one of the USVs has to go over and investigate a questionable vessel, the other USVs can adjust their routes to compensate."

These new capabilities were made by possible by improved algorithms in CARACaS, which were developed by NASA's Jet Propulsion Laboratory based on work on the Mars rover and other space projects. For example, the planning and scheduling components of CARACaS come from NASA.

The most difficult part of the second demonstration was devising new algorithms, in part because so much depends on the quality of the situational awareness data.

"If the boat's perception engine [sensors and algorithms] does not detect the presence of other vessels, that's a problem," Brizzolare said. "There could be a collision, or the vessel that isn't detected could be the vessel we want to inspect to see if it's a threat."

As with any automated system that responds to sensor data, filtering out false alarms is also a challenge.

The USVs are equipped with commercial-off-the-shelf maritime radar as well as cameras. The vessels have stereo cameras — based on those used in the Mars rover — that are better suited for determining the range to an object. However, stereo cameras have shorter ranges than monocular cameras, but USV Swarm researchers were able to extend it, according to Brizzolare.

Cameras for an automated ship require automated imagery analysis so that the computers can interpret the visual data. Brizzolare said because imagery analysis is computationally intensive, the challenge there was the ability to analyze camera images fast enough to enable the USV to avoid a collision.

The boats themselves are standard Navy small craft, surplus 7- and 11-meter rigid hull inflatable boats. Human control — or more accurately, human supervision — was exercised in 2014 through a desktop control unit. The second test will feature a tablet-based station.

The ability to operate in low- or no-bandwidth environments has become obligatory for many military systems, but it is especially crucial for unmanned craft that must be capable of functioning without human intervention. Depending on the circumstances, USV Swarm can operate under "sparse supervisory control” with no human supervision. Their responses to loss of communications would need to be preset so that they might, for example, hold position or return to base. They would need fresh

instructions if the mission changed. But otherwise, "as long as the information they have is current, they can keep going without an external connection to the outside world for some period of time," said Brizzolare. "If there is nothing else out on the water, the boats can keep going. If there is a lot of traffic or complexity, we would want more human supervision."

At first glance, ACTUV and USV Swarm are dissimilar projects. ACTUV is a relatively large, unmanned vessel that can operate as a solo ship. USV Swarm is all about multiple boats. ACTUV is designed for the open ocean while USV Swarm is designed for operating on rivers where traffic is dense and ships are in close proximity to each other. Each ACTUV will cost $20 million. A small Navy boat can be converted into a swarm craft for as little as $50,000 apiece.

Yet the two projects are really two sides of the same coin. "There is no reason why this CARACaS swarm concept could not be applied to a group of ACTUV-sized vessels," Brizzolare said. "Then you get the benefits of the range of that size of vessel, the seakeeping ability and the payload capacity."

The trick, he said, would be to integrate USV Swarm's group behavior algorithms into the ACTUV control software.

During ACTUV's christening, Deputy Secretary of Defense Robert Work spoke glowingly of swarms of ACTUVs.

"Imagine anti-submarine warfare pickets," he said. "Imagine anti-submarine warfare wolf packs. Imagine mine warfare flotillas, distributed surface warfare action groups, deception vessels, electronic warfare vessels."

Neither ACTUV nor USV Swarm is armed. The creators of both are focusing more on developing autonomous ships than turning them into weapons platforms. But there is no reason why they can't be armed someday.

Ultimately, what is significant about the Navy's robotic ships isn't the ships, but rather the robotics. USV Swarm and ACTUV are, at heart, concepts that are about controlling ships rather than building ships. Their essence is the computer algorithms that enable vessels to function autonomously and cooperatively with a minimum of human guidance. Taken to its logical extreme, the path the Navy has embarked on suggests that if you can develop a sufficiently sophisticated control system, the size of the platform doesn't matter. Dismaying as that prospect may sound to old salts and anybody else wary of an inhuman future, it does suggest that a battle fleet composed primarily of robots could become reality someday.

http://www.c4isrnet.com/story/military-tech/uas/2016/04/21/swarming-unmanned-surface-vessels/83290120/

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Should Silicon Valley Take The Pentagon Seriously?

Culture still trumps law in the quest for military innovation.

(DEFENSE INDUSTRIALIST (ATLANTIC COUNCIL) 21 APR 16) ... James Hasik

On Tuesday evening, as part of the Council's Captains of Industry series, our Lund Fellow Steve Grundman hosted a panel discussion amongst the CEOs of three Californian startup firms. Mylea Charvat's Savonix is building a "mobile, clinically valid, reliable, neuro-cognitive assessment and brain health platform." John De Santis's Hytrust is writing and deploying software that automatically monitors and secures computing infrastructure for "continuous compliance." Gary Gysin's Liquid Robotics is "instrumenting the ocean" with its fleet of Wave Gliders, solar- and wave-powered robots that track everything from whales to submarines. All three want to help, but have had their frustrations with the government. And all three agreed that the government has a ways to go in convincing the startup community that it's serious.

The want for fresh ideas from new sources has been a consistent message during Pentagon officials' periodic pilgrimages west. Last week, the Building went further, asking the Congress to consider, in its final writing of the 2017 National Defense Authorization Act (NDAA), actual set-asides for newcomers. The program would offer contracts for as long as two years, twenty of up to $2 million, and five of up to $5 million, to "companies who have done little or no business with the federal government, but can provide needed innovation." Those aren't the monies that get new bombers or missile cruisers built, or even designed. But they are rather like the engineering funding that CIA venture outfit In-Q-Tel has long been providing. And as our panelists agreed, they're the kind of monies that can get startups interested in work with a military purpose.

The Congress, however, is not yet fully impressed. Defense Secretary Carter is, of course, most enthused about his new outpost in Silicon Valley – the "Defense Innovation Unit Experimental" (DIUx). While the nascent office has started small, the Pentagon's budget submission now requests about $30 million in annual RDT&E funding for the DIUx in fiscal years 2017 through 2021. But in its writing of the 2017 NDAA, the House Armed Services Committee expressed concern "that outreach is proceeding without sufficient attention being paid to breaking down the barriers that have traditionally prevented nontraditional contractors from supporting defense needs, like lengthy contracting processes and the inability to transition technologies." Under that bill, the DIUx would get nothing and like it until the secretary submits yet another report.

The HASC's rather weak remedy does illustrate how the government can't simply legislate change. Our panelists similarly stressed that the Pentagon needs more than an outpost, pointing the way to Washington, advertising that the Defense Department is open for business. No matter how many whiteboards and beanbag chairs the military's people bring, their "lengthy contracting processes" will continue to discourage entrepreneurs and financiers who can find faster, higher returns for their troubles. As one discussant at our subsequent dinner argued, speeding the contracting isn't a training issue, but a cultural one. The dense rulebooks actually offer considerable flexibility in contracting already, but the layers of acquisition bureaucracy have encouraged legions of veto players who search

those books for ways to say no. That sort of thinking is simply anathema in Silicon Valley, and it can't be cleared away by inserting language in a bill.

It's also rejected at the Special Operations Research, Development and Acquisition Center (SORDAC) in Tampa, even without any special authorities in law or regulation. As Hondo Geurts told us back in January, he has been working there to acculturate a team that can say yes. Proximity to the leaders they support makes that easier, as the materiel managers can draw their inspiration from people who actually need to operate "at the speed of SOF." In this way, there's a reason that the U.S. Air Force runs so much electronics work out of Hanscom Field, alongside Route 128. There's a reason that the Army Research Laboratory is situated in Durham. The Army's Tank and Automotive Command is also most logically at the Detroit Arsenal. If you want to buy trucks, set up shop where the trucks are designed and built.

Silicon Valley is the leading example of this dynamic globally. The unique mixing of financial, legal, marketing, and engineering talent in commercial clusters propels what the people there can achieve. So could the Defense Department benefit by relocating some contracting officials to Sand Hill Road? Real estate sticker shock aside, our panelists were unconvinced that was necessary. But place matters in business, and the DIUx still feels a bit out of place.

http://www.atlanticcouncil.org/blogs/defense-industrialist/should-silicon-valley-take-the-pentagon-seriously

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The US Needs More Weapons That Can Be Quickly and Easily Modified – UAS

Something truly astonishing happened this month, although many in Washington were too busy chattering about "the broken defense acquisition system" to notice. When Defense Department officials totaled up the cost growth on the 38 major defense acquisition programs (MDAPs) launched in the wake of the landmark Weapon Systems Acquisition Reform Act of 2009, they found that the grand total was…negative. That is, costs actually declined.

These 38 programs represent half of all MDAPs, so this result is probably the best evidence to date that acquisition cost growth is not, in fact, the grave threat to humanity and national security we had imagined. And while it is premature to declare victory over cost growth, perhaps it is at least appropriate to consider whether such growth is really the acquisition system's central problem. To make a long story short, the answer is: no.

But hold the parties on K Street and the clapping of slide rulers in certain halls of the Pentagon; the end of history has not come. The real challenge to defense acquisition, the enemy in whose service cost growth was only ever a minion, is the rapid erosion of the technological advantage upon which U.S. national security strategy depends. The United States is being challenged by Russian aggression in the Ukraine and elsewhere, underpinned by dramatic improvements in Russia's military technology and operational proficiency; and by Chinese aggression in the South China Sea, enabled by military reforms

that have driven, among other things, advances in anti-access area denial capabilities. It is even being challenged by ISIS and other non-state actors, who are using car bombs and other relatively low-tech systems to confront national armies.

While the defense acquisition system has contributed to the problem — maddening program failures and drawn-out acquisition timelines are still too common — the source of this erosion lies elsewhere. It is driven by competitors' focused investments in advanced capabilities, and by the increasing availability of commercial technologies that bear on military problems. Consider the iPhone, which essentially hosts in one pocket-sized device all of the imaging, networking, and geolocation capabilities that the U.S. military developed over multiple decades, then used to overwhelm opponents. The diffusion of sophisticated military capabilities is outside of anyone's control, and is unlikely to be limited or reversed. U.S. adversaries will use them to undermine, challenge, or even exceed U.S. systems in certain niche areas that support their objectives.

The Defense Department's much-discussed Third Offset Strategy, its new outreach to Silicon Valley, and its internal Better Buying Power 3.0 initiative are all responses to this fundamental problem. Each is important and worthwhile, but even more needs to be done. There are important steps the department and Congress, working together, can take to add agility to the defense acquisition system so that it fields an enduring technological advantage. Among them: increase the prominence of DoD's head of research and engineering, as suggested by Dr. John Hamre, former deputy defense secretary of Defense and president of the Center for Strategic and International Studies.

The past decade of war taught us how to field weapons and gear faster through dedicated rapid-acquisition lanes. Now we must apply those lessons to create a new lane for adaptable systems. The best example is the Predator drone, which has been continuously modified, upgraded, and morphed into new variants to respond to new threats and new technology. Today a program of record, Predator didn't start that way and has never followed the typical path for a major weapon. If we're lucky, it never will.

To start with, this new adaptable-systems lane needs more financial flexibility. Today's new efforts generally take at least two years to start receiving funding; even when existing budgets contain relevant funding, a year can pass before the money can be redirected. This is far too slow for areas of fast-moving technology. The rapid-acquisition lane has successfully used flexible funding accounts, rapid reprogramming, and rapid acquisition authority; the new adaptable-systems lane needs these as well. Just as important is flexibility in the "color of money" — that is, the rules that separate the funds for development and testing from those used for production. A truly adaptable system will be simultaneously in production and development for most of its operating life.

Also needed: a modified requirements process. The standard approach focuses on system-level attributes, extended analysis, and inflexible performance parameters that become pass/fail criteria. Adaptable systems need dynamic requirements that can be revisited and modified constantly, as well as a recognition that system-level attributes will often be less important than the subsystem attributes they enable.

Even baselines and other foundational acquisition concepts need a rethink. In the standard approach, baselines are established when a program enters development, are rarely modified, and are used to judge the program's success. For an adaptable system, however, deviation from the baseline is to be expected. It is a feature, not a bug. A better approach would ensure reasonable planning and accountability, but would also allow the program to evolve through use of a dynamic baseline. Having a dynamic approach to requirements and baselines will also require testing regimes that keep up with many program changes.

Ultimately, having technology that is ready to go and organizations prepared to do things differently will be critical. Prototyping and experimentation will provide the technology feed-stock for the adaptable systems lane. As well, Defense Department leaders must offer their support as systems enter the adaptable systems lane to ensure they receive the resources and attention they need.

This concept of an adaptable systems lane complements current Congressional efforts on defense reform. Recent hearings in the House and Senate have sought to identify areas where reforms are possible. A public web survey on defense reform that my think tank, the Center for Strategic and International Studies released on March 14, finds that a large majority of the public believes acquisition reform remains deeply needed. The chairman of the House Armed Services Committee, Rep. Mac Thornberry, has said he will include in the 2017 defense authorization bill language to foster more prototyping and the use of modular open systems architecture to make it easier to modify and upgrade systems. His counterpart in the Senate, Sen. John McCain, has likewise indicated that he is looking to make reforms this year. The time is ripe to give the DoD the tools it needs to field an enduring technological advantage.

http://www.defenseone.com/ideas/2016/04/us-needs-more-weapons-can-be-quickly-and-easily-modified/127787/

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