Unmanned Systems Sentinel

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NAVY/USMC:

Air Boss: Looking for 'Sweet Spot' in MQ-25 Unmanned Aircraft Design

SILVER SPRING, Md. — The Navy is looking for the right balance of characteristics for its planned MQ-25A Stingray unmanned carrier-based aircraft for its missions and carrier handling.

Vice Adm. Mike Shoemaker, commander, Naval Air Forces, speaking Aug. 12 to an audience at the Center for Strategic and International Studies, a Washington think tank, said the defense industry responses to the Navy's request for proposals for the MQ-25A have been received.

"We're looking at where the trade space is," he said. "There's a tanker trade study, and it's really the design of the two mission sets we think that airplane will do: mission tanking and intelligence, surveillance and reconnaissance [ISR], [with] ISR a gap that we need filled on carriers. Those platforms that do one of those mission sets alone are different."

He noted that a high-endurance, efficient, large-wingspan ISR platform would be different from a tanker, which would need to carry a large amount of fuel internally.

"Where that sweet spot is to do both of those missions [is the goal of the MQ-25 design]" he said. "How big that platform will be on the ship is a key attribute — the spot factor, and then how many people it will take to run that detachment."

"We need to get [the MQ-25A] to the fleet as quick as we can so we can learn about that manned/unmanned teaming," he said.

The MQ-25 is the latest iteration of a carrier-based unmanned aircraft design, preceded by the Unmanned Carrier-Launched Aerial Surveillance and Strike (UCLASS) system. Initially named the Carrier-

Based Aerial Refueling System (CBARS), the MQ-25A will not have survivability as a key performance parameter, Shoemaker said.

For mission tanking, "you've got to push [a tanker] out ahead of everybody to get it on station so you can launch your other airplanes to get up there and tank, so if you send the MQ-25 out by itself, and it doesn't have survivability, you've got to make sure you know where you're sending it so it's not going to get shot down," noting that the defense industry has designed in airframe shapes that help with survivability.

"If there's a way to capitalize on existing designs in what we come to with what MQ-25 ends up being, even though we've not said survivability is a key [performance] parameter this time around, there [are] ways to tank advantage of shapes already out there."

Referring to a recent article about a "stealth tanker," "those two [concepts] don't go together with MQ-25," Shoemaker said.

http://www.seapowermagazine.org/stories/20160818-mq25.html

MQ-25 Unmanned Aircraft Poses Design Challenges for Navy, Industry

http://www.nationaldefensemagazine.org/blog/Lists/Posts/ViewPost.aspx?ID=2277

Top Navy admiral: New Stingray drone will be a tanker

https://www.navytimes.com/articles/cno-new-stingray-drone-will-be-a-tanker?utm_source=Sailthru&utm_medium=email&utm_campaign=Defense%20EBB%2008-25-16&utm_term=Editorial%20-%20Early%20Bird%20Brief

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Drones Take to Sea As Navy Aims to Tap Tech

Possible uses for unmanned vehicles include gathering intelligence on opponents, hunting submarines and charting the ocean floor

This fall, an unusual vessel will begin sea trials off the coast of California.

The 51-foot-long Boeing Echo Voyager will have no crew. It will glide underwater for days or weeks, quietly collecting data from the ocean floor to send back to crews on ships or on land.

Ever since the start of the war in Afghanistan in 2001, the U.S. military has relied more and more on flying drones to take on dangerous air missions. But increasingly, drones are taking to the sea as well.

The U.S. Navy has proposed about $319 million for the development and purchase of underwater drones in the president's FY2017 budget. It envisions them stealthily gathering intelligence on opponents, detecting and neutralizing mines, hunting submarines and charting the ocean floor.

Last year, the Navy created the first deputy assistant secretary position (General Frank Kelley, USMC/Ret) focused on managing the development of unmanned systems, including underwater, surface and aerial efforts.

Recent advances in autonomy, data transmission and miniaturized computing power coincide with the military's increased interest in finding ways to integrate unmanned systems into its war planning.

"As tensions continue to grow with China and Russia, 2 militaries that have sophisticated and very large navies, there is a growing interest in making use of unmanned technology in the maritime sphere," said Arthur Holland Michel, co-director of the Center for the Study of the Drone at Bard College in New York.

"They are scalable, they are dependable, they can operate with a fairly high degree of autonomy," he said. "All these things would have been useful 30 years ago, but the technology wasn't quite there."

The potential for naval drones to operate free of human operators was shown this year when the DARPA unveiled its Sea Hunter, a largely autonomous, unmanned anti-submarine vessel.

The prototype 132-foot-long Sea Hunter is designed to sail on its own for as long as three months, find a submarine using sonar and other sensors and trail it while sending location data to human operators. The vessel completed its first performance trials off San Diego in late July, its builder, Reston, Va., company Leidos said.

Underwater drones face different challenges than their aerial counterparts. For one, communication is more difficult, making it hard for an autonomous vehicle to report information.

That hurdle is being worked on by Liquid Robotics, a Sunnyvale, Calif., firm that makes the Wave Glider. The unmanned vehicle floats on the surface and uses wave and solar power to propel itself and its sensors for as long as a year.

The surfboard-shaped drone functions as a kind of gateway between underwater acoustic communications and air-based radio transmissions.

The vehicle's sensor computer connects a surface radio modem and antenna with an underwater acoustic modem, allowing information to be transmitted quickly back and forth.

The same connection can be established with ships, though that can be expensive, or with buoys, which don't allow for much movement.

Other underwater vehicles have towed long antennas, but that is a much slower method of transmitting data, said Graham Hine, senior vice president of global partner development at Liquid Robotics.

"We're thinking it would be the router of the ocean," he said. "Once you start to network things and then have ubiquitous communications and positioning, things start to get interesting."

The Wave Glider can carry a range of acoustic sensors that listen for vessels on the sea or piece together a picture of the ocean floor.

Originally developed by company co-founders Roger Hine and Joseph Rizzi to listen to whale songs, the Wave Glider caught the interest of the Navy, which has worked with the company since 2008.

Two years ago, the company struck a partnership with Boeing Co. to develop a military version, the Sensor Hosting Autonomous Remote Craft, or SHARC, that combines the Wave Glider platform with Boeing's sensor technology.

Boeing sees the platform as a potential communication conduit between underwater vehicles and aircraft, ships or satellites. It is working with the Navy's research lab to develop additional capabilities.

"Ultimately, it is a more efficient and effective way to do maritime surveillance, we think, in large ocean areas," said Egan Greenstein, senior director of autonomous maritime systems at Boeing.

But to do a thorough job of surveillance and undersea data collection, drones need to stay submerged for weeks or even months without external help or power.

Boeing experienced this challenge first-hand when it used its Echo Ranger unmanned underwater vehicle for oil and gas surveying. The drone charged up and reported its status at a host ship, but when storms blew in all operations had to stop.

Eventually, Boeing stopped using the Ranger for that kind of commercial work.

"It was profitable while we were out doing the survey missions," said Dan Tubbs, deputy director of Sea & Land at Boeing Phantom Works in Huntington Beach. "It was not profitable when it was in port all the time."

In March, Boeing unveiled the 50-ton Echo Voyager, which is designed to carry out months-long surveillance and reconnaissance missions for defense, commercial and scientific customers.

Powered by a hybrid electric-battery/marine diesel system, the drone periodically surfaces to snorkel depth to recharge its batteries by raising a mast and running the diesel engines. That's when the drone also can connect to satellite operations to transmit data to operators. It can send limited communications while submerged, but only to a nearby ship.

To bolster its endurance, the Echo Voyager has backup systems. To give it a degree of autonomy, the navigation system incorporates motion and rotation sensors, as well as sonar to avoid obstacles.

Autonomous systems have the potential to cut personnel costs, but developing them has proved to be complex and costly.

In February, the Navy canceled further production of a remote mine-hunting system developed by Lockheed Martin Corp., cutting down the expected order from 54 to 10 that had already been delivered. The system was to be used in the Navy's new littoral combat ships, but the autonomous vehicles that towed mine-hunting sensors were unreliable.

"The autonomy side of the equation, the research is happening at a very quick pace," said Holland Michel of Bard College. "But as you see time and time again, it's very challenging to make unmanned systems that can make intelligent and dependable decisions on their own."

The biggest challenge to the industry's growth could be its lack of versatility. There are simply more applications for unmanned aerial vehicles than underwater drones, especially in the commercial market, said Michael Blades, senior industry analyst for aerospace and defense at research and consulting firm Frost & Sullivan.

"I think the market will grow steadily, but it won't be explosive like the unmanned aerial vehicle market," he said.

Eventually, though, the two drone worlds will merge.

In May, AeroVironment Inc. of Monrovia announced it had a contract to sell to the Navy its small, Blackwing unmanned aircraft, a single-use drone that shoots out of a tube from submarines or autonomous undersea vehicles. It sends back data, then drops into the water once it's done.

http://www.latimes.com/la-bio-samantha-masunaga-staff.html

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Latest Naval Technology Includes Blackwing Drones

NEWPORT – Some of the latest innovations in undersea technology were on display here Thursday, including an unmanned aerial vehicle that can be launched into the air from a submarine or from unmanned underwater vehicle.

Demonstrated technologies ranged from cutting-edge research to products that have already been acquired by the Navy.

Take the Blackwing, a 20-inch-long, 4-pound unmanned aircraft that folds up into a 3-inch-wide canister. Once the canister is launched from a submarine, for example, and hits the surface, the Blackwing comes out and opens its wings. Its flight time is about an hour.

The Navy is set to acquire 150 Blackwings to be used on its attack and guided missile submarines and unmanned underwater vehicles.

Developed by AeroVironment, the Blackwing is designed primarily for intelligence, surveillance and reconnaissance missions.

The Blackwing embodies what Navy officials mean when they talk about developing “longer arms” for submarines to increase their capabilities.

“The submarine force has wanted flying-periscope capability, if you want to think about it that way, for a long time,” Jeffrey G Morrison, a program officer with the Office of Naval Research, said.

The Navy will begin installing the software on submarines in the 2019 time frame, and every submarine from that point on will have it "as part of its baseline, so they can use it when they need to.

The technology was derived from the Switchblade, which AeroVironment officials call "a weapons system." The Switchblade, which is designed to take out small targets without causing a lot of collateral damage, is being used by the Army and Marine Corps. About 1,500 Switchblades have been produced.

The Senate's version of the 2017 defense budget includes $127 million for undersea warfare technologies, U.S. Sen. Murphy, D-Conn., noted in addressing Thursday's crowd. That's $7 million more than what President Barack Obama requested in his budget.

The Senate and House, which are in recess, still need to work out the differences between their two defense bills and vote on a finalized version.

On a trip aboard the USS Hartford to the Arctic this spring, Murphy "saw firsthand all of the new capabilities that we will need as we head into a decade, as we head into a quarter century in which the Arctic is going to be up for grabs, in which there is going to be more navigation."

Earlier in the summer, Murphy went on a congressional visit to Asia, where he talked "nonstop" with officials in Japan, the Philippines and Korea about "the activity of the Chinese to try to build and take control of enough territory in the South China Sea, to be able to cast a detection net for U.S. submarines that is unprecedented."

"As our adversaries and our competitors ... rapidly advance their technologies to try and catch up with us, it provides a mandate for us to get much better not only in our means to figure out what they're doing as they try to exert more control over places like the South China and East China Sea but also our ability to be able to conduct our activities and missions that we have become accustomed to," Murphy said.

http://www.theday.com/military/20160818/latest-naval-technology-includes-blackwing-drones

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Marine Corps Experimenting with New Drones

The hum of unmanned aerial vehicles could be heard during a recent experiment in California. Tiny quadcopters zipped across the sky as an MQ-9 Reaper flew overhead.

The test — known as the Marine Air-Ground Task Force Integrated Experiment, or MIX-16, and hosted by the Marine Corps' warfighting laboratory — marked an effort by the service to study and eventually acquire new, powerful drones to give troops increased situational awareness and communications.

Unmanned aerial vehicles evaluated at the event — which took place in California at Camp Pendleton and Twentynine Palms in July and August — included a mix of tiny drones that could fit in a Marine's

hand to systems that weighed thousands of pounds, said Lt. Col. Noah Spataro, unmanned aerial systems capabilities integration and requirements officer at the Marine Corps' capabilities development and integration office.

The service — which currently operates systems such as the Raven, Wasp, Shadow, Puma and Blackjack — is looking for new systems that can provide troops with increased capability, and is especially interested in small systems, he said.

Vertical take-off and landing aircraft, also known as VTOL, could be especially useful, he noted.

"Those right now aren't part of our program of record, and so that's where this experiment is really important because it's helping us define how do you operate with these things? How do you sustain them? What are the best tactical scenarios to integrate them with?" Spataro said.

Such systems would be ideal in urban environments where buildings can make it challenging to launch fixed-wing drones, he said.

"If you are say in a city and you need to get eyes on a specific area, or you're doing a patrol through a city and you have all these vertical obstructions, it's really hard … to try and launch this aircraft if you've got fixed wings," he told National Defense.

At the same time, VTOL systems often have limited battery life, making a fixed-wing asset potentially more useful for certain missions, he noted.

"With the fixed wing, you need a little bit more space for launch and recovery but you're going to get better endurance," he said. Plus, "it's going to orbit the target so you're going to get a bunch of different views while it's flying around."

The Marine Corps will need a combination of both kinds of systems in the future, he said. During MIX-16, it tested systems such as Prox Dynamics' PD-100 Black Hornet, PSI Tactical Robotics' InstantEye and Lockheed Martin's Terminator. It is also looking at potentially acquiring a medium-altitude, long-endurance system, such as a Reaper, he noted.

At the exercise, the service used an MQ-9 as a way to create a communication network with Marines on the ground, Spataro said. "It's providing a mesh network overhead — so basically Wi-Fi for grunts. I like to call it GruntNet."

Using a connected radio, "I can talk over a mountain. … I can talk to folks in vehicles that are moving, Marines on patrols," he said. "All those things can be networked together and they can share their position, their actual location information. They can chat with each other and they can even push video."

Marines on the ground "are looking for something that is over the shoulder that is able to give them that heads up and it feels like a guardian angel," he said.

Large systems often need to be stealthy. That would not be the case for a system the Marine Corps would purchase, Spataro said.

“To keep things cheap for like a Group 5, I don’t know that … [a low-observable capability] is specifically a key performance parameter. It may be important but the Marine Corps is not rich,” he said. Group 5 systems weigh more than 1,320 pounds and fly at an altitude of more than 180 feet.

The service is also interested in employing a mother ship concept for its unmanned systems, he said. The Marines could fly a Reaper to a certain location and once it reaches its endurance limit it would launch smaller systems, he noted.

“It would extend the network, it could extend the sensors,” he said. “When you’re done with the mission … ideally you’ll recover it back and be able to use it again and maybe even refuel it off the big aircraft, the mother ship. But if you lose it, it’s not the end of the world either.”

For these smaller systems, which would likely be Group 3 aircraft such as a Shadow or Blackjack, there would be a need for them to be stealthy, he said. Group 3 systems weigh less than 1,320 pounds and fly at an altitude of less than 180 feet at speeds of less than 250 knots.

“That’s kind of what I’m thinking is the future — you have big things carrying smaller things and that will be able to affect a higher threat environment where low-observable [technology] might be more important,” he said.

Peter W. Singer, a strategist and senior fellow at New America, a Washington, D.C.-based think tank, said small drones would be a top priority for the Marine Corps.

“The future is more likely to be smaller systems, regardless of the region” the Marine Corps operates in, he said in an email. “They are not just cheaper and thus more disposable, but also have been the ones that have received the most enthusiasm in exercises.”

There is “a greater need for systems that can aid in the urban fight,” he said. “Urbanization is taking off regardless of region, so it’s a good bet that future USMC deployments, whether in war fighting to humanitarian disaster relief, will be in an urban zone.”

Purchasing new unmanned systems will be critical for the Marine Corps as it goes back to its sea-based roots, said Paul Scharre, director of the 20YY Future of Warfare Initiative at the Center for a New American Security, a Washington, D.C.-based think tank.

“The situation the Marine Corps has been in for the last 15 years has actually been a little unusual in that in some ways they have been functioning as a second land Army in Iraq and Afghanistan,” he said. “The Marines have been going back to the sea. They’ve been transitioning to a posture where they are back on ships and they are ready to respond to crises around the world. That’s ... sort of reinvigorating some training and doctrine that they haven’t used in a while and it certainly has implications for their unmanned aircraft.”

The service will likely need aircraft that can be rail-launched off ships to protect Marines on the ground, he said. Such systems could also be recovered with a hook or a net.

“Having a larger fixed-wing aircraft that could fly off of an amphib … [would put] powerful capabilities over Marines’ heads,” he said. “You could have persistent surveillance, you could have weapons on board, you could have communication relays which is very valuable for them in the kinds of environments they are going to be in sometimes — where they’re going to be pretty austere.”

But such a system could affect deck space, making a smaller, VTOL aircraft a more appropriate choice, he said. They have “limited range and endurance, [but] there is a benefit because they can … [take off and land] without disrupting deck operations for Marines and their amphibious ships.”

There is an effort by industry to create larger VTOL systems, Scharre said. These systems could be “game changers,” he noted.

“I’ve seen a lot of really interesting designs from companies where now that you’re building something that doesn’t have a person on board, you just can do a lot of innovative things in terms of aircraft design,” he said.

“As we see the technology develop you’ll see a desire in the Marine Corps for larger, vertical take-off things that might be like a tilt-rotor, like an Osprey, or some other type of transitional aircraft,” he said.

While the Marines will invest in new UAVs, they will also look at developing powerful new sensors to put on board those systems, Scharre added.

“The most interesting sensor development in the last couple of years that has just sort of flirted with operational maturity are these wide-area surveillance sensors,” he said. “Instead of putting one camera on a drone why can’t I put 60 cameras, like a fly’s eye that can survey an entire city and then stream down [data]?”

Wide-area sensors would make a massive difference for troops on the ground, he said. While the technology is still being developed, it could be ready for primetime within the decade.

“You could see this being increasingly valuable — you could have drones overhead that are actually telling the Marines on the ground what the things are that are coming,” he said. “Instead of having someone watch the video feed and look for objects, the drone is actually watching. It’s actually sensing and detecting the environment and it’s telling them, ‘There’s a car approaching. There’s a RPG [rocket-propelled grenade] up ahead.’”

“If you think about the Asia-Pacific, you think about systems that are survivable in contested airspace,” said Philip Finnegan, director of corporate analysis at the Teal Group, a Fairfax, Virginia, defense and aerospace market analysis firm. “That means they need to be faster, stealthier and have greater autonomy than existing systems.”

Such a system would have to be relatively large, on the scale of a medium-altitude, long-endurance unmanned aircraft, he said. A Gray Eagle might be one option, he said.

"There are … companies that want to get into the MALE market and this could be an entry point for them," he said.

Lockheed Martin, General Atomics, Northrop Grumman and Boeing would all likely be interested in competing for such a contract, he said.

"It's those larger players with a lot of aircraft capability that are going to be" interested in this, he said. However, it will ultimately depend on the direction the Marine Corps decides to go, and it is still early in the process, he noted.

http://www.nationaldefensemagazine.org/archive/2016/september/Pages/MarineCorpsExperimentingwithNewDrones.aspx?utm_source=Sailthru&utm_medium=email&utm_campaign=New%20Campaign&utm_term=Editorial%20-%20Early%20Bird%20Brief

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Navy Tests Underwater Drones at Exercise

NEWPORT, R.I. — In Rhode Island's Narragansett Bay, unmanned underwater vehicles bobbed up and down during a three-day exercise designed to test cutting edge technologies for the Navy. The drones ranged from systems that could fit in a backpack to vehicles that required cranes.

Rear Adm. Moises DelToro III, commander of Naval Undersea Warfare Center, said Aug. 18 that the Annual Naval Technology Exercise is "designed to demonstrate future naval technologies in action today. Naval warfare centers, universities and our industry partners are here showcasing their latest unmanned systems and related technologies in water."

At the exercise — known as ANTX 2016 and hosted by NUWC's Newport division — scientists and engineers were able to evaluate their technology at the research and development level before the systems become militarized and are integrated at the operational level, he said during a speech on the last day of the exercise. ANTX 2016 focused on cross-domain communication between unmanned systems, he added. The exercise featured more then 300 personnel and 30 companies, he said.

"ANTX takes the idea of collaboration one step further by giving participating organizations the opportunity to demonstrate their technologies and products live in the water here at Narragansett Bay," said Mary S. Wohlgemuth, technical director at NUWC Newport.

The Narragansett Bay Test Facility provides an ideal, low-cost environment for industry to test their technology, she said.

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

Murphy said developing unmanned underwater vehicle technology would be critical as adversaries beef up their spending on defense.

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

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

China has been making major investments in its naval fleet as it attempts to control the South China Sea, he said.

“As our adversaries and our competitors have new means and new capabilities to find us, as they rapidly advance their technologies to catch up with us, it provides a mandate for us to get much better — not only our means to figure out what they’re doing as they try to exert more control in places like the South China and East China Sea, but also our ability to be able to conduct our activities in a means that we have become accustomed to,” he said.

Lockheed Martin brought an autonomous underwater vehicle known as the Marlin to the exercise. The system, equipped with a canister, was able to launch a Vector Hawk unmanned aerial vehicle when it surfaced, said Gregory Lester, thought leadership lead at Lockheed Martin.

“Together that’s a novel cross-domain … communication activity,” he told National Defense.

Marlin was also able to examine the floor of the bay, Lester said. Using information collected by the system, Lockheed created a model of the ocean floor using a 3D-printer onsite.

General Dynamics also tested its SandShark and Bluefin-21 underwater systems at the event, said Tracy Howard, director of undersea programs at the company.

The Bluefin-21, a heavyweight UUV, carried four SandSharks during one demonstration. Two systems then were launched from it to complete other missions, he said.

Once launched, the SandSharks collected information, surfaced and sent that data to a Black Wing unmanned aerial vehicle, which then relayed it to a simulated submarine combat control system.

http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=2278

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Navy asks for help spotting drones in Idaho

BAYVIEW, Idaho — The U.S. Navy is asking northern Idaho residents to report any unauthorized drones flying near its base in Bayview.

The Bonner County Daily Bee reports that the U.S. Navy Acoustic Research Detachment on Lake Pend Oreille says drones flown near military operational areas pose a safety and security risk for the Navy and the local community.

Retired Navy Capt. Roxie Merritt said in an email that there have been some drone issues near Bayview. She says two drones recently collided over the facility and could have hurt someone when they fell down.

Drone pilots are required to follow Federal Aviation Administration regulations.

The Navy is asking residents who see or hear drones over the Bayview base to report it to the Navy .

https://www.navytimes.com/articles/navy-asks-for-help-spotting-drones-in-idaho?utm_source=Sailthru&utm_medium=email&utm_campaign=Defense%20EBB%2008-24-16&utm_term=Editorial%20-%20Early%20Bird%20Brief

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Board Recommends Further Use of Autonomy in Sea Control, Support of Ground Troops

The U.S. Navy and Marine Corps should advance the way they use unmanned systems, favoring greater autonomy over remotely-controlled missions and developing multi-vehicle systems such as swarms and cascaded operations, according to a recently released report by the Defense Science Board.

The DSB report, requested by the Pentagon's acquisition chief in November 2014, notes a variety of Pentagon-wide challenges in developing, testing, fielding and operating autonomous systems, such as operator trust, cyber security and developing a test and evaluation plan for learning systems.

Specific to the Navy, the board recommends adding greater autonomy to Navy counter-mine unmanned underwater systems as a way to save time and keep personnel even farther from potential dangers.

"Currently deployed counter-mine applications use UUVs for persistence and protecting humans from danger, but rely on human operators at a command center to process data for target classification. This is followed by a separate mission to neutralize any mines detected," according to the report.

"Autonomy can reduce both the time to neutralize the threat and the danger to the personnel assigned to the task."

The report notes progress in incorporating unmanned technology into the mine countermeasures mission, going from MCM-1 class ships that "can detect, classify, and neutralize all known types of mines, but are manned by a crew of over 80 individuals" to the MK-18 Mod 2 UUV – though Mk-18 operations today "continue to require long tactical timelines with intensive operator involvement, including a manned platform entering the minefield during the neutralization stage. Increased autonomy could reduce the demand for manning and personnel risk, and decrease the tactical timeline."

DSB acknowledges ongoing Navy research efforts such as the Single Sortie Detect-to-Engage program, but the report recommends a focus on automatic target recognition and autonomous launch and recovery – which would eventually allow MCM-related UUVs to be delivered by even larger UUVs, keeping personnel even farther from potential underwater mines.

To achieve these goals, the report recommends that the Office of Naval Research (ONR) and Program Executive Office for Littoral Combat Ships (PEO LCS) conduct a user operational evaluation system program that would cost about $60 million a year for three years. The first step would be to take a UUV already in the platform and outfit it with an automatic targeting recognition system, which would locate and identify mine-like objects and ping a remote operator only for verification of the object's identification, instead of today's two-sortie operation with "intensive operator interaction."

The user operational evaluation program would then add communication from the remote operator to the mine disposal platform to avoid a scenario in which humans would have to go into the minefield. In a final step, the whole detect-to-engage system would be delivered by a large UUV or an unmanned surface vehicle, not only keeping personnel further from the minefield but also adding an element of covertness.

"Utilizing this acquisition model, fleet operators would work with developers during the course of the program to experiment with the system to rapidly evolve (concepts of operations), and design and characterize system strengths and limitations. After four years, the program would transition the enhanced MCM package to the Navy's 5th Fleet," the report recommends.

Related is the report's recommendation to pursue "cascaded UUVs," where an extra-large UUV might deliver smaller UUVs to an area of operations, collecting real-time information and passing that along to its small UUVs before deploying them for their mission – offensive mining, mine countermeasures, decoy delivery and more.

The report recommends that the Navy and the Defense Advanced Research Projects Agency (DARPA) conduct an experiment in which these large and small UUVs work together to create a minefield to restrict enemy movement. The experiment, which would also cost $60 million a year over three years, would first demonstrate the ability to find and target enemy surface combatants using radio frequency (RF) emissions and acoustic signatures. Next, the Navy and DARPA would select the right UUV modular torpedo for the mission, which could balance the command and control smarts of a UUV with the high-explosive warhead of a torpedo.

In the final demonstration, the extra-large UUV would navigate to its area of operations and deploy the UUV modular torpedoes, which would begin to seek adversary targets. Once they begin hitting targets, the UUV modular torpedoes might even recognize remaining UUVs' locations to spread out and autonomously "heal holes" in the minefield.

"These concepts could be readily applied to other missions. For undersea missions, acoustic and RF decoy payloads would likely be much smaller than sea mines, and thus could be more easily deployed in quantity from existing commercial UUVs," the report notes.

"While today's electromagnetic maneuver warfare capabilities are limited, UUVs could provide a means to significantly extend capabilities and enable a covert option with a small observable footprint until electronic warfare (EW) operations are initiated."

On the Marine Corps side, the report recommends developing unmanned aerial support teams that can operate swarms of 10 or more vehicles in support of tactical units. The service, ONR and DARPA should collaborate with a university-affiliated or federally-funded research center to test a "low-cost UAS fleet of at least ten vehicles with distributed (intelligence, surveillance and reconnaissance), (electronic warfare), communications, and strike payloads."

They would develop concepts of operations for this swarm of UAVs; refine launch and recovery processes so that a three-man team could recover, refuel and re-launch the vehicles within 15 minutes; and create communication, information management and user interface systems to connect the UAVs, the UAV support teams and small tactical units on the front lines through a tablet or smart phone.

In parallel, the report states, the Marine Corps Combat Development Command should hold a competition to design the UAV, with an emphasis on using non-proprietary avionics and command and control and including an "Integrated software switch allowing the remotely piloted command and control system to switch between automatic and autonomous operating modes."

DSB makes these experimentation suggestions and others as a way to highlight "the need to strengthen the operational pull for autonomy by demonstrating operational value across a broad range of missions." The report also highlights the need to build trust in autonomous systems, the need to accelerate adoption of autonomous systems though Pentagon-wide enablers such as acquisition and test and evaluation changes, and the need to use new autonomous technologies to help the U.S. sustain its military advantage.

https://news.usni.org/2016/08/24/board-recommends-use-autonomy-sea-control-support-ground-troops?utm_source=Sailthru&utm_medium=email&utm_campaign=Defense%20EBB%2008-25-16&utm_term=Editorial%20-%20Early%20Bird%20Brief

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ARMY:

NORTHCOM official: JLENS provides valuable data

Despite the embarrassing setbacks and incidents that felled the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System, or JLENS, one official lauded the information gathered from the aerostat program.

“I do think it did bring us value in the data that we did collect as part of the experiment,” Brig Gen Ronald Buckley, deputy director of operations at Northern Command, said of JLENS at the Space and Missile Defense Symposium in Huntsville, Alabama, Aug. 17.

While teeing up his comments with the caveat that his North American Aerospace Defense Command counterparts would be better-suited to address JLENS issues, he offered that “for me sitting on the sidelines and watching them deal with it, obviously JLENS getting away from us and taking the trip to Pennsylvania was an unfortunate outcome that I think the exercise itself, the experiment of JLENS, did highlight the fact that we do need elevated sensors and certainly we did collect valuable data from that.”

In the fall of 2015, the system broke free and traveled from Aberdeen Proving Ground in Maryland to Pennsylvania causing disturbances for the military forcing the scrambling of two F-16 fighter jets as well as residents left without power in its path.

JLENS was designed to track cruise missiles and other threats toward North America.

“JLENS provides unique cruise-missile defense capability to our integrated air defense system for the National Capitol Region. It is in the best interest of the nation to continue the program. Investigators took a hard look at the causes of the incident, and I am confident that we have a plan of action to safely fly the aerostat again,” said Adm. Bill Gortney, former commander of North American Aerospace Defense Command and U.S. Northern Command.

The Pentagon has spent roughly $2.7 billion across nearly two decades on aerostats designed to protect against airborne threats. These programs have been marred with problems. JLENS specifically was part of a three-year experiment to integrate aerostat blimps into the NORAD air defense system, but problems included difficulty in tracking flying objects, software glitches, vulnerability to attacks and, to some extent, inability to operate in inclement weather.

Despite the significant costs and investments made in the program, it suffered from a raft of problems and is slated to be retired in forthcoming legislation, leaving some defense officials scrambling for a missile warning sensor alternative.

“I think at this point we all recognize that it’s probably a road too far to get JLENS back in the mix,” Buckley said.

http://www.c4isrnet.com/articles/northcom-official-jlens-provides-valuable-data?utm_source=Sailthru&utm_medium=email&utm_campaign=Defense%20EBB%2008-22-16&utm_term=Editorial%20-%20Early%20Bird%20Brief

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US Army to assess C-UAS capability for AN/TPQ-53

The US Army has issued a Sources Sought notice to assess the potential to add a counter unmanned aircraft system (C-UAS) capability to the service's AN/TPQ-53 radar.

The radar is employed in a counter-fire role, where it is used to automatically detect, track, classify, and locate the point of origin of mortar bombs, artillery rounds, and rockets and is deployed as part of a wider Counter-Rocket Artillery and Mortar (C-RAM) system.

The army has identified the addition of the C-UAS capability to the AN/TPQ-53 as an urgent operational requirement and the radar has been designated as a key system for this capability.

Among the requirements outlined in the notice, any capability upgrade would have to not impact the radar's current counter-fire capability and maintain the associated waveforms, nor increase manpower.

As well as detection and tracking of UASs, the new capability will need to offer target classification also.

At present the AN/TPQ-53 software interfaces with the Advanced Field Artillery Tactical Data System and Forward Area Air Defense Command and Control (FAAD C2) systems, passing to them data on targets; the modifications to introduce the C-UAS capability will need to provide these systems with information on the UAS detected.

As IHS Jane's previously reported, Lockheed Martin - manufacturer of the AN/TPQ-53 - has developed an upgrade to the radar's software that brings the ability to identify and track UASs, and to relay that data to a command and control node.

The company demonstrated the capability during the US Army's Maneuver Fires Integration Exercise (MFIX) 2016, held in May at Fort Sill, Oklahoma, and has seemingly met the requirements outlined in the Sources Sought notice. During the demonstration, the radar identified and tracked multiple UASs and provided data to a FAAD C2 system while simultaneously providing a C-RAM capability.

The Sources Sought notice calls for the integration of the C-UAS capability on up to 10 radars, as well as the addition of a non-developmental identification friend or foe (IFF) system.

http://www.janes.com/article/63165/us-army-to-assess-c-uas-capability-for-an-tpq-53?utm_source=Sailthru&utm_medium=email&utm_campaign=Defense%20EBB%2008-24-16&utm_term=Editorial%20-%20Early%20Bird%20Brief

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US Army - Unmanned aerial vehicle to provide battlefield intelligence

FORT IRWIN, Calif. -- Soldiers may someday have a new set of eyes on the battlefield thanks to a small unmanned aerial vehicle so new that it doesn't yet have a name.

The "battlefield" where the unmanned aerial vehicle is currently being evaluated and employed in training exercises is the National Training Center here at Fort Irwin. The vehicle is designed to collect information on an adversary for analysis by cyber operators and military intelligence personnel.

That information is ultimately provided to brigade commanders for their use, according to Maj. Deonand Singh, operations officer for the 781st Military Intelligence Battalion at Fort Meade, Maryland.

During actual combat operations, brigade commanders need information quickly, information Singh termed "tactical insights."

During its most recent employment at the National Training Center, the unmanned vehicle supported 1st Infantry Division's 1st Armored Brigade Combat Team, out of Fort Riley, Kansas. That unit was on a two-week training rotation at NTC during the first part of August.

The unmanned vehicle conducted reconnaissance of the training scenario's operational information environment, said Lt. Col. Jon Burnett, chief of Army Cyber Command's Cyber Support to Corps and Below, at Fort Belvoir, Virginia.

Capt. Samuel Lough, an offensive cyber operations planner for the exercise, said such information gathered from unmanned vehicles and other means can provide useful insight to the commander in an area of operations, once it is analyzed.

https://www.army.mil/article/174059/unmanned_aerial_vehicle_to_provide_battlefield_intelligence

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USAF:

Air Force envisions new roles for drones

Small aircraft will play a big role in the future of the U.S. Air Force.

Air Force leaders envision unmanned aircraft taking on new roles, from better scouts to "weapons mules" to teamed-up weapons that work in tandem with other manned aircraft. But don't throw that flight suit away just yet — manned aircraft aren't going anywhere.

3D-printed drones sit on a table near the Air Force Research Laboratory booth at the UAS Midwest conference. The Air Force sees a changing role for small drones to work in tandem with its manned aircraft.

Col. Brandon Baker, chief of the Air Force's remotely piloted aircraft capabilities division, said the Air Force could no longer forego small systems for larger ones, noting the various uses for these craft and the flexibility of smaller, customized systems. Baker spoke at the 2016 UAS Midwest conference, held at the Dayton Convention Center.

The Air Force wants to develop technologies around UAS, from the systems that control them, to their autonomy and launch and recovery. Baker foresees a mission commander overseeing the systems and someone ensuring their functions, but letting the aircraft themselves have the ability to manage some capabilities such as sensing and avoiding obstacles.

"I don't envision pilots in the future, but people with similar capabilities ... someone like a mission commander we need to build a control mechanism around," Baker said. "We believe we can change the game and make combat look different in the future."

Beyond line-of-sight capabilities and getting unmanned aircraft to work together in teams or "swarms" are also further down the line as the Air Force looks to have one person control multiple aircraft.

"Because a UAS is a different kind of platform — it can be more risk-accepting, it creates a new option space," said Reid Melville, Air Force Research Laboratory strategy lead for unmanned air systems.

Melville said unmanned systems should work in tandem with manned systems and not replace them. He likened the relationship between manned and unmanned systems to a chess board.

"You know all the valuable pieces are in the back row that you use judiciously, but in the front you have those pawns that you use to control the space and distribute risk and expend if necessary," Melville said.

http://www.bizjournals.com/dayton/news/2016/08/17/uas-midwest-air-force-envisions-new-roles-for.html

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Global Hawk in Line for New Ground Stations

Raytheon has been awarded a subcontract valued at up to $104 million to modernize the ground segment for the RQ-4 Global Hawk, an unmanned aerial vehicle used by the U.S. Air Force for intelligence, surveillance and reconnaissance missions.

Raytheon, who partners with Northrop Grumman as the ground integrator for the Global Hawk, will develop new mission control stations and incorporate an open architecture to allow flexibility for adding new platforms and mission payloads to the Global Hawk.

Todd Probert, vice president of Mission Support and Modernization at Raytheon Intelligence, Information and Services, called the subcontract "an exciting move forward" for the Global Hawk's ground segment.

"The Global Hawk was put into service to serve an immediate mission need, and this architecture allows us to gain some pretty significant efficiencies on the sustainment side," he said. As new capabilities or software come online, the open architecture allows for easy incorporation into the system as a "graceful and efficient evolution of the system," Probert said.

The ground segment, which includes the mission planning, sensors control and command and control, will have "better cyber hardening," as a result of these modernization efforts, he said.

Raytheon will develop and install new building-based mission control stations at Beale Air Force Base in California and Grand Forks Air Force Base in North Dakota, the Global Hawk's operator headquarters.

The current stations are shelter-based, described by Probert as cargo containers. They "will be done away with" in a "large cosmetic upgrade," he said.

"This will increase the operators' experience … giving more tools to do his or her mission," he said. Ground segments for the launch and recovery element of the Global Hawk in Italy, Guam and classified locations will also receive upgrades, although not as extensive as at Beale and Grand Forks, he said.

"Many of these [Global Hawk] programs came online as quick responses, to serve a particular mission or need, and in doing so, were not particularly elegant in their fielding," he said. The Air Force Global Hawk was originally developed from Defense Advanced Research Projects Agency technology and was deployed overseas shortly after the Sept. 11, 2011 terrorist attacks, according to Northrop Grumman.

"Functionally, the open architecture is the big move, in opening it up to more cyber capabilities and additional automation and additional analytics," Probert said, adding that the subcontract would take advantage of the advanced state of capabilities now available for the Global Hawk.

A production timeline has not yet been established, Probert said.

The Fiscal Year 2017 President's Budget Proposal includes $256 million for research, development, test and evaluation funds for the RQ-4 Global Hawk, up from $188 million allocated to the program in 2016. The budget includes a request for $49 million in procurement costs, down from $80 million in 2016.

The 2017 program "funds the development and modification efforts for the Block 30, Block 40, ground stations, and Multi-Platform Radar Technology Insertion programs; the Global Hawk modernization program; and the U.S. contribution to the NATO [alliance ground surveillance program,]" according to the defense department.

http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=2279

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Air Force outlines UAS plans as NASA pursues traffic management

The second day of the 10th Annual UAS Summit & Expo in Grand Forks, North Dakota, provided a clear demonstration of how far the military has come in the deployment and use of unmanned aircraft systems (UAS) and how government-industry partnerships are working to advance UAS integration.

Brig. Gen. John Rauch, U.S. Air Force director of intelligence, surveillance and reconnaissance capabilities, Washington, D.C., told attendees that the growth in the Air Force's use of UAS is exponential and that there's an insatiable demand for intelligence from the technology.

For example, he said that in 2006, there was an average of 12 Predator missions and one Global Hawk mission per day. Today, the daily average is 60 Predator missions and five Global Hawk missions. There are 8,000 Airmen and more than 1,400 Air National Guard and Reserve personnel dedicated to UAS operations, according to Rauch.

In fiscal year 2015, Northrop Grumman Global Hawks flew 1,500 missions and amassed 32,000 flying hours, numbers that will be eclipsed during the next fiscal year. The Global Hawk has now reached more than 200,000 total flight hours.

Rauch outlined a number of programs from fiscal year 2017 and beyond aimed at upgrading and improving the Global Hawk. They include weather radar, anti-icing capabilities, a ground segment modernization program and an airborne signals intelligence payload upgrade. Other programs are planned to improve sensors, communications and program protection.

Rauch said the Air Force's General Atomics MQ-1 Predators and MQ-9 Reapers have 270,000 combat flight hours for the current year and have exceeded 3 million flight hours total. The service is expected to transition to an all-Reaper force by fiscal year 2018, he said.

For fiscal year 2017, planned Reaper improvements include ground control station modernization, sensor upgrades and communications upgrades. Beyond that, Rauch said the Air Force is planning to modernize communications systems, add auto takeoff and land capabilities, extend the aircraft's range and integrate new bomb and missile weapon systems.

U.S. Sen. John Hoeven, R-N.D., spoke of his efforts to obtain a certificate of authorization (COA) from the Federal Aviation Administration (FAA) that would allow beyond-line-of-sight flights in North Dakota for UAS research. He said he expects a decision from the FAA before year's end and believes that such flights will be conducted in the first quarter of 2017.

"We've got all the things in place to do beyond-line-of-sight without a chase plane," Hoeven said. "Once we have it, it's not just for companies here, but anyone else that wants to come up."

Making his second trip to North Dakota this year, John Cavolowsky, director of NASA's airspace operations and safety program, said, "There is an enormous center of gravity here that's important for us to be apart of."

He compared the current growth in the UAS industry to the growth and development of the automobile, saying that he believes projections of 7 million small UAS in operation by 2020 are low.

Displaying an old photo of a massive traffic jam on a city street, Cavolowsky explained, "We don't want to put ourselves in that situation in relation to UAS—small UAS in particular."

To grow UAS and manage the air traffic, he said the U.S. needs national and regional security, safe airspace integration and scalable operations that will create economic growth. To integrate UAS into the national airspace, Cavolowsky said a strategic view of technologies for secure communications and detect-and-avoid systems are necessary.

He outlined plans for NASA's UAS traffic management (UTM) program that earlier this conducted testing at North Dakota's North Plains UAS Test Site in conjunction with the other five FAA-approved test sites.

A successful UTM system will provide operators with the flexibility they need and structure that regulators require, Cavolowsky said.

“Part 107 is huge; beyond visual line of sight operations are essential,” he noted. “We need to be able to enable coordinated manned and unmanned operations.”

Following Cavolowsky, a panel discussion led by Shawn Bullard, president of the Duetto Group LLC in Washington, D.C., explored the ways in which businesses large and small had partnered with NASA to advance the integration of UAS into the national airspace.

Panelists include Jaclyn Louis, director of government relations and senior counsel for Intel Corp., San Francisco; Craig Marcinkowski, director of strategy and business development for Gryphon Sensors, Syracuse, N.Y.; Chris Theisen, director of research, development, test and evaluation with the Northern Plains UAS Test Site; Joseph Burns, CEO of Sensurion Aerospace, Minneapolis, Minn.; and Terri Zimmerman, CEO of Packet Digital and Botlink, Fargo, N.D.

To mark the 10th anniversary of the UAS Summit & Expo, former U.S. Senator Byron Dorgan, D-N.D.—one of the events original organizers—spoke on the early days when a UAS mission at the Grand Forks Air Force Base meant keeping the base open. It also gave North Dakota’s leaders a vision of what the new technology could offer.

Noting that the first UAS Summit was attended by 130 people and had almost exclusively a government focus, Dorgan said he was impressed that hundreds from all over the world now attend the conference which is decidedly more business-oriented than it was in the past.

“The rate of change and the depth of change is breathtaking. Let’s be world class; let’s create something here no one else has,” Dorgan implored.

The final day of the UAS Summit & Expo is Wednesday and will include an update on the Northern Plains UAS Test Site; a review of plans and accomplishments by major UAS manufacturers; initiatives to assist the UAS industry in handling big data; and presentations by international UAS business that have opened operations in North Dakota.

http://uasmagazine.com/articles/1545/air-force-outlines-uas-plans-as-nasa-pursues-traffic-management

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NATIONAL AIR SPACE:

Research Flights Lay the Groundwork for Teaching Unmanned Aircraft to Detect and Avoid

ONewswise — For unmanned aircraft systems to safely fly in increasingly crowded airspace, they must be able to accurately detect and avoid obstacles like trees, power lines; and critically, other aircraft.

In efforts to safely introduce more unmanned aircraft into the nation's skies, Virginia Tech researchers and scientists from Brigham Young University have equipped an unmanned aircraft with a newly designed radar system and optical video cameras to collect data that will help aerospace engineers develop avoidance technology.

"This is one of the core challenges with unmanned aircraft systems: the ability to detect and avoid other aircraft," said Mark Blanks, the director of the Virginia Tech Mid-Atlantic Aviation Partnership, which is headquartered at the Institute for Critical Technology and Applied Science.

In the future, unmanned aircraft will likely rely on advanced sensors and control software to detect and avoid obstacles, and these systems must be rigorously tested.

"Until someone demonstrates that their hardware and algorithms can meet or exceed human capabilities, unmanned aircraft won't be able to fly beyond an operator's visual line of sight, and that limits their application," said Craig Woolsey, a professor of aerospace and ocean engineering in the College of Engineering and an expert in control systems. "The first phase is collecting realistic data that the community can use to test their algorithms."

Acquiring that data was the goal of research flights last week involving the Mid-Atlantic Aviation Partnership, Woolsey, and Karl Warnick, a professor of electrical and computer engineering at Brigham Young University.

They aim to create a database similar to ones used in computer vision research, where huge repositories of labeled images are used as test sets for visual-recognition software. In this case, the database will provide researchers with information on what potential obstacles, like a telephone pole or a small quad-copter, would look like to an aircraft's sensors.

"We want to gather this data in advance so that we can enable people to test their algorithms before they get implemented," Woolsey said.

The flight team, which included graduate and undergraduate students from Virginia Tech and Brigham Young, along with Woolsey, Warnick, and Mid-Atlantic Aviation Partnership personnel, outfitted a 35-pound fixed-wing unmanned aircraft with a video camera on each wing and a unique radar system designed in Warnick's lab.

Flying over a rural test range near the Blacksburg campus, the aircraft collected video imagery and radar signals of fixed objects and two other unmanned aircraft — a quad-copter and a small fixed-wing vehicle — from a variety of distances and angles.

Using two types of sensors could allow aircraft control software to assess potential hazards more accurately.

For example, the high resolution of optical cameras offers enough detail to identify objects the camera detects. However, optical cameras are also less effective under certain lighting and weather conditions. Adding radar to the system can provide both the distance and direction to an obstacle, in any weather.

Warnick's system, which weighs less than half a pound, is the first phased-array radar light enough to be carried by a small unmanned aircraft.

The researchers are analyzing and processing the sensor data from the flights, and will store the data in a publicly available database, along with the GPS coordinates corresponding to each data point — showing an obstacle's true location as well as its sensed location.

This data will aid the community's understanding of the capabilities and challenges of detecting and avoiding small unmanned aircraft, and allow researchers — including Woolsey's and Warnick's groups — to develop and refine aircraft control systems.

"We want to start testing our own ideas against images in the database," Woolsey said.

The project is funded through the Center for Unmanned Aircraft Systems, a National Science Foundation Industry/University Cooperative Research Center led by Brigham Young. Woolsey is the director of Virginia Tech's arm of the center, which uses university research to tackle fundamental challenges preventing the integration of unmanned aircraft systems in the national airspace.

"This is an exciting project, because having a readily accessible database like this will be a key enabler for development of new technology to facilitate unmanned aircraft systems integration," Blanks said. "It will be phenomenally impactful for the future of unmanned aircraft in the national airspace."

The Virginia Tech Mid-Atlantic Aviation Partnership runs one of only six national test sites for unmanned aircraft systems designated by the Federal Aviation Administration.

The test site's work in areas including agriculture, journalism and emergency management has positioned Virginia Tech as a leader in unmanned aircraft systems research.

Current research topics include flight beyond visual line of sight, flight operations over people, unmanned aircraft system airworthiness certification, air traffic management, remote sensing and payload development support, and airspace integration.

http://newswise.com/articles/research-flights-lay-the-groundwork-for-teaching-unmanned-aircraft-to-detect-and-avoid-obstaclesbstacles

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Workhorse Offers Drone Delivery System That Complies With FAA Rules

While Amazon is tussling with regulators over drone deliveries, one company has found a way to make the unmanned flying machines deliver packages today, by launching them out of the roof of a truck.

U.S. firm Workhorse has created a system called "HorseFly" that has managed to stick to the Federal Aviation Administration's (FAA) latest rules.

The drone can travel at 50 miles per hour, carry a 10 pound package and fly for 30 minutes. Workhorse's idea is to address the last mile of delivery – places trucks or vans can't reach such as rural areas.

Earlier this year, the FAA issued new rules on unmanned aerial vehicles (UAV). One of the key points was that drones needed to remain in the visual line-of-sight of the operator, something that essentially thwarted Amazon's plans for drone delivery.

Workhorse's solution has been to place these drones to launch out of trucks because they remain within sight of the driver. Steve Burns, chief executive of Workhorse said that the drones remain within the line-of-sight of the truck drivers.

Workhorse

"We launch from atop the truck, and efficiencies are not as good as if you could just launch from 30 miles way, but they are staggering," Burns told CNBC in a TV interview on Thursday.

Burns explained that drone deliveries are interesting because of cost savings. He said drivers are paid around $30 to $40 per hours and deliver between 150 and 200 packages. Drones however cost about 2 cents per mile because of electricity, and the fact that drivers are not involved.

The current solution, which requires drivers to take a truck to a location, then release the drone, is just the beginning of Workhorse's plan.

"Like a lot of new technologies you kind of go for the low hanging fruit. And the long distance out in rural areas and some suburban, that's the longest cost per package because it's not very efficient for the driver or the truck. So you start there, then you move inland, if you can imagine a drone jumping up on top of a building, maybe, and there is a central landing spot where everybody picks up their packages…it could get that precise," Burns said.

US regulators behind?

Of course, Amazon is continuing to invest in drone technology. Recent patents show the company's potential plans with drones being perched in high places like lampposts ready to be deployed at any time.

But the FAA's regulations are so far holding Amazon back. As a result, the U.S. e-commerce giant recently struck a partnership with the U.K. government to test its drone delivery technology in rural and suburban areas in Britain.

Burns said that the drone industry was "disappointed" with the FAA's latest rules, but within them, the regulator has said companies can operate drones for deliveries if they can prove that you can stay within the rules and still be safe, an exemption Workhorse has taken advantage of.

Workhorse is developing and testing the HorseFly drone with the University of Cincinnati and is hoping to sell it to customers later this year.

http://www.cnbc.com/2016/08/18/this-firm-beat-amazon-to-drone-deliveries-by-launching-it-from-the-roof-of-a-truck.html

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U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION Air Traffic Organization Policy – UAS

This order combines new guidance for implementing 14 Code of Federal Regulations (CFR), Part 101,

Subpart E, Special Rule for Model Aircraft, and 14 CFR, Part 107 Small Unmanned Aircraft Systems

(sUAS) with existing UAS guidance in J NO 7210.891 Unmanned Aircraft Operations in the National

Airspace System (cancelled) and General Notice (GENOT) JO 7210.886, Model Aircraft Operations in the Vicinity of Airports (cancelled).

http://www.faa.gov/documentLibrary/media/Order/FAA_JO_7200_23_2.pdf

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New FAA drone rule lowers pilot requirements

WICHITA — In a little more than a week, a new Federal Aviation Administration rule takes effect that lowers the barrier for commercial use of small drones — those weighing 55 pounds or less — that could affect Wichita businesses providing services using unmanned aircraft.

The Small Unmanned Aircraft Rule lowers the qualifications of the person operating the drone commercially from holding a recreational or sport pilot certificate, which require classroom time, flying with an instructor and completion of a solo flight.

Instead, the new rule that takes effect Aug. 29, will require the pilot to hold a remote pilot airman certificate with a small UAS (unmanned aircraft system) rating, which is awarded after passing a written aeronautical knowledge test at an FAA-approved testing center.

Other requirements are that the applicant be no younger than 16 years old and be checked by the Transportation Security Administration.

“We’re basically going to be competitors with the clients we’ve been working for,” said Fawcett, whose company was the first in Wichita to receive an FAA exemption to use drones for commercial purposes.

Blue Chip operates commercial-grade drones and offers services such as topographical surveying and three-dimensional mapping as well as filmmaking.

Fawcett said because the new rule’s pilot requirements are less stringent than the ones in the FAA’s Section 333 exemption — a rule put in place by the FAA for commercial drone use while it was working on the Small UAS Rule — Blue Chip could lose some of its clients. He thinks some of them could opt to

train their own employees and purchase their own aircraft instead of paying someone else. Long-term, though, they may not want the hassles of maintaining aircraft, training pilots and dealing with the paperwork of those activities, Fawcett said.

RSM Marketing also spent the time and money to obtain a Section 333 exemption so it could use drones for video production for its clients.

“Early on, it was important for us to meet the standards,” RSM managing partner Bruce Rowley said.

He doesn’t consider the cost of getting an exemption, including pilot training for his staff, wasted money.

“We’ve got a lot of hours now, a lot of experience, a lot of great projects we can share with people that show the quality and experience we bring,” Rowley said. “So getting an early start on this was certainly worth it.”

http://salina.com/news/state/new-faa-drone-rule-lowers-pilot-requirements/article_4dbb785b-243c-52e7-a76e-377c98f846b9.html

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DoD releases autonomy study

The Defense Science Board released the results of its summer study on autonomy.
http://www.acq.osd.mil/dsb/reports/DSBSS15.pdf

The document provides a raft of recommendations for DoD in the way of further adopting autonomy into systems and operations while ensuring sufficient security against adversarial adoption of similar technologies and the inherent vulnerabilities that exist within the interconnected cyberspace architecture.

The board’s study focused on three areas: institutional and enterprise strategies to widen the use of autonomy, approaches to strengthening the operational pull for autonomous systems, and an approach accelerate the advancement of the technology for autonomy applications and capabilities, with recommendations across three vectors:

-- Accelerating the adoption of autonomous capabilities

-- Strengthening operational pull of autonomy

-- Expanding the envelope of technologies available for mission use

Among the study's conclusions:

-- Action is needed in the three aforementioned study areas to build trust and enable the most effective use of autonomy to defend the nation.

-- Autonomy has the potential to deliver substantial operational value across a diverse array of vital missions.

-- DoD, while adopting autonomy into systems presently, should speed up its adoption to realize these potential benefits, as many of the systems it has adopted are remotely operated as opposed to autonomous.

Autonomy, according to the study, can deliver value by mitigating operational challenges such as rapid decision making, high heterogeneity and/or volume of data, intermittent communications, high complexity of coordinated action danger of mission and high persistence and endurance.

The authors defined autonomy as a means of framing the discussion as resulting from "delegation of a decision to an authorized entity to take action within specific boundaries. An important distinction is that systems governed by prescriptive rules that permit no deviations are automated, but they are not autonomous," they wrote. "To be autonomous, a system must have the capability to independently compose and select among different courses of action to accomplish goals based on its knowledge and understanding of the world, itself, and the situation."

The study did not recommend any major new programs, given the existing budget environment. Rather, the study's authors recommended a series of experiments and prototypes to demonstrate clear operational value across operational challenges.

One of the key challenges greater autonomy adoption can facilitate is anti-access and area denial, the report said. "Anti-access and area denial (A2/AD) is a primary example of a mission that could be enhanced by autonomous systems. Autonomously operating [unmanned aircraft] UA could assume several functions now performed by manned aircraft in areas that are difficult to access (e.g., aerial refueling, airborne early warning, intelligence, surveillance, reconnaissance, anti-ship warfare, and command)," it said. "Additionally, large UA could be designed to dispense small UA that could operate autonomously to facilitate both offensive strike (via electronic warfare, communications jamming, or decoys), as well as defensive measures as decoys, sensors and emitters, target emulators, and so on — to confuse, deceive, and attrite adversary attacks. These small swarms could be deployed as perimeter and close-in defensive actions with payloads tailored to the situation."

These concepts can be applied to other missions or domains. The report noted that undersea, acoustic and RF decoy payloads, likely smaller than sea mines and thus more easily deployable from existing unmanned undersea vehicles, could significantly extend electromagnetic maneuver warfare capabilities enabling covert options with a small observable footprint until electronic warfare operations are initiated.

The report also noted how adversaries will be employing autonomy as commercial technologies become more widely available. "This situation is similar to the potential adversary use of cyber and electronic warfare. For years, it has been clear that certain countries could, and most likely would, develop the technology and expertise to use cyber and electronic warfare against U.S. forces," the report said. "Yet most of the U.S. effort focused on developing offensive cyber capabilities without commensurate

attention to hardening U.S. systems against attacks from others. Unfortunately, in both domains, that neglect has resulted in DoD spending large sums of money today to “patch” systems against potential attacks.”

The U.S. must apply lessons learned from these two areas to adversarial autonomy adoption now, the report states. “The potential exploitation's the U.S. could face include low observability throughout the entire spectrum from sound to visual light, the ability to swarm with large numbers of low-cost vehicles to overwhelm sensors and exhaust the supply of effectors, and maintaining both endurance and persistence through autonomous or remotely piloted vehicles,” it continued.

One of the more hotly debated issues surrounding autonomous systems revolves around the level of autonomy. For example, in cyber systems, many officials have expressed the desire for fully autonomous cyber tools that can respond in so-called “cyber speed,” which happens much faster than human speed.

“I want autonomous basic security tools – not automated, I want autonomous basic security tools that I can just let go that will look at my network, sensor it, and say ‘you know what, there’s an attack happening here, we’re immediately going to quarantine this part of the network, we’re going to add some security protection over…I can’t have people in that loop…it’s too fast,” DoD CIO Terry Halvorsen, said at an event hosted by FedScoop in June.

Conversely, human rights groups have expressed grave concern regarding the potential for fully autonomous systems to deploy weapons or lethal payloads. Several leading technologists, from Stephen Hawking to Elon Musk, signed an open letter endorsing a “ban on offensive autonomous weapons beyond meaningful human control.” This is what Vice Chairman of the Joint Chiefs of Staff, Gen. Paul Selva describes as the “Terminator Conundrum.” “What happens when that thing can inflict mortal harm and is empowered by artificial intelligence. How are we going to deal with that? How are we going to know what's in the vehicle's mind, presuming for the moment we are capable of creating a vehicle with a mind,” he said in an event at the Brookings Institution in January. “Those are the problem sets that I think we are going to have to deal with in the technology sector.”

The Defense Science Board’s report noted that there will be skepticism and resistance regarding the employment of autonomous weapons. The report noted that DoD has taken steps in the way of a 2012 directive. “The most important policy points to be made from the Directive,” the report notes, “that are relevant to public concerns are that there are no proscriptions for the development of lethal autonomous weapon systems, but their development would require a much more rigorous review and approval process. Emphasis is placed on assurance that the system will perform as intended and be as immune as possible to unintended loss of control, capture, or compromise by the adversary. Moreover, appropriate use of human judgment over the use of force is required and use must be in accordance with all applicable domestic and international law, in particular, the law of war.”

Peter Singer, strategist at New America and author of "Ghost Fleet," believes it is likely autonomous systems will be deployed more in regions with low probability of civilian casualties. “It is likely in the near term that we will be more comfortable in placing autonomous systems in domains and settings where there are less likely civilian casualties, such as antisubmarine warfare, or where pattern matching

against known targets is less complex (radar emissions from SAM batteries vs trying to ID a ISIS technical truck from a civilian truck)," Singer said in an email. "We'll also see it take place in areas where the data is too complex or fast moving for human reaction time, like missile defense (where it is already largely automated) or cyber warfare."

The report also devotes partial focus toward fostering the man-machine team, the cornerstone of Deputy Defense Secretary Bob Work's so-called Third Offset Strategy, he described as "basically hypothesizing that the advances in artificial intelligence and autonomy – autonomous systems – is going to lead to a new era of human-machine collaboration and combat teaming." The report notes that today rule-based coordination of multiple platforms along with high-volume communications data transfer exist while in the near term observability and directablity, provably correct emergent behavior, trustworthiness and trust calibration under defined conditions and natural language processing are likely available in the near term. Shared "mental models," mutual predictability, understanding intent, fully adaptive coordination and implicit communication might be available in the long term, the report said.

http://www.c4isrnet.com/videos/military-tech/uas/2016/04/13/82979794/?utm_medium=player&utm_campaign=player_referral

"While difficult to quantify, the study concluded that autonomy — fueled by advances in artificial intelligence — has attained a 'tipping point' in value. Autonomous capabilities are increasingly ubiquitous and are readily available to allies and adversaries alike," study co-chairs Ruth David and Paul Nielsen wrote. "The study therefore concluded that DoD must take immediate action to accelerate its exploitation of autonomy while also preparing to counter autonomy employed by adversaries."

http://www.c4isrnet.com/articles/dod-releases-autonomy-study

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Drone rule takes effect Monday, awaited by thousands

WASHINGTON – The first comprehensive federal rule governing drones takes effect Monday, when government and industry officials say thousands of pilots of remote-controlled aircraft are eager to start their engines.

Earl Lawrence, director of the Federal Aviation Administration's drone office, said 3,351 people signed up to take a test of aviation knowledge Monday —the first day possible — to certify themselves as drone pilots. Another hint of the pent-up demand is that 20,000 commercial drone operators have already registered to start flying, in anticipation of passing those tests that become available Monday, he said.

"That's a good indication we're going to have a lot of people and a lot of aircraft operating from day one," Lawrence told a group of dozens of congressional staffers Wednesday.

The rule governing drones weighing up to 55 pounds will largely replace the special permission that FAA granted in recent years to 5,542 applications for commercial uses of drones, such as for aerial photography, utility inspection or crop observation. Special waivers could still be granted.

But the rule basically allows pilots who pass the test to fly whenever they want up to 400 feet in the air during daylight hours while keeping the aircraft within sight of the pilot and away from other aircraft.

Hobbyists have always been allowed to fly under similar guidelines, but commercial pilots have had to file cumbersome applications for special permission — until now.

FAA completes landmark rules for commercial drones

The rule released in June was a long time coming. Congress ordered FAA in 2012 legislation to have drones sharing the skies with passenger planes by September 2015. The agency wasn't able to move that quickly, but just having a daytime rule for small drones is expected to boost the industry in ways advocates can't calculate.

A trade group, the Association of Unmanned Vehicle Systems International, estimated in 2013 that drones could add 100,000 jobs and $82 billion in economic activity by 2025. At the panel discussion Wednesday, manufacturers and operators said those figures are likely far short of what could happen even before drones are allowed to fly routinely at night or farther than the pilot can see.

"Those numbers are indeed tired at this stage of the game," said Brian Wynne, the trade group's CEO. "Because of the way they were put together, they undershoot the potential quite dramatically."

White House explores ambitious uses for drones

For example, Jesse Kallman, director of regulatory affairs for Airware, a San Francisco-based company developing software to guide drones, said major insurance companies alone could train tens of thousands of workers to use drones to assess claims in damaged areas.

Brendan Schulman, vice president of policy and legal affairs for DJI, a Chinese drone manufacturer with an estimated 70% of the worldwide market, said new uses emerge every day, such as research flying a drone through a whale's exhale to study the animal's health, pregnancy and migratory patterns.

"I think we're going to see a huge influx of investors," said Diana Marina Cooper, vice president of legal and policy affairs for PrecisionHawk, which has been researching with FAA the use of its drones to monitor agriculture.

Lawrence, the FAA official, cautioned "a few things need to be worked out" before allowing drone deliveries in downtown Washington, D.C. The next step for FAA will be a proposed rule expected by December for flying safely over people who aren't associated with the flight, which is now generally discouraged, and then a proposed rule expected a year from now for expanded flights such as at night.

Even under the comprehensive rule that takes effect Monday, Lawrence said FAA will issue waivers for night flights and flying farther away than the pilot can see, such as farmers scanning crops in remote areas, if the applicants demonstrate how they'll reduce risks.

"We're trying to get as many operations that we know we can safely allow in the system allowed and done now," he said.

http://www.usatoday.com/story/news/2016/08/24/drone-rule/89276370/

http://www.spokesman.com/stories/2016/aug/24/business-use-of-drones-takes-off-as-new-rules-kick/

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PUBLIC SAFETY:

U.S. Department of the Interior Awards Contract for Small Unmanned Aircraft Systems

Boise, Idaho – The U.S. Department of the Interior has awarded a contract to 3D Robotics of Berkley, California for up to 40 small, unmanned aircraft systems (UAS). The award follows a lengthy process to develop performance requirements and select the most useful type of aircraft.

"The contract is extremely important to the Department, as it will allow us to conduct many missions that were previously impossible due to limited resources and costs associated with using manned aircraft," said Deputy Assistant Secretary for Public Safety, Resource Protection, and Emergency Services Harry Humbert.

The aircraft weigh 3.3 pounds, are capable of carrying a variety of sensors, and are easily customized for the types of fieldwork and emergency response operations performed by the Department. The size and weight of these small UAS provide operators a simple, efficient and inexpensive tool to collect aerial data. Their design allows for rapid deployment of new payload options, as new sensors become available.

"The Department expects to use these aircraft for a diverse set of missions including, wildlife and vegetation surveys, fire management, search and rescue, hydro-logic study, cultural resource inventory, and surface mining monitoring, just to name a few," said the Department's Office of Aviation Service Director Mark Bathrick. "These UAS will not only provide us with better science and reduce the risk to our employees, but they will result in cost savings and better service for the Department and the American people."

https://www.doi.gov/pressreleases/us-department-interior-awards-contract-small-unmanned-aircraft-systems

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Drone startup Aptonomy introduces the self-flying security guard

Aptonomy Inc. has developed drone technology that could make prison breaks, robberies or malicious intrusions of any kind impossible for mere mortals.

Dubbing it a kind of “flying security guard,” the company has built its systems on top of a drone often used by movie-makers, the DJI S-1000+, a camera-carrying octocopter.

To that skeleton, Aptonomy adds a new flight controller, and second computer to power day- and night-vision cameras, bright lights, and loudspeakers, among other things.

And more importantly than the hardware features, Aptonomy has developed artificial intelligence and navigational systems that allow its drones to fly low and fast, avoiding obstacles in structure-dense environments, and detecting human activity or faces in the area, autonomously.

A user can open up a browser, get onto the Aptonomy interface, click on a point on a map to send out a drone to a particular location, then watch that flight in real time, or review a recording of it later.

Aptonomy’s drones can be programmed to fly wherever a motion detector transmits data suggesting unusual activity on the ground, as well.

The drones are not just self-flying. When their batteries are running low, they fly back to a charging station to power up.

They explained that most unmanned aerial systems in commercial use are being used from hundreds of feet in the air to do things like thermal or topographic mapping at this point. But those drones can’t perceive human faces, like security guards must.

Meanwhile, prosumer camera drones that fly lower don’t have the motion controls and perception required to navigate safely, and without a human pilot, around complex environments like a nuclear power plant, cell towers or a supermax prison.

Aptonomy’s drones rove over a set area, and can be accessed by a guard who is hundreds or thousands of miles away.

They can record suspicious activity, shine a light on intruders, allow two-way communication with the intruder through loudspeakers, and generally scare off potential troublemakers as an intimidating presence in the air.

One energy company has preordered Aptonomy’s drones to use at oil refineries this year. “Refineries are in remote locations and are very hard for human security guards to patrol. But they are a target for attacks,” Pivtoraiko noted.

The startup believes that businesses with lots of infrastructure-related assets will want to use their drones to supplement, or even replace, their human patrols.

One thing businesses with deep security concerns will like most about Aptonomy's drones, Sanan said, is that they can be programmed to approach intruders in a way that is compliant with all relevant laws and protocols.

That involves shining a light, recording if possible, and using your voice before ever approaching an intruder, physically, or before escalating to physically stop him or her.

https://techcrunch.com/2016/08/22/drone-startup-aptonomy-has-created-robotic-flying-security-guards/

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SENSORS/APPLICATIONS:

NSF supported research is improving UAS for scientific and societal benefit

From strengthening wildlife conservation efforts to improving disaster response, researchers are finding new ways to use small, unmanned aerial vehicles (UAVs) -- also known as drones or unmanned aerial systems (UAS) -- to gather data, improve communication, and explore environments where humans and larger aircraft dare not go.

These advances are due, in part, to improvements in UAV technology, as well as clearer ground rules that govern the many uses of unmanned aircraft. Increased federal funding, including a recent $35 million commitment from the National Science Foundation (NSF), will advance the basic research needed to design UAVs that can save lives, improve safety, and enable more effective science.

"Designing and developing highly-capable UAS platforms requires basic research in the theoretical principles of UAS, including sensing, perception, control and communications," says Lynne Parker, NSF director of the division of information and intelligent systems. "Once these agile and robust UAS systems are developed, they can be extended to operate in a variety of challenging domains, such as serving as vital tools for scientific exploration."

Since 2010, NSF has funded dozens of UAV research projects related to computing, engineering, earth science and biology, and supported entrepreneurs through its Small Business Innovation Research program.

The examples below demonstrate the potential for researchers to advance their scientific knowledge and provide benefits to society through the use of unmanned aircraft.

Wildlife conservation

With their ability to travel at altitudes and in environments where manned aircraft cannot, UAVs can study species in difficult-to-reach locations, and to help researchers address a number of important questions about ecosystems.

Michael Shafer, an assistant professor of mechanical engineering at Northern Arizona University, is working on an NSF-funded project to better track wildlife -- particularly small animals such as bats and birds -- in non-intrusive manner. By developing low-cost, UAV-mounted radio telemetry systems that can receive radio signals from tagged wildlife, and by making the pre-engineered systems available to wildlife researchers via open source publishing, he hopes to significantly reduce the barriers to tracking animals in the wild.

Shafer's lightweight modules leverage the flight capabilities of UAVs to better detect signals from wildlife transmitters. This involves developing signal-processing algorithms to assist in detecting and localizing very high frequency radio tags, and assembling a radio system capable of providing the required sensitivity. It also involves designing a system compact enough to fit on a UAV, along with special vehicles for field researchers and the radio-sensing modules they carry.

In addition to the technical development effort, Shafer and his team plan to work with the Upward Bound program at Northern Arizona University to guide first-generation, low-income high school students from the Four Corners region -- Arizona, Utah, Colorado and New Mexico -- toward successful college careers.

Increasing the accuracy of weather forecasts

UAVs are particularly well-suited for gathering data in the lower atmosphere (1,000-4,000 meters), where many weather phenomena begin and where manned aircraft are too dangerous or expensive to fly. Radar cannot always track conditions at this level and weather balloons have too short of a duration at these altitudes.

Through the $6 million, four-year Collaboration Leading Operational UAS Development for Meteorology and Atmospheric Physics (CLOUD-MAP) project, Oklahoma State University, the University of Oklahoma, the University of Kentucky, and the University of Nebraska will work together to develop the capabilities of meteorologists and atmospheric scientists to use unmanned aircraft as an everyday research tool.

The CLOUD-MAP project recently completed its first flight campaign, which resulted in nearly 250 unmanned flights of 12 separate UAV platforms over a three-day period -- one of the largest scientific unmanned aircraft operations ever. The effort, which brought together more than 65 researchers and students, collected important meteorological, climatological and operational data that will increase the accuracy of weather forecasts, ultimately saving lives and property.

Enhancing communications in a disaster

NSF CAREER awardee Yan Wan from the University of North Texas is developing aerial networking systems that use directional antennas on UAVs to deliver on-demand communication to first responders in emergency response situations.

Typical wireless communications have a range of only 100 meters, or just over the length of a football field. Wan and her colleagues, however, developed technology that extends the Wi-Fi reach of drones to 8 kilometers, or about 5 miles.

Wan and her team have worked with emergency agencies across Texas to test their system's ability to quickly establish emergency communications in disaster drills and exercises. In May 2015, working with researchers from Worcester Polytechnic Institute and the Austin Fire Department, she demonstrated how UAVs can establish aerial communication in a search-and-rescue operation, providing emergency responders with the aerial views they need to direct robots to find victims quickly and transmitting video streams of survivors to control centers. For this, and other activities, she and her colleagues won the Dallas-Fort Worth Metroplex's 2015 Tech Titan Award.

UAVs in hurricane and nuclear disasters

Robin Murphy, the director of the Center for Robot-Assisted Search and Rescue (CRASAR) at Texas A&M University, has deployed UAVs to some of the worst natural and man-made disasters in recent memory.

In the wake of Hurricane Katrina, Murphy directed UAVs to explore buildings along the Gulf Coast -- the first time an unmanned aircraft was used for emergency structural inspections. During the nuclear meltdown at the Fukushima Daiichi plant in Japan, she was part of a team that flew UAVs to determine radiation levels and inspect damage at the reactors. And in the days following the 2015 floods in Texas, Murphy led a team that deployed UAVs to inspect the storm-ravaged area.

Murphy determined that one 20-minute drone flight would generate roughly 800 photographs, each of which takes a minute to inspect. This led her to conclude that data analysis tools, deployed alongside unmanned aircraft, are necessary to make UAV technology useful in time-sensitive situations.

Working with collaborators and students, Murphy has developed software that uses computer vision and machine learning to improve UAV flight paths, as well as anomaly detection techniques to better locate survivors with UAVs.

Combining the capabilities of UAVs with tools that allow them to work in a targeted way is the secret to developing effective search-and-rescue UAVs, Murphy believes.

Sea ice mapping

Last year, scientists aboard the Nathaniel B. Palmer research vessel carried out two separate UAV trials as part of a research cruise in the Southern Ocean. The flights evaluated the aerial mapping of sea ice to determine the distribution of floating sea ice. [Watch a video of the flights.]

Researchers on the trip were exploring the vulnerability of Antarctic ice to melting due to the presence of relatively warm ocean water below it. Melting ice would drive glaciers into the sea faster and raise sea levels worldwide. This data will inform for future integrated observation programs.

In remote and dangerous locations such as Antarctica, UAVs can help to gather critical information without endangering human pilots, which is why the NSF-managed U.S. Antarctic Program is developing a policy on the safe and environmentally sound use of UAVs in Antarctic research.

Safer, cheaper infrastructure monitoring

As U.S. infrastructure ages, its operators need more efficient and affordable techniques to monitor and assess bridges, railroads, power lines, dams and other large systems. UAVs enable innovative approaches for monitoring the health and stability of structures from above and below.

Ivan Bartoli of Drexel University leads a project that focuses not just on UAVs, but on what those unmanned aircraft look at. Using novel manufacturing processes, his team designs special surface coatings -- like paint -- that enable UAVs to rapidly collect multi-spectral imaging data. Advanced algorithms then analyze that data to find structural deformations, allowing engineers to quickly identify damage to critical components of monitored structures.

Scientists and engineers are already moving many of these technologies out of the lab and into the marketplace. Hung La of the University of Nevada, Reno is building on NSF-funded research to create low-cost UAVs and robotic systems that can efficiently inspect steel and concrete bridges.

La is part of an NSF Innovation Corps Team that has completed more than 160 customer interviews, helping him focus on customer uses as the research team finalizes the drone and robotic platform and thinks about the long-term commercialization of the technology. The product has been tested and deployed in the field, and La is working with his university to patent the technology.

These and other new ways of thinking about infrastructure are leading to a safer, more stable future.

http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=189521&WT.mc_id=USNSF_8

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Unmanned aircraft readies to sample Atlantic hurricanes

The NASA Global Hawk unmanned aircraft touched down Friday morning at NASA Wallops Flight Facility on the Virginia coast where NOAA and NASA scientists are preparing it for flights over Atlantic hurricanes.

“We’ll be using the Global Hawk to sample weather data from tropical storms as they develop this season,” said Robbie Hood, director of NOAA’s Unmanned Aircraft System Program. “We’re studying the value of using data collected by this unique plane to improve hurricane track and intensity forecasts.”

This is the second year of NOAA’s Sensing Hazards with Operational Unmanned Technology or SHOUT, a three-year research project with NASA to evaluate the benefits of using the unmanned aircraft in routine operations to improve severe storm forecasts. Initially funded by Congress after Hurricane Sandy, the research also looks at whether unmanned aircraft can fill data gaps if there are problems with weather satellites.

Preliminary analysis of data collected by the Global Hawk last hurricane season during Tropical Storm Erika is showing promise.

NOAA uses the NASA Global Hawk to sample hurricanes from high above and for long periods of time. The unmanned aircraft can fly nearly twice as high as manned aircraft and for 24 hours. (NASA)

“We looked at how adding Global Hawk data affected hurricane forecast models and found that combining satellite data that gives a broad picture of a storm in a particular area with more granular data on wind speed, moisture and temperature from the Global Hawk in the same area can improve forecasts,” said Robert Atlas, Ph.D., director of NOAA’s Atlantic Oceanographic and Meteorological Lab in Miami, who added that more data and analysis is needed.

Able to fly higher and for longer periods of time than manned aircraft, the Global Hawk can stay with a storm as it develops, providing more detail on the evolution of a storm from its very beginnings as it builds off the coast of Africa to its strengthening, weakening and changing over time.

NOAA’s SHOUT flights with the Global Hawk build on capabilities pioneered by NASA in previous research campaigns.

This season, the SHOUT team will look for fairly significant storms that allow multiple flights and more extensive data gathering. “Our skill in forecasting hurricane track has been improving steadily due to better data from satellites, improved models and higher speed computing for forecast models, but we still need improved understanding of the mechanisms that cause hurricanes to intensify rapidly,” Hood said. “Predicting this more accurately would help save lives and property.”

http://research.noaa.gov/News/NewsArchive/LatestNews/TabId/684/ArtMID/1768/ArticleID/11840/Unmanned-aircraft-readies-to-sample-Atlantic-hurricanes.aspx

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Drones, not dirt: Making farm careers cool for vets

Federal officials have spent the last few years developing new resources to help put veterans into agriculture jobs. Now, they’re working to make those jobs look cool.

Officials from the Department of Agriculture on Tuesday unveiled new plans to better explain and market a host of industry jobs to recently separated service members, calling it a growth area that fits nicely with the skills and training of those veterans.

“People need to know this is about more than just handling livestock,” said Lanon Baccam, deputy undersecretary for agricultural services at USDA. “This is about engineering, drone technology, data analysis and more. Breaking down the walls is key.”

Earlier this year, department officials partnered with the U.S. Chamber of Commerce on promoting agriculture as a potential career path for troops after they leave the military. Now, the officials are shifting that work to highlight many of the industry's cutting-edge agriculture jobs, through a new web portal and jobs site.

The goal is both to help veterans find work and to help industry officials find workers.

Agriculture Secretary Tom Vilsack, who spoke to corporate officials and veterans advocates during an unveiling event Tuesday, said that current training programs and job applicants are expected to fill only about half of the industry's open jobs in the next decade.

Meanwhile, department officials have raised concerns about the long-term viability of domestic food production in the country and the significant drop in America's rural population in recent decades. The average age of farmers in America is 58, according to USDA data. There are twice as many farmers in America older than 65 than farmers under the age of 35.

Vilsack said those challenges point toward encouraging veterans to take an opportunity to serve their country again, in an agriculture career.

"These folks understand duty, responsibility and teamwork," he said. "Anyone who hires them benefits from the training they received."

Mike Michaud , assistant secretary of labor for veterans employment and training, said his agency has worked to help connect veterans to those openings. But chamber officials acknowledged that most veterans' perception of agriculture jobs involves shovels and dirt.

Industry leaders want to redefine the potential opportunities as careers with flexibility and plenty of cool gadgets. That includes jobs like drone operators, who help collect data on crop growth and spray pesticides for farms.

USDA, Chamber of Commerce partner to put vets in agriculture jobs

The new effort will also include collection more stories of veterans in agriculture, to better relate how their skills and experiences translate into the civilian work.

http://www.militarytimes.com/articles/agriculture-jobs-veterans-new-push?utm_source=Sailthru&utm_medium=email&utm_campaign=Defense%20EBB%2008-24-16&utm_term=Editorial%20-%20Early%20Bird%20Brief

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COUNTER UAS:

DARPA Seeks New Anti-Drone Weapon By 2020

The Pentagon is thinking about the future, and how to shoot it down. We don't know, exactly, what the future holds, but DARPA, the Pentagon's future-projects wing, expects that there will be a lot of small drones, and if possible, they'd like a tool that can protect against those drones.

Specifically, DARPA is soliciting a form of "Mobile Force Protection." They've put out a request for information to identify "novel, flexible, mobile layered defense systems and component technologies that could be leveraged to improve force protection against a variety of sUAS (small unmanned aerial

system) threats and tactics, could be fielded within the next three to four years, and are structured to rapidly evolve with threat and tactic advancements."

Or, in plain language, something that can see and thwart drones, will be ready by 2020, and is upgradeable. DARPA has a laundry list of ways they want this new system to see drones, with sensors detecting, identifying, and tracking the small unmanned aerial systems. What happens next is captured by the much vaguer "neutralization," which could include everything from catching it in a net to overriding its flight controls to being caught by an eagle.

But that's not all! DARPA wants this system, which could go on trucks and ships, to also "address rocket, artillery, mortar, and other conventional threats." There are only a few weapons in the world that can do all of that, and they're mostly lasers. The United States Air Force and Army are developing laser weapons, and the U.S. Navy already fielded one laser weapon, and is working on others. The Marine Corps, which shares a budget with the Navy, is even working on laser-toting anti-drone trucks. And while DARPA will probably want to stick with American companies, both Israel and Germany are showing off anti-drone laser weapons at military trade shows.

What's remarkable about this DARPA request, then, isn't so much that they want a laser weapon to shoot down flying robots, it's that a lot of other people making military technology already had this idea, and are working on it too.

http://www.popsci.com/

https://defensesystems.com/articles/2016/08/19/darpa-endurance-anti-missile-laser-aircraft.aspx

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DoD Eyes More Complex Counter-UAS Exercise

The U.S. military plans to introduce several changes into this year's version of the annual Black Dart counter-drone exercise, including making the threat scenarios more complex and more challenging to defend against.

Compared to earlier Black Darts, next month's event will increase the number of unmanned aircraft systems flying at one time and provide more variation in their direction and altitude, according to organizers. More than 20 different small- and medium-sized UAS will fly in the Sept. 11-23 demonstration, and various government and industry systems will try to detect, track and negate the drones.

"Ultimately, the goal is to get a broad understanding of what is in the realm of possible," said Navy Lt. Cmdr. Ryan Leary, the Joint Staff's Black Dart project officer. "We want to fly as many types of UAS in as many ways as possible so we understand what these potential counter-UAS solutions can and cannot do."

Another change is that this year's venue, Eglin AFB, Fla., offers a larger land range than last year's location, Naval Base Ventura County and Sea Range at Point Mugu, Calif. The extra room will provide more opportunities for experimentation on both sides of the fight.

"We can array our counter-UAS systems and spread them out," Leary told Defense Daily Aug. 22. "We can also spread out the threat so that they're flying at multiple threat vectors and multiple times," which "helps us deliver more uncertainty on the threat side."

While UAS have been shot down in past exercises, this year's Black Dart will focus on jamming and other "non-kinetic, non-destructive" means to bring down UAS. More than 10 different negation systems will be tested.

"There's a large number of systems coming [to Black Dart] with some sort of non-kinetic or jamming capability," Leary said.

Aegis combat system-equipped destroyers, five kinds of military surveillance aircraft and two types of military ground-based radar also will participate. One of the goals of the exercise is to improve the fusion of data collected by different UAS detection systems, including radar, acoustic sensors and electro-optical/infrared cameras.

"There's no one single modality of detection where we can reliability count on detection of all types of UAS," Leary said. "We're really looking at how can these systems combine and fuse their data in a way that we can get a solid confidence of detection and tracking regardless of the type of UAS."

http://www.defensedaily.com/dod-eyes-more-complex-counter-uas-exercise/

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COMMENTARY:

Realizing the potential of drones, yet preserving our privacy

Searching for a new home in a different city is hard, especially if you want a sense of the neighborhood and a true picture of what prospective properties look like. Wouldn't it be great to have a close-up view of that seemingly perfect house on the market from all angles, as well as a bird's-eye view of the yard? Good news: Drones are making that possible.

This is just the tip of the iceberg when it comes to the amazing potential of these flying robots (or, as industry folks like to call them, unmanned aircraft systems [UAS]). With drones, a groom can get the perfect group shot of his wedding party; a coach can closely monitor the progress of their athlete as she races a marathon; emergency responders can survey larger swaths of territory during disaster relief efforts; and a farmer can monitor crops in a remote corner of their land.

Drones, much like smartphones and tablets before them, have the potential to revolutionize our lives in many ways. However, as with any new technology, some people have concerns. In the case of drone technology, one we hear often is the possible invasion of privacy.

That's why stakeholders from the UAS industry, civil liberties organizations and government agencies have been working together to help facilitate the safe, responsible and ethical use of drones, while still supporting the growth and development of this cutting-edge technology.

In February 2015, President Obama directed the National Telecommunications and Information Administration to convene a multi-stakeholder process to develop a set of best practices for privacy, accountability and transparency regarding both commercial and recreational UAS use. In other words, create guidelines for "neighborly" drone use. Together, we have worked to do just that.

We can all agree that privacy must be protected without stunting the growth of the still-nascent UAS industry.

After months of discussions, this collaborative process resulted in a consensus set of voluntary best practices that balance people's rights to operate drones with all of our rights to privacy. These best practices represent clear, common-sense guidelines for anyone wishing to operate a drone, from a general hobbyist to an entrepreneur with an innovative business model.

The guidelines discourage drone operators from invading people's personal space by flying without permission over private property. They encourage those using UAS technology to not collect or record unnecessary information and to ensure that any data collected is used only for its intended purposes. Importantly, the best practices also promote transparency of usage — tell those around your drone that it is there and why.

These best practices complement existing UAS privacy recommendations already developed by and for government agencies. Additionally, they provide a streamlined set of federal recommendations to commercial and recreational drone operators.

It is estimated that UAS sales could top more than 2.8 million units in 2016, and already more than 5,500 businesses have been approved by the Federal Aviation Administration (FAA) to fly. Now that the FAA has finalized long-awaited rules for small, commercial UAS, which will take effect on August 29, even more businesses will be taking flight. The time was clearly right for these guidelines to be created and we encourage all drone operators to adopt the recommendations we set forth.

We can all agree that privacy must be protected without stunting the growth of the still-nascent UAS industry, just like many other technologies before it. Clear, consistent, national guidelines such as these are critical for the timely and safe integration of drones into the national airspace and unlocking the economic benefits of the technology. An economic impact study by AUVSI found the industry is projected to create more than 100,000 jobs and provide more than $82 billion in economic impact in the first decade following UAS integration into the national airspace.

These best practices are not the end of our collaboration. By continuing to work together, civil society, government and industry can ensure that civil liberties are protected, while taking full advantage of the economic and societal benefits that UAS offer.

https://techcrunch.com/2016/08/18/realizing-the-totential-of-drones-yet-preserving-our-privacy/

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The Legal and Ethical Ramifications of Letting Police Kill Suspects with Robots

Thursday night, after a shocking night of violence in which five police officers were killed by snipers, Dallas police took the unprecedented step of using a remote-controlled "bomb robot" to kill one of the suspects. Now that law enforcement in America have killed a suspect remotely, it's important to consider the legality of the decision—and what might happen next time.

State laws generally allow law enforcement to legally use lethal force against a suspect if he or she poses an "imminent threat" to the officer or other innocent parties, which is underscored by a standard of whether the force is "proportional and necessary." A 1985 Supreme Court case called Tennessee v. Garner allows for deadly force if a fleeing suspect poses "a significant threat of death or serious physical injury to the officer or others."

Does the means of killing matter for that legal standard? In this case, probably not, according to several legal experts I spoke to. The bomb disposal robot that turned into an improvised remotely triggered killing machine wasn't autonomous and can, in this instance, be looked at as a tool that was used to diminish the threat suspect Micah Johnson posed to Dallas police officers.

"It might be justified to use remotely controlled robots to apply lethal force where such force is justified," Jay Stanley, a senior legal analyst at the American Civil Liberties Union told me. "As a legal matter, the choice of weapon in a decision to use lethal force does not change the constitutional calculus, which hinges on whether an individual poses an imminent threat to others, and whether the use of lethal force is reasonable under the circumstances."

"It is essentially a jury-rigged version of a drone strike"

"It is essentially a jury-rigged version of a drone strike," Ryan Calo, a University of Washington School of Law professor specializing in cyber and robotic law, told me. "If they would have been justified in throwing a grenade, then they're likely justified in doing this, which was quite frankly a creative thing."

The fact remains, however, that law enforcement using a robot to remotely kill a suspect on American soil without a trial is widely believed to be without precedent in US history and ushers in a new era of policing. I consulted with four top technology lawyers—Calo, Stanley, Elizabeth Joh of UC Davis School of Law, and Ian Kerr, Canada Research Chair in Ethics Law and Technology at the University of Ottawa, who each said that remote killing in the United States raises a host of new questions and scenarios.

Dallas police have “reconfigured the realm of the possible”

There is a long history of new technologies being used for the first time in extreme cases and slowly being normalized over time. Brown said Dallas had “no other option,” Thursday night, but a tactic that was once reserved as a last resort can quickly become a first or second option if it’s effective and protects officers’ lives.

There will be a temptation to weaponize these machines so as to potentially reduce risk to officers

“There will be a temptation by some people to reduce this down to a functional equivalence—‘If a police officer could justifiably go in and if it was deemed necessary to kill the assailant, why couldn’t a robot controlled by a police officer do it?” Kerr, who edited the book Robot Law with Calo, told me. “There will be a temptation to weaponize these machines so as to potentially reduce risk to officers, but what it does in the long run is it changes the calculus about decisions such as when to use lethal force in hostage situations.”

“There’s a road we’re starting to go down here … by taking a robot originally designed to disarm bombs and using it to blow people up, the Dallas Police end up reconfiguring the realm of what is possible,” he continued. “And, as we have seen by their response, expanding the arsenal of possibility in this way makes it easier to recalibrate the calculus regarding which actions are necessary. Very quickly the argument moves from 'we can use a robot to blow him up' to 'we saw no other option but to use our bomb robot.’”

In the past, we’ve seen standard mission creep with most technologies that law enforcement use—surveillance tools that were developed to be used against terrorists and violent offenders have been turned on innocent civilians, for example.

“Because ground robots may allow deadly force to be applied more safely and easily, they raise the danger that they will be overused,” Stanley said. “When things get easier to do, they tend to be done too much. Remote uses of force raise policy issues that should be carefully considered and addressed by our society as technology advances and should remain confined to extraordinary situations.”

"Once you send a robot in, compared to a human, you’re no longer thinking about it as a human process of negotiation"

Telepresence and killing

Remotely interacting with a suspect—whether the robot is negotiating with or using force against him or her—fundamentally changes the interaction. This is of course part of the point; by removing human officers from the area under threat, you’re removing their risk. But remotely responding to rapidly-changing, volatile scenarios is something that human police officers are trained to do. A police officer can elect to shoot a suspect, or tase them, or negotiate with them, or otherwise subdue them. The robot used Thursday had essentially two remote-controlled options: detonate or don’t detonate.

“Once you send a robot in, compared to a human, you’re no longer thinking about it as a human process of negotiation,” Kerr said. “A human can think—is this guy going to lay down arms or not? This can only really be done once they’ve decided this is far past the point of negotiation.”

Legally speaking, courts have in the past taken into account whether or not a human is actually present to make decisions about things such as ownership. Case law on the subject is all over the place, but for example, a 1990 court case established “telepossession” standards for the robotic exploration of shipwrecks.

“Aggressive use of robots and telepresence can cause legal changes,” Calo said.

Robots can dehumanize killing

Kerr works with the Campaign to Stop Killer Robots, an organization that lobbies groups like the United Nations to prevent a future where autonomous killing machines are used in war. There was nothing autonomous about the robot that killed Johnson, but, then again, there’s not much autonomous about a drone strike in the Middle East, either. In both cases, however, the act of killing is spread out among multiple people along a chain of command.

"How do we ensure that such robots aren’t taken over by third parties?"

“With a drone strike, you’ve distributed the decision making process, so you have intel on the ground, a commander somewhere else, and a drone pilot,” Kerr said. “That is in a sense dehumanizing because it makes it easier for the each person to play their role without taking into account that we’re making decisions about human lives.”

What are the guidelines for remotely killing a human?

Chief Brown said Dallas police “placed a device on [the robot’s] extension” that later exploded, suggesting that the robot was improvised on the fly. Given the extreme circumstances, it’s unlikely that the Dallas police department has published guidelines about when it’s OK to remotely kill a suspect (we’ve asked and will update if we hear back). Law enforcement will inevitably need those.

“With any new technology that the police use, what precautions should be taken to make sure that things don’t go badly wrong? The Dallas robot appears to have been a jury-rigged one,” Joh told me. “But if police robots become part of the future, how do we ensure that such robots aren’t taken over by third parties? The current landscape of easily hacked devices isn’t very assuring in this regard.”

What does the future hold?

Many people in the robotics industry say that robots do “dull, dirty, and dangerous work” that humans shouldn’t have to do. Hostage standoffs, shootouts, and active shooter situations are without question dangerous. If the technology exists to allow police officers to do their jobs more safely, why wouldn’t they employ the use of robots?

The most important consideration in a situation in which a robot could be used, Kerr says, is whether a human police officer would kill a suspect if the robot weren't available.

"The question is, what would happen if it was not possible to send a robot? Would we have still sent in a human?" he said. "If the answer is different, then it has reframed everything."

https://motherboard.vice.com/read/dallas-shooting-bomb-robot-legal-analysis

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What's Next for Drone Warfare?

The Air Force, once reluctant to accept unmanned drones as part of its combat force, now recognizes their value for missions such as surveillance and isolated attacks that are better suited for unmanned than manned aircraft. But, the Air Force needs to replace the hodgepodge of drones in its inventory with a force optimized to meet future scenarios in which they can excel. The next evolutionary step for remotely piloted aircraft -- RPAs, as the Air Force calls them -- is to refine their roles and operational concepts better, and put them through normal DoD requirements and acquisition processes and incorporate them as an integral part of the Air Force structure.

The Air Force operates Predator and Reaper RPAs, the first generation of unmanned strike aircraft. Most are flown from Creech Air Force Base near Las Vegas. B-1 bombers and manned aircraft have also flown sorties on precision strikes against terrorist targets in the Middle East. The rush to get large numbers of RPAs quickly to surveil and attack terrorist threats in Iraq caused impulsive decisions.

Consequently, this force was thrown together more like a neighborhood pick-up team, not designed or procured through a rigorous requirements-based acquisition process nor positioned optimally for missions they fly. Now, the Air Force finds itself with RPAs and mission-control centers not well suited to the challenges they will face in the future.

Experience has shown that RPAs fill a critical need in warfare. Their characteristics of endurance, long range, continuous surveillance of broad and narrow areas, and immediate on-call precision attack of small, high-value targets in low-threat airspace make them preferable to manned aircraft in many scenarios.

The way forward should be to design, develop and procure the next generation of RPAs to perform missions in which RPAs have shown their advantages over manned aircraft while not trying to perform missions better suited to manned aircraft. The domain for this next generation of RPAs is vast, and it need not conflict with the domain of manned aircraft, a contentious aspect that has impeded their acceptance and future roles. Manned and unmanned combat aircraft can coexist, but to operate in synergy, they must be designed to take advantage of the strengths of each.

There is no shortage of scenarios well suited to this next generation of combat RPAs. Obviously, their current effectiveness can be improved with all-weather stealth technology, longer endurance, better sensors, larger payloads and connectivity to the global "info-sphere". With these improvements, they

can cover targets in other regions where terrorists congregate, such as North Africa, Yemen, Somalia and Southwest Asia. Further, with an optimized vehicle, RPAs can be incorporated into war plans against aggressive nation-state adversaries.

Next-generation RPAs can also be the foundation for enforcing international truces and treaties. They can provide continuous, high-resolution surveillance of important facilities to detect activity that could violate agreements, and immediately strike targets.

Establishing no-fly zones over contested areas is a viable alternative to nation-building. The continuous no-fly zones over Iraq for twelve years after the First Gulf War in 1991 demonstrated their effectiveness as a deterrent to further warfare. No-fly, no-drive zones patrolled with RPAs and manned aircraft can detect and strike any air or ground target, obviate the need for "boots on the ground", and maintain air dominance over the area.

In the same vein, new, optimized RPAs would be the best choice for tracking activity and exerting U.S. influence in hot spots such as the Ukraine, Taiwan Straits, North Korea, Spratley Islands and Central America.

A new fleet does not require new infrastructure. Today's RPAs have capable ground-based flight and mission-control facilities, and robust, jam-resistant data links. Fortunately, programs are already underway to upgrade them such that fielding a new force of RPAs would require little, if any, additional capabilities. And, the global info-sphere of space-borne, networked communications already exists to link RPAs in any region of the world.

The current fleets of Air Force RPAs were bought hastily to meet the immediate demands of counterinsurgency in Iraq and Afghanistan. They are unsuited for future world-wide scenarios. The Air Force now has an opportunity to put together an orderly program to replace the current RPA inventory with RPAs designed and developed from the outset for future roles and missions in which they can excel.

The Air Force is reconstituting its development planning process to be responsive to DoD’s push for acquisition reform under its Better Buying Power initiative. The service has done well in planning the development of manned aircraft. The same logical, disciplined development process should be applied to the next generation of combat RPAs. The result will yield the right combination of manned and unmanned combat airpower to ensure air dominance for any future contingency across the full spectrum of conflict.

http://www.defensenews.com/story/defense/commentary/2016/07/07/what-next-drone-warfare/86433910/

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Regulations Are Still a Top Concern Among Drone Experts

Drone regulation is still in limbo, and the industry is nervous.

“I think regulation is an existential threat to drones,” said Descartes Labs CEO Mark Johnson, whose company makes image recognition software, during a panel discussion at Fortune‘s Brainstorm Tech conference in Aspen. Colo. He added that if too restrictive, “regulations from the FAA could nip a lot of these use cases in the bud,” referring to the various applications and uses the industry is experimenting with.

“There’s gotta be some sort of appropriate lightweight and tech-agnostic regulations,” said Airware CEO Jonathan Downey, whose company provides data management software for commercial drone operators, referring to the sometimes overly specific rules that vary from device to device.

“There’s already an existing corpus of laws that say you can’t do things like spy on your neighbor,” he added. “Whether you’re using binoculars or a drone, it shouldn’t matter.” Privacy has been a hotly debated issues when it comes to drones, including where they can fly and what recourses private property owners can use against their spying.

In June, the FAA finally released its rules for business uses of drones, though many companies like Amazon (amzn) and Google (googl) still have concerns over issues like requiring that drones remain within the pilot’s line of sight. At the time, the FAA said it was only the first step in creating rules for commercial drones.

http://fortune.com/2016/07/15/drone-regulations-concerns/

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